

11th Annual Progress Report

Animal Sciences

Name of Project: Angora Rabbit Farming as High Value Livelihood Source for Pakistani Women

Name of PI/Institute: Dr. Muhammad Afzal
Senior Scientific Officer, LRS, ASI, NARC, Islamabad

Duration: 18. 01. 2010 to 31. 12. 2013

Financial Status: Total Cost: Rs.4.568 million
Funds Released: Rs.3.594 " (upto 31.12.2013)
Funds Utilized: Rs.2.970 " (upto 30.06.2013)

Objectives:

- To study the performance of Angora rabbit under Pakistan conditions.
- Develop Angora rabbit farming as high value livelihood source particularly for women in Pakistan

Achievements:

Standardize Angora rabbit farming technology under the local conditions.

Breeding process of angora rabbits was controlled due to shortage of space. The number of rabbits was 60 as on 30. 06. 2013. These were maintained properly (combing on alternate days, wool shearing when approximately 3-4 inches long, daily routine cleaning of hutches, feeder and water pots (formulated feed), mating, gestation period, kindling process, care for babies and disease studies and use of medicine).

Angora wool handed over to PATCO and thread was prepared with their collaboration. 22 shawls (36" x 72") were weaved and shawls are with PATCO.

70 rabbits were distributed to different farmers and are rearing successfully.

The project staff remained in touch with farmers and gives them advice for proper maintenance of rabbits. Animals showed heat and mating took place at farmers' level. However, after kindling, the survival rate of baby angora was very poor probably due to poor management. The farmers have been advised to keep babies in kindling boxes made of hard sheets. It is hoped that improved management will result in increased survival of babies.

Name of Project: Use of Exogenous Fibrolytic Enzyme: Influence on Chemical Composition, Digestion Kinetics of Fodder Grass Silage and Buffalo Performance

Name of PI/Institute: Dr Mahr-un-Nisa,
Asstt. Prof., Inst. of Animal Nutrition and Feed Tech., Uni. of Agri., Faisalabad

Duration: 01.07.2012 to 30.06.2015

Financial Status: Total Cost: Rs.6.480 million
Funds Released: Rs.2.183 " (upto 31.12.2013)
Funds Utilized: Rs.1.150 " (upto 30.06.2013)

Objectives:

- Chemical composition and digestion kinetics of FG (fodder grass) as influenced by varying levels of fibrolytic enzymes.
- Effect of varying levels of exogenous fibrolytic enzymes on ruminal characteristics, in-vivo digestibility and blood metabolites of Nili-Ravi buffalo bulls fed FG silage.
- Growth and fattening performance of Nili-Ravi calves as influenced by diets varying in silage to concentrate ratio with or without exogenous fibrolytic enzymes.
- Influence of diets varying in silage to concentrate ratio with or without exogenous fibrolytic enzymes on milk production and its composition in Nili-Ravi buffaloes.

Achievements:

The inadequate and irregular supply of quality fodder is one of the major factors affecting the ruminant animal productivity in Pakistan. Ensiling fodder will not only ensure its availability round the year but will also help to maintain its quality. Enhanced feeding value of silage by the application of fibrolytic enzyme will spare concentrate and also improve the digestibility of forage-based diets leading to economical milk and meat production. Direct fed exogenous enzymes may improve the growth performance and milk production in ruminants by improving the feed utilization efficiency.

Two trials were conducted separately during the report period to determine the best levels of exogenous fibrolytic enzyme fed indirectly and directly to animals. In one experiment oat grass was ensiled in laboratory silos using varying enzyme levels and thereafter an in-situ trial was conducted to examine its digestion kinetics. Laboratory silo and digestion kinetics studies yielding best results were used to ensile oat grass at larger scale. The results showed a linear increase ($P < 0.05$) in CP and TP contents with increasing enzyme level. However, a linear decrease ($P \leq 0.05$) in NDF and ADF contents was noticed with increasing enzyme level. Thus highest enzyme level (4g/kg DM) was used to ensile oat grass at larger scale.

In second experiment oat grass was ensiled using enzyme (4g/kg DM) at larger scale and metabolic trial was conducted to determine the best direct-fed enzyme level yielding best result. The DM, CP, NDF and ADF digestibilities were higher in buffalo bulls fed diet containing medium enzyme level (2g/kg NDF) and hence this direct-fed enzyme level (2g/kg NDF) will be used in subsequent studies.

It can be concluded from these trials that 4g/kg DM exogenous fibrolytic enzyme furnishes better results. Indirect use of fibrolytic enzyme for silage treatment can reduce pH that is the good indicator of quality silage. Silage treated with 4g/kg DM enzyme increase CP and TP contents and decrease NDF and ADF contents. In case of direct feeding, 2g/kg NDF enzyme offers better results. Nutrients digestibilities in buffalo bulls can be improved by feeding direct fibrolytic enzyme.

Name of Project: Up-gradation of Our Local Rabbit for Meat Production

Name of PI/Institute: Dr Sarzamin Khan,
Associate Professor, Department of Poultry Science, The
University of Agriculture, Peshawar

Duration: 24.05.2012 to 23.05.2015

Financial Status: Total Cost: Rs.3.922 million
Funds Released: Rs.2.247 " (upto 31.12.2013)
Funds Utilized: Rs.1.802 " (upto 30.06.2013)

Objectives:

- To assess the meat production potential of our local rabbits under farm condition.
- To assess the cost benefit ratio of rabbit farming
- To evaluate the future of rabbit farming for introduction among local farmers through development of a local breed and optimum set of local condition.

Achievements:

In order to document the status of rabbit farming and its acceptability as meat animal, a survey study was conducted. The survey study documented rabbit production practices and its acceptability as meat animal in Khyber Pakhtunkhwa province.

Proper detail about rabbit breed was not available. However the local people have grouped them into six varieties according to their body color. These included black & white, white bay, black, gray and bay. Among these black & white breed was the most dominant. The adult body weight of different breeds recorded ranged from 1.25 kg to 2.25 kg. The white bays were heavier while bay was lighter than the other breeds. Existing practice of breeding was found as natural and the mates select their opposite sex irrespective to the breed type on the base of available opposite sex mate. Prolificacy rate is very high in some regions and reach to 10 births per annum with 8-12 kids per birth. Three types of housing systems i.e. kacha & covered, kacha and rabbit made tunnels were used in the province with no proper scientific housing and feeding practices. The survival rate in different age groups showed a high survival of the young as well as adult stock. No proper attention is paid to rabbit nutrition according to rabbit body requirements. Green grasses, fruits and vegetable wastes are fed to them. In some regions like Bannu, D.I.Khan, and Kohat, very high acceptability of rabbits as meat animal was observed (above 80%). While in other regions like Mardan, Malakand, Peshawar and Hazara, the acceptability was comparatively lower (60%). The survey study concluded that scope for improvement in rabbit production and its use as meat animal exists in the province and could be explored under present project in future.

Feed palliating unit established in December 2012. Breeding and maternity cages were also

procured through local producers after providing them the desired designs. Now rabbit collection from different locations of the province is in progress. On overall basis, 70% people have accepted the rabbit as meat animal; however there were some traditional and religious myths about the use of rabbit meat in some people.

Name of Project: **Improved Utilization of Beetal Goats through Open Nucleus Breeding Scheme**

Name of PI/Institute: **Dr Muhammad Sajjad Khan,**
Professor, Department of Animal Breeding and Genetics,
University of Agriculture, Faisalabad

Duration: 17.05.2012 to 16.05.2015

Financial Status: Total Cost: Rs. 1.942 million
Funds Released: Rs. 0.880 " (upto 31.12.2013)
Funds Utilized: Rs. 0.619 " (upto 30.06.2013)

Objectives:

- To devise strategy of breed improvement in the two strains of Beetal goats through participatory approach under open nucleus breeding system.
- Recording of flocks of two Beetal strains viz; Makhi-Cheeni and Faisalabadi.
- Selection of superior does and bucks for breeding in the registered flocks.
- Distribution of superior bucks in field for genetic improvement.

Achievements:

Twelve Makhi Cheeni Beetal farmers and six Faisalabadi/Desi Beetal farmers were initially visited at two sites (Chishtian and Faisalabad) and basic data on flock structures were recorded. Data formats were finalized both for flock level and animal level information keeping in view the project objectives.

Eight Makhi Cheeni Beetal farmers and four Faisalabadi Beetal farmers were registered. One flock of Beetal Makhi Cheeni was registered later at site-I. In nine flocks of Makhi Cheeni Beetal, 149 does and 8 bucks have been phenotyped/ measured at site 1 and in five flocks of Faisalabadi Beetal at site II, 154 does and 4 bucks were phenotyped. Kids (45 female and 25 male) born with registered flocks were tattooed and weighted and are being followed for selection and culling decisions by farmers. Non-availability of good quality breeding bucks and high mortality during winter were apparent during the reporting period. Awareness regarding selection protocols is improving with registered flocks. To improve availability of good quality bucks another project is being initiated with different stakeholders on board.

One student enrolled in M.S (Hons.) Animal Breeding and Genetics at University of Agriculture, Faisalabad is working in project utilizing project data for thesis writing.

It has been concluded from the survey and study that a lot of variation exists in performance traits in Beetal goat indicating that selection can be effective in making improvement. Farmer's awareness regarding genetic abnormalities is low and can be improved through interacting with them and training them. Convincing farmers to retain certain male kids is difficult due to financial compulsions to meet their domestic needs.

Name of Project: Evaluation of microorganisms, clays and herbs for mycotoxin degradation and their effect upon nutrient availability in chicken

Name of PI/Institute: Dr. Muhammad Zargham Khan
Professor, Department of Pathology, Faculty of Veterinary Sciences, University of Agriculture, Faisalabad

Duration: 01.07.2012 to 30.06.2015

Financial Status: Total Cost: Rs. 7.081 million
Funds Released: Rs. 3.802 " (upto 31.12.2013)
Funds Utilized: Rs. 2.952 " (upto 30.06.2013)

Objectives:

- To evaluate the aflatoxin inactivating/binding potential of locally available mycotoxin binding/inactivating agents like bentonite clay, distillery sludge, yeast and *Silybum marianum* in poultry birds.
- To evaluate the ochratoxin inactivating/binding potential of locally available mycotoxin binding/inactivating agents like bentonite clay, distillery sludge, yeast and *Silybum marianum* in poultry birds.

Achievements:

Procurement of Candidate Toxin Binding Agents: Bentonite clays were procured from Chakwal region. Distillery sludge, a waste product of ethanol production, was initially obtained from Shakar Ganj Distillery Jhang. After its closure till end of the year, it was obtained from Crystalline Chemical Industries Sargodha. It is a liquid substance containing spent yeast. At present attempts are being made to bring it in the solid/ semisolid form for mixing in the poultry feed. Attempts are being made to bring it in the solid/semisolid form for mixing in the poultry feed. Seeds of *Silybum marianum* were obtained and experimentally sown in the fields. The seeds germinated and plants grew successfully yielding about 3 kg seeds. This year *Silybum marianum* will be again cultivated to collect more seeds for experimental studies.

Chemical Analysis of Bentonite: The suppliers of bentonites came with the chemical analysis already conducted at PCSIR and PAEC labs. This chemical analysis is mandatory for these suppliers to market this product to different industries using bentonite. The chemical examination report generated by PCSIR Lab, Lahore is given below:

Chemical Analysis of Bentonite Clay (w/w%)

Method Used: ASTM-18 & ASTM-D-4318

Loss in Ignition (L/I)	14.00
Silica (SiO ₂)	46.28

Alumina (Al ₂ O ₃)	14.70
Iron Oxide (Fe ₂ O ₃)	07.50
Calcium Oxide (CaO)	11.22
Magnesium Oxide (MgO)	05.00
Sodium Oxide (Na ₂ O)	00.91
Potassium Oxide (K ₂ O)	00.38
Specific Gravity	2.24
Liquid Limit	40
Plastic Limit	24
Plasticity Index	16

Chemical Analysis of Distillery Sludge: The chemical analysis of distillery sludge was conducted at Institute of Animal Nutrition and Feed Technology at UAF. It was also published in an international journal. The chemical analysis of the distillery sludge is given below:

Proximate Composition			Amino Acid Profile (%)		
	Raw	Washed		Raw	Washed
Metabolizable energy (kcal/kg)	2,200	2,375	Lysine	0.435	0.549
Crude protein	27.40	34.80	Methionine	0.542	0.689
True protein	18.10	28.20	Threonine	0.827	1.047
Ether extract	1.10	1.20	Arginine	1.465	1.861
Crude fiber	0.00	0.00	Leucine	1.183	1.503
Ash	22.08	11.88	Isoleucine	1.019	1.294
Acid soluble ash	20.10	7.91	Valine	0.989	1.252
Nitrogen free extract	49.52	52.22	Phenylalanine	0.912	1.158
Mineral Contents			Histidine	0.504	0.640
Calcium	3.44	1.330	Tyrosine	0.537	0.685
Phosphorus	1.220	0.550	Cystine	1.016	1.291
Potassium	3.520	1.293	Proline	0.619	0.786
Sodium	1.142	0.571	Glutamate	4.553	5.776
Magnesium	2.000	1.200	Serine	0.589	0.751
Manganese	0.010	0.004	Aspartate	1.726	2.192
Iron	0.194	0.107			
Zinc	0.010	0.008			
Copper	0.045	0.033			
Cobalt	0.003	0.002			
Chromium	0.011	0.010			

After production of sufficient quantities of aflatoxin/ ochratoxin, the experimental work will be conducted in the poultry birds to study the effects of different candidate binding agents by feeding them concurrently with the mycotoxins.

Name of Project: Evaluation of Bio-available Phosphorus in Indigenous Feedstuffs for poultry (NARC Coordinating Unit - Comp. I)

Name of PI/Institute: Dr Muhammad Iqbal Anjum,
SSO, Animal Nutrition Prog., ASI, NARC, Islamabad

Duration: 01.07.2012 to 30.06.2014

Financial Status: Total Cost: Rs. 2.265 million
Funds Released: Rs. 1.784 " (upto 31.12.2013)
Funds Utilized: Rs. 1.470 " (upto 30.06.2013)

Objectives:

- To generate database on phytate P of all plants source poultry feedstuffs i.e. cereal grains, cereal by products and vegetable meals.
- To determine bio-availability of P in all plant source poultry feedstuffs i.e. cereal grains, cereal by products and vegetable meals.
- To determine bio-efficacy of exogenous phytase enzyme from different origin in broiler chicks.

Achievements:

Collection of Samples of Poultry Feedstuffs: Samples of all plant source poultry feedstuffs i.e., cereal grains (corn, wheat, rice, sorghum, millet), cereal by products (wheat bran, rice polish) and vegetable meals (corn gluten meal 30% and 60%, canola meal, rapeseed meal, soybean meal, sunflower meal, guar meal, cottonseed meal) were collected from primary producers.

Chemical Analysis of Poultry Feedstuffs: Samples of poultry feedstuffs including cereal grains, cereal by products and vegetable meals were analyzed for proximate composition and minerals (K, Na, Cl, P and Ca) according to AOAC (1990) using atomic absorption spectrophotometer (M-Series Thermo Electron Corporation 150204). Sodium and potassium were analyzed by flame photometer. Aflatoxin was estimated by Vican (Fluorometer Series-4) and gross energy was measured with oxygen bomb calorimeter (Cal 2-3 Calorific Value) by Nukamp (1965) method. Phytate content was determined with Holt's method (Holt 1955). Poultry feedstuffs analysis information will help the feed millers/poultry farmers in precise poultry feed formulation.

Metabolic Trials: Twenty four layer male (cockerels) were purchased and reared for metabolic trials. Fifteen metabolic trials were conducted to determine the bio-availability of phytate P of all plant source poultry feedstuffs using cockerels by quick bioassay technique developed by Sibbald (1986). Six birds were used for each feedstuff to measure P bio-availability. A set of another six birds served as negative control used to determine endogenous excretion of P.

The results indicated that cereal grains contained undigested phytate P in the range of 61.58 to 63.68% and it was found that the lowest quantity of undigested phytate P was present in sorghum and highest in wheat. Undigested phytate P in cereal byproducts were 73.55 to 81.51% in wheat bran and rice polish respectively. Undigested phytate P in vegetable meal ranged from 61.13 to 77.24% and it was lowest in corn gluten meal 30% and highest in cottonseed meal. It showed no significant variation in undigested phytate P in corn gluten meal 60%, rapeseed meal, guar meal, soybean meal. In both canola meal and sunflower meal the undigested phytate P was almost similar.

Experimental Feeds Formulation: Based on chemical composition and phytate contents of ingredients, precise experimental rations formulated (broiler starter and finisher) was done for optimum growth. These rations will be used in growth trials on broiler chicks.

Remodeling of Shed and Installation of Broiler Battery Cages: Re-modeling of animal shed at Animal Nutrition Program ASI, NARC according to project requirement established. Sixteen broiler battery cages having rearing capacity of 250-300 broiler chicks under hygienic conditions installed in the environmental controlled house.

