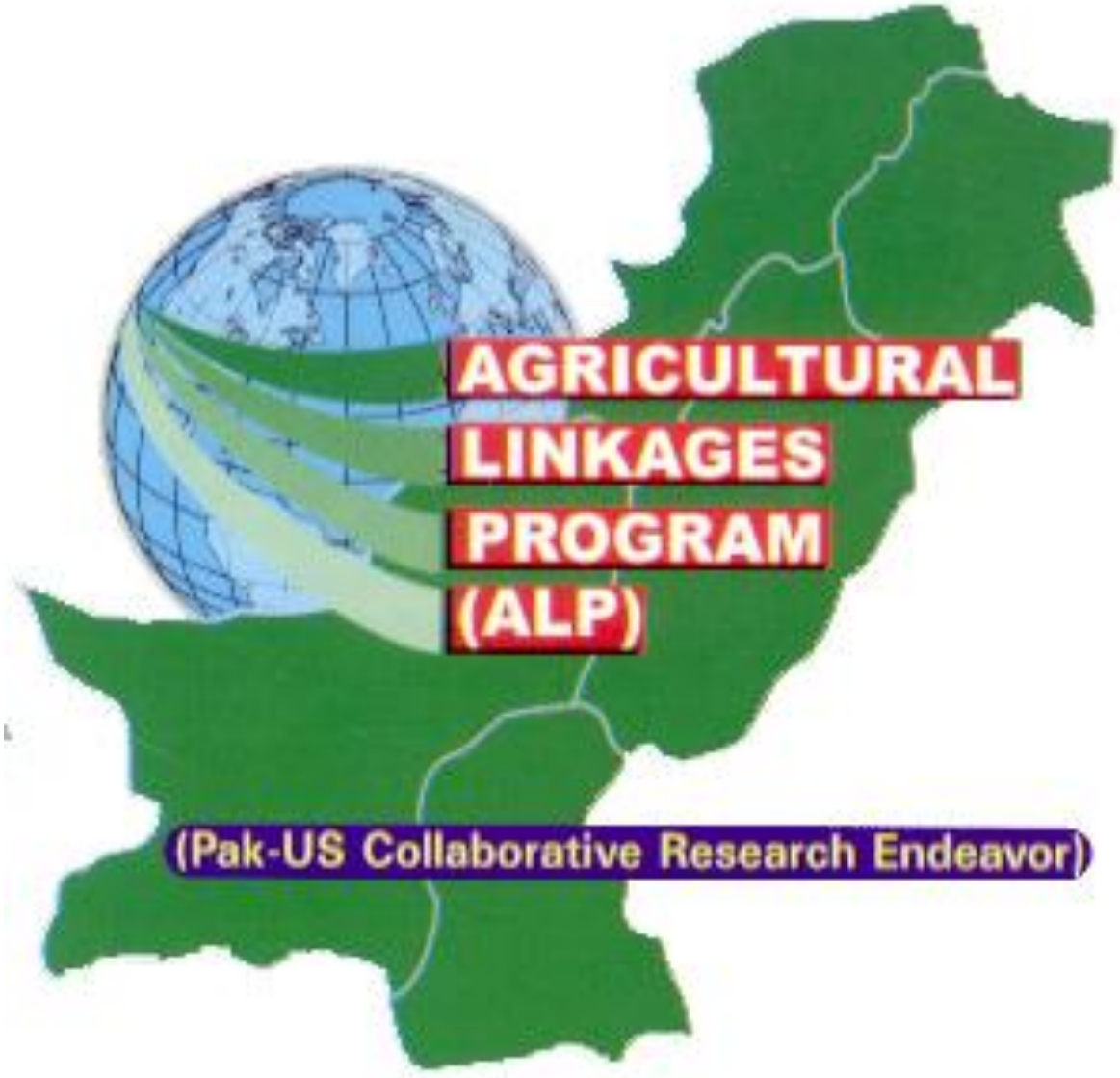
ANNUAL PROGRESS REPORT (December-2006)



4th ANNUAL PROGRESS REPORT

(December- 2006)

ALP SECRETARIAT/ DIRECTORATE OF PLANNING

PAKISTAN AGRICULTURAL RESEARCH COUNCIL

ISLAMABAD

Foreword

Nature has blessed Pakistan with fertile land, a large network of irrigation canals, and climate that is favourable to produce all types of food and non-food crops. Agriculture sector has a unique position in Pakistan's economy. It supports a growing food demand, stimulates growth and development in industries and services sectors and promotes overall development of the country. There are vast tracts of potential culturable wastelands, perennial rivers to provide water for irrigation, suitable climate for raising different crops and sturdy human resources to exploit these resources.
There is a paradigm shift in agriculture. The new millennium demands new and fresh initiatives. Growing population requires that the existing knowledge be modified to seek new avenues and new patterns of thinking. It is in these patterns that one sees the future.

Agriculture has made steady progress. This will serve as a base for future economic development. There are, however, some technical, management and financial problems that have besieged the agriculture sector. The use of modern technology is not widespread either because of the lack of financial resources or lack of education and training In spite of all these constraints, agriculture sector continues to respond to the ever-increasing demand for food, fibre and exportable surpluses.

If Pakistan has to prosper under the competitive environment of the global economy, then it must move into technology based products where global growth is concentrated. Pakistan has for too long remained at a low-level skill trap. If it is to move-up in the global economy then it must break out of this trap by investing in research and development.

Since 2000 dilemma of lack of financial recourses has been addressed amicably with creation of Agricultural Research Endowment Fund (AREF) under ALP. So far PARC has launched three batches of ALP for funding the research projects. In first two batches **1236** preliminary proposals were received and BOD of ALP finally approved **257** projects. At present, **146** are in operation and **85** projects have been completed, while nine projects are in process of agreement, thirteen dropped and four have been terminated. In response to PARC call for 3rd batch 599 concept papers were received, against which 160 were short-listed and in process of approval.

There is no doubt that ALP is a gigantic task in which hard work of many professionals of PARC, GOP & USDA is involved. I appreciate the efforts of the group of expert consisting ALP Secretariat, the Technical Divisions and Finance Division for working beyond their capabilities to implement this program successfully. ALP has not only improved research culture, but also upgraded most of our research labs. with latest scientific equipments and material.

The findings/ research achievements of the projects highlighted in this report are evidence of the industrious work of the scientists engaged in ALP. It also mirrors the excellent performance of ALP Secretariat and Technical Divisions of PARC. At end I heartedly appreciate efforts of Ms. Shahida Jamil and her crew for compiling this progress report and sailing this titanic carefully/efficiently.

(M. E. Tusneem)
Chairman, PARC

ACKNOWLEDGEMENT

Pakistan has tremendous potential for the development of its agriculture in view of land, water, suitable climate and human resource base. However, the lack of ability to exploit the potential needs an in-depth analytical review of constraints. The removal of these constraints through appropriate strategy and financial resources would lead to productivity enhancement in agriculture sector.

Since the inception of ALP the deficiency of financial resources has been addressed adequately. Agricultural scientists from all over the country have now opportunity to win the ALP grants for operational funding through a highly competitive grant system. The overall allocation to the operational funding through this program is over Rs. 100 million per year.

This program is fully functional since 2000 .So far 85 projects have been completed and more than 146projects are in operation and 160 projects of the 3rd batch are in pipe line. The success of this program is due to tireless efforts of ALP Secretariat. The role of Technical Divisions of PARC for providing continuous guidance and support to ALP Secretariat in monitoring & evaluation of the projects is deeply acclaimed. The effective fund management by Finance Division of PARC is also commendable.

The contribution of USDA in establishing and running ALP is highly appreciated. The prudence of Technical Advisory Committee (TAC) and Board of Directors (BOD) of ALP must be acknowledged for approving the projects of priority in the agriculture sector and providing policy guidance for the smooth implementation of the funds and project grants.

The implementation of ALP would not have been possible without the firm commitment and substantial contribution of my colleagues namely includes Dr. Ikram Saeed, Additional Director, Dr. Muhammad Mushtaq, Dy. Director, Mr. Noor M. Khan, Dy. Director, Mr. Zia-ul-Haq, Dy. Director, Dr. M. Kamal Shiekh, Dy. Director, Mr. Muhammad Asif, Dy. Director, Mr. Shujaat Yaqoob, Assistant Director, Mr. Tahir Zahoor Chohan, Assistant Director

The working of ALP Secretariat squad consists of highly qualified and devoted scientists in processing, monitoring, review, evaluation and day to day management of ALP projects is deeply acknowledged. Similarly, the logistic arrangements by Mr. Muhammad Ali, Superintendent, maintenance of files by dealing assistants, Mr. M. Javed Bhatti, Mr. Jahangir Khan, Mr. Zahid Hussain and typing assistance provided by Mrs. Nighat, Mrs. Musarrat Mohsin, and Safeer A. Sabri is deeply appreciated. Appreciation is also for Sheikh M. Ikhlaq, P.S. to Director (Planning), PARC.

Lastly a word of gratitude to Mr. Mushahid Raza, D.E.O. for typing and composing the annual

progress report.

(Shahida Jamil)
Executive Director (ALP)/
Director (Planning)

EXECUTIVE SUMMARY

In Pakistan, agriculture contributes substantially to the economy in terms of food, employment and foreign exchange earnings and will continue to be a very important sector in future. Despite the importance of agriculture in the national economy, there is an ever-widening gap between food supply and demand due to some serious constraints. The constraints on land productivity include soil degradation (salinity/water logging, soil fertility depletion), mismanaged irrigation system and distribution of land holding. There is inadequate and inefficient use of farm inputs affecting land productivity. Agriculture research is meagre and lacks support. Networking of intra and inter-provincial and federal research institutions is lacking. Efficient management and effective coordination is wanting. Closer contacts and feed back from the farmers need improvement.

In past financial allocation for agriculture research, which is the most cost-effective investment in agriculture, was pathetically low. Fortunately, since 2000 dilemma of lack of financial recourses has been addressed amicably with creation of Agricultural Research Endowment Fund (AREF) under ALP. The Government of Pakistan with financial assistance of USDA (Govt. of USA) has established Agricultural Research Endowment Fund (AREF) with an amount of Rs. 1.3 billion. The challenging task of implementing this program was entrusted to PARC. Income generated out of endowment fund is being used for ALP activities in line with Pakistan's long-term research and development goals for agricultural sector. The goal focus on food security, poverty alleviation and promoting broad based equitable and sustainable agriculture.

Since the creation of AREF, PARC has launched three batches of ALP *(1st in December 2000 and 2nd in July 2002 and 3rd in March 2006)* for funding the research projects. In first two batches **1236** preliminary proposals were received and BOD of ALP finally approved **257** projects costing to **Rs.765.89** million. At present, **146** are in operation and **85** projects *(81 of 1st Batch and 4 projects of 2nd batch)* have been completed, while nine projects are in process of agreement, fourteen dropped and three have been terminated.
The 3rd batch was announced in March 2006 for invitation of preliminary proposals .In response to PARC call, 599 concept papers were received, against which 160 were short-listed by the Technical Division. In the 8th meeting of the Technical Advisory Committee (TAC) of BOD of ALP held on 23rd September 2006 at PARC Headquarters, 42 projects recommended by both National Referees were considered. Of 42 projects, TAC recommended/ cleared 19 projects subject to revision to these projects in the light of TAC decision/ recommendations and National Referees' observations/ suggestion and resubmission to next TAC.

ALP Secretariat with the active involvement of concerned Technical & Finance Divisions, PARC has completed on-site review of 58 projects. In addition to that annual/ mid term review in respect of on-going projects also conducted at PARC Headquarters. The recommendations of review teams have been conveyed to concern PIs and also summarized in subsequent chapter of this report.

ANNUAL
PROGRESS REPORT
December-2006

AGRICULTURAL LINKAGES PROGRAM (ALP)

Prepared By

Shujaat Yaqoob
Planning Officer
&
Ms.Shahida Jamil
Executive Director (ALP)

ALP SECRETARIAT/ DIRECTORATE OF PLANNING
PAKISTAN AGRICULTURAL RESEARCH COUNCIL
ISLAMABAD

DISCIPLINE WISE COMPILED BY

Name & Designation	***Discipline***
Dr. Ikram Saeed **Addl. Director**	**Crop Sciences**
Mr. Noor M. Khan **Dy. Director**	**Natural Resources**
Dr. M. Kamal Sheikh **Dy. Director**	**Animal Sciences**
Mr. Muhammad Asif **Dy. Director**	**Crop Sciences**
Mr. Shujaat Yaqoob **Assistant Director**	**Social Sciences**
Mr. Tahir Zahoor Chohan **Assistant Director**	**Crop Sciences**

Overall Editing
by

Dr.Muhammad Mushtaq
Deputy Director

Contents

STATUS OF RESEARCH PROJECTS

Since the inception of Agricultural Linkages Program (ALP), three batches of projects have been announced and a tremendous response from the scientists all over the country has been received. Now there is hardly any agriculture department and university which has not been awarded ALP projects. The status of ALP three batched announced so far is summarized below:

ALP 1ST BATCH 2001-2002

ALP 1st Batch was announced in December, 2000 for inviting the preliminary proposals from the promising Pakistani Agricultural/ Social Scientists for funding out of Agricultural Research Endowment Fund (AREF).In response 592 preliminary proposals were received from all over the country for funding under ALP 1st batch. Out of these 218 preliminary proposals were short-listed by the Technical Divisions, PARC for developing detailed projects and 374 preliminary proposals, which do not fall under ALP laid down criteria were dropped.

APPROVAL STATUS

Short listed 218 detailed projects were considered by the Technical Advisory Committee (TAC) meetings and Board of Director (BOD) of ALP finally approved 116 detailed projects for funding under 1st batch.

IMPLEMENTATION STATUS

Of 116 approved projects 27 projects are on-going, 81 have been completed and eight projects have been terminated/ dropped due to one or other reasons.

ALP 2ND BATCH 2002-03

ALP 2nd Batch was announced on 28th July, 2002 for inviting the preliminary proposals from the promising Pakistani Agricultural/Social Scientists for funding out of Agricultural Research Endowment Fund (AREF).In response 644 preliminary proposals were received for funding under ALP 2nd batch. Out of these 267 preliminary proposals were short-listed by the Technical Divisions, PARC for developing detailed projects and 377 preliminary proposals, which do not fall under ALP laid down criteria were dropped. Of 267 short listed proposals 232 detailed projects were received and 35 PIs had not responded. Incomplete 10 projects were also found among detailed projects which were dropped and only 222 projects were processed further.

APPROVAL STATUS

Of 222 detailed projects completed in all respects, finally 141 projects were approved by BOD of ALP.

IMPLEMENTATION STATUS:

Out of 141 approved projects, 118 projects are on-going; four have been completed, eight projects are in process of agreement, ten projects have been dropped due to one or other reasons.

ALP 3rd BATCH 2005-06

The 3rd batch was announced in March 2006 .In response to PARC call, 599 concept papers were received, against which 160 were short-listed by the Technical Division. The division-wise summary of preliminary proposals and short-listed projects is as under:

Discipline	***Pre-Proposals***	***Short-Listed***
Animal Sciences	129	31
Crop Sciences	354	79
Natural Resources	88	39
Social Sciences	28	11
	599	**160**

In the 8th meeting of the Technical Advisory Committee (TAC) of BOD of Agricultural Linkages Program (ALP) held on 23rd September 2006 at PARC Headquarters, 42 projects of 3rd batch of ALP recommended by both National Referees were considered

Out of these 42 projects, TAC recommended/ cleared 19 projects subject to revision to these projects in the light of TAC decision/ recommendations and National Referees' observations/ suggestion and resubmission to next TAC.

MONITORING & EVALUATION

Monitoring and review of the on-going projects is a regular activity of the ALP Secretariat. ALP Secretariat through a panel of expert comprising a representative each from the concerned Technical Division, ALP Secretariat, Finance Division leading by a Subject Matter Specialist has completed the on site evaluation of 58 projects as detailed below:

Discipline	***No.of projects***	***Rating***		
		Satisfactory	***Partially Satisfactory***	***Unsatisfactory***
Animal Sciences	8	8	-	-
Crop Sciences	25	21	3	-
Natural Resources	11	7	2	2
Social Sciences	14	3	8	3
Total	***58***	***31***	**13**	**5**

In-house review of two projects of Natural Resources was also performed. Progress of both the projects was satisfactory.

The recommendations/ observations have been conveyed to the concerned PI's for improvement and future guidance. The evaluation reports comprising the salient finding, deficiencies found and summary statement of recommendations of the experts are summarized in subsequent chapter of this report.

ALP International Workshops:

Since the launching of ALP, PARC has organized three international workshops in collaboration with USDA on 24-26 April, 2001, 20th April, 2004 and 13th December, 2006 respectively. The purpose of

these workshops was to internationalize the program and seeking partnership with potential national and international development agencies committed to poverty reduction through science-based agriculture development. Scientists from all over the Pakistan, representative of USDA and diplomats attend the workshop.

Training Workshop:

From the past experience of launching two ALP batches it was realized that in many research institutions (specially form Sindh & Balochistan) scientists do not have sufficient know how in project proposal writing and budget preparation due to lack of sufficient knowledge of financial rules and regulations. Consequently, either they can not make the proposals or their proposals do not win the funding.

Therefore, soon after the announcement of ALP 3rd batch ALP Secretariat organized one day training workshop on 22.03.2006 on **"Project Preparation"** at ARI, Tandojam, and Sindh. 65 scientists from Balochistan and ARI, Tandojam participated in the workshop.

Financial Status:

So far an amount of Rs. 630 million has been earned by investing the total amount of Agricultural Research endowment fund (AREF) i.e. Rs 1.3 billion. The total approved cost of 85 completed and 146 on-ongoing projects is Rs. 192.78 million and Rs. 486.13 million respectively. Up to 30th June, 2006 against the releases of Rs. 390.548 million an expenditure of Rs. 320.554 million have been reported.

ANIMAL SCIENCES

BACKGROUND

1st Batch:

ALP Secretariat received 114 preliminary proposals relating to animal sciences for funding under the 1st batch. In process of preliminary appraisal 47 proposals were short listed for the invitation of detailed projects and 67 proposals which were not up to the standard were dropped. Finally, 24 projects costing Rs.59 million were approved by the Board of Director (BOD) of ALP for funding to conduct the research in following different disciplines.

2nd Batch:

ALP Secretariat received 118 preliminary proposals relating to animal sciences for funding under the 2nd batch. In process of preliminary appraisal 59 proposals were short listed for the invitation of detailed projects and 59 proposals which were not up to the standard were dropped. Finally, 33 projects costing Rs.143 million were approved so far by the Board of Director (BOD) of ALP for funding to conduct the research.

3rd Batch:

ALP Secretariat received 129 preliminary proposals relating to Animal Sciences for funding under the 3rd batch. In process of preliminary appraisal 31 proposals were short listed for the invitation of detailed projects and 98 proposals which were not up to the standard were dropped. Short listed proposals are in process by the TAC & BOD of ALP.

Region wise details of approved projects are given below:

S.No	***Region***	***No. of Projects***		
		1st Batch	***2nd Batch***	***3rd Batch*** (in pipe line)
1	***PARC/NARC***	9	8	9
2	***PUNJAB***	8	18	10
3	***NWFP***	3	2	3
4	***SINDH***	3	2	6
5	***BALOCHISTAN***	-	1	1
6	***NGO/ OTHERS***	-	1	1
7	***OTHER FEDERAL***	1	1	-
8	***AJK***	-	-	1
TOTAL		***24***	***33***	***31***

IMPLEMENTATION STATUS

1st Batch:

Out of 24 approved projects 14 are on-going and 8 projects have been completed and two projects have been dropped/ terminated due to one or other reasons.

2nd Batch :

Out of 33 approved projects 29 are on-going, two have been completed and two projects are in pipe line.

MONITORING & EVALUATION

Monitoring and review of the on-going projects is a regular activity of the ALP Secretariat. ALP Secretariat through a panel of expert comprising a representative each from the concerned Technical Division, ALP Secretariat, Finance Division leading by a Subject Matter Specialist has completed the on site evaluation of eight projects. The recommendations/ observations have been conveyed to the concerned PI's for improvement and future guidance. The evaluation reports comprising the salient finding, deficiencies found and summary statement of recommendations of the experts are summarized below:

S. No	Project Title	Name & Address of P.Is	Salient Findings
1	Studies on Biology & Mapping of Warble Fly Infested Areas	Dr. M. Qasim Khan Senior Scientific Officer NARC, Islamabad	Progress **satisfactory** and according to work plan. P.I asked to cover systemic treatment of dieses and survey non-endemic areas as well.
2	Development of local Starter Culture Technology for Preparation of Fermented Milk Products	Dr. Tariq Aziz, Senior Scientific Officer, Animal Sciences Institute, NARC, Islamabad.	Progress **satisfactory** and according to the work plan. Starter cultures developed and maintained.
3	Role of steroid hormone in regulation of ovarian follicular development in *Tor Putitora*.	Dr. Amina Zuberi Assistant Director (Fisheries) Fish Hatchery & Research Center, Rawal Town, Islamabad	Progress **satisfactory** and according to the work plan. Samples for first cycle of study collected & analyzed.
4	Genetic improvement of buffaloes (GIBP) in Pakistan	Dr. Abdul Ghaffar , SSO, ASI, , NARC, Islamabad	Progress **satisfactory** and according to the work plan. Data from 1991-2004 collected & computerized.
5	Studies on epidemiology of peste des petites ruminant (PPR) in Pakistan	Dr. Aamer Bin Zahur Senior Scientific Officer Animal Sciences Institute, National Agricultural Research Centre, Islamabad	Progress according to the work plan. Broacher of Trans- boundary diseases produced in English and under languages.
6	Effect of Civic Pollution on Fish and Fisheries in the Riverine System	Mr.Muhammad Afzal, SSO, Fisheries, NARC, Islamabad	Progress **satisfactory** and according to the work plan. Lot of useful information generated.
7	Development of Milk Replacer and Early Weaning Diets for Sustainable Calf Rearing	Dr. Abdul Ghaffar Khan Principal Scientific Officer Animal Nutrition (ASI), NARC, Islamabad.	Progress was **satisfactory** and accomplishments are according to the work plan. Milk replaces and early weaving diet formula have been developed and are ready for field testing. Patents are also expected.
8	Development of database on minerals profile of feedstuffs, their availability and strategic supplementation of minerals block to dairy animals	Dr. Atiya Azim Senior Scientific Officer Animal Sciences Institute, National Agricultural Research Centre, Islamabad.	Progress was found **satisfactory**. 85 samples of feed stuff collected, which are being analyzed for study of micro/macro nutrients. Procurement of equipment and shed remodeling were little slow.

Project Title: ***Protection of buffaloes against brucellosis.***

Principal Investigator: ***Dr. Rukhshanda Munir***
Senior Scientific Officer

Location of Project: *Animal Sciences Institute, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.458*
Start Date:	*5/9/2002*	*Funds Released (Rs):*	*2438000*
Project Status: Completed		*Funds Utilized (Rs):*	*2012063*

Objectives:

- Evaluation of protective efficacy of commonly used Brucella abortus vaccines in buffaloes.
- To determine the most suitable age for vaccination brucellosis in buffaloes.
- To determine the best dose schedule for adult buffaloes so that the residual titers are minimum.
- To determine the protective antigens of Brucella for buffaloes.
- Develop and implement strategies for the control of brucellosis in farming systems' prospective of Pakistan.

Achievements/Progress:

Brucella abortus strain 19 a smooth strain with reduced virulence and a rough mutated strain RB-51 were procured from NVSL, Ames Iowa US and C.Z Veteraneria, Spain respectively. These strains were characterized biochemically for confirmation and limited doses of vaccine from leach strain were prepared following the method of Corbel and Macmillan (1966) and Stevems (1994). Vaccine prepared from Brucella abortus strain RB-51 was tested for immunogenic response in buffaloes of different age groups i.e. adults, heifers and calves.

Two serological tests i.e. Indirect ELISA for the detection of antibodies against strain RB-51 and strain 19 were developed and standardized. Humoral immune response of 3 groups of animals vaccinated with RB-51 was detected by an indirect ELISA. Animals in all groups showed non-significant difference in the mean antibody titers ranging from 0.513 to 0.780.

Thirty buffaloes of various age groups were vaccinated with RB-51. Serum samples collected period to vaccination and after vaccination were stored at - 20 C. Vaccine was prepared from B aborlus strain RB-51 and was evaluated for the confirmation of immunogencity in buffaloes of various age groups by using indirect EUSA test. Antigen and amboceptors was prepared for complement fixation test.

Project Title: ***Ovarian follicular dynamics and endocrine activity in postpartum anoestrus buffaloes.***

Principal Investigator: ***Dr. Nemat Ullah***
Principal Scientific Officer

Location of Project: *Faculty of Veterinary Sciences, University of Arid Agriculture, Rawalpindi*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.985*
Start Date:	*5/8/2002*	*Funds Released (Rs):*	*2985000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2929000*

Objectives:

- To study the ovarian activity in postpartum buffalo in order to understand anoestrus phenomenon.
- To study the effect of mineral supplementation on post partum ovarian activity in buffalo.

Achievements/Progress:

Poor feeding and low mineral intake have been described among the possible causes of low reproductive efficiency of buffaloes. Present study was conducted to see the effect of mineral supplementation on ovarian hormone levels in post partum Nili Ravi buffaloes kept on optimum nutritional requirements. In experiment one ovarian activity was monitored in mineral supplemented and non supplemented buffaloes over one year after calving. The second experiment was conducted to note calving to heat and calving to conception intervals in summer and winter calving buffaloes. It was noted that 60% buffaloes acquired and maintained ovarian cyclicity within four months after calving when kept on National Research Council (NRC), USA recommended feed. Mineral-supplementation had no edge on non-supplementation in terms of triggering ovarian activity of the 40% non cyclic buffaloes. Optimum management and NRC recommended nutrition resulted in 100% conception in summer-calving buffaloes within four months after calving irrespective of extra mineral supplementation. However, a higher percentage of winter-calving 'interval- supplemented buffaloes' resumed ovarian activity and conceived within 3 months after calving as compared to non-supplemented ones (75% and 3.3%, respectively). It is concluded that when kept on NRC recommended feed, the summer calving buffaloes show heat and conceive within 4 months after calving. However mineral supplementation is beneficial for winter calving buffaloes to attain an ideal service period.

To meet the NRC recommended nutrient requirement of buffaloes, cottonseed cake, wheat bran and yellow maize mixed with wheat straw were used and mot grass and millet were fed in winter and summer, respectively. The minral supplementation comprised of dicalcium phosphate (50 grams), zinc sulphate (1-gram) and manganese sulphate (1-gram).

3 research papers presented in conferences by making use the information from this project.

Project Title: ***Polyculture of freshwater prawn, Macrobrachiuii malcolmsonu with Indian major and Chinese carps at farmers ponds in Pakistan.***

Principal Investigator: ***Dr. Rafia Rehana Ghazi***
Director

Location of Project: *VPCI, Southern Zone Agricultural Research Centre (SARC), Karachi.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.984*
Start Date:	*4/22/2002*	*Funds Released (Rs):*	*1983000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1982737*

Objectives:

- To study growth and survival of fish and prawns in polyculture system.
- To determine economic feasibility of fish/ prawn polyculture system.

Achievements/Progress:

The project was launched in April, 2002 at two sites" Dilshad Fish Farm, Chilya and Jafery Fish Farm, Mirpur Sakro, Thatta. At Chilya, Thatta, two ponds of about half acre each were utilized as experimental ponds for fish and prawn and one pond of about 0.75 acre as control, for only fish culture: while at Jafery Fish Farm, Mirpur Sakro two ponds of about one acre each were utilized, one for Polyculture and other for fish culture only. Stocking of ponds was made at the rate of 5000 prawn and 500 fish (composite) in Polyculture and 500 fish (composite) in control pond per acre. Prawn seeds were collected from the lower belt of Indus river near Jamshoro and Sajawal bridges. Fish seeds were procured from Sindh Govt. Fish Hatchery, Chilya, Thatta.

Fish seeds stocked were Labeo rohita (Rohu), Cirrhimus mrigala (Mori), Catla catla (Thaila) and Ctenopharyngodon idella (Grass carp). Liming of ponds were carried out before stocking, fertilization in the ponds was made with urea and DAP (Diammonium Phosphate) added on regular basis as and when required to maintain 1.5 Sachi disc value. Supplementary feed was utilized in the ponds at 2% body weight ration level. Feed was utilized once a day for 7 days a week. Growth data was monitored on monthly basis. First growth cycle started during September to October, 2002 and continued up to Oct.-Nov., 2003. During the period stocked fish and prawn were monitored periodically for growth in respect of length and weight. Survival rate of stocked fish and prawn were assessed at the time of harvest, additionally water quality parameters were also monitored and managed in ponds at both sites, i.e. in Mirpur Sakro and Chilya, Thatta. Final growth data revealed successful Polyculture of prawn and fish in Sindh.

Similarly second growth cycle was started at two sites one at Dilshad Fish Farm, Chilya and other at Ijaz Fish Farm, Pirphutto, Thatta, during June & July, 2004 and continued upto May, 2005. Two ponds of about half acre each were utilized at Chilya, one for experimental purpose and the other for control and two ponds at Ijaz Fish Farm pir puttho of 3.5 & 2.8 kanal for experimental and control pond each.

During the period, above mentioned parameters were encountered as in the first growth cycle with increased density of Prawn and Fish, i.e. 6000 prawn and 600 fish per acre. Fish stocked for second

growth cycle were: Labeo rohita Ctenophayngodon idella, Cirrhimus mrigala, Catla and Cyrimus carpio. Final growth data revealed successful Polyculture of prawn and fish over monoculture.

In the third and last growth cycle during 2005-06 increased density of prawn and fish i.e 6000 : 600 per acre respectively were repeated to optimize the yield from fish ponds at both sites according to the objectives and plan of work. For this (Third) growth cycle Juvenile Prawns were collected from Indus river near Jamshoro Bridge and near Sajawal Bridge. A representative sample for data collection were separated and stocked in experimental ponds for acclimatization at the rate of 6000 prawns and 600 composite fish per acre in Polyculture system. While control ponds were stocked with 600 fish per acre. During the period, stocked fish and prawn were monitored periodically for growth in respect of length and weight as in the 1st & 2nd, growth cycles. Survival rate of stocked fish and prawn were assessed at the time of harvest. Final growth data revealed successful Polyculture of prawn and fish in Sindh in this cycle too. Data for water quality was monitored on monthly basis including Dissolved oxygen, pH, Hardness, Ammonia, Nitrate and Temperature etc. Regular feeding was made, consisting of CG 30% rape seed cake in each pond. Ponds were properly fenced to avoid prawn escape and predator entrance. Water level was checked daily by the pond managers and recharged as and when needed. Organic manure was added to keep the water green and for proper plankton growth.

The study findings revealed an optimal production when polyculture of prawn with fresh water fishes in ponds at 600:6000 fish (composite) and prawn ratios maintained with culture period of 317-322 days. The benefit cost ratio for this was worked out to be 2.8:1 on per acre basis.

There is need for further work on prawn breeding, prawn hatchery prawn nursery and prawn feed and prawn nursery diseases in order to introduce and popularize prawn -fish poly culture in Sindh. Similar experiments need to be conducted in other parts of the country especially in coastal areas of Balochistan for verification and popularization of the technology.

Project Title: ***Studies on the prospect of introducing American channel cat fish (Ictalurus puncutatus) in pond fish culture system of Pakistan – A pilot project.***

Principal Investigator: ***Mr. Abdul Rab***
Senior Scientific Officer

Location of Project: *AFRI, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.035*
Start Date:	*3/22/2002*	*Funds Released (Rs):*	*3062000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2915784*

Objectives:

- Feasibility study to test the suitability of channel cat fish (Ictalurus puncutatus) culture to fill the void of catfish culture in pond system of Pakistan.
- To test through series of experiments the most desirable culture system of catfish culture using various quality and quantity of feed and other inputs.
- To disseminate the package of technology to promote catfish culture in Pakistan.

Achievements/Progress:

2000 fingerlings of channel catfish (average wt 10.8 g, length 10.9 cm) were imported in two batches from Cold Water Research Station, Chiang Mai Province, Thailand. The fingerlings were acclimatized for one month. Weight gain of 8.8 g was recorded in indoor fiberglass tanks and 11.8 g in outdoor concrete raceways during the acclimatization period. The condition factor (length-weight relationship) showed an allometric growth from October-December, 2003.

Three artificial feeds formulated from locally available ingredients, with 40%, 35% and 30% CP levels were compared for their acceptability and FCR with imported floating feed (37% CP), used as control. Maximum weight gain (7.2 gms/months) was observed with imported floating feed with 37% CP, followed by diet containing 40% CP(3.7 gms/month) at water temperature 18-19o C. On the basis of results obtained in 1st experiment, diets containing 35% CP and 30% CP, using different combinations of feed ingredients were formulated and tested. Weight gain of 12.9 gms/ month (water temp. 22.0 – 23.0o C) was observed with diet containing 35% CP. Experiment on effect of replacement of fish meal with soybean meal in channel catfish diets showed that the diet containing 10% fishmeal and 30% soybean can be used as low cost feed fro channel catfish culture without affecting growth rate.

Growth performance of channel catfish in fertilized ponds with and without artificial feeding showed that catfish is omnivorous and can be reared in fertilized fish ponds without artificial feeding. Fish gained 385.3 gm weight with artificial feed and 337.0 gms without artificial feeding during four months (July- October). Although the growth rate was significantly higher with artificial, but the cost of fish production was minimum (Rs. 19.7/ kg) as against Rs. 28.29/kg with artificial feeding.

Effect of two different stocking densities 1800/ha on the growth of channel catfish in earthen ponds was also studied. Fingerlings stocked at 188/ha achieved significantly better growth 433.11 gm/month as compared to stocking density 2400/h (124.8 g/month). The study revealed that net profit per hectare was greater as compared to low stocking density (Rs. 213533/ha)

Channel catfish cultured in polyculture system with major and Chinese carps in fertilized fish ponds showed 10% catfish could safely be cultured with other carps under polyculture system without affecting the growth of carps.

Efforts were made to breed channel catfish in local conditions during the month of February, 2005. Twenty nine pairs of channel catfish with average weight of 1386.15 gm were selected for breeding experiment. Different natural and induced breeding methods, using Ovaprim C (0.6 ml/kg of female and 0.1 ms/ kg of male) and Proffassi (HCG, 110 IU/kg body wt. of both male and female) were used but no spawning was achieved.

Feasibility of introduction of channel catfish in Pakistan has been explored, that will have a far-reaching impact on our fish farming. Channel catfish culture will fill the void in freshwater culture system and will help in achieving the target of optimum resource utilization. Channel catfish can also be used in stressed water as fish being hardy and with wide range of tolerance.

The other significant outcome of this project are that 5 students graduated including 4 M. Sc. and one Ph. D. degree programs as well as five abstracts published in research periodical.

Project Title: ***Molecular characterization and pathogencity of avian adeno-viruses causing HPS.***

Principal Investigator: ***Dr. Mansur ud Din Ahmad***
Associate Professor

Location of Project: *Department of Microbiology, University of Veterinary and Animal Sciences, Lahore.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.746*
Start Date:	*4/2/2003*	*Funds Released (Rs):*	*2474600*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2046377*

Objectives:

- Determining the role of immunosuppressive viruses in the causation of hydropericardium syndrome(HPS).
- Development and characterization of monoclonal antibodies for Avian adenovirus causing hydropericardium syndrome (HPS)
- Development of various diagnostic tools with particular emphasis on differentiation of virulent and non-virulent AAdVs.
- Evaluation of egg passaged local isolate for vaccine production.

Achievements/Progress:

Pathogenicity Studies: The Pathogenicity of the Fowl adenovirus causing hydropericardium was studied in susceptible broiler birds. The experimental birds were infected with infectious material directly prepared from the morbid material (liver homogenate) and virus propagated in chicken embryo liver cells. The birds were infected with varying doses of HPS virus through parental and oral route and the age of 25 days. Data for post-infection mortality was recorded.

Evaluating the role of Immunosupprssive Viruses: The changes in blood values of infected birds had decreased hemoglobin and packed cell volume as compared with the uninfected control birds. The drop in hemoglobin value was more in birds infected with infectious material prepared directly from liver tissue as compared with cell culture propagated virus. The decrease in hemoglobin value could be the indication of an infections agent which could lead to anemia such as chicken anemia virus.

Studies on Antigenic Homogeneity of FAdV causing HPS (Hydro pericardium): The homogeneity of different strains of virus collected from field and various biological production units was studied by Agar gel Immunodiffusion (AGID) assay and by studying biological cross neutralization in host (challenge protection studies).

Conclusions:

The cell culture propagated virus has lower pathogenicity as compared with the liver homogenate prepared form infected birds; this change in biological behavior of the virus on in-vitro cultivation needs to be further investigated.

The pathogenicity of virus decrease if given through natural route (Orally).

The strains prevalent in the country and used by different biological production units are antigenically homogenous.

None of the local vaccine produced from liver homogenate gives 100% protection. However, cell culture propagated oil adjuvant vaccine (imported provided the solid immunity).

Project Title: ***Hyper-secretion of xylanase &/or cellulase thermophile for its application in poultry feed industry.***

Principal Investigator: ***Dr. Farooq Latif***
Principal Scientific Officer

Location of Project: *National of Institute Biotechnology and Genetic Engineering (NIBGE), P. O. Box 577, Jhang Road, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.743*
Start Date:	*8/18/2002*	*Funds Released (Rs):*	*1583080*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1454059*

Objectives:

- Chemicals mutagenesis of Chaetomium thermophile for enhanced xylanase expression.
- Genetic manipulations to decipher xlanase/ cellulase gene/s.
- The genetic construction will involve plasmid construction of amplified xylanase gene.
- Up-stream and down stream processing of enzymes from the mutant and wild type at lab scale and pilot scale.
- Study the in-vitro digestibility of feed treated with enzymes with regard to improvement in performance of chicks.

Achievements/Progress:

The molecular biology of C.thermophile resulted in the chromosomal DNA isolation and purification. Genomic DNA was PCR amplified using primer sequences of C.thermophile xylanase 11A gene from the net. The xylanase gene fragment of 890 bp (approx.) was eluted from the gel and cloned in to the T/A cloning vector (pTZ57R) and subsequent transformation into IPTG induced E coli DH5a. White/Blue colonies selection lead to miniprep of the T/A cloning vector harboring gene of interest. This T/A cloning vector was handed over to the Microsynth GmbH, Switzerland for sequencing of the gene which was later given to the GenBank (accession number AY366479). An intron stretch of 35 nucleotides was indicated between 300 hp of exon on the 5' end and 500 bp on the 3' end. Amino acids of glycosyl hydrolases family 11 active sites were indicated. DNA synthesized by RT-PCR was cloned into T/A cloning vector, however, problems originated in in-frame cloning of insert. Another strategy was designed to remove intron of the gene for cloning into pET expression vector.

Three primers were designed in order to amplify the 300 bp exon on the start site and 500 bp exon on the far site of the intron. Xho I site was introduced for generating and sticky ends through the primer P3 at the 3' end of the exon and P4 at 5' end of the intron. The 300 bp fragment was excised using EcoRI and XhoI and 500 bp fragment was excised by XhoI and HindIII. Eventually, the sticky ends generated with Xhol were used for ligation of these fragments to get one full length gene and later cloned into cloning vector pTZ57R (pSSZ810a).

The confirmed PCR target xylanase gene fragment from pSSZ810(a) approx. 810 bp was ligated into pET 32a(+) vector and transformed into BL21 strain of E. coli. The recombinant clone pSSZ810(b) resulted in maximum xylanase activity of 5.9U/ml in the presence of 1mM lactose as an inducer carbon source after 3 hours. The maximum xylanase activity of 4.6 U.ml in case of IPTG as an inducer was observed after 1.5 hours. Saccharification of xylan with recombinant enzyme resulted in larger

xylose peak from the hydrolyzates of 1 mM lactose as compared to I mM IPTC inducer as detected by HPLC. SDS-PAGE and wester blot analysis showed approx. 43 kDaa molecular weight of xylanase alongwith fusion protein of pET 32a(+) vector. Without fusion protein the xylanase activity was 0.39 U/ml., respectively.

In case of yeast expression system the xylanase gene from recombinant pSSZ810(b) was ligated into Pichia pastoris pPIC3.5k vector and confirmed as recombinant clone pSSZ8120(c). It was then transformed into the genome of P.pastoris GS115 strain at HIS 4 region through electroporation. Transformants were selected on YPD (yeast peptone dextrose medium) plates containing antibiotic genetiein (100 mg/mL) up to final concentration of 0.75 mg/ml. The maximum xylanase activity of 2.0 U/mL was observed in the presence of 100% methanol as inducer and after incubation of 2 hrs at 50 C. However, HPLC analysis showed larger peak of xylose in the xylan hydrolyzates as compared to the prokaryotic expression. SDS-PAGE indicated approx. 28kDa protein.

Xylanase protein of C.thermophile was purified using 70% ammonium sulphate. The precipitated protein was subjected to FPLC Mono Q ion exchange column chromatography. One of the two peaks (A) carried xylanase activity and was further resolved through Gel filtration. Three to four peaks were obtained with xylanase activity and was further resolved through Gel filtration. Three to four peaks were obtained with xylanase activities in the molecular weight range of 22.50 kDaa.

Strain improvement of C. thermophile was another major objectives of these studies using physical and chemical mutagenesis. UV radiation used on the fungal spores resulted in more than 90% killing of spores after 80 minutes of exposure. After optimization of U.V doses twelve colonies which showed better clearance on xylan based agar medium were selected. Some of the mutants showed dark velvety appearance, kwhereas, others showed pale colored appearance. Whereas, others showed pale colored appearance. Among the probable mutants M7, showed significant increase in xylanase activity of almost 1.5 fold (57 U/ml) over the control. There results were validated by similar increase in extra-cellular protein.

In the follow up studies for chemical mutagenesis MNNG (0.5 mg/ml) was used on fungal spores and mycelia. The survivors were selected on de-oxy-D-glucose 0.2%, lkwhich resulted in mutant M205 that showed a 2 fold improvement in kxylanase activity 70 U/ml). The enzyme (Nibzyme) produced from improved strain was also used for the poultry feed studies on broiler and layer. Gamma radiation (120 Krad) was found to be optimum for spore kill. The residual spores lselected for de-repression on deoxy de-glucose at 0.6% level resulted in mutant DG 76. It produced 15% higher xylanase activity even in the presence of 2% glucose and wheat straw in shake flasks.

The ultimate objective of the research was to produce the enzyme from C. thermophile wild type and developed mutant (M205) Nibzyme in 20 liter fully automated bioreactor for applications in poultry feed. A series of three layer feed experiments were conducted at Poultry Research Centre, University of Agriculture, Faisalabad. Fiber-degrading liquid enzymes (cellulase/xylanase) produced form C. thermophile were used at various concentrations of IX to 5X at 1L/100 kg of feed. This enzyme product from wild type contained xylanase (37 U/Ml), Enkdoglucanase (2.5 U/ml) and B-glucosidase (1.5U/ml). In a 150 laying white Leghorn commercial hens of same age were selected for a biological trial of 8 weeks (39 to 46 week of age). The enzyme added at 1 liter/100 kg of feed showed that 2 fold concentration of enzyme was optimal as far as improvement in birds was concerned. There was a negative effect of high fiber feed on performance of birds which was nullified with the addition of enzymes. The effect of enzyme supplementation on the feed consumption was significantly improved. Feed conversion ratio per dozen as well as per kg egg mass was significantly affected ($P<0.05$) by the

enzyme supplementation. However, egg production showed to significant increase. The egg quality parameters showed increase in egg breaking strength, while all other parameters were not affected.

The second experiment of the same layer group was further enhanced from 46 to 53 weeks, however, three levels of enzymes and two levels of fiber i.e.4 and 6% were used. The fiber degrading cellulase/xylanase liquid enzyme treated feed showed insignificant improvement of egg number. However, the feed consumption was significant for the enzyme treated groups. The mean values for FCR/dozen of egg and albumen height showed significantly better results (p5 0.05) with 2x addition of enzyme in feed. In egg quality parameters including increase in egg shell thickness wa snon significant. Maximum profit was in the feed group supplemented with Nibzyme as compared to control group.

In the third experiment of this series same birds as used previously, but of the relatively old age group of 80 to 88 weeks were checked for performance studies. The difference in number of egg production was non-significant. Feed consumption was significantly less for the birds fed enzyme treated feed than the control. FCR per dozen eggs showed better results for 6% fiber with enzyme treated feed than the control. FCR per dozen eggs showed better results for 6% fiber enzyme supplemented feed. There was significant increase in egg weight ($p<0.05$) and yolk height. Whereas, there was decrease in egg shell thickness, albumin height , yolk index and Haugh unit.

Another set of five experiments were conducted on broiler feed supplemented with the Nibzyme. The first experimental trial was conducted on broiler chicks to study the effect of enzyme supplementation to low and high fiber based diets on performance of broilers in two factorial completely randomized design. Low fiber (4%) feed along with high fiber (7%) carrying higher wheat and sunflower meal based diet was used. The enzyme treatment was given during the finisher phase. Results showed an increase of average weight gain of 2.02 and 13.05 percent with enzyme supplementation, respectively. There was 4.65 and 5.55 percent reduction in FCR, in LF and HF feed, respectively. Enzyme supplementation decreased feed consumption (FC) in low fiber based diet to 2.57% than control, whereas, it had increased feed consumption by 7.13% in high fiber based diet. No mortality was noted with enzyme supplementation. In the finisher phase high fiber feed showed the effect of enzyme significantly ($p>0.05$) on the overall performance of birds than in the low fiber feed.

In the second 320 birds experiment four different feed compositions were used alongwith Nibzyme. Consumption was found to be non-significant among all treatments. The overall better weight gain (1919 g) and FCR (1.83) was observed at 15% sunflower oil meal SFOM (75 Fiber in feed) with Nibzyme.

In the thirds experiment 2.5 fold Nibzyme was added at 1 liter/100kg of feed. Feed consumption was non-significant among all treatments. Best results for weight Gain (1566 g) and FCR (2.01) were observed at 15% SFOM, 7% Fiber with Nibzyme against control. In the fourth experiment a total birds of 480 with replicates were used in a 4x4 factorial design. Highest weight gain (1696 g) was observed at 10% SFOM, 6% Fiber with Grindazym followed by Nibzyme and control. However, best results for FCR (1.84) were observed at 15% SFOM, 7% Fiber with Nibzyme followed by Grindazym (1.87).

It was found that the fiber degrading enzyme of C. thermophile showed a gradual weight gain with the increased fiber level. On the contrary it was found that without enzyme (control) the weight gain dropped after 5% of fiber level. However, there was no significant difference in feed consumption among the various fiber levels of feed by the birds. The enzyme application studies have foresighted a bright future for fiber degrading enzymes in poultry feed industry. These enzymes have promising

potential for poultry & poultry feed industry. There is need to start commercial scale testing and production of these enzymes for the more profitable poultry feed and poultry industry in the country.

The other significant contribution gauged in terms of 7 students graduated with 3 M. Sc., 3 M. Phil. and one Ph. D. degree program as well as two research publications, one research paper in international journal and one in national journal.

Project Title: ***Refinement of multi-nutrient urea-molasses blocks technology through research and development.***

Principal Investigator: ***Dr. Muhammad Ashraf Mirza***
Principal Scientific Officer

Location of Project: *Animal Sciences Institute,NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*0.952*
Start Date:	*8/10/2002*	*Funds Released (Rs):*	*711000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*650000*

Objectives:

- Improve utilization of low quality roughages.
- Improve utilization of molasses.
- Minimize wastage of ammonia.
- Reduce chances of ammonia toxicity.
- Improve health and production of animal.
- Improve livestock raisers income.
- Alleviate poverty from the country.
- Increase availability of livestock products like milk, meat etc. Overall we are expecting 5 to 15 percent improvement in animal's performance and about similar improvement in income generation.

Achievements/Progress:

The present study was conducted to come up with certain better formulae of urea molasses blocks for improvement in livestock production. In this connection, a series of experiments were conducted. The salient findings of these experiments were that urea molasses blocks (UMB) offer an easy and economical method of supplementing buffalo claves under traditional low quality roughage feeding system. To avoid wastage of ammonia due to higher solubility of urea, slow releasing chemical Yucca schidigera extract may be used. Use of UMB supplements not only helps the host animals but also the ruminal microbes for an efficient utilization of poor quality feed, higher live weight gain and economic benefits. Dry matter digestibility and crude protein digestibility improved with increasing salt level in UMB. i.e up to 9%. Highest daily net return was found in (+5.38) on UMB with 5% of maize gluten feed. Higher level of urea up to 11% gave maximum net benefit (Rs.29.13/h/day). UMB with 10% soybean meal gave better weight gains of 550g with better FCR and net benefit of Rs.23.68/h/day. Dicalcium phosphate @ 2% also resulted in better average daily weight gain of 464g and net benefit of Rs.15.83 per head. Increased level of molasses in UMB resulted in decreasing benefits, replacement of wheat bran with sunflower meal produced similar results.

Urea molasses block technology has been improved and the refined version has given better results which offers an easy and economical method of supplementing buffalo calves under traditional low quality roughages feeding system. This has resulted in better growth rates and net benefit. The research has also resulted in better utilization of roughages and molasses with minimum wastage of ammonia and chances of urea toxicity with the addition of slow releasing chemical Yucca schidigera extract.

Project Title: ***Strategic breeding of red Sindhi cattle (SBRSC).***

Principal Investigator: ***Dr. U. N. Khan***
Director General

Location of Project: *Southern Zone Agriculture Research Center (SARC), Karachi*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.785*
Start Date:	*4/23/2002*	*Funds Released (Rs):*	*2740000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2656000*

Objectives:

- Assessment of production environment of Red Sindhi cattle.
- Introduction of Open Nucleus Breeding Scheme (ONBS) at LES, Karachi.
- In-vitro production of superior germplasm of Red Sindhi cattle.

Achievements/Progress:

A benchmark survey was conducted in four districts of Sindh and Balochistan, which have dominant population of Red Sindhi. It was evident from the survey that the Red Sindhi holdings were small in the area, above 60% farmers kept <5 animals whereas the breed seemed to be mostly confined in Thatta and Lasbella districts. Above 80% heifers/young stock was raised at small farms, whereas 76% farms did not have Red Sindhi bulls.
About 20% farms kept only one bull for breeding purposes. About 96% farmers used grazing as well as stall-feeding method for feeding their cattle; only 2.7% used stall-feeding. Grass and maize were commonly used as green fodder in all districts except Thatta, where sugarcane top was popular. However, majority of farmers reported little use of green fodder (<5 kg/animal/day). Besides this, occasionally wheat straw and cottonseed cake was also given in small quantities, 1-4 kg/animal/day. Based on the response of farmers to the survey questionnaire, the average intake of fodder and concentrates was worked out. It is evident that the animals were generally under nourished. Majority of the farmers (57.4%) reported daily milk yield ranging between 5-8 liters, however, 33.5% farmers indicated higer yields (9-12 lit./day). Slightly lower milk yield (7.02 lit/day) were reported in Lasbella district, apparently due to prevailing feed scarcity. Majority of farmers (99%) did not practice AI service. Use of exotic/crossbred and scrub bull was common in almost all districts surveyed especially in Lasbella Balochistan. However, Red Sindhi male was used wherever available. The age at first calving was higher (4-5 years) as reported by almost 50% farmers. Likewise, for 46.1 cows, the postpartum period was also reported higher, ranging between 61-120 days. The overall average for Age at 1st calving and postpartum period were calculated as 3.7 years & 96.5 days, respectively. Although there was a large variability in the duration of postpartum period, it is obvious that both these parameters needed improvement through better nutrition and reproductive management.

On Station Performance: The average lactation length was 247.86 days in Red Sindhi cattle. Lactations shorter than 305 days are a typical characteristic of zebu cattle. This was regarded as a limiting factor towards higher yields and it needs further improvement. The lactation yield of Red Sindhi cows was 938.89 litres, which was alarmingly lower than the values generally reported in the literature, however, the average milk production was higher in Red Sindhi crosses as compared to pure Red Sindhi cattle. Selection of high producing animals and relatively better management seems to have caused better

milk yield in Red Sindhi crosses, besides the effect of heterosis, as the crossbreds non Red Sindhi animals were purchased from the market under a scheme to provide farmers with productive animals.

Red Sindhi cattle exhibited longer dry periods (387.79 days). The average values for the other genetic groups were also high. This indicated that the management at the farm adopted the policy of completing the lactations to its full term, which led to longer dry periods. As a consequence, the calving intervals of all genetic groups turned out to be much higher than the desired limit of 365 to 400 days.

The age at first calving ranged from 1021 to 2825 days with a mean value of 1605.8+60.0 days in Red Sindhi cattle. The average age at first calving was generally high in all genetic groups indicating slow maturity and partially due to under nourishment of the animals at the Station. The age at first calving can be reduced markedly through improved feeding management and also by paying individual attendtion to slow maturing animals. The age at first calving can further be reduced through keen observation of heat symptoms and timely conception of the cows. The average calving interval of 600.87 days in Red Sindhi cattle estimated in the present study was regarded as highly undesirable. The calving intervals were also high in the other genetic groups ranging from 544.60 to 576.30 days. The breeding efficiency of Red Sindhi cattle with an average value of 61.16+2.98% was the lowest as compared to other genetic groups studied. Generally, the breeding efficiency of all genetic groups was low. The average calf birth weight was recorded as 20.61 + 0.23 kg for males and 19.38 + 0.25 kg for females born at the Station. The overall birth weight averaged 19.98+ 0.17 kg for all genetic groups.

The analysis of variance for fixed effects suggested year of birth and year of calving as highly significant effects on the total milk yield. This reflected the differences in the management practices over the years. Likewise, the effect of genetic groups was highly significant in the present study, which is logical. The effect of season of calving and lactation number turned out to be non-significant. The coefficients of variation turned out to be quite high for almost all traits studied viz. milk yield, lactation length, dry period and calving interval. Respective heritability estimates were 0.30, 0.16, 0.44 and 0.36 indicating a likelihood of slower genetic gain through future selection of the animals for the milk yield and lactation length. Hence, an open nucleus breeding scheme accompanied with higher selection intensity may stand as a better choice for the improvement of Red Sindhi herd. Open Nucleus breeding scheme has been introduced at LES-Karachi. In vitro production of superior germplasm of Red Sindhi cattle could not be started.

There is need to carry out further work to exploit further genetic improvement in economic traits such as milk production, puberty and parity of Red Sindhi Cattle. To study the influence of nutrient manipulation on milk production and reproduction of Red Sindhi Cattle, more work need to be done. A Red Sindhi calf rearing and fattening program has to be established for wider as a continued selection process.

One graduate student earned M. Sc. degree out of this project information.

Project Title: ***Immuno-prophylaxis of Foot and Mouth Disease (FMD) in bovines.***

Principal Investigator: ***Dr. Khushi Muhammad***
Professor

Location of Project: *Department of Microbiology, University of Veterinary & Animal Sciences, Lahore.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*5.945*
Start Date:	*7/22/2003*	*Funds Released (Rs):*	*4549700*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*4480068*

Objectives:

- Isolation and characterization of field isolates of FMD virus.
- Development and standardization of ELISA and CFT for sero-typing of field FMD isolates.
- Prevalence of FMD and its economical losses.
- Preparation of multivalent vaccine and its evaluation in animals.

Achievements/Progress:

Trivalent FMD vaccine was prepared and is being evaluated in farm animals. The vaccine was injected in animals at military dairy farm, Lahore, Bahader Nagar Farm, Okara, and village animals Chak No. 65 G.B., Faisalabad in January, 2006. The samples are being collected after every 2 months. Three samples up to June have been processed and result is satisfactory. More over, no disease has occurred in these animals in response to exposure to field viruses.

One Ph. D student is working on "Molecular Characterization of FMD virus from field samples", 2nd is working on "Immune Response of Buffaloes to Foot and Mouth Disease Vaccine" and 3rd is working on "Epidemiology of FMD in bovines".

One workshop on "Preparation and Evaluation of Trivalent FMD Vaccine in bovine" was conducted in 2 phases and more than 22 researches from teaching and research organization of the country were trained. Moreover, recently a workshop on "Molecular characterization of FMD viruses from field infected animals" was conducted. In the program 10 candidates from veterinary research and teaching organization were also trained.

Project Title: ***Studies in the effect of Bovine Somatotropins on productive and reproductive parameters of Kundi buffaloes in Sindh.***

Principal Investigator: ***Dr. Saghir Ahmed Sheikh***
Professor (Meritorious)

Location of Project: *Department of Vet. Physiology & Biochemistry, Sindh Agriculture University, Tandojam*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.975*
Start Date:	*7/26/2004*	*Funds Released (Rs):*	*2898500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2481480*

Objectives:

- Evaluate the raise in meat and milk production of rbST treated buffaloes
- Evaluate productive and reproductive performance of rbST treated bullaloes.
- Determine the biochemical and hematological changes in rbST treated animals coupled with hormonal imbalances if any.
- Determine quality of meat and milk from rbST treated animals.
- Appraise feasibility of rbST use.
- Produce manpower with Ph. D degree as part of Human Resource Development.

Achievements/Progress:

Sixteen primaparous Kundhi buffaloes were purchased from the markets. Animal shed repaired according to requirement. Animal acclimatized at livestock experimental station, Department of Livestock Management, Faculty of Animal Husbandry and Veterinary Sciences. Sixteen buffaloes were randomly divided into four groups i.e. Group-A Group-B Group-C and Group-D placing four buffaloed in each group. Groups were used for experimentation. Feed intake of all groups was recorded and computed. Data was analyzed. Milk yield of each buffalo recorded and computed. Data was used as control information before treatment and compared after treatment. Nutritive value of feed stuffs analyzed. Data was used as control information. High energy protein and low energy protein rations were computed. Both ration were formulated and used for study in the animals. Blood samples were collected for biochemical and haemotological analysis. Data before treatment was used as control information and then study was carried out. Hormonal Assay in blood each week specially growth hormone levels in normal and rbST treated animals were carried out, including T3 & T4 of each buffalo. Serum and milk samples were collected for hormonal assay. Data before rbST treatment was used as control information and then comparative study was carried out. Three Ph.D students are enrolled on the project. Three non skilled and two skilled personnel are appointed on contract basis to look after and help in the management of herd. Two research fellows selected through selection committee on merit.

Project Title: ***Genetic improvement of buffaloes in Pakistan (GIBP). (Component-I)***

Principal Investigator: ***Dr. Abdul Ghaffar***
Senior Scientific Officer

Location of Project: *ASI, NARC, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.287*
Start Date:	*11/12/2004*	*Funds Released (Rs):*	*1447200*
Project Status: On-Going		*Funds Utilized (Rs):*	*1112900*

Objectives:

- To initiate a strategic buffalo breeding program on Kundhi buffaloes in Sindh province.
- To supplement the on-going improvement program in the Punjab province.
- To produce performance tested buffalo bulls and superior frozen semen for domestic use and export.

Achievements/Progress:

The detailed work plan for Punjab and Sindh in consultation with respective PIs were finalized and executed at both places.

The data of Kundhi buffaloes from 1976 to 2004 was collected, transferred to specific format, computerized an genetic analysis for ranking the animals was completed. There were 961 records of 242 animals included in this analysis. Amount the 5 sires used during this period one sire contributed positively in mild production of the daughters. The 103 Kundhi buffaloes have positive breeding values for mild production.

Visited the sub-units in both provinces and monitored the field activities. The concerned staff was advised for improvement in data recording procedures.

The PI could not get short term training in USA due to additional security requirements to issue a non-immigration visa.

The cooperating scientist Professor Dr. Ignancy Missztal could not visit Pakistan.

Project Title: ***Enhancing milk yield of Kundhi buffaloes through production of performance tested bulls. (Component-II)***

Principal Investigator: ***Dr. Mushtaque Hussain Jokhio***
Veterinary Officer

Location of Project: *Breed Improvement and Development Centre (SPU), Kundi Buffalo Farm, Rohri*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.556*
Start Date:	*9/14/2005*	*Funds Released (Rs):*	*1521900*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*929558*

Objectives:

- To exploit the production of Kundhi buffalo through genetic improvement.
- To initiate a strategic buffalo breeding program on Kundhi buffaloes in Sindh province.
- To produce performance tested Kundhi buffalo bulls for AI.
- Community involvement in the genetic improvement of Kundhi buffaloes.

Achievements/Progress:

Nucleus herd at K. B. F Rohri consisting of 35 buffaloes has been established. Milk production of all milking animals once in a month is being recorded. Buffaloes came in heat are inseminated. 729 buffaloes of 17 villages of 109 farmers at Rohri, Sukkhur, Ali Wahan, and other villages have been registered under the project. Once in a month milk production of milking animals is recorded. Buffaloes came in heat are inseminated. About 345 buffaloes of 35 farmers of Mirzaabad, Nizam colony, New Cattle and Old Cattle colony and village Kiran Khan Shoro at Hyderabad have been registered. Milk yield of milking animals once in a month is also recorded. P.I and other technical staff regularly visit the registered farmers to give technical advices about the project.

Three bulls of B.I.C unit and two K. B. F are registered under the project. These bulls have been provided separate sheds. Ration to these bulls is supplied from the project funds. Semen is being collected from three bulls for the use in registered buffaloes two bulls of KBF are trained for semen collection after full training semen will be collected from these bulls. Two A. I sub centers at Old Cattle Colony and New Cattle Colony to cover the area around these centers at Hyderabad and one at Rohri have been established.

About 2500 doses of semen from registered bulls have been collected and will be used in the registered buffaloes at Rohri and Hyderabad. This work is in progress. About 2500 doses of semen have been produced and are kept at Hyderabad and Rohri to use in the registered buffaloes.

Project Title: ***Production of breeding bulls to improve milk production of Nili Ravi buffalo in rural areas of Punjab. (Component-III)***

Principal Investigator: ***Dr. Munir Ahmed Chaduary***
Research Officer

Location of Project: *Livestock Production Research Institute, Okara*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.796*
Start Date:	*12/20/2004*	*Funds Released (Rs):*	*3157000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2372904*

Objectives:

- Production of genetically superior bulls progeny testing program to improve the milk production rural buffaloes with the semen of superior bulls.
- Motivation of registered buffalo breeders through educational tools like personal contacts, group meetings and discussions.
- Holding farmer days and milk competitions at quarterly intervals among the registered buffalo breeders.

Achievements/Progress:

Established three sub-centres in Distt. Kasur, Sheikupura & Vehari. Work on these sub-centres is continued during the reporting period. Registration of Nili-Ravi buffaloes.770 buffaloes are under registration at three sub-centres. Milk recording of registered buffaloes. At present 469 buffaloes are under milk recording on monthly basis and 202 buffaloes dried. Purchase and rearing of buffalo male calves. 17 buffalo male calves have been purchased and are being reared. Recording of growth performance of male calves. The calves are weighted on monthly basis. Insemination of registered buffaloes with test bulls semen. Insemination of 341 out of registered buffaloes has been performed with superior bulls semen. Purchase will be made accordingly. Other purchases are made accordingly during the reporting period.

Project Title: ***Effect of civic pollution on fish and fisheries in the riverine system.***

Principal Investigator: ***Mr. Muhammad Afzal***
Senior Scientific Officer

Location of Project: *Fisheries, ASI, NARC, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.996*
Start Date:	*5/21/2004*	*Funds Released (Rs):*	*1848100*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1597586*

Objectives:

- To determine water quality of rivers/streams including estimation of the pollutants such as heavy metals and pesticide/ insecticides
- To study the effect of civic/industrial pollution on planktons, fish and fisheries of our riverine system.
- To devise managemental- plan for sustaining fish population in our
- riverine system and to suggest measures to protect and sustain/increase
- present fish production level.