Name of Project: Evaluation of Bio-available Phosphorus in Indigenous Feedstuffs for Poultry (Uni. College of Agri., Rawlakot, AJK Comp. II)

Name of PI/Institute: Dr M. Safdar Anjum,
Prof., Uni. College of Agri., Rawlakot, Uni of Poonch, AJK

Duration: 01.07.2012 to 30.06.2014

Financial Status: Total Cost: Rs. 0.750 million
Funds Released: Rs. 0.258 " (upto 31.12.2013)
Funds Utilized: Rs. 0.065 " (upto 30.06.2012)

Objectives:

- To determine bio-efficacy of exogenous phytase enzymes from yeast origin in broiler chicks.

Achievements:

The funds to the project were released in October, 2012 after the agreement of the project implementation was signed with the host institute. Work was initiated on opening project accounts and making other necessary arrangements in January, 2013. During first half of the year, necessary cereals and other feed ingredients were collected from the AJK and chemically analyzed for computing the broiler rations. Formulae for computing the rations based on chemical compositions have been prepared.

In addition to the scientific work, broiler shed in the vicinity of the University has been constructed for launching the desired experimental trial.

Name of Project: Evaluation of Bio-available Phosphorus in Indigenous Feedstuffs for Poultry (Feed Dev. Centre, PARC, Naudero, Larkana Comp. III)

Name of PI/Institute: Dr Shahbaz Javaid,
SSO, Feed Dev, Centre, PARC, Naudero, Larkana

Duration: 01.07.2012 to 30.06.2014

Financial Status: Total Cost: Rs. 0.750 million
Funds Released: Rs. 0.276 " (upto 31.12.2013)
Funds Utilized: Rs. 0.084 " (upto 30.06.2013)

Objectives:

- To determine bio-efficacy of exogenous phytase enzymes from bacteria origin in broiler cheeks.

Achievements:

Phosphorus (P) in plant feedstuffs is mainly present in the form of phytate-P and it is not available for poultry due to lack of endogenous phytase enzyme. Supplementation of inorganic P i.e. di-calcium phosphate (DCP) is commonly done in poultry feed to fulfill P requirement of the birds which elevate cost of feed. Supplementation of exogenous phytase enzyme could be another option however; it could only be effective when phytate P content and their availability to bird are known for local feedstuffs. The project was therefore, formulated with aim to generate and compile database on phytate-P and bio-availability of P of all local plant source poultry feedstuffs. The main task during the reporting period was to collect samples of plant source feedstuffs commonly used in poultry feed i.e. cereals, cereal by products and vegetable meals. Three to four samples each of cereals (rice, wheat and maize) and cereal by products (rice polish, wheat bran) were collected from different parts of Sindh province including Larkana, Shikarpur, Sukkur and Jacobabad. Whereas, samples of vegetable meals (cotton seed meal, rape seed meal, canola meal, sunflower meal) were collected from Karachi. These samples were then dried and grinded in small size. These samples were analyzed in laboratory of Animal Nutrition Program at NARC, Islamabad for proximate composition, energy value and percent availability of P. The analysis for the estimation of phytate-P remain in progress during the reporting period. A biological trial using cockerels to determine bio-availability of P has also been conducted. Analysis of dropping samples to determine bio-availability of P remained in process. These values will help in accurate and precise feed formulation, particularly inorganic P supplementation in poultry diet. On the basis of information generated regarding phytate-P content of local plant source feedstuffs and bio-availability of P, feed will be formulated and supplementation of phytase enzyme of bacterial origin will be done and growth performance trial using broiler chicks will be conducted to assess bio-efficacy of that enzyme.

As a conclusion, generation and compilation of data base on phytate-P and bio-availability of P of all local plant source feedstuffs has been done the generated information will assist poultry feed manufacturers in accurate and precise formulation

Name of Project: **Development of Models for the Control of PPR in Pakistan and PPR Vaccine Using Local Isolate (Coordinating Unit, NARC- Comp. I)**

Name of PI/Institute: **Dr Aamer Bin Zahur,**
PSO, ASI, NARC, Islamabad

Duration: 01.11.2012 to 31.10.2015

Financial Status: Total Cost: Rs. 23.549 million
Funds Released: Rs. 5.877 " (upto 31.12.2013)
Funds Utilized: Rs. 2.819 " (upto 30.06.2013)

Objectives:

- Develop model for the control of PPR virus infection through vaccination among sheep and goats population in high risk tehsils of the country
- Systematic socio economic impact assessment and economic analysis of PPR vaccination programme
- Monitoring of viral activity in target districts with special emphasis on the changes in virulence of PPR virus circulating in small ruminants population
- Development of PPR vaccine using local isolate.
- Awareness campaign and capacity building of field staff

Achievements:

A total of 8 outbreak of PPR were investigated in Jhang (3), Faisalabad (2), Kahuta (1), Doltala (1) and Bhimber, AJK (1). The outbreaks were confirmed by ic-ELISA, RT-PCR, virus isolation and c-ELISA.

A standardized panel of diagnostic assay developed for detection of PPR virus. PPR virus are detected by RT-PCR using samples collected on filter paper.

For selection of local isolates of PPR virus strain for development of vaccine, genetic characterization of six local isolates of PPR virus strains is in process. After that a homologous lineage PPR vaccine will be developed.

Accomplished one million doses of PPR vaccine from Centre for Advance Studies for Vaccinology & Biotechnology (CASVAB), Quetta for distribution among provincial coordinating units.

One stakeholder workshop was arranged at Bhimber, AJ&K and one at Umarnkot, Sindh by the project components there. One awareness workshop to sensitize field veterinary staff and farmers about the issue was arranged by AJ&K project component.

Name of Project: Development of Models for the Control of PPR in Sindh Province (L&DD Deptt., Sindh, Hyderabad - Comp. III)

Name of PI/Institute: Dr Zahid Iqbal Rajput,
Vet. Officer, L&DD Deptt., Sindh, Hyderabad.

Duration: 01.12.2012 to 30.11.2015

Financial Status: Total Cost: Rs. 2.616 million
Funds Released: Rs. 0.837 " (upto 31.12.2013)
Funds Utilized: Rs. 0.419 " (upto 30.06.2013)

Objectives:

- Develop model for the control of PPR virus infection through vaccination among sheep and goats population in high risk tehsils in district Mithi, Tharparkar of Sindh Province.
- Systematic socio economic impact assessment and economic analysis of PPR vaccination programme
- Monitoring of viral activity in target districts with special emphasis on the changes in virulence of PPR virus circulating in small ruminants population
- Development of PPR vaccine using local isolate.
- Awareness campaign and capacity building of field staff

Achievements:

The project started on release of funds from January 2013. During the period upto June, 2013, target area of taluka/ tehsil Umerkot was selected for project activities. During the selection of tehsil, due consideration was given to small ruminant's population and animal movement pattern of the area.

A stakeholder's workshop on awareness regarding PPR disease to farmers was organized at Umerkot on 25th June 2013. Altogether 200 persons including Director General Livestock, Director Animal Husbandry Sindh, Disease Investigation Officer, Deputy Director Livestock (Umerkot/ Mirpurkhas), Farm Superintendent LES Nabisar Road, representative of NGO, distinguished speakers, veterinary officers, stock assistants, progressive farmers and sheep & goat farmers participated/ attended the workshop.

A colorful brochure in Sindhi (local) language regarding PPR disease and its control in animals was published and distributed among the participants during workshop to help in control of PPR following the remedial measures.

Name of Project: Development of Models for the Control of PPR in Khyber Pakhtunkhwa Province (L&DD Deptt., Khyber Pakhtunkhwa - Comp. IV)

Name of PI/Institute: Dr Ehsan Ullah Khan,
Director, Animal Health, L&DD Deptt., Khyber Pakhtunkhwa,
Peshawar.

Duration: 01.11.2012 to 31.10.2015

Financial Status: Total Cost: Rs. 2.616 million
Funds Released: Rs. 0.253 " (upto 31.12.2013)
Funds Utilized: (Financial report not provided)

Objectives:

- Develop model for the control of PPR virus infection through vaccination among sheep and goats population in high risk tehsils in district Chitral of Khyber Pakhtunkhwa
- Systematic socio economic impact assessment and economic analysis of PPR vaccination programme
- Monitoring of viral activity in target districts with special emphasis on the changes in virulence of PPR virus circulating in small ruminants population
- Development of PPR vaccine using local isolate.
- Awareness campaign and capacity building of field staff

Achievements:

The releases of funds to the project made in November, 2012. The project activities were initiated as per work plan. Since there no financial and technical progress has been reported by the PI of the project.

Name of Project: **Development of Models for the Control of PPR in Balochistan Province (L&DD Deptt., Balochistan - Comp. V)**

Name of PI/Institute: **Dr Gohram Khalid,**
Dy. Director (Livestock), L&DD Deptt., Balochistan, Lasbella

Duration: 01.11.2012 to 31.10.2015

Financial Status: Total Cost: Rs. 2.616 million
Funds Released: Rs. 0.253 " (upto 31.12.2013)
Funds Utilized: (Financial report not provided)

Objectives:

- Develop model for the control of PPR virus infection through vaccination among sheep and goats population in high risk Tehsil Bela in district Lasbella of the Balochistan Province
- Systematic socio economic impact assessment and economic analysis of PPR vaccination programme
- Monitoring of viral activity in target districts with special emphasis on the changes in virulence of PPR virus circulating in small ruminants population
- Development of PPR vaccine using local isolate.
- Awareness campaign and capacity building of field staff

Name of Project: Development of Models for the Control of PPR in Gilgit Baltistan (L&DD Dept., Gilgit - Baltistan - Comp. VI)

Name of PI/Institute: Dr Aziz ure Rehman,
Dy. Director, Livestock & Dairy Development, District Diamir,
Gilgit - Baltistan

Duration: 01.11.2012 to 31.10.2015

Financial Status: Total Cost: Rs.2.616 million
Funds Released: Rs.0.253 million (up to 31.12.2013)
Funds Utilized: Rs.0.240 million (up to 30.06.2013)

Objectives:

- Develop model for the control of PPR virus infection through vaccination among sheep and goats population in high risk tehsil in Astore, Chillas, district Diamir, Gilgit Baltistan
- Systematic socio economic impact assessment and economic analysis of PPR vaccination program
- Monitoring of viral activity in target districts with special emphasis on the changes in virulence of PPR virus circulating in small ruminants population
- Awareness campaign and capacity building of field staff

Achievements:

A high risk tehsil Chilas having 0.247 million sheep goat population selected as model for control of PPR. An awareness workshop was organized in November 2013 in Chilas and discussed the issues and challenges regarding control of PPR with stakeholders.

Two hundred thousand (200,000) sheep & goats were vaccinated using PPR vaccine through fourteen vaccination teams in tehsil Chilas in October/November, 2013.

Rapid response team established to investigate PPR outbreaks. Two suspected outbreaks of PPR were investigated in tehsil Chilas in August and October, 2013. The disease was confirmed by typical clinical signs, postmortem findings and epidemiological observations. Appropriate samples were collected and disease was confirmed by Disease Investigation Lab., Gilgit. The outbreak control measures were implemented and prevent further spread and transmission of disease. As a result the disease was efficiently controlled by implementing zoo sanitary control measures and vaccination in outbreak scenario.

Name of Project: Development of Models for the Control of PPR in Azad Jammu Kashmir (Dept. of Animal Husbandry, AJK, Muzaffarabad - Comp. VII)

Name of PI/Institute: Dr Adnan Rashid Malik,
Asst. Dir. (Tech), Dept. of Animal Husbandry, AJK,
Muzaffarabad

Duration: 01.11.2012 to 31.10.2015

Financial Status: Total Cost: Rs.2.616 million
Funds Released: Rs.0.644 million (up to 31.12.2013)
Funds Utilized: Rs.0.226 million (up to 30.06.2013)

Objectives:

- Develop model for the control of PPR virus infection through vaccination among sheep and goats population in high risk Tehsil in district Bhimber of AJK
- Systematic socio economic impact assessment and economic analysis of PPR vaccination program
- Monitoring of viral activity in target districts with special emphasis on the changes in virulence of PPR virus circulating in small ruminants population
- Awareness campaign and capacity building of field staff

Achievements:

High risk tehsil Barnala of district Bhimber, AJ&K having 0.100 million sheep goat population selected for development of model for control of PPR. A stakeholder workshop was organized in target district (Tehsil Barnala, District Bhimber) and discussed the issues and challenges regarding control of PPR on 10th February 2013. The objectives of the project were discussed and work plan was finalized.

A day long training workshop was organized in town Kote Jamel, tehsil Barnala for field staff and small ruminant farmers as an awareness campaign and capacity building. Awareness created through the workshop among the stakeholders for understanding the nature and consequences of PPR and benefits of its control to mitigate their sufferings.

Suspected outbreak of PPR was investigated in target tehsil in February, 2013. Appropriate samples were collected and provided to Animal Health Labs., ASI, NARC for analysis. The outbreak was confirmed by Ic-ELISA, RT-PCR and attempts were made to recover the PPR virus on cell culture. Outbreak control measures were taken to prevent further spread and transmission of disease.

Name of Project: **Surveillance Pathogenesis and Management Strategies Against Major Emerging Avian Diseases (NARC Coordinating Unit Comp. I)**

Name of PI/Institute: **Dr Muhammad Athar Abbas,**
Scientific Officer, NRLPD Program, ASI, NARC, Islamabad

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs.24.041 million
Funds Released: Rs.8.468 million (up to 31.12.2013)
Funds Utilized: Rs.4.552 million (up to 30.06.2013)

Objectives:

The overall objective is to improve poultry health management practices through disease monitoring, investing researchable issues and imparting training to stakeholders for increasing its productivity for achieving food security and safety.

- Establishment of major avian disease surveillance and Lab Information Management System at Federal and Provincial level.
- Strengthening of Diagnostic facilities by harmonization of lab procedures at federal and provincial levels through capacity building.
- Conduct research experiments/trials focusing pathogenesis, disease control strategies and Zoonotic role of selected avian pathogens.

Achievements:

Under the activity ‘Surveillance set up against major avian infectious diseases’, 4087 samples received (serum: 2358, Swab: 1521, Tissues: 208) and 19 isolation (NDV:10, AIV: 3, Salmonella: 3, IBV: 1 and E. Coli: 2). The isolated pathogen will be beneficial to understand their types currently circulating in the field by biological characterization.

Protocols standardized for AIV, Salmonella and NDV isolation and seromonitoring. The standardized protocols are documented as SOPs to be used for training of provincial staff for isolation and identification of selected avian pathogens.

Protocols standardized for production of diagnostic biological reagents against AIV, Salmonella and NDV. This will help in harmonization of diagnostic protocols in the country at low cost.

Molecular characterization by sequences and phylogenetic analysis of recent field isolates of NDV with older strain was conducted and protocols standardized for AIV & NDV sequencing and analysis. Eight (8) NDV isolates were requested for Fusion and HN gene. Sequence analysis of Fusion gene will be helpful in identification of genetic variations in field isolates of NDV. AIV H4N6 isolated in 2012 was requested for 3 genes (HA, NA and NS). Sequencing of LPAIV H4N6 will help in analysis the introduction of new AIV type in the poultry population of Pakistan.

Protocols developed for type specific diagnosis of Salmonella in poultry for further characterization on molecular basis. The characterization of *Salmonella* spp. will help in understanding the presence of different variants of particular pathogen in the field to develop strategies of disease management.

Name of Project: Surveillance, Pathogenesis and Development of Disease Management Strategies Against Major Emerging Avian Diseases (PRI, Rawalpindi - Comp. II)

Name of PI/Institute: Dr Nasim Fawad,
Asstt. Research Officer,
Poultry Research Institute, Rawalpindi

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 2.580 million
Funds Released: Rs. 0.410 " (up to 31.12.2013)
Funds Utilized: Not reported

Objectives:

The overall objective is to contribute towards improving poultry health management practices through surveillance, training and research for increasing its productivity and bringing food security and safety to the public.

- Undertake provincial field surveillance activities regarding AI, IB, ND & avian salmonellosis and coordinate with NRLPD for sharing data and field samples for strengthening National LIMS.
- Harmonization of diagnostic procedures at provincial labs. in coordination with the federal NRLPD – Lab.
- Conduct research experiments/trials focusing epidemiology, pathogen typing and pathogenesis of selected avian pathogens

Achievements:

Name of Project: Surveillance, Pathogenesis and Development of Disease Management Strategies Against Major Emerging Avian Diseases (PRI, Korangi, Karachi - Comp. III)

Name of PI/Institute: Dr Rashid Farooq
SRO, PRI, Singer Chorangi, Korangi, Karachi

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 2.730 million
Funds Released: Rs. 0.440 " (upto 31.12.2013)
Funds Utilized: Rs. "

Objectives:

The overall objective is to contribute towards improving poultry health management practices through surveillance, training and research for increasing its productivity and bringing food security and safety to the public.

- Undertake provincial field surveillance activities regarding AI, IB, ND & avian salmonellosis and coordinate with NRLPD for sharing data and field samples for strengthening National LIMS.
- Harmonization of diagnostic procedures at provincial labs. in coordination with the federal NRLPD – Lab.
- Conduct research experiments/trials focusing epidemiology, pathogen typing and pathogenesis of selected avian pathogens

Achievements:

The project started in October 2012 on release of funds. Activities on surveillance set up against major avian infectious disease, isolation and characterization of Salmonellae in commercial poultry, isolation of *Pasteurella multocida* in chicken and isolation of new castle disease started. Under surveillance set-up 1425 sample (Blood: 403, Swabs: 279, Tissue: 736 and others: 07) and isolates (NDV: 12, AIH9: 03, Multocida: 02, Salmonella G: 01 and Salmonella P: 01) collected and analyzed. In light of current isolation, poultry farmers will be able to manage vaccination and preventive strategies for healthy flocks and environments.

Documentation for isolation of Salmonella and protocol for preventive measure established, will help poultry farmers to find the cause of mortality as Salmonella and breeding flocks management will be able to take step fir the containment of disease.

Established preventive SOP for isolation of *Pasteurella multocida* in chicken in light of bio-security, which will benefit the commercial layer farmers for the treatment and biosecurity against *Pasteurella multocida*.

Vaccination program for high risky area against new castle disease prepared to enable all type poultry to increase survivability through the result for ND isolation and vaccination program.

It was observed during surveillance that New Castle Disease in commercial and wild bird particular in peacocks are on increasing pattern.

Name of Project: **Surveillance, Pathogenesis and Development of Disease Management Strategies Against Major Emerging Avian Diseases (Diseases Investigation Lab., Peshawar - Comp. IV)**

Name of PI/Institute: **Dr Malik Ayaz Wazir,**
Disease Investigation Officer, Diseases Investigation Lab,
Peshawar

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 2.880 million
Funds Released: Rs. 0.460 " (upto 31.12.2013)
Funds Utilized: Rs. 0.358 " (upto 30.06.2013)

Objectives:

The overall objective is to contribute towards improving poultry health management practices through surveillance, training and research for increasing its productivity and bringing food security and safety to the public.

- Undertake provincial field surveillance activities regarding AI, IB, ND & avian salmonellosis and coordinate with NRLPD for sharing data and field samples for strengthening National LIMS.
- Harmonization of diagnostic procedures at provincial labs. in coordination with the federal NRLPD – Lab.
- Conduct research experiments/trials focusing epidemiology, pathogen typing and pathogenesis of selected avian pathogens

Achievements:

Since the project has been started on releases of Ist installment of funds in October, 2012, no progress has been reported by the PI.

Name of Project: Surveillance, Pathogenesis and Development of Disease Management Strategies Against Major Emerging Avian Diseases (Diseases Investigation Lab., Quetta,- Comp. V)

Name of PI/Institute: Dr Abdul Bari,
Disease Investigation Officer,
Diseases Investigation Lab, Quetta

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 2.460 million
Funds Released: Rs. 0.625 " (upto 31.12.2013)
Funds Utilized: Rs. 0.225 " (upto 30.06.2013)

Objectives:

The overall objective is to contribute towards improving poultry health management practices through surveillance, training and research for increasing its productivity and bringing food security and safety to the public.

- Undertake provincial field surveillance activities regarding AI, IB, ND & avian salmonellosis and coordinate with NRLPD for sharing data and field samples for strengthening National LIMS.
- Harmonization of diagnostic procedures at provincial labs. in coordination with the federal NRLPD – Lab.
- Conduct research experiments/trials focusing epidemiology, pathogen typing and pathogenesis of selected avian pathogens

Achievements:

In Balochistan, three teams (Veterinarian & Para Veterinary Staff) at Loralai, Quetta and Hub trained in surveillance work and deputed to collect samples from commercial and rural poultry birds on regular basis. These samples were provided to the National Reference Lab for Poultry Diseases (NRLPD Islamabad) for confirmation/ diagnosis of Avian Influenza and other poultry disease. 2367 samples collected in target areas of project from birds for emerging Avian Disease during January to July, 2013 have been provided to NRLPD for conformation of disease as detailed below:

Detail & Number of Collected Samples (Blood, Tissue, Swab etc)

- Blood/ Serum Samples:	789
- Tracheal Swab:	789
- Cloacal Swab	789
Total	2367

Two awareness programs about emerging avian disease were arranged at Quetta and 25-30 farmers/ poultry workers participated in each program trained on avian disease bio-security disease diagnosis.

Name of Project: **Surveillance, Pathogenesis and Development of Disease Management Strategies Against Major Emerging Avian Diseases (Diseases Investigation Lab., Gilgit - Comp. VI)**

Name of PI/Institute: **Dr Izzat Khan,**
Poultry Dev. Officer, Diseases Investigation Lab, Gilgit

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 1.740 million
Funds Released: Rs. 0.525 " (31.12.2013)
Funds Utilized: Rs. 0.250 " (30.06.2013)

Objectives:

The overall objective is to contribute towards improving poultry health management practices through surveillance, training and research for increasing its productivity and bringing food security and safety to the public.

- Undertake provincial field surveillance activities regarding AI, IB, ND & avian salmonellosis and coordinate with NRLPD for sharing data and field samples for strengthening National LIMS.
- Harmonization of diagnostic procedures at provincial labs. in coordination with the federal NRLPD – Lab.
- Conduct research experiments/trials focusing epidemiology, pathogen typing and pathogenesis of selected avian pathogens

Achievements:

Established provincial surveillance net work at the Directorate in Gilgit for selected poultry diseases. Lab information management system has been established at six different provincial surveillance units at Gahkuch - Ghizar, Skardu, Khaplu - Ghanche, Chilas - Diamer, Eid Gah - Astore and Ali Abad - Hunza/Nagar

A questionnaire was designed for collecting information and preliminary data. Data have been collected on the proformae (questionnaire) from 06 commercial poultry farmers in three districts (2 in Ghizar with 60 + 210 layers, one in Gilgit with 1000 layers and 600 broilers and 3 in Ghanche with 40 + 30 + 51 layers). Basic information related to commercial poultry farmers such as source of supply of commercial chicks, purpose of poultry farming, poultry related problems, marketing of poultry, disease outbreak record, source of medication/vaccination and trained/untrained manpower engaged in commercial poultry farming etc. were included in the information collected in the survey.

Only 12 samples to evaluate poultry disease have been collected at Tero Ghizar, however, all the samples were spoiled during transportation to main lab.

Name of Project: **Production Performance and Reproductive Efficiency Enhancement of Indigenous Goats and Sheep in Turbat Area under Optimum Feeding, Breeding and Health Management**

Name of PI/Institute: **Mr Nazeer Ahmad,**
SO, Livestock Research Institute, PARC, Turbat

Duration: 05.06.2012 to 04.06.2014

Financial Status: Total Cost: Rs. 7.350 million
Funds Released: Rs. 2.473 " (31.12.2013)
Funds Utilized: Rs. 1.313 " (30.06.2013)

Objectives:

- Improvement of production performance and reproductive efficiency of native goats and sheep under optimum feeding, breeding and health management.
- Training of farmers in feeding and health management practices and distribution of prototype, genetically superior selected breeding-bucks/rams among farmers.

Achievements:

Total number of 218 livestock farmers (sheep: 7883 and goats: 14233) were registered in 15 Union Councils of 4 tehsils (Turbat, Buleda, Dasht, Tump) of district Kech, Balochistan for improvement of production performance and reproductive efficiency of native goats and sheep. Three workshops organized by LRI, Turbat on improvement of sheep/ goat production practices and fodder survey, were attended by 30 farmers.

In order to study the comparative performance of goats and sheep, 21 flocks of Shababad village were provided supplemented feed. Data regarding body weight of 60 goats/ sheep and milk production of 18 goats recorded.

Health coverage facilities (vaccination: 2902, drenching: 1650, deworming: 2649, dipping: 700 against internal parasitic diseases of goat/ sheep) provided to goats/ sheep through veterinary camps. Thirty farmers were also trained in two workshops arranged by LRI, Turbat in feeding, health management and kid management. Twenty one (21) farmers were provided 59 bags of feed for fattening of their sheep/ goat (142 numbers of sheep/ goat and 134 kids/lambs).

Demonstration trials of three varieties of fodder, sorghum and maize janther sown at LRI, Turbat field area. Nursery of Lentiformis, Canecens and Gladitchia (4000) raised on the filed of LRI, Turbat to introduce these plants among the farmers for their livestock feeding and increasing milk productivity.

Name of Project: **Improving Reproductive Efficiency of Sahiwal Cows and Nili-Ravi Buffaloes through Oestrus Synchronization and Timed Artificial Insemination at NARC (Coordinating Unit NARC – Comp. – I)**

Name of PI/Institute: **Dr. M. Anwar,**
Principal Scientific Officer/PL (ARP),
Animal Sciences Institute, NARC, Islamabad

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 8.100 million
Funds Released: Rs. 2.402 " (31.12.2013)
Funds Utilized: Rs. 1.133 " (30.06.2013)

Objectives:

Overall objective is to improve reproductive efficiency of cows and buffaloes through oestrus control and artificial insemination (AI).

- Compare hormonal protocols (including progestagens, GnRH and PGF2 α) and managerial factors (biostimulation, wallowing and housing) for induction of fertile estrus in Nili-Ravi buffalo during peak and low breeding seasons.
- Compare hormonal protocols (including progestagens, GnRH and PGF2 α) and managerial factors (biostimulation) for induction of fertile estrus in Sahiwal cows.

Achievements:

Artificial insemination (AI) is one of the major reproductive techniques through which rapid genetic improvement has been achieved in dairy cattle in developed countries. The technique is being applied in Pakistan in only 10% of the total cows and buffaloes. Scattered and small scale farms and difficult mobility in the field are some of the most important obstacles in large scale use of the technology in Pakistan. In recent years biostimulation has been used to improve fertility in cattle sheep and goat and it seems a relatively economical management tool. However, information related to the effect of bio-stimulation in combination with estrus synchronization protocols in buffalo is scarce. Therefore, present year's work was designed to compare efficiency of estrus synchronization protocols with or without bio-stimulation in buffaloes (heifers and adult).

Work was conducted at a commercial dairy farm located at Ghazi road, Lahore under experiments; i) Effect of bio-stimulation on pregnancy rate in buffalo heifers (n = 28) synchronized for heat using either OvSynch or double PGF2 α protocol and ii) Effect of bio-stimulation on pregnancy rate in adult buffaloes (lactating Nili-Ravi buffaloes = 32) synchronized for heat with OvSynch protocol.

The study evaluated pregnancy rate and estrus responses to treatment of buffalo cows with two synchronization protocols i.e. ovsynch (GnRH on day 0, PGF2 α on day 7, GnRH on day 9) and double PGF2 α (PGF2 α at day 0 and then at day 11). It was observed that conception rate in synchronized buffalo heifers might be affected by the presence of a bull. In case of adult buffaloes, conception rate was higher in bull exposed buffaloes although the difference was not significant. Serum progesterone above 1 ng/ml was considered as an indicator of corpus luteum on one of the ovaries. OvSynch (GnRH plus prostaglandin) worked better in buffalo heifers as compared to PGF2 α . So GnRH plus PGF2 α seems to be a preferred treatment for buffalo heifers. In conclusion the results of this study indicated a positive effect of bull exposure in buffalo heifer and adult buffaloes treated for estrus synchronization on estrous behavior and pregnancy rate.

The effect of bio-stimulation during two estrus synchronization protocols in buffalo heifers on pregnancy rate revealed that pregnancy rate did not differ significantly among the four treatment groups ($P > 0.05$). Pregnancy rate was highest (57%) in the OvSynch bull exposed group. Pregnancy rate in OvSynch non-exposed, PGF2 α bull-exposed groups were 42.8% and it was 28.5% in the PGF2 α non-exposed group.

Name of Project: **Improving Reproductive Efficiency of Thari Cows and Kundi Buffaloes through Oestrus Synchronization and Timed Artificial Insemination in Sindh (Component II- Sindh Agri. University, Tandojam) AS125**

Name of PI/Institute: **Prof. Dr Aqeel Ahmed Memon,**
Asstt. Professor, Dept. of Animal Reproduction, Sindh
Agriculture University, Tandojam

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 6.040 million
Funds Released: Rs. 0.730 " (upto 31.12.2013)
Funds Utilized: -

Objectives:

Overall objective is to improve reproductive efficiency of cows and buffaloes through oestrus control and artificial insemination (AI).

- Compare hormonal protocols (including progestagens, GnRH and PGF2 α) and managerial factors (biostimulation, wallowing and housing) for induction of fertile estrus in buffalo (Kundi) during winter and summer season.
- Compare hormonal protocols (including progestagens, GnRH and PGF2 α) and managerial factors (biostimulation) for induction of fertile estrus in Sahiwal cows.

Achievements:

No work has been done to assess the effectiveness of various synchronization protocols in local breeds of cattle and buffaloes in Sindh. Synchronization of estrus is a very useful tool for extensive use of artificial insemination in scattered livestock population in the cattle (Thari cows) and buffalo (Kundhi) breeds of Sindh province. It is necessary to evaluate the efficacy of various estrous synchronization protocols in terms of timing of heat and conception rate at synchronized heat before application of the technique.

The work is therefore designed to compare effectiveness of various estrus synchronization protocols in Thari cows and Kundhi buffaloes. Work plan was proposed to start the research activities at Kundhi Buffalo Farm, Rohri and Thari Cattle Farm Nabisir Road, Umerkot. Selection of private farms for conducting research trials also finalized for first trial. Registration and grouping of animals for estrus synchronization and fixed timed artificial insemination is in progress.

Two M. Phil students of the Department of Animal Reproduction, Sindh Agricultural University, Tandojam started research work in the project for thesis writing.

Name of Project: **Improving Reproductive Efficiency of Cows (Bhagnari & Crossbred) through Oestrus Synchronization and Timed Artificial Insemination in Balochistan (Lasbella Uni. Of Agri., Water & Marine Sciences (LUAWMS) Component – III)**

Name of PI/Institute: **Prof. Dr Muhammad Azam Kakar,**
Professor/Dean,
Lasbella University of Water, Agriculture and Marine Sciences
(LUAWMS), Quetta

Duration: 15.03.2013 to 14.03.2016

Financial Status: Total Cost: Rs. 6.680 million
Funds Released: Rs. 0.560 " (upto 31.12.2013)
Funds Utilized: -

Objectives:

- Improve reproductive efficiency of cows through oestrus control and artificial insemination (AI).
- Compare hormonal (CIDR, Ovsynch and PGF2 α) and managerial factors for induction of fertile estrus in cows (Bhagnari & Crossbred).

Achievements:

The 1st installment of funds to the project released in April, 2013. Since then the PI has not reported any financial and technical progress of the project

Name of Project: **Improving Reproductive Efficiency of Cows through Oestrus Synchronization and Timed Artificial Insemination in Gilgit – Baltistan (MARC, Juglote, Gilgit - Component IV)**

Name of PI/Institute: **Mr. Faridullah Khan,**
SSO, Mountain Agri. Research Centre (MARC), Juglote, Gilgit

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 5.670 million
Funds Released: Rs. 2.645 " (upto 31.12.2013)
Funds Utilized: Rs. 2.551 " (upto 30.06.2013)

Objectives:

- Compare hormonal (CIDR, Ovsynch and PGF₂α) and managemental factors for induction of fertile estrus cows.

Achievements:

Frozen semen was procured from Livestock Complex, Khyber Pakhtunkhwa, Peshawar.

The Area around MARC proper Juglote was focused to start the project activities. Some farmers were selected and briefed about usefulness of artificial insemination (AI) to replace low milking cows by high yielding cows. Animals were first registered. The cows showing natural heat sign were made artificial insemination with frozen semen. By the end of June 2013, 51 cows were inseminated with Jersey or Friesian semen or treated with estrus synchronization treatment.

Out of 51 cows, 22 were treated with estrus synchronization treatment by injecting Lutalyse (dinoprost tromethamine) 5cc for each cow. (The active ingredient in LUTALYSE contains the naturally occurring prostaglandin F₂ alpha (dinoprost) as the tromethamine salt). Thirty per cent cows showed heat response within 72 hours after lutalyse injection and they were inseminated.

In Chamugar, district Gilgit, 15 cows were treated with Lutalyse 5cc each for estrus synchronization. Only 5 cows showed heat sign and were inseminated. In Pari, district Gilgit, 15 cows were treated with lutalyse for estrus synchronization. Within 72 hours, only 3 cows showed estrus they were made artificial insemination. Under the project activities at Bunji Gilgit, 16 non-pregnant and healthy cows were treated with lutalyse 5cc for estrus synchronization. Within 72 hours, 6 of the treated cows showed heat sign and were inseminated with frozen semen. At Damote (Sai) district Gilgit, 13 non-pregnant and healthy cows were first checked per rectum and then treated with lutalyse 5cc (i/m) to each for induction of heat. Within 72 hours they were again checked and 7 cows showed good heat signs. They were inseminated by using frozen semen. In Chakarkot district Gilgit, 14 non-pregnant and healthy cows were checked and treated with lutalyse for estrus induction. Within 72 hours they were again checked for heat. Only one cow was in heat and was inseminated.

Visit was paid and successful discussion made with 113 farmers in Juglote, Damote, Daroot, Shamogar, Pari and Bunji in district Gilgit.