Achievements/Progress:

Twelve month (June 2005-May 2006) data of Kabul, River, Korang River, Soan River and Nala Lai regarding physico-chemical parameters i.e Dissolved oxygen, pH, Alkalinity, Hardness and Electrical conductivity of water were recorded and statistically analyzed. Some highly polluted Sites were found in River Kabul, Korang River, Soan River and Nala Lai. Four sampling sites of Nala Lai Rawalpindi/Islamabad Gawalmandi and Jhanda Chichi, one site of River Soan near Soan bus stand, two sampling Sites of Korang River (Ponah Faqeeran and Pindorian) and six sampling sites of Kabul River at Peshawar, Nowshera and Kund were found highly polluted and showed poor water quality.

Heavy metals (Ar, Zn, Cu, Pb, Ni, and Cd) were analyzed in the water of different rivers. The results showed some polluted sites regarding the heavy metals. In river Kabul Marble Factory Kund (Source) and Dalda Oil Mill site (Upsteam) were higher in Nickel and Cadmium respectively. Copper was higher in New Katarian bridge and Soan Bus stand sites of Nala Lai. Zinc was higher in New Kartarian sites. In River Soan Nickel was higher in Humak Industrial Area, Sihala Bridge, Kahuta Bridge and Soan Bus stand sites. Cadmium was higher in Sihala and Kahuta Bridges. Zinc was on higher side at Hummak Industrial Area site.

Total eight fish species were caught from River Kabul and River Korang. Concentrations of Zinc, Copper, Lead, Cadmium, Arsenic and Nickel in different organs (muscles, kidney, scales, heart, gills and liver) of fishes, viz. Clipisoma naziri (Shermahi), Labeo dyocheilus (Torki), Cirrhina reba (Bhangan,), Cyprinus carpio (Gulfam), Ompok bimaculatus, Shizopyge labiatus, Puntius sarana and Wallagu attu (Mulli) were studied. The organs like gills, heart and liver were found to be higher in heavy metals estimated. POPS (Persistent Organophosphate Pollutants) were determined with the help of HPLC and found absent in all samples collected from polluted sites of River Kabul and Nala Lai.

Nine genera of zooplankton and twelve genera of phytoplankton were identified from all sampling sites. The Bioassay experiments were conducted for LC 50 estimation of Nickel Chloride and Copper Sulphate on two fish species viz, Bighead Carp (Aristichthys nobilis) and Gulfam (Cyrinus carpio).

Two students form Department of Zoology, University of Arid Agriculture, Rawalpindi have completed their Thesis and Research repot writing.

Project Title: ***Maintaining genetic diversity of 'Kari" sheep breed for sustained development of chitrali patti cottage industry and mutton production***

Principal Investigator: ***Mr. Sohail Ahmed***
Lecturer

Location of Project: *Veterinary Sciences, NWFP Agri. University, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.15*
Start Date:	*8/24/2004*	*Funds Released (Rs):*	*2849500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2789132*

Objectives:

- To study and document the population and characteristics of the Kari sheep.
- To study productive and reproductive performance of sheep under the prevailing small farming system at the habitat.

Achievements/Progress:

The "Kari" was found as a mini breed, involved in the domestic sheep (Ovis aries). This was confirmed from the karyotyping, as the chromosomes number for the breed were same in number as for other breeds in the region. Most of the females were hornless and the males horned. Some males were extraordinarily four horned. The breed can be classified as thin-tail, fine wool mini breed and was believed to the multiplication of the unique strain/bread originated from "Koth" the valley situated as sub-district, Torkhow, of Chitral. The breed is most commonly named as Kari" or "Kedhi", while some people call it as "Kothakan Kari/Kedhi" or Kothakan" accounting for its origin. A report from AKRSP also call it Chitrali sheep.
Patti and Kari sheep were the indivisible parts of the socioeconomic system of Lotkho. Farmers in Lotkho harvested wool from their sheep flocks three times in a calendar year i.e. winter, spring/summer and autumn. Autumn shearing was more restricted to the months of September and October, where as winter and spring shearing was haphazard. Annual greasy and clean fleece yield for Kari sheep was 1098 and 901 g respectively. Wool fiber from Kari sheep was the finest in country and had a mean diameter of 23.17 um, which is comparable to Australian, South African or Booroola Merino.

According to preliminary data analysis, the Gestation period for the breed was extra ordinarily shorter. The mode for the traits was 92 days out of the total observation (above 350). Variation for the trait within and between location/farms was considerablel. The detail of this and the remaining traits will be furnished after careful anaysis of the available data.

Project Title: ***Evaluation of indigenous medicinal plants for the steroid hormonal activities for veterinary and medical usage.***

Principal Investigator: ***Dr. Nazir Ahmad***
Associate Professor

Location of Project: *Department of Animal Reproduction, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*5.046*
Start Date:	*9/8/2005*	*Funds Released (Rs):*	*1556600*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1406592*

Objectives:

- To study the steroid sex hormonal or like activities (oestrogen, progesterone and testosterone) of several common indigenous medicinal and fodder plants.
- To isolate and purify the active hormonal or like substances in the indigenous medicinal plants.
- To investigate feasibility of production of hormonal preparations from the indigenous medicinal plants for therapeutic purposes in animals.

Achievements/Progress:

The first phase of the project was aimed at studding steroid sex hormone or like activities of some common medicinal/fodder plants. For this purpose, search for relevant literature was carried out with a view to select some suitable plants with desired activities and to establish methodology for the preparation of their extracts for further use. As a result, five medicinal/fodder plants including Calotropis procera (roots, branches and leaves), Mucans prurins (Koonch, seeds), Tribulus terrestris (Bakhra, seeds), Medicago sativa (Lucern, whole plants) were selected. These plant materials were dried under shade, grinded into powder form and used for the preparation of aquous, as well as ethanolic extract using Soxhlet Apparatus.

The result indicated that when ethanol was used for extraction, the extract obtained from the leaves (14.17% of the dried plant material) of Calotropis procera (ak) was higher than that from roots (5.33%) or from branches (6.67%) of the same plant. The extraction efficiency for Mucan prurins and Tribulus terrestris I ethanol was 4.50 and 9.09%, respectively. When water was used for extraction, the quantity of extract obtained was much higher than that procera, respectively. The extraction efficiency for Mucuna pruriens and Tribulus terrestris in water was 10.53 and 19.44%, respectively. These results indicate that the extraction effiency was much higher when water was used for extractionas compared with ethanol for the extraction of the same plant. It is well known that the steroid sex hormones (estrogen, testosterone and progesterone) are lipid soluble, while they are insoluble in water. Under such cases, only ethanolic extracts would be suitable for the investigation of steroid sex hormones or like activities of the plants used for extraction. However, if steroid hormonal or like activities are based on specific metabolites, aqueous extracts would also be useful. These results also revealed that leaves of Calotropis procera yielded higher amount of ethanolic, as well as aqueous extract then the roots or branches of the same plant.

One M. Sc (Hons) student has been involved in the project, which is carrying out his thesis research on "Studies on Oestrogenic or like Activity in Different Parts of Calotropis procera". One Research Fellow has been appointed in June, 2005, while the appointment of the second Research Fellow by the

University authorities is still awaited. The purchase of the equipment has been made during the period under report.

Project Title: ***Mott grass as a potential source of dietary forage for lactating Sahiwal cows.***

Principal Investigator: ***Dr. Muhammad Qamar Bilal***
Assistant Professor

Location of Project: *Department of Livestock Management, University of Agriculture, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.66*
Start Date:	*9/14/2005*	*Funds Released (Rs):*	*1101900*
Project Status: On-Going		*Funds Utilized (Rs):*	*803978*

Objectives:

- To determine the proper stage of cut for mott grass feeding and silage making.
- To establish the best additive, level of additive and fermentation period for mott grass silage making.
- To determine the effect of mott grass and its silage on the performance of lactating Sahiwal cows.

Achievements/Progress:

Mott grass is vegetable perennial, highly productive, stay for years in the field and maintains its quality over longer growth intervals. Mott grass is also important because of its abundant availability during feed shortage period (May-June). Silage making of surplus mott grass at this time can cover the other feed scarcity period (Dec-Jan) and can bridge the gap between supply and demand. Thus, mott grass has the potential to provide the quality fodder throughout the year. The objective of the present study was to determine the best stage of cut beneficial for livestock feeding and to enhance the quality of mott grass silage by the addition of additives as it is low in water soluble carbohydrates. To produce the quality silage the addition of additives becomes necessary as it facilities the efficient fermentation. The result of the present study indicated that mott grass cut at 45 days stage of maturity is the best to harvest maximum nutrients needed for more production. The addition of molasses @ 3% found to be the best one at 35 days fermentation period. The pH decreased and lactic acid increased due to level of additive and fermentation period. Dry matter and Crude protein contents increased and fiber contents decreased to some extent. However, in silage where no additive was used maximum pH and low lactic acid was found, indicating the poor quality of silage. Similarly, a loss in Dry matter and Crude protein was observed. The outcomes of this study allow to say that mott grass has the potential to provide quality fodder year round if preserved as silage accordingly, when available in abundance.

Project Title: ***A comparison of concentrate and fodder based finishing diets on the performance, carcass composition and meat quality of Lohi and Sipli lambs***

Principal Investigator: ***Dr. Muhammad Iqbal Mustafa***
Assistant Professor

Location of Project: *Department of Livestock Management, University of Agriculture, Faisalabad*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*1.79*
Start Date:	*9/8/2004*	*Funds Released (Rs):*	*1464550*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1340781*

Objectives:

- The effect of breed of lamb on growth performance, carcass composition and meat quality.
- The effect of diet has on lamb growth performance, carcass composition and meat quality.
- The effect of sex (castrated vs intact) on lamb growth, carcass composition and meat quality
- The interaction between breed and diet for growth performance, carcass composition and meat quality of lamb.

Achievements/Progress:

Statement of Problems:

Pakistan is an important sheep producing country and ranks 11th in sheep population in the world with 25 million sheep (Anonymous, 2005). Pakistani sheep are raised mainly for meat and wool and are important to the economy of Pakistan. There are 28 distinct and recognized breeds of sheep (Alvi, 1991) spread all over the country in small flocks in the irrigated areas. They are also maintained under transhumant system in arid and semi arid regions. The size of flock varies from a few to hundreds. The productivity is fairly low but is still contributes substantially to the national income. The sheep would continue to have importance for increased mutton is expected to increase gradually. All breeds need to be carefully selected and bred for higher growth rate to yield heavier carcasses at young ages. Mutton is one of the most preferred meat in Pakistan.

There is a large population of sheep and goats with substantial production of wool and meat, the entire sheep and goat industry is in more or less primitive condition. The sheep are the principal species for nomadic and transhumant pastoralists in Pakistan. It is estimated that five million farmers and 0.5 millions landless families own sheep in Pakistan. It has also been estimated that about 60 percent of the holdings are up to 5 sheep, 36 percent from 5 to 50, 2.8 percent fro 51 to 100 and only 1.4 percent have more that 100 sheep. It was noted by FAO (1977) that at national level, about 50 percent of flocks are under nomadic system of husbandry. The remaining consist of transhumant and sedentary.

The genetic improvement and nutrition are complementary to each other since the normal growth and development of a healthy animal rest upon adequate nutrition and management. There is no fun in spending a huge amount on breeding or importing of exotic reeds and selecting top quality animals, if these animals are not given chance to balanced rations that should meet the nutritional requirement of the animals all the year round are the most important for growth, development and performance of the animal. Overfeeding is, however, wasteful that it may produce excess fat in the carcass, which quality products and can prevent the animals from attaining its genetically ordained stature and weight. So the

right kind of approach with nutrition of animals is necessary if we want the best result from them. Research in this field is essential to improve growth rate, carcass composition and meat quality.

There is a great variation in lamb carcass quality due to the number of breeds and crosses involved in lamb production. Breed of lamb appears to influence the pattern of development of the important carcass component, and thus carcass quality when comparison is made at equal weights. (Berg and Butter field, 1975, Makarechian et al., 1978; Wolf and Smith, 1983; Lloyed et al., 1985; Gatenby, 1985). It has been found that distinct difference in chemical, physical and organoleptic properties exist between lambs from different genetic backgrounds (Morse et al., 1980).

Plane of nutrition may also affects growth rate, carcass composition and sensory quality of lambs of the same genotype (Drew and Reid, 1975; Murray and Slezacek, 1976; Trenkle et al., 1978; Webster, 1986; Field et al., 1990). However, comparative information on growth performance, carcass quality and carcass composition of lambs of different breeds is scant. The information available has been obtained largely from practical experience.. it does not relate to lambs of different breeds reared in contemporary groups.

This experiment is designed to investigate the effects of two different breeds and diets on growth performance, carcass composition and meat quality characteristics of similarly managed lambs from weaning to slaughter. The lambs of two common breeds from two different systems are being sued in this experiment. Lohi lambs represent the predominant breed of irrigated areas of central Punjab. The other lambs are Sipli which are found in desert areas of the Punjab. Wether and intact from both the breeds will be chosen to see the effect of sex on growth performance, carcass composition and meat quality. The lambs will be finished on two commonly used concentrate and fodder-based diets.

Identification of the breed of sheep suited to a certain system of production e.g. concentrate or forage based, will make it possible to finish the animals of that breed according to their actual requirements and potential. This will certainly help to reduce the feed and labour cost and thus benefiting the farmers. This will also make it possible to slaughter the animals at appropriate time, which will definitely improve feed efficiency and meat production per animal. The meat thus obtained will be of good quality.

Project Title: ***Clinical and biochemical studies on genital prolapse in the buffalo***

Principal Investigator: ***Dr. Laeeq Akbar Lodhi***
Professor/Chairman

Location of Project: *Dept. of Clinical Medicine and Surgery, Faculty of Veterinary Sciences, University of Agriculture, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.794*
Start Date:	*8/25/2005*	*Funds Released (Rs):*	*2025000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*377100*

Objectives:

- To conduct survey of the genital prolapse under different agro-ecological zones and production systems in the country.
- To study haematological, biochemical and hormonal profile in buffaloes suffering with the problem and in clinically healthy buffaloes as a control.
- To investigate level of macro and micro minerals in soil, fodder and blood of the buffaloes suffering with genital prolapse for the adoption of therapeutic measures.
- Development of suitable packages for treatment, prevention and control of the problem according to various zones.

Achievements/Progress:

Epidemiological survey proforma was developed and discussed with statisticians and field staff for drawing meaningful outcome. The survey work was spread over 3 agro-ecological zones of the Punjab and areas of Hyderabad and Karachi from Sindh for Kundi buffaloes. Six districts two from each zones of the Punjab and two districts of buffalo colonies in Hyderabad and Karachi were visited to develop cooperation and training of the personnel for survey work. Distribution of respondents in each district was based upon the population of buffaloes in that district documented by Ahmad et al. (2000). Under prevailing production, housing and feeding system out of total 750 survey proforma 145 have been completed by the end of June, 2006. Retrospective information to determine occurrence of genital prolapse in the buffalo was recorded in terms of parity, season, milk yield, time of gestation for vaginal/vaginal-cervical prolapse and uterine prolapse after the delivery of the calf. Fate of diseased buffalo and cost of treatment was also taken into account.

Comprehensive review of literature on the subject was made to seek guidance on analytical methodology and to find out reported risk factors leading to the development of genital prolapse in small and large ruminants including buffaloes. Regarding biochemical studies on genital prolapse in the buffalo 50 plasma/serum samples have been collected from the disease cases, in addition to the same number of plasma/serum samples from clinically healthy buffaloes to fulfill the requirement of case control studies. Samples of feed and fodder fed to these animals were collected, digested and preserved for subsequent biochemical analysis. Purchase of equipments worth Rs.825219/- has been made during the year.

Project Title: ***Effect of long term use of bovine somatotropic (bST) hormone on milk production, reproduction, health and various physiological parameters in Nili-ravi buffaloes***

Principal Investigator: ***Dr. Makhdoom Abdul Jabbar***
Chairman/Associate Professor

Location of Project: *Department of Animal Nutrition, University of Veternary and Animal Sciences , Lahore*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.464*
Start Date:	*7/17/2004*	*Funds Released (Rs):*	*1084500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1081327*

Objectives:

- To study the long term effect of Bst hormone on milk production in Nili-Ravi buffaloes.
- To study the effect of use of bST on reproductive behaviour and other physiological parameters in buffaloes.
- To compare the efficiency and economics of milk production of treated animals versus control.
- To determine the quality of milk under influence of Bst hormone through chemical composition.

Achievements/Progress:

Thirty lactating buffalo at about same stage of lactation and 8-10 lit. of milk were randomly allotted to two groups.
One group A was treated with BST-hormone, while group B was kept as control. The group A was further divided into two sub groups, A-1 and A-2. The animals in group A-1 were given BST hormone injection at the interval of 14 days while the group A-2 was given the same injection at 3 equal sub doses on alternate days. All the 3 groups were kept under similar feeding and management conditions. The trial started in December 2004 and completed in May 2005. Duration of study was 6 months.

Nutritional requirements of animals were met through fodder and concentrate ration. The maintenance requirements were met through fodder while the production requirements were provided through concentrate ration. The weighment of fodder offered was made on weekly basis. The per animal fodder offered was 65 kg/animal/ day. The ration was given @ half of milk production. This was given mainly at the time of milking and rest of ration if any was given in the morning before offering fodder. Composition of fodder and ration are given in results section.

Milk production of each animal was recorded in the morning and evening time. Both records were then added and processing of data was done on daily milk production basis.

Both weight of experimental animals were recorded on monthly basis.

The animals were observed for postpartum estrous, service period and service per conception.

The milk samples were analyzed for fat, SNF and total solids percentage. The fat % was determined using Gerber test while SNF & TS were determined using lactometer reading Richmond formula.

Project Title: ***Genetic characterization of native cattle breeds of Pakistan***

Principal Investigator: ***Dr. Safdar Ali***
Professor

Location of Project: *Department of Animal Breeding & Genetics, University of Agriculture, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.628*
Start Date:	*4/6/2004*	*Funds Released (Rs):*	*3651800*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3265307*

Objectives:

- To develop phylogenetic relationship among indigenous cattle and buffalo breeds of Pakistan.
- To identify breed specific DNA markers for genetic characterization of different breeds of cattle and buffaloes.

Achievements/Progress:

Since the present project on the genetic characterization of Native Cattle and Buffalo Breeds of Pakistan was started recently, we have shown some results of using RAPD markers in 3 Buffalo breeds. The work on the remaining cattle and buffalo breeds is in the process of completion. We have collected more blood samples both from cattle and buffalo breeds from different parts of Pakistan. The sampling on all the buffalo breeds including Azi-Kheli has been completed. The DNA extract from most of the samples of blood from different breeds of cattle and buffalo has been completed. The DNA extraction has been completed from all the available samples (about 200). DNA concentration of most of the samples has also been calculated. The quality of DNA extracted was checked by running 10 ng of DNA on agarose gel in 0.5 X TBE buffer. Most of the samples showed good quality and concentration. In the next phase we shall use RAPD analysis for genetic characterization of these breeds.

Project Title: ***Development of milk recording and genetic evaluation models in Sahiwal cattle***

Principal Investigator: ***Dr. Muhammad Sajjad Khan***
Associate Professor

Location of Project: *Department of Animal Breeding &Genetics, University of Agriculture, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.695*
Start Date:	*5/22/2004*	*Funds Released (Rs):*	*2811800*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2135731*

Objectives:

- To develop an information system for Sahiwal cattle for data recording in public and private sector to be used for dairy cattle recording in future.
- Computerization of the available data on the breed from various public institutions maintaining Sahiwal breed for use in genetic evaluation.
- Development of recording schemes for milk recording at institutional as well as tenant herds to introduce recording culture at farmer level.
- Development of genetic models for different recording plans and identification of genetically best animals for use as dam/sire lines for up-gradation and propagation of Sahiwal population.

Achievements/Progress:

Project continues with the objective of computerization of historical performance data of the Sahiwal breed and development oif statistical models to genctically evaluate cows and bulls for traits like milk yield. Tenant Sahiwal farmers both around Livestock experiment Station Bahadurnagar, Okara (LESB) and Livestock Experiment Station Jahangirabad, Distt. Khanewal (LESB) to assess the availability of cows to be monitored for development of recording protocol at farmer level as expected in the project document. Surverys condutcted in September 2004 indicated that there were 89 tenant herds at LESB. They were required to have 290 cows while total number of cows kept by them was 270 at LESJ total number cows available with the 118 Pattahdars were 387 as opposed to 422 expected. The quality of animals were also not upto mark in terms of breed characteristics and productivity. Starting of milk recodrding at LESJ was real challenge because this had never been done. Tenants did not agree with the plastic tags as identification mark because some of the applied tags got torn off, application was difficult and farmers perceived them to be a source of reduction in price of the cow. The practice was abandoned after intitial failure to convince the farms for plastic ear tagging. Almost all the cows with the tenants were then marked with hair coloring dyes but then with 30 days (before fading of black color) all the cows were freeze branded. Research Centre for conservation of Sahiwal Cattle (RCCSC) cooperated in this regard. To find genetically superior bulls for use under AI for the tenant herds and the other Government Sahiwal farms, a study was conducted (Appendix I). The recording sheets to record milk yield were developed and monthly recording started. Both the stations are composed of 5 clusters. To highlight the objectives of the project and to bring all the stakeholders on board, a workshop was held, proceedings of which are being annexed (appendix II). Some of the historical dada were computerized at lactation level and test-day computerization continued

Longitudinal performance data on Sahiwal cattle breeds was computerized for the main five herds of Sahiwal with Livestock and Dairy Development Department of Punjab to develop a database for the development of statistical models to genetically evaluate cows and bulls for traits like milk yield. Recording continued with the Tenant Sahiwal farmers around. Livestock Experiment Station Bahadurnagar, Okara (LESB) and Livestock Experiment Station Jahangirabad, District, Khanewal (LESJ). These farmers were facilitated for deworming of their animals and fodder seed. Using complete lactations of about 5000 Sahiwal cows, three studies were completed. Study is being prepared regarding the effect of inbreeding on performance traits. Test day records of LESj since 1980s have also been computerized while similar effort is underway for LESB. Comparison of lactation curves for institutionally recorded and filed recorded cows is being initiated. A color inheritance study is also planned for the next few months.

Project Title: ***Development of supplementary feed based on apparent nutrient digestibility of different feed ingredients for Labeo rohita fingerlings.***

Principal Investigator: ***Dr. Muhammad Salim***
Assistant Professor

Location of Project: *Department of Zoology & Fisheries, University of Agriculture, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.137*
Start Date:	*9/14/2005*	*Funds Released (Rs):*	*1373500*
Project Status: On-Going		*Funds Utilized (Rs):*	*855139*

Objectives:

- To determine apparent nutrient digestibility of twenty feed ingredients.
- Development of compatible and suitable supplementary diet.
- To increase the integrated period of the test and reference diets.

Achievements/Progress:

The polyculture system is a common practice for the cultivation of local fish species (major carps) and exotic fish species (Chinese carp) in Pakistan. The growth of major carps is comparatively slower than Chinese carps. For better growth of major carps, fish farmers generally used supplementary feed, prepared by mixing 2 or 3 conventional feed ingredients. To facilitate the fish farmers, there is need to develop nutritionally balanced supplementary feed. The formulation of fish feed depends on the knowledge of digestibility of feed ingredients. The information on digestibility of locally available feed ingredients for major carps is not available under local environment.

The main problem associated with digestibility research for aquatic species is the collection of fecal material. For the collection of fecal material, a settling column system has been modified and designated as modified UA system. The present information of digestibility of twenty feed ingredients will facilitate the formulation of fish feed.

Project Title: ***Pharmacokinetics and dosage of flouroquinolones in animals.***

Principal Investigator: ***Dr. Faqir Hussain Khan***
Associate Professor

Location of Project: *Department of Physiology and Pharmacology, University of Agriculture, Faisalabad*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*3.1*
Start Date:	*2/11/2006*	*Funds Released (Rs):*	*1977000*
Project Status: On-Going		*Funds Utilized (Rs):*	*481602*

Objectives:

- Establish therapeutic norms/ dosage regimen in the indigenous domestic animals and environments.
- Pharmacokinetics of quinolones would provide a basis for determination of an optimal dosage regimen of these antibacterial agents in indigenous animals under indigenous conditions.
- The rational dosage regimen of fluoroquinolones on the basis of the original kinetic data under our own specific indigenous conditions would be helpful for successful treatment of infectious diseases in animals.
- Describe the preslaughter withdrawal period to provide wholesome food to human beings.

Achievements/Progress:

Survey of relevant literature was carried out. Purchase of chemical and equipment is in progress. Preliminary trials of drugs (norfloxation, in sheep and goat has been conducted). One post of research fellow was advertised in the press, selection has been made and order has been issued and the research fellow has joined on 15-07-06.

Project Title: ***Application of PCR technology for the detection of avian mycoplasma in poultry birds and farm environment.***

Principal Investigator: ***Dr. Sajjad-ur-Rahman***
Associate Professor

Location of Project: *Deptt. of Vet.Microbiology,University of Agriculture, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.939*
Start Date:	*2/22/2006*	*Funds Released (Rs):*	*1476000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1419096*

Objectives:

- To establish methods for isolation and biocharacterization of avian mycoplasma species from respiratory problems in birds and from poultry farm house environment.
- Screening test antigens of MS, MG and MM will be prepared from local isolates separately and techniques for conventional screening tests like RSA and HI will be standardized using hyper immune serum.
- Latest technique of PCR based diagnosis of avian mycoplasma will be adopted in the Mycoplasma Research Laboratories (MRL), Department of Veterinary Microbiology.
- To compare the efficacy of conventional screening methods (RSA, HI) and latest diagnostic technique of PCR for the detection of mycoplasma species in birds and farm house environment.
- To introduce the latest technology for raising mycoplasma free flock to the farmers in public and private sector and field veterinarian, particularly to meet the requirements of World Trade Organization (WTO) programs in the country through seminar and workshop.
- To establish Mycoplasma Research Laboratories (MRL) in the Department of Veterinary Microbiology in collaboration with National Agricultural Research Centre (NARC).

Achievements/Progress:

Eighteen different Mycopasma culture (Mycoplasma maleagrids, Mycoplasma gallisepticum & Mycoplasma synoviae) were procured from Poultry Diagnostic & Research Centre, Georgia USA, through the courtesy of Prof. Dr. S. H. Kleven. Maintained fresh cultures in the laboratory at refrigeration temperature (8-10c). Prepared selective media (Frey's Modified Medium, Swayne. Et al. 1998) for the isolation of Mycoplasma spp. from poultry birds and farm environment. Successful propagation of standard cultures was achieved on the Frey's modified broth, Indicating that qualities of medium and cultivation technique is satisfactory.

Necessary repair and renovation of Research Laboratory was started which include the adjustment of imported ceiling, fixture of cupboard and table. Purchase of necessary equipment for the laboratory/all the minor equipment were purchased particularly Computer (P-IV), Freezer ((20c), Vertex Shaker, Micro dispensers, Microwave oven, Temperature control unit (Split type Haier) and Laminar air Flow Cabinet. The supply orders have been issued for the Thermocycler, Gel Documentation System and Gel Electrophoresis apparatus. Necessary equipment for the smooth running of the Laboratory work will be completed in the next six months period of time subject to the release of funds without further delay.

Project Title: ***Influence of altering dietary cation anion difference on productive and reproductive efficiency of buffaloes***

Principal Investigator: ***Dr. Muhammad Sarwar***
Professor/ Director

Location of Project: *Department of Animal Nutrition, University of Agriculture, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*5.058*
Start Date:	*5/28/2004*	*Funds Released (Rs):*	*4389800*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3777645*

Objectives:

- The main objectives of the present project are to examine the influence of altering DCAD on
- Reproductive efficiency,
- Milk fever incidences
- Milk yield and its composition in buffaloes under different physiological and environmental conditions and
- Extension of DCAD technology to dairy farmers.

Achievements/Progress:

The summer trial experiment was focused to examine the influence of varying DCAD on occurrence of milk fever in Nili Ravi buffaloes in a randomized complete block design during summer. Four iso-nitrogenous and iso-caloric diets were formulated with -110 +110, 220 and +330 DCAD levels. These DCAD levels were attained by using CaCl2 and NaHCO3. Twelve early pregnant buffaloes were randomly allocated to four dietary treatments, three buffaloes in each treatment. The experiment lasted for five month.

A linear increase in nutrients intake was recorded with increasing the DCAD level. Buffaloed fed -110 DCAD diet had higher nutrients digestibilities than those fed the +110 + 220 and +330 DCAD. Blood pH and HCO3 also increased linearly with increased DCAD level. Serum CI was high in buffaloed fed -110 DCAD diet. While serum cation anion difference increased linearly with increasing the DCAD level. Serum Ca increased with decreased DCAD level while serum Mg, P and S remained unaffected. Urine pH increased with increased DCAD level. A contant increase in urinary excrtion of Ca, Mg, P and CI was observed with decreasing while Mg, P and S balance remained unaltered due to DCAD alteration. Not a single case of hypocalcemia was observed in buffaloes fed the -110 and +110 DCAD diets. However, one buffalo from each group fed +220 and +330 DCAD diets had hypocalcemia. This experiment indicated that -110 and +110 DCAD diets not only increased calcium balance but also hypocalcemia in Nili Ravi buffaloes.

This Winter trial experiment was conducted to examine the influence of varying DCAD on nutrient intake, digestibility, acid base status, milk yield and its composition in Nili Ravi buffaloes in a randomized complete block design during winter. Four iso-nitrogenous and iso-caloric diets were formulated to have -110, +110, +220 and +330 DCAD consentration. These DCAD levels were attained by using CaCl2 and NaHCO3. Twelve early lactating buffaloes were randomly allocated to four dietary treatments, three buffaloes in each treatment. The experiment lasted for five months.

Data obtained so far indicated that nutriet intake, milk yield and milk fat content increased in buffaloes fed +220 and +330 DCAD diets. Blood pH and HCO3 and urine pH increased nitrogen balance than those fed -110 and +110 DCAD diets. Serum Na, K, S, Mg and P concentration remained DCAD. Buffaloes fed +220 and +330 DCAD diets had higher energy balance than those fed -110 and +110 DCAD diets. Rectal palpation also revealed increased ovarian activity in buffaloes fed +220 and +330 DCAD diets. This trial indicated that higher DCAD diet (+220 and +330) not only increased nutrient intake, acid base, energy balance, milk yield fat contents but also increased ovarian activity.

[Note: Serum samples for mineral balance (Na, P, Ca, Mg, S, K and CI) and hormones (Estradiol, Progesterone and cortisone) are yet to be analyzed}.

Project Title: ***Taxonomical studies of the prevalent ticks species on different livestock hosts throughout NWFP***

Principal Investigator: ***Dr. Rehim Ullah Shah***
Research Officer

Location of Project: *Veterinary Research Institute, NWFP, P.O.Box 367, Peshawar*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*2.629*
Start Date:	*1/25/2005*	*Funds Released (Rs):*	*1092000*
Project Status: On-Going		*Funds Utilized (Rs):*	*459295*

Objectives:

- Survey for Collection / Preservation and Processing of the prevalent Ticks.
- Collection, preservation and mounting of collected tick specimens.
- Taxonomical identification of prevailing ticks throughout NWFP using proper keys.

Achievements/Progress:

Data collection on the questionnaire format enclosed herewith. Preserved for onward processing. Field visit made to Distts of:
I.Buner
II.Lower Dir
III.Sawat
IV.Shangla
V.Mansehra and Malakand agency

Collected specimens preserved. Methodolgy preservation in 70 % Ethanol. Mounting not yet been started officially and will be intended for permanent preservation pl. Specimens collected: Serial sampling i.e. Age, Sex and Spp wise in specimens collection tubes 10 from each group (each containing 03-10 ticks) 40 X 6 Distt= 240

Project Title: ***Promotion of animal balanced feed in farmer community***

Principal Investigator: ***Mr. Abdul Rehman Soomro***
Technical Coordinator

Location of Project: *Indus Resource Center Haji Allam Channa Colony, Sehwan, District Dadu, Sindh*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*2.376*
Start Date:	*5/29/2004*	*Funds Released (Rs):*	*2344685*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2263090*

Objectives:

- To exploit leadership potential of both men and women at the local level and build their skills to benefit from modern knowledge and technology;
- To reduce gender disparities with regard to socio-economic indicators of the partner communities;
- To design and implement community-based poverty alleviation programs as tools for individual and institutional strengthening;
- To pick up issues from the field and turn them into subjects of meaningful research, workshops, seminars, advocacy and policy dialogues;
- To facilitate and network with other resource organizations for field testing of innovative and cost effective ideas for income generation;
- To collect and disseminate information leading to awareness, development and empowerment of marginalised communities on a regular and routine basis;
- To bring out publications and use print and electronic media extensively for development education and image building of the civil society;
- To join other civil society organizations in the struggle for good governance and democratization.

Achievements/Progress:

Indus Resource Centre (IRC) conducting an action research project titled " Promotion of Animal Balanced Feed in Farmer Community" through testing the PARC animal balanced feed in rural field circumstances through adopting changes and test the viability of the process of promoting the feed in farmer community' was initiated in 20 villages of two talukas of district Dadu, Sindh, Pakistan. Main activities during the reported period were selection of potential villages, formation of Livestock Management Committees (LMCs), capacity building of organizations regarding animal balanced feed and livestock management, organization strengthening to continue the feed promotion in farmer community; P ARC feed demonstration and promotion of animal balanced feed.

Out of 40 identified villages 20 were selected at particular criteria and baseline survey was conducted of selected villages. A comprehensive baseline survey report is also ready for publication. In potential villages 38 (20 male & 18 female) livestock owners' organizations formed in three steps (i.e. introductory meetings; consultation meetings and organization formation meetings). After organization formation, conducted 94 village level training workshops in three series, each series was conducted with each organization and two Office Bearers' level workshops conducted at IRC office. Consequently 663 (437 male and 226 female) farmers' trained against targeted 400 (200 each male & female) farmers'. Manuals and training material was developed before each training. All the three series of trainings were documented and would .be included in final project report.

During capacity building activities the demonstration of PARC balanced feed was the core activity from October to December 2004, to evaluate the performance of feed in rural field conditions. For the purpose 40 milking and 40 meat animals selected at particular criteria in farmers' workshop and fed PARC feed for 90 days. Performance indicators were set, pre-demonstration data of each milking animals was collected through a questionnaire. During demonstration weekly monitoring conducted through monitoring formats. Data analyzed and revealed that 20 % more use of PARC feed than local concentrate with usual fodder:

The lactating buffalo significantly decreased the dry fodder consumption (14.56%) while lactating cow have non significant effect;

Lactating buffaloes increased milk production and profit 23.8% and 74.4% respectively and lactating cows increased 25.55%milk production per animal per day.

Lactating buffaloes and cows improved health and milk quality parameters like eye conditions improved from pasted to moderately shine; skin improved from rough to moderately shine; hairs improved from rough to smooth and digestibility remained soft.

Regarding milk quality, the density recorded normal to moderate dense and milk sweetness recorded normal to moderate sweet averagely.

In rural field circumstances buffalo and cow calves and male goat raised at P ARC feed for 90 days and gained weight 42.5±13.06±33.13 ±16.49 and 9.0±3.563 kg in 90 days per animal respectively. Beside this considerable improvement in health was also noted, like eye conditions improved from normal to moderately shine; skin improved from rough to moderately shine; hairs improved from rough to smooth; digestibility remained soft and average fat deposition observed from poor to excellent.

All the activities enabled the environment to promote the PARC feed in farmer community. In seven months period from December 2004 to June, 2005 at a total 26 PARC feed shops have been opened, highly encouraging feed sale 951 bags (71 %) out of 1.332 bags was recorded.

Project Title: ***Microbiological studies on caprine mycoplasma in Balochistan***

Principal Investigator: ***Dr. Mohammad Arif Awan***
Veterinary Officer

Location of Project: *Centre for Advanced Studies in Vaccinology and Biotechnology (CASVAB), University of Balochistan, Livestock Complex, Brewery Road, Quetta.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.8*
Start Date:	*10/26/2004*	*Funds Released (Rs):*	*2130000*
Project Status: On-Going		*Funds Utilized (Rs):*	*387652*

Objectives:

- To study the clinical manifestations and pathology in the mycoplasma suspected affected animals.
- To carry out the isolation and identification of caprine mycoplasmas particularly Mccp from the morbid tissues.
- To reproduce an experimental disease in the susceptible goats using the local field isolates of mycoplasma. Spp.
- Prepare an effective vaccine from the suitable local field isolates of mycoplasma.

Achievements/Progress:

Placement of work orders for the procurement of lab equipments, chemicals, media, reagents, glassware, furniture, computers and other consumable items and partial supply of the same have been made. Further three DPLs have been selected and are working in mycoplasma laboratory at CASVAB. The districts having maximum goats population with and without the complaints of contagious caprine pleuropneumonia have been marked and selected to make the scheduled visit for animal sampling, tandardization of laboratory procedures for the isolation and identification of mycoplasmas from the morbid samples of goats have been started.

Project Title: ***Studies on mineral imbalances in the livestock of canal irrigated districts of the Punjab.***

Principal Investigator: ***Dr. Talat Naseer Pasha***
Professor

Location of Project: *Department of Animal Nutrition, University of Veterinary and Animal Sciences, Lahore*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*8.596*
Start Date:	*9/21/2005*	*Funds Released (Rs):*	*3509000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3233316*

Objectives:

- The long-term project objective is the efficient and balanced feeding resulting in better health of the livestock at lower cost of production leading to increased productivity of milk and meat of livestock resulting in higher income, better nutrition and improved food security for small holder farms.
- Mineral (macro and micro) mapping of the ten canal irrigated districts of the Punjab based on water, forages, feedstuffs, soil and serum analyses.
- Development of mineral mixers, feed supplements for livestock as per needs of the different districts of the Punjab.

Achievements/Progress:

Tenders for purchase of chemicals were floated. The required chemical and glassware procured. Laboratory furniture and fixture was purchased and installed. For the renovation of Laboratories for proper working condition, tenders were floated by the purchase of cell for the University and rates were determined for hiring of vehicles for the project area. A contractor was appointed by the University for Provision of Vehicle for project activities. One Research Associate and two Research Fellows were hired w.e.f 1-02-2006. The Director General (Extension) Livestock Department and District Livestock Officers were approached for their assistance in samples collection, Samples collected from 5 sites at districts of Hafizabad, Okara, Kasur, Lahore, Sheikhupura, Gujranwala. Different proformas were developed for the obtaining information of each sample. The proformas were printed and sampling records are maintained. Total samples collected are Soil: 45, Water: 83, Fodder: 104, Feedstuff: 1520 Blood & Milk: 121.

Preparation of samples for analysis and digestion of samples completed. The standards for the macro procured. The test samples and standards were run at the instrument. Standard curves for each required mineral were made and analysis of the samples initiated. GIS center of Department of Geography, University of the Punjab, Lahore was approached. A presentation was made by Mr. M. Nawaz, GIS-Expert to the project staff at UVAS.

Project Title: ***Development of database on minerals profile of feedstuffs, their availability and strategic supplementation of minerals block to dairy animals.***

Principal Investigator: ***Dr. Atiya Azim***
Senior Scientific Officer

Location of Project: *Animal Sciences Institute, National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.513*
Start Date:	*9/17/2005*	*Funds Released (Rs):*	*1067500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*462053*

Objectives:

- To generate database on minerals profile of feedstuffs i.e. crop residues, green fodder and concentrate feed ingredients.
- To quantify availability of minerals to dairy animals.
- Execution of minerals supplementation strategy through minerals powder mixture and particularly minerals block development.

Achievements/Progress:

Samples of feedings i.e, green and dry roughage and concentrate feed ingredients were collected in two phase. During first phase of the study, samples were collected from LRS, Islamabad and Livestock Breeding and Dairy Farm Harichand, NWFP and from its periphery farms. However, during second phase of the study, samples were collected from LRS, Islamabad, BLPRI Kherimurat, Attock, Livestock Breeding and Dairy Farm Harichand, NWFP and Livestock Research Station, Surazi, NWFP and from its periphery farms. The above mentioned research stations are defined as the location whereas under each location, there were about 3 to 4 sub locations.

During first phase of the study, samples were collected from LRS, Isamabad and Livestock Breeding and Dairy Farm Harichand, NWFP and its periphery farms. However, during second phase of the study, samples were collected from LRS, Islamabad, BLPRI Kherimurat, Attock, Livestock Breeding and Dairy Farm Harichand, NWFP and Livestock Research Station, Surazai, NWFP and from their periphery farms. Collected samples were dried at 100c for dry matter determination. Dried samples were labeled, ground through lmm screen and stored for mineral analysis. Samples were analyses for macro and micro minerals. Sodium and potassium were analyses by flame photometer, phosphorus by spectra photometer and calcium, magnesium, copper, cobalt, manganese and zinc were analyses by atomic absorption spectra photometer (Varian). Samples were also analyses for proximate composition.

Discussion was held with different Feed Mill Plant manufactures and survey conducted to prepare the blue print/design of the proposed plants for preparation of minerals premix and mineral blocks. Tender document for Lab. Equipments and machinery for mineral premix and mineral block was prepared, administrative approval obtained and tender has been floated. Tender document for Re-modelling of animals shed according to the project requirement has been prepared and submitted to the concerned department. Tender has also been floated.

Project Title: ***Studies on epidemiology of peste des petites ruminant (PPR) in Pakistan***

Principal Investigator: ***Dr. Aamer Bin Zahur***
Senior Scientific Officer

Location of Project: *Animal Sciencises Institute, National Agricultural Research Centre,Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*5.969*
Start Date:	*9/17/2005*	*Funds Released (Rs):*	*3845000*
Project Status: On-Going		*Funds Utilized (Rs):*	*2493482*

Objectives:

- To study the epidemiological factors responsible for persistence/ transmission of PPR virus in small ruminants.
- Development of laboratory assay for the diagnosis of PPR.
- Isolation and characterization of PPR virus from field cases.

Achievements/Progress:

Developed a data base of PPR outbreaks in Pakistan from May, 2002, to June, 2005 from information available in PDS reports and documented outbreaks. Six suspected outbreaks of PPR were attended during the year. The field investigation were carried out regarding the transmission of PPR virus. Clinical and postmortem examination of diseased and dead animals were carried out and forty samples comprising of blood, lungs, spleen, liver and mesenteric lymph nodes were collected. These samples were analyzed in the laboratory using IcELISA for PPR. The positive samples were processed for virus isolation and haemagglutination (HA) test. Moreover field's investigations were also carried out in five selected areas of Sindh province i.e, Sukkur, Dadu, Hyderabad, Mithi and Karachi to ascertain the epidemiological factors responsible for persistence/transmission of PPR virus.

Established cell culture facility and isolated PPR virus from field cases (Three isolates). The isolates were identified using CPE and Immunocapture ELISA, electron microscopy and RT-PCR. Standardization of haemagglutination test (HA) for diagnosis of PPR using field samples is in process. RBCs of different species (catle, buufalo, sheep, goat, mice, rabbit, chicken, monkey, and human group "O" were tested. However activity of PPR virus was observed using chicken RBCs. Now developing a positive control by adopting the isolates onto vero cells.

Five workshops for sensitizing the field staff and farmers were planned and organized successfully at Karachi, Hyderabad, Dadu, Sukar, and Mithi districts of Sindh provinces and districts Dera Ismail Khan of NWFP provinces on the diagnosis and control of Transboundary Animal Diseases in collaboration of SLSP, FAO region projects and PARC. About 600 participants (100 at each venue) including veterinarians, paravets and farmers attended the workshops at all venues. The participatans were briefed about the etiology, epidemiology, clinical signs, treatment and control of PPR and FMD. The current status of PPR in the country was also discussed.

Project Title: ***Role of steriod hormone in regulation of ovarian folliclar development in Tor Putitora***

Principal Investigator: ***Mr. Zafarullah Bhatti***
Dy. Director (Fisheries)

Location of Project: *Fish Hatchery & Research Center, Rawal Town, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*8.5*
Start Date:	*9/27/2005*	*Funds Released (Rs):*	*5253500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1414435*

Objectives:

- To generate information which would enable us to better understanding of hypophyseal and steroidal regulation of the ovarian follicle in Tor putitora This information help in conservation of this species through artificial breeding. Although the objectives of the program are evident in the above description, these may be more precisely stated as follow:
- Although it is known that gonadotropins cause follicular growth, maturation and ovulation in fish, it has not been possible to stimulate follicular growth in vitro or in vivo at the time when fish ovary contain young oocytes. It is hoped that in vitro incubations of ovarian segments with gonadotropin alone or in combination with steroids will provide useful data in this context.
- We hope to achieve answers regarding relative importance of various steroids in follicular development. According to the presently available information a variety of both interregnal and gonadal steroids regulate final maturation of follicles in teleost fishes. However species variation exist. We hope to learn
- (a) which steroids are important in the local species selected for research, and
- (b) which stage of follicular development is regulated by particular hormones (gonadotropin, steroids) in this species.
- Endocrine research of any importance has hardly been done on any commercially important local species and only one study (Zuberi et al., 2002a, b) related to hormonal regulation of ovarian development in two local species of fish from this country exist.
- We hope to achieve useful and essential information about hormones available in the incubate following exposure of ovarian segments to various hormones in vitro, particularly gonadotropin and steroids. Such studies have been done on only two local species (Ghaffar, 1988; Zuberi, 1990, 2002a, b). The data have revealed species variability on the one hand and incompleteness of approach on the other.

Achievements/Progress:

1.Market Survey
Market survey was performed in order to purchased all the items related in project. Most of chemicals/ steroids was not available in local market. So for the unavailability of these chemicals and steroids, project activities were delayed. Under such situation competent authority decided to purchase theses items through tender. So, open tender was called and contract of chemicals, glassware and steroids was assigned to following three companies.

M/S Imran Scientific Company
M/S A.M. Scientific System

M/S Great Pak Scientific Company
Survey for all other items is completed.

2.Purchase of Major Equipment
For the purchase of major items open tender on FOR basis was called and except HPLC workstation all the other major equipments has been purchased and installed which are follows.

Cooled incubator Model MJR-153
Laminar Flow Cabinet Model SHC-4AX-ESCO
Microscope Digital Binocular with USB camera

Contract of PHLC workstation was awarded to M/S Analytical Measuring System on dated 31-08-2006. Now its installation will be completed in December 2006. As the major equipment is not available so project activities was greatly hampered.

3.Site Survey
Different site such as Wah Garden, Simly Dam, Mangla Dam, Rawal Dam, Jand (Indus River) and Hattian Nursery unit Attock have been visited for checking the availability of live Mahseer and two sites i.e., Jand and Hattian nursery Unit Attock have been selected for the Collection of Fish samples. As Mahseer is a game fish so transportation of alive fish to Nursery unit become the basic problem so fishes was sacrifice on the spot and blood was collected.

4.Ovarian Cycle and Gonadosomatic Index
Preliminary work on ovarian cycle and gonadosomatic Index of female Tor putitora has been made. Fishes were collected from different sources i.e wild Mahseer from (Jand and Ziarat at Indus river) and pond fish from (Hattian Nursery Unit Attock) but reports showed the difference in the breeding cycle of wild and pond raised fishes, so next year, only one site will be selected for the collection of fish sample.

5.Extraction of Steroid.
Extraction of steroid hormones from ovarian tissue and blood has been started. But remained uncompleted due to unavailability of cartridge and HPLC solvent in open market.

6.Histology
Other scientific work like histology, photography and invitro incubation of ovarian follicle is in progress.

Project Title: ***Aquaculture of fin fishes (Snappers and groupers) in ponds along Hub river Estuary/ Gharo Creek***

Principal Investigator: ***Syed Makhdoom Hussain***
Professor

Location of Project: *Centre of Excellence in Marine Biology, Karachi University, Karachi,*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.679*
Start Date:	*4/17/2004*	*Funds Released (Rs):*	*3731000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3078439*

Objectives:

- Growth potential and survival rate of one species each from Snapper and Grouper out of the two species mentioned below will be studied Snappers: Lutjanus lutjanus Bloch, 1790 and L. johni (Bloch, 1792)
- Groupers: Epinephelus fuscoguttatus (Forsskal, 1775)and E.tauvina (Forsskal, 1775). The selection of the species will be based on the easy availability of seed from wild.
- Step wise development of grow-out techniques on different protein level diets based on locally available ingredients.
- Determine economic feasibility of marine fin fish culture.

Achievements/Progress:

Grow out of fishes in Mono and Bi-culture. Fishes were recaptured and weighed and length measurement was taken. Growth of fishes is satisfactory. The general status of the ponds is good and fishes have gained size and weight. In pond 2, stocked with small size fishes (20 mm TL and 5 gram in weight) total weight increased at the rate more than 200%. In Bi-culture and Monoculture setups growth showed more than 80% increment. One fish has grown to 1 Kg. Mono culture setup, for Snapper species L. lutjanus and E. fuscugotatus have shown encouraging results.

Exploratory surveys are in progress to collect the seed of L. johni. Field survey to various coastal areas such as Korangi, Bhit Island were made two to three times in a months. Results are not encouraging some fishes were caught but it was difficult to transport them to site. Cheap ingredients are selected and the prepared feed has floating time of 5-8 minutes to allow fish to attack and swallow the pallets. Attempts are also made to modify the available fish feed in the market. The total requirement is approximately about 2 Kg/for one pond every alternate day.

The prepared feed is cheap, has more floating time and most of the feed is utilized by fish and gives low rate of wastage. The analysis of feed also shows encouraging results i.e more than 40% protein level is maintained. To observe the reproductive changes and to establish maturity season of groupers and snappers in the coastal area, survey at fish landing centers like Karachi and Korangi fish harbours. The study started in the month of June and so far no mature snappers and groupers were observed in the commercial monsoon season fish landing is very much reduced. Observation will be continued till next June.

Regular Zooplankton samples are being collected and preserved in formaldehyde. The samples are stored in Laboratory and sub samples are analyzed for Quantitative estimations. Since the cultured

fishes are given prepared feed every alternate day in addition to the available food from tides. The study of plankton the biomass available in the water. Similar data of other species of fish and invertebrate caught during fishing have been recorded. These fish become the feed for the cultured species. Normally the prepared diet is nutritionally rich as far as protein and lipid are concerned. The diet showed 54-58% protein and 10-14% lipids the rest are the carbohydrates and moisture.

Both species Snapper (Lutjanus lutjanust) and Groper (E. fuscugotatus) are growing well. The two species have gained size and weight. The smaller sized snapper slow high growth compared to larger species. This gain in size has been achieved in a period of six-eighth month. We expert the fish will gain marketable size in one year. The study shows that E. fuscugotatus marine species is suitable for culture along the coastal and in Brackish water of Sindh and Balochistan.

Project Title: ***Epidemiology of helminthiasis in sheep.***

Principal Investigator: ***Dr. Haji Ahmad Hashmi***
Associate Professor/Chairman

Location of Project: *Department of Parasitology, University of Veterinary & Animal Sciences, Lahore*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*0.547*
Start Date:	*9/21/2005*	*Funds Released (Rs):*	*432100*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*275427*

Objectives:

- To determine epidemiology of helminthosis in sheep by studying various epidemiological determinants.
- To devise forecasting methods for helminthosis
- To generate epidemiological information which may lead to the development of integrated methods of control of important helminth parasites of small ruminants with a view to increase their productivity.

Achievements/Progress:

Helminth parasites, mainly the gastro-intestinal nematodes are a major constraint in small ruminant production. Current reliance on frequent use of anathematic treatments to these parasites is neither sustainable nor desirable. Therefore, epidemiology has been recognized as a major tool for the control of disease in developed countries. Epidemiological studies were carried out in two districts; Kasur & Sheikhupura. During the period from 1st January to 30th June the following parameters were noted to see the monthly prevalence of gastrointestinal parasites.

a. Mean fecal egg counts
b. Month wise prevalence of alive Snails
c. Herbage larval counts under natural conditions

The fecal egg counts of those sheep were carried out which used to graze on the same pasture on which larval counts were performed. Every time 20 randomly selected sheep were examined. The identification of ova was also done. The counts were expressed as egg per gram of faeces (EPG). On January 7-01-06 and 21-01-06 the average EPG counts were 225 and 245 respectively in Sheikhupura and Kasur. In April, 2006 the average EPG reached to 570 and 680 in both districts. The maximum number of ova was observed in June, 2006 i.e, 1400 and 1560 in Sheikhupura and Kasur respectively.
Haemonchus countries, Ttrichostrngylus colubriformis, Ostertagia circumcincta eggs were found most commonly and the number of ova of these parasites was greater as compared to other parasites eggs members like Fasciola sp, Cooperia, Oesophagostomum and Chabertian which were observed in negligible number.

The research was undertaken during the period from December 2005 to June, 2006 to see the month wise prevalence of alive snail. A total of 8000 snail was collected from five places in and around Sheikupura & Kasur, which included different genera namely; Lymnaea, Gyrayulus, Physa, Bulinus & Oncomelania.

Mushtaq (1983) found Month wise prevalence of alive Lymnaea snails in maximum number when the temperature and warmest & minimum in number when the temperature was coldest. The present findings are in the agreement with it but differs with Hassan et al. (1984) who reported the highest prevalence of Lymnaea snails during the month of January but lowest in June to October, in Fayum Province of Egypt. The difference may be due to different ecological conditions in both the studies.

During the study it was noticed that Lymnaea spp. disappeared in pond due to dryness of pond. These result sustained with the findings of Mushtaq (1983) who claimed that Lymnaea cannot live long in an environment devoid of water as they are least resistant to desiccation. The temperature & humidity are other factors for the survival of Lymnaea spp. and other snails as it has been studied by Tanveer et al. D (1989). They concluded that the optimal temperature for Lymnaea spp was 26+- 1c where as the maximum lethal temperature noted was 40c. During December, 2005 & January, 2006 the minimum temperature ranged between 8.5c & 6.2c respectivity which is detrimental for survival of snail. So Lymnaea snails were minimum in number during these months.

Project Title: ***Development of local starter culture technology for preparation of fermented milk products***

Principal Investigator: ***Mr. Tariq Aziz***
Senior Scientific Officer

Location of Project: *Animal Sciences Institute, National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.75*
Start Date:	*4/14/2004*	*Funds Released (Rs):*	*3091800*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2843658*

Objectives:

- Identification and characterization of local strains of starter cultures.
- Maintenance and preservation of defined local starter culture in lyophilized form.
- To develop and expand the modern cheese and yoghurt production technology.

Achievements/Progress:

The major thrust in the 1st phase/year of this project has been on isolation and characterization of indigenous strain of lactic and bacteria (LAB). Under this activity, so far 77 milk/dahi samples of indigenous origion have been processed to hunt potential strains of these bacteria. On the basis of growth pattern on selective media, staining and biochemical characteristics had a negative response to catalase test 30 strains of cocci and 27 that of rods (totaling 57) have been identified as "potential starter strains", On the basis of another test of "quantification of lactose fermentation", 21 strains have been preserved in a special medium/ container, the "Microbank".

Project Title: ***The status of shrimp's fisheries in Sonmiani Bay Lagoon, Balochistan, Pakistan***

Principal Investigator: ***Dr. Naureen Aziz Qureshi***
Professor

Location of Project: *Centre of Excellence in Marine Biology, University of Karachi, Karachi*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.471*
Start Date:	*7/28/2004*	*Funds Released (Rs):*	*3682300*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2182008*

Objectives:

- To study and analyze the state of shrimp stock in the Sonmiani lagoons by carrying out a full-scale population dynamics analysis of the shrimp population in Sonmiani Bay area (Miani Hor) in order to describe the current state of the shrimp fishery and population.
- Biology of one important commercial shrimp of Balochistan.
- To assess the fishing fleet and link it to the fishery productivity of the areas by developing relationship between shrimps stocks and fishing pressure.

Achievements/Progress:

A result bi monthly survey has continued Jan 2006 to June 2006 to collect monthly estimated of shrimp landings of sale category for all hella (one day trip) or ice fisheries (week or longer trip) at different mole holders companies (average 6 companies per visit) to determine the fisheries landings.
Experimental data for collcting shrimps in Sonmiani is also continued during the period of Jan 2006 to March 2006 using commercial designed gill nets.
Beach seine sampling has also continued for the procurement of juvenile shrimps to study the distribution pattern of different life stages and shrimp biology.
An experiment to estimate the distribution and abundance of shrimp in mangrove channel was also under taken in February and March 2006. Fishing-boat counting survey in active fishing season was conducted in January 200+.

Zooplankton sampling has been accomplished since June 2005 to date.Socio economic survey of fisheries by interviewing and filling the questionnaire was put on hold during these six months.
Important role of mole holders (companies owned by the fisher folks or non fisher folks has been identified at Sonmiani).

The seasonality in the fisheries landing or a pattern have emerged that show certain periods of exclusive fishing for shrimp, fish and crabs by the fishing community at Sonmiani.

In some months Jaira are more abundantly collected while in other month Kiddi and Patash dominate the fish catch. Variability of shrimp species present in all three local grades or categories was also observed.

Small shrimps known as Kiddi are the most abundantly caught shrimps at Sonmiani and these shrimps are being extensively exploited using illegal nets of small mesh size locally known as Kadda net (purse seine nets), this size group includes juveniles of commercially important larger species includes

Penaeus merguiensis, Penaeus monodon and Penaeous indicus locally known as Jaira and Metapenaeus affinis Metapenaeus stebbingi locally graded as Patash. There is also need to stop indiscriminate fishing of Kiddi.

Project Title: ***Application of molecular techniques for differential diagnosis of rinderpest and related diseases***

Principal Investigator: ***Dr. Qaiser Mahmood Khan***
Principal Scientific Officer

Location of Project: *National Institute for Biotechnology and Genetic Engineering(NIBGE), Jhang Road, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.76*
Start Date:	*7/17/2004*	*Funds Released (Rs):*	*2529975*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1932605*

Objectives:

- To develop and apply molecular-based technologies (mainly PCR based) for more effective diagnosis and differential diagnosis of rinderpest and related diseases.
- Designing & Synthesis of primers (universal, nested, hemi nested)
- Devising successful PCR based methods which can be applied to local conditions
- Development of Multiplex PCR
- National level training workshop
- Molecular Epidemiology

Achievements/Progress:

Clinically it is very difficult to differentiate Rinderpest disease from the other related ones is very difficult task. Conventional diagnostic techniques used include; virus neutralization, agar gel immunodiffusion and virus isolation in cell culture followed some times by reproducing the disease in susceptible animals. All these techniques are either time consuming, labour intensive, insensitive or expensive to perform. Polymerase Chain Reaction (PCR) based methodology has shown great promise, providing the potential of high sensitivity combined with specificity. Sequences analysis of morbilliviruses suggests that there are sequences across the N and P gene which are conserved ones and primers targeted to these regions can amplify all the morbilliviruses. On the other hand sequences across the F gene of PPRV will amplify specifically PPRV in biological samples.

In our present project by this time we have been able to differentiate the PPRV from RPV on the basis of RT -PCR technique. For the facilitation of multiple analyses, the reverse transcription step was performed using random hexanucleotides primers and aliquots of cDNA were then amplified using a panel of primer sets to identify and differentiate between the virus nucleic acids in the samples. Two sets of primers were used; one is universal primers corresponding to conserved region and second specific primers namely: FI b, F2d and FI, F2 and Fla and F2a corresponding to F region which gave the band size of 448bp, 372bp and 308bp specifically. For the study of genetic relationship between isolates of distinct geographical origin, the amplified fragment of 372bp of the fusion (F) protein gene was cloned and sequenced for the phylogenetic analysis, which showed the virus belongs to lineage4 group.

Another vesicular disease the Foot and Mouth Disease (FMD) is very important disease in terms of economics in the shape of very heavy economical losses and even the restrictions on the export of

animals and animal products. RT ~PCR based technique for the diagnosis of FMDV by using universal primers has been developed and tested on the field samples.

Project Title: ***Trout farming in the Mountains of Northern Areas. A Research Project at TRMC Juglote.***

Principal Investigator: ***Mr. Faridullah Khan***
Scientific Officer

Location of Project: *Karakuram Agricultural Research Institute for Northern Areas, (PARC), Juglote, Gilgit*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*5.713*
Start Date:	*10/19/2005*	*Funds Released (Rs):*	*3029200*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2770306*

Objectives:

- To conduct research on fattening, reduction in mortality rates in early stages, disease diagnoses and their proper control.
- To enhance per year growth rate of trout fish.
- Introduce trout farming in Northern Areas through trainings of fish farmers' about pond culture to enhance income of the rural communities.
- Develop packages of technology on trout production in ponds, striking in streams and commercial farming through the communities.
- To motivate communities like water waste, land for income generation.
- Capacity building through training etc.

Achievements/Progress:

Feed ingredients have been purchased for the experiments on need basis and five selected feeds as envisaged in the project documents with different ingredients, percentage/cost have been applied in the experiment to select most suitable for fattening of trout fish. Different chemicals and drugs have been purchased and applied in the experiments as envisaged in the project documents to reduce percent disease and mortality rates and to enhance growth & survival rates. To conduct the same experiment two silt trapping tanks were constructed. Different silt levels have been collected to study the effect of silt level on growth and survival rates of trout fish.

Project Title: ***Studies on biology & mapping of warble fly infested areas***

Principal Investigator: ***Dr. M. Qasim Khan***
Senior Scientific Officer

Location of Project: *National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*6.072*
Start Date:	*5/21/2004*	*Funds Released (Rs):*	*2715500*
Project Status: On-Going		*Funds Utilized (Rs):*	*2335842*

Objectives:

- To study the biology of warble fly in different ecological zones of Pakistan.
- Mapping of warble fly areas and identification of high and low intensity habitats.
- Development and demonstration of controlled strategies in different disease frequency zones.

Achievements/Progress:

A pre-designed proforma was distributed amongst the field staff for gathering information on disease prevalence and biology of the fly. Up till now a total of 832 proformae have beed received (Punjab =133, Sindh= 244, NWFP=318, Balochistan= 137. The disease has been reported from all the provinces of Pakistan particularly from hilly. Semi hilly and desert areas (Bahawalnagar and Sangar) areas of Pakistan. The nodules formation on the back of the infested animals starts appearing from the last week of the October through last week of December. The incidence of the disease varies from 5-75%. It is higher of interior of hilly areas and its intensity gradually decreases while moving the plain areas. The disease was physically verified in the reported areas and co-ordinates of map were recorded from Punjab (Rajanpur, Dera Ghazi Khan, Mianwali, Khushab, Jhelum, Attock, Layyah, Bhakkar), Sind (Dadu, Thana Bulla Khan, Sann), Balochistan (Pishin,Quetta) and whole of NWFP. These readings have been computerized for developing a map.

Project Title: ***Development of milk replacer and early weaning diets for sustainable calf rearing***

Principal Investigator: ***Dr. Abdul Ghaffar Khan***
Principal Scientific Officer

Location of Project: *Animal Nutrition (ASI), NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*6.076*
Start Date:	*8/24/2004*	*Funds Released (Rs):*	*4367500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3629795*

Objectives:

- Development of milk repalcer and early weaning diets for calf feeding.
- Evolving suitable feeding systsm based on milk replacer and early weaning diets for sustainable and bio-econimical calve rearing.

Achievements/Progress:

Socio economic survey on calves rearing practices was conducted in Rawalpindi and Islamabad capital territory. Twenty farmers were interviewed using the structured proforma. Survey revealed that 78% farmers clean their newly born claves. Hundred percent farmers do not feed colostrums to newly born claves till the placenta is shed. Diarrhoea was found to be No. 1 killer of calves at suckling stage. Buffalo calves are fed on certain amount of milk until 60 days age. In case of cow calves, all the farmers were found to complete the wean cow calves during 10-12 months period.