Name of Project: **Improving Reproductive Efficiency of Sahiwal and Cholistani Cows through Estrus Synchronization and Timed Artificial Insemination (UVAS, Lahore - Component V)**

Name of PI/Institute: **Prof Dr Nasim Ahmad,**
Faculty of Vet. & Animal Sciences, Dept. of Theriogenology,
Uni. of Veterinary & Animal Sciences, Lahore

Duration: 01.04.2013 to 31.03.2016

Financial Status: Total Cost: Rs. 9.849 million
Funds Released: Rs. 1.146 " (upto 31.12.2013)
Funds Utilized: Rs. 0.473 " (upto 30.06.2013)

Objectives:

- i. To compare methods of estrus synchronization (CIDR, Ovsynch and PGF2 α) on estrus response and fertility in Cholistani cows.
- ii. To determine pattern of ovarian blood flow during different phases of estrous cycle using Doppler ultrasound and during post breeding period in order to differentiate pregnant and non pregnant Sahiwal cattle.
- iii. Determination of plasma progesterone level in blood and CL size during different phases of estrous cycle and during post breeding period and relate it with ovarian blood flow in Sahiwal cattle.

Achievements:

Livestock sector is progressing at high pace and it has a big share in economic development of Pakistan since past few years. More efficient reproduction is necessary for sustainable production. Native cows like Sahiwal and Cholistani are more suitable in our local conditions. Reproduction in these animals is slowed down by delayed puberty, seasonal breeding, repeat breeding, cystic ovarian disease (COD) and lowered fertility. The objectives of the project during reporting period were to determine the effect of various synchronization protocols on estrus behavior, ovulation and fertility of these animals.

Two preliminary experiments were conducted during the period under report. In first experiment, the objective was to determine if the reproductive efficiency of chronically repeat breeder Sahiwal cows (on an average each cow had taken about six services but remained open) can be improved using estrus synchronization protocols (CIDR, Ovsynch, PG). Results indicated that only one of the fourteen cows became pregnant. Thus suggesting that treatment with antibiotics and followed by sexual rest should be first given followed by estrus synchronization. In second experiment, objective was to determine the effect of three synchronization protocols (CIDR, Ovsynch, PG) on estrus response, ovulation and pregnancy rates in Sahiwal cattle. Result indicated that pregnancy

rate was higher in CIDR treated cows 40% (2/5) as compared to Ovsynch 25% (1/4) and PG 33% (1/3). Overall pregnancy rate was 33%.

As a conclusion in experiment one the overall estrus response is good however, the fertility following any method of synchronization with time AI is not helpful in chronically repeat breeding Sahiwal cows. Alternatively, treatment of repeat breeding with antibiotic and sexual rest is suggested as first measure. In second experiment, it is concluded that Sahiwal cows overall respond well in terms of estrus signs and CIDR protocol is more effective than the other groups in terms of conception rates.

Name of Project: **Improving Reproductive Efficiency of Achai Cows through Oestrus Synchronization and Timed Artificial Insemination (L&DD Deptt., Khyber Pakhtunkhwa - Component VI)**

Name of PI/Institute: **Mr Hassan Khan,**
Dy. Director (Farm), Achai Cattle Conservation & Deve.
Program, Livestock & Dairy Development Department, Khyber
Pakhtunkhwa, Peshawar

Duration: 01.06.2013 to 30.05.2016

Financial Status: Total Cost: Rs. 4.505 million
Funds Released: Rs. 0.088 " (upto 31.12.2013)
Funds Utilized: Not reported

Objectives:

The overall objective is to improve reproductive efficiency of Achai cows through oestrus control and artificial insemination (AI).

- Compare hormonal (CIDR, Ovsynch and PGF2 α) and managerial factors for induction of fertile estrus in Achai cows.

Achievements:

The 1st installment of funds released to the project in June, 2013 and activities initiated after June, 2013 i.e. reporting period.

Name of Project: **Intensification of Fish Culture to Increase Per Unit Area Fish Production in Farm Ponds Using Different Managemental Inputs (Coordinating Unit NARC Comp. I)**

Name of PI/Institute: **Dr Muhammad Afzal,**
PSO, Aquaculture and Fisheries, Animal Sciences Institute,
NARC, Islamabad

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 12.375 million
Funds Released: Rs. 5.561 " (upto 31.12.2013)
Funds Utilized: Rs. 3.799 " (upto 30.06.2013)

Objectives:

- Evaluation of balanced fish feed at varying protein levels for growth of fry and fingerlings of carps under polyculture system.
- Development of cost effective supplementary feed for grow out fish under varying stocking densities.
- Dissemination of intensive fish culture technology to the fish farmer in the country.

Achievements:

Initial survey of project areas (upper Punjab) conducted during February and March 2013 for the selection of progressive farmers. The areas visited for survey were Ali Pur Chatta, Gujranwala, Hafizabad, Faisalabad, Shiekhpora, Lahore and Attack. Twenty fish farms and fish hatcheries were visited and information collected regarding the existing fish farming practices in the area. The fish farmers stocked fish @ 1200/ acre according to availability with no or limited feeding. After collecting the initial data three fish farms were selected for the project at farmers' field.

Trials were conducted to evaluate the balanced diet on the growth of carps with varying levels of crude protein formulated from locally available feed ingredients in aquaria at Aquaculture and Fisheries Program (AFP), NARC. Three artificial diets were formulated based on different crude protein (CP) level i.e. 20%, 25% and 30% CP. The growth performance of all species of treatments having 30%CP and 25% CP were found to be non significant with each other. Feed containing 25% CP artificial diet level was found to be satisfactory feeding level and have low cost in comparison with rest of the other two treatments.

The trials were conducted at farmer's field at Ali Pur Chatta, Gujranwala and Faisalabad to evaluate the production performance of carps at various stocking density. The experimental design consists of three treatments of stocking densities 1800, 2100 and 1500 fish/ acre at Ali Pur Chatta, Gujranwala. The species combination stocked in fish ponds of fish were Silver Carp 35%,

Rohu 30%, Grass Carp 20%, Mori/Gulfam 20% and additional 5% of channel catfish were added. The experimental design consists three treatments of stocking densities 1000 fish/ acre, 1500 fish/ acre and 2000 fish/ acre in Faisalabad.

The initial data indicates that the production level is better at high stocking density with artificial feeding and production of 2000-2500 fish/ acre is expected at stocking density of 2100 kg/ acre followed by stocking density of 1800 fish/ acre where production is expected 1800-200 kg/ acre with 66% increase in the production. The final data will be collected at the time of harvesting.

An experiment was conducted at Aquaculture and Fisheries Program, NARC to evaluate the production performance of Tilapia at various stocking densities of 8000 fish/ acre, 10,000 fish/ acre and 12,000 fish/ acre. The production of 4500 kg/acre was achieved at stocking density of 12,000 fish/acre followed by 4000 kg/acre at stocking density of 10,000 fish/acre.

Name of Project: **Intensification of Fish Culture to Increase Per Unit Area Fish Production in Farm Ponds Using Different Managerial Inputs (Inland Fisheries, Govt of Balochistan - Comp. II)**

Name of PI/Institute: **Mr Khalil ur Rehman,**
Dy Director, Inland Fisheries, Govt of Balochistan, Fisheries Complex Ward No 8, Dera Murad Jamali

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 4.839 million
Funds Released: Rs. 1.172 " (upto 31.12.2013)
Funds Utilized: Rs. 1.066 " (upto 30.06.2013)

Objectives:

- Evaluation of balanced fish feed at varying protein levels for growth of fry and fingerlings of carps under polyculture system.
- Development of cost effective supplementary feed for grow out fish under varying stocking densities.
- Dissemination of intensive fish culture technology to the fish farmer in the country.

Achievements:

Three ponds of one acre each in size were constructed at Dera Murad Jamali (DMJ) Fisheries Complex, The ponds were stocked with 3 inch size fish fingerlings of *Labeo rohita* (Rohu) *Cirrhinus mrigala* (Mori) and *Catla catla* (Thaila) @ 1200 (Pond 1), 1600 (Pond 2) and 2000 (Pond 3) respectively.

After five months *Labeo rohita* has attained an average weight of 700, 600 and 650 g while *Catla catla* weighted 650, 700 and 750 g and *Cirrhinus mrigala* attained weight of 450, 600 and 650 g in pond 1, 2 & 3 respectively. Fish were not fed with the artificial feed due to non-availability of feed ingredients in local market.

Name of Project: **Intensification of Fish Culture to Increase Per Unit Area Fish Production in Farm Ponds Using Different Managerial Inputs (Uni. of Peshawar, Khyber Pakhtunkhwa - Comp. III)**

Name of PI/Institute: **Mr Zaigham Hassan,**
Asstt Prof., Dept of Zoology, Uni. of Peshawar, Khyber Pakhtunkhwa

Duration: 01.11.2012 to 31.10.2015

Financial Status: Total Cost: Rs. 4.338 million
Funds Released: Rs. 0.473 " (upto 31.12.2013)
Funds Utilized: -

Objectives:

To enhance the existing level of carp fish production from 1000-1200 kg/acre to an extent of 2000-2500 kg/acre through intensification using supplementary artificial diet.

- Evaluation of balanced fish feed at varying protein levels for growth of fry and fingerlings of carps under polyculture system.
- Development of cost effective supplementary feed for grow out fish under varying stocking densities.
- Dissemination of intensive fish culture technology to the fish farmer in the country.

Achievements:

Name of Project: **Intensification of Fish Culture to Increase Per Unit Area Fish Production in Farm Ponds Using Different Managerial Inputs (Uni. of Sindh, Jamshoro - Comp. IV)**

Name of PI/Institute: **Dr Naeem Tariq Narejo,**
Prof. (Fisheries), Dept. of Fresh Water Biology & Fisheries, Uni. of Sindh, Jamshoro

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 4.434 million
Funds Released: Rs. 0.803 " (upto 31.12.2013)
Funds Utilized: Rs. 0.787 " (upto 30.06.2013)

Objectives:

- To enhance the existing level of carp fish production from 1000-12kg/acre to an extent of 1500-2000 kg/acre.
- Intensification of carp fish culture by using different managerial inputs (organic, inorganic fertilizers artificial diet) for increase the fish production.
- To study the specific species combination and stocking density in intensive fish culture system at farmer's pond.
- Dissemination of intensive fish culture technology to the fish farmers.

Achievements:

Survey was conducted during October to December 2012 to identify the potential fish farmers of various districts like Khairpur, Naushehro Feroz, Dadu, Badin and Thatta. Fish farmers (Dr Ghulam Qadir, Sayed Ashraf Ali Shah and Hazor Bux Khoso of districts of Khairpur, Thatta and Badin respectively) agreed to participate in intensification of fish culture to increase per unit area fish production in farm ponds using different management inputs and provide full support to the proposed study in their fish farms and ponds.

The growth responses of three indigenous carps fed with experimental diet containing 30% crude protein (iso-caloric) in terms of initial and final mean weight gain, percentage weight gain, specific growth rate (SGR), food conversion rate (FCR), survival rate and production of the experimental fishes recorded under pond conditions at Chilya - Thatta, University of Sindh, Jamshoro and district of Badine. The fish with an initial average weight of 6.4 ± 1.6 g reached to a final weight of 135.50 ± 2.66 , 110.30 ± 1.44 and 120.50 ± 2.11 g at ponds of Chilya Thatta, University of Sindh, Jamshoro and Badin district respectively. Results of these parameters indicated that the pond of University of Sindh showed significantly ($p < 0.05$)

highest growth in terms all parameters like (weight gain, percentage weight gain, specific growth rate, food conversion and production followed by ponds of Chilya, Thatta while significantly ($p < 0.05$) lowest growth and production was recorded in ponds of Badin district. No mortality was recorded (100% survival rate) in the experimental fish throughout the study period from February to July 2013.

Growth of experimental fish in ponds (cemented cisterns) indicated that the growth rate varied in different stocking densities. Treatment II (1200 fish/pond) showed significantly ($p < 0.05$) highest growth and survival rate among the treatments. The net length and weight gain of individual fish in treatment II was higher (128 mm and 16.4 g) than those of Treatment I (108 mm and 11.7 g) and (88 mm and 8.8 g) in treatment III respectively. The survival and specific growth rates were also found highest in treatment II (100% and 0.48) followed by treatment I (90% and 0.36). While significantly ($p < 0.05$) lowest survival rate and SGR was recorded (80% and 0.31) from treatment III. The water quality parameters and their monthly fluctuations recorded throughout the study period were found within the suitable ranges for the fish culture.

It was observed from the results of the present investigations that the highest growth rate and survival of the experimental fish was observed from the ponds of University of Sindh, Jamshoro followed by the ponds of district Badin and lowest growth and survival was recorded from ponds of Chilya Thatta. The results of the present study indicated that a stocking density (1200 fish/ pond) might be suitable for the culture of (*L. rohita*, *C. catla* and *C. mrrigala*) under polyculture system with high density.

Name of Project: **Intensification of Fish Culture to Increase Per Unit Area Fish Production in Farm Ponds Using Different Managerial Inputs (Bahauddin Zakarya Uni. Multan, Punjab, - Comp. V)**

Name of PI/Institute: **Dr Muhammad Naeem,**
Asstt. Prof. (Fisheries), Inst. of Pure & Applied Biology,
Bahauddin Zakarya Uni., Multan

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 4.360 million
Funds Released: Rs. 1.516 " (upto 31.12.2013)
Funds Utilized: Rs. 1.087 " (upto 30.06.2013)

Objectives:

To enhance the existing level of carp fish production from 1000-1200 kg/acre to an extent of 2000-25000 kg/acre through intensification using supplementary artificial diet.

- Evaluation of balanced fish feed at varying protein levels for growth of fry and fingerlings of carps under polyculture system.
- Development of cost effective supplementary feed for grow out fish under varying stocking densities.
- Dissemination of intensive fish culture technology to the fish farmer in the country.

Achievements:

After the releases of funds the project activities started in January, 2013. The project activities conducted upto June 30, 2013 are as follows:

Prepared artificial diet with locally available feed ingredients of varying protein level 30% (F1), 25% (F2), 20% (F3).

<i>Ingredients</i>	<i>F1</i>	<i>F2</i>	<i>F3</i>
	<i>30%</i>	<i>25%</i>	<i>20%</i>
Fish meal	10	10	10
Soyabean meal	15	10	8
Sunflower meal	5	5	5
Canola meal	5	5	5
Rice polish	15	25	30
Wheat brawn	20	15	30

Di-calcium phosphate	1	2	1
Corn gluten 30%	9	10	6
Corn gluten 60%	15	10	-
Vitamin premix	1	1	1
Season meal	2	5	2
Soyabean oil	2	2	2
Total	100	100	100

Experiment started at Nursery Unit, Multan, where four ponds size 2 kanal with stocking density 100/ acre with species combination of Rahu and hybrid (Rahu x Thatta) to analysis of artificial feed, present level 20%, 25% and 30% on growth performance, water quality parameters tested fortnightly. Water quality parameters, DO, temperature, CO₃, HCO₃, hardness, calcium and total carbonate all are within available range. Overall fish feed formula No. 1 (30% protein level) showed the best results for fish growth.

Experiment started in aquarium to study the effect of different protein level diet in growth collected data fortnightly on fish growth and water quality parameters.

Established feed mixing and mincing machine to prepare pelleted feed of protein level 20% and 30%.

Experiments started at Fisheries Lab of Bahauddin Zakaryia University Multan in glass aquaria.

Eight Aquarium 76 cm x61 cm x 37cm each with stocking density 1 g fish/ liter water with species combination of *Labeo rohita* (Rahu) *Catla catla* (Thaila), *Ctenopharyngoden idella* (Grass carp), *Hybophthalmichthys molitrix* (Silver carp) and *Cyprinum carpio* (Gulfam) for analysis of artificial feed 30% (F1), 25% (F2) and 20% (F3) on growth performance. Water quality parameters tested fortnightly. Overall fish feed formula No. 1 (30% protein level) showed the best results for fish growth.

Experiment started at Fisheries Lab of Bahauddin Zakria University, Multan in fiberglass holding tanks. Nine fiberglass holding tanks 135x75x75 cm. Each with stocking density 1g fish/3liters water with species combination of *Labeo rohita* (Rahu) *Catla catla* (Thaila), *Ctenopharyngoden idella* (Grass carp), *Hybophthalmichthys molitrix* (Silver carp) and *Cyprinum carpio* (Gulfam) for analysis of artificial feed 30% (F1), 25% (F2) and 20% (F3) on growth performance water quality parameters tested fortnightly. Overall, fish feed formula No. 1 (30% protein level) showed the best results for fish growth.

Crop Sciences

Name of Project: **Development of Mechanized Multipurpose Nursery Raising Facility at NARC, Islamabad**

Name of PI/Institute: **Mr Shabbir Ahmad Kalwar,
PSO, ABEI, NARC**

Duration: 01.03.2012 to 28.02.2015

Financial Status: Total Cost: Rs. 38.982 million
Funds Released: Rs. 5126658/-
Funds Utilized: Rs. 1017378/- (up to March, 2013)

Objectives:

- To develop a mechanized multipurpose nursery raising technology
- To establish infrastructure for timely and cost-efficient nursery raising methods and to raise and maintain all type of nursery plants under shade/green house for large scale
- To demonstrate and disseminate the technology among the local manufactures, commercial nursery growers, Government Bodies, farmers and NGOs.