Potential feed ingredients for milk replacer were analyzed for micro mineral composition i.e. Cu, Mn, Zn and Co. Similarly, feed ingredients for development of early weaning diets were also analyzed for their micro mineral composition. Maximum copper was found in milk whereas, minimum was found in casein and wheat flour. Plant protein sources/Zinc and Cobalt concentration was higher in Soya flour. Copper and manganese contents were higher in meals compared to cereal grains. Almost similar ratios were found in case of zinc and cobalt.

Vegetable oil and tallow were analyzed for their peroxide values and found that these were within the acceptable limit. Three different types of milk replacer's viz. A, B and C were prepared having different proportion of tallow and vegetable oil along with other ingredients having uniform percentage in all the milk replacers. Average dry matter protein and ether extract of milk replacers were found 92, 27.73 and 16.73% respectively. Color of these milk replacers were either milky white or creamy white whereas the odor of these milk replacers was milky. Nature of these milk replacers was either fine powdery or sticky. It was also observed that none of the milk replacers exhibited sedimentation before 90 minutes. With the increase in the level of lecithin concentration, rate of flow of oil was found to be greater but 1.1% lecithin was most effective for emulsification of oil to be used in milk replacers.

Procurement of laboratory equipments is accomplished and re-modeling of animal shed has been completed.
Tender for purchase of feed mill machinery for preparation of milk replacer has been awarded and machinery is being manufacture.

Acceptability, digestibility and nitrogen balance trial developed milk replacer ad early weaning diets in calves was conducted. It was revealed that the nutritional values of whole milk and milk replacer was better that the early weaning diets, however, there was no significant difference in time consumption i.e. second/liter fed on whole milk replacer. Digestibility trial revealed that dry crude protein digestibility was better both in whole milk and milk replacer compared to whole milk +EWD and milk replacer + EWD.

Feeding and growth performance trials on evaluation of milk replacer and early weaning diets was conducted and it was found that performance of calves on whole milk and milk replacer was slightly better compared to whole milk + EWD and milk replacer + EWD. These preliminary trials suggest that milk replacer has almost the same nutritional value and efficacy similar to whole milk.

Project Title: ***Epidemiological survey of mastitis and evaluation of economic losses due to clinical & subclinical mastitis in NWFP.***

Principal Investigator: ***Dr. M. Iqbal Khattak***
Research Officer

Location of Project: *Veterinary Research Institute,Peshawar.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.248*
Start Date:	*9/8/2005*	*Funds Released (Rs):*	*1579600*
Project Status: On-Going		*Funds Utilized (Rs):*	*1229173*

Objectives:

- Survey for prevalence of mastitis and determination of various epidemiological factors in different zones of NWFP.
- Study of somatic cell count and bacteriology of mastitis milk.
- Evaluation of economic losses due to different forms of mastitis.

Achievements/Progress:

Purchase/Procurement of equipment, furniture, chemical, glass ware, repairs work and other etc has been completed. Survey regarding the study of prevalence of mastitis and determination of various managemental, epidemiological & other risk factors in different regions/zones of NWFP has been carried out. Somatic Cell Count and evaluation of economic losses due to different forms of mastitis has been carried out.

High prevalence of sub-clinical mastitis was recorded due to poor managemental and other factors which resulted into high economical losses. This will attract the attention of the policy makers/technical personal to adopt special measures for the control of mastitis in light of the results.

CROPS SCIENCES

BACKGROUND

1st Batch:

ALP Secretariat received 314 preliminary proposals relating to crops sciences for funding under the 1st batch. In process of preliminary appraisal 122 proposals were short listed for the invitation of detailed projects and 192 proposals which were not up to the standard were dropped. Finally, 62 projects costing Rs.159 million were approved by the Board of Director (BOD) of ALP for funding research in the different disciplines.

2nd Batch:

ALP Secretariat received 347 preliminary proposals relating to crops sciences for funding under the 2nd batch. In process of preliminary appraisal 128 proposals were short listed for the invitation of detailed projects and 219 proposals which were not up to the standard were dropped. Finally, 62 projects costing Rs.155 million were approved by the Board of Director (BOD) of ALP for funding research in the different disciplines.

3rd Batch:

ALP Secretariat received 354 preliminary proposals relating to Crop Sciences for funding under the 3rd batch. In process of preliminary appraisal 79 proposals were short listed for the invitation of detailed projects and 275 proposals which were not up to the standard were dropped. Short listed proposals are in process by the TAC & BOD of ALP.

Region wise detail of approved projects is given below:

S.No	***Region***	***No. of Projects***		
		1st Batch	***2nd Batch***	***3rd Batch***
1	*PARC/NARC*	27	13	18
2	*PUNJAB*	9	21	34
3	*NWFP*	8	10	15
4	*SINDH*	4	3	8
5	*BALOCHISTAN*	5	3	2
6	*NGO/ OTHERS*	2	-	2
7	*OTHER FEDERAL*	7	12	-
TOTAL		***62***	***62***	***79***

IMPLEMENTATION STATUS

1st Batch:

Of 62 approved projects, 16 are on-going, 41 have been completed, and remaining projects have been dropped/ terminated due to one or other reasons.

2nd Batch:

Out of 62 approved projects, 51 are on-going, 5 projects are in process of agreement and six projects have been dropped/ terminated due to one or other reasons so far.

MONITORING & EVALUATION

Monitoring and review of the on-going projects is a regular activity of the ALP Secretariat. ALP Secretariat through a panel of expert comprising a representative each from the concerned Technical Division, ALP Secretariat, Finance Division leading by a Subject Matter Specialist has completed the on site evaluation of 25 projects. The recommendations/ observations have been conveyed to the concerned PI's for improvement and future guidance. The evaluation reports comprising the salient finding, deficiencies found and summary statement of recommendations of the experts are summarized below:

S#	**Title of Project**	**Name of P.I.**	**Salient Findings**
1	Integrated Nematode Disease Management (INDM) in some cereals, fruits and vegetables of Pakistan.	Dr. Shahina Fayyaz, National Nematological Research Centre, University of Karachi	• Performance rated as **satisfactory** • Advised to P.I. to undertake field studies for demonstration of bio-pesticides formulations of parasitic nematodes in fruits and vegetables fields
2	Component 4: Developmental Biology, Feeding Pattern and Management Strategy against Indian Crested Porcupine *(Hystrix Indica)* in Sindh and Balochistan.	Mr. Amjad Pervez , SSO, VPCI, (SARC), Karachi.	• Performance rated as **satisfactory** • Some irregularities observed in procuring research and office equipments, and P.I. was reluctant to show the research and office equipments to the review team.
3	Development of low cost plant protection technologies through integrated pest management approaches and use of sacrificial crop/ plants in Sindh	Dr. Abdul Sattar Buriro, Entomologist, ARI, Tandojam, Sindh	Performance rated as **satisfactory** • Prominent achievements are on intercropping of maize, sunflower, marigold or Baja in okra or cotton have shown concrete results. Work on bio-control agents is also good. • Review team recommended that IPM model for cotton and okra in Sind should be developed and demonstrated on bigger area in comparison with farmer practices.
4	Nematodes of Fruit and Vegetable Crops and Their Management in Karachi and Hyderabad Districts Using Plant Extracts	Dr. Aly Khan, Crop Diseases Research Institute (CDRI), , Southern zone Agricultural Research Centre, University of Karachi,	• Performance rated as **satisfactory** • One of the outstanding achievements was preparation of dendograms of nematode population in various crops • The P. I. was suggested to use a range of organic solvents to extract whole profile of chemical fractions from promising plants effective against nematode pests. • PI was also suggested to test a range of application rates to find out economic dose and demonstrate research results

			in the field at a bigger scale.
5	Management of Spider Mites on Apple	Dr. Inamullah Khan, Assistant Professor, Dept. of Plant Protection, NWFP Agricultural University, Peshawar.	• Performance rated as **satisfactory** • P. I. advised to undertake further surveys and provide data in a presentable form and should be statistically analysed. • Mass rearing and releases of predators should be done at bigger level.
6	Bread wheat (T. aestivum L.) improvement for late planting/ terminal stress and high yield potential.	Mr. Tila Muhammad Principal Scientific Officer Nuclear Institute for Food and Agriculture(NIFA) Peshawar.	• Performance rated as **satisfactory** • PI used all possible approaches like evaluation of material at different planting time for heat tolerance, creating genetic variability through mutation and testing segregating populations • It was suggested that heat stress must be ensured through different planting dates and multi location testing during 2006-07 season
7	Utilization of seaweeds in the control of soil-borne pathogens and growth of crop plants	Dr. Viqar Sultana, Professor Biogeochemistry, University of Karachi.	• Performance rated as **satisfactory** • Extracts of different sea weeds have been collected and are being tested in field and laboratory conditions for the control of different fungal diseases and are also being tested for their efficacy as fertilizer • P.I. has collected many sea weeds and preserved in proper solutions. PI was requested to prepare a hand book covering the characteristics and photographs of those weeds which can serve a good text book for the students of Botany
8	Weed Management Studies of Wheat and Cotton Crops in Sindh (Component-V)	Mr. Allah Ditta Jarwar, Plant Physiologist/PI , Agriculture Research Institute, Tandojam, Sindh	• Performance rated as **partially satisfactory.** • It was suggested that PI may consolidate the collected information in a package of integrated technology as recommendation to the farmers for proper weed control in the wheat and cotton crops
9	Studies on monitoring of contaminants in exportable food commodities	Dr. Zahida Perveen, SSO. Southern Zone, Southern Zone Agricultural Research, Centre (SARC), Karachi.	• Performance rated as **satisfactory** • Fruits and vegetable samples were collected both from farmers' fields and at export points and were processed to analyze for pesticide residues and heavy metal contaminants • It was suggested that the Sampling procedure must be described in detail and the samples to be collected from farmers field should represent the proper filed and crop. • In the field experiments proper experimental design should be followed to have reliable data for good

			interpretation.
10	Mapping of Bacterial Diversity in Sindh Agricultural Fields and Deserts – A molecular level	Prof. Dr. Nuzhat Ahmad, Director/PI of ALP Project, Centre for Molecular Genetics, University of Karachi,	• Performance rated as **satisfactory** • Five strains of biopolymer producing bacteria and five strains of phosphate solubalization have been identified. • The bacteria identified must be named up to species level. DNA Finger Printing should be completed as soon as possible to achieve the project objectives. • PI was suggested to prepare the financial reports well in time and also submit the honorarium application to ALP Secretariat to regularize the honorarium of FY 2005-06 drawn by the PI.
11	Introduction and Yield Improvement of Moth-bean in NWFP	Dr. Muhammad Yaqoob, SSO Pulses, ARI, PARC, D.I. Khan	• **Satisfactory** • Selection of YMV resistant Mothbean lines is very important aspect for introducing this crop among the farmers for getting seed yield and growing as fodder for animals.
12	Better Utilization of Food for Healthy and Productive Life in Agriculture Sector	Dr. Alam Khan, Professor, Department of Human Nutrition, NWFP Agricultural University, Peshawar	• **Partially Satisfactory** • Data was analyzed for nutrients intake which may not necessarily be the nutrients absorbed like in case of protein Biological value (BV) should be considered. • According to the personal history table of the farmer with reference to table 1, weight and height of different farmers of different villages do not show their status as UNDER-WEIGHT • All the research activities were according to their approved work plan.
13	Quality Characterization of Oilseed Crops through NIRS	Mr. Iftikhar Ali, Principal Scientific Officer, Nuclear Institute for Food & Agriculture (NIFA), Tarnab, Peshawar	• **Satisfactory** • The calibration equations developed at the end of the project will be useful and valuable for the breeders and researchers in the country for prediction of quality characteristics (oil content, protein content, fatty acid profile, uric acid and total glucosinolate content) of major oilseed crops like rapeseed/mustard, canola, sunflower, sesame, soybean and groundnut through NIR spectroscopy technique.
14	Development of Heat Tolerant, Early Maturing and High Yielding Mungbean (Vigna Radiata (L.) Wilczek) Genotypes	Dr. Gul Sanat Shah, Senior Scientists, Nuclear Institute for Food & Agriculture (NIFA), Peshawar	• **Satisfactory** • One variety i.e. Ramzan has been released through this project
15	DNA-based genetic characterization of cotton germplasm (Component-I)	Dr. Yusuf Zafar, Head, Plant Biotechnology Div. NIBGE, Faisalabad.	• **Satisfactory** • Total 95 genotypes of *G. hirsutum* and 33 *G. arboreum* were utilized for this study. Genomic DNA of all these genotypes was isolated and amplified

			using PCR analysis. • Information of each polymorphic locus for structural genomic markers was gathered and mass scale DNA characterization of cotton germplasm was carried out using different SSR series
16	Use of RNA Interference for Genetically-Engineered Male Sterile Tomato Plants for Production of Hybrid Tomato	Dr. Shahid Mansoor, PSO, Plant Biotechnology Division, National Institute for Biotechnology & Genetic Engineering (NIBGE), Faisalabad	• **Satisfactory** • For developing male sterility in tomato two genes namely Lat 51 and Ta 29 were targeted using RNAi technology • TA 29 gene was amplified and cloned from the genomic DNA of tomato and was sequenced by di-deoxy method • Sequencing of TA-29SN1 clone from tomato showed maximum homology with tobacco TA-29 gene. In the same way a pollen specific gene Lat 51was isolated and successfully cloned in a vector and is being transformed
17	Application of DNA Finger Printing for Drought Tolerance in Wheat	Dr. Mehboob-ur-Rehman, SSO/PI of ALP Project, Plant Biotechnology Division, National Institute for Biotechnology & Genetic Engineering (NIBGE), Fsd	• **Satisfactory** • Analysis of cell membrane stability of 95 genotypes and synthetic population was completed. The other characters recorded were seed size, coleoptile length, photosynthesis, relative water content. Kohistan 97, Chakwal 86, Barani 83 and Rawal 87 were found drought tolerant lines as compared to others whereas MH-97 was sensitive to drought. • The F1 generation was raised to F2 from the crosses made last year between drought tolerant (Kohistan 97) and sensitive genotypes (MH-97). A population of a cross between Opata and genotype-257 was raised in the field.
18	Molecular Characterization of Available Germplasm of Wheat in Pakistan (Component-II)	Dr. Iftikhar Ahmad Khan, Professor & Chairman, Deptt. of Plant Breeding & Genetics/ University of Agriculture, Faisalabad.	• **Satisfactory** • 350 accessions of wheat germplasm have been acquired from Plant Genetic Resources Program and other sources. The material acquired is being characterized using Random Amplified Polymorphic DNA (RAPD) and Simple Sequence Repeats (SSR). • The data generated form the experiments reveal that medium to low genetic diversity exist in the germplasm. So there is need to broaden the genetic base through acquisition/collection from diverse ecologies.
19	Development and Testing of a Resource Conservation Tillage implement	Dr. Jehangir Khan Sial, Professor, Faculty of Agricultural Engineering & Technology, University of Agriculture, Faisalabad	• Report is in Pipeline
20	Development of Integrated Pest Management of	Dr. Sohail Ahmed, Associate Professor, Department of Agri.	• **Satisfactory** • Sufficient work has been undertaken and

	Subterranean Termits in Agro-Ecosystem	Entomology, University of Agriculture, Faisalabad	data collection in properly laid out trial. • PI has been collected the sufficient data regarding the behavior of termites using standard monitoring techniques
21	Studies on Resistance Monitoring and Insecticide Effects on Chrysopid Predators (Neuroptera)	Mr. Attaullah Khan Pathan, Senior Scientific Officer/Incharge, PARC-IPM Sub-Station, University College of Agri., Bahauddin Zakira University, Multan	• **Satisfactory** • Collection of the *Chrysoperla carnea* had been made from Multan, Bahawalpur, D. I. Khan, D. G. Khan and Rahim Yar Khan. The results given in the report are in line with the objective of the project as per approved work plan • Interpretation of the results is reasonably good and results are nicely presented in tabulated forms. A good synthesis of the overall results is presented analytically
22	Molecular Characterization of Rice Germplasm Using RAPD Analysis	Dr. M. Ashiq Rabbani, SSO, PGRP, IABGR, NARC, Islamabad.	• **Satisfactory** • The accomplishments are quite well according to the approved work plan. • P.I. taking a very cautious approach has ensured the purity of varietal material form reliable sources. This would eliminate any later confusion due to any past error in labeling/indexing of the collection in germplasm resource.
23	Characterization of Pakistani Isolates of Chili Veinal Mottle Potyvirus (ChiVMV) and Cucumber Mosaic Cucumovirus (CMV) Infecting Chili Crop	Mr. Hussain Shah, Scientific Officer, IPEP, NARC, Islamabad	• **Satisfactory** • The project Scientists studied 44 different plant species as probable host of ChiVMV virus and found that out of these six were susceptible to this virus. However, the project Scientists have not made similar studies on CMV • The target of screening Capsicum germplasm against ChiVMV virus under controlled condition was achieved for Sindh and Punjab isolates of ChiVMV virus
24	Development and Evaluation of a Mobile Flat-Bed Dryer for Sunflower and Canola	Dr. Munir Ahmad, PSO, Farm Machinery Institute (FMI), NARC, Islamabad	• **Satisfactory** • A complete operational model of the Mobile Flat Bed Dryer for Sunflower and Canola has been manufactured
25	Studies on Breeding Biology and Post-Natal Development and Control Trails against Rodent Damaging Date-Palm Orchards of Tehsil Nok Kundi Distt: Chagai-Balochistan	Syed Muzaffar Ahmed, Scientific Officer, Vertebrate Pest Control Research Institute , Southern zone Agricultural Research Centre, University Campus, PARC, Karachi	• **Partially Satisfactory** • Collection of 10 live rodent specimens has been carried out who damage the Palm Trees and the taxonomic and morphometric data gleaned from these specimens confirm the genus Nesokia and suggest the species as short-tailed mole rat (Nesokia indica) • The economic analysis has showed a loss of Rs. 5.33 million per crop season and it is has been estimated on the basis of prevailing market rates and estimated production of dates per tree per season.

Project Title: ***Some physiological studies on vegetative growth pattern and its impact on productivity and malformation of mango (Mangifera indica L.).***

Principal Investigator: ***Dr. Faqir Muhammad Tahir***
Associate Professor

Location of Project: *Department of Horticulture, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.384*
Start Date:	*3/22/2002*	*Funds Released (Rs):*	*1027000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*962482*

Objectives:

- To generate some basic informatiom on vegetative and reproductive growth behaviour of the tree and to use this knowledge for the control of mango malformation.
- To indentified the behaviour of different recommended varieties of mango towards mango malformation and their relationship with the growth pattern.
- To establish effects of growth retardants on growth management and control of maformation.
- To determine leaf nutritional standards to control malformation and enhance productivity of the mamgo orchards.
- To prepare a pakage of recommendations for orchard management which could be helpful to minimize or control completely the problem of malformation and increase per acre fruit yield.

Achievements/Progress:

To study the effect of split application of fertilizers on vegetative-reproductive growth pattern and malformation of inflorescence in mango cv. Chaunsa, fertilizer application and pruning practices were carried out in order to reduce malformation of inflorescence. Continuous fertilizer application resulted in more and early emergence of shoots. More shoots emerged on bimonthly fertilizer supplied trees as compare to quarterly fertilizer supplied trees. There was more emergence of shoots on malformed panicle pruned terminals as compared to non-pruned terminals. Carry over effect of malformation was less on April shoots. Fertilizer application resulted in reducing carry over effect of malformation of inflorescence. For the determination of the effect of dose and type of fertilizer application on induction of shoots and reducing malformation of inflorescence in mango cv. Chaunsa, in 2 experiments, different doses of simple and compound fertilizers were applied (during April 2003 and February 2004 in order to regulate vegetative growth and reduce malformation of inflorescence in mango cv. Chaunsa. There was early emergence of shoots due to fertilizer application. More vigorous shoots emerged on compound fertilizer supplied trees. There was an increase in nitrogen level from April to June and decrease up to September. Regardless of the type and dose of fertilizer application, more nitrogen level was estimated in leaves of shoots carrying malformed panicles as compared to healthy ones. Moreover, there was higher level of nitrogen in malformed panicles as compared to healthy panicles. Carry over effect of malformation was less in high /optimum dose fertilizer supplied trees regardless to type of fertilizer. In the study of effect of various times of panicle pruning and fertilize application on the induction of vegetative shoots and reducing malformation of inflorescence in mango cv. Chaunsa, pruning of panicles was carried out from march to May with 15 days interval and fertilizers were supplied in order to reduce malformation of inflorescence. There was significant affect of pruning and fertilizer application on induction of shoots and reducing malformation of inflorescence. Early emergence of shoots occurred as a result of March April pruning. More number of

shoots sprouted on barren panicle pruned terminals. Carry over effect of malformation was more on malformed panicle pruned terminals followed by barren and healthy panicle pruned terminals. The present studies were designed to minimize the problem through pruning of malformed and barren panicles. For comparison, the healthy panicles were also pruned to induce prompt healthy vegetative growth and to see if these flushes could bear healthy panicles during the subsequent year.

Project Title: ***Integrated management of fruitflies in Pakistan.(NARC, Component)***

Principal Investigator: ***Dr. Ghulam Jilani***
Program Leader

Location of Project: *Insect Pest Management Program, Institute of Plant and Environmental Protection, NARC, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.675*
Start Date:	*3/21/2002*	*Funds Released (Rs):*	*2922400*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2513114*

Objectives:

- To enhance quality and quantity of various exportable fruits, i.e., mango, guava and citrus through the reduction of economic losses caused by fruit flies.
- To ensure pest and pesticides free fruit production of export, to meet WTO standards.
- To develop capabilities in farmer communities for controlling fruit flies through IMP technologies/eco-friendly management of fruit flies in the country.

Achievements/Progress:

Laboratory:

Out of many plant extracts tested, feeding of fraction F1 of acetone extract of turmeric at 500 ppm in diet caused 72.22% mortality of B. zonata in 20 days as compared with 38.88% in control. It also significantly inhibited fecundity in the surviving individuals.

Field:

The IPM model for fruit flies has been demonstrated on 450 acre mango orchards at Bukhari Farms located at 33 km on Bahawalpur Road, Multan during 2003; at 50 acre in 2005 and 500 acre in 2006 at Gardezi Farms in Amirpur, Kabirwala. It has also been demonstrated in 45 acre guava orchard at Malik Fayyaz Guava Farm Tridewali on Lahore-Sharaqpur Road during 2005 and 2006. Application of the technology has shown more than 90% success in Mango and more than 80% in guava. Therefore, application of IPM model can protect fruits from fruit fly infestation and provide better quality fruits for local consumption and export.

THE TECHNOLOGY
Model:
Application of Pheromone; A mixture of methyl eugenol and a contact insecticide (95:5) is applied to plywood blocks measuring 6x6x1.25 cm by dipping for 24 hours. These are nailed on the tree trunk at 1.5 meter height @ one block per acre and recharged with the same pheromone insecticide mixture after 10-12 days during fruiting season.
Application of Bait; A mixture of protein hydrolysate and a stomach poison (90:10) is sprayed @ 3% solution in water on 1m2 on the underside of the tree canopy on each tree in mango and alternate plants in guava and other such plants at 10-12 days interval during fruiting.
Application of 2% Neem Seed Powder Water Extract on susceptible varieties at 10-12 days interval during fruit ripening.

Sanitation; Collection of fallen infested fruits at 3 days interval and keeping the collected fruit in the sun during summer or burying deep during winter.

Publications: Research Papers = 3
Ph. D. = 1 (Ongoing) M. Sc. = 3

Project Title: ***Integrated management of fruitflies in Pakistan. (CABI Bioscience - Component)***

Principal Investigator: ***Dr. M. Ashraf Poswal***
Director

Location of Project: *CABI-Biosciences Centre, Data Gunj Bakhsh Road, Satellite Town, Rawalpindi.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.254*
Start Date:	*3/22/2002*	*Funds Released (Rs):*	*4235000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*4255375*

Objectives:

- To enhance quality and quantity of various exportable fruits, i.e., mango, guava and citrus through the reduction of economic losses caused by fruit flies.
- To ensure pest and pesticides free fruit production of export, to meet WTO standards.
- To develop capabilities in farmer communities for controlling fruit flies through IMP technologies/eco-friendly management of fruit flies in the country.

Achievements/Progress:

Selection of a control method or a combination of methods depends largely on the management strategy to be adopted which in turn depends on the nature of the fruit industry being affected and the costs versus benefits of the whole operation. Reliance on a single form of control has not been satisfactory in achieving control of fruit flies therefore effectiveness of combined application of male annihilation technique (MAT), bait application technique (BAT) and crop hygiene was studied in controlling fruit flies. In three years (2002-05) study combined application of MAT, BAT and crop hygiene on isolated large area of 450 acres at 5 Faiz was found most effective in suppressing fruit flies population and the infestations in fruits were in the range of 0.1- 3.0 % at 5 Faiz Compared with 3-5% when applied on 100-acre area of the large spread mango belt at Moza Amir Pur Kabir Wala. This supports the conclusion that management strategy for controlling fruit flies when applied on area wide basis is most effective than applying on individual farms. In orchards where this package was applied compared with 6%.in orchards where only pesticides were applied and 12- 25% in orchards where only MAT was applied and 35% where no control measures were applied at Multan. The encouraging results of experiments on controlling fruit flies in guava with augmentation and conservation of parasitoids are evidential that the natural enemies have the potential of controlling fruit flies. In long term strategy of controlling fruit flies on area wide basis option of integration of biological control in IPM of fruit flies cannot be over looked. There is need to research on strengthening the natural resources to address the issue of fruit flies in the country.

Certification of absence of Med fly Ceratitis capitata from Pakistan was made out of project findings and fears about chances of contamination of other fruit flies like oriental fruit fly (Bactrocera dorsalis) and peach fruit fly (B. zonata) in Kinnow were also removed by providing the scientific evidence of their year round activity and habit of undergoing hibernation from December to February at Sargodha and Bhalwal. This is the period when Kinnow matures and harvested, therefore, the export of Kinnow from this area of Pakistan is safe (copy of this information was provided to Pakistan Horticulture Development and Export Board). This facilitated to reach a trade agreement with China for export of

kinnow from Pakistan. These will double the export of kinnow from Pakistan and farmers and traders will directly have monetary benefits from this development.

In 2003-04 record export of 150,000 tons of Kinnow was obtained earning over US$ 30 million and target of 250,000 tons was fixed for next year to take the figure of earning to US$ 50 million (PHDEB News letters November 2004 and February 2005). In view of trading requirements and pest risk analysis monitoring of fruit flies has to be taken up at national level as a regular activity of the department of agriculture for providing updated information of fruit flies status.

Extension methodology through farmer field school activities seems very effective as the farmers became involved in season long activities in addressing mango crop issues. They took keen interests in experimentation making agriculture profitable with less input costs. During the course of training some issues, besides fruit flies, were identified as outcome of mango eco- system analysis (MESA) in FFS plots. Mango midges and quick decline disease were recorded as the most serious constraints in mango yield. Scale insects and mealy bugs populations were also found increasing to high level and in some cases trees were turning black because sooty mold development on honey dew secreted by the scale insects. This impacted on mango yield indirectly by interfering with photosynthesis. The farmers from Sindh also reported serious outbreak of quick decline disease and scale insects in mango. On examination of samples of diseased mango, brought by them, beetles adults and immature stages in green and dry twigs were found. Thus insects seem playing role in spread of the disease. Farmers and researchers in Sindh, who contacted CABI in this regard, reported that insects seem playing the primary role in mango decline.

Project Title: ***Integrated management of fruitflies in Pakistan. (ARI, D. I. Khan Component)***

Principal Investigator: ***Dr. Abdul Latif***
Entomologist

Location of Project: *Agricultural Research Institute, D.I. Khan.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.063*
Start Date:	*3/22/2002*	*Funds Released (Rs):*	*2060500*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1958241*

Objectives:

- To enhance quality and quantity of various exportable fruits, i.e., mango, guava and citrus through the reduction of economic losses caused by fruit flies.
- To ensure pest and pesticides free fruit production of export, to meet WTO standards.
- To develop capabilities in farmer communities for controlling fruit flies through IMP technologies/eco-friendly management of fruit flies in the country.

Achievements/Progress:

Infliction estimation caused by fruit flies to various fruits was carried out. Diagnostic survey revealed fruit infestation muskmelon, mango, and guava ranging from 12 to 70%. Trials on management techniques showed significant reduction in fruit infestation when bait of protein hydrolysate along with the crop hygienic practices were carried out on the periphery of melon field. Efficacy studies on behavior-modifying Semiochemical and Biochemical were found effective in reducing onset of fruit flies. Highly significant reductions in mango and guava fruit infestation were achieved by installation of male sex-lure traps impregnated with methyl eugenol (@ 4/acre) alongwith2 applicationsofeitherbait of protein hydrolysate or neem extract. Laboratory studies on behavioural aspects of fruit fly speices showed that neem extracts in larval diet and/or its treatment on guava fruits have robust effect on fruit oviposition and with least fruit infestation as compared to untreated fruits. Some parasitoid of Diachasmimorpha spp. Was was recovered from the pupae of B. Zonata collected from the guava fruits. Pupa diapauses was determined in melon flies (Myiopardalis pardalina) from the melon, grown under rain fed condition, which lasted for about 8 months (July-February). Bionomics of B. zonata revealed the duration of egg. Larval, pupa and audit period which were lasted 48 hours, 6 to 9 days,12 days and 180 days respectively.

Benefits were extended to stakeholders by implementation of technology developed through training and on farm demonstration. A total of 30 training seasons were organized and 758 growers, extension field staff and NGOs were trained. On farm demonstration was carried out by covering a total of 580 acre and benefit received by 66 growers. In addition, organized 2-days workshop of eminent scientists on fruit flies, supervised and facilitated research to Master and Doctoral scholor for their postgraduate thesis, reproduced 6 research papers for scientific journals and published 4 Urdu bulletin and 6 research manuscripts.

Fruit growers to manage and control the fruit flies are advised to:

i. Always practice sanitation, especially dispose off dropped infested fruits;

ii. Familiarize yourself with fruit flies life cycle;
iii. Determine which other plants in your area are fruity fly hosts and when these plants are fruiting;
iv. Always adopt preventive measures and monitor its population;
v. If flies population exceeds economics injury level, reduce it by applying baits or neem extract alongwith installation of sex-lure traps;
vi. Monitor pests again and re-evaluate your strategies.

Project Title: ***Integrated management of fruitflies in Pakistan. (ARI, Sariab, Quetta Component)***

Principal Investigator: ***Mr. Muhammad Karim Shawani***
Entomologist

Location of Project: *Agricultural Research Institute, Sariab, Quetta.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.031*
Start Date:	*3/1/2003*	*Funds Released (Rs):*	*1674900*
Project Status: Completed		*Funds Utilized (Rs):*	*1543412*

Objectives:

- To enhance quality and quantity of various exportable fruits,i.e., mango, guava and citrus through the reduction of economic losses caused by fruit flies.
- To ensure pest and pesticides free fruit production of export, to meet WTO standards.
- To develop capabilities in farmer communities for controlling fruit flies through IPM technologies/ eco-friendly management of fruit flies in the country.

Achievements/Progress:

Bactocera (Dacus) zonata appeared as a most serious and dominating pest of fruit and vegetable like guava beer, peaches, chickoo, melons, squashes and cucumber during the whole three year of project period. The data collected reveals that the combination of IPM technique including "Male Annihilation Technique (MAT), + Bait Application Techniques (BAT), + spray of bio-pesticides and cultural practices (CP)" were effected and economical against the control of fruit flies on guava as compared to pesticides application. Among all these techniques, Male Annihilation Techniques was observed almost effective tool in reduction of fruit fly population and fruit infestations in melon and peaches. The consecutive use of IPM package on Guava, Melon Vegetable and Peaches are early in application, economical more beneficial environmentally safe and produce chemical free quality and vegetable for export purposes and to up lift the socio economic status of farmers and to earn foreign exchange for the country. Farmers training were conducted for awareness among farmers, regarding IPM techniques against fruit flies in Guava, Melon, Vegetable and fruit, beneficial insect and other related subjects. In these trainings 153 farmers and 110 Agriculture Research, Extension Officials participated.

Project Title: ***Exploitation of forage legume diversity endemic to salt range in Soan valley of the Punjab.***

Principal Investigator: ***Dr. Farrukh Javaid***
Asstt. Professor

Location of Project: *University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.095*
Start Date:	*4/6/2002*	*Funds Released (Rs):*	*510000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*421000*

Objectives:

- Collection, listing and description of wild and weedy relatives of forage legumes from 1066 thousand hectares in Soon Valley (Salt Range) in the Punjab.
- Isolation and characterization of symbiotic Rhizobia from some selected leguminous plants.
- Determination of nutritive value of different legumes for livestock
- Conservation of endangered leguminous plant species through their cultivation and multiplication at farmers fields and botanical gardens.
- - Training and education of students for the conservation of natural resources, and maintenance of herbarium and gene banks for the welfare of future generations.

Achievements/Progress:

In the present study ten ecologically diverse sites were selected in the valley mainly on the basis of variation in topography, vegetation type and soil characteristics. Ecological study indicated that flora of this valley comprised of nineteen leguminous species along with some non-leguminous plants. The species were classified on the basis of their frequency ranges in selected study sites. Acacia modesta was the most common plant of this valley and was the only species, which grows in almost all, selected sites and categorized as very abundant one followed by Medicago laciniata and Vicia sativa grouped as the abundant plant species. On the other hand Acacia fernesiana, Dalbergia sissoo and Melilotus indica were the frequent species and Albizzia
lebbeck was categorized as occasional one Acacia hydaspica, Acacia nilotica, Argyrolobium stenophyllum, Medicago Polymorpha, Melilotus alba, Prosopis glandulosa, Prosopis juliflora, Prosopis spicigera, Rhyncohsia minima, Sophora mollis, Trigonella monantha and Vicia monantha formed a group of rare species.

According to nutritional status of plants species for grazing livestock, out of nineteen leguminous species only Sophora mollis was poisonous while, all others are nutritive and palatable, and are being used for grazing livestock. However, classification according to proximate analysis indicated that maximum energy is possessed by Acacia modesta which is closely followed by Albizzia lebbeck among the woody species. While Vicia sativa and Medicago polymorpha had maximum energy among herbaceous species closely followed by Vicia monantha. Other studied plant species also have a reasonable supply of energy; however, they failed to compete with the above mentioned plant species. Observation about the possible threats showed that the flora of Soon valley of Pakistan is under severe danger of loss of biodiversity due to water deficiency (low rainfall) which is consequently lowering the water table of the soil in this area. Heavy and uncontrolled grazing, cutting of trees and shrubs for

forage/fodder, fuel and for timber purposes were also the serious threats. Natural and accidental fires by illegal honey hunters/local herd's men are also playing significant role in eliminating the rare plant species in this valley. Official surveys by representative of Government of Pakistan have also identified the above mentioned threats to plant diversity. Different NGOs are trying to save the plant diversity of this area but they are facing similar problems as described above

Project Title: ***Development and commercialization of mobile seed processing unit.***

Principal Investigator: ***Dr. Tanveer Ahmad***
Senior Engineer

Location of Project: *Farm Machinery Institute, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.679*
Start Date:	*3/29/2002*	*Funds Released (Rs):*	*2154400*
Project Status: Completed		*Funds Utilized (Rs):*	*2076000*

Objectives:

- To adapt mobile seed processing unit.
- To test and evaluate the performance of mobile seed processing unit.
- To demonstrate mobile seed processing unit to end-users.

Achievements/Progress:

A Mobile Seed Processing Unit has been developed at Farm Machinery Institute, NARC, Islamabad with funding frpm ALP-PARC. It consists of an aspirator, grader, length separator (with double indent cylinder), scourer, and a precision grader. It is a multi-crops seed processing unit. It cleans and grades serials seeds, oil seeds, and round seed vegetables.

The seed processing unit was tested on wheat, paddy, gram, and mung crops. It has 1-1.5 tons/hour capacity with 98% cleaning efficiency. Local manufacturing FMI Mobile Seed Processing Unit has started

The FMI seed processor removes inert material, weeds, broken grains and shriveled grains from healthy grains. It also grades seeds into three components: healthy seeds, light seeds, broken and shriveled seeds. It has a seed processing capacity of 1-1.5 tons/hr for wheat and 1 ton/hr for paddy. Saving/machine as compared to conventional methods is Rs 1.5 million/annum

Project Title: ***Survey and integrated pest management of cotton insect pests in Balochistan.***

Principal Investigator: ***Mr. Muhammad Karim Shawani***
Entomologist

Location of Project: *Agriculture Research Institute Sariab, Quetta.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.2*
Start Date:	*3/1/2003*	*Funds Released (Rs):*	*1078000*
Project Status: Completed		*Funds Utilized (Rs):*	*1026000*

Objectives:

- Survey, collection and identification of cotton insect pests and their natural enemies.
- To evaluate different varieties of cotton for the insect pests and diseases resistance and their suitability for specific area in the Balochistan.
- To study the biology and population dynamic of bollworms i.e. spotted bollworm and American bollworm. These two insects have been recorded in preliminary survey.
- To find out the most effective insecticide and best time of application of insecticides against different insect pestsof cotton.
- Training of farmers, publication of booklets and leaflets for the dissemination of IPM technology development under this research project.

Achievements/Progress:

In a survey to study the population dynamics of insect pest complex attacking cotton crop in Balochistan. It was observed that the crop was attacked by jassid, white fly, thrips, aphids and spotted bollworm at all cotton growing areas of Balochistan, Mites and Heliothesis were attacking some areas where cotton is growing. The infestation of these pests remained below Economic Thresh Hold (Eth) level through out season, except white fly, due to hot & dry weather condition. The population of spotted bollworm was found a little more as compared to other pests. In order to find out best varieties of cotton for insect pest tolerance for Balochistan, 15 varieties were tested against insect pest in different locations in 2004 & 2005. All varieties performed well and insects equally preferred to all as a general CIM variety proved better as high yielding varieties in both years. In an efficacy trial of different insecticides against sucking & chewing insects in 2004 & 2005, confider, Mospilan, and Crown were found most effective followed by advantage, thiodan and Carbosulfan against white fly in both years. While steward, larvin, cascade and tracer were most effective insecticides against spotted boll worm of cotton in 2004 & 2005, farmers training were conducted for awareness among farmers regarding IPM, beneficial insects and improved varieties in these training 320 farmers and 70 Extension workers participated.

Project Title: ***Collection, conservation, evaluation and documentation of horticultural crop germplasm and its wild relatives.***

Principal Investigator: ***Mr. Muhammad Afzal***
Senior Scientific Officer

Location of Project: *PGRP, IABGR, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3*
Start Date:	*7/18/2002*	*Funds Released (Rs):*	*2266010*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2112691*

Objectives:

- Survey and collection of Vitis and its related species germplasm
- Establishment of field genebenk at NARC,Islamabad.
- Evaluation of germplasm in collaboration with respective horticultural/agronomists.
- Documentation of genetic resources information and its circulation to horticulturaists in the country.

Achievements/Progress:

There is urgent need to collect, conserve and evaluate the crop genetic resources diversity for crop improvement and sustainable crop production. Many fruit plant genetic resources including grapes are getting extinct. No systematic on farm conservation of grapes have been made in the past. Pakistan has varied topography and a considerable range of genetic diversity.

Keeping in view the importance of genetic diversity of plants, a clonal repository of grapes and its wild relatives has been established at National Agricultural Research Centre, Islamabad. A total of 162 samples of different grape species including Vitis vinifera, Vitis labrusca and Vitis jacquemontii were collected from Northern Areas, NWFP, Azad Kashmir and Baluchistan areas. The collecting expeditions were arranged during the dormant seasons. Cuttings of grape germplasm were brought to Plant Genetic Resources Programme at NARC, where these were dumped in the soil for about one month for callusing. The Plants were shifted to the field in the month of February. Plantation was carried out according to recommended plant to plant (8 Ft) and row to row distance (11 Ft). Iron pipes were installed in the field along with iron wires. Bamboo sticks were also inserted into soil along with each plant for staking.

Characterization of grape varieties was done following the IPGRI descriptors. Data was recorded for different traits such as form of tip, shoot attitude , colour of leaf size of blade, shape of blade, number of lobes, shape of teeth, length of teeth, length of petiole and length of internodes, shape of bunch, size of bunch, colour of berries and maturity time.

The germplasm conserved in the Field Genebank has been documented and available for distribution to researchers interested in grapes improvement.

Project Title: ***Invitro conservation and cryo preservation of plant germplasm of vegetatively propagated crops.***

Principal Investigator: ***Dr. Mustafa Sajid***
Senior Scientific Officer

Location of Project: *Plant Genetic Resources Institute (PGRI), NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.1*
Start Date:	*5/15/2002*	*Funds Released (Rs):*	*1608000*
Project Status: Completed		*Funds Utilized (Rs):*	*1509973*

Objectives:

- Acquisition of germplasm cuttings, buds and meristematic tissues of proposed species for in vitro preservation.
- Establishment of rooted cuttings in the green house to serve as the explants source
- Evaluation of hormonal regimes for successful culture establishment and their effect on growth parameters.
- Cry preservation of in vitro propapagules of horticultural plant species cultured deterioration and mortality.
- Establishment of rooted cultures in the soil in green house and field conditions under protected cultivation.

Achievements/Progress:

A field gene bank has been strengthened at the PGRP premises and also at the HRP premises to serve as an explant source for in vitro conservation as a standby arrangement. The media composition for in vitro culture establishment and conservation has been found to be different for different species and also to some extent it varies for different accessions of the same species. Grapes generally require low salt levels of MS media as compared to other plant species for successful establishment of in vitro cultures and subsequent stages of conservation protocols. The exotic germplasm that was grafted earlier onto the root stock collaboration with the scientists of the HRP have borne fruit this year and will become part of the persistent research activities of HRP and PGRP scientists. During the project, a comprehensive protocol has been established for germplasm conservation and cryopreservation of grapes, peaches, pear, and sugarcane and potato germplasm. The rate of growth retardation was found to be dependent on the amount of the osmotica used in the media, namely mannitol and sorbitol. These findings are useful for medium term conservation strategy. Culture longevity and viability was improved if plantlets were maintained in the rooted form rather than unrooted plantlets, as the effect of temperature fluctuations was worst on the unrooted plantlets. In vivo rooting was achieved from double node cuttings of grape accessions as single node cuttings failed to produce rooting. This information is useful in establishing the plantations for gene bank. Benzyl adenine was found to be critical in reducing or eliminating the culture senescence and thus, it was helpful in extending the culture life. It was possible to extend the culture life beyond one year time without subculturing them, thus saving labor and material resources. However, this ability is more profound in grapes as compared to peach and pear germplasm which need to be sub cultured relatively more frequently to prevent culture browning and resultant mortality and deterioration. On the other hand, cryopreservation was successfully employed for long term storage of germplasm whereas conventional in vitro techniques were exploited for medium and short term storage of germplasm. Recovery growth of cryopreserved

plant germplasm varied from accession to accession and was generally low but overcompensated by high proliferation rates on the optimized growth media specially amended with plant growth regulators.

In conclusion, project experiments yielded valuable information for successful conservation of plant biodiversity. Biodiversity is undergoing fast paced depletion and its conservation is vital to ensuring food security for an ever-growing population of the world as it serves as a raw material for genetic improvement for higher productivity and better quality.

Project Title: ***Acquisition screening and utilization of peas germplasm for development of superior cultivars.***

Principal Investigator: ***Dr. Abdul Ghafoor***
Senior Scientific Officer,

Location of Project: *Plant Genetic Resources Institute (PGRI), NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.1*
Start Date:	*5/15/2002*	*Funds Released (Rs):*	*1665000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1576556*

Objectives:

- To identify /produce base material with high yield potential and disease tolerance, i.e powdery mildew and blight.
- Collection and assessment of genetic bio-diversity based on characterization, evaluation and biochemical markers.
- Screening of pea germplasm for powdery mildew and blight to identify resistant sources.
- To identify linkage between qualitative/biochemical markers and quantitative traits for future utilization by the breeders.

Achievements/Progress:

One hundred and ninety two diverse genotypes of Pisum sativum L. were studied for qualitative traits, quantitative traits and total seed protein profiles during 2004-2005. High allelic variation was observed for seed colour, anthocynin pigmentation, flower colour, plant colour spot and plant vigour. Quantitative traits, viz., branches plant-1, plant height, pods plant1, biomass plant-1 and grain yield plant-1 exhibited high diversity. In SDS-PAGE analysis the Electropherogram was divided into two regions, region I reflected 45% polymorphism among total bands, whereas region II indicated 49% polymorphism. Five clusters were observed for the germplasm based on all the three techniques in each case. The indigenous germplasm presented high diversity for all the three techniques, i.e., qualitative traits, quantitative traits and SDS-PAGE. Overall, qualitative traits and total seed protein profiles were important for explaining diversity level and geographic relationship clearly as compared to quantitative traits. Keeping in view the importance of plant genetic resources collection, evaluation and conservation, diversity should be systematically assembled and this is primary responsibility of plant genetic resources institute and centre in the world. Further there is need to exchange pea germplasm especially where low diversity is prevalent.

In another experiment 177 genotypes were screened against powdery mildew that is affected by Erysiphe pisi Syd. and reduces significant yield and quality allover the world. Screening through artificial inoculation under controlled conditions revealed that three genotypes (Fallon, PS99102238 and PS0010128) were highly resistant, while eleven (Shawnee, Lifter, Franklin, PS610152, PS810240, PS710048, PS610324, PS810191, CGN3273, CGN3272, and PS9910188) showed mild symptoms after inoculation but the infection was not severe and recovered rapidly. Overall powdery mildew caused 86% loss to the germplasm and the severity of disease was associated to various phases. The pathogen inhibits seed development in the pod and due to sever natural infection, the susceptible germplasm is expected to eliminate although some may have unique characteristics. Therefore, it is suggested to transfer genes including disease resistance and economic yield in one genotype. The data

were used to explore relationship between susceptible and resistant genotypes with to genetic diversity for geographic pattern but no evidence was observed to resolve the issue either on the basis of plant developmental phases or seed protein banding patterns. Seed protein could not identify genotypes either for geographic pattern or disease relation.

During 2005-2006 the selected genotypes on the basis of powdery mildew were retested for reconfirmation of disease status. Four known resistant checks (DASAN, DMR-7, DMR-20 and DMR-4) were used and among these DASAN was highly resistant and the reaming were escaping from disease although they were susceptible under controlled conditions. Eight genotypes; 10603, 10625, 10629, 10635, 10636, 10673, 10674 and 10683 were selected from field evaluation, whereas 34 genotypes; Lifter, Franklin, Joel, PS610152, PS010128, PS610324, PS810240, PS710048, PS810191, Shawanee, Fallon, PS810765, PS9910188, PS99102238, 3272, 3273, 16602, 13210, 3049, 16607, 2961, 2933, 2930, 2928, 16568, 2922, DMR-7, DMR-20, DMR-4, 10599, 10610, DASAN, 10603 and 10607 were selected from the greenhouse screening during 2004-2005. All the genotypes were sown in the greenhouse for reconfirmation of powdery mildew sensitivity during 2005-2006. Among the field condition selected genotypes, three (10603, 10629 and 10674) were escaping genotypes, while the remaining showed 100% disease in greenhouse house. While the genotypes selected from the greenhouse during 2004-2005, Fallon, PS99102238 and PS0010128 were highly resistant to powdery mildew, but under high disease pressure only Fallon showed resistance to powdery mildew and other two showed mild disease reaction and hence could be considered escaping genotype. Same results were reconfirming in Shawanee and 3273, which recovered and resist to powdery mildew when reach to full maturity.

In an experiment during 2005-2006 on evaluation 345 genotypes from different countries were investigated for qualitative and quantitative traits along with total seed protein profiles. For characterization, the data were recorded for 12 qualitatively controlled traits, viz., flower color, anthiocynin pigmentation, plant type, tendril type, plant vigor at seedling, leaf margin, seed color, cotyledon color, fresh pod curvature, fresh pod color, fresh pod texture and seed texture. Data on evaluation were observed for days to flower initiation, days to 100% flowering, branches plant-10, plant height, 10 fresh pod weight, fresh pod width, fresh pod length, dry pod weight, dry pod width, dry pod length, number of pods plant-10, grain yield plant-10. Data for first flower and 100% flowering were recoded on line basis and single value expressed one genotype, whereas 100-seed weight was measured for each genotype with the help of electronic balance (Metteler AE 200) and harvest index was expressed as percentage of grain yield over biological yield. All other data were recorded on ten plants randomly sampled from each genotype.

Project Title: ***Molecular breeding of Kabuli chickpea for Ascochyta blight resistance and high yield potential.***

Principal Investigator: ***Dr. Ahmad Bakhsh Maher***
Senior Scientific Officer

Location of Project: *Pulses Program, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.701*
Start Date:	*4/11/2002*	*Funds Released (Rs):*	*1375000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1375000*

Objectives:

- Under standing of genetic mechanism involved in the inheritance of resistance against blight.
- Development of molecular markers associated with blight resistance.
- Introgression of genes for blight resistance from resistant source into well adapted susceptible cultivars.

Achievements/Progress:

It was concluded from the present study that different genetic sources of resistance against Ascochyta blight exist in Kabuli chickpea. It is quite likely that these sources may possess different genes that confer resistance. Different genes for resistance available in different genetic backgrounds can be transferred to well adapted cultivars. The yield evaluation of bold seeded Kabuli types exhibited high grain yield potential in Potohar area. These genotypes can serve as base material for breeding high yielding blight resistant lines. The study on relationship of traits with grain yield unveiled that the biological yield, number of pods per plant, and number of fruit bearing branches are the most important characters that contribute significantly to grain yield. The study on DNA polymorphism in 36 genotypes using 40 RAPD primers revealed that these primers were unable to exhibit DNA polymorphism in these genotypes. The cluster analysis showed that these genotypes were similar to each other to the extent of 87-95%. However, discrete differences between DNA amplification profiles of 3 blight susceptible and 2 blight resistant genotypes were recorded for RAPD primer OPC-5, OPC-15, OPC-14 and OPC-9. These differences may have link with disease reaction of the genotypes. The genotypes that differed for blight reaction and DNA band profile were intercrossed to develop mapping populations. Seven blight resistant genotypes with high yield potential were identified from exotic material. These genotypes may be exploited in breeding programs to utilize their genes for resistance against blight through introgression. These genotypes may also be released after studies on adaptability and grain yield performance under farmer's conditions.

The 7 genotypes with high yield potential and blight resistance identified under this project will be studied in national testing program together with their on-farm evaluation in macro-plots to evaluate their adaptability in Potohar area under farmer's conditions. The hybrid populations developed between selected extreme parents will be utilized for development of random inbred lines (RIL) and for selection of single plants with resistance against blight. These inbred lines will be studied for establishment of linkage between DNA profile/bands and blight reaction (Susceptibility or resistance against Ascochyta blight) using selected RAPD primers.

Project Title: ***Pathobiology of Foliar Spots of Wheat and their Integrated Management.***

Principal Investigator: ***Dr. Shamim Iftikhar***
Senior Scientific Officer

Location of Project: *IPEP, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.069*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*2761700*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2756739*

Objectives:

- Assessment of distribution, incidence and severity of foliar diseases of wheat in different agro-ecological zones of Pakistan.
- To understand variability in the pathogen causing foliar disease in relation to resistance in host.
- Identification of new source of multiple disease resistance with other promising traits.
- Devise an integrated strategy for foliar disease management.
- Enhance Pakistani research knowledge base across the disciplines of this project.

Achievements/Progress:

Wheat disease, in general is one of the most important factors limiting the wheat yield. Among fungal disease spot blotch (Bipolaris sorokiniana) is of incrasing concern in developing countries. Bipolaris sorokiniana causes foliar blight/spot blotch, root rot and black point on grains. The pathogen in considered to contribute significantly to low average yields of cereal crops in many developing countries. In Pakistan Helminthosporium leaf spots (spot blotch) has been noted in southern province of Sindh, where winter temperature are warmer. Biplaris sorokiniana was isolated as predominant pathogen during last two years and current year survey of different agro-ecological zones of Pakistan out of two hundered leaf samples which were collected during current crop season, Biplaris sorokiniana has the highest incidence 100% in zone 6 followed by 66%, 55%, 31% and 31% in zone 7, 9, 10 and 11. The lowest percent incidence (3%) is observed in Sindh area (zone3 &4). This years 71 isolates of B. sorokiniana have been collected from zone 3, 4, 5, 6, 7, 9, 10 and 11. Mono conidial isolates of B. sorokiniana were tested for their virulence.

Fifty one lines of durum (Triticum turgidum) parents were screened against B. sorokinian under controlled condition. One accession of durum showed resistance, eight showed moderate resistance and sixteen showed moderate susceptibility.

Under the epidemiological studies on spot blotch different studied have been taken. The best temperature for the growth of the pathogen has been identified at 25 c out of 20c, 25c and 30c. The maximum growth is found on 12th day of pathogen growth. It was observed that the frequency of B. sorokiniana was highest in the samples collected from the flat area in rice wheat cropping system where different technologies are in practice like bed plantin, zero tillage and flat planting. The samples of zero tillage and bed/ridge plantation only Altenaria sp. or saprophytes were isolated.

Project Title: ***Evaluation and incorporation of new genetic diversity in Pakistani wheats for stripe (yellow) rust resistance.***

Principal Investigator: ***Dr. Iftikhar Ahmad***
Member

Location of Project: *Plant Sciences Division, PARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*2092000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1712000*

Objectives:

- Survey and gather pathogen virulence in Pakistan;
- acquisition of novel wheat genetic stocks and their parents for conducting stripe rust screening in the seeding and adult plant stage in Pakistan;
- identify stable genetic stocks from the test germplasm and seed increase;
- screening of segregating populations of the crosses, selecting desired derivatives, and stabilizing them by maize mediated double haploid protocol; and
- transfer of resistant stable advanced genetic stocks to wheat breeding program.

Achievements/Progress:

Assessment of virulence patterns and availability of virulent inoculum is prerequisite for the identification of resistance sources. In order to assess virulence patterns in wheat growing areas of Pakistan TRAP nurseries were planted at National Agricultural Research Center (NARC), Islamabad, Cereal Crop Research Institute (CCRI), Pirsabak and Nuclear Institute of Food and Agriculture (NIFA), Peshawar. No virulence was found for stripe rust resistant gene Yr10. Virulence for gene Yr 15 was found only in 2003-04 cropping season at NARC. To confirm virulence patterns of the inoculum to be used for identification of rust sources in wild wheat accessions disease samples were collected from farmer wheat fields in Punjab, NWFP and Sindh and Azad Kashmir. The samples were analyzed under glasshouse conditions for their race patterns. Analysis of 100 disease samples from the farmer field revealed presence of 18 races throughout Pakistan (0E0, 0E8, 2E0, 6E0, 34E0, 64E0, 66E0, 67E0, 68E0, 66E1, 70E0, 70E32, 71E28, 71E0, 64E128, 68E16, 103E0 and 194E0).

Many wild relatives of wheat are known to carry disease resistant traits. To acquire material to be screened for stripe rust resistance 200 hundred accessions of Triticum turgidum (durum), 40 accessions of Aegiolops tauschii, 12 accessions of Aegiolops spp, 6 accessions of Aegiolops triuncialis and 6 accessions of Agropyron were obtained from PGRI. Screening of the acquired material showed that 35 accessions of Triticum turgidum (durum) were resistant 20 accession were Moderately resistant, while 14 accession of Aegiolops tauschi were resistant and 12 were moderately resistant Two accession of Aegiolops spp, and 1 accession of Aegiolops triuncialis were found resistant.

Use of the wild wheat relatives in wheat breeding is limited as they can not be crossed directly with bread wheat. Synthetics wheat provide an edge of bridging gap between wild wheat relatives and bread wheat for transferring desired traits from wild wheat relatives to bread whet. 179 lines of synthetic hexaploid, 10 lines of Roya AA genome synthetics, 15 lines of Roya DD genome synthetics were thus developed and provided by the overseas collaborator of the project. These synthetics were screened

against identified stripe rust races to identify resistant synthetic lines. Total 10 lines of synthetic hexaploid ELITE I, and 7 lines of Triticum tergidum were resistant where as 46 Lines of ELITE I and, 17 lines of ELITE II and 10 lines of Triticum tergidum were moderately resistant and 15 accesions of Ae speltoides and 8 lines Ae. speltoides x Durum were found resistant to stripe rust uder glasshouse conditions at seedling stage. Twelve of the Ae. speltoides accessions screened were resistant and 2 moderately resistant , 4 lines of Ae. speltoides x Durum" crosses and 1 were moderately resistant at seedling stage.

Field assessment of the synthetics for the identification of promising lines with horizontal resistance the material was screened under filed conditions at adult plant stage using bulk inoculum containing mixture of races mentioned above. 40%Elite I, and 36% Elite II had AUDPC ranging between 0-10%. These lines had relatively less AUDPC and were considered to have adult plant resistance. Seven lines of Roya AA, 14 lines of Roya DD and were found resistant to stripe rust disease, Out of 15 lines of Roya DD genome 10 lines were found resistant at adult plant stage. 92 lines of Pakistani commercial wheat were also screened for adult plant resistance and only Auqab 2000, Zarghoon-29, AS2003, Wadanak-85, Barani 70, NIAB-T-183, were found to have adult plant resistance. These lines can act as good background for transferring new genes.

Project Title: ***Identification of sources of resistance to Karnal bunt disease of wheat.***

Principal Investigator: ***Mr. Javed Iqbal Mirza***
Sr. Scientific Officer

Location of Project: *CDRP, IPEP, NARC, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.54*
Start Date:	*7/3/2003*	*Funds Released (Rs):*	*1590500*
Project Status: On-Going		*Funds Utilized (Rs):*	*1235240*

Objectives:

- Identification of Karnal bunt disease resistance sources.
- Making available Karnal bunt resistant germplasm to breeders.

Achievements/Progress:

To identify new sources of Karnal bunt disease resistance a set of 193 A genome synthetic hexaploid wheat lines, 79 Historic wheat varieties and 19 candidate wheat lines (included in National Uniform Wheat Yield Trials 2005-06) were screened in NARC fields. Two sets Synthetic Elite-I (95 lines) and Synthetic Elite – II (consisting of 33) of the synthetic hexaploid wheat lines and set of their Durum parents, acquired from collaborating scientist Dr Abdul Mujeeb Kazi were screened against Karnal bunt disease under glasshouse conditions to confirm resistance of the lines found free of Karnal bunt during field screening. Most of the Historic wheat varieties were found highly susceptible to Karnal bunt. Only eighteen lines did not develop disease symptoms under field conditions when inoculated with Karnal bunt pathogen. Among 19 lines included in National Uniform Wheat Yield Trial 2005-06 only 8 did not develop Karnal bunt symptoms when screened for resistance under field conditions. Out of 193 A genome synthetics 168 did not develop any disease symptoms when screened under field conditions.

Lines found resistant in set of historic wheat varieties, NUWYT and set of A genome synthetic need to be re-screened under glasshouse conditions as escape phenomenon is very common under field screening conditions. Such escape phenomenon was confirmed in our studies when lines of Elite I, Elite II and their Durum parents showing resistance under field screening were found susceptible under glasshouse conditions. "A" genome synthetics (2n = AAAABB) developed by the overseas collaborator Dr. Abdul Mujeeb Kazi (Mujeeb Kazi et al.2003) have tremendous potential for resistance against karnal bunt resistance and are not exploited yet. Taping this resistance can result in addition of valuable germplasm for the improvement of bread wheat.

Screening of the synthetic Elite- I and Elite – II under glasshouse conditions revealed that 45 lined of Synthetic Elite-Is, and 17 lines of Synthetic Elit-IIs, remained resistant to karnal bunt disease under field and glasshouse conditions. Among Durum parents only 8 lines did not develop Karnal but susceptibility under field and glasshouse conditions. Synthetics found resistant under field and glass house conditions can directly be used in breeding program, their crosses with leading bread wheat lines will provide a better option for transferring resistant genes to the desired bread wheat lines. Comparing susceptibility of Durum parents with that of synthetics identifies sources of resistance in later derived

from Aegilops squarossa accessions. Combination of this resistance with that of Durum's, through double haploid mediated synthetics, can give excellent resistance against Karnal bunt disease.

Project Title: ***Investigation on barley yellow dwarf virus (BYDV) in wheat crop in Pakistan.***

Principal Investigator: ***Dr. Shahid Hameed***
Senior Scientific Officer

Location of Project: *CDRP, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.892*
Start Date:	*1/1/2004*	*Funds Released (Rs):*	*2691700*
Project Status: On-Going		*Funds Utilized (Rs):*	*22526396*

Objectives:

- Epidemiological studies on BYDV
- Characterization of Pakistani isolates of BYDV
- Identification of source of resistance against BYDV.

Achievements/Progress:

During the 2004-05 wheat cropping season seventeen fields were sampled in Sindh, 89 in Punjab, 21 in NWFP and 2 in Balochistan. The overall incidence of BYDV was around 36.63%. In Punjab, Sindh, NWFP and Balochistan the values of incidence with DAC-ELISA were 19.61, 18.04, 56.29, and 11 respectively. Following plants were found to be infected with BYDV-PAV strains; Zea mays (maize), Avena sativa (oats), Saccharam officinarum, Sorghum halepense, Echenocloa colonum, Eragristis mino and wheat var. (Fakhar-e-Sarhad). The purification procedure described here does not provide the substantial quantity of particles required for the antiserum production. The data for the average of response of wheat genotypes to the BYDV infection in field test indicated differences in resistance level. Out of fifteen wheat lines, seven were found moderately resistant and remaining showed various levels of susceptibility. The same fifteen wheat lines obtained from ICARDA were also screened using aphid vector under controlled conditions at NARC and scored for virus presence/absence by DAC-ELISA. Two genotypes did not get infected namely BW-11(113.1/MLT/TUI) and CHA4/tam2000/rsk/fkg15) suggesting that they could be resistant and remaining showed various levels of susceptibility. A molecular marker for the Bdv2 gene conferring resistant to BYDV in wheat was also standardized. The PCR screening with markers provides a quick efficient method that could be used to screen thousands of wheat lines for BYDV resistance based on Bdv2 and possibly to identify resistances bases on other genes like Bdv1.

Project Title: ***Assessment of Suitable Sealant material (s) for increasing the gas-tightness of Public Sector warehouses and Tarpaulins used for covering the open-stacks (ganjees).***

Principal Investigator: ***Syed. Asim Rehan Kazmi***
Senior Scientific Officer

Location of Project: *GSRI, Southern Zone Agriculture Research Centre (SARC), Karachi Code No. 75270.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*5.258*
Start Date:	*5/1/2003*	*Funds Released (Rs):*	*1523000*
Project Status: Completed		*Funds Utilized (Rs):*	*1296289*

Objectives:

- Identify and evaluate suitable material to attain minimum gas-tightness in existing house-type and binishell warehouse (godown structures).
- To test the candidate material under laboratory and field conditions for effect on retention of phosphine gas.
- To design and demonstrate the most economical treatment/ method for the application of candidate materials.
- To prepare and test gas-tight, waterproof and fireproof tarpaulins under laboratory and field conditions for open storage (ganjees) fumigation.

Achievements/Progress:

Public sector grain storage warehouses particularly “BINISHELL” type structures are not suitable for fumigation with Phosphine (ALP3) gas. Three sealants i.e. ZSG-12/99, ZSAC-10/55 and ZSP-1191, manufactured locally, have been tested in laboratory for increasing the gas-tightness of BINISHELL.
Under laboratory conditions the sealants were applied onto small earthen pots from inside, outside and both sides with control set kept untreated. These highly porous pots when injected with 1500 ppm of 1-3 weeks at room temperature of 25+5c compared to control. Variations/drop in gas concentration was recorded using automatic phosphine detection meter (range0-2000 ppm)
Performance of the sealant materials in high temperature 50-55c is being evaluated under controlled conditions within Welkin-type Environmental Chambers.

Project Title: ***Sustainable Cropping Patterns for Pothowar Plateau.***

Principal Investigator: ***Dr. Shahbaz Ahmad***
Professor

Location of Project: *Department of Agronomy, University of Arid Agriculture, Rawalpindi.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.036*
Start Date:	*5/1/2003*	*Funds Released (Rs):*	*1957800*
Project Status: On-Going		*Funds Utilized (Rs):*	*1577633*

Objectives:

- Identification of cropping patterns for efficient soil moisture and fertility use under rainfed conditions.
- Identification of the most ruminative cropping pattern under rainfed conditions.
- Demonstration and popularization of the best cropping pattern to the farmers.

Achievements/Progress:

The second year (2004-05) experiments were laid out at five locations i.e. University of Arid Agriculture, Rawalpindi (UAAR), National Agricultural Research Center, Islamabad, (NARC), Barani Agricultural Research Institute, Chakwal (BARI), Barani Agricultural Research Station, Fateh Jang (BARS) and Groundnut Research Station, Attock (GRS). There were ten cropping patterns including wheat, canola, groundnut, sunflower, maize (grain / fodder), mungbean and fodder oat crops. Each trial was replicated thrice at all the locations. Spring crop 2004 (groundnut) and rabi crops 2004-05 (wheat, canola and fodder oat)- were planted according to plan of work. The results of spring 2004 indicated that groundnut performed better at UAAR than all other locations followed by BARI. The lowest groundnut yield was recorded at BARS. Monetary benefit of the groundnut showed that groundnut based cropping patterns fit well for high rainfall regions as compared to low rainfall regions. The rabi crops (wheat, canola and oat-fodder) performed better at UAAR followed by NARC and BARI. The monetary benefits of rabi crops was better in high rainfall zones than the medium and low rainfall zones; however, the monetary benefits for growing these crops at GRS and BARS were lowest. Canola and fodder oat are possible alternative for wheat as their economic return was 2-3 times higher than wheat.

Soil moisture in the fields having all the four crops differed significantly due to variation in the environmental conditions and physiochemical properties of soil. Locations differed significantly for soil moisture availability for the crops that was translated into yields.

Soil fertility status was also different among the locations. The nutrient status of the soil at the time of harvesting was lower than at the time of planting before fertilizer application. The general trends of the data were similar at different locations and for all the crops.

Project Title: ***Introduction of soft fruit (strawberry, black berry, rasp berry, black currant) in the potential areas of Pakistan for economic returns.***

Principal Investigator: ***Dr. Khalid Mahmood Qureshi***
Senior Scientific Officer

Location of Project: *IFHC, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*3301200*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2794324*

Objectives:

- The primary objective of the programme is the introduction of improved exotic planting material of soft fruits.
- To select the best adapted one to local climate soil and biotic condition for commercial exploitation.
- To develop appropriate production technology.
- To established plants nursery for production of pedigree plants.

Achievements/Progress:

Survey was continued for identification, selection and collection of germplasm of strawberry, , black berry, rasp berry, black currant. Planting materials were collected from Malam Jabba, Matta, Bakain, Mingora, Peshawar, Murree, Rawalakot, Ghari Dopatta, Muzafrabad, Soan valley and Islamabad surrounding areas. Plants were multiplied through different propagation techniques and planted in green house and are being maintained for research purpose at NARC. Plants multiplied at NARC were distributed to ARI Mingora and Tarnab Peshawar, Experimental trials were conducted to observe growth behavior of cultivars at NARC. Following data regarding vegetative and reproductive growth were repeated this year and being collected.

1.Response of strawberry cultivars to different chilling and duration.
2.Effect of different environment on growth and yield of strawberry.
3.Effect of crown size of various wild soft fruit species.
4.Characterization of various wild soft fruit species.
5.Comparison of strawberry cultivars under Islamabad condition.

Observation were made on number of runner produced per plant, leaf area, leaf fresh and leaf dry weight, number of fruits per plant, fruit weight and fruit size. Data showed that chilling treatment increased vegetative and reproductive growth. Plants chilled at 4c0 performed better comparatively and plants grown under green house yielded earlier compare to other environment.

Results from this study showed that chilling caused increased in vegetative and reproductive growth of strawberry. The difference in vegetative and reproductive growth may also be associated in some way with difference in growing environment. Crown size showed positive effect on plant growth and yield. Bigger crown size produced fruits of quality. During survey it was observed that specious soft local Germplasm available at various sites, needs attention and promotion for commercial cultivation.

Project Title: ***Mutation breeding for high grain yield, improved quality and earliness in non-aromatic rice (Oryza sativa L).***

Principal Investigator: ***Mr. Abdul Wahid Baloch***
Principal Scientific Officer

Location of Project: *Nuclear Institute of Agriculture, P.O. Box 70060, Tandojam, Sindh.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.112*
Start Date:	*8/1/2003*	*Funds Released (Rs):*	*846000*
Project Status: On-Going		*Funds Utilized (Rs):*	*6846000*

Objectives:

- To evolve new rice varieties with i) Early maturity ii) Superior grain quality iii) High yield and iv) tolerant to biotic and abiotic stresses.

Achievements/Progress:

Mutant plants selected from M2 population for various traits were confirmed in M3 generation which showed phenotypic stability. Out of 31, only IS mutant lines were confirmed as 10-22 days earlier in maturity period than the parent varieties (IR8, Shua-92 and Sarshar). Out of 28 only 7 mutant lines were confirmed for improved grain quality and out of 30 only II mutant lines were confirmed for high grain yield. The selection and confirmation percentage of mutant lines from M2 to M3 were 48, 25 and 37 percent for earliness in maturity, improved grain quality and high grain yield respectively. The performance of mutant lines with respect to plant maturity days, plant height, numbers of panicles per plant and grain yield kg/plot were found superior than parent varieties viz; IR8, Shua-92 and Sarshar respectively.

The use of induced mutation was considered as an appropriate approach for developing short duration mutants accompanied by high yield and excellent grain quality. This will boost the income of farming community and help enhancing the foreign exchange earnings.

The seed of mutant lines developed at NIA will be available to national and international institutes on request.

Project Title: ***Production of doubled haploids wheat with longer coleoptile.***

Principal Investigator: ***Dr. Fida Muhammad***
Associate Professor

Location of Project: *Department of Plant Breeding, NWFP Agriculture University, Peshawar.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.859*
Start Date:	*8/1/2003*	*Funds Released (Rs):*	*1408700*
Project Status: Completed		*Funds Utilized (Rs):*	*1398904*

Objectives:

- Develop wheat genotypes with longer coleoptile;
- determine the narrow-sense heritability of coleoptile length; and
- determine genotypic and phenotypic correlations of coleoptile length with yield components.

Achievements/Progress:

The problem of seedling emergence prevails in areas where seed is seeded relatively deeper in search of moisture for germination. The present day semi dwarf wheat cultivars fail to emerge when planted deeper because of shorter coleoptile. To achieve these objectives, twenty wheat varieties/lines of exotic and indigenous origins were screened for coleoptile length in laboratory at different planting dates to overcome the temperature effect on the development of coleoptile and to identify varieties with longer coleoptile for hybridization. The varieties with longer coleoptile were hybridized with high yielding varieties of shorter coleoptile to pyramid high yield with relatively longer coleoptile. Doubled haploid technique was used to get homozygous/pure lines from segregating populations. Doubled haploidy is a procedure where segregating wheat populations are pollinated with maize pollen for the production of haploid embryos. The haploid embryos were raised to tillering stage and were treated with colchicine to double the chromosomes for homozygous seed production. Field data on yield and its contributing traits were recorded at different stages of plant development and significant findings were published. Some promising lines were identified and will be released for commercial cultivation after necessary testing. All objectives of the project including identification of suitable germplasm for coleoptile length, heritability estimates for coleoptile length and correlation of coleoptile with important traits were ascertained. In addition, the facility of doubled haploid technique got established in the department of Plant Breeding & Genetics, NWFP Agricultural University, Peshawar.

Eight students completed their research in the project for degrees leading to B.Sc (Hons), M.Sc. (Hons) and Ph.D. Three research papers prepared from this project have been accepted in the HEC recognized journal.

Project Title: ***Control of phytopathogenic microorganisms by bacteriocins from indigenous strains.***

Principal Investigator: ***Dr. Sheikh Ajaz Rasool***
Senior Professor

Location of Project: *Department of Microbiology, University of Karachi, Karachi-75270.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.133*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*2024500*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2019623*

Objectives:

- Isolation &identification of the pathogenic orgnisms(from different diseased fruits, vegetables)
- Bacteriocin production potential of the isolated strains against the isolated and other standard phytopathogenic bacterial strains.
- Genetic determination location monitoring experiments for positioning the bacteriocin regulating genes by curing experiments.
- Plasmid isolation and characterization by mini-prep method and agarose-gel electrophoresis.
- Purification (partial) and characterization of the representative bacteriocin preparation w.p.r. to molecular weight/sizing etc.
- Technology development for mass application.

Achievements/Progress:

Eight strains namely Xanthomonas oryzae NA1. Xanthomonas oryzae NA2, Xanthomonas citri NA3, Psendomonas andropogonis NA4, Erwinia Carotovora NA5, Agrobacterium radiobacter. NA6, Agrobacterium radiobacter NA7 and Erwinia carotovora NA8 were isolated from diseased fruits, vegetables and soil (near onion and pepper rhizosphere). All the isolates were screened for bio activity against phytopathogenic bacteria whereby only three i.e. Erwinia carotovora NA5, Agrobacterium radiobacter NA6 and Aggrobacterium radiobacter NA7 were fiound to produce bacteriocin. Their bacteriocins are designated as Erwiniocin NA5, Agrocin NA6 and Agrocin NA7 respectively. However bacteriocins are designated as Wrwinicoin NA5, Agrocin NA6 and Agrocin NA7 respectively. However the Erwiniocin NA5 were shown as a mega bacteriocin. The inhibitory activity could not be related to bacteriophages and hydrogen peroxide. It has a broad-spectrum activity against many gram-positive and gram-negative bacteria (including phytopathogens). It showed wide thermostability (60oC, 80oC, 100oC and pressured 121oC for various time periods) and remained stable at wide (2-14) pH range. The substance is resistant to treatment with several metal ions and organic solvent, lipase, lysozyme, and catalase but sensitive to proteinase K and protease suggesting its proteinaceous nature. The antibacterial titre of Wrwiniocin NA5 was found to be 160 AU/ml. Its production starts in early logarithmic phase and continues till late stationary phase. Erwiniocin NA5 revealed bactericidal effect on Zanthomonas oryzae NA1 as well as on Ewrinia carotovora NA8. Erwiniocin NA5 is dialyzable through dialysis membrane (Erwiniocin NA5 was roughly estimated to be less than 12 KD a, which was confirmed by SDS-PAGE). Bacteriocin was precipitated (up to 80% saturation) by ammonium sulphate. The precipitate was found to contain 5.1 mg/ml of protein. When partially purified bacteriocin was subjectd to gel filtration (using sephadex G 75 column) a major active peak of protein (containing 4.9 mg of protein estimated by biurett method) with 2.7 fold purification. The amino acid composition ref. NCBI genomics server of the protein is estimated to

contain 7.9%alanine, 5.7% arginine, 4.56% asparginine, 5.28% aspartic acid, 1.37% cystein, 4.27% glutamine, 7.16% glutamic acid, 6.95% glycine, 2.17% histidine, 9.7% leucin, 7.09% isoleucine, 5.7 lysine, 3.3% methionine, 3.2% Phenylalanine, 2.9% praline, 7.46% serine, 4.42% threonine, 1.45% tryptophane, 3.4%tyrosine and 6.5% valine. The production of the bacteriocin is regulated by extra chromosomal genetic factor (s). The in vivo effect of Erwiniocin NA5 was monitored against Xanthomonas oryzae oryzae (Xoo), the causative agent of bacterial leaf blight (BLB) of rice and was found effective. Bacterocins like Erwiniocin NA5 should be preferred over antibiotics and synthetic chemicals. The production of Erwiniocin NA5 should be stuied by shake flask, Lab and pilot scale fermenters technologies. Before mass scale production possibilities.

Project Title: ***Conservation and sustainable utilization of agro-biodiversity of under-utilized crops.***

Principal Investigator: ***Dr. Zahoor Ahmad***
Principal Scientific Officer

Location of Project: *Plant Genetic Resources Institute (PGRI), NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.896*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*1697689*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1390264*

Objectives:

- To expand germplasm collections of underutilized crops (upto 10 species)
- Evaluation of collected germplasm (10 to 50) for various morphological and agronomic traits.
- To increase the yield of under utilized crops through selection/ breeding and substantially increasing the income of small farmers.
- To open up marginal lands by cultivating underutilized crops.

Achievements/Progress:

Eighty three accessions of Sesame (Sesamum indicum L.) were evaluated for plant height, days to maturity, number of branches per plant, number of capsule per plant, 100 seed weight and biological yield. The data revealed that high diversity was observed for all the quantitative traits. The plant height ranged from 68-180 cm, with Mean±SE 145.59±2.73; days to harvesting ranged from 88-93 days, with Mean±SE 89±0.21; number of branches pr plant ranged from 1-66, with Mean±SE 10.2:1:0.67; number of capsules per plant ranged from 12-366, with Mean±SE 146.5±7.22; biological yield ranged from 1.18- 336.34 with Mean±SE value 75.96±7.55 and 100 seeds weight ranged from 0.03-0.99, with Mean±SE 0.63±0.02. The maximum diversity was recorded for number of branches per plant and number of capsules per plant. The single branched genotypes having fruit capsules in clusters were recognized as elite lines with high yield potential. The correlation coefficient. Was computed among all the traits i.e. plant height, days to harvesting, number of branches, number of capsule per plant, total weight (biological yield) and 100 seeds weight. The results regarding correlation revealed that all the characters were correlated positively.

Forty three accessions of Linseed (Linum usitatissimum) were planted in augmented design at NARC in October, 2004. The data on plant height, No. of branches per plant, flower colour, days to maturity, yield per plant, seed yield per row were recorded. There was low genetic diversity for days to maturity while high genetic diversity was recorded for other quantitative traits.

Eighty one accessions of Hibiscus species were evaluated for various qualitative and quantitative traits and high genetic diversity was recorded particularly for plant height and yield. Based upon yield, PK-4019, PK-4025, PK-3987 and PK-4018 were found high yielding for fiber content and seed yield.

Thirty six accessions of Trigonella foenum graceum germplasm were evaluated at NARC and data for various genetic characters (qualitative and quantitative) were recorded. High diversity was recorded for plant height, biomass and 1000 seed weight. All the accessions were also subjected to bio-chemical

evaluation (total seed protein) using SDS-PAGE. The banding pattern in all the accessions were almost similar indicating narrow genetic base at seed protein levels.

Sixty two accessions of Kalongi (Nigella sativa L.) were evaluated for days to first flower, days to 50% flower, days to initiation of capsules, flower color, plant height, plant size, growth vigor, plant color, plant type, plant hairiness, days to maturity, days to harvest, biological yield, number of branches, number of capsules per plant, capsule weight, capsule length, capsule width, number of locules, 1000 seed weight, seed yield, Physio-chemical properties of oil, oil contents. Highly significant diversity was recorded for character leading to yield (i.e. number of branches per plant, number of capsule per plant, number of seed per capsule, 1000 seed weight). Based upon the yield data, four germplasm lines (MP-007, MPOO13, :MP-0022 and MP-0024) were found high yielding lines in comparesion to other material. These lines have been selected and seeds are being multiplied for further research and development. The SDS-P AGE data revealed narrow variability for total seed protein. The statistical analysis of evaluation data based upon quantitative traits put all the germplasm in five different clusters.

The germplasm of all the ten plant species (Cyamopsis .tetragonoloba, Mentha spp., Plantago ovata, Ricinus cummunis, Hibiscus cannabinus, Sesamum indicum, Trigonella foenum graceum, Linum usitatissimum, Nigella sativa and Vigna unguiculata) collected during the execution of this project has been multiplied and conserved in the Genebank under active and base collection. The germplasm of Nigella sativa, Cyamopsis tetragonoloba and Mentha spp. Has been distributed to various research organizations and some farmers to create the awareness about the importance and production technology. The demonstration plots of Nigella sativa were planted at Ludan, Vehari and Kasur while of Plantago ovata at three different localities in Hasilpur and Bahwalpur.

Nineteen accessions of Ispbaghol (Plantago ovata) were evaluated for various quantitative traits (days of first flower, days to 50% flowers, plant height, spike length, tillers per plant, biomass, number of seeds per spike, 1000 seed weight, and seed yield. The accession No. 596483, 596485, 596492 and 242825 were identified as high yield lines comparatively.

Fifty one accessions of cowpeas were evaluated for different agro-morphological traits. High variability was present in the pod width, pod length, plant height, number of branches, seed per pod, days to 50% maturity, days to harvesting, seed size, seed yield, biomass, harvesting index and 100 seed weight.

Project Title: ***Studies on mycotoxins in corn.***

Principal Investigator: ***Dr. Yasmin Ahmad***
Principal Scientific Officer

Location of Project: *IPEP, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.5*
Start Date:	*8/1/2003*	*Funds Released (Rs):*	*1720800*
Project Status: Completed		*Funds Utilized (Rs):*	*1557751*

Objectives:

- Survey and mapping for the incidence of mycotocxin producing fungi in corn grains under storage and field conditions.
- To determine the incidence of mycotoxins in corn stalks.
- Isolation and characterization of mycotoxins.
- Developing strategies for the management of identified mycotoxins.

Achievements/Progress:

A survey of corn ear rot disease at different locations under various agro-ecological zones of Pakistan showed the presence of 9 fungi viz., Aspergillus flavus, A. niger, Diplodia maydis, Fusarium graminearum, Fusarium moniliforme (Fusarium verticillioides), Fusarium oxysporum, Penicillium, Trichoderma and Alternaria. Of fungal organisms, F. verticillioides was found more destructive and in combination with the insect pest Chilo partellus, caused more ear rot disease by 7.7, 10.1, 2.4 and 9.5 % in the Punjab, NWFP, Sindh and ICT areas, respectively.

Analysis of 127 samples with the most severe ear rot showed mycotoxin contamination (fumonisin B1, aflatoxin and deoxynivalenol). Of all, fumonisin and aflatoxin were found the major mycotoxins in different areas of Pakistan. Different strategies were developed by using agro-chemicals, composts, soil solarization and resistant cultivar/ hybrids for the management of mycotoxins in corn. Of all, soil solarization was found effective in reducing the incidence of corn ear rot disease and consequently mycotoxins (fumonisins & aflatoxin) which could be used for the management of mycotoxins in food grains in future.

Collaboration with the Overseas Cooperating Scientist Charles P. Woloshuk at Purdue University, West Lafayette, Indiana, USA. from 01.10.2005 to 17.12.2005.

A two days Workshop on Mycotoxins in Food Grains was organized under ALP Project from June 14-15, 2006 and prepared recommendations. Presented two research papers/ abstracts in the science conferences

Project Title: ***Investigations on Indian Crested Porcupine, Hystrix indica, Damage to Forest Flora and Development of Prevention Practices in Tarbela-Mangla Watershed Areas.***

Principal Investigator: ***Mr. Rafiq Massih***
Senior Scientific Officer

Location of Project: *VPCL, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.866*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*2254600*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1572863*

Objectives:

- To quantify porcupine damage to tree stockings, trees, surface vegetative cover (plant communities) and crops.
- To study reproductive biology, population structure (distribution, density etc.), behavior and food habit preferences, energy budgeting and seasonality.
- To develop environment friendly and sustainable management strategies to prevent porcupine infestations and damage.
- To train forest staff and stakeholders (farmers) on the management of porcupine damage.

Achievements/Progress:

There was only 4.23% damage to potato crop at maturity stage was observed. However no damage to vegetable crops (peas and tomato) was recorded.

In the stomatch contents of the porcupines, 29 plant species were found. Among them the 5 most preferred plant species were; Pinus roxburghii> Sorghum helepense > Zea mays (Maize) > Malia azadrach (Dharek) > Aesculus indica.

Analysis of faecal contents revealed that there was more than 20 plant species, which contributed in the feeding of porcupine. The most preferred food of the porcupine was in the following order of preference Malia azarderch (14.4%) Pinus roxburghii (12.6%) > Diospyrus lotus (10.1%) Triticum aestivum (6.3) > Zea mays (5.8%) Hordeum vulgare (4.6%) > Sorghum vulgare (4.2%)>.

Average porcupine burrow density was 0.08 burrows per ha and average number of porcupine occupying in a single burrow system was estimated to 1.8 animals per burrow.

Groundnut and maize were evaluated as the most preferred food for porcupine. It was also evaluated that mixture of groundnut and maize in a ratio of 50:50 can be used as suitable material for preparation of rodenticide baits.

Project Title: ***Biology and Management of Porcupine, Hytrix indica in Centeral Punjab.***

Principal Investigator: ***Dr. Afsar Mian***
Dean

Location of Project: *Faculty of Sciences, University of Arid Agriculture, Rawalpindi.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.094*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*1489300*
Project Status: On-Going		*Funds Utilized (Rs):*	*1463100*

Objectives:

- To quantify porcupine damage to tree stockings, trees, surface vegetative cover (plant communities) and crops.
- To study reproductive biology, population structure (distribution, density etc.) behavior and food habit preferences, energy budgeting and seasonality.
- To develop environment friendly and sustainable management strategies to prevent porcupine infestations and damage.
- To train forest and irrigation staff and stakeholders (farmers) on the management of porcupine damage.

Achievements/Progress:

During the period under report much emphasis was laid on the management of porcupines in different habitats by way of evaluating different materials and methods. Large-scale field trials were conducted to determine the efficacy of two poison baits, i.e. racumin and zinc phosphide and to furnigants, i.e. carbon monoxide and calcium cyanide. On the average, carbon monoxide, calcium cyanide and racumin caused 95.84, 96.52 and 100% mortality, and were equally effective. Zinc phosphide bait gave 27.78% mortality indicating that it was less effective and poorly consumed by porcupines. A new delivery system for the generation of carbon monoxide inside the den of porcupine was evaluated in Daphar forest plantation, Gujrat. Forty two dens were fumigated by employing this technique. Four days post-treatment observation showed 100% mortality of porcupines. This technique is safe and environment friendly. This is the most significant achievement, Two percent zinc phosphide bait mad eup from maize grain was evaluated in protected bait stations. Preliminary observations indicated bait shyness and neophobia towards bait stations.

Additional information was gathered on different aspects of biology and ecology of Indian crested porcupine. Burrow density was estimated in three more places suggesting a very high density along the drainage canal in Daphar plantation, Gujrat. Burrow observations during the night with the help of night vision infrared camera suggests that burrow is inhibited by some other small mammals, i.e Indian Pangolin (Manis crassicaudata), palm civit (Vivericula indica) and fruit bats. Further observations recorded showed that two members of a pair leave the burrow for foraging separately with an interval of about an hour. Animal comes out of burrow sniffing the ground in a zigzag manner. After foraging they return to their burrow before sun rise (4:00 – 5:00 am in summer). Data were collected on morphometery of thirty adult five porcupines trapped using kill/live trap from different eco-zones of Punjab. A summary of the data (n = 35) collected on different morphometric records showed that the average weight of male is 11.15 +- 0.47 kg) but lies in the same range limit (8.3 -15 kg). The maximum total length recorded is 96.5 cm incase of male and 100cm in case of female. Average adult

body length has been recorded as 82.50+-1.66cm and 84.07+-2.42 cm in male and female, respectively. Lower incisors are significantly ($P<0.05$) larger than the upper ones both in case of male (3.87+-0.10cm vs 2.26+-0.07cm) and female (3.74+-0.08cm vs 2.12+-0.04cm). Unlike the other rodent species, in case of porcupine the incisor seem to achieve its maximum size (upper/lower = ¾.5 and 2.5/4.5 in male and female, respectively) during adulthood. However the general observations on the adult porcupines indicate that there is no remarkable morphological differences between the males and females (no sexual dimorphism). Observations on female reproductive system suggests that the animal have a single cervix followed by a common uterus body (duplex) and then the division of uterus into two rather than bi-carnuate as reported for other related species. Body weight has no correlation with the paired testes weight ($R2 = 0.03$).

Project Title: ***Developmental Biology, Feeding Pattern and Management Strategy against Indian Crested Porcupine (Hystrix indica) in Sindh and Balochistan Provinces.***

Principal Investigator: ***Mr. Amjad Pervez***
Senior Scientific Officer

Location of Project: *VPCI, Southern Zone Agriculture Research Centre (SARC),Karachi University, Karachi.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.962*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*1582000*
Project Status: Completed		*Funds Utilized (Rs):*	*1536000*

Objectives:

- To quantity porcupine damage to tree stocking, surface vegetation cover and crops in Sindh and Balochistan provinces;
- to study reproductive biology, behavior and food habit preferences, energy budgeting and seasonality;
- to develop an environment friendly and sustained management strategy against porcupine; and
- o train forest, irrigation staff and farmers related to porcupine management technique.

Achievements/Progress:

Indian crested porcupine (Hystrix indica) is the largest rodent pest of field crops, forestry and irrigation network. It is widely distributed throughout Pakistan right from Himalaya to coastal areas of Sindh and Balochistan provinces. In Balochistan, the porcupine damage to orchard plantations and tuber crop is very prominent ranging from 10 to 25% and some areas farmers have stopped growing apple nursery and potato. Like wise in Sindh, several cases of canal breaches are pointed out by irrigation department due to its extensive tunneling along the canal banks resulting in loss of precious water. During the vegetables damage survey, potato, cabbage, peapod, carrot and sweet potato were recorded the highly preferred one. In Balochistan apple, wild sheena, cherry and fig tree species were observed to be seriously damaged by this pest both through uprooting and debarking of the stem.

For its management purpose, integrated pest management (IPM) approach was applied through mechanical and chemical control measures. Trap success of single catch traps and leg-hold traps in Mastung Balochistan was recorded 46% and 76% respectively. Under chemical control ‘’PARC Rat blocks’’ incorporating zinc phosphide (acute rodenticide) and brodifacoum (anticoagulant) were tested in Mastung, Hanna and Muslim Bagh study areas of Balochistan and 92.60% and 98.52% respectively pest mortality was achieved. The ‘’PARC Rat blocks’’ for porcupine control, developed by VPCI/PARC Karachi are an innovative technology as it is cheaper, easy to use and cost effective. During the project life, eleven training sessions were held in which 510 participates including local farmers, NGO’s and provincial agricultural personnel were imparted training pertaining to pest behaviour, biology and its management through audio-visual aid and on-field demonstration.

Project Title: ***Quantification of maize yield losses from leaf blights and improving maize populations for grain yield and leaf blight resistance.***

Principal Investigator: ***Dr. Hidayat-ur-Rehman***
Professor

Location of Project: *Department of PBG, NWFP Agriculture University, Peshawar.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.173*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*1520000*
Project Status: Completed		*Funds Utilized (Rs):*	*1215000*

Objectives:

- Obtain an estimate of the yield losses caused by leaf blights in maize growing belt of Peshawar and Swat valleys of NWFP;
- determine the relationship between disease severity and grain yield loss caused by maydis leaf blight;
- adopt an effective maize breeding methodology for improving yield and disease resistance to leaf blights;
- uantify the expected gains in resistance to leaf blights using S family selection;
- develop maize populations having stay green characters for dual use as grain and green fodder for livestock; and
- increase the research capability of the institution by establishing foundation for term maize breeding programs.

Achievements/Progress:

Maize breeding programs in NWFP during the past have mostly concentrated on the improvement of yield and little attention has been given to the improvement of disease resistance levels in the released cultivars. The result is that the recently released maize varieties are increasingly becoming vulnerable to diseases like leaf blights. An integrated maize improvement scheme was therefore, initiated at NWFP Agri. University, Peshawar to address this fast increasing potential threat to maize productivity. The breeding scheme concentrated on combining yield improvement with increased resistance to leaf blight.

Field study under artificial inoculated conditions for maydis leaf blight was carried out using 16 experimental genotypes along with two local checks. The objectives were to screen the available promising maize genotypes for tolerance to maydis leaf blight and to quantify grain yield losses from maydis leaf blight. Genotype DK 19806 was found resistant to MLB (2.2 disease severity). Mean grain yield losses were 27% when averaged across all the genotypes.

Two cycles of S1 recurrent selection were completed in two maize populations, Sarhad White (SW) and Azam. High heritability estimates, desirable selection differentials and close correspondence of expected and observed responses were manifested for all the traits. Blight disease severity was significantly reduced from 2.9 to 2.3 in SW, and from 3.1 to 2.5 in Azam population. On the other hand, grain yield was significantly increased in SW from 2041 kg ha-1 cycle-1 to 2528 kg ha-1 cycle-1 or 19.24% cycle-1, whereas from 2346 kg ha-1 cycle-1 to 2772 kg ha-1 cycle-1 or 15.34% cycle-1 in Azam population. This yield improvement in SW and Azam was probably the result of concomitant

reduction in the blight disease severity by 26.08% and 24.00% cycle-1, respectively. These findings suggested that S1 recurrent selection is effective in improving disease resistance and grain yield. However, some additional cycles of selection may be necessary to further improve grain yield and resistance level to maydis leaf blight in these two maize populations.

The research capability of the institution has been improved considerably. For the first time, the two maize populations were planted in glass house during the winter months (October 2005 – March 2006) and a successful winter season maize crop has been produced. This will enable the researchers to produce three generations of maize crop in one year thus considerably reducing the time span for maize variety development.

Four students were involved for their research in the project for M.Sc. (Hons) degrees and one student completed his Ph.D degree. In addition to this, two papers have been published in the periodicals.

Project Title: ***Integrated Nematode Disease Management (INDM) in some cereals, fruits and vegetables of Pakistan.***

Principal Investigator: ***Dr. Shahina Fayyaz***
Officer Incharge

Location of Project: *National Nematological Research Centre, University of Karachi, Karachi.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.435*
Start Date:	*5/1/2003*	*Funds Released (Rs):*	*3327000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*3303000*

Objectives:

- Nematode investigation of cereal, fruit and vegetable crops of Pakistan for the preparation of locality wise map indicating the nematode problem in different regions of Sindh. Punjab and N.W.F.P;
- survey, taxonomy and morphology of nematodes associated with economically important cereal crop (rice and maize), sugarcane, vegetable, (tomato, potato, okra and cabbage) and fruit (citrus, banana, papaya, mango and coconut);
- estimation of damage caused by nematodes to these important crops. The data will be statistically analyzed to determine (1) the distribution pattern of nematodes in the fields (2) the seasonal changes in density (3) to relate the distribution, abundance and seasonal changes with soil and climatic factors;
- to educate and train researchers and the extension workes for the identification of nematode problem in the field through a series of lectures and practical demonstration; and
- chemical, biological and other methods of control (Physical methods, cultural methods, use of resistance varieties, integrated management of important insect pests) will be demonstrated.

Achievements/Progress:

Survey and Collection: About 2515 root and soil samples of 13 economically important crops were collected from 150 localities of Punjab, Sindh & NWFP.

Taxonomy and Identification: Identified 250 nematodes, one new genus,30 new species,42 new record genera and 25 new species were recorded.

Education and Training: Organized three months advanced training course for NNRC research staff by renowned nematologists, Dr. M. R. Sidiqui, UK. Fourteen M, Phil./ Ph.D. students, researchers and extension workers received training for nematode identification. Training was also given to the farmers on their filed by field demonstrations.

Nematode Management:

Biological Control:

Mass-rearing of EPN: Four most virulent nematode species were cultured successfully on mass scale for the control of insects, pests of agricultural importance for the first time in Pakistan.

Isolation of symbiotic bacteria: Entomopathogenic nematodes are symbiotically associated with bacteria of the genera Xenorhabdus for Steinernematidae and Photorhabdus for Heterorhabditedae. They were isolated and reported for the first time form Pakistan.

EPNs as biopesticides: Entomopathogenic nematodes viz,. Steinernema and Chlamydsoporium (fungi) have been crops and promising results were obtained.

Pasteuria penetrans (bacteria), Paeiclomyces lilacimus and Verticilium chlamydosporium (fungi) have been used for the control of root-knot nematodes infecting banana and vegetable crops.

Soil amendment: Soil amendment with organize materials extracted from different plant parts have been used for the control of nematodes in different crops.

Plant extracts: Many aqueous extracts of weeds and plants have been screened for their nematicidal properties and promising kills of root-knot nematodes and others nematode species were observed.

Chemical Control: Experiments were conducted by the use of nematicides viz. carbofuran and Tenekil for the control of root-knot nematodes infecting banana and different vegetable crops.

Resistant Varieties: Some varieties of various crops were found resistant when screened against cyst and root-knot nematodes.

Establishment of laboratories: PCR laboratory and Insect rearing laboratories were established during 2003.

Symposium / Workshop:

A day-long seminar/workshop on “Integrated Nematode Disease Management (INDM) in some cereals, fruit and vegetables of Pakistan” was held under ALP project on 26th April, 2006 at KIBGE, University of Karachi.

Twenty four (24) research papers have so far been published in national and international journals. A booklet on “Bio-control of mango fruit flies by Entomopathogenic nematodes” has been published under this period.

Project Title: ***Development of heat tolerant wheat varieties.***

Principal Investigator: ***Dr. Muhammad Aqil Khan***
Director

Location of Project: *Wheat Research Institute, AARI, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.955*
Start Date:	*10/1/2003*	*Funds Released (Rs):*	*2112000*
Project Status: On-Going		*Funds Utilized (Rs):*	*1802694*

Objectives:

- Screening and testing of wheat germplasm for heat tolerance and disease resistance.
- Incorporating of genes for heat tolerance into commercial and high yielding varieties.
- Testing of heat tolerant lines/ varieties at farmer's field/ Govt. Agri. Farms.

Achievements/Progress:

During the project period 26 lines out of 196 advance lines of wheat tested showed heat tolerance. These lines will be tested further for yield performance and disease reaction. The tolerant lines marked were utilized in the wheat hybridization program during the season 2005-06 to transfer the tolerant genes in the high yielding wheat varieties/lines.

Project Title: ***Development and promotion of improved technology for sorghum and millet production through participatory research in dry-land areas of Pakistan and AJK.***

Principal Investigator: ***Dr. Javid Fateh***
Senior Scientific Officer

Location of Project: *MSMP, NARC, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.121*
Start Date:	*4/28/2004*	*Funds Released (Rs):*	*945200*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*602900*

Objectives:

- To develop and promote improved technology of sorghum and millet through participatory research.
- To establish a participatory sorghum and millet seed production and dissemination program.

Achievements/Progress:

It is only through this ALP activity the neglected but important crops of the dry land areas, i.e., Sorghum and Millet, have received attention, and productive work being carried out which will help in improving the livelihood of the resource-poor small farmers in the hot and dry land areas of Pakistan. Huge quantities of quality seed of improved varieties has been distributed to farmers. The grain producing farmers of these commodities have been transformed into seed entrepreneurs which has greatly increased their incomes. A sustainable seed and technology production and dissemination system has been initiated through participatory research for enhanced productivity of these crops in Pakistan and AJK. The improved technology especially quality seed can revolutionize sorghum and millet.

Project Title: ***Development of low cost plant protection technologies through integrated pest management approaches and use of sacrificial crop/ plants in Sindh.***

Principal Investigator: ***Dr. Abdul Sattar Buriro***
Entomologist

Location of Project: *Agriculture Research Institute, Tandojam, Sindh*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.877*
Start Date:	*4/29/2004*	*Funds Released (Rs):*	*2156000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1844121*

Objectives:

- To develop IPM package for cotton & okra crops. The technology will provide alternate to pesticides for control of insect pests and grower can save inputs expenditure by 20%.
- To minimize pesticide use in cotton & okra based on low cost plant protection technologies. The pesticide use will be reduced by 30% and also will fulfill the WTO requirements.
- Dissemination of proven pest control technologies among farmers & extension workers through extension approaches. After dissemination of farmers and extension workers through extension approaches. After dissemination of farmers and extension workers awareness will be increased by 25%.
- Training of manpower. Capabilities of technical staff will be improved by 50% in advanced technologies to combat insect pests through pest management techniques.
- Development of linkage between growers, research and extension workers. After linkages between growers, researchers and extension workers. The feed back and coordination will be improved and focus will be given on farmer research oriented problems.

Achievements/Progress:

Experiments on host plants resistance studies against major insect pests in cotton and okra were conducted during 2005 at the Experimental Field of Entomology Section, Agriculture Research Institute, Tandojam.

Other experiments conducted in year 2005 were on crop phenology in relation to major insect pests in cotton and okara.

Impact of mix cropping and trap crops/Sacrificial plants in pest buildup in cotton and okra and Control of insect pests in cotton and okra.

The practices were used i) Botanical pesticides ii)) Releases of Trichogramma & chrysopa iii) Sex pheromones iv) Trap crops v) Resistant varieties

Augmentation and releases of predators and parasitoids against insect pests in cotton and okra.

The Trichogramma was released in cotton at initiation of first flower. 8 cards were tagged per acre.

The cards were changed after 15 days interval.

The Chrysopa larvae were released for jassid and spotted bollworm. The larvae were release at 4 days interval. Total population of Chrysopa was maintained at 25000 to 30000 larvae per season.

Similarly Trichogramma and Chrysopa larvae were released in the okra crop for control of jassids and fruit borer.

Training/Lectures imparted to growers, Eextension workers and NGO'S regarding pest management techniques in cotton and okra.

Training were imparted to Extension works, Growere and NRSP (NGOs) of District Matiari, District Mirpurkhas, Tando Fazal , Tando Mohammad Khan, Hala, Matiari and Nawabshah District.

Printing & Publication of Booklet, Pamphlets on IPM Meethods for cotton and okra.

The three Ph. D Students viz Mr. Muhamamd Qasim Memon, Mr. Allah Wasayo Kaleri and Mr. Abdul Majeed Noonari, Assistant Research Officers of Entomology Section, A.R.I. Tandojam are conducting their research studies on these aspects.

Project Title: ***Introduction and yield improvement of mothbean (Vigna unguiculate L.) in NWFP.***

Principal Investigator: ***Dr. Muhammad Mansoor***
Scientific Officer

Location of Project: *Agri. Research Institute, D. I. Khan*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.03*
Start Date:	*5/1/2004*	*Funds Released (Rs):*	*1023140*
Project Status: On-Going		*Funds Utilized (Rs):*	*906321*

Objectives:

- Screening of mothbean lines/ germplasm for yield and Yellow Mosaic Virus (YMV).
- Study of yield reducing as well as yield enhancing factors of moth bean.
- Acclimatization studies of moth bean for wider adaptation.

Achievements/Progress:

Mothbean crop is severely attacked by Yellow Mosaic Virus and ts cultivation is now limited up to some parts of Sindh and Balochistan a quite low yield level. To improve the grain and fodder yields of , a research project was initiated at Agricultural Research Institute, Dera Ilring 2004 with the entire financial assistance of Agricultural Linkages lP), PARC,

The seed material collected from various part of country was planted in trials at Agricultural Research Institute, D.I.Khan during 2004. Some resistant/susceptible lines were identified. The seed thus obtained from lines were again planted in replicated and non-replicated trials along with ~cks during 2005. The yellow mosaic resistant lines had again shown susceptible lines was badly attacked by the YMV thereby showing on response in present studies. The seed of most of desirable lines will be tested at various locations in replicated trials by involving the susceptible.

Project Title: ***Utilization of seaweeds in the biological control of soil borne pathogens and growth of crop plants.***

Principal Investigator: ***Dr. Viqar Sultana***
Professor

Location of Project: *Department of Biochemistry, Univeristy of Karachi, Karachi*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.78*
Start Date:	*7/26/2004*	*Funds Released (Rs):*	*1220150*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*791610*

Objectives:

- To collect and identify the potential seaweeds having nematicidal and fungicidal activity.
- To use potential seaweed as organic amendments alone or with microbial antagonists.
- To compare the efficacy of seaweeds with chemical fertilizers and pesticides.
- To develop a simple and cost effective method for the field application of seaweeds.
- To produce seaweed-based agrochemicals such as seaweed-extract products and seaweed fertilizer.
- To isolate and characterize fungicidal and nematicidal compounds from potential seaweeds.

Achievements/Progress:

During the studies 22 species of seaweeds Caulerpa racemosa, Coelarthrum, muelleri, Codium iyengarii, Codium sp., Colpomina sinuosa, Dicfyota dichotoma, D.indica, Halimeda tuna, Iyengaria stellata, Jania capillacea, Padina pavonia, P.tetrastromatica, Rhizoclonium implexum, Sargassum binderi, S.swartzii, S. variegatum, Sciania shameelii, Solieria robusta, Spdtoglossum variabile, Stoechospermum marginatum, Stokeyia indica and Ulva lactuca were collected from costal areas of Karachi under low tides. Seaweeds were washed under tap water, dried under shade and powdered in miller.

Ninteen water extract of seaweeds were tested for nematicidal activity against juveniles of root knot nematode Meloidogyne javanica, Padina pavonia, Caulerpa racemosa and Sargassum variegatum caused more 50% juveniles mortality after 24 hours at 1 mgiml. With increase in dose level i.e 10 mgiml mortality of nematodes further increased. In addition of these three seaweeds, Solieria robusta also caused more than 50% mortality at 10 mgiml. After 48 hours 50% or more mortality of nematode larvae was caused by P.pavonia, C.racemosa, S. variegatum and S.robusta. At 10 mgiml more than 90% mortality was caused by D.dichotoma, P.pavonia, C.racemosa and S. variegatum. In dual culture plate assay ethanol extract of Coelarthrum muelleri and Sargassum tennerrimum inhibited the growth of Macrophomina phaseolina by producing a zone of inhibition of 9 and 12 mm, respectively. Ethanol extract of Padina tetrastromatica, C. muelleri, S. tennerrimum and Halimeda tuna also suppressed the growth of Rhizoctonia solani. While water extract of Codium sp. Inhibited the growth of R.solani.

Solvent fractions such as n-hexane, chlorofonn and methanol soluble fractions of ethanol extracts of Sargassum binderi and Codium iyengarii tested produced more than 50 % mortality of juveniles after 24 hours @ 10 mg/ml. n-hexane and chlorofonn fractions of Stokeyia indica, methanol fraction of S. robusta .and n-hexane fraction of J. capillacea produced more than 50 % mortality of juveniles @ 10 mg/ml after 24 hours. N-hexane fraction of J. capillacea showed more than 50 % mortality of juveniles @ 1.0 mg/ml. After 48 hours, almost all the fractions (n-hexane, chlorofonn and methanol) of the

seaweeds viz., Stokeyia indica, S. robusta, J. capi/lacea, and C. iyengarii showed more than 50 % mortality of juveniles @ 10 mg/ml. Whereas n-hexane fraction of Stokeyia indica, J. capillacea and C. iyengarii and chlorofonn fraction of S. robusta also showed more than 50 % mortality after 48 hours @ 1.0 mg/ml.

In screen house experiment, application of Stokeyia indica and Solieria robusta as soil amendment alone or with Pseudomonas aeruginosa significantly suppressed the infection of root infecting fungi and root knot nematode on chili roots and enhanced plant growth. Application of Stokeyia indica, Solieria robusta and benlate, a fungicide also significantly reduced Mphaseolina and Fusarium solani infection on chili seedlings in field plots.

Project Title: ***Transgenic tomato with resistance to bacterial wilt.***

Principal Investigator: ***Dr. Zubeda Chaudhry***
Scientific Officer

Location of Project: *Scientific Officer,ABP,NARC, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.085*
Start Date:	*10/25/2004*	*Funds Released (Rs):*	*2313933*
Project Status: On-Going		*Funds Utilized (Rs):*	*1854556*

Objectives:

- Amelioration of tomato cultivars through Agrobacterium medicated transformation to develop resistance against bacterial wilt disease.
- Selection of desired R1 & R2 transgenic lines in the glass house.

Achievements/Progress:

The report comprised of results obtained from two tomato cultivars (Riogarande and Money maker). Gene for disease resistance has been introduced in tomato cultivars by Agrobacterium mediated transformation using hypocotyls and leaf discs as explants with p TCL5 containing gene for disease resistance, gene for hygromycin resistance and gene for GUS. Age of seedling is critical for transformation procedure. Maximum percentage of GUS expression i.e. 72.2% for Money maker and 75% for Riogarande was observed at 24 days old in-vitro plants (Table 8). Ling et al., 1997, showed the same results. However with the increase in the age of seedling i.e. more than 24 days, percentage of GUS expression was decreased. From these results it can be concluded that young explants are more effective, as compared to mature explants for transformation studies. Two days of co-cultivation was found to be most effective for the better transformation efficiency. After co-cultivations, the pre-selection period is very important. Without pre-efficiency. After co-cultivations, the pre-selection period is very important. Without pre-selection stage, when the explants were taken directly to the selection stage with Hygromycin 25mg/I, no callus or shoot formation was observed. However duration of 7 days of pre-selection is optimum for obtaining more selected calli. 500 mg/l of cefatoxime was optimum to control the bacteria. Acetosyringone, a phenolic compound mostly used to enhance the transformation process, is applied with AA medium during co-cultivation stage. Co-cultivation at 50uM -200uM Acetosyringone showed a high level of transient GUS expression i.e 72-80% in Money maker and 70-80% in Riogarande, as compared to those experiments in which no Acetosyringone was applied i.e. 44% in Riogarande and 30% in Money make. With the increase in concentration of acetosyringone the explants size doubled and tripled the original size and the GUS expression is increased.

Project Title: ***Studies on monitoring of contaminants in exportable food commodities.***

Principal Investigator: ***Dr. Zahida Parveen***
Sr. Scientific Officer

Location of Project: *Southern Zone Agri. Research Centre, SARC, PARC, University of Karachi, Karachi*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.997*
Start Date:	*1/1/2005*	*Funds Released (Rs):*	*3096600*
Project Status: On-Going		*Funds Utilized (Rs):*	*2413137*

Objectives:

- Standardization of analytical techniques for pesticide and heavy metal residues in fruits/ vegetables.
- Monitoring of pesticide/ metal residues in fruits and vegetables.
- Identification/ distribution of areas on basis of pesticide contamination.

Achievements/Progress:

Detection of Mercury (Hg) a potentially toxic element in three Kinnow samples of exporters is a serious concern which needs further research/monitoring in the production area of the said fruit for further detailed reasons.

Arsenic (As) also a potential toxic element found in vegetable samples collected from farmer's fields of Sultanabad, Tando Allah Yar is also a serious public health concern which also needs attention and further research/investigation in this area.

The application of Organophosphate insecticides needs to be discouraged especially in vegetable crops where spray to harvest periods is hardly followed.

Project Title: ***In-situ evaluation of indigenous walnut germplasm in Malakand Division, NWFP, Pakistan.***

Principal Investigator: ***Mr. Amjad Khan***
Research Officer

Location of Project: *ARS, Mingora, Malakand Agency, P.O.Box.22, Swat*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*0.693*
Start Date:	*7/29/2005*	*Funds Released (Rs):*	*334400*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*323000*

Objectives:

- Identify promising walnut genotypes growing wild in Malakand Division.
- In-situ evaluation of local germplasm to select promising genotypes for Horticultural purposes (i.e., variety evaluation).
- Incorporate the selected types in the routine fruit variety evaluation trials at ARS, Mingora; ARSS, Kalam and ARSS, Chitral, for further evaluation against exotic types.

Achievements/Progress:

Walnut growing areas of Malakand Division, including districts Swat, Chitral, Dir Upper and dir Lower were surveyed for the identification and evaluation of desirable walnut genotypes. Nut samples from 123 genotypes including 74 from district Swat, 29 from twin Dir districts, 20 from Chitral were collected and compared with exotic approved varieties for several nut quality traits. Preliminary data revealed that several indigenous genotypes excelled exotic approved walnut varieties in various nut quality traits including, nut diameter, nut length, in-shell nut weight, kernel weight and kernel percentage. Among these genotypes, 46 desirable types were selected for further in-situ evaluation. In spring, 2006, phenological data were recorded on the selected genotypes.

Project Title: ***Utilization of genetic variation in yield response to drought stress for the development of improved wheat germplasm.***

Principal Investigator: ***Dr. Muhammad Yaqub Mujahid***
Senior Scientific Officer

Location of Project: *Wheat programme, National Agricultural Research Centre,Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.861*
Start Date:	*8/13/2005*	*Funds Released (Rs):*	*2358000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2001813*

Objectives:

- To develop the improved wheat germplasm adapted to drought stress through the use of new genetic variability.
- To create genetic variability for drought resistance/ tolerance in the wheat germplasm through hybridization.
- Exploration of the amount of appropriate genetic variability for drought resistance in the species.
- To know the physiological and biochemical aspects of drought resistance especially in relation to osmotic adjustment and water relations.
- To identify and recommend desired genotypes for cultivation in rainfed canal tail end and water shortage areas.
- To identify possible molecular markers for drought tolerance.

Achievements/Progress:

Multilocation testing of the available germplasm in the rain fed and water limited areas of Pakistan. The desirable genotypes will be identified as a parental source for inclusion in the hybridization program to develop the recombinants for drought and moisture limited areas. The material being tested for yield and adaptation at various locations/ecologies in different parts of the country will help identify the wheat germplasm for further enhancement and wide scale testing in the defined ecologies. Collection of the available information/resources of the drought resistance from National and international centers. The collected genetic variability from various locations and national and international research institutes involved in relevant research will help identify and develop the suitable germplasm for rain fed areas of Pakistan. Segregating populations (filial generations) developed at NARC and CIMMYT will be enhanced and selections will be made in the subsequent generations to fix the homozygosity for the development of appropriate breeding material. Screening of available germplasm at seedling stage. The correlations will be developed to determine the relationships between various morphological and physiological traits conferring drought resistance for initiating the crossing program.

Project Title: ***Development of heat tolerant, early maturing and high yielding mungbean (Vigna radiata (L) Wilczek) genotypes***

Principal Investigator: ***Dr. Gul Sanat Shah***
Senior Scientific Officer

Location of Project: *Nuclear Institute for Food and Agriculture (NIFA), P.O. Box 446, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.674*
Start Date:	*7/1/2004*	*Funds Released (Rs):*	*1494200*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1178472*

Objectives:

- To develop improved mungbean genotypes with traits as bellow: -
- Short duration (60-65 days to maturity)
- Heat tolerant (above 400C)
- Short stature (50-60 cm)
- High seed yield (1.0-1.5 t/ha)

Achievements/Progress:

1175 and 735 single plants selected from M2 populations of NM 92 and NM 98, respectively, were evaluated as plant progeny rows in M3 generation during kharif 2005 and selected 86 and 92 phenotypically true breeding mutants in high temperature environment. 69 and 65 single plants were also selected from the segregating progenies. The selected mutants and single plants selection are currently being evaluated in field.

The bulk M1 seed of NM 92 and NM 98 collected during kharif 2004 was planted as bulk M2 generation during kharif 2005. More pods bearing plants were selected and bulked again and sown as bulk populations in M3 generation during summer 2006 to make desired single plant selections.

F1 generation of three cross combinations e.g., ML-5 x NM 51, NM 19-19 x ML-5 and NM 92 x nm 19-19 were raised during kharif 2005 and picked hybrid plants. F2 populations of these crosses have been planted during summer 2006 for further selection. ML-5 and blackmung seed were irradiated through gamma rays at 0.2, 0.3 and 0.4 KGy doses and M1 generation was raised during kharif 2005. All M1 plants were picked individually and planted M2 populations as plant progency rows during summer 2006. To enhance genetic variability, 14 different mungbean genotypes are being hybridized in Triple Test Cross manner.

Project Title: ***Development and evaluation of a mobile flat-bed dryer for sunflower and canola***

Principal Investigator: ***Dr. Munir Ahmad***
PSO

Location of Project: *FMI, National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.55*
Start Date:	*7/1/2004*	*Funds Released (Rs):*	*2330800*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1816279*

Objectives:

- To develop and evaluate a drying technology for sunflower and canola in order to reduce post harvest losses.
- To develop a mobile flat-bed dryer for sunflower and canola.
- To evaluate the performance of this dryer by drying sunflower and canola.
- To perform the economic analysis of the mobile flat-bed dryer.
- To demonstrate this dryer to sunflower and canola growers and local manufacturers.

Achievements/Progress:

A mobile flat-bed dryer was developed under this project at Farm Machinery Institute, NARC, Islamabad during the report period. The dryer is made of angle irons, steel channels, steel sheets, and every thing except the engine is manufactured locally. The dryer consists of a wheel adjustment assembly, a frame, a plenum chamber, a grain container, an engine, a diesel fired furnace, and an axial flow fan to force hot air through plenum to grain bed. The grain container holds the grain above the plenum chamber on a false floor through which the air is forced. The length, width, and depth of the grain container are 5.0m, 2.15m, and 0.78m, respectively. The grain container holds 1250 kg of sunflower at a depth of 30cm.

A 65-cm diameter axial flow fan was used for forcing the drying air through grain bed. It is powered with a 5.7 kW diesel engine with V-belts and pulleys arrangements. The fan provides 1.85 m3 of air per second against the static pressure of 2.0 cm of water. This is an air flow rate of above 103 per minute per square meter of drying floor area, which is usually recommended for designing the flat-bed dryer. A direct fired diesel tank, a pump for pressurizing the diesel, a filter, a nozzle for vaporizing the diesel, and a diesel burning chamber. The diesel firing system has a combustion capacity of 6.0 liters of diesel per hour. This system is designed to heat the ambient air up to 58oC during the month of November and December.

The first preliminary sunflower drying trial using the newly developed mobile flat-bed dryer was conducted at Faisalabad in November-December, 2005. During the typical tests, on average the dryer took three hours to dry 1250 kg sunflower grains from 30.2% to 9.6% moisture content. The drying capacity of the dryer was worked out about 2.5 tons in 8 hours (one day). The dryer was also tested for drying canola at Mongi Wali, District Attock. The economic analysis revealed that the cost of drying sunflower is about Rs.1.25/kg.

Project Title: ***Management of weed in wheat-Maize cropping system in Barani areas of Potohar. (Component - NARC)***

Principal Investigator: ***Dr. Tahira Zafar Mehmood***
Principal Scientific Officer

Location of Project: *IPEP, National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.036*
Start Date:	*4/1/2004*	*Funds Released (Rs):*	*2466200*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2180189*

Objectives:

- Improvement of weed management techniques.
- Campaign against problem weeds.
- Transfer of long term weed control techniques to the farmers.

Achievements/Progress:

In the experiment carried out on integrated weed Management in Maize at NARC it was found that the lowest weed density (16.5 weeds/plot) was recorded from plots where Primextra (metolachlor + atrazine) was sprayed as a pre-emergence herbicide this was followed by Hand weeded (16.6 weeds/plots) and Dual Gold (D-metolachlor) treatments (17.3 gm) followed by Hand Weeded treatment (78.1 gm..). Primextra gave higher yield (4.7 tons/hec) as compared to the other treatment.

Result of the experiment on Integrated Weed Management in Maize at Fateh Jang were similar to those reported above. Lowest weed density was recorded from plots where Primexrtra was sprayed followed by Dual Gold and hand weeded plots. Amongst the herbicides Primextra gave the highest yield. It was followed by the Dual Gold. Similar trend was observed in case of plant height, number of plants per plot, stalk weight and ear weight.

Nutgrass, Cyperus rotundus is regarded as the world's most wider spread weed as well as one of the world's 10 worst weeds. Within the arable ecosystem there are many beneficial organisms that feed on crop pests to the extent that pesticide use may be reduced or made unnecessary. Nutgrass is infecsted both by Bactra spp. (B.venosana =B.truculenta and B. minima) that was the first recorded on 2-8-01. The infestation peak was reached in the first weed of August and lasted till the second week of August. Field collected / lab reared pupae and adult were released in the field to increase the population of the insect and to put pressure on the density of the weed. Approximately 1000 insect stages were released. Their establishment will be checked in the next season.

Wheat (Triticum aestivum L.) is the number one crop of Pakistan. Broadleaf as well as grassy weed are responsible for causing crop losses. The weed problem in wheat has increased with the introduction of dwarf varieties. At NARC and Fatehjang all herbicides showed sufficient control of weeds. In the experiment on Integrated Weed Management in Wheat at NARC amongst the herbicides lowest weed density was recorded from the plots where Buctril-M was sprayed as a post-emergence herbicide. It was followed by Affinity sprayed as a post-emergence and Sectril-M also applied as a post emergence herbicide. Affinity gave the highest grain yield followed by hand weeded plots and Buctril-M. similar trend was observed in case of plant height, spikelets per spike and 1000 grain weight.

Result of the experiment on Efficacy of Different Herbicides in Wheat at Fatehjang lowest weed density was observed in the plots where Affinity was sprayed. Affinity produced the highest increase in grain yield. It was closely followed by Sectril-M and Buctril-M. Affinity being the best broad spectrum herbicide showed a substantial control of broad leaved as well as grassy weeds resulting into enhanced grain yield.

In the experiment of Effect of Sowing Dates of Wheat on Weed Population and Wheat Yield weed density was lowest and yield highest when sowing date was 9-11-04 i.e. early sowing.

It was observed that in experiment “Effect of Wheat Seed Rate on Weed Population” weed density is lowest when seeds rate was 80 kg/hec. And grain weigh was highest in the same treatment indicating 80 kg/hec the best seed rate.

Project Title: ***Integrated weed control for major rabi crops (wheat & rapeseed) and fallow land in Pothwar. (UAA, Rawalpindi Component-II)***

Principal Investigator: ***Dr. Muhammad Azim Malik***
Professor

Location of Project: *Department of Agronomy, University of Arid Agriculture, Rawalpindi*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.236*
Start Date:	*7/9/2004*	*Funds Released (Rs):*	*1369250*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1060201*

Objectives:

- To develop economically suitable weed control technology package for wheat, rapeseed/ mustard and fallow land in Pothwar by the combined use of mechnical, chemical and cultural methods.
- To study the economics of integrated weed control methods to be developed in comparison with traditional weed control practices in Pothwar and their impact on

Achievements/Progress:

The results of the rabi trials showed that the performance of canola was better at Rawalpindi as compared to Chakwal. This might be due to better soil condition and adequate moisture availability at Rawalpindi site. Among the different integrated weed control practices, Hand weeder (twice), Chemical + Hand Weeder and weed free treatment along with below seed application for NPK suppressed weed and produced relatively less weed biomass at harvest. Similarly, the performance of wheat was better at Rawalpindi site compared to Chakwal. Among the different weed control methods, chemical treatment along with below seed application of NPK and narrowest row spacing of 6 inches, produced the highest grain yield. These treatments were on the top with respect with respect to efficient weed control practices.

Efficacy of nine different post emergence herbicides was also investigated at Rawalpindi site. All herbicides increased grain yield as compared to weedy check. The application of Buctril Super along with MCPA and Aim decreased weed biomass significantly and increased grain yield as compared to other treatment.

Trials regarding integrated weed control in fallow land showed that deep tillage increased grain yield significantly as compared to farmers' practice of using cultivator alone after every treatment.

Project Title: ***Integrated weed management in wheat, cotton, rice and pulses in Punjab (AARI, Faisalabad Component-III)***

Principal Investigator: ***M. Sarfraz Iqbal***
Director

Location of Project: *Agronomic Research Institute*
Ayub Agriculture Research Institute, Faisalabad

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.12*
Start Date:	*8/30/2004*	*Funds Released (Rs):*	*766500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*753953*

Objectives:

- To establish authentic weed spectra for the wheat, cotton, rice and pulses in Punjab based on survey.
- To find out effective cultural and chemical weed control methods for various weeds of wheat, cotton, rice and pulses in Punjab.
- To import training to extension workers and farmers about weed control methodology of wheat, cotton, rice and pulses.

Achievements/Progress:

Survey regarding weed flora of wheat, cotton, rice and Pulses was carried out in different crop zones. Up to 30/06/06 300, 250,, 100 & 50 farmer's fields are surveyed for identifying weed flora of Wheat, Cotton, Rice and Pulses crops respectively.

To standardize weed management practices for wheat, Cotton, Rice and Pulses, 20 trials were conducted in different Agro-ecological zones of Punjab. :

Thirty seven demonstration plots were sown on farmer fields regarding weed control in wheat, cotton, rice and pluses in different zones of the Punjab.

20 Research Workers were trained regarding lay out of herbicides trials, calibration of water for spray & adjustment of Nozzle, Precaution for herbicidal spray.

500 Extension workers were trained regarding weed control technology of Wheat, Cotton, Rice and Pulses. Collaborating agencies were University of Agriculture, Faisalabad, Plant Protection Institute, Faisalabad, Technology Transfer Institute (PARC), Faisalabad. Extension workers include Deputy District Officer (Agriculture), AgricultureOfficers and Field Assistants

500 Farmers were provided information regarding losses due to weeds and weed control technology of wheat, cotton, rice and pulses.

A weed bank was established at Research area of Plant Physiology Section, in which 30 weeds were grown. Each weed was grown in I m2 separate bed for demonstration identification and seed production purpose. The weed bank got popularity among researchers, Extension workers and students. 250 Extension workers and 300 students from University of Agriculture Faisalabad, Arid

Agricultural University, Rawalpindi and Agriculture College D.G. Khan visited the weed bank. They highly appreciated weed bank while writing their comments in visitors book kept at site for this purpose. Seeds of 30 weeds were collected and preserved for identification. Seeds of weeds are being provided to the researchers and students of weed science for research purpose.

Preparation of checklist of weeds of wheat, cotton, rice and pulses is under progress, so for about 200 weeds are enlisted. Preparation of checklist of approved herbicide along with their recommended dose, stage of application, target weeds and year of approval is in progress and up-till now 130 herbicides are enlisted.

Project Title: ***Integrated weed management in cereals (Wheat and Maize) in NWFP (ARI, Tarnab, Peshawar Component-IV)***

Principal Investigator: ***Dr. Nasir-ud-Din***
Director

Location of Project: *Cereal Crop Research Institute, Pirsabak, Nowshera*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.154*
Start Date:	*8/17/2004*	*Funds Released (Rs):*	*789000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*705336*

Objectives:

- To identify weeds problem and loss thereof in wheat and maize.
- To develop integrated weed control technology in wheat and maize.
- To demonstrate integrated weed management on farmers fields.
- To transfer weed control technology to the farmers, the end users, through print and electronic media and field days.

Achievements/Progress:

In the project over all ten experiments were conducted. Two experiments on maize and eight experiments on wheat crop were conducted. In maize, these experiments were laid out at the station and on the farmers' field.

Out of ten experiments, two experiments were on the effect of three spacing (10cm, 18cm and 25cm),four seeding rates (75, 100, 125, 150 kg/ha) and two weed control practices (weed control with Puma Super + Buctril Super and no weed control) on weed dry weight, weed density and wheat grain yield.

Result of the study indicated that spacing response was not clear in the experiments. Effects of weed control were significantly obvious on weeds dry weight and wheat grain yield. Lowest weed dry weight was recorded in the herbicides treated plots as compared to the control. Interaction among seeding rate and weed control practices were significant and more grain yield was recorded with seeding rate of 125 kg/ha.

Two experiments were carried out to study the effects of three seeding rates 100, 125, 150, kg/ha and two weed control practices (weed control with Puma Super + Buctril Super and no weed control). The result indicated in these two experiments that weed control effects were significantly different than no weed control however the interaction between seeding rate and weeding was not very clear. However assessing three seeding rates and two weed control practices it was observed that increase in seeding rate alone is not important where as weed control response was distinctly obvious in both the trials.

Four experiments were carried out to study the effect of different herbicides on weed density, weed dry weight, and wheat density and wheat grain yield. The response of application of herbicides was more obvious at Ikrampur (Mardan) and Nizampur (Nowshera). The application of herbicides increased wheat grain yield at Cereal Crops Research Institute, Pirsabak, and Agricultural Research Institute, Tarnab. In all experiments all different herbicides controlled weeds effectively compared with control.

However, the response of different herbicides was not same at all the location because of different kinds of weeds species at various location.