Achievements:

During the reporting period survey of local nurseries in Islamabad and Rawalpindi was conducted and information regarding nursery development practices, pot sizes, soil media, seed and dealers contact etc. collected. After surveying all nurseries situated in Islamabad/Rawalpindi, it was found that there is any nursery establishment manual or hand book is available with these nursery growers. Neither they know any standards or right size of pots for the plant or required compound ratio etc. A manual /hand book of commercial nursery establishment for guidance is therefore under preparation.

A suitable site at NARC has been selected for establishment of the nursery. Technical specifications for tender documents of pot filling plant, tractor front bucket, nursery trailer, tripping trolley, office computer and equipments, machinery shads, shad house for nursery raising and civil work prepared. The tender of civil work, machinery shad, shad house, farm yard manure, silt and soil will be open when pot filling machinery is imported.

Name of Project: Modeling for Targeted Weed Management Through Exploitation of Competition Indices for Wheat in Khyber Pakhtunkhwa

Name of PI/Institute: Dr Muhammad Azim Khan,
Asstt. Prof., Dept. of Weed Sciences,
Khyber Pakhtunkhwa Agri. Uni., Peshawar

Duration: 17.03.2012 to 30.06.2015

Financial Status: Total Cost: Rs. 5.692 million
Funds Released: Rs. 2651000/-
Funds Utilized: Rs. 1796909/- (up to 31.12.2013)

Objectives:

- To categorize and enlist major weeds based on their importance values in different agro climatic regions of Khyber Pakhtunkhwa.
- To figure out yield losses due to weeds in wheat for different regions of Khyber Pakhtunkhwa.
- To develop strategy for weed management through use of competition indices for different agro-ecological regions of the project area.
- To evaluate the threshold levels of major weed species.
- To find out competition indices of major weeds of wheat using ecological designs

Achievements:

To investigate the major weeds of wheat in Khyber Pakhtunkhwa province, a comprehensive survey was conducted during February to June, 2012 at D.I. Khan, Lakki Marwat, Kohat, Peshawar, Mardan, Swat, Mansehra and Chitral. Quadrante method was used to record density, relative density, frequency, relative frequency, canopy coverage, relative canopy coverage and importance value index. Several fields were visited at each location and the data average was calculated. The data obtained showed that *Avena fatua* is a major weed of wheat at all the above mentioned eight locations. While the second major weeds were; *Rumex dentatus*, *Phalaris minor*, *Rumex crispus*, *Phalaris minor*, *Silybum marianum*, *Neslia apiculata*, *Silybum marianum*, and *Rumex crispus* at D. I. Khan, Lakki Marwat, Kohat, Peshwar Mardan, Swat, Mansehra and Chitral, respectively. The major and most problematic weeds of wheat were identified and the importance value index was calculated. The seeds of two major weeds that ranked first and second at each location were collected at maturity and used for detailed experimentations.

Field experiments were conducted at D.I. Khan, Peshawar and Swat in November, 2011 to determine the competitive ability of *Avena fatua* in wheat. Two experiments were conducted each at D.I. Khan, Peshawar and Swat by using ecological designs namely; Additive design and replacement series. Ecological formulae were used and competitive index of *Avena fatua* was determined. The results showed that competitive index (CI) of *Avena fatua* in wheat was 0.033,

0.031 and 0.031 at D.I. Khan, Peshawar and Swat, respectively. The instant results showed that the same weed (*Avena fatua*) was more competitive with wheat in D. I. Khan as compared to Peshawar and Swat. Competitive index of *Avena fatua* was determined for the first time in these areas and is helpful for weed management program. The competitive index will enable us to decide application of weed control method in wheat crop. Thus by calculating the yield losses, weed management plan can easily be decided. However, the profitability of the weed management depends on the CI rather than density of *Avena fatua*. As the competitive index of a weed species could be changed due to cultural practices like wheat variety used, fertilizer dose, irrigation levels, time of sowing, seed rate used soil type and climatic conditions, therefore these results will be verified in the next seasons at all locations for the major weeds identified as above.

Name of Project: Promotion of Safflower (*Carthamus tinctorius*) through Participatory Approach in Pothwar

Name of PI/Institute: Dr Fayyaz-ul-Hassan,
Prof., Dept. of Agronomy, PMAS Arid Agri. University,
Rawalpindi

Duration: 01.07.2012 to 30.06.2015

Financial Status: Total Cost: Rs. 3.077 million
Funds Released: Rs. 900500/-
Funds Utilized: Rs. 419611/- (up to 31.12.2013)

Objectives:

- Collection, multiplication and characterization of exotic germplasm
- Adaptability evaluation of collected exotic germplasm.
- Multiplication of already tested/ adopted genotypes of safflower.
- Popularization of safflower through participatory approach in Pothwar.
- To impart practical training to students relevant to safflower cultivation

Achievements:

Safflower is a drought resistant crop grown throughout the world and in many underdeveloped countries for its seeds which contain oils rich in mono and polyunsaturated fatty acids. It has been under cultivation in arid and semi-arid conditions since ages as fodder and minor oilseed crop, however, due to different socioeconomic and technical difficulties farmers have abandoned sowing of safflower. Compared to more widely grown oilseeds like canola, safflower has received little investment in research and development in Pakistan resulting in limited information on agronomic management options. Safflower crop characteristics have the potential to be a successful crop in Pothwar region. The studies under the project were initiated to explore the potential and evaluation of spiny and spineless promising cultivars from local and exotic cultivars under rainfed conditions and distribution of potential cultivars among the farming community of Pothwar.

A total of 100 accessions were obtained from Plant Genetic Resources Institute, Islamabad and were sown under rainfed conditions at Taxila on November 6, 2012. All the accessions were evaluated for 9 phenotypic and agronomic traits.

To evaluate adaptability of exotic genotypes under rainfed conditions of Pothwar, three cultivars K1, K2 and K3 were cultivated at Taxila. For multiplication of already adapted genotypes (SAF-30, SAF-31, SAF-32, SAF-28, SAF-129, SAF 130, Leed-00, Thori-78) were sown at farmers field for introduction and extension among farmers. This not only served the purpose of extension and popularization of safflower as a crop but also seed multiplication was achieved by this activity. For this purpose safflower was sown at University Research Farm, Chakwal Road and farmers

field at Gujar Khan, Taxila, Attock and Talagang and half of the seed harvested was taken for distribution among other farmers and half was collected as stock.

Name of Project: **Development of an Effective Phytoremedial Technology for Metal Contaminated Calcareous Soils**

Name of PI/Institute: **Dr. Shazia Iftikhar**
Assistant Professor, Department of Environmental Science,
Fatimah Jinnah Women University, Rawalpindi

Duration: 01. 03. 2012 to 28. 02. 2015

Financial Status: Total Cost: Rs.5.477 million
Funds Released: Rs. 2667000/-
Funds Utilized: Rs. 1795000/- (up to April, 2013)

Objectives:

- Assessment of heavy contamination load in soil and crop produced in peri-urban areas being irrigated with untreated wastewater.
- Test the various chelates and tolerant fungal strains for their metal extraction and solubilizing efficiency.
- Explore the natural and chemically enhanced phytoextraction potential of native plant species.
- Develop a model in order to predict the interactions between plant, contaminants and soil characteristics using data and other information

Achievements:

Four peri-urban agricultural areas (Multan, Kasur, Lahore and Gujranwala) were selected and surveyed. Soil, plants (crops/vegetables) and wastewater samples were collected from four peri-urban areas. Total 138 soil samples were collected from Multan (n=42), Kasur (n=40), Lahore (n=36) and Gujranwala (n=20) at different depths (0-15” & 15-30 cm from Multan and 0-6” & 6-12” from Kasur, Lahore and Gujranwala). Similarly total 131 plants and vegetables samples were collected from Multan (n=45) Kasur (n=23), Lahore (n=30) and Gujranwala (n=33) from the same peri-urban agricultural areas. Total 52 municipal and industrial effluents (used for irrigation purposes) samples were collected from Multan (14), Kasur (10), Lahore (18) and Gujranwala (10). All the collected samples were labeled, stored and brought to laboratory properly.

The soil samples collected were analyzed for their physiochemical parameters which were particle size distribution, pH, electrical conductivity, percentage organic matter, lime contents and heavy metals contents. Effluent samples were analyzed for pH, electrical conductivity, chloride ions, carbonate, bicarbonate, sodium, potassium and heavy metal contents. Plants samples were tested for heavy metals contents. Filamentous fungi were also isolated from soil and effluent samples by using serial dilution method.

Results showed that, Pb content were noticed more than recommended permissible limits (WHO/FAO, 2001) in Multan, Kasur and Gujranwala soil samples. In soil samples Cd and Cr were found above than recommended permissible limits in all four surveyed areas. In Multan and Gujranwala soil samples, Cu was observed above than recommended permissible limit. Similarly incase of wastewater samples Cr, Cd and Pb was found more than permissible limits in all the studied areas (Multan, Kasur, Lahore and Gujranwala). Whereas Cu was found above than recommended permissible limit in Multan and Lahore. However, Kasur and Gujranwala were not showing the exceeded levels of Cr contents. Heavy metals were also analyzed in collected plants samples and metal accumulation ability varies from plant to plant at different sites. Maximum Pb accumulation was observed in sorghum, maize, cauliflower and Fenu greek/ methy grown in Multan, Kasur, Lahore and Gujranwala respectively. In case of Cd content, coriander, spinach, barseem and potato were found good accumulators. Maximum Cr metal was observed in rice crop cultivated at Kasur areas. However coriander, rice, wheat and brinjal were noticed good Cu accumulators in all the studied areas.

Fungal diversity was also assessed in Multan, Kasur, Lahore and Gujranwala agricultural soils samples and municipal/industrial effluents. Maximum fungal diversity was found in Multan soil samples and wastewater samples followed by Kasur, Lahore and Gujranwala agricultural areas. Most of the fungal isolates belonged to three classes. The most common class was Ascomycota (*Acremonium*, *Aspergillus*, and *Curvularia genera*) then Zygomycota (*Mucor* genus), and Oomycetes (*Puthium* genus). *Aspergillus* spp. were the most frequently encountered among the isolates from the soil samples of the all sites. This preliminary assessment concludes that at vast scale remediation procedures required for the treatment of industrial, domestic and sewage wastewater and used for irrigation purposes. Indigenous fungal strains and native plants species could be used for developing a good phytoremediation and mycoremediation technologies for the decontamination of heavy metals.

The study conducted so far revealed that; heavy metals Pb, Cd and Cr were found above than recommended permissible levels in Multan, Kasur, Lahore and Gujranwala soil samples. Whereas exceeded level of Cu was observed in Multan and Gujranwala locations. In overall assessment Pb and Cd was showing high level of contamination in the studied areas.

Accumulation of metals in crops was also estimated with major problem of Cd in crops and fodder plants and incase of Kasur Cr was found maximum. Analyzed plants samples are also showing exceeded concentration of Pb, Cd, Cu and Cr in Lahore whereas, Gujranwala Pb, Cd and Cr was found above the permissible limits in contrast to this Cu was noticed below the threatening level of concentration.

Name of Project: Development and Evaluation of Indigenous Sunflower Hybrids in Different Ecological Zones

Name of PI/Institute: Dr. Muhammad Ayub Khan,
PSO, Oilseed Program, NARC

Duration: 01.04.2012 to 31.03.2015

Financial Status: Total Cost: Rs. 4.848 million
Funds Released: Rs. 1611000/-
Funds Utilized: Rs. 877391/- (up to March, 2013)

Objectives:

- Sustaining and strengthening breeding program on sunflower
- Development and evaluation of locally developed sunflower hybrids in various ecologies of the country.
- Adaptive research/on-farm testing of the indigenous sunflower hybrids for demonstration and transfer of improved production technologies to sunflower growers

Achievements:

Hybrid seed of sunflower has enormous scope due to higher yield potential, uniform maturity and resistance/tolerance against insect pests and diseases. Sunflower crop in Pakistan is being planted with 100% hybrid seed imported. Breeding program on sunflower in Oilseed Research Program, NARC has been strengthened and developed indigenous sunflower inbred lines and hybrids with higher yield potential. For sustaining and further strengthening the hybrid development program established after the efforts of two decades, efforts under this project are in progress for the development of new inbred lines with good general and specific combining abilities and new hybrid combinations. The potential hybrids will be evaluated in advance yield trials and on farmers' field in various ecologies.

Following is the progress summary of the experiments/ trials conducted on development and evaluation of sunflower hybrid:

- Two new open pollinated varieties of Russian origin have been introduced and will be used for the development of new inbred lines.
- Five new inbred lines have shown desirable characteristics for desirable plant type, height, genetically stable and tolerance against moisture stress.
- 37 hybrid combinations were developed during 2012 and parent lines of 17 have been planted during spring, 2013.
- Two new CMS and two restorer lines were used for testing their combining ability.
- Three local hybrids (SMH-0925, SMH-0926 and SMH-1101 produced significantly

higher yield than three imported commercial hybrids (Hysun-33, NK-S-278 and Agsun-8251 during autumn, 2012. Four new hybrids, SMH-1201, SMH-1216, SMH-1218 and SMH-1220 planted during current spring season seem promising.

- Potential hybrids have been included in NUYT for testing their adaptability and performance (yield potential) under different environmental conditions (16 locations) during spring, 2013.

Name of Project: **Development and Evaluation of Indigenous Canola Hybrids in Different Ecological Zones**

Name of PI/Institute: **Dr Abdul Rashid,**
PSO, Oilseed Program, NARC

Duration: 01.04.2012 to 31.03.2015

Financial Status: Total Cost: Rs. 4.369 million
Funds Released: Rs. 1088600/-
Funds Utilized: Rs. 329430/- (up to 31.12.2012)

Objectives:

- Development and maintenance of A, B and R lines
- Development and evaluation of new hybrid combinations
- Testing of locally developed canola hybrids in various ecologies of the country for the selection of new potential ones.

Achievements:

Development and Maintenance of A, B and R Lines:

- To maintain pipeline breeding material and develop genetically stable inbred lines; 362 CMS/maintainer and 8 restorer lines from R-786 were grown at NARC during rabi 2012-13. These cms and restorer lines were maintained by crossing and selfing, respectively. Pure seed of CMS and restorer lines is available for making new hybrid combinations.
- In order to develop new inbred lines; 23 backcrosses (BC₂) were successfully made and sufficient seed of each backcross was obtained. Backcrossing will be continued upto BC₄.
- For seed multiplication of parent lines of potential hybrids (CMS, maintainer and restorer) at pilot scale; A and B lines of PARC Canola Hybrid were planted at NARC field and R line in the tunnel during rabi 2012-13. Total 50 kg seed of CMS, 10 kg seed of B-line was obtained from field and 20 kg seed of restorer was obtained from tunnel.

Development and Evaluation of New Hybrid Combination:

- To develop new hybrid combinations; 60 CMS lines and one Restorer lines were planted in 2:1 ratio at Kaghan during summer 2012. At flowering stage, honey bee hives were placed beside the crop to ensure cross pollination and better seed setting. A total 60 new hybrid combinations were made using cms restorer system.
- To evaluate new combinations for seed yield potential; the 60 hybrids of canola including one check “Hyola-401” were evaluated in Hybrid Yield Trial conducted at NARC during rabi 2012-13. The seed yield ranged from 1003 to 1975 kg ha⁻¹ between hybrids as given in table below. Seed yield of 13 hybrids was better than commercially grown hybrid “Hyola-401”

(1686 kg ha⁻¹). The hybrid of NCMS 226 x R-786/55 produced highest seed yield of 1975 kg ha⁻¹ followed by hybrids NCMS 274 x R-786/55, NCMS 110 x R-786/55 and NCMS 271 x R-786/55 with respective seed yield of 1930, 1894, and 1881 kg ha⁻¹. Maximum heterosis (17% yield increase over Hyola-401) was recorded in the cross of NCMS 226 x R-786/55. The 12 other crosses also produced 0-14% higher seed yield than Hyola-401.