It was observed that effects of application of herbicides were different at different location therefore, selection of herbicides is very important at certain place due to different species of weed at different places. It was also observed that Puma Super alone is not much effective. Therefore, Puma Super + Buctril Super are recommended in combination for effective weed control according to the presence of weeds in specific location.

Project Title: ***Weed management studies of wheat and cotton crops in Sindh (ARI, Tandojam Component-V)***

Principal Investigator: ***Dr. Muhammad Allah Ditta Jarwar***
Plant Pathologist

Location of Project: *Agriculture Research Institute, Tandojam*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.154*
Start Date:	*5/13/2004*	*Funds Released (Rs):*	*1713427*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1484655*

Objectives:

- To study different methods of weed control, including, cultural, mechanical and chemical for wheat and cotton crops.
- To determine weed crop competition periods and their effects on yield of wheat and cotton corps.
- To determine the economics (cost benefit ratio) of different weed control methods.
- To develop modern weed control technology for farming community.
- To disseminate the technology developed of the farming community through training manuals advisory leaflets, farmers training extension workers training field open days farm trials workshop and seminars.

Achievements/Progress:

Sugarcane trash found better control on weeds and checks their growth as well as keep the soil moist, and can be used for better utilization of irrigation in the cotton crop.

Weedicides Dual Gold 960 EC, stop 330EC and Pendimethlin are recommended for controlling the weeds in cotton crop. There weedicides found better control on weeds when cotton crop was grown on ridges after 24 hours of sowing the seeds.

Delivered lectures during the training programme of Agriculture Officers of Extension Wing at Agriculture training Institute, Sakrand.

1000 copies of the Booklet have been published and distributed among the growers in the Seminar. Booklet also distributed to the Field Staff of Extension Wing through District Officer of Project Districts.

Project Title: ***Integrated weed management in wheat and vegetables (onion and tomato) in Balochistan (ARI, Quetta Component-VI)***

Principal Investigator: ***Mr. Qazi Bashir Ahmed***
Director

Location of Project: *Agriculture Research Institute, Sariab, Quetta*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.154*
Start Date:	*7/28/2004*	*Funds Released (Rs):*	*1407745*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1405065*

Objectives:

- Development of integrated wed management technology for wheat, onion and tomato.
- Demonstration of integrated weed technology of wheat, onion and tomato at farmers' field.
- Transfer of long-term weed control techniques to the extension staff and farmers in various districts of Balochistan.

Achievements/Progress:

New techniques with safe and effective methods under culture, physical and chemical methods were studied. It was found that yields of wheat and vegetables were increased more than 30% by the application of improved techniques. Effective and economical herbicides were also tested with improved methods. It was also found that the economy of the farmer can be improved by adopting these techniques. In the study some old culture methods were replaced with improved methods. Mechanical techniques were used to minimize weed losses. After completing the project package of technology will be developed that will be help full in minimizing weed population. Seeing believes, demonstration of effective control measures of weeds was carried out during the reporting year for rapid dissemination of awareness of weed losses in different crops. Through training program Extension front line field staff and farmers were equipped with weed control techniques. The independent capacity of the farmers is developing that will ultimately helped them for long-term basis.

Some old culture methods vs. improved get better result. Through demonstration plants farmers get maximum awareness of weed losses in wheat, onion and tomato. Improved technology is spreading rapidly in potential areas. Awareness of cost of production was also introduced in field days to demonstrate difference between farmer’s practices vs. improved practices.

Project Title: ***Screening of drought tolerant wheat genotypes and estimation of genetic basis***

Principal Investigator: ***Dr. Muhammad Munir***
Professor & Chairman

Location of Project: *Dept. of Plant Breeding and Genetics, University of Arid Agriculture, Rawalpindi*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.967*
Start Date:	*7/1/2004*	*Funds Released (Rs):*	*1640500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1484436*

Objectives:

- Testing and screening of drought tolerant wheat germplasm.
- To study the genetic basis of drought tolerance.
- Incorporation of genes for drought tolerance into high yielding varieties.

Achievements/Progress:

To screen drought tolerant wheat genotypes, the following activities were undertaken during the reporting period:

The seeds obtained from last year's experiments were sown at University of Arid Agriculture Rawalpindi (UAAR) and Barani Agricultural Research Institute (BARI) Chakwal. The data on the following characters were recorded:

1. smotic potential
2. Relative water contents
3. Epicuticular was
4. Leaf diffusive resistance
5. Succulence
6. Flag leaf area (cm2)
7. Plant height (cm)
8. No. of spike/m2
9. No. of spikelets/spike
10 No. of kernels/spike
11. One thousand kernel weight
12. Grain Yield/m2

One set of field trial comprising of forty wheat genotypes was sown at UAAR during the November, 2005. Two sets of crosses were made i.e four drought tolerant and four drought susceptible genotypes were crossed and four drought tolerant and four high yielding genotypes were crossed. Seeds for F1 were harvested and stored for sowing during next year.

Field testing of second set of experiments was done at BARI, Chakwal to evaluate the performance of same forty wheat cultivars as sown during last year under drought conditions as well as under non-drought (irrigated field) conditions. The data were analyzed according to standard analysis of variance techniques and genotypic means were separated through LSD at 5% level of probability.

The analysis revealed significant differences among genotypes for all the parameters studied depicting differential response of genotypes under rainfed conditions.

Project Title: ***Characterization and determine the adaptive role of dehydrins under drought stress in wheat (Triticum aestivum)***

Principal Investigator: ***Dr. Rehana Asghar***
Associate Professor

Location of Project: *Department of Botany, University of Arid Agriculture, Rawalpindi*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.044*
Start Date:	*4/29/2006*	*Funds Released (Rs):*	*1569000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*162441*

Objectives:

- Characterization of dehydrins in the promising cultivars of wheat using immunoblots.
- Isolation of dehydrin genes using Dhn gene probs in the genome.
- Determination of adaptive role of dehydrins under drought stress.
- Use of dehydrins antibodies for screening the drought tolerant varieties of wheat.

Achievements/Progress:

Selection of four promising tolerant cultivars.
Collection of wheat seedlings for drought stress.
Storage of unstressed wheat seedlings for protein extraction.
Determination of drought stress in the seedlings by 40% reduction in weight.
Storage of drought stressed seedlings for protein extraction.
Quantification of protein from stressed and unstressed samples.

Project Title: ***Studies on breeding biology post-natal development and control trails against rodent damaging date-palm orchards of Balochistan province***

Principal Investigator: ***Syed. Muzaffar Ahmed***
Senior Scientific Officer

Location of Project: *Vertebrate Pest Control Research Institute, SARC, (PARC), Old Block 9 & 10, Karachi University Campus, Karachi-75270*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.102*
Start Date:	*1/25/2005*	*Funds Released (Rs):*	*1539900*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1144500*

Objectives:

- To identify rodent pest species involved in damaging the date-palm trees.
- To quantify the economic losses of date palm caused by the rats.
- To conduct studies on breeding biology, growth, post-natal development/behavioral aspects and food preference.
- To draw an exact picture of the rodent population of the area.
- To conduct control trials for the evaluation of different rodenticides and fumigants to determine their efficacy and to develop a control package against rodent pests.
- To train the farmers and extension staff of the area in Rodent Pest Management.

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Achievements/Progress:

Short-tailed mole rat (Nesokia idica) and Indian gerbil (Tatera indica) were identified as pre-dominated species causing colossal losses to date-palm. Food habit studies reveals that food of N. indica largely consists of date-palm fruit, stem portions, insects and common grass of the area. The trees bearing sapling plants were damaged more severely. The Clump of sapling plants provide good cover and shelter to rats. Similarly soil binding around the trees provide good support for burrowing. The inner layers of the soil was damp and relatively more compact due to high water table enabling the rats to burrow and live inside it. Dampness in the soil may play an important role in an effective fumigation for the control of rats. Out of 1837 trees observed in datepalm orchards or Nok Kundi, 406 (22.10%) were found damaged and economic losses of Rs, 5.33 million was calculated to justify the control operation. Face washing and social grooming behavior among the short-tailed mole rat (N. indica) may be useful in using the tracking rodenticide for effective control of rats.

Project Title: ***Nematodes of fruit and vegetable crops and their management in Karachi and Hyderabad districts using plant extracts***

Principal Investigator: ***Dr. Aly Khan***
Principal Scientific Officer

Location of Project: *Crop Diseases Research Institute (PARC), University of Karachi, Karachi-75270*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.641*
Start Date:	*1/1/2005*	*Funds Released (Rs):*	*1388000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1287273*

Objectives:

- Collection of root and soil samples.
- Identification of plant parastic nematodes.
- To test efficacy of plant extracts in pot and field trials.
- Analysis of data using different statistical procedures.
- To achieve environmental safety.
- To obtain cost-effective control of nemadote population.
- Finally to attain increased crop production.

Achievements/Progress:

The nematodes associated with tomato in Karachi and Hyderabad districts were Helicotylenchus indicus; Meloidogune javanica; Meloidogne incognita; Hopolaimus indicus; Basiria graminophila; Longidorus dipsaci.

The dendrogram derived from agglomerative clustering shows two major groups, group 1 and group 2. Group 1 is characterized by the localities of species abundance of species Meloidogyne incognita. On the other hand group 2 contains localities where species Ditylenchus dipsaci is dominant in the nematode communities associated with tomato root zones.

Withania somnifera was the most effective in controlling the development of root-knot nematodes (Meloidogyne incognita).

This study expands our knowledge on the distribution of plant parasitic nematodes in the different vegetable and fruit crops in Karachi and Hyderabad districts. In chilli seedling nurseries located at different localities of these two districts. Helicotylenchus was highly prevalent genus, most likely reflecting the plasticity of this genus.

Project Title: ***Development of integrated pest management for Subterranean Termites in agro-ecosystem***

Principal Investigator: ***Dr. Sohail Ahmad***
Assistant Professor

Location of Project: *Deptt. Of Agri. Entomology, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.431*
Start Date:	*7/1/2004*	*Funds Released (Rs):*	*1619000*
Project Status: On-Going		*Funds Utilized (Rs):*	*1451174*

Objectives:

- To determine the like range of biotic and abiotic factors that will influence termite establishment
- Applied research, using knowledge of the basic biology and behavior of termites to develop and assess control strategies, that precisely target the economically important subterranean termites in the crops, and that minimize the use of pesticides in and around structures, and crops.

Achievements/Progress:

Termites'attach in not independent of varieties/host races. Types of maize used in these experiments were hybrid being promoted in market for higher yields.

The chemical control for borers and other insects with potent insecticides can have an effect on termites but cannot prevent the damage.

Additional application of chemical or other practices to discourage the plant damage is therefore needed. The plant damage was obvious in the latter stage of crop maturity and it will be an arbitrary time to decide when to apply the chemicals if the termites were problem in certain fields. Use of plant oils as soil and stem treatments can prevent damage by the termites.

Project Title: ***Development and testing of a resource conservation tillage implement***

Principal Investigator: ***Dr. Jehangir Khan Sial***
Professor

Location of Project: *Faculty of Agri. Engineering & Technology, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.91*
Start Date:	*10/1/2004*	*Funds Released (Rs):*	*839025*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*571146*

Objectives:

- Select and test the locally available materials for construction of sweep shovels.
- Investigating variations in different engineering parameters (suction, pitch, lift, angle of attachment and thickness of plate) for design of the shovels.
- Attachment and testing of a depth wheel with the sweep cultivator for facilitating its penetration control.
- Comparative testing of the sweep cultivator developed using local materials and workmanship.
- Information dissemination for adoption of the implement

Achievements/Progress:

A detailed survey for identification and availability of materials for manufacturing weeps was conducted. The survey included visits to various places throughout the country. Generally it was learnt that the materials of varying qualities were available in sufficient quantities in the country for small/large scale manufacturing of the sweep shovels anticipated to be developed in the present project. Moreover, it was delightfully learnt that materials of desired composition can also be manufactured in Karachi shipyard facility. However, the order for such a consignment should not be less than one ton of material. This information was quite valuable since the project personnel are also interested in selecting a new material that should resist shocks and at the same time possess least wearing characteristics while working in the soil.

Similarly it was learnt that there are many implement manufacturing industry well equipped to manufacture sweep shovels, Faisalabad being the hub of such activities. During second half of the reported period, materials were selected for manufacturing of the sweep shovels and their development was initially started using local facilities at Faisalabad. Two companies of good repute for innovative development e.g. Danishmand & Company, Gobind pura were assigned the task of development. Sweep shovels of varying design specifications are at various stages of preparations. They are depth wheels is also compete. It was thoughtfully designed that two depth wheels installed on two sides of the implement would enable the depth control of implement in addition to maintaining the static as well as dynamic balance of the cultivator. Work is in progress and sailing smoothly as planned except that project started late due to availability of the last week of October. Now the project team is planning to embark upon the field testing of the tool and the implement.

Project Title: ***Management of apple spider mites in NWFP***

Principal Investigator: ***Dr. Inamullah Khan***
Assistant Professor

Location of Project: *Department of Plant Protection, NWFP Agricultural University, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.408*
Start Date:	*10/1/2004*	*Funds Released (Rs):*	*766400*
Project Status: On-Going		*Funds Utilized (Rs):*	*733112*

Objectives:

- Biological agents (predators) will be investigated in the field.
- Augmentation of local/ exotic predatory mites or predatory ladybird beetles in the laboratory.
- Mass rearing of the most potential predator(s) in the glass-house.
- Develop methodology for production and supply of mass rearing predators to researchers/ farmers.

Achievements/Progress:

During survey it has been found that Stethours papuperculus Wiese is a predator of the apple spider mite Tetranyshus urticae Koch. To understand the influence of biotic factor on the development of S. pauperculus experiment were conducted at constant temperature to assess its effects on the development of immature stages. The goal was to obtain development data over a wide range of constant temperatures, which could be used to calculate the lower development threshold temperatures and to construct a degree day model for all life stages of S. paurperculus. This study was also understood to assist interpretation and prediction of seasonal development of S. pauperculus in the field. Therefore its life cycle has been studied on 10, 15, 20, 25, 30, and 35 degree temperature, respectively.

Project Title: ***Mapping of bacterial diversity in Sind Agricultural fields and Desert: At Molecular level***

Principal Investigator: ***Dr. Nuzhat Ahmed***
Director & Professor

Location of Project: *Centre for Molecular Genetics, University of Karachi, Karachi-75270*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.274*
Start Date:	*8/1/2005*	*Funds Released (Rs):*	*2219500*
Project Status: On-Going		*Funds Utilized (Rs):*	*1904173*

Objectives:

- Cataloguing of bacteria from agricultural and deserted area of Sind
- Analysis of differences (at molecular level) in soil biota from agricultural and deserted area
- Selection of bacteria from different geographical positions which have the following characters:
  - Biocontrol agents
  - Bioabsorbent producers and
  - Maintaining N, P and S in soil
- Preparing a database of diversified bacteria in Sind region, which may help in conserving the VIII. bacterial diversity in Sind. This is important, as Pakistan is a signatory of CBD.

Achievements/Progress:

The aim of the first year of the project was to acquire the facilities and collect samples, to isolate, purify and preserve bacteria collected from the soil of Agricultural fields and Deserts of Sindh. Isolation of bacterial strains from various Agricultural fields was carried out, from National Nematological Research Centre (NNRC), Karachi University, Memon Goth, Malir, Khokarapar, Jam Goth, Jam Tando, Atomic Energy Research Centre, Tandojam (NIA), Mirpurkhas, Sakrand, Khairpur, Larkana, Ghotki. Isolation of bacteria from Thar Desert was carried out from different parts of the desert. Bacteria isolated from different areas of Sindh were purified and preserved. Qualitative and quantitative analysis of samples using different selective media was carried out to select a suitable media for screening of diversified bacteria. Further, these bacteria were charactcrized on the basis of Gram staining, colonial and cellular morphology.

Project Title: ***Better utilization of food for healthy and productive life in agriculture sector***

Principal Investigator: ***Dr. Alam Khan***
Professor

Location of Project: *Department of Human Nutrition, NWFP Agricultural University, Peshawar.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.278*
Start Date:	*7/1/2004*	*Funds Released (Rs):*	*2277500*
Project Status: On-Going		*Funds Utilized (Rs):*	*1953817*

Objectives:

- To know the eating pattern/habits, intake levels of energy, macro and micro nutrients of the agriculturists residing in the plain districts of NWFP.
- To analyzed the foods of agriculturists for macronutrients (Protein, Carbohydrate and Fat) and micronutrients i.e. vitamins A, C and Folic Acid and minerals Calcium, Iron and Zinc.
- To know the energy distribution amongst the macronutrients.
- To assess the nutritional status of agriculturists from the collected (questionnaire) and analyzed (duplicate samples) data.
- To prepare guidelines for good eating habits and develop methods for balanced diet from the findings of the research project for the Agriculture communities of the plain districts of NWFP.

Achievements/Progress:

The second year activity of the ALP project "Better utilization of foods for Healthy and productive life in Agriculture sector" was to collect the dietary recall data on food intake, collection of duplicate food samples and prepared dishes samples from farmers of Kohat and Bannu districts. Three villages namely Sherkot, Kharmato and Larchi in district Kohat and 3 village namely Saifal Khel, Mamash Khel and Kakki in district Bannu were selected for the second year study of the project. One hundred farmers from each village of each district were selected for the for the survey. Twenty percent duplicate food samples from each v illage of the already selected farmers were collected for chemical analysis. Prepared dishes of 20 percent of the selected farmers of each village were also collected for chemical analysis. The dietary recall data was compiled. The data indicated that farmers of villages of both the districts are at fair level of nutrients intake. However, the actual analysis of duplicate food samples indicated that intake level of both macro and micro nutrients are deficient in farmers of all the villages in both the districts. The prepared dishes analysis indicated that their fat content is really low. Vitamin A and C of the samples are under analysis and will be communicated later on.

Project Title: ***Investigation disease control of die back/citrus decline in NWFP.***

Principal Investigator: ***Dr. Mahmood Khan***
Plant Pathologist

Location of Project: *Plant Pathology Section, ARI, Tarnab, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.838*
Start Date:	*8/16/2005*	*Funds Released (Rs):*	*1563400*
Project Status: On-Going		*Funds Utilized (Rs):*	*1340245*

Objectives:

- To find the biotic and abiotic factors responsible for citrus die back/ decline in the major citrus growing area of NWFP.
- To find out effective, safe and economical control measures for the solution of the problem.
- Train farmers and extension workers on the use of integrated disease management practices for citrus die back.

Achievements/Progress:

During this period diagnostic surveys were carried out in the districts of Peshawar, Nowhere, Marian, D.I. Khan, Dir, Swat, Bunker and Malakand Agency. The disease die back was present in almost all orchards. The disease incidence was 20-50% and severity was more than 40% while in every orchards some trees were found totally killed. Affected trees showed shoot die back & leaf loss, poor fruiting and small leaves. In some cases a branch was seen wilted from one side of the tree while in some other cases half of the tree was wilted & remaining half was healthy. Affected trees showed shoot die back & leaf loss, poor fruiting and small leaves. In some cases a branch was seen wilted from one side of the tree while in some other cases half of the tree was wilted & remaining half was healthy. Both young and old trees were found affected by the disease but severity of the disease was more in older trees. Bark on collar regions,. Stems of the trees at the soil line, was rotten & black in colour. Soil samples, roots, bark & twigs samples were collected. Analysis of these samples were carried out in laboratory for fungi & Nematode isolation. Also analysis of soil sample for the major nutrients were carried out. The fungi isolated from the samples are: Fusarium spp; Diplodia spp; Phytopthora spp; And Collectortrichum spp. The Collectortichum spp. was mostly isolated from dried twigs on older trees. Nematodes were also isolated from the soil samples. Another thing which we got from soil sample during this period was deficiency of potash, phosphorus alongwith nitrogen in most of the samples. During the survey the farmers were trained. The farmers, whose orchards were visited, were educated about the location of the disease i.e. the problem is from soil, roots and trunk of the tree. They were further advised to carry out corrective pruning of the diseased branches, try to avoid direct contact of irrigation water to the trunk of the tree & keep exposed the bud union above ground level.

Experiments were laid out at Tangi Khattak, District Nowshera and Sadhoki, District Mardan sites for finding out effective control measures for the problem. Data on these experiments will be recorded in the coming August and September.

Project Title: ***Sustainable approaches toward adaptation of sorghum and millet improved varieties for grain and fodder purpose in rainfed areas of Kohat Division.***

Principal Investigator: ***Dr. Mohammad Khan***
Senior Research Officer

Location of Project: *Barani Agri. Research Station, Jarma, Kohat*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.476*
Start Date:	*3/15/2006*	*Funds Released (Rs):*	*469000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*147398*

Objectives:

- The ultimate goal to which we all are striving is to increase the production of crops under conditions that are less than required for maximum production. To achieve this goal we have to take into consideration the dry areas of the country. Majority of land lies fallow after rabi season. Crops like sorghum and millet can be adjusted in the cropping system of these areas. Thus it is imperative to carry out an extensive research on evolving the adaptable sorghum and millet genotypes. The objectives of the project are:
- Survey, collection and introduction of germplasm from exotic and local sources.
- Preliminary screening and selection under ecological condition of Kohat.
- Introduction & evaluation of high yielding, drought & disease tolerant lines/ varieties.
- To replace the undesirable local types grown by the farmers with the improved/ quality types through improved varieties and better production technologies.

Achievements/Progress:

Visited different Agriculture Research Organizations and Universities like University of Agriculture Faisalabad, FRI Sargodha and NARC Islamabad for technical discussion and collection of germplasm. Collected genetically diverse germplasm/varieties of sorghum and millet from various parts of the country. The collected verities and germplasm were sown at the station and adaptive plots.

Project Title: ***Development of botanical pesticides from traditionally used plant derivatives against stored grain pests.***

Principal Investigator: ***Dr. Ghulam Jilani***
Dy. Director General

Location of Project: *National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.385*
Start Date:	*7/23/2005*	*Funds Released (Rs):*	*1797000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*720378*

Objectives:

- Determination of pest control properties of indigenous plant derivatives.
- Preparation of effective formulations based on active plant extracts/ fractions.
- Demonstration of botanical pesticide based integrated pest management of stored grain insects.

Achievements/Progress:

Survey was made during August/September, 2005 for the collection of Plants from Rawalkot, Bagh area (Azad Jammu & Kashmir). Sweet flag was collected and shade dried and used for extraction. Other plant parts were purchased from market and used for extraction. Culture of Tribolium castaneum, Rhizopertha dominica (F) oryzae (L.) and Sitotroga cerealella being maintained for experimental purposes. Plant extracts were prepared in petroleum ether and ethanol solvents to have a complete range of plant compounds. Petroleum ether, acetone and ethanol extracts were used for testing of repellency against T. castaneum. For growth inhibition studies ethanol extracts of all the plants were tested against S. cerealella and T. castaneum. Meetings were held with Director (Food), Punjab Additional Director (Food) Punjab, Lahore for providing necessary facilities at four locations namely Multan, Lahore, Faisalabad and Rawalpindi. Experiments are planned in the near future.

Project Title: ***Studies on Resistance Monitoring and Insecticide effects on chrysopid predators Chrysoperia carnea (Stephen) (Neuroptera; Chrosopidae)***

Principal Investigator: ***Dr. Attaullah Khan Pathan***
Senior Scientific Officer

Location of Project: *Incharge, PARC-IMP Sub Station, University College of Agriculture B.Z. University,Multan*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.986*
Start Date:	*8/26/2004*	*Funds Released (Rs):*	*1891100*
Project Status: On-Going		*Funds Utilized (Rs):*	*1482235*

Objectives:

- To monitor insecticidal resistance in Chrysopids from different geographical zones of vegetable and cotton crops.
- To study and compare the predatory potentials of resistant Chrysopid strains with that of susceptible one.
- To study the effect of selection pressure on the developmental rates, fecundity, fertility, sex ratio and on the development of a resistant / tolerant Chrysopid strain.
- To use the information in integrated pest management strategies.

Achievements/Progress:

Five locations were tested against five insecticides to monitor the resistance factor in Chrysoperla carnea. Curocron ® (profenofos) showed 56.153, 33.85, 27.239, 26.049 and 12.868 R.F. against D. G. Khan, Multan, D. I. Khan, Bahawalpur and Rahimyar Khan strains, respectively. Same way Lorsban ® (chlorpyrifos) showed 153.029, 49.068, 39.761, 10.194 and 8.72 R.F against D. G. Khan, Bahawalpur, Rahimyar Khan, D. I. Khan and Multan strains, respectively. The Karate ® (lemdacyhalothrin) showed 109.265, 94.857, 38.701, 28.62 and 20.507 R.F against D. G. Khan, Multan, D. I. Khan, Bahawalpur and Rahimyar Khan strains, respectively. Bestox ® (alphamethrin) showed 81.633, 75.388, 30.61, 28.689 and 19.457 R.F against Multan, D. G. Khan, Bahawalpur, Rahimyar Khan and D. I. Khan strains, respectively. Further more Decis Super ® (deltamethrin) showed 22.254, 10.08, 7.205, 4.264 and 2.966 R.F against D. G. Khan, Multan, Bahawalpur, D. I. Khan and Rahimyar Khan strains, respectively. All the tests were conducted under control conditions at the temperature 27 ± 1 C; relative humidity 60-70% for continues light periods.

Project Title: ***Investigation of citrus decline and preliminary management studies in Punjab.***

Principal Investigator: ***Ms. Khurshid Burney***
Senior Scientific Officer

Location of Project: *CDRP, National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.801*
Start Date:	*7/1/2005*	*Funds Released (Rs):*	*1537200*
Project Status: On-Going		*Funds Utilized (Rs):*	*1361203*

Objectives:

- Survey of Citrus growing areas and citrus nurseries of Punjab. Investigation of the presence of the pathogen in citrus nurseries. Isolation of pathogens from diseased plant and soil samples.

Achievements/Progress:

Surveys of citrus growing areas of Punjab comprising of Sargodha, Sahiwal, Toba Taik Singh Faisalabad, Jhang and Kasur (Pattoki) were conducted for the assessment of citrus decline and collection of diseased plant and soil samples. The decline in citrus is being investigated through multidisciplinary approach. During the first year surveys it is noticed that citrus nematode is prevalent in all the citrus grooves except on Sweet lime (Mitha). Kinnow on Rough Lemon is highly susceptible to citrus nematode. The percentage of different fungal pathogens of the 152 plant samples analyzed was fusarium 59, Nattrassia 10, Diplodia 4 and Phytophthora 2. An average of 26% of diseased leaf samples tested positive for Spiro plasma citri by amplification of the pathogen DNA using universal primers for mycoplasma. Soil was analyzed for the presence of plant parasitic nematodes by Baermans funnel technique. A total of 152 soil samples revealed that most frequently present plant parasitic nematode in the soil is Tylenchulus semipenetrans being present in 38% of soil samples. Among the districts 100% samples from Jhang are infested with this pathogen and the least infested district is Sahiwal. Seven citrus nurseries were visited in Pattoki and sills of three have been found infested with T. semipenetrans. The rootstock Rough Lemon and Sour Orange that are mostly used for citrus are both found to be highly susceptible to the nematode. Fungi isolated are being assessed for their pathogenicity in available environmental conditions on different citrus rootstocks that are already being used with new ones. Soil samples from different districts are being used with new ones. Soil samples from different districts are being analyzed for NPK and micro nutrients, Boron, Zinc, Manganese and Iron.

Project Title: ***Characterization of Pakistani isolates of chili veinal mottle potyvirus (ChiVMV)and cucumber mosaic cucumovirus(CMV)infecting chili crop***

Principal Investigator: ***Dr. Hussain Shah***
Scientific Officer

Location of Project: *IPEP, National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.933*
Start Date:	*8/26/2004*	*Funds Released (Rs):*	*1627500*
Project Status: On-Going		*Funds Utilized (Rs):*	*1087468*

Objectives:

- Serological characterization of Pakistani isolates of ChiVMV and CMV
- To study the biology of ChiVMV and CMV
- Antisera production against ChiVMV and CMV
- Management through identification of source of resistance against ChiVMV and CMV in available Capsicum germplasm

Achievements/Progress:

Surveys revealed that ChiVMV and CMV were prevalent in most of the surveyed areas with high relative incidence of ChiVMV in NWFP while CMV was higher in Sindh and Balochistan than NWFP.

ChiVMV was purified successfully by PEG method and polyclonal antiserum has been produced with a tire of 1:3000.

Out of 32 chilli pepper lines screened against CiVMV, CV-1, CV-2, CV-3, CV-7, CV-11 and CV-12 were found Highly Resistant (HR). Whereas the lines CV-5, CV-6, CV-10, Ghotki, BSS-269, and ELAPSO were resistance against both Sinch and Punjab isolates of ChiVMV.

Project Title: ***Identification of superior soybean cultivars for different agro-ecologies of Pakistan***

Principal Investigator: ***Dr. Muhammad Ashraf***
Senior Scientific Officer

Location of Project: *Oilseeds Research Programme, National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.796*
Start Date:	*10/20/2004*	*Funds Released (Rs):*	*2205300*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1744525*

Objectives:

- To screen/evaluate soybean germplasm for specific cropping systems.
- To Collect and acquisition various germplasm.
- To develop base material with high yield potential for future breeding needs.
- To enhance land utilization and farmers' income through induction of soybean in various cropping system.

Achievements/Progress:

20 new accessions were collected and will be evaluated for seed multiplications at NARC, Islamabad during autumn 2007.
Out of 15 accessions, four viz., AK (Kames), Amcor, Carlin and Clark were produced higher grain yield (1850 to 2167 kg ha) than standard check varieties NARC-II which produced 1828 kg ha at Islamabad during autumn 2006.
18 accessions viz; 95014, 95029, A-3127, AGS-19, Centur, Clay, CNS-210, Hamption-266, Monkey hair, NARC-I, NARC-II, No-2, No-4, No-58, Ottawa, RX (5-2-1), Swat-84 and William were selected to evaluate in replicated trials (preliminary yield trial) for spring sowing during 2007 at about three to four locations.

Project Title: ***Quality characterization of oilseed crops through NIRS***

Principal Investigator: ***Mr. Iftikhar Ali***
Principal Scientific Officer

Location of Project: *Nuclear Institute for Food and Agriculture (NIFA), Tarnab, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.013*
Start Date:	*7/5/2004*	*Funds Released (Rs):*	*1762500*
Project Status: On-Going		*Funds Utilized (Rs):*	*1382152*

Objectives:

- To establish NIR technology based oilseed quality analysis facilities and services for oilseed researchers, industry and growers.
- To increase the profitability of oilseed crops growing through the increased capability, availability and adoption of NIR technology based non-destructive quality analysis.
- To develop consistency in quality of oilseed crops through NIR technology based check.
- To develop calibration to determine oil, protein, moisture, fatty acids and glucosinolate on NIR instrumentation for major oilseed crops in Pakistan.

Achievements/Progress:

Systematic collection and computerized documentation of the collected oilseeds genetic resources completed. A database of total 1640 different accessions of rapeseed, mustard, canola, sunflower, sesame and soybean germplasm including landraces, cultivars and breeding materials has been successfully developed.

Total 225 seed samples representing the different species in the total collection analyzed by "wet chemistry" techniques for total oil content, protein content, fatty acid profile and total glucosinolate content according to the project work plan. The information on these 225 samples used to develop NIRS reference libraries for each above mentioned constituent in each species. To develop prediction equation comparative investigations made and the partial Least Squares regression method (PLS) is used to develop predicition equation on NIRS FOSS 6500. The results demonstrated that PLS is an efficient method to use in NIRS technicque to asses variability for Oil content, Protein, Fatty acid profile (oleic, linoleic, linoleic and erucic) in whole seed of multiple oilseeds samples. So the task of development of calibration/validation equations on NIR system for oil content, protein content, fatty acids and Glucosinolates successfully accomplished according to the work plan during the 2nd year (2005-06) of the project. Conformity quality analysis in second sample lots of oilseed crops for the aforesaid analysis through wet chemistry also

Project Title: ***Biochemical and molecular approaches to study the effect of pesticide on nitrogen fixing bacteria in legumes.***

Principal Investigator: ***Mr. Sohail Hameed***
Principal Scientist

Location of Project: *National Institute for Biotechnology and Genetic Engineering, (NIBGE) P. O Box 577, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.65*
Start Date:	*8/3/2005*	*Funds Released (Rs):*	*869500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*695000*

Objectives:

- Isolation and development of pesticide resistant bacterial strains from mungbean (spring & summer crop) and pea (winter crop) legumes.
- Selection of beneficial bacterial strains and pesticides with low toxicity.
- Evaluation of these resistant bacterial strains in vivo.
- Improvement of biofertilizers with pesticide resistant bacterial strains and their application in the field.

Achievements/Progress:

Effect of fungicide application as seed dressing to prevent fungal colonization was checked on the interactive role of beneficial bacteria with legume roots, namely, (Brady) rhizobium species as N2-fixers and an Agrobacterium strain Ca-18 as a phosphate solubilizer & growth hormone producer in mungbean and cultivated peas. Initially two commonly used fungicides: Darosal and Topsin, at recommended dose of 2g/kg seed were tested in separate field experiments and nodulation, nitrogen fixation, nitrogen/phosphate uptake and the crop yield data was collected. The microbiological and agronomical data showed a non-significant effect of fungicide application on bacterial population and their beneficial symbiotic relationship. This was also confirmed through ultra structure studies of root and nodule samples. Moreover, the fungicide resistant rhizobia that formed root nodules and present indigenously in the soil, were isolated and studied for sensitivity against the two fungicides in vitro, again showing a non-significant effect on rhizobial population. The fungicide resistant isolates are being identified through 16 S rRNA sequence analysis.

Project Title: ***Molecular marker facilitated pyramiding of bacterial blight resistance genes in super basmati rice.***

Principal Investigator: ***Dr. Muhammad Arif***
Senior Scientist

Location of Project: *Plant Biotechnology Division, NIBGE, P. O Box 577, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.458*
Start Date:	*7/18/2005*	*Funds Released (Rs):*	*2360000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2228291*

Objectives:

- Evaluation and identification of IR24 based near isogenic lines with single major gene or gene combinations effective against virulent Xoo strains in Pakistan.
- Incorporation of four bacterial blight resistance genes into high yielding commercial Super Basmati rice variety.

Achievements/Progress:

Bacterial blight (BB) is a serious disease of rice caused by the bacterial pathogen xanthomonas oryzae pv. (Xoo), resulting in significant crop yield of around 20 to 40% in many rice growing countries. Several studies has been taken for the identification of different BB resistance genes from different rice germplasm and cultivars worldwide which resulted in the identification of more than 20 resistance ® genes, and the development of donor lines carrying major R genes. These lines (IRBB) lines have been used in different countries to check the effectiveness of these resistance genes against local pathogen races. In Pakistan, some studies have been made to identify the rice cultivars which are showing some resistance against the causing pathogen. However, not a single study has been taken to identify the effectiveness of already identified BB resistance genes against the local strains of the pathogen. The objective of this study is to identify the BB resistance genes which are showing any resistance against various strains of pathogen prevalent in Pakistan. Also we are aiming to incorporate multiple resistance genes in Basmati rice line for the stable and long lasting resistance against this disease. To carry out the proposed objective, we received the donor lines (IRBB lines) carrying single and multiple resistance genes from International Rice Research Institute (IRRI), Philippines. The seeds of 20 IRBB lines were multiplied in rice season 2005 so that we could plan the experiment in replications to check the effectiveness of resistance genes against the local strains. In rice season 2006, the IRBB lines multiplied in 2005 are growing in three replications with 10 plants in each replication. These lines will be challenged with two different virulent strains of BB pathogen identified from the study conducted by the researchers at National Institute for Agriculture and Bilogy (NIAB), Faisalabad. The experiment is in progress. In order to incorporate the four BB resistance genes in Basmati line, one IRBB line possessing four BB genes I.e. Xa4, xa5, xa13 and Xa21 was also crossed with the Super Basmati and Basmati 385. F1 seeds were collected from the female plants and were grown during off-season in green house for backcrossing with the respective parents. The true F1hybrids were identified and confirmed with the use of molecular markers. F1 plants were used as a female parent where as their respective parents Super Basmati and Basmati 385 were used a pollen parent. The backcrossed seed were collected from the F1 plants. The backcrossed (BC1F1) and the F2 seeds are planted in the field in rice season 1006. The BC1F1 and the F2 plants will be checked for the presence of desired number

of resistance genes using molecular markers and will be crossed to the respective parents at flowering stage.

Project Title: ***Use of RNA interference for genetically engineered male sterile tomato plants for production of hybrid tomato***

Principal Investigator: ***Dr. Shahid Mansoor***
Senior Scientific Officer

Location of Project: *National Institute for Biotechnology and Genetic Engineering, (NIBGE) P. O Box 577, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.223*
Start Date:	*1/1/2005*	*Funds Released (Rs):*	*1427000*
Project Status: On-Going		*Funds Utilized (Rs):*	*1531768*

Objectives:

- Development of gene construct to block expression of male specific genes through RNA interference in tomato.
- Transformation of construct and selection of male sterile plants.
- Identification of tomato lines with combining ability to enhance yield and disease resistance.

Achievements/Progress:

Usefulness of RNAi technology for generation of male sterility by silencing of anther-specific genes has been established in Arabidopsis thaliana and tobacco. Regeneration and transformation system for some local adapted varieties of tomato has been established. TA 29 gene from tomato has been characterized and deposited in EMBL data base. A patent application is under preparation for use of RNAi for male sterility. A proper on use of RNAi technology for engineering of novel traits in plants has been submitted to “Trends in Plant Sciences” (impact factor 13.5) A manuscript is in preparation on engineering of male sterility through RNAi in tobacco.

Project Title: ***Application of DNA fingerprinting for drought tolerance in wheat***

Principal Investigator: ***Dr. Mehboob-ur-Rehman***
Group Leader

Location of Project: *National Institute for Biotechnology and Genetic Engineering, (NIBGE), P. O Box 577, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.073*
Start Date:	*9/4/2004*	*Funds Released (Rs):*	*2276742*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1915052*

Objectives:

- Screening of wheat germplasm for drought tolerance.
- Development of segregating population by crossing the most tolerant and susceptible wheat genotypes.
- Application of DNA fingerprinting tools like RAPD, AFLP, ESTs and SSRs to find DNA polymorphisms among the selected wheat genotypes.
- Development of genetic linkage map for different traits conferring drought.

Achievements/Progress:

Sowing of 95 wheat genotypes.

Sowing of 100 synthetic wheat genotypes.

Sowing of the wheat genotypes in greenhouse conditions for imposing drought stress at seedling stage. Analysis for cell membrane stability of95 wheat genotypes p and synthetic tetraploids has been completed.

Analysis of 100 synthetic for cell membrane stability has been completed. All the above mention genotypes have been planted during 2005-06. Wheat samples have been harvested at maturity. viii- Data Analysis Re-sowing of wheat genotypes

Paper presented in the international conference on drought tolerance in crop plant, Unvi Agric Faisalabad Pakistan.Tentative Fl crosses between the tolerant and sensitive wheat genotypes were made. Harvesting of the crosses has been completed. F2 seed have been sown for population development.DNA has been isolated from F2 population Analysis of osmotic potential has been completed on F2 plants. Data was analyzed. Re-sowing of the segregating population.

DNA extraction of 60 wheat genotypes completed.21 microsatellite loci were surveyed on the genotypes.A dendorgram has been constructed. Two genotypes, MH-97 and Kohistan from the cultivated varieties, and one synthetic wheat genotypes Var-257 and Opata (drought sensitive) have been subjected to DNA fingerprinting. 100 RAPD primers have been surveyed on MH-97 and K-97; while 21 SSRs were surveyed on the Var-257 and opata.100 more RAPD primers have been surveyed on the wheat parents.All the available RAPD primers (520) have been surveyed on the parents. The polymorphic primers are being surveyed on F2 population. New microsattelite primers have been designed.

Project Title: ***Evolution of wheat varieties for low water requirements using conventional and mutation breeding techniques***

Principal Investigator: ***Mr. Mahboob Ali Sial***
Senior Scientific Officer

Location of Project: *Nuclear Institute of Agriculture,Tandojam, P. O. 70060, Sindh*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.944*
Start Date:	*7/26/2004*	*Funds Released (Rs):*	*1479140*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1057995*

Objectives:

- To identify high yielding genotypes at low water requirements.
- To identify genotypes with early maturity and increased grain filling period.
- To develop germplasm tolerant to drought for future breeding.
- Better grain quality

Achievements/Progress:

The research studies under this ALP project were conducted with objectives i) screening of newly developed genotypes and wheat varieties/cultivars under low water requirements and ii) selection of drought-tolerant genotypes with high grain yield, high 1000-grain weight and early maturity. Out of 84, at least 21 genotypes (developed through mutation and conventional breeding) have been identified with better tolerance to water shortage conditions having improved characteristics as compared to local checks during wheat season 2003-04. These genotypes produced reasonable yields at less water quantities (2-3 irrigations) during entire cropping season. To confirm the stability among genotypes, 21 selected drought tolerant genotypes have been evaluated under low water requirements at 5 different locations in Sindh province during last rabi season 2004-05. It is expected that some of the lines might confirm drought tolerance and come forward as new entities.

Project Title: ***Bread wheat (T. aestivum L.) improvement for late planting/ terminal stress and high yield potential***

Principal Investigator: ***Mr. Tila Muhammad***
Deputy Chief Scientist

Location of Project: *Nuclear Institute for Food and Agriculture (NIFA) Tarnab, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.868*
Start Date:	*7/1/2004*	*Funds Released (Rs):*	*1488500*
Project Status: On-Going		*Funds Utilized (Rs):*	*1289543*

Objectives:

- Development of early maturing wheat varieties with high grain yield, high biomass, high grain weight, wide adaptation and disease resistance for different wheat growing areas of NWFP.
- Creation of genetic variability for tolerance to late planting and terminal heat stress.
- Identification of plant traits showing high association with grain yield and late planting/heat stress.

Achievements/Progress:

Out of 56 wheat lines evaluated in 4 preliminary yield trials under normal as well as late planting conditions, 26 lines out yielded both the check varieties under normal planting while 17 line were superior to the two check varieties under late planting condition. Based on the average performance of these lines under normal and late planting, 20 lines showed their superiority over both the check varieties. Out of 693 spike to row M4 progeny rows 91 uniform with normal maturity and disease resistance were selected, harvested and threshed individually. Similarly out of 800 spike to row F4 families of different cross combinations, 85 uniform fixed lines were selected. These lines have been harvested and threshed individually for their further studies regarding breeding their behavior and other traits. Selection was also carried out in the M2 M3 and F2, F3 for identification of new putative mutants and lines. About 42 new cross combinations were made between different wheat varieties and lines for creation of new genetic variability.

Project Title: ***Hybrid seed production of rice.***

Principal Investigator: ***Dr. Muhammad Akhtar***
Rice Botanist

Location of Project: *Rice Research Institute, Kala Shah Kaku,Lahore*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.483*
Start Date:	*1/7/2005*	*Funds Released (Rs):*	*869500*
Project Status: On-Going		*Funds Utilized (Rs):*	*759251*

Objectives:

- To develop Basmati and coarse rice hybrids in the Punjab.
- To develop hybrid rice seed production technology.
- To enhance per hectare yield of the Punjab.
- To increase the farmer's income from the same piece of land.
- To boost up rice export and foreign exchange earnings.

Achievements/Progress:

The available TGMS lines were evaluated for their fertility /sterility behavior during the first year of the project. The data revealed that only two TGMS lines showed TGMS behavior under the local conditions at the Institute. These two lines were also evaluated in swat. For the transfer of TGMS gene in to our best varieties, four new crosses were attempted. Besides this, desirable lines from source nursery were utilized for making 192 fresh testcrosses. Out of these, 182 successful testcrosses were harvested for further evaluation in 2006. It has been observed that the germination of TGMS lines is poor. Therefore, to improve the germination, different seed priming techniques were used. Different varieties behave differently to various seed priming techniques. Soaking in water at 19 0C for 72 hrs & Soaking in KNO3 SOLUTION FOR 1-2 days gave maximum germination across varieties. Since most of the available TGMS lines did not show the desired performance therefore, stable TGMS lines along with pollen parent were selected during the visit of International Rice Research Institute (IRRI), Philippines. The seed of some of these TGMS lines and pollen parents has been received recently. Twenty local elite lines were evaluated for the TGMS gene. IR34686 showed maximum spike let sterility I.e. 84% followed by DR 83 (49%), IR 68945-4-14-48 (46%) & IR36 (43%) in D6 (16/8). Eighty elite lines were studied for their agronomic characteristics during the current year for their use as pollen parent for the production of hybrid rice. Out of these, 28 genotypes were selected on the basis of economic traits. Nursery sowing of all the desired genotypes for different experiments for next financial year will be completed within this month

Project Title: ***Production of doubled haploids of wheat by using wheat x maize crosses technique.***

Principal Investigator: ***Dr. Abid Mahmood***
Director

Location of Project: *Barani Research Institute,P.O.Box-35 Chakwal*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.817*
Start Date:	*7/1/2005*	*Funds Released (Rs):*	*2856000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2639360*

Objectives:

- Reduction of variety evolution period (breeding period) from 12 years to 4 years.
- To increase the durability of varieties by having 100% homozygosity which is not possible by conventional breeding methods.
- Cost for the evolution of new varieties will be reduced due to reduction in time, space and labor.
- Transfer of this modern technology to other scientists in the country will be done.
- Production of drought tolerant, good quality and high yielding varieties for barani areas.
- Creating maximum variability to develop germplasm of specific nature for the utilization of lines in crossing program

Achievements/Progress:

A collection of thirty five genotypes was made from Wheat Coordinator, NARC, Islamabad, Wheat Research Institute, Faisalabad, Regional Agri. Research Institute, Bahawalpur and BARS Fateh Jang. The above mentioned thirty five wheat genotypes were screened for stem rust, yellow rust and powdery mildew. The genotypes were inoculated with rust spores, whereas occurrence of powdery mildew was recorded under natural field conditions. Thirty five genotypes were evaluated for drought resistance. These genotypes were screened for drought tolerance on yield reduction basis when grown under rain shelter and irrigated field conditions. Thirty five genotypes were evaluated for drought resistance. These genotypes were screened for drought tolerance on yield reduction basis when grown under rain shelter and irrigated field conditions. On the basis of preliminary results, ten crosses involving 2KC050, Inqlab-91, Rawal-87, Bhakkar-2001,2KC050, Chakwal-86, Margalla-99 and 00FJ03 parents were attempted. Studies have been started to seek genotypic difference among wheat and maize cultivars for efficient crossability initially six wheat genotypes viz; Pak-81, Chakwal-86, Inqlab-91, Chakwal 97.GA-2002 and 2KC050 and five open pollinated maize genotypes viz.' C-20, C-53, C-77, C-78 and popcorn were tested. Wheat cultivars after emasculation were pollinated with maize genotypes. The pollination was followed by injection of 2,4-D in peduncle and drop of this solution was applied to each pollinated floret, Search for embryo harvesting was started 10-18 days after pollination. Wheat cultivars were planted after 10 days interval starting from first September to 31st December. Similarly Planting of five open pollinated Maize genotypes after 10 days interval was to ensure pollen supply at the time of pollination. Emasculated wheat spikes were pollinated with maize pollen. The maize cultivar popcorn proved better for embryo production. Ten to twenty five days old seeds were used to harvest haploid embryos and it was observed that 16-20 days old seed (light green in color) produced haploid embryos of optimum size. Harvested embryos were cultured on MS and B5 salts (Gamborg et al. 1968) supplemented with 20 g litre-1 sucrose and 8 g litre-1 agar. Embryos were incubated at 18-24oC (in the dark). Another lot of embryos are being harvested and it

will be rescued on different concentrations of MS medium. Plants were developed in nutrient media under artificial growing condones in growth room. 8/1 hours Day/night lights and 18-24oC temperature was maintained. Plantlets thus produced were shifted to green house in small pots. 20/8oC d/n temp, and 90% RH in growth room/green house helped to establish plantlets. The plantlets were supplied with nutrient solution (NPK) at weekly interval.

Project Title: ***Coordinated project "National Plant Genomic Research Project"***
DNA bases genetic characterization of cotton germplasm (Component-I)

Principal Investigator: ***Dr. Yusuf Zafar***
Director

Location of Project: *Plant Biotechnology Division, NIBGE, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.384*
Start Date:	*10/16/2004*	*Funds Released (Rs):*	*2941442*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2578602*

Objectives:

- Training of the students at the graduate and postgraduate level
- Assessment of diversity and relatedness in the germplasm and breeding material.
- Preparation of documents on DNA profiles of crop germplasm.

Achievements/Progress:

- Collected 95 G hirsutum and 33 G arboreum cotton genotypes.
- Extraction of cotton genomic DNA
- Synthesis of new SSRs.
- A total of 20 SSRs have been surveyed.
- A total of 15 RAPD primers has been surveyed on G arboreum cotton genotypes.
- Additional 35 RAPD primers were surveyed.
- Also, 15 SSRs were surveyed on the cotton genotypes.
- Additional 10 SSRs were surveyed on the cotton genotypes.
- Resistant sources (LRA-5166 & CP-15/2) have been collected from different cotton research stations.
- Extraction of genomic DNA has been completed.
- The genomic DNA of two stations has been surveyed.
- Continued surveying of the cotton parents with RAPD primers to detect heterogeneity.
- Genomic DNA of G. arboreum var Ravi has been extracted and RAPD analysis has been completed
- Cloning of 20 loci has been completed.
- Cloning of another 80 loci has been completed.
- Sequenced around 80 clones and we designed 22 new SSRs, and started surveying on cotton genotypes.
- The newly identified SSRs were named as PGMB series; and surveying on G hirsutum genotypes has been started.

Project Title: ***Molecular characterization of available germplasm of wheat in Pakistan (Component-II UAF)***

Principal Investigator: ***Dr. Iftikhar Ahmad Khan***
Prof. & Chairman

Location of Project: *Department of Plant Breeding & Genetics, University of Agriculture Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*5.23*
Start Date:	*10/7/2004*	*Funds Released (Rs):*	*3668933*
Project Status: On-Going		*Funds Utilized (Rs):*	*3116264*

Objectives:

- Assessment of diversity and relatatedness in the germplasm and breeding material of wheat.
- Documentation of DNA profiles of wheat germplasm.
- Training of the students at the graduate and postgraduate level.

Achievements/Progress:

A sizable germapslm has been made available for molecular characterization. The germplasm was planted in the field for maintenance and multiplication of the seed. Thus enough quantity of fresh seed was made available for molecular characterization and other studies. After optimization of the conditions, wheat accessions were characterized using RAPD primers and number of bands produced by each primer was scored. Similarity matrix was also constructed to determine relative relatedness and diversity among the accessions. Practical training on molecular markers was imparted to the postgraduate students of Agricultural Biotechnology and Plant Breeding and Genetics. Some of the students are engaged in their thesis studies on molecular characterization of different crops, particularly wheat.

Project Title: ***Molecular characterization of rice germplasm using RAPD analysis (Component-III)***

Principal Investigator: ***Dr. M. Ashiq Rabbani***
Senior Scientific Officer

Location of Project: *PGRP, IABGR, NARC, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*6.561*
Start Date:	*10/1/2004*	*Funds Released (Rs):*	*4117467*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3411234*

Objectives:

- Assessment of genetic diversity in local germplasm of rice at molecular level.
- Documenting DNA profiles of Pakistani rice varieties and obsolete cultivars.
- Training of the students at the graduate and post graduate level in the field of biotechnology.

Achievements/Progress:

Around 50 commercial varieties and primitive cultivars belonging to aromatic (Basmati), non-aromatic (course) and japonica type were used during present investigation. Genetic diversity was investigated at the DNA level using random amplified polymorphic DNA (RAPD) technique and at the phenotypic level using morphological characteristics. Total genomic DNA was extracted from dry seed samples. Each cultivar consisted of 3-5 grains for extracting DNA from bulked samples. After isolation, concentration and quality of DNA was determined using NanoDrop ND-l000 Spectrophotometer at a wavelength of 260 and 280 nm. Genomic DNA of each cultivar was diluted to a working concentration of 20ng/ul to be used for PCR analysis. Twenty-three morpho-physiological traits were recorded from transplanting till harvest of the crop.

After an initial screen, 25 random primers which gave clear and consistent products were ultimately selected to amplify the DNA of each variety/cultivar. RAPDs exhibited several bands that were shared among the Basmati and fine cultivars, whereas a few bands were shared among 'indica' and 'japonica' cultivars of rice. Two japonica cultivars 'Kinmaze' and 'Nipponbare' shared limited number of bands with all the other cultivars, showing their more distant relationship to indica rice varieties. Twenty-five primers used generated a total of 208 RAPD fragments, of which 186 (89.4%) were polymorphic. The number of amplification products generated by each primer varied from 4 to 16 with an average of 8.3 bands per primer. The size of the amplified fragments ranged from 200 to 4000 bp. The level of polymorphism was high and ranged from 40% to 100% for primers used. Multivariate procedure was used to classify the rice varieties/cultivars on the basis of RAPD fragments. Dendrogram was generated for the Nei and Li's genetic distance from RAPD markers. Pair-wise estimates of similarity for 40 varieties and cultivars ranged from 0.50 to 0.96. Based on analysis performed on similarity matrix using UPGMA, 40 commercial varieties and primitive cultivars were grouped into several clusters and a few independent cultivars. Cluster analysis placed most of the aromatic cultivars close to each; wing a high level of genetic relatedness. However, the clusters formed by the aromatic cultivars were distinct from those of non-aromatic and japonica cultivars. Both Japonica cultivars did not fall into any of main groups and formed separate cluster which was more distant from all the aromatic and course varieties and cultivars. Similarly, Swat-2 grouped with japonica cultivars instead with other indica cultivars. Interestingly, a number of commercial varieties and obsolete cultivars originating

from various parts of Pakistan did not form well defined distinct groups and were interspersed with one another in the cluster analysis, indicating no association between the RAPD patterns and the geographic origin of the varieties/cultivars used.

A considerable level of polymorphism was observed among the commercial varieties and primitive cultivars for most of the morphological characters measured. Cluster and principal component analysis were used to classify the rice varieties/cultivars on the basis of phenotypic traits. Dendrogram was generated for the Euclidean distance from the morphological data. Phenotypically, all the commercial varieties and primitive cultivars were classified into four major groups corresponding to the forms of indica rice cultivated in Pakistan, i.e., aromatic (Basmati) and non-aromatic (Non-basmati) with few exceptions. Clustering of the varieties did not show any pattern of association between the morphological characters and the origin of the cultivars. Instead cultivar groups were associated with their morphological similarities and type of indica rice cultivated in various regions of Pakistan.

Besides commercial varieties and primitive cultivars of Pakistan rice, around 172 local landrace genotypes of rice were also evaluated for agro-morphological traits under field conditions. In general large variation was observed among local collections for most of quantitative traits measured. Pattern of variation among the accessions was different for various morphological traits. The largest variation was recorded for days to 50% flowering and maturity, leaf area, plant height, seed-setting percentage, grain and straw yield/plant. Relatively, low level of variability was observed for leaf width, total and productive tillers/ plant, panicle length, spike lets/panicle and harvest index.

Project Title: ***DNA marker for wilt (Fusarium oxysporum) resistant genes in chickpea***

Principal Investigator: ***Dr. Mohammad Saleem***
Associate Professor

Location of Project: *Plant breeding and genectics,University of Agriculture ,Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.893*
Start Date:	*7/5/2004*	*Funds Released (Rs):*	*2489300*
Project Status: On-Going		*Funds Utilized (Rs):*	*2471006*

Objectives:

- Identification of DNA markers from intraspecific crosses and their utilization in marker assisted breeding program for wilt (Fusarium oxysprumr) resistance..

Achievements/Progress:

Chickpea wilt caused by the fungus Fusarium oxysporum is the second most important disease in Pakistan which has reduced the share of chickpea on irrigated lands from 10 to 50% (Hanif et al., 1999) in 1950s to only. The fungs is seed-born as well as soil-born and can survive in the soil for more than five years. The use of resistant cultivars to control wilt disease is the best and the cheapest method. A massive field screening programme for wilt resistance is underway. A large number of germplasm accessions/diverse materials have been screened against Fusarium wilt and elite germplasm lines have been earmarked which will be used in further hybridization programme for the transfer of wilt resistant genes in existing commercial varities. Field screening of Chickpea International Fusarium Wilt Nursery (CIFWN-2005) has shown entries 29101, 29132 and 29208 to be resistant genotypes whereas 29153, 29245 appeared to be susceptible to wilt. From the advanced line developed at the Campus, 810, 96052 and 98144 were found to be susceptible and 1089, 5226 and 205 were moderately resistant. Screening of the material received from the Department Plant Pathology, lines 56, 80 and 121 were susceptible while 5, 30 and 74 have been identified as resistant to wild. Genetic recombinations between susceptible and resistant types were made to study the mode of inheritance of the pathogen. Identification of molecular markers (“tags”) for resistance genes could lead to a quicker assessment of susceptibility, allow screening of seeds are seedlings and reduce the need for maintaining virulent isolates of the wilt pathogen. The F1 material was swon in Kaghan to raise F2 generation. The F2 and other segregating material will be studied at the molecular level for DNA finger printing and for tagging the gene. Chickpea germplasm and advance lines screened will be exchanged/exploited in national breeding programme which will increase and stabilize pulses production in the country. The promising material will ultimately be adopted by the pulse growers for increased productivity. The scientific information generated is in the pipline for publication in national and international journals.

Project Title: ***Selection of zinc efficient wheat genotypes for a balance human nutrition.***

Principal Investigator: ***Dr. Muhammad Imtiaz***
Senior Scientific Officer

Location of Project: *Nuclear Institute of Agriculture (NIA),Tandojam, Sindh*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.705*
Start Date:	*1/9/2005*	*Funds Released (Rs):*	*697000*
Project Status: On-Going		*Funds Utilized (Rs):*	*634166*

Objectives:

- To adapt the strategy to tailor the plant to fit the soil rather than to tailor the soil to fit the plant.
- To assess Zn content in the grain of different wheat cultivars existing in Pakistan.
- To assess the capability of different wheat cultivars for absorbing Zn from Zn deficient medium.
- To study the mechanism(s) which govern the utilization efficiency of Zn in wheat.
- To carry out the molecular markers studies (RADP & AFLP).

Achievements/Progress:

The relative Zinc (Zn) efficiencies of 40 cultivars were determined by growing them in chelate-buffered culture solutions. Zinc efficiency, determined by growth in a Zn-deficient solution relative to that in a medium containing an adequate concentration of Zn, was found to very between 32.80 and 71.89% amongst the cultivars tested. Out of the 40 cultivars tested, 19 proved to be Zn efficient, 09 were Zn-inefficient, while remaining 12 varieties were classed as intermediate. The most Zn-efficient cultivars included: Drawar-95 Bakhtawar, ZA-77 and TJ-83 while the most Zn-inefficient included. RWM-9313, Maxi-pak, Uqab-2000 and Chakwal-86, Zinc-efficient cultivars accumulated greater amounts of Zn in their shoots, than inefficient cultivars but the correlation between shoot-Zn and shoot dry matter production was poor. All the cultivars accumulated higher concentrations of iron (Fe), copper (Cu) and manganese (Mn) at deficient levels of Zn, compared with adequate Zn concentrations. The Zn-inefficient cultivars accumulated higher concentrations of these elements at Zn deficient level compared to efficient cultivars.

Project Title: ***Developing forage-plus-grain winter wheat production system for the Northern areas***

Principal Investigator: ***Dr. Iftikhar Hussain Khalil***
Associate Professor

Location of Project: *Dept. of Plant Breeding & Genetics, NWFP Agri. University, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.458*
Start Date:	*8/26/2004*	*Funds Released (Rs):*	*708000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*480978*

Objectives:

- To introduce and establish dual-purpose (forage-plus-grain) winter wheat production system in the severe winter regions of the Northern areas.
- To increase and diversify source of income of the farmers of the Northern areas by raising both livestock and wheat.

Achievements/Progress:

The result about forage potential, maturity and yield related parameters of 54 winter wheat lines obtained from Oklahoma and Kansas State University wheat breeding programs evaluated in 8-trials at different location clearly shows the potential of winter wheat for the dual-purpose of forage-plus-grain. Averaged green forage production of winter wheat lines was comparatively greater at Abbotabad (6972 kg ha-1) than Malam Jabba (3095 kg ha-1). Good green forage producing genotypes were 05F583 (1000.0 kg ha-1), O5F5 78 (9792.0 kg ha-1), O5F515 (9166.5 kg ha-1) and O5F5117 (9167.0 kg ha-1) at PRC, Abbotabad, while genotypes O5F538 (7350.0 kg ha-1) and O5F509 (5208.4 kg ha-1) at farmers field at Malam Jabba (Swat).

Similarly, genotypes OK99212, Intrada, OK00514 and OK98G508W produced more than 10500.0 kg ha-1 green forage. Plant height of winter wheat genotypes was in acceptable range of 100 to 110cm. A general reduction from 8.0 to 14.0cm in plant height of winter wheat genotypes was observed due to forage cutting in March. In contrast, spike emergence (heading) and maturity were delayed from 3 to 10 days due to forage cutting. Critical yield components like single spike weight, spike length and number of spikelets spike-1 were also reduced in cut than un-cut treatment of trials at Abbotabad, Malam Jabba and Chitral. Analysis of biomass, grain yield and other yield related parameter from these trials are in progress to reach final conclusion and will be presented in forthcoming report of the project. However, the preliminary result indicate that grain yield at acceptable level or even above the national average can be obtained even after green forage clipping form the winter wheat lines.

Data on yield and other important yield components like 1000-grain weight is being complied. Data for important yield traits will be also statistically analyzed across location to know genotype x environment interactions.

Project Title: ***Enhancment and evolution of germplasm for stressed environment through the use of agro-biodiversity***

Principal Investigator: ***Dr. Shafqat Farooq***
Principal Scientific Officer

Location of Project: *Nuclear Institute for Agriculture and Biology (NIAB), Jhang Road, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.468*
Start Date:	*4/1/2004*	*Funds Released (Rs):*	*4002550*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3428943*

Objectives:

- To collect, create, and characterize diversity in the form of varieties/land races/ lines and lines relegated with wheat and incorporating their agronomically important character(s) including low fertilizer and irrigation requirement, salt and water deficiency tolerance into commercial cultivars.
-
- To develop systems and techniques for characterization of created and acquired biodiversity using molecular markers, stress proteins, and anti-oxidant enzymes.
- To streamline production and continuous availability of stress tolerant germplasm for developing environment friendly, sustainable and profitable agriculture for all times to come.

Achievements/Progress:

The evaluation of the collected and new agro-biodiversity produced through crossing made during last experimental season between selected wild species and wheat cultivars and characterization of the selected material were the main tasks for 2nd year. The evaluation of germplasm was to be made primarily for prevailing (drought and salinity) and upcoming (heat resistance/tolerance) stresses.

Evaluation for salinity tolerance was made under saline field blocks maintained at EC 10, 15, 20, and 25 dS-m1. Material planted in these blocks included wheat lines in which each and every chromosomes of D genome was replaced with the D genome from salt tolerant accession of Alegilops tauschii. In addition to that, genotypes obtained from F5 selfed progenies (lines 4909, 4910, and 4911) of three different translocation lines (lines 2407, 2457, and 2461) produced through crossing various wheat cultivars with Thinopyrum junceum and provided by our US collaborator Richard Warg were also included. Reduction in green biomass and grain yield under every salinity level and for each type of genotype is being recorded. Germplasm producing grain yield up to 1900 kg/ha (for wheat) would be considered highly tolerant (the existing germplasm can not produce higher than this). The acceptable lower limit would be 1200 kg/ha.

Potential of the same material to grow on less water has also been determined by growing the material on normal irrigation given to wheat and 75, 50, and 25% less than that. Yield reduction at each level is being recorded.

Characterization of germplasm was to be made through the use of carbon-isotopic discrimination techniques and through the use of morphological and physiological markers that are already established at PMB group of NAIB.

Project Title: ***Development of high yielding, long grain varieties of rice for para boiling purpose***

Principal Investigator: ***Mr. Akbar Ali Cheema***
Chief Scietific Officer

Location of Project: *Nuclear Institute for Agriculture and Biology (NIAB),Jang road, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.696*
Start Date:	*5/11/2004*	*Funds Released (Rs):*	*832000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*607190*

Objectives:

- Induction of high-yielding long grain germplasm/varieties of rice for par boiling purposes.

Achievements/Progress:

The research efforts are being focused to the induction of high yielding long grain varieties/germplasm for parboiling purpose. For this purpose, three Basmati rice varieties, namely Basmati-370, Basmati-Pak and Super Basmati, were exposed to 0, 150, 200, 250, 300, 350, and 400 Gy of gamma rays from the 60 Co source at 13% moisture to study radio-sensitivity Five hundred seeds of each irradiated dose along with un-irradiated control were sown in the nursery beds on 24-06-2005. Forty days old seedlings were transplanted to the field as M1 by keeping plant to row distance of 100 cm (in order to suppress the tillering) in a randomized complete block design (RCBD) with three replications. Data on plant height (cm) and panicle fertility (%) were recorded at maturity on 10 randomly selected plants per treatment per replication. The germination was found 150, 200, and 250 Gy doses of gamma rays and the data was subjected to analysis of variance. Highly significance differences among the varieties as well as among the radiation dose were observed for plant height and panicle fertility. Significant effects of variety x dose interaction for panicle fertility showed does dependent response whereas the interaction between does and plant height was non-significant showing their independent response to radiation.

Low panicle fertility following exposure to gamma rays was observed in all the varieties, which may be attributed due to meiotic disturbance/chromosomal aberrations at cellular level. However, mutagens generally reduce the reproductive ability of the plant and increase the number of sterile florets much more than the environmental effects. Drastic adverse effects were observed for panicle fertility among the varieties showing decrease over control which ranged form 49.8% in Basmati Pak to 73.7% in Basmati 370. Plant height was observed the least affected character ranging form 7.2% to 17.6% decrease in all the varieties at 250 Gy.

A minimum of 10,000 plants in each dose were scored for isolation of morphological mutations. Three long/extra long grain mutants were isolated in Basmati-Pak at 250 Gy dose of gamma rays. Yield components and physical parameters of the paddy were studied in the laboratory. In these mutants, plant height ranged 131-142 cm as compared to parent Basmati Pak (153.0cm). Number of productive tillers plant-1 ranged from 13 to 27 as observed in parent (17.6). The grain length ranged from 13.14 to 13.70 mm as compared to 10.13 mm in parent. The length/width ratio (L/W) in mutants was observed much improved (6.37 to 6.72) as compared to 5.12 in parent. These mutants will be evaluated further for morphological and yield/grain related traits.

Project Title: ***Development of high yielding, disease resistant varieties of groundnut through hybridization and mutation breeding alog with nodulation studies for N2 fixtation under rainfed conditions.***

Principal Investigator: ***Mr. Naeem-ud-Din***
Pulses Botanist

Location of Project: *Barani Agri. Research Instt., Chakwal*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.221*
Start Date:	*7/22/2005*	*Funds Released (Rs):*	*2445000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1979008*

Objectives:

- To enhance the production per unit area by developing high yielding, disease resistant, drought tolerant good quality varieties of groundnut.
- To minimize the use of nitrogen fertilizers through enhancement in nodulation ability.
- Provision of good quality seed to groundnut growers.

Achievements/Progress:

Four parents namely No.334 (local adapted, spreading variety), Bari-2000 (High yielding, drought tolerant, medium pod size), three seeded pods, high yielding, variegated seed color) and 96 CG005 (narrow leaves, drought tolerant, long narrow pods) were crossed in all possible combinations excluding reciprocals. The material was sown in earthen pods on 14-05-2005. The crosses were made during the month of August, 2005. The successful crosses were harvested on 09-11-2005 for further sowing it as F1 generation during next year. Seeds of three desirable lines of groundnut, viz; 01CG001, 02CGA002 and 02CG005 were got irradiated at two radiation levels of 25 Kr and 35 Kr from the Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad during early May, 2005. The seeds of six Mo along with their parents were planted in a replicated trial to raise M1 generation. The trial was sown on 12-05-2005 , 2002 (1.995) whereas entry 02CG001 produced the least nodule mass (1.481). The results suggest that cultivation of check varieties Golden and BARI-2000 may be encouraged. General crop of Groundnut variety BARI-2000 was planted in the month of April, 2005 in rows spaced at 45cm apart. The crop was fertilized @ 20-08-20 NPK Kg/ha at the time of sowing and later on gypsum @ 500 Kg/ha was applied at the time of flowering in the month of July. At maturity in the month of November, 2005, 1000 desirable single plants wee selected. Of these, 518 single plants with higher pod yield will be planted each in separate rows to evaluate the purity of their progenies next year.

NATURAL RESOURCES

BACKGROUND

1st Batch:

ALP Secretariat received 125 preliminary proposals relating to natural resources for funding under the 1st batch. In process of preliminary appraisal 28 proposals were short listed for the invitation of detailed projects and 97 proposals which were not up to the standard were dropped. Finally, 23 projects costing Rs.67million were approved by the Board of Director (BOD) of ALP for funding to conduct the research in different disciplines.

2nd Batch:

ALP Secretariat received 114 preliminary proposals relating to natural resources for funding under the 2nd batch. In process of preliminary appraisal 49 proposals were short listed for the invitation of detailed projects and 65 proposals which were not up to the standard were dropped. Finally, 24 projects costing Rs.64 million were approved by the Board of Director (BOD) of ALP for funding to conduct the research in different disciplines.

3rd Batch:

ALP Secretariat received 88 preliminary proposals relating to Natural Resources for funding under the 3rd batch. In process of preliminary appraisal 39 proposals were short listed for the invitation of detailed projects and 49 proposals which were not up to the standard were dropped. Short listed proposals are in process by the TAC & BOD of ALP.

Region wise details of approved projects is given below:

S.No	***Region***	***Projects***		
		1st Batch	***2nd Batch***	***3rd Batch***
1	*PARC/NARC*	7	7	17
2	*PUNJAB*	5	7	6
3	*NWFP*	4	8	6
4	*SINDH*	1	-	8
5	*BALOCHISTAN*	2	-	-
6	*AJK*	1	-	-
7	*NGO/ OTHERS*	-	-	2
8	*OTHER FEDERAL*	3	2	-
TOTAL		***23***	***24***	***39***

IMPLEMENTATION STATUS

1st Batch:

Of 23 approved projects 3 are in operation, 19 projects have been completed and one project has been dropped due to one or other reasons.

2nd Batch:

Out of 24 approved projects, 21 are in operation and three projects have been dropped due to one or other reasons.

MONITORING & EVALUATION

Monitoring and review of the on-going projects is a regular activity of the ALP Secretariat. ALP Secretariat through a panel of expert comprising a representative each from the concerned Technical Division, ALP Secretariat, Finance Division leading by a Subject Matter Specialist has completed the on site evaluation of 25 projects. The recommendations/ observations have been conveyed to the concerned PI's for improvement and future guidance. The evaluation reports comprising the salient finding, deficiencies found and summary statement of recommendations of the experts are summarized below:

S.No	Name of Project	Name of PI & Institute	Findings/Recommendations
1	National Coordinated Project on Management of Salt Affected Soils and Brackish Water in Pakistan (NIAB, Faisalabad Component-I)	Dr. Zahoor Aslam, PS, NIAB, Faisalabad	The work done by the PI at NIAB, Faisalabad was good and innovative. Field experiments on *acacia ampliceps* was good and used as fodder for goats and sheep. Wheat, barley and fodder beet crops grown on farmers' field were well maintained. Technology has been transferred to the farmers through demonstration experiments, holding farmers field days and by distributing brochures. The farmers were very sentimental in using brackish water for raising crops by ameliorating water with acids. Design used and data collection of experiments was good and such work will produce encouraging results in future for the farming community.
2	National Coordinated Project for the Management of Salt Affected Soils and Brackish Waters in Pakistan (SSRI, Pindi Bhattian Component - II)	Mr. Abdul Rasool, Assistant Agri. Chemist, SSRI, Pindi Bhattian	Trials on crops (wheat and rice) and fruit tress (guava, Jamin, ber) were done in good manners in the beginning of the project. Aquaculture and farm forestry practices were done at the farmers' field. Later on with the change of PI, project work suffered greatly. Field crop experiments as well as lysimetric and pot experiments were not properly maintained. There seems little or no difference between treated plot and control plots. Eucalyptus tree plants and guava plantations were in very poor condition. Achievements made under the project as per objectives were partially satisfactory though releases and utilization of funds was almost 90%. It was felt that due to frequent change of PIs, the progress has been suffered and objectives not achieved fully.
3	National Coordinated Project on Saline Agriculture to Manage Salt Affected Soils and Brackish Water in Pakistant (Uni. of Agri., Faisalabad Component -III)	Dr. Javid Akhtar, Associate Professor, University of Agriculture, Faisalabad	The quality of work was good and experiments were in good condition. Data on various aspects was recorded. The field experiments on farmers' field at 126 R. B. Paharang, Faisalabad were maintained properly. It is hope that analysis of three years data will generate good information and technology will be transferred to farmers for economic utilization of salt-affected soils and water.
4	National Coordinated Project	Dr. Abdul Razak	Trial on wheat crop was conducted at only one

	on Management of Salt Affected Soil and Brackish Water in Pakistan (SALU, Khairpur, Component-IV)	Mehr, Professor, Shah Abdul Latif University, Khairpur Sindh	location in the University, campus. Trials at other three proposed location at Khairpur and Shikarpur were not conducted. Experimental site at University campus was not properly selected, keeping in view the nature of salt-affected soil. The soil was saline and coarse textured in nature and could be reclaimed by simple leaching with canal water. There was no need of using gypsum or any other chemical amendment. This fact was quite evident from treated plots in the field. Crop in control plots was better looking than treated plots. Addition of gypsum perhaps, caused further salt stress in crop grown in saline soil. Thus the objective of developing comprehensive technology for economic utilization of salt-affected soils and brackish water for farmers can hardly be achieved. For yielding good results, it is proposed that award of the project should be done to persons having relevant qualification and experience which was not considered in this particular case. The overall progress is **partially satisfactory.**
5	National Coordinated project on Management of Salt Affected Soil and Brackish Water in Pakistan (NWFP Agricultural University, Peshawar, Component-V)	Dr. Izhar - ul - Haq, Professor, NWFP Agricultural University, Peshawar,	The experiment on sugar-beet grown in Swabi was not in good condition due to poor germination. Due to low population density, useful data cannot be generated. Site selection and soil and water analysis for salinity and sodicity assessment was not proper and satisfactory. That is why' difference between control and amended plots in wheat trial was not visible. Sapling of fruit trees like peach and guava were just transplanted and getting of any useful information at completion stage of project is not possible as these are sensitive to salinity. However, guava fruit trees at Nazar Killi in Swabi was good. A package of technology for judicious use of salt-affected soils and waters was not developed. The selection and transfer of PI from Agricultural Research Institute, Tarnab, Peshawar to NWFP Agricultural University, Peshawar affected the project activities and suffered as PI, could not devote proper time to visit field trials.
6	National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan (ARI, Sariab, Quetta, Component-VI)	Mr. Shahjehan Khan, Dy. Director, Soil Fertility Section, ARI, Sariab, Quetta	The field trials on wheat visited at Nasirabad was in poor condition, infested with weeds and was not even fertilized properly. Farmers' fields were in better condition than the trails on wheat crop. No trials were laid out in other proposed location i. e. Maslakh, Balochistan. Even screening of salt tolerant fruit/forest plants was not done. Data was not properly recorded and analyzed statistically. The PI, was also not successful enough in conducting farmers participatory and friendly project activities due to non availability of manpower. The equipments procured in the project were not installed in laboratory and never used for analytical work. In such situation, objective of ensuring short term and long term income for the farmers can not be achieved.

			The overall progress of the project was **unsatisfactory** and the envisaged objectives could not achieved.
7	National Coordinated Project on Saline Agriculture to Manage Salt Affected Soils and Brackish Water in Pakistan - Umbrella Project (Coordinated Unit-NARC Component VII)	Mr. Banarus Hussain Niazi, PSO, NARC	Work done was **satisfactory**. Field experiments carried out on Sultan Raya (mustard) was reported good, though there were no mustard crop in the field at evaluation time (June, 2006). Farmers were very keen in having seed of "Sultan Raya" mustard crop. However, experiments on fruits (*Guava and Ber*) and forest plants (*Eucalyptus and Acacia*) were not in good condition on farmers' field at Pind Dadan Khan and Sahiwal, Distt. Sargodha. Further research work is required to develop package of technology for judicious use of brackish water. Even screening of fruits/forest plants species for salt tolerance was not carried out. No print media used nor Radio or TV programs were recorded for dissemination of any appropriate technology for benefits of farmers.
8	Impact of Sewage Wastes (Effluent and Sludge) on Soil Properties and Quality of Vegetables	Dr. M. Qasim Khan, Professor, Gomal University, D. I. Khan	The approach and methodology adopted for achieving the objectives of the project is good and according to work plan. The effluent and sewage sludge used was evaluated for its quality (microbes and heavy metals e.g. Pb, Ni, etc). Experiments on summer and winter vegetables were carried out to find suitable dose/concentration of sewage waste. But the experiments laid down were in very poor condition and were not looked after properly. Germination was very poor in most cases and crops were not timely irrigated. Even the site selected for laying experiments was not appropriate. Therefore, accurate data recording was not possible. The PI was asked to repeat experiments under intensive care on farmer's field condition. Efforts are required to get good data for reaching at some good conclusion.
9	Diagnosis and Remedial Measures of Micro-nutrient Deficiencies in Fruit Plants of Economic Importance in Pakistan (ARI, Sariab, Quetta, Component-II)	Mr. M. Idris, Director (Retd.), Water Management, Agriculture Research Institute, Sariab, Quetta	The approach for achieving the progress is fine. Preliminary soil, water and plants samples collected from Quetta, Pishin and Mustung area. were analyzed for macro and micro-nutrient. Apple orchards were given different nutritional treatments and leaf sampling from different orchards was done. However, progress of research work remained slow as resources (financial and human) were not fully utilized. Though PI is an experienced scientist, he was transferred several times under their system and there was no any other scientist to handle the project. The project activities suffered greatly. Crop yield and other quality parameters were not recorded and reports were not prepared and provided.
10	Evaluation and Formulation of Calcium Carbide Based Amendment for Improving Crop Production	Dr. Muhammad Arshad, Prof. (T.I), University of Agriculture, Faisalabad	The research work being carried out is in infant stage. The approach and methodology adopted is relevant to project plan. The preliminary work done and presented by PI on use of CaC_2 in rice produced encouraging results. By inhabiting

			nitrification of fertilizer application of CaC_2 enhanced nitrogen use efficiency of cereal crops. efficiency. Detailed work on rate, time and method of CaC_2 application is being carried out and is progressing well. Wheat crop experiments are in good condition and useful findings are expected to be derived on completion of the project.
11	Improving Yield and Nitrogen Use Efficiency in Cereal Based Cropping System	Dr. M. Tariq Jan, Professor, NWFP, Agricultural University, Peshawar	The approach and methodology adopted for achieving project objectives is good. The wheat experiments going on in the field were properly looked after and were in good condition. Since project is in 2^{nd} year of its implementation, enough data has not yet been obtained to reach at some conclusion. Treatments used in the experiments were enormous, posing handling and data collection problems. In addition, statistical design used for data analysis was not proper and PI was advised to have consultation with statistician for choosing an appropriate design. On completion of the project, some tangible achievements would come out.

Project Title: ***Diagnosis and Remedial Measures of Micro-Nutrient Deficiencies in Fruit Plants of Economic Importance in Pakistan (AARI-Faisalabad).***

Principal Investigator: ***Dr. Muhammad Ibrahim***
Agri. Chemist (Soil)

Location of Project: *Soil Chemistry Section, Ayub Agricultural Research Institute, Jang Road, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.337*
Start Date:	*4/13/2002*	*Funds Released (Rs):*	*1562500*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1206595*

Objectives:

- To investigate the existing status of micronutrients in soils and plants, to find out their deficiency and to delineate the deficient areas.
- To monitor the improvement in quantity (yield) and quality (size, sugars and acidity) parameters with the application of these micronutrients.

Achievements/Progress:

To determine the micronutrients status of soils of citrus growing area in Sargodha District soil analysis of 334 sites was done which showed that Zn was deficient at 80% and B at 86% sites. In citrus orchards, Zn was deficient at 93% sites and boron at 10% sites and low at 43% sites. The Cu, Fe and Mn were optimum both in soils and orchards. Zn application is required in orchards either through soil or foliage. In case of B, its application should be based on both soil and plant analysis.

To determine micronutrients effects on fruit yield of citrus (1) Control, (2) Zn, (3) Zn + Cu, (4) Zn + Cu + Fe, (5) Zn + Cu + Fe + Mn and (6) Zn + Cu + Fe + Mn + B, were tested by applying these nutrients in soil and on foliage in separate experiments. From two years fruit- yield results, it was seen that bearing on plants in all treatments was not uniform. All plants showed alternate-bearing during two years period. It concluded that two years, data are not enough to determine micronutrient effects on fruit yield due to uneven bearing of plants in treatments. It was also observed that applying more than two nutrients at a time may affect plant growth.

To determine micronutrients status of soils and mango orchards, in 270 sites of District Multan and Lodhran, the analysis showed that Zinc (Zn) deficiency is wide spread and 80% sites are low in Zn. The boron (B) is the next nutrient which found to be low at 65% sites and medium at 28% sites. Zinc was low in 92%, Cu in 70%, Mn in 92% and B in 84% orchards. It is concluded that most of the mango orchards are deficient in these nutrients which shows that soil analysis is not a good indicator for determining the deficiency or sufficiency criteria for mango tree.

Fruit yield results from soil and foliar application of micronutrients experiments showed large differences in yield. Soil application of micronutrients did not show any effect on fruit yield. Application of all micronutrients at a time either in soil or on foliage may not be practiced.

Project Title: ***Diagnosis and Remedial Measures of Micro-Nutrient Deficiencies in Fruit Plants of Economic Importance in Pakistan (ARI-Sariab, Quetta).***

Principal Investigator: ***Mr. Muhammad Idress***
Director (Horticulture)

Location of Project: *Agriculture Research Institute, Sariab, Quetta.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.563*
Start Date:	*3/31/2003*	*Funds Released (Rs):*	*715596*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*713062*

Objectives:

- To investigate the existing status of micronutrients in soils and plants, to find out their deficiency and to delineate the deficient areas.
- To monitor the improvement in quantity (yield) and quality (size, sugars and acidity) parameters with the application of these micronutrients.

Achievements/Progress:

Apple is an important fruit of uplands of Balochistan. Three districts (Quetta, Pishin, and Mastung) were selected to carry out the projects activities. A questionnaire was developed to conducted survey in these areas to get a pre-requisite regarding nutritional and other field practices. From the survey it was depicted that most of the growers are practicing intercropping in the orchards. Moreover, farmers plant filler (stone fruit) with early bearing to have income and uproot them when apple trees fully matured. The use of micro nutrients on orchard is almost zero.

Water, soil and tissue samples were collected from three experimental sites. Results of water samples indicate that more than 95% samples are fit for cultivation of fruit trees. From soil analysis data it was found that high pH (varies between 7.8 to 8.6) and presence of calcium carbonate contents between 15-35% reduced up-take of nutrients thus induced chlorsis/necrosis in deciduous fruits particularly apple, peach and to a lesser extent in cherry.

Iron contents monitored in soil samples indicate a high range in Quetta and Pishin (78.9 and 76.3% respectively) followed by medium in Mastung district. The behaviour of Zinc in the soil is more or less similar to Iron.

Results of tissue samples indicate medium range of various estimations in Quetta and Pishin districts followed by low in Mastung area due to light textures soils. Zinc deficiency symptoms were found in older leaves, where reduced shoot growth was observed which results typical rosettes. Total Iron indicates high range in chloratic tissue samples as compared to green leave. Soil application of micro and micro-nutrient improve orchard growth and yield significantly.

Project Title: ***Soil fertility monitoring and management in cotton-wheat (NARC, Islamabad).***

Principal Investigator: ***Dr. A. Rashid***
Chief Scientist-II

Location of Project: *INRES, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.7*
Start Date:	*3/21/2002*	*Funds Released (Rs):*	*2396400*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2322664*

Objectives:

- Investigate the nature, extent, severity and spatial variability of nutrient disorder in cotton-wheat system.
- Develop nutrient management strategies for enhancing and sustaining crop productivity.

Achievements/Progress:

Integrated Soil and Nutrient Management for Sustaining Soil Productivity in Cotton-Wheat System:
Long-term field experiments on four predominant soil series in cotton-wheat system (i.e., Pacca, Shahpur, Sultanpur and Awagat series) was carried out for a period of 4 - year for developing techniques to ameliorate soil nutrient disorders and improve soil quality by integrated use of organic and inorganic fertilizers.

Seed cotton yield increase with integrated nutrient management (INM) was 23-40% over farmers' fertilizer use practice.

Cotton yield was higher in bed-furrow planting by 10% compared with conventional planting.
Wheat grain yield was 19-39% greater with INM than farmers' fertilizer use practice. Grain yield increase with INM was comparable with BNM, i.e., 18-35%.

Fertilizer use efficiency in cotton was better with INM (for example, fertilizer P use efficiency was 18.6% with INM and 16.2% with farmers' practice. Nitrogen fertilizer use efficiency in wheat was 31% with INM and 29% under farmers' practice.

Nutrient Indexing:
An extensive nutrient indexing of cotton crop was conducted in Rahim Yar Khan district.
Diagnostic cotton leaves (forth leaf from top at flowering initiation stage) and associated soils were collected from 70 randomly selected farmers' fields.
Soil and plant samples were processed, i.e., dried, ground, sieved & stored for laboratory analysis.
Plant tissue samples were analyzed for N, P, K, B, Zn, Cu, Fe, and Mn.
Associated soil samples were analyzed for physico-chemical properties as well as for macro- and micro-nutrient contents.

Soil testing indicated that 68% fields were deficient in NO3-N, 58% in P, 11% in K, 44% in Zn and 49% in B.

Plant analysis indicated that 35% field were deficient in N, 54% in P, 15% in K, 48% in Zn and 53% in B.

Application of the deficient nutrients would help to increase crop productivity.

Project Title: ***Soil Fertility Monitoring and Management in Dryland Cropping Systems of Balochistan (AZRC, Quetta).***

Principal Investigator: ***Mr. Ahmad Sami Ullah***
Senior Scientific Officer

Location of Project: *Arid Zone Research Centre, P..O Box 63, Quetta.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.15*
Start Date:	*5/2/2002*	*Funds Released (Rs):*	*1035500*
Project Status: Completed		*Funds Utilized (Rs):*	*1035940*

Objectives:

- Investigate the nature, extent, and severity of nutrient disorders in major dry land cropping systems of Balochistan.
- Develop soil fertility maps delineating nutrient status/disorders in the study area and cropping system.
- Workout nutrient management strategies for wheat under khushkaba, sailaba/ water harvesting/ supplemental irrigation.

Achievements/Progress:

Soil and plant samples were collected during 2002-03 and 2003-04 for nutrient indexing study in major dry areas of Balochistan. Their macro and micro nutrient analysis was carried out at NARC. The pH, electric conductivity, organic matter %, Calcium Carbonate (CaCO3) %, Phosphorus and soil texture test at AZRC, Quetta shows, pH: 7.9-8.7, Calcium Carbonate: 8 - 33.5% and organic matter: 0.59 - 1.3%.

The results of the last two season of 2002-03 and 2003-04 trials reveal that the fertilizer response in dry land is not so simple and do need lot of efforts, on farm presence and punctuality. Micronutrients (Zn & B) performed well in the presence of nitrogen and phosphorous in sorghum. Whereas, nitrogen and phosphorous responded well when they were applied alone or in the combined form in mash

The initial soil fertility map of the area, which shows potential dryland farming areas, soil and plant samplings and soil series of the area, has been developed. The detail map will be prepared after finalization of the results.

Five soil fertility trials on wheat were planted in the residual moisture on farmers fields, but after emergence due to the environmental changes the grass-hopper multiplied in the Rarkan valley and its surrounding districts (Musa Khail and Lorallai) completely destroyed the wheat crop

To get maximum information about the dry land sailaba farming system, experiment also designed for the Kharif (2004) legumes, and experiments by applying various treatments of fertilizer on sorghum, mung and mash were conducted.

Project Title: ***Soil Fertility Monitoring and Management in Rice-Wheat System (NARC, Islamabad).***

Principal Investigator: ***Dr. Fayyaz Hussain***
Senior Scientific Officer

Location of Project: *LRRP, INRES, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2*
Start Date:	*4/27/2002*	*Funds Released (Rs):*	*1911000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1591480*

Objectives:

- Investigate the nature, extent, severity and spatial variability of nutrient disorder in rice wheat system.
- To improve and sustain soil fertility as well as crop productivity in rice wheat system.

Achievements/Progress:

Nutrient indexing of rice-wheat area was done and associated plant tissue samples of rice at maximum tillering stage. Soil pH values ranged from 7.60 to 8.76 in surface and 7.58 to 8.94 in the subsoil. All soils were alkaline in nature and low in organic matter. Among the macronutrients, nitrogen was deficient in 100% surface and sub-surface soils, 65% surface and 61% subsurface soils were deficient in phosphorus. Potassium deficiency was observed only in 15% soils while the maximum soils fell in medium range of K fertility. Zinc was the only nutrient that was deficient in the rice-wheat area while the copper, iron and manganese were adequate. Plant analysis data also showed the deficiency of N, P and Zn. Soil analysis have good correlation with plant shoot analysis. Therefore, application of NP and Zn is necessary while the application of K is needed on soil test basis to get the optimum yield of rice and wheat. Many field studies were initiated at different locations.

Field experiments conducted on P application to rice at various crop growth stages resulted significantly high paddy yield, agronomic efficiency and P use efficiency when P was applied at 15 Days after Transplanting (DAT) as compared to its basal incorporation or application at 25 DAT. Ten P fertilizer treatments applied to wheat and rice were compared from 2003-2006. Wheat grain yield was 3.97 t ha-1 and paddy yield was 3.90 t ha-1 where application of 45 kg P ha-1 to wheat and no P to rice was done, this yield was at par with the yields obtained with cumulative application of 30 and 45 kg P ha-1 to rice and wheat. Indigenous P supplying capacity of soil varied in both experimental fields. Rice soil had a higher P supplying capacity (11.2 kg ha-1) compared with wheat (7.2 kg ha-1). Graded doses of P caused variable fertilizer P uptake.

The levels of B and Zn were below the critical values in most of soils in the area, whereas, use of Zn and B is not common. Paddy and straw yields increased significantly with the application of zinc. Paddy yield increase was 18% with NPK and 25% with NPKZn over farmer' fertilizer practice. Field experiments on Zn and B were also conducted by growing rice and wheat. Combine application of Zn (5 kg Zn ha-1) and B (1 kg B ha-1) was found to be more efficient as compared to all other tested treatments. Maximum mean wheat grain and paddy yields were higher with combined application of Zn + B as compared to application of either Zn or B.

Project Title: ***Recycling of Organic Wastes for Sustainable Crop Productivity (Arid Agri. Uni , RWP).***

Principal Investigator: ***Dr. Mushtaq Ahmed Khan***
Dean

Location of Project: *Department of Crop & Soil Science, University of Arid Agriculture, Rawalpindi.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.642*
Start Date:	*4/25/2002*	*Funds Released (Rs):*	*1280000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1102593*

Objectives:

- Assessment of organic wastes materials in quantitative and qualitative form and their variability in space and time.
- Isolation and identification of effective microorganisms to enhance process of composting (in term of time and quality of composts).
- Test and evaluate selected effective microorganisms to document their effectivity in term of composting process (time and quality) and enrichment.
- Formulation of bio- fertilizer for selected crop.
- Development of composting technology transfer modules for selected ecologies.

Achievements/Progress:

Research studies were carried out at the Department of Soil Sciences, University of Arid Agriculture, Rawalpindi during the year 2002 to 2004.

A. Survey of Poultry Farms:

A total number of 950 poultry farms were visited in the four districts (Rawalpindi, Chakwal, Jhelum and Attock) and farmers were interviewed. Information collected from farmers about the use of poultry litter.

B. Field Studies:

Three maize and two wheat experiments conducted during the year 2002 to 2004. In these studies, seven rates of poultry litter compared with the recommended dose of chemical fertilizers for maize and wheat. Different rates used were: 5, 10, 15, 20, 25, 30 and 35 t/ha. Soil and plant samples were collected to study the effect of poultry litter on soil fertility. The experiments were replicated three time and the experimental design was RCBD. Residual effects of poultry litter, applied to these experiments, were studied in the following wheat or maize crops with no addition of poultry litter at all. The results of these studies indicate that increasing rates of poultry litter increased the crop yields, soil NO3-N, P, K, Cu, Zn, Fe, Mn, B and organic matter. Similarly, plant N, P, K, and the micronutrients were also increased. It was also found that poultry litter application to soil had residual effect on the soil fertility and caused good crop yields. From study, it was concluded that 20 t ha-1 was an optimum doze for wheat and maize production under rain-fed conditions which was equivalent to recommended doze of NP fertilizers. Residual effect of this rate of poultry litter could also give a good

subsequent crop. Additional benefits of the poultry litter would be the removal of deficiency of some micronutrient if any.

C. Composting and Storage Methods of Poultry Litter:

The existing storage method of poultry litter compared with other storage methods for their effects on nutrient composition of poultry litter, and NO3 leaching. The methods studied were: pile, covered with plastic cover and stored in open air; pile placed under the shade; pile stored on cemented floor in the open; poultry litter stored in the pit, and as uncovered pile in the open (farmers' method). Composting of poultry litter was carried out using these five methods to see the effect of composting on quality and nutrient composition of the litter and its comparative effect on wheat production and soil fertility.

The results of this study showed that composting of poultry litter improved the physical structure of the litter and converted it into an odorless material with uniform and smaller sized texture. As compared to un-composted, composted litter gave higher yield of wheat and higher levels of organic matter, extractable P and K. The composting time was about 60 days, which was quite less than the time farmers store it to make it an environment friendly organic waste.

In general, covered storage method was found better than other methods, both for composted and un composted litter. The litter stored under this method had higher nutrient content, and less NO3 leaching.

Project Title: ***Recycling of Organic Wastes for Sustainable Crop Productivity (NWFP-Agri. Uni. Peshawar)***

Principal Investigator: ***Dr. Zahir Shah***
Associate Professor

Location of Project: *Department of Soil & Environmental Sciences, NWFP Agriculture University, Peshawar.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.642*
Start Date:	*4/25/2002*	*Funds Released (Rs):*	*1652537*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1625049*

Objectives:

- Assessment of organic wastes materials in quantitative and qualitative form and their variability in space and time.
- Isolation and identification of effective microorganisms to enhance process of composting (in term of time and quality of compost).
- Test and evaluate selected effective microorganisms to document their effectively in term of composting process (time and quality) and enrichment.
- Formulation of bio- fertilizer for selected crop.
- Development of composting technology transfer modules for transfer to farming community in selected ecologies.

Achievements/Progress:

Various organic wastes, such as municipal solid wastes (MSW), industrial solid wastes (ISW) and farm wastes (FW) produced in NWFP were quantified and their quality and current utilization assessed. The results revealed that huge amounts of MSW is produced in Peshawar (about 868 tons/day) and that contain considerable amounts of plant food nutrients but it is not used for any meaningful purpose. On the other hand, large amounts of ISW and FW are produced in NWFP but most of them are used in one form or the other for some meaningful purpose. However, there was a large reserve of essential plant food nutrients in such wastes and had great potential to convert them into organic fertilizer.

Potential organic wastes were identified for composting. They include crop residues, fruit and vegetable wastes (such as corn stalk, rice straw, sugarcane bagas, wheat straw, fruit wastes, vegetable wastes), manures (such as cattle manure, poultry manure- both broiler and layers, sheep manure), and municipal wastes (such as refuse i.e. fruit mix, paper and so on, and city garbage).

Compost tried from municipal and cattle manure and from municipal wastes and poultry manure and found that the wastes were successfully converted to compost within 120 days when the two wastes mixed together to maintain C:N ratio between 20 and 30, moisture content at around 50%, and the mix turned over 7 times during this period. Composting under aerobic conditions was effective than under anaerobic conditions. The inoculation of composting materials with effective microbes (EM) was ineffective in expediting the process of composting under aerobic or anaerobic conditions.

The effect of compost was assessed on wheat and maize yields and on soil organic field experiments both in pot and field experiments. The pot experiment revealed that compost application increased both

dry matter (DM) yield and N uptake of maize as well as the soil organic fertility in the first season. The carry over effect of compost on the following wheat was highly significant and more pronounced than that during the first season on maize. The effect increased with increasing level of compost applied. The field experiment showed that compost alone at 20 t ha-1 did not perform better than urea alone at 120 kg N ha-1 in improving the crop and N yields of maize in the first season. However, the residual effect of compost was much stronger and significant on the following wheat than on maize in the first season.

In addition, six M. Sc (Hons.) and nine B. Sc (Hons.) students were involved in the project and were all successful. Published seven papers on qualitative and quantitative assessment of municipal waste of project work in national journals. Six M. Sc (Hons.) and nine B. Sc (Hons.) students involved in project successfully completed their thesis research work and special problems assignments and awarded degrees.

Project Title: ***Impact of sewage wastes (effluent and sludge) on soil properties and quality of vegetables.***

Principal Investigator: ***Dr. Muhammad Qasim Khan***
Chairman

Location of Project: *Department of Soil Science, Gomal University, D.I.Khan.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.153*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*2936472*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2890789*

Objectives:

- To evaluate the quality of sewage waste (effluent and sludge) of different sewerage channels of D. I. Khan city and Zafarabad town being used as a source of irrigation/fertilizer for vegetable crops.
- To determine the quality of soil and vegetables being treated with sewage wastes.
- To investigate about the quality of soil and vegetables as affected by different levels of sewage wastes application.
- To propose a most suitable dose/concentration of sewage waste which could be used by the farmers for raising improved quality of vegetables.

Achievements/Progress:

The analysis of the soils treated with different levels of sewage wastes showed an increase in all parameters like pH, EC, % organic matter, NPK, soluble cations (Ca+2 + Mg+2, Na+) and anions C1-1 & SO4-2. The contents of NPK were maximum in treatments having recommended dose of NPK. However, there was no obvious increase in anion, bicarbonate and carbonate were found to be non-detectable in all the soil samples. Concentration of trace elements was also high in waste treated soil samples and it was maximum where sludge was applied. The contents of the trace elements were not higher than the maximum permissible levels (FAO, 1985).

The vegetables treated with different levels of sewage wastes showed an increasing trend in NPK, Na, Ca, Mg, S and all the other trace elements and highest contents Cu, Mn, Pb & Zn were found in treatments receiving sludge.

In the field experiments, soil was treated with sewage sludge @ 0, 75, 100 & 150 t ha-1 while, effluents applied at the rate of 0, 30, 50 & 75% along with control and recommended level of NPK. It was observed that there was a slight increase in soil Ec, pH % organic matter, soluble cations and anions with increasing levels of the wastes. Na, Ca, and Mg concentration in fruit parts of the vegetable was higher in treatments receiving sewage sludge. Trace element contents of the vegetable were also higher in sludge treated samples.

Bacteria species Escherichia coli, Salmonella spp; Streptococcus spp; Pseudomonas spp; Proteus spp. & Staphylococcus spp; were found in effluent used for growing vegetable. The sludge treated soil had Escherichia coli; Staph aureus; Streptococcus spp; Bacillus subtilus & Pseudomonas spp; whereas, effluent & sludge treated vegetables contained Escherichia coli; Stapha aureus; Staph citreus & Bacillus megatarium.

Effluent treated soil samples contained fungal species; Aspergillus spp; Mucor spp; Alternaria spp; Geotrichum spp; & Trichoderma spp. Sludge treated soil had Mucor spp; Geotrichum spp; Rhizopus spp; Aspergillus spp; Alternaria spp; and Penecillium spp. Vegetables treated with sewage wastes were found to be contaminated with Xanthomonas spp; Mucor spp; Rhizopus spp. & Aspergillus spp. Number of Coliform bacteria per 100 gram of vegetable treated with sewage effluent ranged from 7.13 to 164 whereas their count in sludge treated vegetables ranged from 4 to 128/ 100 gm.

Vegetable showed maximum growth in treatments receiving recommended levels of NPK followed by treatments receiving higher concentration of sewage effluent (E6 and E7) and higher amount of sewage sludge (S6 and S7). Maximum number of ;eaves plant-1, leaf length, fruit size & yield (fresh weight) were recorded in case of spinach, cauliflower, pepper, tomato, cucumber, bitter gourd & summer squash having S7, S6, E7 & NPK treatments, while maximum bulb size and root length & width was obtained from turnip, radish, carrot & onion, receiving the same treatments. These findings conclude that application of effluents at a concentration ranging from 50-75% & sludge from 100-150 tons ha-1 may improve soil properties & produce relatively better quality of vegetables.

Project Title: ***National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan.(Component 1: NIAB, Faisalabad)***

Principal Investigator: ***Dr. Zahoor Aslam***
Coordinator

Location of Project: *Saline Agriculture Farmers Participatory Development Project in Pakistan, NIAB, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.017*
Start Date:	*9/6/2003*	*Funds Released (Rs):*	*1276000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*805353*

Objectives:

- Generation of comprehensive technology for economic utilization of salt affected soils and brackish water with the production of appropriate crops/plants species.
- Ensuring short and long term income for the farmers of salt affected lands through popularization and dissemination of selected package of technology by appropriate means.
- To reverse environmental degradation and improve soil health enhancing the value of waste lands.

Achievements/Progress:

Experiments on various aspects of saline agriculture technology viz; saline agro-forestry, water management and animal health care were conducted from 2003-06 resulted in following achievements.

Saline agro-forestry:
Regarding generation of basic information on salt tolerance potential of plant genotypes, studies were carried out to determine salt tolerance limits of five species viz., Desmanthus illionensis, Acacia saligna, Tamarix aphylla, Acacia ampliceps and Carthamus tinctorius. Results showed that 50% reduction in yield of these species occurred at 14.8, 18.5, 35.0, 35.5 and 12.5 dS m-1 respectively.

Studies on the effects of basal dose of DAP on early growth of Acacia ampliceps. (pH 8.4, EC 24.3 dSm-1 and SAR 114) showed that application of DAP had apparent stimulating effects on growth of Acacia ampliceps during first year of growth. However, later on these apparent growth differences disappeared.

A pot culture experiment was conducted to study the effect of KC1on the performance of E. camal in saline sodic soil. Application of KC1 @ 200 Kg ha-1 proved more effective in enhancing plant growth. Increase in uptake of K+ and C1- was observed. Electrical conductivity and SAR of soil decreased significantly while pH remained unaffected. Thus application of KC1 as fertilizer is recommended.

Studies on effects of planting methods and soil amendments on growth of Acacia nilotica and Acacia ampliceps continued applying different combinations of gypsum and farm yard manure with four replicates in RCBD. (Soil analysis: pH 8.7, EC 31.8 dSm-1, SAR 148, GR 20 ton ha-1). Studies are also being carried out on interactive effect of gypsum and phosphorus amendments on growth and development of beri plants in saline environments.

In order to ensure perennial source of forage and amelioration of saline soil, in a field experiment, Acacia nilotica is being grown along with six different kinds of fodders in randomized completes block design in separate plots of 24 x 24 m2 plot size with four replicates. The fodders include swank, jantar, sorghum (summer), muddle, barley and senji (winter). Soil analysis showed various soil properties as sandy clay loam with pH 8.5, EC 20.4 dSm-1 and SAR 47.4. Results showed the suitability of swank with Acacia nilotica for forage production in agro-forestry systems.

Dynamic changes in salinity and moisture regime of soil under Acacia ampliceps grown with different management practices showed that decrease in EC, pH and SAR of soil occurred where as infiltration rate improved with cultivation of Acacia ampliceps, a woody species, after one year of tree growth.

Hydrology:
Effect of different irrigation methods with saline groundwater on the changes in salinity regime was studied with improved bed-and-corrugations method. Bed-and-corrugations were made with the help of small triangular wooden pegs installed under a wooden plank (suhaga) and dragging it on a finally ploughed soil. The use of this water conservation technology saved about 35-40% of irrigation water received by the field under study as compared to the control (formal irrigation practices). About 40% more grain yield was obtained by the use of bed-and-corrugation irrigation method since the water use efficiency was higher.

Evaluation of SAG for Management of Brackish Water was conducted for a period of six months using wheat and kallar grass as test crops grown on the saline-sodic soils irrigated with brackish ground water. After 6 months of their continuous usage, data collected showed that water infiltration rate and production of wheat grain was substantially higher with SAG-treated than untreated brackish water at both sites. The biomass production, however, declined when kallar grass was irrigated with SAG treated water in contrast to SAG untreated water.

A general observation of the study area showed improvement in the soil properties. Some decrease in pH, SAR and EC of the study soil was observed.

The infiltration rate in the SAG-irrigated field and the normal tubewell irrigated field reflect a sign of improvement in the water intake efficiency of soil. Infiltration rate of the adjacent soils of SAG-irrigated field was 0.60 cm/h originally, which improved to 1.20 cm/h (100%).

Animal Health Care:
Survey on carrying capacity of the farmers and prevalence of various diseases of animals in project area showed that more than 60% of the farmers have carrying capacity of 6-8 animals, while less than 40% have the carrying capacity of more than 10 animals. Among the most common disease, foot and mouth diseases, Haemorrhagic septicaemia, Enterotoxaemia hemoglobinurea, goat pox, Pleuropneumonia were prevalent in cattle and buffaloes. Newcastle disease, infectious bursal disease, infectious bronchitis, hydropericardium and pox were common in poultry. After survey of the diseases vaccination schedule for the control of viral and bacterial diseases were designed and vaccination against two major diseases i.e., foot & mouth disease and Haemorrhagic septicaemia was done for the control of these diseases. Farmers were also advised for better management practices. After improving management conditions, animals are safe from external parasite and their growth rate has been improved and due to regular vaccination program the animals are protected against two major diseases.

Work on saline aquaculture shows that some types of fish can be produced successfully using on-farm vegetation in saline environments.

Project Title: ***National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan. (Component 2: SSRI, Pindi Bhatian)***

Principal Investigator: ***Dr. Abdul Rasool Naseem***
Agriculture Chemist

Location of Project: *Soil Salinity Research Institute, Pindi Bhattian.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.19*
Start Date:	*6/30/2003*	*Funds Released (Rs):*	*3060800*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2816677*

Objectives:

- Generation of comprehensive technology for economic utilization of salt affected soils and brackish waters with the production of crops (wheat, rice, and medicinal crops) and fruit trees (guava, jamin, ber) at 10 different sites.
- Ensuring short and long-term income for the owners of salt affected lands through demonstration of 5-10 acres and dissemination in the project area.
- To reverse environmental degradation and improve soil health by growing crops, forest trees and fruit plants. The soil health will be monitored after the harvest of each crop.

Achievements/Progress:

To conduct quality research on different aspects of reclamation/utilization of salt-affected soils and safer usage of brackish water, eleven experiments were conducted. On the basis of data generated through experiments, following general conclusions could be drawn:

Salt affected soils can efficiently and economically be reclaimed with the application of gypsum, compost, gypsum + compost, gypsum+ pressmud, gypsum + FYM and gypsum + chiseling. These treatments significantly improved the soil parameters of EC, pH and SAR and caused appreciable increase in yield of rice and wheat crops.

Acacia ampliceps is a good potential salt-tolerant plant that can safely be grown in highly saline-sodic soils. Its tolerance to salinity alone was assessed to be EC 40 dSm-1 (50% growth reduction). The plant was also successful in sodic conditions with SAR 40. The tolerance limit for combined salinity and sodicity stresses was evaluated to be 30-30 (ECe-SAR).

The effective transplantation technique for nursery plants, particularly Acacia ampliceps was digging pits of 3/ x 3/ x 3/ and filling these pits with silt orsilt and compost (30:1). This technique caused significant growth increase over control in highly saline-sodicsoils.

The brackish water can be used for reclamation purpose safely, when gypsum is applied @ 125% of gypsum requirement of soil.

Brackish water can be managed safely through application of gypsum or cycling (brackish water and canal water) for crop production.

Two hundred ten acres barren land was rehabilitated by supervised reclamation activity. The average paddy and wheat yield at 18 different locations was recorded as 2.7 to 3.6 and 3.4 to 3.9 t ha-1 respectively.

One student conducted research work at SSRI for his Ph.D program and degree awarded by University of Kassel, Germany. Research work of three more students has been completed for their Ph.D program. Prepared and distributed a comprehensive Urdu brochure among the farmers for dissemination of technologies.

Project Title: ***National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan. (Component 3: UA, Faisalabad)***

Principal Investigator: ***Dr. Javid Akhtar***
Associate Professor

Location of Project: *Department of Soil Sciences, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.287*
Start Date:	*8/1/2003*	*Funds Released (Rs):*	*3254500*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2747881*

Objectives:

- Generation of comprehensive technology for economic utilization of salt affected soils and brackish water with the production of appropriate crops/plants species.
- Ensuring short and long term income for the farmers of salt affected lands through popularization and dissemination of selected package of technology by appropriate means.
- To reverse environmental degradation and improve soil health enhancing the value of waste lands.

Achievements/Progress:

National coordinated project on saline agriculture to manage salt affected soil and brackish waters was conducted for three years in district Toba Tek Sing (Village 286 G.B) and Faisalabad (126 R. B Pharanag). Soil was saline to saline sodic. In Rabi, different wheat and barley genotypes were tested initially in green house (solution culture studies), then cultivated in the salt affected field. The SARC wheat genotypes (SARC-1, 2, 4, 5) were compared against Inqulab-91 and three varieties of barley (JO 83, JO-87 and MH-93) were cultivated in highly salt affected fields. It was observed that as the salinity increased the SARC wheat genotypes had better yield than the recommended variety Inqulab 91. SARC-1 and SARC-5 have the potential to grow at EC > 15 dSm-1. In barely, MH-93 produced the maximum fodder biomass than the other (JO-83 and JO-87). In Kharif, sorghum, maize and millet were cultivated. Eight varieties of Sorghum (F 9601, F 9603, F 9706, F 9902, F 9707, JS 263, JS 2002, and SANDALBAR), two varieties of maize (Sahiwal-2002 and Fagawi) and local variety of millet were cultivated. In sorghum JS-263 produced the maximum fodder biomass, in maize Sahiwal 2002 produced the maximum fodder under the salt affected conditions. The local variety of millet performed well in saline conditions. The brackish water experiment was conducted on wheat to evaluate the effect of combined use of canal and tube well brackish water. SARC-1 was cultivated for three years in the same set of treatments and concluded that the combined use of canal and tube well water could be utilized to grow crops, where there is the shortage of canal irrigation water.

Project Title: ***National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan. (Component 4: SALU, Khairpur)***

Principal Investigator: ***Dr. Abdul Razak Mahar***
Associate Professor

Location of Project: *Department of Botany,Shah Abdul Latif University, Khairpur.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.513*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*3168937*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*3162294*

Objectives:

- To generate the salt affected soils for re-using for the production of different crops for human being and livestock.
- Re-use of brackish water and analysis of salt affected soils at various affected areas will be brought under this system.
- To encourage and train farmers to actively adopt the new approach for short and long terms income.

Achievements/Progress:

A series of experiments, using organic/inorganic amendments with canal/brackish waters in cyclic manners, was designed to manage the salt affected soils and brackish waters for production of wheat, rice and fodder crops for the economically depressed people of affected areas of Khairpur and Shikarpur districts, Sindh. The trials were conducted during the year 2003-06 in farmers' fields/villages.; and farmers were also involved in order to expose them to have an objective assessment of the performance of techniques applied so far.

In the study/investigation, effects of brackish water were evaluated on wheat, rice and fodder yields on saline sodic soils. The results indicated that cyclic use of brackish/canal waters can be applied during short spell of irrigation waters with application of amendments (farmyard manure @ 10-15 tons + rice husk 5 tons ha-1, gypsum @ 100 GWR, and poultry waste @ 15 tons ha-1). However, brackish water with an EC 6.28-7.44 dS-1, SAR 17.23-23.37 mmolcL-1 can be used for irrigation for those crops without significantly yield reduction.

The effects of amendments on soil properties were also studied. The application of farmyard manure + rice husk, poultry manure followed by gypsum showed most effective in reduction of soil salinity, improved crop production and minimizing the hazardous effects of brackish water.

In general it is concluded that application of organic amendments is effective to grow wheat, rice and fodder crops as well as amelioration of most saline sodic soils receiving brackish water under agro-climatic conditions of Khairpur and Shikarpur districts.

The techniques applied for management of salt affected soil and brackish water and crop production improvement has been communicated to farmers and agriculturists through distribution of brochures and articles published in news paper and magazine in regional and national languages. Findings of

experiment were also presented in a workshop at Shah Abdul Latif, University, Bahawalpur and national and international conference.

Published a paper in a national research journal from project work. Also presented four papers in national conferences. Three M. Phil students involved in the project completed their research work and two were awarded degrees.

Project Title: ***National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan. (Component 5: NWFP Agriculture University, Peshawar)***

Principal Investigator: ***Dr. Izhar-ul-Haq***
Professor

Location of Project: *Department of Soil & Environmental Sciences, NWFP Agriculture University, Peshawar.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.094*
Start Date:	*7/26/2003*	*Funds Released (Rs):*	*2589400*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2365118*

Objectives:

- Generation of comprehensive technology for economic utilization of salt affected soils and brackish waters with the production of appropriate crops/plants species.
- Ensuring short and long-term income for the farmers of salt affected lands through popularization and dissemination of selected package of technology by appropriate means.
- To reverse environmental degradation and improve soil health enhancing the value of wastelands.

Achievements/Progress:

Scientific/Research:
Experiments were conducted at various sites on the farmers, fields in Charsadda, Mardan and Swabi districts of NWFP during the period 2003-2006 with findings abstracted below:

Management of salt affected soils through the use of amendments such as gypsum, manure and press mud was indispensable for sustainable production of crops. Of these amendments, gypsum was found most effective in increasing yields of cereal and sugar crops and raising orchards of pear and guava. Conjunctive use of these amendments was superior to their application alone. Succeeding crops grown on the same field were also benefited due to the residual effects of amendments. The effect of gypsum on second crop diminished greatly than maure. The effect of organics such as manure and press mud was greater in the 2nd crop compared to the 1st crop.

The quality of under-ground water in the area of Yar Hussain, district Swabi adjoining parts of district Mardan were unsafe for irrigation due to higher levels of SAR and RSC adversely affecting soils. Application of gypsum at full rate of GRw along with 10 tons FYM ha-1 exhibited to be effective technology for management of brackish waters which not only improved crop yields irrigated with these waters through combating their ill-effect but also improved soil health.

Dipping of rice seedlings in 0.4% Zn solution before transplantation was effective in improving rice production on salt affected soils. The treatment proved effective in combating the nutrients stress encountered in salt affected soils.

Sowing soaked seeds of wheat in 4% gypsum solution and sugar beet in water for 10 hours in addition to applying gypsum and manure to the soil was rather a better management approach for higher

production of crops on saline sodic soils. Maximum crops yields resulted from the combined use of soil amendments along with seed priming.

Growing salt tolerant crop varieties provide opportunities for better use of salt affected soils. Of the ten wheat lines tested in saline sodic environment, SR-40 and SR-19 showed tolerance to salts and gave the maximum average yield.

The use of amendments on saline sodic and sodic soils turned out to be economically effective in raising farmers' income as the results of the experiments showed VCR up to 5.86 and net return up to Rs.23000/- per hectare.

These amendments were also found quite effective in reclaiming the soils. Saline sodic and sodic soils were improved for the growth of crops when amended with gypsum and manure through reducing significantly soil pH, SAR and GR and making EC mild.

These findings conclude that combined use of gypsum, manure and press mud is effective to manage saline-sodic and sodic soils for higher production of cereal and sugar crops and raising guava and pear plants on salt affected soils. Harmful effects of brackish water can be alleviated and crop yield irrigated with such water can be increased with amendments i.e. gypsum and manure which are good ameliorants for this purpose. Dipping of rice seedlings in 0.4% solution before transplantation goes in accord with higher production of paddy in salt affected soils. Priming seeds in water or gypsum solution prior sowing promote germination of seeds and help evade the stress of salts.

A paper based on project work research has been published in a national agricultural research journal while one has been submitted for publication. Seven students have completed their master degree program with the help pf project work and four are in progress of completion.

Project Title: ***National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan. (Component 6: ARI, Quetta)***

Principal Investigator: ***Mr. Shahjahan Khan***
Deputy Director

Location of Project: *Soil Fertility Section, ARI, Sariab, Quetta.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.93*
Start Date:	*8/1/2003*	*Funds Released (Rs):*	*1226000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*1224841*

Objectives:

- Generation of comprehensive technology for economic utilization of salt affected soils and brackish water with the production of appropriate crops/plants species.
- Ensuring short and long term income for the farmers of salt affected lands through popularization and dissemination of selected package of technology by appropriate means.
- To reverse environmental degradation and improve soil health enhancing the value of waste lands.

Achievements/Progress:

In order to see amendments effect on yield component of rice crop, experiments were conducted in Nasirabad area using poultry manure and gypsum. Data regarding plant height, number of tillers, panicle length, grains, paddy yield was collected and analyzed. Poultry manure @ ten tons per hectare + gypsum @ 50% requirement gave best result of yield.

Trials were conducted in Nasirabad area to see response of poultry manure and application of different irrigation source on maize yield. Data regarding component was recorded and analyzed.

Effect of sulphur on yield and growth of onion crop in salt affected soils was studied in Nohsar, Muslakh and Panjpai area. Data on various aspects was recorded and analyzed. The highest onion bulbs yield (39.00 ton ha-1) was recorded in T7 with the application of 150-100-100 NPK + 250 S followed by T6 which has given 36 ton ha-1, the minimum yield was recorded in control T1 (00-00-00) 25 t ha-1.

Project Title: ***National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan. (Component 7: NARC, Islamabad)***

Principal Investigator: ***Mr. Banarus Hussain Niazi***
CSO/DDG

Location of Project: *INRES, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.993*
Start Date:	*7/1/2003*	*Funds Released (Rs):*	*2899000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*2704406*

Objectives:

- Generation of comprehensive technology for economic utilization of salt affected soils and brackish waters with the production of appropriate crops/plants species.
- Ensuring short and long-term income for the farmers of salt affected lands through popularization and dissemination of selected package of technology by appropriate means.
- To reverse environmental degradation and improve soil health enhancing the value of wastelands.

Achievements/Progress:

The overall coordination, supervision and management of various components of the coordinated project carried out by NARC/PARC component, Islamabad. The applied research as well as dissemination of technology was carried out in the farmers' field located in various parts of the country.

Field demonstration of the mustard crop at two sites i.e. Pind Dadan Khan and Sargodha district having marginal salinity were conducted. The agronomic data and chemical analysis of Brassica campestris (cv. Toria) sown in the field demonstration was computed.

A pot study was conducted in glass house at NARC in graded saline conditions. For comparison of the response of B. juncea and B. campestris, two cultivars i. e. Anmol Raya and Toria were sown and raised. The agronomic and chemical data was compiled.

In another study performance of B. juncea and B. campestris were compared under Na+ stress in the glass house. Gradient creation of external osmotic potential with NaC1 reveals physiological traits of a plant species. Brassica campestris (cv BSA) and B. juncea (cv. BARD) were grown for six weeks in nutrient solution of various osmotic concentrations, e.g. -0.19, -0.27, -0.31 and -0.42 MPa using NaCl. Shoot and root length of B. campestris and root length of B. juncea declined with increasing osmotic potential as compared to control. Under increasing osmotic conditions relative growth rate, leaf area ratio and relative water contents of both the species were affected.

A study was also conducted to observe the effect of external Ca2+ level in growth medium on ionic and growth parameters of Brassica species under Na+ stress. Seeds of B. campestris (cv. BSA) and B. juncea (cv. BARD-1) were germinated and raised using quartz sand moistened with distilled water. Full strength nutrient solutions were prepared along with 60mM NaC1. Calcium was applied as CaSO4 2H2O @ 2, 4, 6, 8 and 10mM using CRD. Brassica campestris and B. juncea responded significantly ($p < 0.01$) for growth as well as ion concentration on sequential application of Ca2+ in the root

medium. Root and shoot lengths were linear with respect to external Ca2+ concentration. Maximum fresh mass was recorded at 10mM of B. Juncea shoot and root. Relative growth rate of shoot of both species was highest at 8nM of Ca2+ applied. The shoot and root portion of B. campestris and B. juncea, Ca2+ had linear relationship with potassium, sulphur and sodium. Application of Ca2+ to the growth medium under higher salinity enhanced the vegetative growth of B. juncea compared to B. campestris.

Project Title: ***Increasing and sustaining crop productivity of water eroded lands through rainwater.***

Principal Investigator: ***Dr. M. Shafiq***
Principal Scientific Officer

Location of Project: *WRRP, NARC, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*7.49*
Start Date:	*7/27/2004*	*Funds Released (Rs):*	*4434000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2423816*

Objectives:

- Develop and disseminate rainwater and nutrient management technologies for increasing and sustaining productivity in eroded lands.
- Participatory diagnosis of constraints and opportunities (PDCO) related to rainwater, soil and nutrient management.
- Identify factors of soil physico-chemical degradation due to water erosion.
- Determine water-nutrient interactions and nutrient imbalances under rainfed agriculture in eroded lands.
- Develop intergraded nutrient and water management strategies for increasing and sustaining crop productivity.
- Promote proven and cost-effective available/ developed technologies for water conservation and soil fertility restoration by means of innovative extension approaches.
- Asses the potential of soil carbon sequestration through restoration of eroded and nutrient deputed soils.

Achievements/Progress:

After conducting field survey, eight experimental fields, each at Fatehjang and Gujar Kahn were selected. At Fatehjang four fields belonged to Missa soil series and four to Rajar soil series, whereas, at Gujar Khan four fields belonged to Guliana and four to Rajar soil series. Field experiments were initiated from wheat 2004-05 season adopting four treatments (i.e. control, improved fertilization, water conservation and water conservation plus improved fertilization). The rainfall data was collected from both target areas and other climatic parameters at Fatehjang. Rabi (winter) growing season was wet year whereas Kharif (summer) season was normal year. The rainfalls were relatively well distributed throughout the crop growing seasons.

Experimental fields were slightly alkaline and free from salinity problems. Free lime contents (CaCO3) were quite variable. On average soils of Gujar Khan area have relatively low CaCO3 than soils of Fatehjang target area. Almost all the soils are deficient in soil organic matter content. About 100% of soils in both the target areas are deficient in N, P, ZN, and B.

Improved fertilization and rainwater conservation increased total dry matter and grain yield of wheat and maize. Both of these treatments have synergistic effect. However, improvement as a result of improved fertilization is many fold than water conservation. Highest total biomass and grain yield of

wheat and maize was achieved under water conservation plus improved fertilization treatment. The order of crop yields was Guliana > Missa > Rajar soil series.

Water use efficiency is affected by number of factors such as: available water, crop, soil fertility status, weed control etc. Soil moisture contents at sowing and harvest consequently water used by crops was almost similar under all treatments. Fertilization improved all the yield components and resultantly the grain yield. WUE increased appreciably under fertilization over control. Under nutrient deficient soils, simple water conservation practices can not increase crop yield and water use efficiencies, significantly.

Project Title: ***Use of nitrogen fixing, plant growth promoting rhizobacteria (PGPR) for development of biofertilizer for crops on economic importance.(Component-I)***

Principal Investigator: ***Dr. Muhammad Aslam***
Coordinator

Location of Project: *Soil Biology, NARC, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.23*
Start Date:	*4/2/2005*	*Funds Released (Rs):*	*2397000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*757435*

Objectives:

- To exploit the role of plant growth hofDlones (induced or produced) in rhizosphere on growth and yield of wheat and sugarcane for improving quality ofBiofertilizers.
- Isolation, identification and selection of bacterial strains showing high nitrogen fixing activity and phytohofDlone production in pure culture.
- Evaluation of promising strains showing beneficial effects on their respective host crops under lab as well as field conditions and development of crop specific biofertilizers based on single multiple strains in a carrier material for wheat and maize.
- Identification and quantification of phytohormones produced by rhizobia associated with wheat and maize and their beneficial effects on plant growth.
- The influence of wheat root exudates application on the growth of rhizobia and their promotion for phytohomone production.
- Selection of beneficial strains of rhizobia (most efficient in plant growth promoting hormone production) for biofertilizer production for wheat.

Achievements/Progress:

Wheat rhizosphere soil samples (12) were collected from four sites of Faisalabad district and Kala Shah Kaku area. Same numbers of rice rhizosphere soil samples were collected from rice areas of northern Punjab (i.e. Kala Shah Kaku, Sheikhupura and Norowal). Isolation of plant growth promoting rhizobacteria (PGPR) from these samples was done by dilution plate method. The plates were incubated at 26-280C for 3-4 days and then studied for various morphological characteristics of microbes. Different types of colonies were counted and studied under microscope and their morphology was noted. Selected colonies were picked and the microbial strains were purified by 4-way streaking. The strains were characterized from gram staining, growth hormone production and phosphate solubilizing capabilities. The purified strains were then preserved on slants and stored for further testing/evaluation. Screening of four isolates of each, wheat and rice PGPR isolates was done by method adopted by Farah et al (2005) using tryptophan as precursor in the culture media. Development of pink color was an indication. The hormones produced were estimated by standard IAA graph. Identification of hormones was done at HPLC by procedure of Tien et al (1979) using UV-detector and tech sphere 5-ODS C-18 column at Quaid-e-Azam University, Islamabad.

Twelve PGPR isolates of each wheat & rice have been acquired. Most of the wheat PGPR was rod-shaped gram -ve bacteria with irregular colony size/shape. Half of the isolates also had phosphate solubilizing ability. All of the rice PGPR were rod-shaped gram -ve bacteria. Out of 5 tested isolates 2 had phosphate solubilizing ability. All the isolated produced reasonable amount of IAA growth

hormone that ranged 18 - 30 mg 1-1 of solution. Analysis of other growth hormones (Kinetin & gibberlin) has been completed.

Project Title: ***Use of nitrogen fixing, plant growth promoting rhizobacteria (PGPR) for development of biofertilizer for crops on economic importance.(Component-II)***

Principal Investigator: ***Dr. M. Sajjad Mirza***
Principal Scientist

Location of Project: *Biofertilizer Division, NIBGE, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.254*
Start Date:	*3/19/2005*	*Funds Released (Rs):*	*1996000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1701786*

Objectives:

- The main objective of the study will be the development of crop-specific biofertilizer for sugarcane and cotton based on nitrogen-fixing, plant growth promoting rhizobacteria (PGPR).

Achievements/Progress:

Roots of cotton and sugarcane were collected from different cropping areas for isolation of plant growth promoting rhizobacteria (PGPR), From this plant material 31 bacterial isolates have been purified. Phytohormone indoleacetic acid (IAA) from cell - free growth medium of 28 strains was extracted and quantified on HPLC. Among the PGPR obtained from cotton, the isolates U4 and U21 produced highest amount of IAA (12 mg/L and 14 mg/L, respectively) while the isolate A3 from sugarcane was found to be the most efficient producer (IAA production 2.6 mg/L). Nitrogen fixing bacterial belonging to genus Azospirillum has also been obtained from both cotton and sugarcane. Nitrogen fixing ability of four Azospirillum brasilense and Azospirillum lipoferum strains was confirmed by acetylene reduction assay.