Table: Seed Yield Performance of 13 Best Hybrid Combinations in Hybrid Yield Trial at NARC During rabi 2012-13

Codes	Cross Combination	Seed Yield (Kg ha-1)	%Over±Hyola-401
22	NCMS 226 x R-401/55	1975	17
35	NCMS 274 x R-401/55	1930	14
5	NCMS 110 x R-401/55	1894	12
34	NCMS 271 x R-401/55	1881	12
46	NCMS 319 x R-401/55	1822	8
37	NCMS 280 x R-401/55	1817	8
30	NCMS 263 x R-401/55	1788	6
11	NCMS 148 x R-401/55	1771	5
24	NCMS 235 x R-401/55	1762	5
7	NCMS 117 x R-401/55	1754	4
3	NCMS 105 x R-401/55	1739	3
55	NCMS 356 x R-401/55	1712	2
2	NCMS 104 x R-401/55	1686	0
33	Hyola-401 (Check)	1686	0

Testing of Locally Developed Canola Hybrids in Various Ecologies of the Country for the Selection of New Potential Ones:

- To evaluate indigenous hybrids at research institutes of public and private sector under different climate and soil conditions for their adaptability; three Canola Rapeseed Hybrids “101401/786, 148401/786 and 2864401/786” are under testing in National Uniform Rapeseed Yield Trial (NURYT) 2012-13 for seed yield potential and adaptability. The NURYT trials were conducted at ten different locations. Data on days to flowering and maturity, plant height and seed yield was recorded and compiled.
- To identify/select potential hybrids for different ecologies; three Canola Rapeseed Hybrids “101401/786, 148401/786 and 2864401/786” included in National Uniform Rapeseed Yield Trial (NURYT) 2012-13 for adaptability testing. Multi-locations NURYT trials has been conducted at ten different sites during rabi 2012-13 to identify suitable canola hybrid (s) for specific regions. Data compiled from different locations.

Name of Project: **Indigenous Hybrid Development in Vegetable**

Name of PI/Institute: **Mr Taj Naseeb Khan,**
SSO, Horticulture Research Institute (HRI), NARC

Duration: 01.04.2012 to 31.03.2015

Financial Status: Total Cost: Rs. 4.768 million
Funds Released: Rs. 1418600/-
Funds Utilized: Rs. 1422252/- (up to March, 2013)

Objectives:

- Two high yielding F₁ hybrids of each in determinate tomato, chili and bitter gourd will be developed/finalized by the end of the project
- Preliminary/secondary evaluation of developed hybrids of tomato, chilies and bitter gourd.
- Characterization of hybrids and parental lines.
- Seed multiplication/maintenance of parental/promising lines of determinate tomato, chilies and bitter gourd.

Achievements:

Vegetables are an important component of human diet. With the increase in population day by day, there is a dire need to produce vegetables to feed the population at large. In the current scenario, there is the availability of high yielding and better performing hybrids in major crops, which is also the need of the hour for vegetables. The project of hybrid development in selected vegetables is therefore, augmented to cadre the need of the hour of vegetable hybrid seed production. The efforts are being made to develop hybrids in determinate tomato, chilies and bitter gourd for field cultivation.

Chilies: Nursery of chili entries/material was sown on raised beds in tunnel on 30.11.2011. The seedlings of six elite homogeneous chili lines along with one OPV and two international hybrids were transplanted (04.04.2012) in an isolated/net tunnel in order to protect from foreign pollen contamination and out crossing. The true to type plants in all of the lines/OPV were retained by rouging out of the off type plants, while the two international hybrids were subjected to self pollination in order to obtain F₂ for studying the segregation for the identification of segregates. The basic data of characterization of the elite chili lines were recorded. The chili inbreds were crossed in a five different combinations. The emasculations and pollinations were made on the same day. On November 6th, 2012 nursery of chili inbred lines (09); newly developed FI hybrids (05) and International checks (02) was sown under the plastic tunnel and transplanted in the open field for their primary evaluation on March 12th, 2013 and the data were being recorded. The characterization data on 03 elite chili lines right from the cotyledonary stage were recorded according to the descriptor of FSC & RD.

Bitter Gourd: The nursery of all of the bitter gourd material (Developing Inbreds, OPVs & Stable inbreds) was sown on 20.03.2012 and was transplanted on 05.04.2012. The seedlings of all the experimental material were raised in nursery beds in tunnel. Recommended cultural practices and plant protection measures were taken up before and after the sowing of seeds. Up to August 2012, eight stable bitter gourd inbreds (I.B.L 01, I.B.L 02, I.B.L 03, I.B.L 04, I.B.L 05, I.B.L 06, I.B.L 07, & I.B.L 08) and five OPVs (Fsd Long, Kala Karela, Vehari Small, Vehari Long & Vehari Medium) were maintained through manual sib-mating. The male and female flowers were capped in the evening in order to avoid the foreign pollen contamination. The capped female flowers were pollinated the next day with the respective capped male flower in order to maintain it by fixing the gene frequency. The seed of these lines/OPVs were successfully harvested and packed. Further work on bitter gourd is in progress (2013).

Self-pollination was followed in the bitter gourd material for the progression of material towards the development of stable inbred lines. This activity is also underway to date; the material in hand is as below:

$$\begin{aligned}S_0 &= 02 \\S_1 &= 03 \\S_2 &= 06\end{aligned}$$

Tomato: Tomato nursery comprising of ten parental lines viz., Continental, VCT-01, BSX-935, Riogrande, Pakit, Roma, Peto-86, Nagina, Avinash-II, Red Ball and No.17905 was sown on 14.02.2012 and transplanted on 28.03.2012 in the field for its seed multiplication and morphological characterization; to understand their promising characteristics for hybrid development in field tomatoes. The crossing of the selected lines viz., Continental, VCT-01, BSX-935, Riogrande, Pakit, Roma, Peto-86, Nagina and No.17905 was not under taken due to late flowering and high temperature. The morphological characters (days to flowering, days to maturity, number of flowers/ cluster, number of cluster/plant, number of fruits/cluster, single fruit weight, fruit size, number of locules/fruit, yield/plant) and other detail parameters regarding plant botanical characteristics were studied according to the descriptors of FSC&RD. The descriptor of eight candidate lines viz., Continental, VCT-01, BSX-935, Riogrande, Pakit, Roma, Peto-86 and Nagina was completed; however, the descriptor of line No. 17905 will be completed in the next season.

During year 2013, tomato nursery comprising 9 selected entries/parental were sown on 20th February and transplanted on 16th March for hybrid development under the plastic tunnel. The crosses were made using “Line x Testor model”.

Name of Project: Conservation and Sustainable Utilization of Aromatic and Medicinal Plants

Name of PI/Institute: Dr G. Mustafa Sajid,
Director, IABGR, NARC

Duration: 01.04.2012 to 31.03.2015

Financial Status: Total Cost: Rs. 5.749 million
Funds Released: Rs. 1248500/-
Funds Utilized: Rs. 934090/-

Objectives:

- Germplasm collection of aromatic and medicinal plants of commercial importance from diverse ecologies (AJK, Gilgit-Baltistan, northern KPK and Cholistan/Thall areas of Punjab).
- Characterization and identification of promising lines of selected medicinal plants of economic significance.
- Seed multiplication and on-farm demonstration of elite lines of cultivated medicinal plants at farmer's field.
- Chemical (Phytochemical) analysis of cultivated medicinal plants for active ingredients.
- Training of local growers, researchers and students at graduate/postgraduate level in production technology and post-harvest processing of medicinal plants.

Achievements:

Under the project, aimed at devising strategies for conservation and sustainable use of important medicinal and aromatic plants of the Pakistan so that local genetic resources can be efficiently utilized; a total of 134 accessions of indigenous germplasm of *Camellina sativa*, fennel, guar, Kalonji, linseed, sesame, taramira and tikhme-balungoo were collected from diverse ecologies including Cholistan, Hazara and Thall area during first year of the project. Efforts were also made to acquire germplasm of medicinal plants of economic importance from abroad. As a result received 4171 accessions of buckwheat, fennel, guar, Ispaghool, Kalonji, linseed, Methi, sesame and Taramira germplasm from Australia, Canada, Czech Republic, Germany and USA. Diverse gene-pool of said species has enhanced the existing limited genetic resources of medicinal plants germplasm in Pakistan.

A total of 189 accessions of guar and 102 accessions of Taramira were characterized under field trials, while 147 accessions of Ispaghool are being characterized under glasshouse conditions to assess variation for agro-morphological characters and other traits of economic significance. A considerable level of variation was observed among different accessions of guar germplasm for most of the phenotypic traits. A high level of variability was detected among different Taramira accessions for a number of morphological traits. A high level of variation was also observed

among various accessions of Ispaghul for days to flowering. Genetic diversity of sesame and guar landraces was also studied at seed storage proteins level using sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE) and at DNA level using random amplified polymorphic DNA (RAPD) analysis, respectively.

Seeds of selected lines of cultivated medicinal crops of economic significance including fennel (one line), guar (four lines), Methi (one line), 'NARC-Kalonji', Taramira (one line) were multiplied for enhanced cultivation at NARC as well as farmers' fields for using as seed source for the growers. Seed of selected lines of cultivated plant species will be provided to farming community as seed source. Besides NARC, on-farm demonstration trials of four promising lines of guar, one elite line of Taramira and NARC-Kalonji were conducted at Ahmedpur Sharqia, Bahawalpur, Bhakkar, and Pindi Gheb area at farmers' fields.

Two students at postgraduate level (M. Phil.) from QAU, Islamabad and two research internees, one each from Gomal University, D.I. Khan and University of Agriculture, Faisalabad were trained at graduate level in medicinal plants production & post-harvest technology, morphological evaluation techniques using IPGRI descriptors, data analysis and conservation techniques at PGRI gene-bank.

Name of Project: **Packaging Innovation for Quality and Shelf Life Sustainability of Dhakki Dates and the Development of Value Added Date-Products**

Name of PI/Institute: **Dr Shahzada Arshad Saleem,**
Post Harvest Technologist, Food Technology Section,
ARI, Dera Ismail Khan

Duration: 01.04.2012 to 30.03.2015

Financial Status: Total Cost: Rs. 3.694 million
Funds Released: Rs. 1777700/-
Funds Utilized: Rs. 1765557/- (up to 31.12. 2012)

Objectives:

- To devise techniques for shelf life extension and quality enhancement of Dhakki dates through packaging.
- Standardization and development of value added products from inferior grade dates.
- Studies on shelf life stability during storage under various packaging materials at different temperatures, environment & acceptability by end user.

Achievements:

Purchases of equipments, chemicals and packaging materials were made. Some experiments on packaging were conducted and their permeability studied. Value-added date products like Date Candy and Date energy/protein rich Bars were developed from dates of inferior grade. Date bars not only enhanced the Organoleptic values but also increased nutritional qualities providing extra amount of protein, minerals, vitamins and fibrous contents. Enriched date bars would likely be well accepted, among children, offering an opportunity for improving the nutritional quality of their diets.

Name of Project: Molecular Diagnostic Assay for the Assessment of Seed Health in Rice (*Oryza sativa*)

Name of PI/Institute: Dr Riffat Tahira,
SSO, Institute of Agri - Biotechnology and Genetics
Resources, PGRP, NARC, Islamabad

Duration: 01. 04. 2012 to 31.03.2015

Financial Status: Total Cost: Rs.3.366 million
Funds Released: Rs.1489800/-
Funds Utilized: Rs.765853/- (up to March, 2013)

Objectives:

- Assessment of rice germplasm present in the gene bank and the seed available in the market against Bacterial leaf blight and Rice blast.
- Improving the health status of infected rice seed via various treatments and replacing the infected seeds in the gene bank with the healthy seed.
- Documentation of seed health status and dissemination of information.

Achievements:

Assessment of Rice Germplasm against Bacterial Leaf Blight and Rice Blast:

Collection of Rice Germplasm: Rice seeds of 200 accessions acquired from Genebank, PGRI while Twenty nine different varieties including Bas-00515, Bas-6129, Bas-385, Bas-370, Bas-2000. Bas-198, Super basmati, IR-6, K-5282 and Ks-133 were collected from Sheikupura, Kala Shahkaku, Sialkot, Narowal, Pasroor, Hafizabad and Faisalabad area.

Primer Designing: Eight sets of diagnostic primers and designed for the identification of Bacterial Leaf Blight and Rice Blast by using DNASTAR. Conserved sequences of seven different proteins specific to *Xanthomonas oryzae* and *Pyricularia grisea* (from NCBI) were used for primer designing.

Table” List of primers Designed for Bacterial Leaf Blight and Rice Blast

S.#	Primer Name	Sequence	Region
1	Xoo1F	5'-GTTCTTCGAAAAGCCTGGCA-3'	Conserved hypothetical protein
2	Xoo1R	5'-CGATATAGCTGAAAGCCAC-3'	
3	Xoo2F	5'-GCCAAGCAGGTCGAGCAG-3'	HrcC protein (HrpA protein)

4	Xoo2R	5'CCAAAGTTGGCGCCAA-3'	
5	Xoo3F	5'-CAATGTCTACGGTCGTTTCATTA-3'	Hypothetical protein
6	Xoo3R	5'-GCCTGTCTCAAGCAATGTCT-3'	
7	MIF-F	5-GGATCCATTGAGCATGCGTT-3	Hypothetical protein
8	MIF-R5-	5-CGATCCAATACGATCACTCG-3	
9	Po1F	5-CTCCATGGCTCAGCAGAAGTG-3	Hydrophobin-like protein MPG1
10	Po1R	5-GGTGTCCGAGCAGAAGTTGTT-3	
11	Po2F	5-CATGGGCTTCTCCAACGA-3	
12	Po2R	5-CTTCATCTCGATGGTGAAGCCT-3	
13	Po3F	5-GGCTCTCGCTGTGTATATGCTG-3	Hypothetical protein MYG1 protein
14	Po3R	5-CGATGATCTGCTTGCCAAAGTG-3	
15	Po4F	5-CGTCAACAGCTGTTGCCATT-3	Cytochrome C1
16	Po4R	5-GAAGATGTAGTCGCAGCCAC-3	

Extraction of DNA from Rice Samples: Genomic DNA was extracted from 225 rice samples through CTAB method. Quality of DNA was checked through 0.8% agarose gel and concentration of DNA was measure through Nano Drop Spectrometer.

Extraction of Genomic DNA from *X. oryzae*: Extracted genomic DNA from a local isolate of *X. oryzae* to be used as positive control in diagnostic PCRs.

Standardization of PCR Protocols: All the eight pairs of primers were screened on accession No. 6722, 6724, 6787, 6896 and positive control by varying the annealing temperature from 50-60 C and extension time 1-1.5 min.

Improving Health Status of Infected Rice via various Treatment:

Essential oil from Siam Queen Basil (*Ocimum basilicum*) and mint (*Mentha longifolia*) were extracted from dried plant material through hydro-distillation to remove the infection from rice seeds in comparison with hot water treatment.

Documentation of Seed Health Status:

Rice varieties from different areas were deposited in the gene bank and accession numbers were assigned.

Significant outcomes; are Genomic DNA of 225 rice samples extracted and PCR protocols

have been optimized for *Xoo1* and *Xoo2* genes. No amplification for *Xoo1* and *Xoo2* genes was observed in 30 rice samples indicating the absence of pathogen. These experiments will be repeated for confirmation.

Name of Project: Development of Market Life Enhancement Technology to Persimmon and its Dissemination to Growers (CS053 – 5th batch)

Name of PI/Institute: Ms Nizakat Bibi,
Pr. Scientist, Nuclear Institute for Food & Agriculture (NIFA),
Peshawar

Duration: 01.07.2012 to 30.06.2015

Financial Status: Total Cost: Rs. 4.7377 million
Funds Released: Rs. 1816900/-
Funds Utilized: Rs. 21477/- (up to 31.12.2013)

Objectives:

- Establishment and optimization of pilot scale mobile facility for astringency removal and marketable life extension of persimmon fruit.
- Transfer of this technology to the farmers/ entrepreneurs through trainings and demonstration.

Achievements:

The design of air tight Astringency Removal Treatment (ART) facility for astringency removal and marketing life extension of persimmon fruit finalized with HMC-3 engineer and payment made for fabrication of the facility.

A study to explore the effect of modified atmosphere (nitrogen gas) on market life extension and quality improvement by removal of phenolic compounds of persimmon fruit was carried out. Persimmon from the orchard of Agricultural University, Peshawar was collected at the picking stage followed by sorting, washing and keeping for removal of adhering water. The fruits were divided in to five lots for different treatments i.e. control fruit kept in open crates (T1), fruits kept for 24 hrs in closed atmosphere (T2), fruits kept for 48 hrs in closed atmosphere (T3), fruits kept for 24 hrs in nitrogen enrich/ modified atmosphere chamber (T4) and fruits kept for 48 hrs in nitrogen enrich/modified atmosphere (T5). All the samples were stored in cardboard crates at room temperature for periodic evaluation of antioxidants, quality parameters and sensory evaluation. Significant effect of N₂ and storage period was observed on most of the parameters. Highest mean values of total phenols (3.28), weight loss (5.11), acidity (0.26) and TSS (21.11) were found in control sample (T1) while lowest mean values of total phenols (2.77), weight loss (4.32) and acidity (0.24) were found in fruits kept for 48 hrs in nitrogen enrich/ modified atmosphere (T5). Maximum firmness (3.98), flavor (7.67) and appearance (7.25) values were observed in fruits kept for 48 hrs in nitrogen enrich/ modified atmosphere (T5) while minimum firmness (3.75), flavor (6.58) and appearance (5.83) was recorded in control samples. As a whole fruits kept for 48 hrs in nitrogen enrich/ modified atmosphere (T5) retained maximum quality attributes and also got maximum score for sensory evolution.