Project Title: ***Management strategies for metal contaminated soils receiving city waste effluent for sustainable crop production and food security.***

Principal Investigator: ***Dr. Abdul Ghafoor***
Professor

Location of Project: *Instt. of Soil & Environmental Science, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.211*
Start Date:	*7/26/2005*	*Funds Released (Rs):*	*1755800*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1385836*

Objectives:

- Quantification of metal uptake and accumulation in different parts of cereal and fodder crops grown on contaminated soils.
- Identification of plant species from areas receiving sewage having hyper-accumulation capabilities for metals.
- Effectiveness of organic and inorganic amendments to retard the bio-availability of metals in contaminated soils.

Achievements/Progress:

The natural and planted vegetation and soil samples from the sewage irrigated areas around Faisalabad, Gujranwala, Kasur, Multan and Lahore were collected during winter season 2005-06. Chemical analysis showed that in plants namely Puthkanda (Achyranthus aspara), Madhana grass (Dectyloctenum aegyptium), Shahtoot (Morus alba), Neem (Azadirachta indica), Wheat (Triticum aestivum), Sweat lime (Citrus aurantifolia), Shishan (Delbergia sisso), Mango (Mangifera indica), Sunhemp (Crotalaria juncea), Bamboo (Bambusa bambus) and Khabal grass (Cynodon dactylon), the Ni concentration was < 5 ppm, while in beri (Zizyphus jujube) and Sorghum (Sorghum vulgaris), it was > 10 ppm in shoot parts. In case of cadmium, the range of concentration was 0.00-1.20 ppm. Overall there is big variation among plants for Ni and Cd concentration in above ground parts.

A field study to evaluate the bioaccumulation of metal ions by cereal crops grown on metal contaminated soil receiving city effluent for irrigation was conducted on 10 contaminated farmer's fields around Faisalabad. Rabi crops (Wheat, Berseem, Oats, Barley) and Kharif crops (Maize, Rice, Sorghum, Sugarcane) were sampled and determined metal ion and their partitioning in plant parts i.e. roots, stems, grain and soil analysis.

In a hydroponic study with the application of Ni (from 5 to 15 mg L-1), wheat proved better Ni accumulator than barley. However, the Ni concentration in shoot appears very high which will be confirmed next year.

A pot study was conducted using three levels each of lime (4, 6, 8%), CaSO4 (5, 10, 15 me Ca 100g-1 soil), rock phosphate (500, 1000, 1500 ppm of P), KH2PO4 (100, 500. 1000, 2000 ppm of P), (NH4)2SO4 (60, 120, 180 ppm), CaO (5, 10, 15 me Ca 100g-1), elemental sulphur (5, 10, 15 g kg-1 soil), DAP (1000, 500, 1000, 2000 ppm), H2SO4 (5, 10, 15 g S kg-1) and control. Wheat biomass was maximum with 0.6% CaSO4 and minimum with 0.8% MAP. However, amendments

being the direct source of Ca2+ remained relatively better regarding the grain and straw yield compared to the indirect source of Ca2+.

The Cd absorption pattern by wheat as affected by inorganic amendments on metal contaminated soils receiving sewage was assessed in farmer's field at Binda Sindhila, Suraj Miani road, Multan. Treatments were control, MAP, (0.2, 0.4. 0.8 %), CaSO4.2H2O (0.2, 0.4. 0.8% and Sulphur (0.2, 0.4, 0.8 %) in four replication. The spike length (cm) was maximum with 0.4% CaSO4.2H2O and minimum at 0.4% of Sulphur. Plant height was maximum with 0.8% Sulphur but was minimum with 0.8% MAP. Total dry matter and grain yields of wheat was maximum for 0.6% of CaSO4.2H2O which was lowest for 0.8% MAP.

In other pot experiment uptake and distribution of Ni in berseen using organic amendments on metal contaminated soil was evaluated. Treatments included Ni @ 30, 60 and 90 mg kg-1, organic amendments as FYM, poultry manure and press mud @ 7 kg-1. Different organic amendments had non significant effect on concentration in plant shoot. However, press mud was found strong immobilizer of Ni.

Project Title: ***Sustainable Rice-Wheat Farming System on Salt-Affected Soils Using Brackish Water and Amendments***

Principal Investigator: ***Dr. Ghulam Murtaza***
Associate Professor

Location of Project: *Deptt. of Soil Science, Institute of Soil & Environmental Sciences, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.923*
Start Date:	*11/24/2004*	*Funds Released (Rs):*	*1815900*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1733340*

Objectives:

- Screening of existing salt tolerant rice and wheat varieties (3-4 each) against ambient soil salinity and sodicity levels.
- Growth response of saline-sodic soils to the Rice and Wheat varieties (proved tolerant from Lab. Study) in rice-wheat cropping zone to amelioration strategies.
- Farmer education to utilize salt-problem soils and brackish irrigation waters.
- Economic viability of the strategies under investigations.

Achievements/Progress:

Salt tolerant cultivars of rice (SSRI-8) and wheat (SIS-32) crops selected from first year experiments were cultivated in farmers saline-sodic fields near Dijkot, Faisalabad (site 1) and Gojra, Toba Tek Singh (site 2) with the treatments: Brackish water alone (T1); Canal water alone (T2); Gypsum @ 100% soil gypsum requirement (SGR) + brackish water (T3); Gypsum @ 100% (SGR) + one irrigation with brackish and one with canal water (T4); Gypsum @ 100% (SGR) + two irrigation with brackish and one with canal water (T5); FYM @ 25 Mg ha-1 + one irrigation with brackish and one with canal water (T6); FYM @ 25 Mg ha-1 + two irrigation with brackish and one with canal water (T7).

At site 1, after the harvest of first rice and wheat crops, gypsum @ 100% (SGR) + one irrigation with brackish and one with canal water remained better regarding decrease pHs, ECe and SAR. Maximum productive tillers and straw and paddy yields of rice were observed with FYM @ 25 Mg ha-1 + one irrigation with brackish and one with canal water. However, maximum straw and grain yields of wheat were observed with gypsum @ 100% SGR + two irrigation with brackish and one with canal water.

At site 2, maximum decrease in pHs, ECe and SAR was observed, respectively with gypsum @ 100% SGR + brackish water, gypsum @ 100% SGR + two irrigation with brackish and one with canal water and FYM @ 25 Mg ha-1 + one irrigation with brackish and one with canal water. Maximum productive tillers and straw and grain yields of wheat were observed with FYM @ 25 Mg ha-1 + two irrigation with brackish and one with canal water.

The research results concluded that low quality ground water could successfully reclaim saline-sodic soil provided agricultural grade gypsum passed through 30 mesh sieve is applied @ 100% SGR. Addition of farm manure and gypsum is a pre-requisite as well as economical for most of the calcarious saline-sodic soils and brackish water under the agro-climatic conditions of Pakistan for sustainable utilization of low quality soil and water resources. Rice proved better crop for soil

reclamation while wheat yielded better and thus contributed more for net benefit than rice. Saline sodic water could be used without negative effects on soil quality or crop yields if it is used in cyclic irrigation, i.e. alternate use of canal and brackish water or with appropriate soil amendments.

Two M. Sc (Hons.) students have completed their research work for thesis writing during report period. A paper has been published in national journal from project research work.

Project Title: ***Evaluation and formulation of calcium carbide based soil amendment for improving crop production***

Principal Investigator: ***Dr. Muhammad Arshad***
Professor

Location of Project: *Deptt of Soil Sciences, Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.993*
Start Date:	*5/17/2004*	*Funds Released (Rs):*	*2031900*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1781682*

Objectives:

- Evaluation of concentration dependent release of C2H2 and subsequently C2H4 from added CaC2.
- Formulation of cost effective CaC2 – based formulation for improving growth and yield of cereals.
- Effectiveness of CaC2 formulation under different soil conditions (texture, moisture, organic matter, temperature and pH for C2H2/C2H4 production.
- Development of technology transfer package for the farmers for general use

Achievements/Progress:

Laboratory studies were conducted during 2nd year to evaluate the potential of encapsulated CaC2 for gradually releasing C2H2 and C2H4 gases in soil. The GC-FID analysis revealed that encapsulated CaC2 released a copious amount of C2H2 (up to 23700 nmol kg-1 soil) which gradually reduced to C2H4 over a period of time via a strictly biotic reaction as no C2H4 was detected in CaC2–amended soil. Ammonium oxidation was suppressed by the encapsulated CaC2 which revealed that C2H2 acted as an effective nitrification inhibitor. Results of pot trial on wheat conducted in the wire house indicated that encapsulated CaC2 @ 60 kg ha-1 in combination with recommended dose of N fertilizer applied at sowing time or after one week of germination significantly improved number of tillers, root weight, straw and grain yield compared to N application alone.

Similarly, in the case of rice these parameters were also significantly increased in response to the application of encapsulated CaC2 @ 60 kg ha-1 in the presence of N fertilizer applied two weeks after transplanting. Results of field experiments revealed that application of encapsulated CaC2 in combination with recommended dose of N fertilizer applied at two weeks after transplanting significantly increased the growth and yield of rice. Moreover, application of encapsulated CaC2 resulted in higher N-use efficiency by both wheat and rice crops than that observed with N fertilizer alone. These findings imply that CaC2 affects plant growth by improving N-use efficiency in additional to harmonic action which is supported from the results of laboratory experiments that encapsulate CaC2 gradually released C2H2 and C2H4 gases in soil air.

These studied demonstrated the improvement in growth and yield of crops through bi-facet mechanisms of action of CaC2 i.e. as a source of plant hormone, C2H4 as well as nitrification inhibitor, C2H2. Any formulation of CaC2 which leads to slow and gradual release of C2H2 and C2H4 gases in soil air could be useful in improving the nutrient use efficiency as well as growth and yields of crops.

Project Title: ***Management aspects of surface and groundwater resources for irrigated areas***

Principal Investigator: ***Dr. Rai Niaz Ahmed***
Associate Professor

Location of Project: *Deptt of Irrigation & Drainage, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.534*
Start Date:	*5/29/2004*	*Funds Released (Rs):*	*1615000*
Project Status: On-Going		*Funds Utilized (Rs):*	*1581340*

Objectives:

- To determine variability in the available surface water supplies, demands, and potential of safe use of ground water resources in Bari Doab.
- To apply the MODFLOW computer model in Bari Doab for developing practical guidelines and water quality maps for development and use of groundwater to avoid secondary salinization.

Achievements/Progress:

The study was conducted at micro and macro level. The micro level study is to address safe use of groundwater on the basis of surface water supply and demand in selected experimental area and macro level study is to address application of "MODFLOW" in Bari Doab. Experimental sites of micro level study are in Bari Doab across the Lower Bari Doab Canal (LBDC), near Renala Khurd, District Okara with sites in command areas of Bairwali minor and 1-R distributary's, off taking from LBDC and irrigating area of a number of villages. Eighteen piezometers were installed for recording daily water table data. The surface water supplies data were obtained from Irrigation and Power Department and data of cropping pattern obtained on village basis for Rabi 2004-05 and 2005-06 and Kharif 2005 to determine demand of surface water supplies.

Results obtained so far revealed that surface water supplies even on designed discharge basis of irrigation network are unable to meet the crop water requirements of the existing cropping in study area. The shortage in irrigation is because of high delta crop (rice, sugarcane) and increase cropping intensity (132%) in study area. To meet the water shortage, there is increasing trend of using the ground water without knowing the consequence of using low quality water. The ground water quality shows that soil salinity will increase with increase of ground water use. Thus it is imperative to reduce the use of ground water and improve the surface water use efficiency.

The second part of study demands the use of hydrological model (MODFLOW) for determination of water balance in Bari Doab. Enough required data to apply the model have been collected, while remaining is in progress. Once complete data is in hand, model will be applied, calibrated and verified.

Results of the study revealed that there was big gap between water demand and supply during Rabi 2004-05 and Rabi 2005-06. There was 50% ground water contribution to meet the water requirements of existing cropping pattern in Rabi, while it was 60% during the Kharif 2005. The groundwater quality is from good to poor and needs careful management to avoid saline intrusion to sweet water zones. The major groundwater recharge is due to low irrigation application, followed by the water courses. Temporal water table data in Bari Doab show a falling trend in water table levels especially in sweet water zones.

Two graduate students have been involved in project for degree program in M. Sc (Hons.) Agricultural Engineering.

Project Title: ***Testing and Evaluation of Lining and Control Structure Alternatives for Irrigation Channels***

Principal Investigator: ***Dr. Muhammad Rafiq Choudhary***
Professor

Location of Project: *Deptt of Irrigation & Drainage, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.128*
Start Date:	*5/28/2004*	*Funds Released (Rs):*	*2047600*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1258060*

Objectives:

- To identify nationwise problems of existing control structures adopted for watercourse improvement.
- To develop economical and efficient control structure at tertiary level to overcome chipping, leakage and durability problems for sustainable watercourse improvement.
- To test the hydraulic and economic performance of the developed control structures for improving watercourse conveyance efficiency leading towards productivity enhancement in agriculture on sustainable basis.

Achievements/Progress:

Selection of watercourse in the districts of Faisalabad, Toba Tek Sing and Sheikhupura as well as in other provinces i.e. NWFP and Sindh had been completed for performance evaluation of control structures and the collection of relevant data had been completed during 2004-05. Selection of watercourse in the province of Balochistan was carried out during 2005-06. The requisite data regarding the performance of control structures were collected and analyzed.

Survey interview with formers and professionals has been completed. Collection and visual observation of existing (earlier) control structures has been accomplished. Their past evaluation has been reviewed thoroughly and inventory of problems has been established.

One proto type testing of control structure has been produced in plastic material with the help of Husnain RCC, Sargodha and Griffen Pipe Industries, Lahore. The same product is in the process of improvement.

A watercourse at the campus of the University of Agriculture, Faisalabad has been selected for improvement and testing of the developed control structure. The watercourse has been surveyed and design has been prepared to accommodate the maximum flow rate.

Project Title: ***Silicon nutrition for enhancing crop productivity***

Principal Investigator: ***Dr. Rahmatullah***
Associate Professor

Location of Project: *Department of Soil Science, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.431*
Start Date:	*7/19/2004*	*Funds Released (Rs):*	*2150852*
Project Status: On-Going		*Funds Utilized (Rs):*	*1959761*

Objectives:

- Evaluate effects of Si fertilization on growth performance of rice, wheat and sugarcane.
- Study role of Si nutrition in controlling fungal diseases of these crops.
- Identification of Si-accumulator genotypes/cultivars of these crops and their relationship with tolerance to diseases (especially fungal) and other abiotic stresses such as salt tolerance.

Achievements/Progress:

Silicon plays an important role in the mineral nutrition of higher plant such as wheat, rice and sugarcane. Undoubtedly it enhance plant development and growth efficiency both under biotic and abiotic environmental stresses.

During reporting period conducted both soil and solution culture studies that demonstrated both environmental and economical benefits from the active silicon application to combat the plant under adverse environmental conditions of drought and salinity for rice, sugarcane and wheat genotypes. Also compared the organic and inorganic sources of Si for the best source of silicon in agriculture for sustainable agriculture in Pakistan.

Conducted three solution culture and three soil culture experiment to evaluate the role of active silicon application in crop growth and yield.

Results of the experiments conducted during the report period revealed that application of active Si in agriculture enhancing soil fertility, increasing quantity and quality of crop production and also reduce a negative impact of adverse environment.

Project Title: ***Impact of tillage systems, legume and mulches on soil profile moisture dynamics and wheat production.***

Principal Investigator: ***Dr. Safdar Ali***
Associate Professor

Location of Project: *Deptt of Soil Sciences, University of Arid Agri. Rawalpindi*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2*
Start Date:	*7/19/2005*	*Funds Released (Rs):*	*771500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*565411*

Objectives:

- To monitor the impact of different tillage systems, legumes and mulches on soil profile dynamics under three soil series of rainfed wheat production system.
- To investigate the effect of soil moisture and fertility status etc on wheat production.
- Economic analysis of different factors under study for wheat production under rainfed conditions.

Achievements/Progress:

The field experiments on three sites on soil profile dynamic (changes in profile water with time and space as well as under tillage systems, mulch and legume) and wheat production as influenced by tillage systems, legume and mulches are in place from July 2005. The main findings are:

The water stored in the soil profile (90 cm depth) after 30 days of tillage treatments was 12% higher in the deep tillage treatment compared to conventional treatment (TI) at University of Arid Agriculture, Rawalpindi (UAAR) site. Zero till has 7% less water in the profile than that of T2. Similar trend on profile moisture has been in Chakwal and Fateh Jang sites.

The soil profile NO3-N contents were 49, 51, 51 kg ha-1 in conventional, deep zero till treatments, respectively at UAAR. At Chakwal 47, 46 and 46 kg ha-1 in conventional, deep and zero tillage, respectively and 39, 42, 40 kg ha-1 at Fateh Jang, respectively.

Soil P contents in surface soil after summer legumes harvest was 1.07% higher in conventional tillage treatment compared to deep tillage treatment at UAAR site. Zero till yielded 0.45% less P than that of T1. At Chakwal sit, the TI showed 1% higher P compared to T2.

The plant samples were analyzed. After complete analysis, the data will be statistically analyzed and interpreted. Second year experiments are in place again at three sites.

Project Title: ***Improving Root-association of Diazotrophs (Azorhizobium spp,, Azospirillum spp.) in rainfed wheat***

Principal Investigator: ***Mrs. Shahida Nasreen Khokhar***
Senior Scientific Officer

Location of Project: *Soil Biology Lab, National Agricultural Research Centre, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.233*
Start Date:	*7/27/2004*	*Funds Released (Rs):*	*1770825*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1670401*

Objectives:

- To select microbial genetic resource of efficient diazotrophs which can perform well with rainfed wheat.
- To improve rainfed wheat productivity through increased endosymbiotic root colonization with diazotrophic microorganisms under dry as well as irrigated conditions.

Achievements/Progress:

During 2005-06, 250 endophytic diazotrophic isolates (Azospirillum-like), recovered from collected wheat roots from Potowar, D. I. Khan and Quetta; and seven Azorhizobium isolates, obtained from stem and root nodules of Sesbania rostrata from NARC and Kala Shah Kaku were maintained. No Azorhizobium could be found in soils from Potowar and Quetta.

Forty-eight (48) isolates (6 Azorhizobium and 42 Azospirillum), from Potowar area and Quetta region, were evaluated with wheat (var. MH97) for their N-fixation ability in terms of total N-content of shoot/seedling and their effect on plant growth in terms of dry shoot weight and dry root weight/seedling, under sterilized sand culture conditions. Sixteen (16) Azospirillum isolates from Potowar and nineteen (19) from Quetta while six (6) Azorhizobia from Islamabad and Kala Shah Kaku increased shoot N-content by more than 50% over the control.

Selected ten isolates were characterized for their cell osmotic potential. Azorhizobium 3.2ksk and Azospirillum A4 had an osmotic potential above -26.6 bars. Such isolates bear promise as inoculant under dry land conditions. These isolates were also characterized for their ability to utilize malate, lactate and glucose as C-source.

Root Colonization Ability of nine selected isolates (five Azospirillum and four Azorhizobium) was studied in sterilized sand culture conditions. Three Azospirillum isolates (A2, A4, B3) and two Azorhizobium isolates (A-2 and 3.6ksk) were found capable of endophytic colonization on re-inoculation of wheat. Grain yield, N-content of grain, N-content of shoot (8 weeks age), dry root weight and total above ground biomass showed good correlation (0.83, 0.75, 0.65, 0.67, and 0.63 respectively) with root endophytic colonization of the test microorganisms. Highest increase over control (50%) in grain yield was recorded when inoculated with Azorhizobium (A-2), and it did not differ significantly from when inoculated with any of the test Azospirillum.

Project Title: ***Assessment of Productive Potential and Utilization of Rangelands and Sown Pastures in Pothowar Plateau***

Principal Investigator: ***Dr. Maqsood Anwar***
Senior Scientific Officer

Location of Project: *Range Land Research Program, National Agricultural Research Centre, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.58*
Start Date:	*8/10/2004*	*Funds Released (Rs):*	*2126500*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1735306*

Objectives:

- To carryout various studies of grass/legume pertaining to different agronomic, physiological and utilization aspects.
- To find out the present status of range vegetation through phytosocioligcal surveys and quantitative observation on vegetation dynamics.
- To determinate the forage production/utilization characteristics and performance of grazing lambs.

Achievements/Progress:

The continuous heavy grazing has gradually depleted forage production of our rangelands. Therefore, the forage mass of different promising grass species was evaluated at different project' sites (RRP field NARC, Range site, Pabbi hill - Kharian, Punjab Forestry Research Institute, Gatwala, Faisalabad and University of Arid Agriculture, Rawalpindi). The average dry matter yield of Mott grass and Green Panic grass was significantly greater than the indigenous benchmark, i.e. Blue Panic at range research area NARC, Islamabad. However, Blue Panic response in terms of establishment and vigour was found the best among other grass species planted under the rainfall conditions of Pabbi Hills, Kharian. In another study on vegetation dynamics, the total plant cover of 34% was recorded in the beginning of the study. Among grasses, Khabal (Cynodon dactylon) contribution was maximum while among trees, mesquite (Prosopis juliflora) contribution was at the top toward plant cover and composition. Vegetation dynamics over time will be recorded to extrapolate changes in the ecological status of the rangelands of Pabbi Hills, Kharian. Furthermore, pasture of different four grasses over four acres area has been developed at Range Research Program research site, NARC, Islamabad for conducting lamb grazing trials during the coming fall 2006.

Project Title: ***Modeling leaching losses of fertilizer nutrients from root-zone and environmental implications***

Principal Investigator: ***Dr. M. Mahmood-ul-Hassan***
Senior Scientific Officer

Location of Project: *Land Resources Research Instt., National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.409*
Start Date:	*7/17/2004*	*Funds Released (Rs):*	*1718450*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1476094*

Objectives:

- Study leaching losses of fertilizer nutrients with special reference to preferential flow and soil structure development
- Study possible occurrence and quantum of preferential flow of NO3, P and K in soils of Pakistan
- Develop relationships between preferential nutrient transport and soil structure, and
- Validate models' simulated results.

Achievements/Progress:

Phosphorus Sorption:

P-sorption isotherms were constructed using prominent four soil of the project area (Sahiwal and Okara districts) and found that Pacca soil sorbed most of the applied P, whereas the difference between applied and sorbed was wide for Sultanpur soil and order of maximum sorption capacity was Pacca > Lyallpur > Shahdra > Sultanpur.

Nutrient Leaching Experiment:

Field soil nutrient leaching experiments under saturated conditions depicted that presence of N and P contents in leachate shortly after application indicate the nutrients losses from surface soil to subsurface soils. Particularly, the presence of a reactive nutrient – P in leachate of all the soils depicts phosphorus movement despite the soil P sorption capacity.

Comparison of observed first arrival times and break through curves indicated that nutrients moved preferentially in all the columns from all the four soils. However, the magnitude of preferential flow was higher in the Lyallpur soil (relatively better structured) than in the Shahdara soil (massive).

Breakthrough curves of Lyallpur and Pacca soils were more skewed, a quantitative indicator of preferential flow, than Sultanpur and Shahdara. Distribution of the break through curves of Sultanpur and Shahdara soils were relative normal which indicate that solute moves with uniform wetting front.
The Convection Dispersion Equation fitted, relatively better in Sultanpur and Shahdara soils than Lyallpur and Pacca soils, whereas, the preferential flow model fitted well in the relatively better structured Pacca and Lyallpur soils.
The symmetry coefficient values of BTCs of Sultanpur and Shahdara soils curve was similar but was half of the Lyallpur and Pacca soils.

Break through curves parameters indicated large amount of the solute movement through the preferred pathways by passing the soil matrix in the Lyallpur and Pacca soils.

Maize Field Experiment:
Maize field experiment demonstrated that recommended fertilizer dose gave 20% higher maize grain yield over the common farmer practice.

The maize field experiment results indicated that there was nitrate leaching below the active rooting zone in both – Lyallpur and Shahdara soils and nitrate leaching increased from the lowest to highest rate.

Nitrate leaching was consistently higher in the Lyallpur soil than the Shahdara soil.

Blue Dye Tracer Experiments:
Blue dye tracer experiment under field conditions showed that water moved through preferred pathways and supports the laboratory nutrient leaching experiments' results.

Project Title: ***Increasing Crops Production through Humic Acid in Rainfed and Salt Affected Soils in Kohat Division (NWFP)***

Principal Investigator: ***Dr. Riaz A. Khattak***
Professor

Location of Project: *Deptt of Soil, NWFP Agriculture University, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.179*
Start Date:	*10/28/2004*	*Funds Released (Rs):*	*3311900*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2541829*

Objectives:

- To study the effect of different levels of lignitic coal derived humic acid (HA) alone and in integration with different levels of chemical fertilizers on the growth and yield of wheat and maize crops in rainfed conditions.
- To study the effect of different levels of HA alone and reinforced with different levels of chemical fertilizers on the growth and yield of cotton and sugar beet in saline irrigation system.
- To understand the mechanism of the beneficial effect of HA on soil condition and crop production, with respect to soil microbial and enzymatic activities.
- To develop the facility of extraction of humic acids from lignitic coals of various location of Pakistan for large scale utilization in crop production.
- To formulate recommendations for the application of lignitic coal derived humic acid for low fertility and salt-affected arid zone soils.

Achievements/Progress:

Five field experiments to quantify beneficial effects of humic acid (HA) on yield of crop (maize, cotton and groundnuts) and chemical composition of soils and its appropriate levels under saline field conditions were completed during summer (Kharif 2005) at Nasimabad, Jalalabad in Lachi (Kohat) and Tarkha Kohi, Karak.

During Rabi 2005-06, five experiments were executed on wheat and sugar beet on the same three locations but different fields at Nasimabad, Jalalabad in Lachi (Kohat) and Tarkha Kohi (Karak), to design effective application method of HA and confirm the previous results on the beneficial effects and appropriate levels of HA for optimum yields of sugar beet and wheat. The major activities also included extensive and intensive analysis of soil and plant samples and statistical analysis.

The results obtained so far showed that alone application of 0.5, 1.0 and 2.0 kg HA ha-1 increased seed cotton yields by 10.5, 15.6 and 13.5% in Nasimabad and 12.2, 17.7 and 21.1% in Jalalabad, respectively over control (NPK: 0 and HA:0). Alone application of 0.5, 1.0 and 2.0 kg HA ha-1 increased maize grain yield by 14.3, 21.0 and 17.6% in Nasimabad and 5.1, 15.1 and 11.4% in Jalalabad, respectively over control. Such increases were 11.58, 16.67 and 14.55% for wheat and 11.6, 16.7 and 14.6% for groundnut, respectively at Tarkha Kohi, Karak. Combining HA with NPK showed additive effect increasing maize grain yields by 40.5, 51.5 and 55.0% in Nasimabad

and 35.5, 46.4 and 43.1% with 0.5, 1.0 and 2.0 kg ha-1, respectively as compared with control. The same increases were 33.05, 34.18 and 37.85% for wheat and 33.1, 34.2 and 37.8% for groundnut, respectively. Alone application of 0.5, 1.0 and 2.0 kg HA ha-1 at Nasimabad increased beet yield by 10.0, 12.40 and 17.65% over control while combine application of 1.0 and 2.0 kg HA enhanced yield by 12.1and 20.23 when compared with NKP alone. Alone application of 1.0 kg HA ha-1 gave mean additional monitory return of Rs.5028, 2405, 2044 and 4720 ha-1 for wheat, cotton, maize and groundnut, respectively as compared with control. When combined with NPK the same levels of HA gave additional return of Rs.5724, 3305, 2408, 3400 ha-1 as compared with NPK alone.

Methods of HA acid applications also revealed encouraging results. Application of HA through soil spray was found more efficient than banding or broadcast.

It can be concluded from the chemical composition of soil and plant tissues of cotton, maize, groundnut, wheat and sugar beet that HA and NPK did not cause significant changes in the concentration of nutrients. Due to only available saline irrigation, post harvest soil pH, EC and SAR of maize and cotton plots were increased during kharif season when compared with pre-sowing analysis. However, soil pH, EC and SAR were reduced after rabi season which could be associated with low evaporation and less irrigation with saline water as compared with kharif season. Soils were mostly deficient in organic matter, N, P, Cu, and Zn.

Series of laboratory experiments on the mechanism of beneficial effects of HA have been completed. The results suggested positive effects of HA on the activities of acid phosphates, alkaline phosphates and urease under laboratory conditions both in normal soil and as well as saline soil.

Project Title: ***Determination of growth, wood properties and watertable control following afforestation of proven provenances/species under saline and waterlogged conditions in Pakistan***

Principal Investigator: ***Dr. Mohammad Khan***
Senior Research Officer

Location of Project: *Pak. Forest Institute, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3*
Start Date:	*12/28/2004*	*Funds Released (Rs):*	*1616450*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1051931*

Objectives:

- To establish species cum demonstration plots on farmlands over 5-acre area at two sites in two districts in NWFP under waterlogged and saline conditions.
- To monitor watertable and to recommend suitable salt tolerant species for the specific sites in NWFP.
- To develop agroforestry models for problematic areas through community participation to overcome environmental issues.
- To determine wood properties of the species established on marginal lands for farmer's use.

Achievements/Progress:

The project envisages lay-out of two trials one each in 2005 and 2006 for testing various salt tolerant species on saline farmland. The study planned for 2005 was laid out at Tooro village in Mardan district. Twelve species were planted in replicated experiment. The initial year survival and height data indicate suitability of Acacia ampliceps, A. nilotica, Casuarina glauca and Tamarix aphyla for planting on saline farmlands. Soil samples data showed that the the area is saline, saline sodic and dodic. 36 piezometers have been installed to monitor the level of the ground water table. The depth of ground water table ranges from 60 cm to 110 cm in the intial year of the experiment. The data on soil analysis and depth of ground water table will be recorded on sixth month interval in order to establish their correlation with the tree species planted in the trial. The site for laying out the second field trial was selected at village Nazar of Swabi district. The trial for testing salt tolerant species was laid out planting various species viz. Eugenia jambulana, Tamarix aphylla, Casuarina gluaca, Casuarina obesa, Eucalyptus camaldulensis, Albizzia procera, Acacia albida, Terminalia arjuna, Acacia nilotica, Acacia ampliceps, Salix viminalis, and Phoenix dectylefera in March 2006.

The three months survival data at Nazar village, Swabi district and 15ths survival and height data at Tooro village, district Mardan indicate suitability of Eucalyptus camaldulensis, Casuarina gluaca, Casuarina obesa, Acacia ampliceps, and Tamarix aphylafor planting on saline and water logged farmland. The planted tree species have not reached the stage to determine their wood properties.

Project Title: ***Refinemnet of skimming well design and operational strategies for sustainable groundwater management***

Principal Investigator: ***Dr. Muhammad Ashraf***
Director

Location of Project: *Pak Council of Research in Water Resources, H# 3, St#17, F-6/2, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.1*
Start Date:	*5/5/2004*	*Funds Released (Rs):*	*1509600*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1396365*

Objectives:

- To refine the skimming well design and develop operational strategies based on thickness of the freshwater layer.
- Determine depth to interface of the fresh and brackish groundwater in the target area.
- Conduct surveys and characterize design of skimming wells installed by farmers and their operational strategies.
- Fine-tuning of the design and development of operational strategies for sustainable groundwater management using skimming wells.

Achievements/Progress:

A participatory rural appraisal (PRA) was conducted during 1st year of the project to document existing skimming well technology i.e. depth of wells, no. of strains, depth of strains, pumped water quality etc. Based on the information collected, three skimming wells have been selected. Piezometers have been installed on these wells to measure the water table depth and an observation well is also installed at each site to monitor the water quality at different depths. In addition, seven multi-level deep bore observation wells have also been installed in the area to collect water samples from various depths and to measure water table depth. At the selected skimming well sites, pumping tests are being conducted under different strains configurations and operational strategies. Two sets of pumping tests for 4 and 6 hours per day for three consecutive days have been conducted.

The water table dropped quickly in Piezometers close to strains and recovered quickly when pumping was stopped. The water table dropped more during 6 hrs pumping than 4 hrs pumping. The effect of pumping on groundwater extends beyond 30 m distance from the strains. Therefore, the tubewell may not be installed at distance less than 90 m from each other for discharge of about 28 lps or less. The spatial and temporal variability of groundwater is very high. Therefore, site specific information regarding groundwater quality may be necessary for proper installation and operation of skimming wells.

Project Title: ***Use of low quality groundwater for sustainable crop production***

Principal Investigator: ***Dr. Ashfaq Ahmad Sheikh***
Dy. Director

Location of Project: *Pakistan Council of Research in Water Resources, H# 3, St#17, F-6/2, Islamabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.7*
Start Date:	*5/5/2004*	*Funds Released (Rs):*	*1449300*
Project Status: On-Going		*Funds Utilized (Rs):*	*1270345*

Objectives:

- To develop and test strategies for conjunctive use of surface and low quality groundwater using cyclic and mixing modes at the farm level.
- Estimate quality and status of groundwater use in the selected area.
- Design and test strategies for cyclic and mixing modes for saline and sodic groundwater respectively.
- Estimate the potential cropped area and cropping intensity under both strategies and water availability at the farm level.

Achievements/Progress:

A detailed survey of the study area (Sargodha District, Chaj Doab) was carried out to assess the status of groundwater quality and utilization using participatory appraisal survey through a specially designed questionnaire covering various aspects of canal supplies, groundwater, soil, crop production, farmers' practices and perceptions about use of low quality water, etc. Further groundwater and soil samples from surveyed tubewells were also collected for detailed quality analysis. The collected data were analyzed to identify the status, utilization and quality of groundwater being used for agriculture. On the basis of the survey results, four sites were selected at farmers' fields for experiments on productive use of low quality water of various compositions: i) one site with saline groundwater, ii) one with sodic, and iii) two sites with saline-sodic ground water. The developed strategies for various cyclic and mixing modes of groundwater and canal supplies are being tested at these selected sites. Experiments for two seasons have been completed (Kharif 2005 and Rabi 2005-06). The analysis of data has provided that in almost all the cases, the developed strategies provided yield higher than the farmer plot. The reduction in soil salinity (ECe, SAR) has been observed in most of the treatments being tested. However, slight increase in infiltration rate of soil has been experienced in some of the cases whereas in other cases remained almost same. These results support the working of developed strategies for use of low quality groundwater, however, the identification of more suitable strategy(S) would be made after data from experiments of two remaining seasons are available.

Project Title: ***Testing and evaluation of low cost lining materials for water courses in drought endangered areas of Balochistan***

Principal Investigator: ***Mr. Nadeem Sadiq***
Scientific Officer

Location of Project: *Arid Zone Agri. Research Center, (PARC) Quetta*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.776*
Start Date:	*9/1/2004*	*Funds Released (Rs):*	*1510200*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1042000*

Objectives:

- Devise mechanism to minimize the water coarse losses.
- To analyze Financial and Economic feasibility of various lining materials.

Achievements/Progress:

Topographic survey of Quetta, Pishin and Mastung sites was carried out showing slop gradient, farm size and topography for experiments. Three treatments; PE sheet, Bitumen and control (farmers practice) were included in the study to carry out water management research in these areas.

In Mastung site, the discharge loss (cusec) per meter recorded in PE sheet treatment was less than the two treatments which was 0.001 as compared to Bitumen and control treatments of 0.002 and 0.005 respectively. The discharge loss (ft3/day) per 100 m recorded in the three treatment comes to be 8640, 17280 and 43200 respectively. In Pishin the discharge loss (cusec) per meter recorded in PE sheet treatment was 0.0005 cusecs as compared to Bitumen and control treatments of 0.001 and 0.003 cusecs respectively. The discharge loss (ft3/day) per 100 m recorded in the three treatments comes to be 4320, 8640 and 25920 respectively. It was observed that in PE sheet treatment, only one point was found ruptured where as in Bitumen treatment, grasses emerged form 3-5 point in Pishin site. These are initial data and the discharge and life of the material will be observed with time. The cost of PE treatment (182 meter) and Bitumen treatment (110 meter) in Pishin was Rs.8500/- and Rs.10500/- respectively where as in Mastung, the cost of PE treatment (190 meter) and Bitumen treatment (90 meter) was Rs.9500/- and Rs.11900/- respectively. The cost of PE treatment and Bitumen treatment per meter comes to be Rs.46.7 and Rs.95/- respectively for Pishin site where as the cost of PE treatment and Bitumen treatment per meter was Rs.50/- and Rs.97/- respectively for Mastung site.

Project Title: ***Nutrient Indexing and Integrated Nutrient Management for Sustaining Sugarcane Yields***

Principal Investigator: ***Dr. Sagheer Ahmed***
Senior Scientific Officer

Location of Project: *Sugar Crops Program, Institute of field & Horticultural crops, National Agricultural Research Centre, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*5.8*
Start Date:	*3/25/2004*	*Funds Released (Rs):*	*4550800*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3844219*

Objectives:

- To generate scientific information for balanced nutrient management, by integrating organic and inorganic sources, for increasing sugarcane productivity and quality.
- Diagnose the nature, extent and severity of nutritional disorders in sugarcane.
- Use press mud / filter cake as organic fertilizer for improving soil fertility, soil physical conditions, and sugarcane yields.
- Develop a package of technology for on-site integrated, balanced nutrient management, including micronutrients, to obtain maximum economic sugarcane yield and improved quality
- Reduce environmental pollution by recycling pressmud / filter cake in agriculture.

Achievements/Progress:

Conducted field experiments at five sites in the districts of Sargodha and Jhang for determining nutritional needs of sugarcane during 2005-06. Press mud along with chemical fertilizers applied at three sites while chemical fertilizers including deficient micronutrients (Zn & B) were tested at two sites. The treatments included farmers practice (FP), recommended rate of NPK with and without zinc and boron (ZN & B), and half and quarter rate of NPK along with various doses of press mud (10, 20 & 30 t ha-1) and/or micronutrients.

Data on agronomic parameters like germination, stalk height, stalk girth, stalk weight, cane yield and % brix were recorded. Application of press mud at @ 10 t ha-1 along with ZN + B and 50% of recommended rate of N, P and K fertilizer gave better cane yield, brix and number of canes per hectare and also maximum net benefit. Increase in yield was 22.8% over FP. Micronutrients (ZN + B) application also had beneficial effect on cane crop. In an experiment planted at Shahpur, 26.4% increase in cane yield has been recorded with Zn + B application along with recommended rate of N, P and K over that of FP. Nutrient status of cane plants and nutrient uptake were monitored in all fertilizer treatments through plant tissue analysis.

Planted further field experiments in Sargodha and Jhang districts during Autumn 2005 and Spring 2006 with lower rates of press mud than the previously conducted experiments and using Zn and B micronutrients.

The research under these experiments concludes that different press mud levels had varying effect on cane yield and quality under different soil and environmental conditions. Application of press mud @ 10 t ha-1 along with ZN + B and 50 % of recommended rate of NP & K fertilizer gave better cane

yield, brix and the maximum net benefit over the other treatments. Micronutrients (Zn + B) application also had beneficial effect on sugarcane crop at some sites. At Shahpur 26.4% increase in sugarcane yield over that of farmers practice has been observed with the application of Zn (7.5 kg ha-1) and B (1.5 kg ha-1) along with recommended rates of N, P and K.

Project Title: ***Field evaluation of vesicular arbuscular mycorrhizal fungi and their significance in wheat-maize cropping system under different soil series of NWFP***

Principal Investigator: ***Dr. M. Sarirullah Sarir***
Professor

Location of Project: *Department of Soil and Environmental Sciences, NWFP Agricultural University, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.411*
Start Date:	*11/1/2004*	*Funds Released (Rs):*	*1035171*
Project Status: On-Going		*Funds Utilized (Rs):*	*799931*

Objectives:

- Specification of soil series in different ecological zones of NWFP, which are commonly used for crop production.
- Identification and estimation of the status of VAM infection in wheat- maize cropping system in different series of different agro-ecological zones of NWFP.
- Complete characterization and population dynamics of VAM fungi both from crop roots and from the same soil.
- Complete investigation of the nutritional status of both crops as well as soils of the survey sites.
- To design preliminary pot experiments in marginal and fertile solid for study of the scope of inoculating the non-mycorrhizal crop identified during the field survey.

Achievements/Progress:

Field survey was continued during 2005-2006 to determine the status of AM fungal spores density in soil and their colonization in roots of wheat and maize crops in different potential soil series of Bannu and D. I. Khan. Rhizosphere soil samples were collected from unfertilized and from soil applied with fertilizers along with wheat and maize roots. Mycorrhizal spores density and their infections intensity were determined in these samples

In wheat crop higher number of white spores were found in fertilized soil with mycorrhizal infection rate of 28-40%, while in unfertilized soil higher number of white and black spores were found with mycorrhizal infection rate of 30-48%. In maize crop higher number white spores, brown spores and black spores were found in fertilized soil with AM infection rates of maize roots of 24 to 42%, where as in unfertilized soil, maximum numbers of white spores were found.

Pots experiment was conducted under natural conditions to investigate the scope of inoculating the maize crop with AM fungi in soil of Shabqadar with relatively lower AM fungal infection rates. Maize (Zea Mays L. Kissan) was inoculated with AM fungi in the presence of indigenous mycorrhiza. Intensity of AM fungal infection rates in roots, spore density in soil and their identification and effects on plant growth and nutrients accumulation by maize plants were determined.

Results suggest that relatively higher AM fungal spores and their root colonization in wheat and maize crops were observed in unfertilized soil than fertilized soil with varied spores density and infections

intensity from one site to another under different agro-ecological conditions. More AM fungal spores density caused higher roots infection intensity in wheat and maize crops of the area

and higher AM infections rates were observed in soil with low organic matter contents. Inoculation of AM fungi with rock phosphate has potential to increase shoot and root dry matter yield of maize crop due to the improved accumulation of N, P, Fe, Cu, Zn and Mn by maize plants.

Two students have completed their M. Sc. (Hons.) degree while five are currently doing their research in the project for M. Sc (Hons.) degree program. Three students completed their special problems, review paper and seminar for their B. Sc (Hons.) degree programme.

Two papers have been published from project work in national agricultural journal, while one has been accepted for publication and another one has been submitted for acceptance.

Project Title: ***Improving yields and nitrogen use efficiency in cereal based cropping system***

Principal Investigator: ***Dr. M. Tariq Jan***
Professor

Location of Project: *Department of Agronomy,NWFP Agricultural Univesity,Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.234*
Start Date:	*5/17/2004*	*Funds Released (Rs):*	*1005300*
Project Status: On-Going		*Funds Utilized (Rs):*	*819973*

Objectives:

- To develop a sustainable nitrogen management system for cereals (maize and wheat) to utilize the N from crop residues and chemical fertilizers in the year of application and year to follow after application.
- To understand the influence of organic and inorganic-N source on the accumulation and partitioning of dry matter, nitrogen and yield of wheat and maize.
- To determine the cumulative effects of crop residue and fertilizer N on the availability of N to cereal crops.
- To asseses the economic analysis and requirement of N for wheat and maize production from crop residue and either should supplemented or not, with chemical fertilizer.
- To determine the effectiveness of KCl (MOP) as urease inhibitor for urea-N efficiency in continuous wheat-corn cropping system.

Achievements/Progress:

Three field experiments conducted to evaluate wheat response to inorganic/organic N source and urea N efficiency during winter 2004-05. First experiments consists two types of N-fertilizer (NH4 & NO3) and three application time at sowing, 2nd node appearance and boot stage. Second experiment was integrated management of crop residue (cereal and legume), type of N-fertilizer (NH4 and NO3) and its application time. Third experiment was consisted of crop residue and MOP application with urea. Plants grown without N application showed poor performance when compared with N treated plants. Inconsistency in effect of nitrogen sources (nitrate or ammonium) was noticed. NH4 treated plants have higher grain spike-1 and 1000 grain weight, its plant height, productive tillers m-2, grain yield and biological yield were lower than NO3 supplied plants. Sole applications although has more productive tiller m-2, it were statistically at par with split application except split application at 2nd node stage+ boot stage where significantly lower productive tillers were recorded. Grain weight was maximum at split application of N when used at time of sowing + at 2nd node stage or at sowing + at boot stage. Maximum grain yield and biological yield were achieved when N was applied as split application (sowing + at 2nd node stage or at sowing + at boot stage) and was at par with at sowing + at boot stage application. Plant height, grain yield and biological yield were maximum when N was used as mineral source and combined with legumes at either at sowing + pre boot stage or all at pre boot stage while maximum grain spike-1 and productive tiller m-2 recorded with both sources of N with legume and cereal at either sowing and pre boot stage or all at pre boot stage. Urea + MOP in combination with legume or cereal residue have increased productive tillers m-2, grains spike-1, 1000 grain weight, grain yield, biological yield. The preliminary results indicated that split application of mineral N source, addition of crop residue and muriate of potash with urea able to enhance the yield of wheat crop.

Project Title: ***Improvement of groundnut production through Rhizobial inoculation in NWFP***

Principal Investigator: ***Dr. Sabir Hussain Shah***
Soil Microbiologist

Location of Project: *Soil and Plant Nutrition Directorate, Agricultural Research Institute Tarnab, Peshawar*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.701*
Start Date:	*5/22/2004*	*Funds Released (Rs):*	*1662200*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1514143*

Objectives:

- To improve the production of groundnut crop through Rhizobium inoculation. To achieve this goal, the following objectives are being pursued.
- To determine the nodulation status of groundnut in different parts of NWFP
- To popularize groundnut Rhizobial inoculation among the farmers in NWFP
- To prepare and distribute groundnut Rhizobial inoculant, free of cost among the farmers for about 5000 acres.
- To supplement the use of N fertilizers through biological N fixation and thereby reduce cost on chemical fertilizers and minimize environmental pollution.

Achievements/Progress:

One thousand and five hundred packets (one packet enough for inoculation of one acre seed) of Rhizobial inoculum for groundnut crop were prepared in the laboratory and distributed free of cost among the farmers.

Inoculation of groundnut with effective Rhizobia improved root nodulation and pod yield of the crops. A local strain of groundnut "GNK-1" produced almost similar results compared to foreign strains NC-92 and CIAT-3101 in improving the nodulation. The local strain also produced comparatively more yield than other.

Demonstration trials conducted on farmers' fields at different locations showed that inoculation increased the pod yield from 10-40% over un-inoculated plots.

Gypsum application and Rhizobial inoculation had positive impact on root nodulation and pod yield at Swat and Parachinar. Pod yield was comparatively higher at Swat.

One day workshop was organized at Agricultural Research Station, Karak to train the farmers and the extension workers about the Rhizobial Inoculation Technology of groundnut crop. Packet of groundnut inoculation and literature distributed among farmers and lecture delivered on different aspect of groundnut cultivation, its management practices and seed inoculation with Rhizobia.

Two bulletin one in Pushto “-Da zamakey zarkhezi auo phallidar pasloona”and one in Urdu has been printed for guidance of farmers and extension workers in order to popularize the Rhizobium Inoculation Technology.

One student of M. Sc (Hons.) Agriculture of Department of Soil and Environmental Sciences, NWFP Agricultural University, Peshawar successfully completed internship at Soil Microbiology Lab., ARI, Tarnab, Peshawar under the project and awarded master degree by the University.

SOCIAL SCIENCES

BACKGROUND

1st Batch:

ALP Secretariat received 39 preliminary proposals relating to social sciences for funding under the 1st batch. In process of preliminary appraisal 21 proposals were short listed for the invitation of detailed projects and 18 proposals which were not up to the standard were dropped. Finally, 7 projects costing Rs.14 million were approved by the Board of Director (BOD) of ALP for funding to conduct the research in different disciplines:

2nd Batch:

ALP Secretariat received 65 preliminary proposals relating to social sciences for funding under the 2nd batch. In process of preliminary appraisal 31 proposals were short listed for the invitation of detailed projects and 34 proposals which were not up to the standard were dropped. Finally, 22 projects costing Rs. 83 million were approved by the Board of Director (BOD) of ALP for funding to conduct the research in different disciplines.

3rd Batch:

ALP Secretariat received 28 preliminary proposals relating to social sciences for funding under the 3rd batch. In process of preliminary appraisal 11 proposals were short listed for the invitation of detailed projects and 17 proposals which were not up to the standard were dropped. Short listed proposals are in process by the TAC & BOD of ALP.

Region wise details of approved projects are given below:

S.No	*Region*	*No. of Projects*		
		1st Batch	*2nd Batch*	*3rd Batch*
1	*PARC/NARC*	2	10	5
2	*PUNJAB*	2	7	3
3	*NWFP*	1	1	-
4	*SINDH*	2	3	1
5	*BALOCHISTAN*	-	1	-
6	*NGO/ OTHERS*	-	-	2
TOTAL		*7*	*22*	*11*

IMPLEMENTAION STATUS

1st Batch:

Of 7 approved projects, six projects have been competed and one terminated.

2nd Batch:

Of 22 approved projects, 17 projects are ongoing and two has been completed and three dropped.

MONITORING & EVALUATION

Monitoring and review of the on-going projects is a regular activity of the ALP Secretariat. ALP Secretariat through a panel of expert comprising a representative each from the concerned Technical Division, ALP Secretariat, Finance Division leading by a Subject Matter Specialist has completed the on site evaluation of 25 projects. The recommendations/ observations have been conveyed to the concerned PI's for improvement and future guidance. The evaluation reports comprising the salient finding, deficiencies found and summary statement of recommendations of the experts are summarized below:

Sr. #	Title of Project	Name of P.I	Salient Findings
1	Poverty Alleviation through Enhancing Agricultural Productivity by Implementing Priority Interventions the Selected Areas of NWFP	Mr. Muhammad Ishaq, Scientific Officer Technology Transfer Institute (PARC) Tarnab, Peshawar	• Project performance rated as **partially satisfactory** that need improvement in terms of following perspectives: • Prepare a comprehensive action plan covering each of the planned activities emanated from needs analysis carried out in this project; though the outcome of this survey is very general meant to be answering and planning the specific technological interventions. The project's site selection is, generally, convenience based rather than representative one. • The need analysis is performed for the farmers only but the objective of the project suggests for all the stakeholders including technology designers and distributors. Though, it is late to suggest, but some adjustments may be made. • A systematic Information Exchange Forum (IEF) may be streamlined through institutionalizing (by entering into MoU/agreement) between PARC establishments (TTIs) and sister provincial organizations involved in the process of technology transfer. • Extend the scope of the study by addressing the approved title of the project pertaining to poverty alleviation analysis.
2	Development of Agriculture from Subsistence Level to Productive Level Through Transfer of Tested Technology in the Northern Areas of Pakistan	Mr. Shaukat Hayat Sadozai, Director Technology Transfer Institute (PARC) Tarnab, Peshawar	• Performance rated as **satisfactory** based on the classroom review, and the field review will be carried out latter on. • There is a need to revisit the short-listing of the promising sustainable technologies with the targeted specifications rather than disseminating untargeted technologies on the cooperating farmers fields based on the needs analysis findings. • The question of IEF institutionalization is warranted similarly as proposed for the other locations of TTIs.
3	Poverty Alleviation Through Increasing Agricultural by transferring Improved and Tested Technologies at the Farm-Level	Dr. Allah Ditta Sheikh, SSO Technology Transfer Institute (TTI), PARC Faisalabad	• Performance rated as **partially satisfactory**. • An updated action plan was suggested to be prepared by the PI showing all the detailed activities to be performed based on needs analysis outcome for the convenience of reviewers and effective on time implementation of the targeted interventions. • Similarly the question of IEF institutionalization

			is warranted, although the functioning of the provincial sister institutions is well coordinated for expeditious transfer of technology process between PARC and provincial establishments; but it is still a temporary arrangement. • As proposed in other studies, the scope of the project needs to be addressed by extending the poverty alleviation analysis as per approved title. • The institute is fully equipped with the IT equipments including multimedia, digital camera, etc. Thus, its uses for preparing the documentaries covering the success stories is proposed to be managed by the TTIs for future demos among the farming community in other areas as a replicate source of proven, sustainable and successful technologies.
4	Bridging the Gender Gap in Agriculture Extension through Designing and Testing an Innovative and Holistic Out- Reach (Extension) Program of the University of Agriculture, Faisalabad	Dr. Tanvir Ali, Director Department of Agriculture Extension, University of Agriculture, Faisalabad	• Performance rated as **unsatisfactory**. • The project progress was very slow, the PI was engaged in the initial stage of questionnaire development and its pre-testing. Thus he was advised/warned that the project extension will not be granted, so speed up the work to complete timely the planned activities. • For sharpening the targeted training modules/material, PI was asked that a panel of Delphi experts should be consultant to adjudge the required quality material as per objectives of the project. • Preparation of action plan as per timeline and activities need to be readjusted and supplied to the technical as well as planning directorate for seeking on time feedback.
5	Poverty Alleviation through Introducing Improved and Tested Technologies for Rural Agricultural Farming Communities in the Selected Districts of Balochistan	Mr. Muhammad Afzal, Director, Technology Transfer Institute (PARC) Sariab Road, Quetta, Balochistan	• Projected performance rated as **partially satisfactory**. • The question of IEF institutionalization was warranted similar to other TTIs especially, by incorporating the in put of provincial On-Farm Water Management Department, NGOs and Progressive Farmers. • The scope of the study should be extended for addressing the poverty alleviation analysis as per approved title of the project. • So far, livestock development interventions were totally neglected as against the approved plan of work. Thus, it was suggested to include priority livestock interventions, which will arrest in reducing the incidence of poverty, mainly amongst poor small landless ranchers. Because, this activity is supposed to be one of the key indictors assisting toward poverty reduction in this province. • A back stopping support of the technical division (SSD) is recommended, as learned by observing the review team that the scientists working in TTIs are not well equipped in the area of professional technology transfer due to either inadequate academic background or lack of professional experience/expertise, especially in less developed provinces like Balochistan.

6	Enhancing Agricultural Productivity through Transfer of Demand Driven Technologies to the Farmers in the Selected Districts of Sindh	Mr. Manzoor Ali Memon, SSO Technology Transfer Institute, (PARC)Tandojam, Sindh	• Project performance rated as **satisfactory**. • The question of IEF institutionalization is also recommended for sustainable development of functional relationships between PARC and provincial institutions especially by incorporating the representatives of relevant stakeholders including bank (to facilitate soft agriculture loaning) and On Farm Water Management Department. • The short listing of the technologies derived through needs analysis for enhancing productivity is proposed to be revisited in the light of available information about the critical factors contributing towards productivity, accessibility and affordability of quality inputs, etc. Presently, these factors were not properly taken care while designing the interventions for crop and livestock sectors. This observation is true for all the current on-going ALP projects with this scope being operated by TTIs in different regions of Pakistan.
7	Economic Analysis of Agroforestry Plantations in Sindh Province of Pakistan	Dr. Heman Das Lohano, Assistant Professor, *Department of Agri. Economics, Sindh Agriculture University, Tandojam*	• Project performance rated as **unsatisfactory**. • The progress is way behind than the approved plan of work. • Since, P.I is engaged in the formulation of theoretical framework, review of literature and data collection, where as only six months' life of the project remained. At the time of review, PI could not finalize the theoretical model and was struggling in choosing the appropriate model based on the available data. Some suggestions were given by the reviewers in selecting the models under the desired scope of the project; especially one has to deal with the natural resource use and its conservation. Some of the more popular economic techniques are willingness to pay and opportunity cost (cost benefit analysis and net present worth) with the perspectives of returns to investment. • Although, P.I did not seem to be very comfortable in accomplishing on time work against the planned activities, mainly due to lack of experience and the university environment. It is worth mentioning that present PI was originally Co-PI of this project and became P.I after the retirement of the outgoing PI. Since, he committed to accomplish the task on time. Besides, the team members had empowered to the PI by assuring him to provide the full support of the ALP Secretariat in terms of budget revision and on time release of finances with subject to submission of up dated expenditure statement as well as technical progress reports.
8	Poverty Alleviation through Enhancing Agricultural Productivity by Implementing Priority Interventions in the	Mr. Ghulam Sadiq Afridi, SSO, Technology Transfer Institute, (PARC) Muzaffarabad, AJK Camp Office: NARC,	• The project performance is rated **partially satisfactory**. • Behind the schedule as against the planned activities, mainly due to incidence of fatal earthquake and its after effects, as well as shortage of relevant professional manpower. The

	Selected Areas of AJK	Islamabad	PI has to change and adjust the project sites from Muzzaffarabad area to Mirpur and Bhimber areas. • The PI was advised by the review team to follow all the suggestions/ recommendations in order to overcome the shortcomings realized amongst the TTIs including IEF institutionalization, qualifying the poverty alleviation analysis as per approve title of the project, short listing of few promising technology interventions (as against many numbers with untargeted specifications). • Moreover, the PI was suggested to choose the technology interventions, which exhibit distinct, and transparent impact indicators allowing impact assessment studies at latter stages.
9	Structure, conduct and performance of the marketing system, margins and seasonal price variations of selected fruits and vegetables in Balochistan, NWFP, Northern Areas and AJK	Dr. Muhammad Sharif CSO/Dy. D. G. (TT), NARC, Islamabad	• Progress **partially satisfactory** and lots of efforts are required to complete the project as per approved plan of work; • The project has completed almost 18 months of its total allotted time i. e. 24 months. None of the reports (each on fruits and vegetables) is completed so far; • Selection of fruits in AJK and vegetables at all locations of the project may be reconsidered with sound justification of the selection; • Sampling design and sample size may also be reconsidered especially inclusion of consumers in marketing survey; • Margin analysis, vertical integration and efficiency analysis may be re-evaluated as proposed while reviewing the project; • Marketing costs taken into consideration for analysis and deconstruction of margins at all levels of marketing chain need careful consideration and elaboration; and • Variety consideration and seasonal price fluctuations are important and may adequately be taken care of.
10	Socioeconomic, institutional and policy issues constraining the productivity of livestock in the deserts of Pakistan	Dr. Umar Farooq Senior Scientific Officer Social Sciences Institute, NARC, Islamabad	• Progress **partially satisfactory** and lots of efforts are required to complete the work as per approved plan of work; • The project has completed almost 17 months of its total 24 months duration and only did secondary research work and questionnaire finalization;

			• Data collection schedule and sampling design has not been finalized so far. This may be shared with the technical division, ALP secretariat and other colleagues for their comments/input; and • Informal survey was conducted only in Tharparkar area. Hence, questionnaire may be kept flexible to accommodate the peculiar situation of any other location and/or particular desert.
11	The strengthening of design and analysis capabilities in the National Agricultural Research System (NARS)	Dr. M. Inayat Khan Professor Dept. of Math. & Statistics University of Agriculture, Faisalabad	• Progress of the project is **satisfactory**; • The project has completed about half of its life period and achieved the targets as per approved plan of work; and • It is desirable that crop harvest be made by Project's Research Fellow himself at all the trial locations to minimize error.
12	The impact of domestic support to Punjab's agriculture under WTO regime.	Mr. Qamar Mohy-ud-Din, Dept. of Marketing and Agribusiness University of Agriculture, Faisalabad	• Progress of the project is **partially satisfactory**; • The project has completed 17 months of its 24 months life span and work done so far is as per approved work plan; • Aggregate Measures of Support (AMS) may be calculated for Punjab as per scope of the project by adopting indirect method (as discussed) if some figures are not available at provincial level; • Punjab government's subsidy on tube-wells, if any may be taken into consideration; • Subsidy on credit may also be measured for Punjab as discussed; • Other measures of support under Amber Box and S&D Box may also be considered/ discussed besides Green Box; • Econometric model to be used for analysis purpose may have peer review before its finalization; • Measurement of impact on trade and welfare of farmers may be given some special attention; • Positive contribution of research expenditure towards agricultural GDP of Punjab needs more elaboration/ justification; and • Atta sold through Utility Stores Corporations; Government Food Stamp Program under Zakat fund; and Fair Price Shops for wheat flour may be

			discussed in the report w.r.t. subsidy to consumers.
13	Impact of Sanitary and Phytosanitary (SPS) on agricultural exports form Pakistan.	Dr. Khalid Mustafa Chairman/Associate Prof. Dept. of Marketing and Agribusiness University of Agriculture, Faisalabad	• Progress of the project is **partially satisfactory** and some extra efforts are required to complete the project on time; • In a period of one year only review of literature has been done; • To make the study more logical, it is desirable that major importing countries of the selected commodities irrespective of their status of development should be studied; • Producers may be included while studying field problems and issues concerning quality of the produce to understand/record their problems in quality production; • The project report may contain information regarding mandatory requirements of the importing countries w.r.t. selected commodities and Pakistan's capacity to meet the desired standards; • Pakistan inked some FTAs/PTAs with countries like China, Iran, Sri Lanka and Regional Associations/ organization like SAARC, ASEAN etc. Their impact, advantages/ disadvantages w.r.t. selected commodities and SPS issues may be incorporated in the study; and • To analyze the issues in their holistic perspective, agencies/ institutions involved in trade and marketing may be contacted to assess the seriousness of the issues and to present factual position with regard to standardization, trade facilitation and development.
14	Farmers Capacity Building through Information Technology in Pakistan	Dr. M. Zakria Zakar, Asstt. Professor, Department of Sociology, Univ. of Punjab, Lahore	• Progress **partially satisfactory** and work needs to be improved. • False reporting in mid year technical report has created doubts, therefore, commended that some one from Directorate of Planning, PARC may re-check the existence of ICCs before releasing next financial release. • Technology Transfer Institute, NARC could provide great help to develop strong data base for web portal, hence it is suggested that PI may please develop liaison with TTI, NARC. • There is a need to add some attraction or devise some mechanism which could help to ensure the existence of ICCs after the completion of the project.

Project Title: ***Poverty alleviation through enhancing agricultural productivity by implementing priority interventions in the selected areas of NWFP.***

Principal Investigator: ***Mr. Muhammad Ishaq***
Scientific Officer

Location of Project: *Technology Transfer Institute(PARC), Tarnab, Peshawar.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*5.029*
Start Date:	*8/18/2004*	*Funds Released (Rs):*	*4251600*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3436168*

Objectives:

- To find out the current status of agricultural productivity and its potential for enhancement in the project area.
- To identify and prioritized the major constraints through transfer of tested technologies and capacity building programms.
- To remove the identified constraints through transfer of tested technologies and capacity building programs.
- To create Information Exchange Forum (IEF) through existing Community Based Organizations (CBOs) and to create functional linkages with line departments to make IEF operational.
- To assess the impact of the tested technologies on the productivity level of farmers in the selected villages.

Achievements/Progress:

Transfer of tested technologies and capacity building programs remained in progress through out the year.
Organized twenty eight field days.
Organized thirty six training programs
Developed eleven brochures on different crops and distributed among the stakeholders.
Three meetings of Information Exchange Forum(IEF) were also organized in three districts of the project are to review the activities of ALP project.
Functional linkages with sister organizations were strengthened during reported year.

Conclusions:

Priority interventions identified through need assessment survey were exterminated through a basket of tested technologies by organizing a series of field days, training programs, arranging farmers visits to the research stations and printing of pamphlets and brochures in Urdu language. The activities/ interventions will improve the existing level of knowledge of the stakeholders, which will be helpful in increasing the productivity vis-à-vis income of resource farmers

Publications:

Research article on "An Investigation into Low Wheat Yield in Swat, Kohat and Charsadda District of NWFP" was developed and submitted to Sarhad Journal of Agriculture, NWFP Agriculture University - Peshawar for publication.

Research articale on "Maize Status in Swat, Kohat and Charsadda Districts of NWFP" was developed and submitted to Sarhad Journal of Agriculture, NWFP Agricultural Univeristy - Peshawar for publication.