Name of Project: Introduction/Evaluation and Demonstration of Exotic, Local Fruit Germplasm and Vegetable Varieties, Hybrids for Enhancement of Farm Sustainability and Poverty Reduction of Khuzdar District (Coordinating Unit HRI, Khuzdar Component-I)

Name of PI/Institute: Mr Muhammad Yaqoob,
SSO, HRI, PARC, Khuzdar

Duration: 01.06.2012 to 31.05.2015

Financial Status: Total Cost: Rs. 5.337 million
Funds Released: Rs. 1403000/-
Funds Utilized: Rs. 367694/- (up to 31.12.2012)

Objectives:

- To establish a disease free nursery of horticultural crops.
- To develop a modern research laboratory/green houses for multiplication of indigenous and exotic germplasm.
- To develop packages for fruits and vegetable cultivation by evaluating optimum crop productivity, including tunnel farming, trickle irrigation, IPM and ICM.

Achievements:

Established a nursery and green house at HRI, Khuzdar for multiplication of indigenous and exotic germplasm of vegetable and fruit plants. Development of laboratory and purchase of equipment remain in progress. Two thousand (2000) seed of Almond, 2000 of Apricot, 4000 of Pistachio, 2000 of Mulberry, 1000 of Wall Nut, and 500 seed of wild Pistachio were sown at HRI, Khuzdar. Seven thousand (7000) cuttings of Olive and 2000 of Pomegranate were planted in shad house and open field. One hundred (100) plants of Papaya and 100 plants of Ber provided to the farmers of Khuzdar district for their plantation. The overall results of nursery germination were satisfactory.

Collected seeds of exotic and local varieties of different vegetables and planted to check their adoptability/ suitability in agro-climatic conditions of Khuzdar region. Tomatoes and chilies were grown in field for their adoptability and suitability.

Different wheat genotypes received under national uniform wheat yield trial from NARC were tested at Khuzdar. The results analyzed will be submitted to NARC.

Farmers of different areas visited HRI shad house/ green house were briefed about different germplasm of fruit and vegetables suitable to local environment of Khuzdar District.

Name of Project: Introduction/Evaluation and Demonstration of Exotic, Local Fruit Germplasm and Vegetable Varieties, Hybrids for Enhancement of Farm Sustainability and Poverty Reduction of Khuzdar District. (ARI Khuzdar - Comp. II)

Name of PI/Institute: Syed Abdul Qaim Shah,
Director, Agriculture Research Institute, Khuzdar

Duration: 01.07.2012 to 30.06.2015

Financial Status: Total Cost: Rs. 3.235 million
Funds Released: Rs. 883000/-
Funds Utilized: Rs. 334495/- (up to 31.12.2013)

Objectives:

- To study and survey the existing horticultural crops production system in the areas and to identify the key areas for improvement.
- To demonstrate the Good Agricultural Practices (GAP) viz. tunnel farming, trickle irrigation, IPM and ICM to horticultural growers through farming system research.
- To impart training to the service provider, extension agents and progressive farmers for rapid dissemination of developed technologies.

Achievements:

A comprehensive questionnaire to study the most prevalent horticultural crops, cultural practices, production and shot coming in Khuzdar district developed. Potential progressive farmers were identified and registered for future farming system research. Survey was conducted in Naal, Wadh and Khuzdar tehsils of Khyzdar district

Nursery and green house was established for sowing indigenous vegetable and fruit plants. Eighty kg seeds of Almond, 80 kg seeds of Apricot and 500 seeds of Mulberry were sown at ARI, Khuzdar. Twelve thousand (12000) cutting of Olive and 60000 cuttings of Pomegranate were planted at ARI open field to be provided to the farmers of Khuzdar district. The overall results of nursery germination are satisfactory.

Seeds of exotic and local varieties of different vegetables were collected and planted to check their adoptability/suitability in agro climatic conditions of Khuzdar region. Tomatoes were grown in field and green house while chilies in field to determine plant growth and yield.

Farmers visited ARI shad/green house were imparted information about different germplasm of fruit and vegetables suitable to local environment of Khuzdar district.

Name of Project: Introduction and Demonstration of Integrated Farming Systems (IFS) to Enhance Farm Sustainability and Poverty Reduction in Lasbella District (Coordinatin Unit - CARS, Bhawani Comp. I)

Name of PI/Institute: Mr Saeed Ahmad,
SO, Coastal Agricultural Research Institute (CARI),
Bhawani District Lasbella

Duration: 01.06.2012 to 31.05.2015

Financial Status: Total Cost: Rs. 4.780 million
Funds Released: Rs. 516500/-
Funds Utilized: Rs. 485000/- (up to April, 2013)

Objectives:

- To study the suitability of different crop-livestock-aquaculture based IFS models for agro-ecological zone of Lasbella
- To investigate the macro and micro-environments for IFS based multiple commodity models
- To study the effects of integrated farming approach on crop productivity, animal performance and total biomass (animal and fish) yield
- To study the economics of crop, livestock and fish productivity under model integrated farming system.

Achievements:

The area of Lasbella district being close to Karachi is suitable for growing deciduous fruits, vegetables, livestock and fishery business. Coastal Agriculture Research Institute has initiated work on project with objective project to study the suitability of different crops and livestock, poultry, fish farming and study of aquaculture of coastal belt of Lasbella district.

Shade house was established for the propagation of nursery of different fruits in the coastal area of Lasbella district of Balochistan, Eight hundred (800) cuttings of Cassava were planted in the field with 75% germination. One thousand (1000) seed of Lemon were planted panted in polyethylene bags. Overall germination of lemon was successful. Two hundred (200) Chicko planted were also on farmers field and 150 in the CARI field for the purpose of IFS. Moreover, five hundred (500) berry planted on the farmers field in Tehsil Bela are growing successfully. Neem trees were planted the farmers filed.

Fish Nursery was provided to the farmers in Tehsil Bella for the purpose of assessment of crop situation & live stock poultry and fish production system. Sudan grass was tested on the CARI experimental field and result is successful.

Name of Project: **Introduction and Demonstration of Integrated Farming Systems (IFS) to Enhance Farm Sustainability and Poverty Reduction in Lasbella District (Lasbella University of Agri., Water & Marine Sciences (LUAWMS), Lasbella Comp. II)**

Name of PI/Institute: **Mr Khan Mir Khan,**
Lecturer, Faculty of Crop and Plant Sciences
University of Agri., Water & Marine Sciences, Lasbella

Duration: 01.08.2012 to 31.07.2015

Financial Status: Total Cost: Rs. 5.036 million
Funds Released: Rs. 897280/-
Funds Utilized: Rs. 196573/- (up to 31.12.2012)

Objectives:

- To study the existing crop, livestock and aquaculture production system in the Lasbella district.
- To undertake the capacity building program to propagate sustainable crop livestock aquaculture based IFS models.
- To develop cost effective and viable packages for sustainable agriculture productivity.

Achievements:

To assess the potential of oat fodder at coastal areas, 11 entries of oat fodder provided by NUFYT (NARC) sown in October 2012 at LUAWMS. All the entries performed well. Data regarding yield collected at harvesting and analyzed.

Three entries of Lucerne seed provided by NUYFT were planted in October 2012 at LUAWMS and data on various parameter recorded. Data after analysis to recommend ideal variety with better produce will be provided.

Fifty five (55) entries of 8 different varieties of Sugar beet were planted on November 2012 on ridges and compared with flat bed system. Data on sowing time, varietal performance, methods of ploughing, plant spacing, fertilizer application, irrigation, sugar content and bricks recorded.

Eighteen (18) local wheat varieties purchased from local market sown in November 2012 to assess their potential in local climatic condition of coastal area. Data regarding yield parameter collected at the time of harvesting but results were not satisfactory due to fast wind during spike and milking stage.

To introduce fish pond system in district Lsbella as a substitute of marine fishing, a pond was established at LUAWMS for experimental purpose and fish juvenile purchased from local market in June 2013 were introduced. The growth of all fish is satisfactory.

A survey of ample area has been carried out to assess the cropping pattern, agronomic practices and gardening situation at Lasbella. The major crops and fruits grown in Lasbella district are oils seed (mustard, sesame, castor seed), pulses (mung bean, mashes), fodder (lucerne, maize, berseem, janthar, jowar) and fruits (mangoes, citrus, banana, guava, papaya, coconut, water melon, musk melon and oil palm). Majority of people are cultivating banana fruit at Uthal and chiku, papaya at Bella. The produce is marketed in Karachi to fetch better price. The water situation is good while in some areas saline water in dug also found. There is no canal water in the area except Hub canal originating from Hub dam. All the farmers are irrigating their fields on tube wells or flash floods.

Nursery shads constructed at LUAWMS for sowing off season vegetable, fruit plant seedlings of papaya, Guava, Chiku etc. The vegetable seed will be provided to farmers in different location of Uthal and Bella.

Name of Project: Development and Evaluation of a In-bin Seed Drying, Aeration and Storage Technology

Name of PI/Institute: Mr. Liaqat Ali Shahid,
PE/PSO, Agricultural Biological Engineering Institute (ABEI),
NARC, Islamabad

Duration: 01.10.2012 to 30.05.2015

Financial Status: Total Cost: Rs. 5.030 million
Funds Released: Rs. 380500/-
Funds Utilized: Rs. 30450/- (up to 31.12.2013)

Objectives:

- To develop and evaluate an In-bin seed drying, aeration and storage technology.
- To undertake cost analysis of this technology.
- To demonstrate this technology among the local agricultural machinery manufacturers and seed growers/traders.

Achievements:

Literature review about the main design parameters such as input output seed moisture contents, bin diameter and height ratio, choice of raw material, hot and cool air flow, different fuel options, and selection of accessories such as fans, burners etc. has been completed. Conducted one week feed-back survey of seventeen seed companies /millers located in rice zone (Gujranwala, Daska-Sialkot, Lahore, Sahiwal, Chinot, Sargodha and Hafizabad). Results of the survey revealed most of the seed companies have no mechanical drying and storage system. They prefer to buy manually harvested paddy at moisture content not more than 17%. They are willing to use the drying and storage system if it not affecting the quality and emergence capability.

On the basis of feedback from the seed companies and literature review , the In-Bin system design parameter has been quantified and finalized as per following detail:

Bin diameter: 3 m

Height: 3.5 m

Bin capacity: 15 tons paddy

Static pressure: 4-9 cm of water

Air flow rate: Hot air: 1.02 - 1.34 m³/min/ton; Cool air: 0.07 - 0.69 m³/min/ton

Top cone angle: 30⁰

Bottom cone angle: 45⁰

Fan type: Centrifuge type

Heating source: LPG burning

Temperature, humidity and pressure gauges: Standard available

Base frame with rubber tires: Moveable with single point hitch
Loading and unloading elevators: Standard available locally
Control panel: As per requirement

Three potential machinery manufacturers have been short listed during visit in June 2013 on the basis of their manufacturing capabilities and workshop facilities. Pre-requisite tenders procedural formalities are being completed. The tendering process will be started through NARC.

Natural Resources

Name of Project: Centre Pivot Irrigation System for Enhancing Water Productivity of Seed Multiplication System and Crop Production Systems (WRRI, NARC, Islamabad Component-I)

Name of PI/Institute: Mr. Asaf Ali Bhatti,
Principal Scientific Officer, Water Resources Research Institute, NARC, Islamabad

Duration: 01. 03. 2010 to 28. 02. 2013

Financial Status: Total Cost: Rs.8.386 million
Funds Released: Rs.2.953 "
Funds Utilized: Rs.2.611 "

Objectives:

- To develop Center-pivot sprinkler irrigation facilities for seed multiplication and crop production at NARC and other ecologies of Pakistan.
- To conduct research at various ecologies for crop production under center pivot irrigation systems.
- Devise packages of technology for optimum water productivity for seed and crop production.
- Demonstrate and disseminate state of the art irrigation technologies to farmers, extensionists, researchers and planners.

Achievements:

Five Centre Pivot Sprinkler Irrigation Systems (CPSISs) (one at each province and one at Islamabad) were installed ranging from 8 acres to 92 acres of coverage through the country under the ALP funded project. Performance evaluation of each system was done before each cropping period. The water distribution efficiency (DU) and application efficiency (coefficient of uniformity, CU) was determined 82% and 82%; 90 and 91% and 91% and 88%, 82% and 74% and 85% and 90% of NARC, Bahawalpur, Quetta, Thana Boula Khan and Dera Ismail Khan respectively. The water application efficiency of the systems was more than 80% which shows the satisfactory performance of the centre pivot systems at all locations.

The centre pivot system of NARC had travel speed of 4.04 meters per minutes and spent 6.59 hours for 360° rotation at 100% timer. The systems at Thana Boula Khan, Bahawalpur, Dera Ismail Khan and Quetta had travel speed of 4.20, 3.77, 3.77 and 3.9 meters per minute and spent 6.59, 7.6, 4, 4 and 2.3 hours time for 360° rotation at 100% timer, respectively.

Maximum yield of wheat, canola, sunflower and corn was 5770, 2400, 2676 and 4248 kg per hectare, respectively during the year 2011-2013 crop periods under CPSIS at NARC. Water productivity of wheat was 0.69, 0.99, 0.96, 0.50 and 1.74 kg/m³ at Thana Boula Khan, D. I Khan, Bahawalpur, Quetta and NARC, respectively. The CPSIS system was analyzed using for cropping systems; Wheat-Sunflower, Canola-Sunflower, Wheat-Corn and Canola-Corn using maximum crop yield of above crops. Net benefits of Rs. 192637/- per hectare were obtained from wheat-sunflower, Rs. 73665/- per hectare from canola-sunflower, Rs. 230244/- per hectare from wheat-corn and Rs. 12420/- per hectare from canola-corn. Maximum benefits of Rs. 192634/- per hectare were obtained from wheat-sunflower, while minimum benefits of Rs. 73665/- per hectare were obtained from canola-sunflower among the entire cropping system.

Energy consumption was calculated by operating the CPSIS and tube-well at required pressure and 1.085 KWH were consumed in one hour. The CPSIS covered 50 acers in 6.58 hours at 100% speed and consumed 7.14 KWH for an application of 3 mm depth of water and 57 KWH for 24 mm depth of water application. The CPSIS consumed 6 liters of diesel in one hour operation and covered 50 acers in 6.58 hours at 100% speed and consumed 40 liters for an application of 3 mm depth of water and 320 liters for 24 mm depth of water application. By multiplying factor (MF) of 20 as for IESCO for this location, the total electricity consumed 1140 KWH for 50 acers. Using tariff rate for agriculture (w.e.f. 16.05.2012), Rs 13.0 (peak) for one KWH of electricity and Rs. 107/litre of diesel was used for the estimation of operational cost of CPSIS.

One research paper has been published out of research work and one was presented in 20th International Congress on Sustainable Water Management in Developing Countries – Challenges and Opportunities at Jamshoro, Sindh.

Name of Project: Centre Pivot Irrigation System for Enhancing Water Productivity of Seed Multiplication System and Crop Production Systems (FO&S, NARC, Islamabad Component-II)

Name of PI/Institute: Mr. Talat Farid Ahmed
PSO/Sr. Engineer, Farm Operation & Services, NARC, Islamabad

Duration: 01. 03. 2010 to 28. 02. 2013

Financial Status:
Total Cost: Rs.21.231 million
Funds Released: Rs.17.039 "
Funds Utilized: Rs.11.613 "

Objectives:

- To develop Center-pivot Sprinkler Irrigation facility for seed multiplication and crop production at NARC.
- Devise packages of technology for optimum water productivity for seed and crop production.
- Demonstrate and disseminate state of the art irrigation technologies to farmers, extensionists, researchers and planners.

Achievements:

To meet the demand of quality seed by the local farming communities , it is imperative that area under irrigated agriculture be increased by introducing a high efficiency irrigation system like Centre Pivot Irrigation System (CPIS). So a fixed CIPS was procured and installed on 50 acres under the project. Other related infrastructures were also built like construction of onsite ware house, 35 KVA GANSET, tubewell, tubewell networking, mesh fencing with shed on centre pivot accessories pad and mesh fencing with shed on centre pivot fixed tower.

Four season crops were sown on this system during 2011 to 2013. In Kharif 2011, five crops were sown initially which includes Mung, Sorghum, Millet, maize and Sunflower by Pulse, MSM, Fodder and Oilseed Program respectively. The crop productivity and water productivity was not good due to some problems in machine and source of water supply. The second season crops sown in this high efficiency irrigation system (HEIS) were Sunflower, Oat and Wheat in Rabi 2011-12. The crop and water productivity was better compared to previous year. Kharif 2012 was third season and crops sown were Sunflower, Mung, Rice, maize for grain, Guwara, Maize for fodder and Sorghum and Vegetables. The crop productivity and water productivity was much better than previous two seasons. In fourth season i.e. Rabi 2012-13, Canola and Wheat were sown with good crop and water

productivity in comparison with previous three seasons.

Now the system is fully functional. Although results of first two seasons crops were not to the mark due to initial stages of seed development system, insufficient input resources of commodity programs involved in seed increase activities on this system. Some adjustment problems in centre pivot machine and electricity/mechanical problem of tubewell were also observed during the period. However later on results were good due to minimum issues related to the programs and negligible problems were observed in the centre pivot machine and water source.