Project Title: ***Impact of sanitary and phytosanitary agreement (SPS) on agricultural exports from Pakistan.***

Principal Investigator: ***Dr. Khalid Mustafa***
Associate Professor

Location of Project: *Department of Agricultural Marketing, University of Agriculture, Faisalabad.*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*1.438*
Start Date:	*3/17/2005*	*Funds Released (Rs):*	*911750*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*498247*

Objectives:

- To identify the problems that limit effective participation of Pakistan in the SPS arrangements.
- To delineate the impact of Sanitary and Phytosanitary Agreement (SPS) on the export of agricultural and food products from Pakistan to the markets of developed countries.
- To find out the adverse implications of SPS agreement, if any, on agricultural exports from Pakistan and suggest ways to minimize such effects.
- To recommend policy prescriptions in line with the WTO trade liberalization move, based on the research findings.

Achievements/Progress:

Data collection was fed into computer for further analysis. Secondary information/ data collected from various sources (Ministry of Food, Agriculture and Livestock, WTO Cell, Government of Punjab Export Promotion Bureau, Pakistan Horticulture Development and Export Board, Mango and Citrus Export Association) has been scanned and shall be digested in the main body of the final report to be submitted to PARC.

It may be informed that staff appointed in the project has not been paid their salaries during some months of the reporting period, and adversely affected the pace of research.

Project Title: ***Comparative advantage and competitiveness of major crops in Pakistan- Price Risk Analysis.***

Principal Investigator: ***Dr. M. Siddique Javed***
Associate Professor

Location of Project: *Department of Agricultural Economics, University of Agriculture, Faisalabad*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*2.263*
Start Date:	*11/25/2005*	*Funds Released (Rs):*	*541000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*236398*

Objectives:

- To analyze the impact of agricultural policies to assess the degree to which domestic and world input and output prices of agricultural commodities, differ from their equivalents in the international markets. The study will specifically focus on:
- Determining the degree of protection and policy distortions in major agricultural commodities.
- Estimate the comparative advantage and competitiveness of these commodities.
- Demonstrate the use of Policy Analysis Matrix (PAM) using different probability distribution of input and out put prices.

Achievements/Progress:

Collection of time series data on different variables like domestic and world prices of inputs and outputs, cost of production of major crops (i.e. wheat, cotton, sugarcane and rice), by quantity and unit prices and their yields, transportation and marketing costs of these commodities to the borders, exchange rate for the period 2001-01 to 2004-05 were collected.
Review of methodology and methodology development to be used for the project has been completed.
Questionnaire development for primary data collection on major crops regarding enterprises budgets and other information regarding agriculture development has been completed.

Project Title: ***The impact of domestic support to Punjab's agriculture under WTO regime***

Principal Investigator: ***Mr. Qamar Mohy-ud-Din***
Associate Professor

Location of Project: *Department of Agricultural Marketing, University of Agriculture, Faisalabad*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*1.565*
Start Date:	*10/28/2004*	*Funds Released (Rs):*	*988000*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*833900*

Objectives:

- To Estimate the Aggregate Measure of Support (AMS) being provided including:
  a) Market Price Support (MPS)
  b) Input-output subsidies
  c) Other non exempt measures like direct payments etc.
- To Estimate the impact of AMS on production, Trade and welfare of Farmers of the Punjab.
- To determine the extent of domestic support to be provided to the agriculture sector and rural development in the Punjab province.
- To estimate future projection level of domestic support on various sectors and its impact on rural development in Punjab.
- To suggest guidelines for providing domestic support for general development of agriculture and rural development in the Punjab Province.

Achievements/Progress:

The domestic support commitments under the WTO have many implications for developing countries like Pakistan where agriculture is main stay of the economy. In Pakistan from agriculture point of view, the province of Punjab has a paramount importance as it is the major contributor towards total agricultural production of the country. If agriculture in the Punjab province performs well, the overall agricultural growth rate of country improves as well.

In the scenario of AoA of WTO, the domestic support component has special connotations for the economy of Punjab. Keeping this in view, the University of Agriculture, Faisalabad (UAF) in the Department of Marketing and Agribusiness initiated a research project entitled "The Impact of Domestic Support on Punjab's (Pakistan) Agriculture under WTO Regime. The project was fully funded by the Pakistan Agriculture Research Council, Islamabad (PARC) under the Agricultural Linkages Programme (ALP).

RECOMMENDA TIONS

Pakistan is economically an agrarian country largely drawing its economic strength from agriculture sector. In spite of its major role in the economic development of the country, the agriculture sector in the recent past has initiated its journey towards commercialization and this sector has not yet become self supportive. Farming community lacks proper knowledge and is not properly quipped to meet the challenges of modem agriculture. Majority of the farmers are illiterate and are unable to make rational decisions on their own and need institutional support. Moreover market mechanism is not well established and not capable enough to provide proper economic signals to all the stakeholders. All

these factors justify that domestic support to our agriculture should be continued rather enhanced. The agreement on agriculture of WTO sets various rules and regulations regarding the provision and prohibition of domestic support to agriculture. In the following, various suggestions have been extended for the provision of domestic support in the Punjab province within the framework of various WTO rules.

1. On domestic support, there is very little by way of constraint on policy. Total Aggregate Measure of Support (AMS) throughout the implementation period as notified by Pakistan is negative, implying that agriculture sector in Pakistan and Punjab instead of receiving support under the Amber Box was rather taxed. Pakistan has no reduction commitments in case of AMS. Therefore Pakistan can utilize this cushion by increasing its support falling with in the preview of AMS so that first it attains positive sign and then it may use the de minimus provision i.e. 10 percent of the production value of each crop.
2. Pakistan's Gross Domestic Product (GDP) is Rs 4480 billion. The share of agriculture in total GDP is 23 percent i.e. Rs. 1030 bullion (Govt. of Pakistan, 2005). Ten percent of total agricultural output i.e. Rs. 103 billion can be given as non-product specific support to agricultural sector or rural development, without contravening the provisions of ADA of WTO.
3. The results of the study indicate that wheat price support have contributed significantly in increasing agricultural output of the Punjab province. Wheat crop is very important from food security point of view; the price support programme for wheat should be continued. This support can be extended because current total AMS in Punjab is negative and there are as such no reduction commitments in this regard.
4. In the province of Punjab the contribution of food trading services towards agricultural output is not positive according to the findings of the study. Therefore, government should gradually disengage itself from food trading services and let the private sector extend these services for handling the output.
5. Although Amber Box type of domestic support bars provision of certain types of support but Green Box type domestic support has no limit. Therefore, the government of Punjab should explore possibilities to provide domestic support under Green Box measures. This will enable the needy sectors to get their due share.
6. In the WTO regime, agricultural producers of Punjab are confronted with many challenges that call for an increased investment in rural public domain such as agricultural research to further improve agricultural technology and to provide producers with better production conditions that are comparable with their foreign competitors. With increased productivity either in terms of higher yield or lower cost of inputs, farmer's production cost could be brought down to render their products more competitive. The results of the study report negligible contribution of investment in research in Punjab which is because of meager budgetary allocation for operational research. In this direction following steps are recommended:

a) The Government of Punjab should accord high priority to agricultural research and investment spending on agricultural research should be increased manifolds immediately.
b) It should be ensured that major proportion of budget of the various research organizations is incurred on the operational research.
c) There is a need to bring drastic institutional changes in the provincial research organizations in order to stem the current outflow of competent agricultural researchers. Human resource base needs to be strengthened. Agricultural research scientists should be given competitive salaries and all types of research facilities. On the job training facilities particularly foreign trainings should be arranged for the researchers and educationists for acquisition of latest technical knowledge as well as the foreign exposure.
d) All the vacant positions in the research organizations of the province should be immediately filled. Fresh recruitment, promotions and appointment against administrative posts should be on merit and should be tied up with performance.

e) The agricultural research should be problem solving and target oriented. Goals and targets should be set in consultation with various stakeholders. In this regard, there is an urgent need to establish a coordination mechanism among various stakeholders like research and extension organizations, private and public sector organizations and educational institutions.

7. Agricultural extension plays a key role in improving agricultural productivity.

Presently the budgetary allocation for agricultural extension is also far less than the current needs of the province. Government should lay special emphasis on improving extension services in the province and funding in this area should be increased. According to Davidson et al (2001) urgent attention is required for rethinking extension strategies for Punjab so as to narrow down the growing information gap between the rich and the poor farmers. The advance programming principles should be adopted by the extension department of Punjab to bridge the information gap between the farmers, are suggested below:

a) Use of surveys, village visits, and discussion methods can provide a means of assessing needs of the people of village by the extension staff.

b) Extension workers and the school teachers in the villages could be used as contact people to initiate projects and identify key leadership for helping in various projects.

c) Field work for extension workers should consist of farm-:to-farm visits or house-to-house visits in villages. A personal link between the villagers and the extension office could be established and maintained through these visits.

c) Integrated farm projects should be set up with farmers to show methods that were practical for them.

d) Practical training for extension staff should be arranged by working directly in the fields with the farmers, discovering their needs and helping them to improve farm practices.

e) The literate villagers should be provided the extension publications. This will create a link between the universities and the villagers, and will improve farm practices of village people.

g) To increase family income and to make available a higher quality of product for the market, the trainers should be selected to attend training on developing a marketable product and sharing this information with other villagers.

8. The results of the study establish a significant relationship between the distribution of improved seed and agricultural output in the province of Punjab. Therefore, efforts should be made to further enhance the distribution of seed in the province. In this regard, the cost of transporting seeds can be subsidized in the province with the objective of ensuring universal and timely access to this vital input. Seeds should also be made available in case of natural calamity and seed storage infrastructure should be developed. Grants should be provided to both public and private seed corporations for the maintenance of certified and foundation seeds. The core poor should be given improved seed at cheaper rates and in small packs.

9. Fertilizer constitutes a major component of cost of production of the crops. The government should ensure timely and proper availability of all types of nitrogenous, phosphate and potash fertilizers at affordable rates to farming community. The government is already giving gas subsidy to the fertilizer sector which should be continued and additionally the government should give subsidy on the import of fertilizers. Besides this, technical and advisory services should be arranged for to the farmers so that they may utilize the fertilizers effectively.

10. High priority in the budgetary allocations should be accorded for the development of infrastructure by the Punjab government. Public expenditure on the irrigation, and land reclamation should be further enhanced and spendings on lining of canals and water courses for overcoming water losses during conveyance of water should be increased. In water deficient areas, water conservation techniques should be introduced and promoted among the farmers. Where installation of tube wells is feasible, farmers should be provided incentives and technical expertise for tube well installation. In this connection, electricity should be provided at subsidized rates. In our neighboring country India, power to agriculture sector is offered at a very low price; in a few cases it is even free. Like many Indian

states, the government of Punjab can also adopt the policy of providing irrigation subsidies to facilitate the resource poor farmers.

11. Under the commodity loan programs the producers of designated crops should be allowed to receive a loan from the government by pledging production as loan collateral. Following harvest of the crop, a farmer may obtain a loan for all or part of the new crop. The government can adopt such policies to issue commodity loans to the farmers to facilitate production and to render them free from the exploitation by the middlemen and wholesalers. Furthermore, loans for marketing, storage and transportation purposes of agricultural commodities should also be liberally arranged.

12. Expenditure on public stockholding of food for food security under green box expenditures of Punjab has been quite low in the past. The provincial food department receives no allocation from the provincial budget; rather it finances its expenditure by taking loans from the banks. Whereas, India's green box payments during 1995-1997 were dominated by expenditures on public stockholding for food security and totaled to US$2,872.9 million in 1997. Government has the cushion to increase spending on stockholding of food to ensure timely availability of food to the poor on concessional rates. This area of domestic support should be vigorously explored.

13. To encourage the farmers for setting up of scientific storage systems for vegetables; The Directorate of Economics and Marketing, Government of Punjab should provide not only the financial assistance to farmers to erect storage structures but should alsq be given technical guideline for the process. As much as 25-50 percent of the construction cost of the storage structure could be offered to farmers. The scientific drawing on modem lines and cost estimates for storage structures should be made available free of cost by the district agriculture offices.

14. Huge demand exists for cut flowers in the international market. Cooling is one of the important steps in bringing fresh cut flowers from the grower to the marketplace. To ensure the quality of these flowers, government should provide financial incentives to the private sector to construct and maintain cold storage facilities at market and farm levels.

15. The general and product specific disease control measures such as early warning systems, quarantine and eradication has assumed high importance because of Sanitary and Phyto-Sanitary Agreement of WTO. Since the province of Punjab is the major producer and exporter of fruits and vegetables, the government should ensure proper pest and disease control mechanism in the province in lines with the international standards if is to increase the exports from the Punjab. A strict system of inspection including general inspection service and the inspection of particular products for health, safety, grading and standardization purposes should be enforced and inquiry points at various places should be set up.

16. Agricultural marketing in the past in Pakistan and the province of Punjab has largely remained ignored but the disposal of occasional surpluses of some of agricultural commodities; emergence of agribusiness sector and challenges posed to agrarian economy by WTO has increased its importance. The farmers of Punjab in general and small farmers in particular lack modem marketing techniques that result in high post-harvest losses. Although a separate Ministry of Agricultural Marketing has been established but there is a need to make it vibrant and functionally working for the provision of various marketing related services to the farmers. The farmers should be facilitated in the product preparation, handling, storage, bargaining, grading, standardization, packing and disposal of their produce. Market information system should be strengthened in order to provide information to all stake holders and bring coordination in agricultural markets.

17. The findings of the study indicate that contribution of agriculture labour in increasing agricultural production of the province of Punjab has been quite significant in spite of the fact that labour in our country is not equipped with modem techniques used in Agriculture sector. It is therefore, urgent need of the time to arrange training programmes for not only the farmers but other stakeholders as well. The Govt. should chalk out comprehensive training programmes in collaboration with various research and training institutes and agricultural Universities.

All the above suggested sectors, sections, stakeholders need domestic support of the provincial government. The suggested provisions can help directly or indirectly, the agricultural and rural development in the province. The government can extend domestic support to the above suggested areas without contravening the provisions of AOA of the WTO.

Project Title: ***Economic analysis of agroforestry plantations in Sindh province of Pakistan***

Principal Investigator: ***Dr. Heman Das Lohano***
Assistant Professor

Location of Project: *Department of Agri. Economics, Sindh Agriculture University, Tandojam*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*1.328*
Start Date:	*10/28/2004*	*Funds Released (Rs):*	*386791*
Project Status:	*Completed*	*Funds Utilized (Rs):*	*339208*

Objectives:

- To assess the current status of forestry development in Sindh and Pakistan.
- To conduct a benchmark survey of agro forestry plantations in selected districts of Sindh.
- To undertake economic analysis of major tree species grown in agroforestry plantations.
- To study the needs, availability, marketing, and export aspects of forestry with special reference to Sindh province.
- To recommend policy measures and program initiatives for the development of agro forestry in Sindh on a sustainable basis.

Achievements/Progress:

Agroforestry is a land-use system in which forest trees are integrated with crops and/or animals on the same land management unit either in some form of spatial arrangement or temporal sequence. Pakistan is a forest-poor country with very low forest cover of 5 percent of the total land as compared to the recommended level of 20-25 percent. Currently, Pakistan is facing timber and firewood shortage of about 29 million cubic meters (Government of Pakistan, 2006a). Due to shortage in local supply and rising demand for forest products, Pakistan imports various wood products and other forest products each year. Agroforestry on private farmland can help in achieving the national targets of forest cover and in meeting the rising demand for forest products.

The present study aimed at assessing the current status of agroforestry in Sindh and Pakistan, conducting economic analysis of agroforestry plantation on private farmland, and exploring the marketing of agroforestry products in Sanghar, Badin, Matiari and Hyderabad districts of Sindh.

It has been estimated that 90 percent of fuel-wood and 46 percent of timber requirements are being met from tree plantations at private farmlands in Pakistan. In terms of area, the farmland trees plantations account for 1 I percent of the total forest area in Pakistan. Farmland trees plantations account for 14 percent of the total forest area in Sindh. However, farmland trees are very productive in terms of growth per year, as they account for 53 percent in the total forest growth per year in Pakistan, and 55 percent in Sindh.

In the province of Sindh, the most common practices of agroforestry on private farmland are block plantation of Acacia nilotica (hurrie), and shelterbelt and scattered tree plantations with common tree species of Acacia nilotica (Babul), Eucalyptus camaldulensis (Sufaida) and Azadirachta indica (Neem). Results from the survey of the selected disctricts of Sindh indicate that the block plantation of Acacia nilotica provided 34 percent internal rate of return to the farmers. The internal rate of return was 27

percent and 23 percent from Acacia nilotica and Eucalyptus camaldulensis, respectively, grown as shelterbelt and/or scattered trees.

Results of the study showed that the highest net margin per 40 kilograms received by middlemen was on the block plantation of Acacia nilotica (hurries). It was observed in the survey that few local assemblers were available in each location, thus, there is lower degree of competition in the transaction between local assemblers and farmers.
Furthermore, farmers need to sell trees of hurries as they mature because their wood is best for mining props at this stage, and also because the farmland is to be used for sowing agricultural crops. It was observed that there were few middlemen in wood marketing at each location, as compared to marketing of agricultural crops. Thus, the middlemen involved in wood marketing purchase and sell a large quantity of wood. Thus the total returns were much higher than on per unit basis.

For promoting agroforestry on private farmlands, the government needs to make efforts on providing technical assistance, extension services, awareness and availability of seed and seedlings. The government should promote research on agroforestry for exploring tree-crop combination suitable at different types of soil. Based on research outcomes, the government should disseminate the information to farmers about trees species suitable for a particular area and tree-crops mix that can be used in agroforestry system.

Project Title: ***Socio-Economic, Institutional and Policy Issues Constraining the Productivity of Livestock in the Deserts of Pakistan***

Principal Investigator: ***Dr. Umar Farooq***
Senior Scientific Officer

Location of Project: *Social Sciences Institute, National Agricultural Research Centre, Islamabad.*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*3.77*
Start Date:	*10/1/2004*	*Funds Released (Rs):*	*1733325*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*874964*

Objectives:

- To study the socio-economic characteristics of livestock holders in Thal, Thar, Tharparkar, D.I.Khan and Chaghi, Kharan deserts of Pakistan.
- To study the livestock composition at farm household level from various perspectives such as large and small animals with their breeds; buffaloes and cattle; milking and dry large animals and pack animals in the deserts of Pakistan.
- To examine the productivity existing productivity status of various livestock species in the study area.
- To study the production and marketing related constraints faced by the livestock herders in the study area.
- To suggest various guidelines in a prioritized fashion for the development of the livestock economics of the deserts of Pakistan.

Achievements/Progress:

The review of literature, questionnaire design and finalization of questionnaire
Field survey for data collection in ThaI Desert of Punjab
Data entry and editing of the collected data
Data analysis of ThaI desert data in progress

Results and Discussion

Regarding living conditions of the sample livestock herders, only 37% has electricity and in non-electrified village, kerosene oil is the main source of light. Hand pump is the main source of drinking water and firewood is the only major fuel in the area. On average, there were 200 houses per village, the highest in Noorpur tehsil (343 houses) and lowest in Chaubara (33 houses). Three- fourth of the households in sample villages was farming families. The proportion of pucca houses (bricks made with/without plaster) was varied from 40 to 43% across tehsils.

The living environment of the sample livestock herders was also assessed by asking the distance to various places like tehsil and district headquarter, transport pickup points, milk collection center, grocery market, crop and livestock markets, primary, middle and high schools for boys and girls, basic health units/dispensaries for human being and livestock with the availability of doctor or qualified staff, medical stores, agricultural and commercial banks and drinking water facilities. Overall, more than 64% respondents reported as no access to milk marketing facilities, 12.5% and 17.5% as non-availability of primary school for boys and girls, respectively, 27.5% as non-availability of middle

schools for boys/girls, 16.7% as secondary school for girls. On average, tehsil and district head quarters were reported at the distances of 23 and 66 km respectively, transport pickup point at 2.5 km, milk collection center at 12 km, grocery, crop and livestock markets at 15 km, 19km and 39 km respectively, primary, middle and high schools for boys at nearly 2 km, 5.4 km, and 7.5 km, respectively and for girls at 2.5 km, 10.5 km, and 13.5 km, respectively, basic health units/dispensaries for human being at 8.5 km and for livestock at 10.8 km with the probability of finding doctor/qualified staff as more than 70% in public hospitals/dispensaries and more than 90% in private hospitals/dispensaries, medical stores at 15 km, and agricultural and commercial banks at more than 20 km This indicates that the general living environment of livestock farmers in Thal desert is quite hard when compared with other irrigated parts of the Punjab.

The average age of the respondent farmers was about 44 years, with nearly 5 years of formal schooling, however, 40% respondents were illiterate. The crop and livestock farming experiences were more 20 years and two-third of the sample respondents also performed livestock marketing activities. Among those having no formal education, about 88% were not able to read and write while 92% were unable to read Holy Quran. This implies that the respondents belong to physically and mentally active age groups and possess quite good level of literacy ratio with adequate (in view of desert economy) level of education and professional experiences. However, the condition of those having no formal schooling is quite miserable:

The average family size was 12.6 members living mainly under joint family system (72%) with a composition of 1.2 olds (> 60 years), 3.6 adult males (16-60 years) and 3.0 adult females (1660 years), 2.5 girls and 2.3 boys under 16 years age. On average, the primary school going boys and girls were 1.2 and 0.6 per household respectively, in middlelhigh schools as 0.5 and 0.1 per households respectively, and in college/university as 0.1 and 0.05 per household respectively. These findings are quite matching with the a priori expectations from the study area.

The average farms size of agro-pastoralists farms was 75 acres with in 2.2 the largest in Mankera followed by Noorpur and Chaubara tehsils. The average number of parcels is 2.2 and the lands were relative more fragmented in Chaubara and less fragmented in Noorpur tehsil. About 71 % of the sample respondents were owner operators and remaining were owner-cum-tenants and more than 90% farmers were using tractor for ploughing. The major land type was sandy (77% farms) followed by sandy loam (17%) and the soils are well drained and the underground water was fit for irrigation.

Regarding cropping patterns, in rabi season, gram followed by wheat and rabi fodder were the main crops grown in the area. In kharif guar seed, sorghum and millet are the major crops grown. In rabi and kharif seasons, 6% and 71% of operational holdings were left fallow, respectively. The mean cropping intensity for the area was estimated as 100 percent.

The average herd in the study area comprised 2.6 buffaloes, 6.9 cattle, 0.9 camel, 22.5 sheep and 17.1 goats. Instead of keeping donkey as pack animal (like Cholistan), the camel is kept as pack animal. The camel farming is relatively more in the area because the adult animals are sold as draft animal (for camel cart) in the adjoining districts like D.G. Khan which is further sold out to traders in Lorali and Quetta. The objectives of keeping large ruminants (buffalo and cattle) were home consumption of diary products followed by sale of young stock and adult animals. The purpose of keeping camels is mainly the sale of loading/pack animals, followed by sale of adult animals and status symbol. The purpose of keeping small ruminants is sale of adult and young animals followed by home consumption of dairy products. In breeding, the crossing indigenous cattle breeds of desert (ThaI and Cholistan) with exotic milk breeds, like Sahiwal and Friesian is common with the sole objective of increase in milk availability and stout calves.

Considering gender based distribution of crop related activities, males were involved in operations like seed preparation, seed sowing, weeding, hoeing, thinning, spraying, fertilizer application, harvesting/picking, threshing and handling of crop by 54%, 98%, 88%, 37%, 8%, 7%, 70%, 99%, 100% and 67%, respectively while female participation in these corresponding activities was 73%, 3%, 56%, 18%,2%, 0%, 0%, 73%, 13% and 47%, respectively. In livestock farming activities, the males were involved in operations like animal grazing, stall feeding, water animals, milking, milk processing, caring sick animals, collection of farm yard manure, making dung cakes, cleaning of animals' sheds, and marketing of crop and livestock output by 99%, 73%, 60%, 48%, 6%, 38%, 8%, 0%, 17% and 100% while females participation was correspondingly recorded as 1 %, 73%, 76%, 73%, 97%, 63%, 84%, 65%, 53% and 5%, respectively. This indicates that in crop sector, seed sowing, weeding, fertilizer application, harvesting are major male jobs with relatively less assistance from females. In livestock farming, male activities are marketing of crop and livestock output, animal grazing, stall feeding and watering of animals whereas females assumed the major responsibility of milk processing and collection of farm yard manure with assistance in watering of animals, stall feeding and milking.

In the light of operational realities prevailing in Thal desert system, the following development areas are suggested.

Intensifying production of fodder crops and cereals to improve both food and fodder security on the agricultural lands. Increasing the availability of rangelands vegetation. Increasing rain water harvesting capacity for crop production purposes. Improvement in the genetic potential of local livestock breeds through selection and improved management. Provision of efficient livestock health coverage. Introduction and promotion of milk collection and processing activities in the area.

Expected Output

As already discussed that a notable proportion of the livestock of the country is reared in marginal environments like deserts where arable cropping is highly risky due to wide fluctuations in average yields. Food and fodder securities are the major problems of desert economies. These economies are also ignored in the development policy planning and implementation. This project was specifically designed to generate information about livestock farming in desert ecologies of Pakistan. The preliminary results clearly signify that the access to farm inputs and output markets is very poor. The necessary facilities of life are also situated at very long distances. The farming community own their own is struggling for increasing productivity of the livestock farming mainly through cross breeding their animals with exotic breeds. The harsh climatic conditions are mostly hindering them from producing high quality live animals. After finalizing reports from other deserts of Pakistan, it is expected that some commonalities would be thrashed out in order to suggest the policy, research and development measures for the livestock sector in the desert ecologies of the country.

Conclusions:

In summary, it is concluded that the desert economics need attention of the policy makers as now Pakistan is struggling to alleviate poverty from the country. Therefore, these economics should be given special attention in the poverty alleviation strategy policies, despite the fact that at this stage we have data from only one desert of the country with us.

Publications:

Draft Report on “Socioeconomic, Institutional and Policy Issues Constraining Livestock Productivity in Thal Desert of Punjab”

Project Title: ***Bridging the gender gap in agri. extension through designing and testing an innovative and holistic out-reach (extension) program of the University of Agriculture, Faisalabad***

Principal Investigator: ***Dr. Tanvir Ali***
Director

Location of Project: *Department of Agriculture Extension, University of Agriculture, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.193*
Start Date:	*3/17/2005*	*Funds Released (Rs):*	*1038000*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1049498*

Objectives:

- To explore the perceptions of male and female adults involved in farming and non-farming profession in rural areas regarding gender equality for access to education sources.
- To identify and prioritize the training needs of male and female adults in rural areas for improving their livelihood strategies.
- To assess the gender gap regarding information need related to agriculture and home economics.
- To analyze the gender gap regarding information need related to agriculture and home economics.
- To analyze the obstacles to gender and development.

Achievements/Progress:

Review of literature has been completed.
Visits to study site were undertaken.
Identification of experimental and control sites were undertaken.
Sample selection has been done.
Appointment of contractual staff has been done.
Training of staff, instrumentation, field testing of instruments, revision of instruments has been done.
Arrangements made for fields survey.
Key persons of the villages were interviewed.
Data collection for quantative study for base line survey, needs assessment and problem analysis.
Editing of questionnaire.
Data analysis.
Preparation of draft report.
Workshop regarding gender equality (mission, objectives and working methodology)
Recommendations made under the light of workshop report.
Initiating activities related to equal involvement of gender in access to information sources in experimental area.
Preparation of extension material (leaflets, pamphlets, broachers, posters, charts etc.)
Development of knowledge for livelihood and gender equality.

Main Findings:

After the completion of preliminary data collection major problems alongwith their soulutions were identified and listed bolow.

Problems:

Due to vicinity of Faisialabad city where job opportunities are available due to textile activities, farmers send their children to city for better earning from textile industry. However, the main problems of the area are given below:

Male dominant society
Shortage of irrigational water
Non-resident extension worker
Adulterated weedicides/ pesticides
Non-availability of proper agri implement.
Lack of credit facility
Non avaialability of labor
Primitive fertilizer application techniques
Less participation of women in agriculure due to orhtodox behaviour by males.

Problems regarding livestock:

Majority of rural females in their spare times rear the livestock to increase their income. Females carried most of the activities regarding the livestock, and they faced the following problems in livestock sector

- Lack of knowledge about diseases
- Lack of knowledge about vaccination
- Lack of knowledge about the balanced ration.
- Shortage of fodder
- Concentrates are costly
- Lack of artifical inseminaiton facitilities
- Less availability of land

Problems regarding the village:

- Shortage of pure drinking water
Poverty
Conflicts
Lack of educational facilities
Lack of health facilties
Lack of natural gas
Lack of road facility
Lack of sanitation

Overall Problems:

Lack of planning
Planners had no exposure to actual problems of the particular area
Misuse of funds
Wrong use of power
No check and balance

Female Education:

Overall the literacy rate for rural females is lower than the rural males. The reasons for the low literacy rate are:

A) There was only secondry school for females and far away from their houses. They get up early in the morning and travel towards their school and after attending again travel the same distance. This activity exhausted them and they are unable to participate in other actvites.

B) Transportation, the owner of the transport has their own times for running the vehicles on the road.
C) Insecurity
D) The female teachning staff is insufficient, especially female staff in the science subjects like Math, Chem., Phys., & Bio.
E) Contract system is not useful
F) Some private schools are working in this area and their fees are very high.

Job Opportunity

Educated females can't do the job because the place where they get the job is far away from their homes and their family has to hold responsible a person for their pick and drop from the work place. The educated females who do nto join any institution opened tuition centre in their own houses but claimed heavy tution fee. An ordinary laborer is unable to pay this amount of fee; therefore, they restrict their daughter to attend these tuition centers.

It was reported in an interview that if a family send, its daughters to learn embriodery and handicrafts, then the teacher would like to get her household work done in the first six month and after passing the six months, she start teaching the girls and in the next six months, she teaches the girls how to put a string into needle. It means female training is much time consuming and troublesome.

Project Title: ***Structure, Conduct and Performance of the Marketing System, Margins and Seasonable Price Variations of Selected Fruits and Vegetables in Balochistan, NWFP, Northern Areas and AJK***

Principal Investigator: ***Dr. Muhammad Sharif***
Dy. Director General (TT)

Location of Project: *Social Sciences Division, PARC, Islamabad*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*3.881*
Start Date:	*10/19/2004*	*Funds Released (Rs):*	*2127400*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1602932*

Objectives:

- To study the existing structure, conduct and performance of the marketing systems of selected fruits and vegetables in Balochistan, NWFP, Northern Areas, and AJK.
- To determine the technical and socioeconomic constraints in the marketing system, which have an impact on the expansion of its production and marketing in Balochistan, NWFP, Northern Areas, and AJK
- To quantify the market margins of producers and other market intermediaries; and assess ways and means to improve the producer's share and consumer's surplus in Balochistan, NWFP, Northern Areas, and AJK.
- To develop policy recommendations for efficient marketing system to safeguard the interests of producers as well as consumers; and to enhance output and exports of fruits and vegetables in Balochistan, NWFP, Northern Areas, and AJK

Achievements/Progress:

The study area provides a substantial scope for the development of fruits due to the diversity of fruits present in the area. However the quality of the fruits and the area under orchard was limited due to underdeveloped marketing system even for the major fruits of the area. Diversity of climatic environment is available for the development of fruit enterprise in the area through promotion of modem and efficient marketing system. Keeping in view the importance of the marketing of fruits in the area a detailed investigation was carried out at all level of the stakeholders involved in the marketing chain of the fruits in AJK. The whole marketing chain of walnut, apple and mango was thoroughly surveyed starting from producers to consumers.

The farming was a part time activity in the study area due to small land holdings and majority of the producers reported agriculture as secondary source of income. The transportation cost was also high due to hilly areas and also due to small scale production; the economy of scale could not be achieved. The bullocks were the main source of farm traction. The flow of information was very weak as majority of the producers had no information about agriculture and marketing aspects which further leads to inefficient marketing for the fruits and other agricultural products.

The pre-harvest selling of the orchards was found in most of the cases and nearly one third reported delayed payments. Profitability of the fruit trees was the main factor behind the decision to plant any fruit tree. An increasing fruit plantation intention was observed among the producers. Prices at producers' level were mainly determined by the condition of the fruit and prevailing prices in the area.

The flow of market information was primitive as more than half of the producers get market information from the neighbouring farmers and personal visits to the beoparies was the second main source of market information. Response of the producers regarding the price they received was indifferent as nearly half were satisfied and others reported low prices of the fruits.

Advance payments were mostly paid by the contractors to the producers. After the contract in majority of the cases the full management of the orchard was done by the contactors and in some cases only plant protection measures were done by them. Very few contractors had their own telephone facility and mainly use peDs. The purchase of orchards was on the basis of number of tree and in case of walnut the plants purchased by the contractors range from 40 to 250 with 80 to 1462 mds of quantity with 65 percent A grade quality. The purchase amount ranges from 60,000 to 1950000 by the walnut contractors and 66 percent were financing through credit from different sources.

In case of apple the plants purchased by the contractors range from 100 to 300 with 40 to 200 maunds of quantity with 30 percent A grade and 45 percent B grade quality. The purchase amount ranges from 14000 to 75000, by the apple contractors and 46 percent were financing through credit from different sources. Apple orchards were mainly managed by the farmers whereas 41 percent reported contractor management. Good repute, honesty and long term working relationship were the criteria for the selection of commission agents of the contractors. Majority of the commission agents were working as sole entrepreneurship and only 20-30 percent had partnership and all have contacts in other markets in Pakistan. They get market information from these markets through telephone. The wholesalers of walnuts were marketing on both whole sale and retail price and purchase in bulk according to their capacity. Some wholesalers purchases walnut from contractors through commission agents and sell to other markets after washing and cleaning. Due to the less volume of the apple that comes in the market there is no role of wholesalers. Retailers do all in marketing process of apple. Retailers were located in Mandi, Bazar, Bus / wagon stop etc.

The consumers were mainly purchasing walnut, apple and mango from the retailers while some r also purchase it from producers and were mainly concerned with low quality of the produce. Marketing margins analysis was carried out to assess the efficiency of the marketing system to examine the extent to which prices are transmitted along the marketing chain and determine I, what price producers received.

In mango the wholesalers/retailers receive the highest margin (4.64 Rs./Kg) followed by the contractors (3.97 Rs./kg). Producers was getting 6.40 out of the sale price of 15.79 Rs./Kg while commission agents gets only 0.78 Rs./kg. Percent share in consumers' rupee of mango for producer was 40.53, contractor got 25.16, commission agent received 4.94 and wholesaler earned 29.36.

In walnut the retailers receive the highest margin (29.24 Rs./Kg) followed by the contractors (12.06 Rs./kg) and wholesalers (11.27 Rs./Kg). Producers was getting 32.32 out of the sale price of 88.21 Rs./Kg while commission agents gets only 3.32 Rs./kg. Percent share in consumers rupee of walnut for producer was 36.64, contractor got 13.67, commission agent received 3.67 and wholesaler earned 12.78.

In apple the wholesalers/retailers receive the highest margin (11.25 Rs./Kg) followed by the contractors (5.78 Rs./kg). Producers was getting 6.85 out of the sale price of24.67 Rs./Kg while commission agents gets only 0.84 Rs./kg. Percent share in consumers' rupee of apple for producer was 27.78, contractor got 23.22, commission agent received 3.40 and wholesaler/retailers earned 45.61.
Despite the present environment in which growers are operating, characterized by lack of market information, little institutional help in the form of credit and extension services, limited research

support, imperfect marketing system and low level of production alongwith higher cost of transportation due to hilly area, low level of mechanization, little choices due to non availability of processing units and diseconomy of scale of production due to small farm size the producers share in consumers rupee was high in mango and walnut while wholesalers/retailers were grabbing higher share followed by the producers. However the small farm size/number of trees, low level of production and poor quality due to local varieties of mangos and apple were the main factors responsible for the market improvement.

Development of horticulture in AJK should be a high priority area in view of high value fruit crops. Fruit when produced for the market can generate cash surplus with which farm family can purchase cheaper staple food required for family sustenance. This requires a major change in both the following practices and the philosophy of production. The importance of producing for the market overrides all other considerations and must be the guiding principal on selection of crops, cultivars and production practices. The range of climatic zones in AJK, combined with adequate rainfall or irrigation facilities allows the culture of a wide range of horticulture crops, all of which offer considerably higher monetary returns than the current crops of staple cereals. However, farmers or not attuned to the needs of producing for a market environment nor was the basic information in place to insure that there produce will find a ready outlet.

Fruit culture was not practiced as a commercial activity and only scattered and un-organized fruit plants were grown in a traditional way. Improper production technology, including traditional varieties and poor orchards management, besides inferior nursery plants was found.

Heavy fruit losses due to natural hazards (hailstorms etc) and improper post harvest handling alongwith lack of marketing facilities and disregard to quality and inadequate and untimely availability of agriculture inputs were also reported.

The policy measures were required to improve the productivity and quality of these crops by reduction in post harvest losses and improvement in the marketing system for exports. Private sector needs to encourage for establishing, processing, grading, packaging and cold storage facilities.

Germplasm introduction of scion and rootstock cultivars was an ongoing process. The cultivars needs be screened for their adaptability to agro-climatic conditions and market acceptability.

Fruit nurseries in the private sector should be suitably regulated and supplied with high quality propagation material from the government controlled centers. The government nurseries should now focus on the establishment of high health status germplasm units, which can supply highly quality, and true to type rootstock and bud wood to the nurseries.

Proper orchard management was important for fruit cultural to become a high value activity. Well-managed orchards come into production earlier, bear heavier fruit and earn more income than poorly managed plantations. Orchard management includes establishing semi permanent legumes instead of maize as intercrop, weed control, proper fertilizer management, balanced and optimum pruning, besides adopting IPM approach.

Demonstration orchards should be established at selected sites with farmers fully committed to better management practices leading to high yield and quality production of fruit.

Food processing industry should be encouraged in AJK to utilize fruit, especially apple, which was surplus through processing into pulp or other final products such as jams, jellies.

Production factors including good climate, soil and sufficient water are favorable to produce high quality fruits in AJK. Therefore there is need to improve the management practices, introduction of high yielding good quality varieties, reducing post harvest losses.

Reduce the transaction cost and risks through public investment in all forms of infrastructure. Government must make considerable efforts to develop the roads and improve the transport system in the AJK as the major cost in marketing of fruits was the transportation cost. The improve infrastructure and transportation system will enhance rapid supply of the fruits to distant markets.

Poor flow of market information and dependence on the commission agents leads to market imperfections and low return to the producers.

Commission agents could also be encouraged to extend seasonal loans to progressive growers along with market information to develop competition between producers and contractors.

All the above recommendations would help to improve the income of the producers which would create incentives to invest in agriculture if it becomes the primary source of income for majority of the farmers.

Identifies production areas and practices to allow farmers produce economic yield of the identified marketable products or cultivars (preferably on farmers fields and in cooperation with interested and committed farmers). This can be undertaken in medium to long term for perennial fruit crops.

Establishes effective demonstration on farmer's fields of the production and marketing potential of these crops. Only when all these factors were in place i.e. correctly identified market opportunities, identification of production area, practices and cultivars to meet this market requirements, local production of the recommended crops and cultivars to meet the market requirement, combined with a marketing chain from farmers field to the major market of Pakistan, commercial horticultural can make a significant impact on changing the lives of resource poor farmers in AJK. This cannot be achieved in the short time frame of a single project or even program, but needs a sustained policy of support from the government over a period of fifteen to twenty years. But the beginning has to be made soon defining activities for the short-term period along with work plan for medium to long term. The priorities should be set separately for the two regions: northern and southern. In the northern region there were two sub regions, higher altitudes, which can produce fruit plants having high, chill requirements and lower altitudes where intermediate chill fruit species can be grown.

Suitability of growing fruits plants for different areas was cited below as an example. It can be further refined and crystallized:
Apple, cherry, plum and walnut for higher altitudes in the northern sub zone, which suits growing plants requiring high chill.
Peach, apricot, nectarines, persimmon, etc, for lower altitudes in the northern sub zone suitable for growing fruit species of intermediate chill
Citrus, guava and mango for the southern zone
Neelum valley, a non monsoon area may be treated separately
Grapes cultural can be chosen for sloping fields at appropriate places suitable for it.

Publication:

Draft report on "Structure, conduct and performance of marketing systems, margins and seasonal price variation of selected fruits in AJK.

Project Title: ***Extension interventions through public and private sectors in agriculture of Balochistan.***

Principal Investigator: ***Syed Mohammad Arif***
Associate Professor

Location of Project: *Department of Economics, University of Balochistan, Quetta*

Duration:	*24(months)*	*Total Cost (Rs. million):*	*1.865*
Start Date:	*9/13/2005*	*Funds Released (Rs):*	*828900*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*727634*

Objectives:

- To assess the impact of extension interventions in term of increase in agricultural productivity and increase in farmer's income of the target people in the province of Balochistan.
- The assessment of effectiveness, suitability, adoption and continuity (sustainability) level of these interventions/ technologies/ technical packages by beneficiaries of the target area.
- To compare the public sector efficiency with that of private sector in terms of extension efforts, technology transfer, addressing sustainability issue and standard of delivery of services at grass root level.
- The factors and constraints responsible for low or non-adoption and non-continuity of the introduced packages for improvement in production system in the province.
- The lessons to be drawn from the experiences of the introduced extension packages to be used as guideline in future for any intervention.
- Based on the information generated from this project, suggest a workable mechanism of functionality of the institutions ensuring sustainability of the packages of intervention.

Achievements/Progress:

Conducted the field survey and collected the information through the questionnaires structured for the purpose. The farmers were interviewed in detail and questionnaires were filled in a required number in Qilla Saifullah District.

A second sample district was Quetta where the same process of collecting data was adopted. A field survey was conducted "and the required information was collected through questionnaires. The required farmers were interviewed in detail and questionnaires were filled in a required number in the district.

Data of the two districts; Las Bella and Naseerabad was entered to be used for analyses and the entry of the data of other two districts is in process. Also a process of related tabulation work under a well thought tabulation plan is in process. This tabulation plan is the basis for analyses of the data to be carried out as a next step.

Before initiating the process of data analyses, a required tabulation plan was prepared during the period under discussion and the related work of structuring required tables commenced. The tabulation work of the two districts of Las Bella and Naseerabad has been carried out and for the other two districts; Qila Saifullah and Quetta; similar work will be started in the first week of January 2007.

Project Title: ***Socio-economic and health implecations of female unpaid work in agriculture and livestock sector: A study of three cropping zones of Punjab***

Principal Investigator: ***Dr. Muhammad Iqbal Zafar***
Professor

Location of Project: *Department of Rural Sociology, University of Agriculture, Faisalabad.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*1.155*
Start Date:	*10/4/2004*	*Funds Released (Rs):*	*409100*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*292940*

Objectives:

- To identify the extent of female unpaid work and the recognition of their multiple roles in agricultural production and livestock management and the family maintenance.
- To study the issues of women's poverty, economic dependency, lack of autonomy in the decision-making process in the context of their unpaid work in agriculture and livestock sector.
- To identify the implications of women's participation in agriculture and livestock farming on their health in general and particularly reproductive health.
- To explore the women's perceptions about the government of Pakistan's efforts for their socio-economic and health development.
- To suggest measures to the government in the light of research findings for farming a comprehensive policy for gender development.

Achievements/Progress:

The research work conducted by different researchers on the subject has been reviewed. The process of literature review will remain in process at the different stages of the project.
Site selection survey was carried out in three districts (Six thesis) of the Punjab-Faisalabad Gujranwala and Chakwal as proposed in the project document.
Project equipment was purchased through purchased through purchase committee constituted by the University of Agriculture, Faisalabad
The case for the recruitment of research fellow as provided in the project is under process.

Project Title: ***Strengthening of design and analysis capabilities in the National Agricultural Research System (NARS)***

Principal Investigator: ***Dr. Muhammad Inayat Khan***
Professor/ Chairman

Location of Project: *Department of Mathematics & Statistics, University of Agriculture, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*2.833*
Start Date:	*8/28/2004*	*Funds Released (Rs):*	*1575700*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*1107702*

Objectives:

- To conduct experiments on improved experimental designs at PARS (university agricultural field experiments station), NARC Islamabad and at AARI to test the efficiency of the designs.
- To disseminate and introduce novel statistical methods and advance but statistically efficient experimental designs for agricultural experimentation, through trainings and workshops.
- To tutor statistical softwares (GENSTAT and SPSS) for the scientists of NARS to improve their data handling and analysis capabilities.

Achievements/Progress:

To meet the objectives and examine the effectiveness of Alpha Lattice design in field, experiments on wheat, rice and maize crop were conducted in both years under different layout plans.

To determine the efficiency of alpha lattice design as compared to randomized complete block design, thirteen experiments in year one and eleven experiments in year two on different cops, instead of nine experiments in work plan, were conducted.

Data on different parameters was recorded during the crop seasons. The collected data was edited and put on the computer for data analysis. Since the design efficiency was the primary objective, therefore at this stage of the project the analysis was focused on providing the answer to the efficiency problem.

One of the major advantage of the alpha lattice design is that it can be analyzed as RCB design by treating the super blocks as ordinary block when no benefit of extensive blocking is noticed in the analysis. This property of Alpha design makes it more usable.

The error mean square (EMS) and coefficient of variation (C.V.) for both RCBD and Alpha lattice design for each experiment were presented in the results at this stage of the project. Also relative efficiency of Alpha lattice design over RCBD were calculated.

For each wheat trial, the analysis shows the smaller mean square error, smaller C.V. values as compared to RCB design except the NARC trials. It indicates that small blocks have undoubtedly improved the precision of variety trials resulting in better discriminating power to test the significance of differences between varieties.

The results of wheat trials conducted at different research institutes indicate that the gain in efficiency of alpha lattice design is comparatively high as compared to previous year. Results, however, varied greatly from trials to trials in both years.

The maximum efficiency!n this year was 141% in BAR!, Chakwal and 139% in PARS, Faisalabad respectively. It is important to note here that no gain in efficiency in BAR!, Chakwal under the same layout in previous year. Gain in efficiency in other trials were 127% and 123 %. No gain in efficiency in NARC experiments in both years.

The results of the both rice trials conducted at Rice Research Institute, Kala Shah Kaku indicates that error mean square (EMS) for Alpha design are smaller than RCB design, which implies that blocking is effective for both these trials. The CV values from both experiments for Alpha design are reasonable and indicating that the trials are reliable. The relative efficiency calculated for these experiments are 115 % and 121 %. This indicates that the use of the alpha lattice design instead of RCB design increased experimental precision by 15 % and 21 % respectively.

Gain in efficiency in maize trials is not very high. Maximum 22 % efficiency was observed while in remaining trials we obtained 9% and 1 % precision which is not very high. The results of these trails show that Alpha lattice design was not very efficient in these trials. This indicates that reducing the size of the blocking has not benefited. So for these trials, a randomized complete block design analysis would suffice. In trials where, there is no gain in efficiency due to designing, we will explore modeling approach to refine the results. So it is planed that, in final report of the project, some reliable and efficient modeling techniques are used to obtain maximum gain in efficiency through design and analysis. Keeping in view the importance of human resource development in agriculture two courses has been conducted to enhance the analytical capabilities of the statisticians and biological scientists so that they have better grip on the latest tools of data analysis for use in research, as well as they have knowledge about new statistical design whjch can provide them better efficiencies for their experiments.

Twenty participants from different research institutes who already attend the previous year course were participated in the workshop. In training course "Advanced Biometric Techniques for Agricultural Research System in Pakistan" the emphasis was given on basic statistical concepts specially related to experimental design. All basic designs CRD, RCBD Latten Square design, factorial experiments, split plot design, nested design, incomplete block design and generalized lattice design were taught. While in course "Applied Multivariate Statistical Techniques using different Statistical Packages" the emphasis was given on important multivariate techniques like MANDV A, principal component analysis (PCA), factor analysis and cluster analysis, and the interpretation of results, using application data. Experiments on other two crops namely rice and maize were conducted according to plan. Data on different agronomic parameters of these crops at harvest time will be collected.

Project Title: ***Enhancing agricultural productivity through transfer of demand driven technologies to the farmers in the selected districts of Sindh***

Principal Investigator: ***Mr. Manzoor Ali Memon***
Senior Scientific Officer

Location of Project: *Technology Transfer Institute (PARC),Tandojam,Sindh*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.36*
Start Date:	*8/18/2004*	*Funds Released (Rs):*	*3996800*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3297405*

Objectives:

- To identify issues, constraints, and opportunities and prioritize farmer's needs of improved interventions through PRAs & other informal & multi-disciplinary approaches.
- To create Information Exchange Forum (IEF) at the village/community level through already formatted Community Based Organizations (CBOs).
- Establishment of database of research-based tested and proven technologies/interventions available with ARS located in the province.
- Creation of functional linkages with Extension, Research and other line departments to make IEF operational through two-way flow of information developing effect mechanisms of technology transfer to the end users.
- Organize and undertake capacity building programmes for farmers, activists, and extension workers of all cadres as well as district government functionaries on sustainable basis.
- To transfer the demand driven technologies to the farmers according.
- Institutionalize Participatory Monitoring & Evaluation (PME) system at CBO level for performance assessment and on-going monitoring and Evaluation.

Achievements/Progress:

Based on the agro-ecological zones or major cropping system in the province four districts has been selected. From each district one taluka selected as project area. From Thatta taluka Sujawal, from Mirpurkhas taluka Kot Ghulam Muhammad, from Shikarpur taluka Khanpur and from Hyderabad taluka Tando Allahyar has been selected.A cluster of five village in each selected for project activities. From each village number of CBOs and Vos and their members has been listed to provide them support through the project for capacity building. Technology transfer activities through the project will be continuous process specially in the area of skill improvement, communication and adoption of new technologies.

PRA has been carried out in collaboration with extension staff and other line department and CBO office bearers. A comprehensive questionnaire has been developed to collect the base line information form the target population. Questionnaire has been finalized to conduct the baseline survey in the selected village to document the existing situation. Technology transfer through latest technologies i.e. computer with other electronic media (TV & radio) will be used for transfer of required information to the farmers. Distribution of printed brochurs etc. through IEF will be carried out. The collected information may also be useful even after completion of the project as it provide a basis for measurement/ evaluation of the impact of the projects. The purpose of the need assessment survey was to generate information regarding existing situation of the target area.

The personal characteristics of the farmers and socioeconomics conditions related to their families and farmers are generally considered important influencing their innovations, decision making and productivity. These include farms age and education levels, family size and composition, family labor, on-farm and off-farm implements has been analyzed and farmers' irrigation source and location of on-farm water course has been identified. The most important intervention identified is lack of availability of certified seed of major crops and vegetables in the selected districts of Sindh. The main reason for this is that most farmers use their own seed for many years and do not appreciate the need for good seed. A seed purification and replacement program could help to over come this problem. The Sindh Seed Corporation needs special attention, funds and resources to produce quality seed of major crops. There is need of more sales points, greater participation of private sector distributions, sale of certified seed in small lots of 5-10 kgs, and more widespread information dissemination through extension, radio and TV. Timely sowing is an important factor for its rapid and successful growth. Crop sown on proper time gave best germination. The sample farmers 82 percent reported that they do not practices timely planting. It is suggested that awareness among farmers in the target area is necessary to adopt timely planting of crops to enhance crop production.

Good land preparation is important component of the recommendations to obtain better crop yield. There are number of other advantages for good land preperation.Among its advantages are timely planting, improved crop stand and a substantially reduced cost of land perpetration and sowing. It is suggested that farmers in the target areas are educated for good land preparation to enhance crop portability through promotion of land perpetration. Water is an important input and plays an important role on crop production. Overall 62 percent farmers reported inadequate water availability in the study area. It is suggested that increase water availability in the study area. It is suggested that increase water availability in the study area us important to enhance crop productivity. Credit is an important instrument which enables farmers to acquire command over the use of working capital and consumption goods. In the study area most of the farmers found interest in obtaining institutional credit for investing in various activities of crop and livestock enterprise, it is suggested that institutional credit should be provided to the farmers on easy terms and conditions.

Keeping in view the above priority intervention to enhance the crop productivity, the back stopping support will be provided for capacity building of selected CBOs members and extension workers in the selected districts of Sindh. A continuous process, especially in the area of capacity building and transfer of new technologies. The target population for human resources development: GBOs (male and female) members, extension workers. A future strategy has been outlined for enhancing crop productivity and poverty alleviation in the target area.

Project Title: ***Poverty alleviation through increasing agricultural productivity by transferring improved and tested technologies at the farm-level***

Principal Investigator: ***Dr. A. D. Sheikh***
Senior Scientific Officer

Location of Project: *Technology Transfer Institute (TTI) , PARC, Faisalabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*5.115*
Start Date:	*8/18/2004*	*Funds Released (Rs):*	*3671600*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3458814*

Objectives:

- Transformation of traditional agriculture into science based agriculture by enhancing interface of research scientists with agricultural extensionists and farmers.
- To reduce poverty in the rural areas through enhancing productivity of less privileged and resource poor farmers of the project area. The specific objectives of the project are:
- To identify issues, constraints, and opportunities and prioritize farmer's needs of improved interventions through PRAs & other informal & multi-disciplinary approaches.
- To create Information Exchange Forum (IEF) at the village/community level through already formatted Community Based Organizations (CBOs).
- Establishment of database of research-based tested and proven technologies/interventions available with ARS located in the province.
- Creation of functional linkages with Extension, Research and other line departments to make IEF operational through two-way flow of information developing effect mechanisms of technology transfer to the end users.
- Organize and undertake capacity building programmes for farmers, activists, and extension workers of all cadres as well as district government functionaries on sustainable basis.
- To transfer the demand driven technologies to the farmers according.
- Institutionalize Participatory Monitoring & Evaluation (PME) system at CBO level for performance assessment and on-going monitoring and Evaluation.

Achievements/Progress:

Three sites have been selected in mix cropping zone (One union council in each district)
- Sammundri (Faisalabad)
- Jhang
- Gojra (Toba Tek Sindh)

Three sites have been selected in rice wheat zone (One union council in each district)
- Gujranwala
- Sialkot
- Sheikhupura

Questionnaire has been designed.

Need assessment survey has been completed in Rice-Wheat and Mix Cropping Zone.
Farmers' needs have been identified on basis of the preliminary results of Need Assessment Survey.

List of farmers have been prepared.

Agricultural (Research Scientists, educationists and extensions) experts have been identified.

Meetings with agricultural experts are underway to seek their consent on formation of IEF.

Nine field days on all six sites of the project were conducted on production technologies of following crops (Detail of FDs attached at end), Rice Maize, Kharif Fodders, Sugarcane and Sesame.

Three demonstration plots of rice crops have been plotted at three project sites in the Rice-Wheat Zone.
- Sahnawali, UC Per Chak (Daska)
- Kot Yousaf, UC Jora Sian (Wazirabad)
- Bhattainwal, UC Daukey (Murredkey)

Data analysis and report writing for Need Assessment Survey Report has been completed.

Farmers' needs have been identified on basis of the results of the Need Assessment Survey.

The information exchange forum has been completed and submitted to SSD for approval.The information exchange forum has been notified by the SSD for working.Three demonstration plots of rice were conducted in Daska, Wazirabad and Muridkey for increasing plant population as per recommendation of Agri. Department.

Eight field days on all six sites of the project were conducted on production technologies of wheat crop.

Project Title: ***Poverty alleviation through introducing improved and tested technologies for rural agricultural farming communities in the selected districts of Balochistan***

Principal Investigator: ***Mr. Muhammad Afzal***
Director

Location of Project: *Technology Transfer Institute (PARC), Siriab Road, Quetta,Balochistan.*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.822*
Start Date:	*8/28/2004*	*Funds Released (Rs):*	*3253200*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2354739*

Objectives:

- Identification of issues, constraints, opportunities and prioritize farmers' needs of improved technologies.
- To establish information exchange forum (IEF) at the village and community level through existing CBOs;
- To enlist research based tested and proven technologies/ interventions available with NARS located in the province;
- Arrangement of capacity building programs for farmers, activist, and extension workers, of all cadres as well as district government functionaries on sustainable basis;
- To create the functional linkages with extension, research and all line departments to make IEF operational through two way flow of information. Developing mechanisms of technology transfer to the end users.
- Disseminate the demand driven technologies to the farmers;
- Establishment of a participatory, monitoring and evaluation (PME) system at CBOs level for performance assessment and ongoing monitoring and evaluation.

Achievements/Progress:

Baseline survey was conduected from 256 farmers from floowing 5 locations were interviewed:
- Pishin
- Dhadar
- Loralai
- Lasebela
- Turbat

Priority interventions has been done in the following districts:
- Jaffarabad
- Bolan
- Loralai
- Pishin
- Mastung

Five field days were conducted on the following locations:

Title	Venue
i. Wheat varietal adoption and production technology	Bolan
ii. Wheat varietal adoption and production technology	Loralai
iii. Wheat varietal adoption and production technology	Pishin
iv. Wheat varietal adoption and production technology	Mastung
v. Blight disease in Tomato	Bolan

Project Title: ***Poverty Alleviation through Enhancing Agricultural Productivity by Implementing Priority Interventions in the Selected Areas of AJK***

Principal Investigator: ***Mr. Ghulam Sadiq Afridi***
Sr. Scientific Officer

Location of Project: *Technology Transfer Institute (PARC), Muzaffrabad, AJK*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.279*
Start Date:	*8/27/2004*	*Funds Released (Rs):*	*3020000*
Project Status: On-Going		*Funds Utilized (Rs):*	*2306650*

Objectives:

- To alleviate poverty in rural areas through enhancing productivity of farmers in the project areas.
- To find out the current status of agricultural productivity and its potential for enhancement in the project area.
- To identify and prioritized the major constraints in the enhancement of agricultural productivity.
- To remove the identified constraints through transfer of tested technologies and capacity building programs.
- To create Information Exchange Forum (IEF) through existing Community Based Organizations (CBOs) and to create functional linkages with lie department to make IEF operational.
- To assess the impact of the tested technologies on the productivity level of farmers in the selected villages.

Achievements/Progress:

Literature regarding the project has been collected and reviewed.
Site selection in four districts (Mirpur, Bagh, Kotli and Muzaffarabad) already mentioned in the approved PC-I has been completed.
Cos at all four project sites have been created.
Baseline/ Need Assessment Survey of the Cos (beneficiaries) at all four sites has been completed and report writing is in progress.
Constraints hindering agricultural productivity in the project area have been identified.
Functional linkages with line departments have been established.
Information Exchange Forum (IEF) have been formed for efficient intervention in the project area.

Project Title: ***Development of agriculture from subsistence level to productive level through transfer of tested technology in the Northern Areas of Pakistan***

Principal Investigator: ***Mr. Shaukat Hayat Sadozai***
Director

Location of Project: *Technology Transfer Institute, (PARC) River View Road, KARINA, Gilgit*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*3.926*
Start Date:	*8/18/2004*	*Funds Released (Rs):*	*3641300*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*3056072*

Objectives:

- To find out the current status of agricultural productivity and its potential for enhancement in the project area.
- To identify and prioritized major constraints in the enhancement of agricultural productivity.
- To remove the identified constraints through transfer of tested technologies and capacity building programs.
- To create Information Exchange Forum (IEF) at the village/ community level through existing Community Based Organizations (CBOs) and create functional linkages line departments to make IEF operational.
- To assess the impact tested on the productivity level of farmers in the selected villages.

Achievements/Progress:

On the basis of the outcome of need assessment survey pre and post harvest losses in fruits/veg. were identified as one of the major problem of ALP core project area. To minimize these losses priority intervention on fruits/veg. was developed in collaboration with PCSIR/AKRSP/KARINA. The following training programmes were organized for the capacity building of farmers/activists and extension workers.

Eleven training programmes on preparation of plum syrup/Plum Jam/Tomato Purey /Cheery jam /Apple Jam and Apricot jam were organized in village Hussain Abad, Tohrgo Bala, Tohrgo Payain of Skardu District, Gintha, Kharfuk, Bara Bala of Ganchi District, Nazar Abad, Prince Abad Bala, Prince Abad Payain of Gilgit District, Gas Payain and Gonar Farm of Diamer District. In addition to above mentioned activities three training programmes and two field days were also organized on orchard management with special reference to insect pest control for minimizing pre harvest losses. These training programmes/field days were arranged in the core project area of District Gilgit, Skardu and Ghanchei.

Moreover brochures on Tomato Purey Preparation, Fruits Jam Preparation, Fruits Syrup Preparation, Preparation of Tomato Products on Domestic Level, Tunnel Technology and Vegetable Cultivation in NAs were also developed and distributed among all the stakeholders to sustain these activities.

Wheat is the most dominant crop grown in all parts of Northern Areas. It has pivotal position in the rural economy of NAs. During the survey it was observed that wheat yields are very low in NAs. The major factors contributing these low yields are unawareness of improved wheat varieties, late sowing due to free grazing and inefficient' use of fertilizers. Keeping in view the above scenario wheat

intervention was developed in the ALP core project area in collaboration with AKRSP/NADP/KARINA. Eight training programmes on 'Wheat management practices with special attention to variety, time of sowing and efficient use of fertilizer were organized in Gonar Farm, Gas Payein, Bonar Das in District Diamer; Princeabad Bala and Nazar Abad in District Gilgit and Pakora, Rahim Abad and Chatorekand of District Ghizer. Training programmes arranged for Ghanche and Skardu Districts were not performed due to prevailing law and order situation in the area. In addition to above activities six field days were also arranged in different villages i.e., in Villages Gas and Gonar Farm of District Diamer, Prince Abad of District Gilgit and Chatorekand, Pakora and Rahim Abad of District Ghizer. Moreover Brochures developed on wheat were also distributed. Among all the stakeholders.

Livestock sector in the area plays an important role by contributing 67% in the income generation of the households. Survey indicates that the prevalence of diseases in livestock on higher scale in the area not only hinders the livestock production but also affect the income generation –activities negatively.

Keeping in view the above facts, interventions in livestock management practices were also developed with special emphasis on disease prevention and treatment. Three training programmes on livestock disease preventive and curative measures were organized in collaboration with the Livestock Department of Nas at Gonar Farm of Diamer District, Princeabad of Gilgit District and Pakora of Ghizer District. Brochure on livestock diseases and their cure was developed and distributed among the livestock holders in the project area.

Project Title: ***Human Resource Development (HRD) in the Changing Environment of Globalization – Collaboration with APO***

Principal Investigator: ***Dr. Abdul Hayee Qureshi***
Senior Scientific Officer

Location of Project: *(WTO) Social Sciences Division, PARC, Islamabad*

Duration:	*36(months)*	*Total Cost (Rs. million):*	*4.735*
Start Date:	*4/27/2005*	*Funds Released (Rs):*	*3732100*
Project Status:	*On-Going*	*Funds Utilized (Rs):*	*2486183*

Objectives:

- To provide an opportunity to the participants from the APO member countries to share their views and experiences on the issues confronting to agriculture sector;
- To learn methods and procedures to assess and analyse policies and issues pertaining to the chosen areas of agriculture;
- To suggest policy recommendations and solutions for higher agricultural productivity and production.

Achievements/Progress:

The project has been launched successfully and capital assets to carry out project activities have been purchased.

First International workshop on "Food Safety Standards for Better Export of Fruit and Vegetable Products" had successfully been organized from 12-16 December, 2005 at Holiday Inn, Islamabad

Participants from eight APO member countries participants in the workshop besides international resource persons from Australia, Canada, Pakistan and Thailand.

Second workshop has also been organized successfully on "Intellectual Property Rights in Agriculture" from 3-7 April 2006 at University of Agriculture, Faisalabad.

Participants from thirteen APO member countries participated in the workshop besides international resources persons from Holland, Philippines and Pakistan.

Two workshops per year were planned in the project and third workshop on "Techniques of commercialization Agricultural Technologies for increased Productivity" is being negotiated with the APO, Japan. Notification by the APO Secretariat will be made soon.