Name of Project: Centre Pivot Irrigation System for Enhancing Water Productivity of Seed Multiplication System and Crop Production Systems (AZRI, Bahawalpur Component-III)

Name of PI/Institute: Dr. Rukhsana Anjum/ Malik Muhammad Yousaf,
Director/Principal Scientific Officer,
Arid Zone Research Institute - PARC, Bahawalpur

Duration: 01. 03. 2010 to 28. 02. 2013

Financial Status: Total Cost: Rs.8.639 million
Funds Released: Rs.5.975 "
Funds Utilized: Rs.5.720 "

Objectives:

- To develop Center-pivot sprinkler irrigation facilities for seed multiplication and crop production at NARC and other ecologies of Pakistan.
- To conduct research at various ecologies for crop production under center pivot irrigation systems.
- Devise packages of technology for optimum water productivity for seed and crop production.
- Demonstrate and disseminate state of the art irrigation technologies to farmers, extensions, researchers and planners.

Achievements:

Appropriate site was selected for installation of center pivot irrigation (CPI) system at AZRI farm, Bahawalpur. The M/s Valley Irrigation Inc. completed the installation of CPI system at AZRI farm during February-March, 2010. The system is irrigating an area of 20 acres at AZRI farm and has brought improvement in the seed and crop production in Rabi crops like wheat, barley, chickpea, medicinal and Kharif crops including cotton, maize, castor bean, fodder and *Jatropha curcas*.

The system was commissioned in the month of May 2011 and its proper functioning was ensured in the subsequent months. It was repaired in September 2011 after its some parts in main control panel destroyed in a terrible dust storm. Since then the system is working very well and is being utilized for efficient irrigation for good quality seed production of both rabi and kharif crops. Cultivation of wheat, canola, fodder and *Jatropha* crop has been carried out during rabi season on an area of 20 acres which is being irrigated by the CPI system as per irrigation schedule developed.

Various research trials on different crops such as pulses, cereals, fodders, oilseed, medicinal

and biofuel crops are being conducted under this irrigation system that have also shown encouraging results. Efficiency of the system is to keep the crops in a healthier condition. The data collected so far has clearly indicated the improvement in the crop production at AZRI farm.

Name of Project: Centre Pivot Irrigation System for Enhancing Water Productivity of Seed Multiplication System and Crop Production Systems (WRI Field Station, Thana Boula Khan, Hyderabad, Sindh Component-IV)

Name of PI/Institute: Mr. Abdul Ghani Soomro, Scientific Officer, Water Resources Research Institute, Field Station, PARC Thana Boula Khan, Hyderabad

Duration: 01. 03. 2010 to 28. 02. 2013

Financial Status:

Total Cost:	Rs.18.884 million
Funds Released:	Rs.13.789 "
Funds Utilized:	Rs.13.786 "

Objectives:

- To develop Center-pivot sprinkler irrigation facilities for seed multiplication and crop production at NARC and other ecologies of Pakistan.
- To conduct research at various ecologies for crop production under center pivot irrigation systems.
- Devise packages of technology for optimum water productivity for seed and crop production.

Achievements:

Name of Project: Centre Pivot Irrigation System for Enhancing Water Productivity of Seed Multiplication System and Crop Production Systems (AZRC, Quetta Component-V)

Name of PI/Institute: Mr. Saifullah Khan,
Senior Scientific Officer,
Arid Zone Research Centre - PARC, Quetta

Duration: 01. 03. 2010 to 28. 02. 2013

Financial Status: Total Cost: Rs.8.432 million
Funds Released: Rs.6.280 "
Funds Utilized: Rs.6.239 "

Objectives:

- To develop center-pivot sprinkler irrigation facilities for crop production in Balochistan province ecologies of Pakistan.
- To conduct research for crop production under center pivot irrigation systems.
- Devise packages of technology for optimum water productivity for seed and crop production.
- Demonstrate and disseminate state of the art irrigation technologies to farmers, extension workers, researchers and planners.

Achievements:

The Centre Pivot Irrigation System (CPIS) was installed in 2011. Water connection to CPIS was carried out through reservoir connected to main tube well line temporarily.

Plantation of three improved wheat varieties, Tijaban-10, AZRC-1 and AZRI-96 was carried out on 3 acre. Plantation of two barley improved varieties, Sanober-96 and Rakhsan-10 has also been completed on 2 acre. Five irrigations of 10 mm each were applied on the wheat and barley varieties. Cumin was also planted on 0.5 acre area but due to unavailability of irrigation water, no irrigation could be provided. Only 5.5 acre area was brought under cultivations, out of 8 acres under CPIS, due to abundant presence of stones and non-availability of irrigation water to the CPIS.

Crop data on germination percentage in wheat varieties (Tijaban-10, AZRC-1 and AZRI-96) was recorded as 85% 85% and 75% respectively. In barley (Sanober-96 and Rakhsan-10) it was 72% and 75% respectively. The cold effect data on wheat varieties (Tijaban-10, AZRC-1 and AZRI-96) was recorded as 5%, 5% and 5% respectively while in barley (Sanober-96 and Rakhsan-10) it was 12% and 10% respectively. Crop yield data and water productivity result presented in detail progress report.

The seed yields of 2011-12 of improved varieties i.e. wheat, barley and lentil are reutilized again for research activities of seed multiplication during 2012-13.

More area of unlevelled land was brought under cultivation which was not possible without this system. Quality breeder's seed has been produced with this system under scientist's supervision which was not possible at farmers' field. Devised packages of technology for optimum water productivity for seed and crop production.

Name of Project: Centre Pivot Irrigation System for Enhancing Water Productivity of Seed Multiplication System and Crop Production Systems (AZRI, D. I. Khan, Component-VI)

Name of PI/Institute: Mr. Noman Latif,
Senior Scientific Officer,
Arid Zone Research Institute- PARC, Ratta Kulachi, D. I. Khan

Duration: 01. 03. 2010 to 28. 02. 2013

Financial Status:

Total Cost:	Rs.8.689 million
Funds Released:	Rs.7.438 "
Funds Utilized:	Rs.7.233 "

Objectives:

- To develop center-pivot sprinkler irrigation facilities for seed multiplication and crop production at NARC and other ecologies of Pakistan.
- To conduct research at various ecologies for crop production under center pivot irrigation systems.
- Devise packages of technology for optimum water productivity for seed and crop production.
- Demonstrate and disseminate state of the art irrigation technologies to farmers, extension workers, researchers and planners.

Achievements:

The center pivot system (ALP project) was launched at AZRI Farm, D. I. Khan for the period of three years with effect from 01.03.2010 to 28.02.2013. The center pivot system was installed during the month of December, 2010 with a total area of 33.35 acres installed by M/S Valley Irrigation with components including Genset, turbine pump with motor, controlling panel, sprinkles, pressure gauge, flow meter and fertilizer injection tank and pump with motor. The circumference of CP system covers 20 acres. The operational performance of the system like emitter discharge, pressure, operating speed and genset produced voltage were satisfactory during the whole project period. Mung bean crop was tested in Kharif 2011 for its response on different moisture levels applied by CP irrigation system. However, during the crop season it was concluded that due to hard clayey soil, the moisture is not reaching the root zone. Thus the trails were discarded and only 73 kg seed was taken as a result of general cropping. For soil amendments including sand and Farm Yard Manure (FYM) was added in large quantity to improve the soil texture (tilth). Seed multiplication plots of wheat, chickpea, canola and rapeseed were sown during Rabi (2011-12) but very little produce were obtained due to hard and clayey nature of soil. During Kharif, 2012, three crops were sown but due to hard soil only 35 kg guar, 15 kg mung bean and 17 kg sunflower were obtained. During Rabi, 2012-13, wheat crop was sown on 4 acres,

getting total yield of 32 bags, each bag containing 100 kg of seed. All the bags were sold on Tehsil rate Rs. 2900/bag. An amount of Rs 110825/- was deposited in bank. A trial was designed titled “Effect of various methods of sowing on mung bean” planted under CPIS during spring 2013. The results showed that drill sowing gave maximum yield of 747 kg/ha. During spring 2013 sown three (03) acres of Dhancha (Jantar) and ploughed up in the soil as a green manure for the improvement of soil texture.

Two research students conducted their study under the project required for their thesis writing one from UET, Peshawar for M. Sc and one from Gomal University for B. Sc degrees. and one from

The study conducted revealed that CPIS is the best platform for production of good quality seed of various crops. Its performance can be rated better in sandy soils as compared to fine clayey type of soil. CP are easily automated and can have much lower labor cost than periodic move sprinkler system. The CP machine has not yet adaptive and getting popularity amongst the farming communities because of high initial and running cost.

Name of Project: Use of Alternative Energy Sources for Pumping Water in Agriculture (NARC, Islamabad Component-I)

Name of PI/Institute: Mr. Abdul Wahab Siyal,
PI/Coordinator, Asstt. Agri. Engineer,
Water Resources Research Institute, NARC, Islamabad

Duration: 01. 03. 2010 to 28. 02. 2013

Financial Status:

Total Cost:	Rs.10.414 million
Funds Released:	Rs.8.692 "
Funds Utilized:	Rs.7.839 "

Objectives:

- Develop and adapt pumping systems for irrigation water using alternative energy sources (solar, wind and biogas)
- Evaluate and improve efficiency of pumping systems run by alternative energy sources,
- Evaluate economics of pumping systems run through alternative energy sources.

Achievements:

The overall objectives of the project was to explore the use of alternative energy sources to combat soaring energy crises faced by the agriculture sector specially in pumping of irrigation water. The project activities started after completion of 1st objective ‘to develop and adapt pumping system for irrigation water using alternative energy sources (solar, wing and biogas)’. The existing dug well at Climate Change, Alternative Energy and Water Resources Institute (CAEWRI), NARC field station was dig 6 feet more deep to increase water column for experimentation through its pumping with alternative energy sources. The solar system already installed was renovated with replacement of its previous setting and also a new solar pumping system installed.

During project activities two types of biogas digesters; fixed dome 35 m³ and ultraviolet black carbon polyethylene floating type 22 m³ capacities were developed and introduced in the country. Biogas plants were developed at four locations: NARC, Islamabad; AZRI, Bahawalpur, Punjab; AZRI, Umerkot, Sindh and AZRI D. I. Khan, Khyber Pakhtunkhwa. Local industries were involved and empowered to develop polyethylene biogas digester with more than 20 years life. Biogas digesters were evaluated throughout the year. Results showed that average biogas production was 13 m³/day in June and 3 m³ in February in fixed dome digester. While in floating type digester, biogas production was 6 m³/ day in the month of June and 2 m³ in December.

A 16 horse power direct injection dual fuel engine simultaneously operating a 7.5 kilowatt

generator and 3 stage centrifugal pumping system for pumping groundwater was tested. Data was collected to run engine on only diesel for comparison with running on dual fuel mode (diesel + biogas). The results showed that average fuel consumption per hour operation through diesel was 1.5 liters. While on dual fuel mode the average consumption of diesel was 0.56 liters combine with 2 m³ biogas. Almost 62% diesel was saved during one hour operation on dual fuel mode.

Designed, developed and installed biogas compression, purification and storing system at Alternative Energy Laboratory, CAEWRI, field station for the first time in Pakistan. Developed techniques to compress and store biogas at medium pressure (between 2 and 200 psi) which was an unresolved issue in biogas system's history in Pakistan. By removing carbon dioxide (CO₂) and Hydrogen Sulfide (H₂S) the refined biogas thus was of the grade to natural gas (Sui Gas). This refined biogas was used to run petrol engine/ generator. Many techniques for removed CO₂ from the generated biogas were tried but the most cost effective way found was passing gas at high pressures through showering of water. The developed water based scrubber is easy to operate without any chemical or complex machinery cost.

Solar powered 1.5 to 2.5 hp submersible pumps having discharge capacities of 1.5 to 3.5 liter/ sec with controlled and Photovoltaic (PV) modules of 1200 to 2880 watts have been installed at five project sites; NARC and Satramile Islamabad, AZRI Bahawalpur, Punjab; AZRI Umerkot, Sindh and AZRI, D. I. Khan, Khyber Pakhtunkhwa. Three acres orchard of high density fruit plants were developed through drip irrigation systems operated with solar powered pumping systems. Moreover, 2 kilo watts wind generator was installed at AZRI, Umerkot which is hybrid with solar pumping system to irrigate orchard.

By analyzing livestock population all over Pakistan and AJ&K, study reveals that province of Punjab has the maximum potential for biogas production as compare to all other provinces, followed by Sindh, Khyber Pakhtunkhwa and AJ&K.

The total volume of biogas produced from fixed dome and floating drum was 2424, 1350 m³ respectively. The retention time of fixed dome biogas plant and floating drum was 58 and 61 days respectively. More biogas was produced in summer months, when the biogas plant inside temperature was in the range of 20 to 40 °C and less biogas produced during the winter months when the biogas plant inside temperature was in the range of 10 to 20.

Supervised 6 students BS (Hons) of International Islamic University, Islamabad for their research thesis under the project. A student also conducted research for M Phil in NRM for thesis writing 'Performance Evaluation of a Fixed dome Bio Digester for Biogas Production'.

Name of Project: Use of Alternative Energy Sources for Pumping Water in Agriculture (AZRI, Bahawalpur Component-II)

Name of PI/Institute: Dr. Rukhsana Anjum,
Director, Arid Zone Research Institute - PARC, Bahawalpur

Duration: 01. 02. 2010 to 28. 02. 2013

Financial Status: Total Cost: Rs.6.912 million
Funds Released: Rs.2.610 "
Funds Utilized: Rs.2.268 "

Objectives:

- Develop and adapt pumping systems for irrigation water using alternative energy sources (solar, wind, and biogas),
- Evaluate and improve efficiency of pumping systems run by alternative energy sources,
- Evaluate economics of pumping systems run through alternative energy sources.

Achievements:

The objectives of the project is to explore the use of alternative energy source to combat soaring energy crises faced by the agriculture sector particularly in pumping irrigation water by developing cost effective pumping systems and introducing the concept of mini tube wells for small farmers. In order to achieve the objective, an appropriate site was selected at AZRI farm of Bahawalpur and biogas unit (35 cubic meter, concrete dome shape Chinese model) has been constructed in October, 2010 for the production of biogas to operate tube well for continuous supply of irrigation water. The production of biogas started after one month filling of biogas well with fresh farm yard manure and tested in the field. The data of per day production of biogas was recorded regularly. The production of gas is not up to the mark to make self sufficiency to fully relay on this for continuous supply of irrigational water. Efforts have been made to increase the efficiency of biogas production through various means to make the tube well operational for longer time to meet the irrigation requirements. The biogas unit is serving as a model

A solar powered pumping system along with drip irrigation was also installed in March 2012 having an output of 38000 L/day. The system is being utilized at Cholistan farm whenever required. The efficiency of solar tube well is being evaluated and cropping pattern managed accordingly. Citrus and guava plants have been planted on 02 acres at Cholistan farm.

Economic analysis of these two pumping system has been carried out which needs further

refinement and sufficient data is required to verify the results.

Name of Project: Use of Alternative Energy Sources for Pumping Water in Agriculture (AZRI, D. I. Khan, Component-III)

Name of PI/Institute: Engr. Noman Latif,
Principal Scientific Officer,
Aird Zone Research Institute - PARC, D. I. Khan

Duration: 01. 02. 2010 to 28. 02. 2013

Financial Status: Total Cost: Rs.7.176 million
Funds Released: Rs.5.381 "
Funds Utilized: Rs.3.311 "

Objectives:

- Develop and adapt pumping systems for irrigation water using alternative energy sources (solar and biogas)
- Evaluate and improve efficiency of pumping systems run by alternative energy sources.
- Evaluate economics of pumping systems run through alternative energy sources.

Achievements:

40 plants of guava, citrus, lemon and mango were re-planted in March 2013, as to gap filling in the drip irrigated orchard with solar pump. The survival rate can be reported as 95%. Seasonal vegetable were also sown under drip irrigation system.

During the data collection it is reported that water table is going down because of less rainfall in monsoon. The submersible pump at the depth of 120 ft is at times showing the "low water source" sign. The situation appears after operating the pump for around 30 min i.e. approximately after extracting 1000 gallons of water. Data collection is under process to evaluate this seasonal variation and improvement if any in coming days.

Not good enough progress report

Name of Project: Use of Alternative Energy Sources for Pumping Water in Agriculture (AZRI, Umerkot, Component-IV)

Name of PI/Institute: Mr. Hamaz Ali Samoon,
Asstt. Engineer, Arid Zone Research Institute - PARC,
Umerkot

Duration: 01. 02. 2010 to 28. 02. 2013

Financial Status: Total Cost: Rs.4.980 million
Funds Released: Rs.3.723 "
Funds Utilized: Rs.3.465 "

Objectives:

- Develop and adapt pumping systems for irrigation water using alternative energy sources (solar, wind, and biogas)
- Evaluate and improve efficiency of pumping systems run by alternative energy sources.
- Evaluate economics of pumping systems run through alternative energy sources.

Achievements:

Name of Project: Solubility Enhancement of Phosphorus from Rock Phosphate (NARC, Islamabad Component-I)

Name of PI/Institute: Mr. Matiullah Khan,
Senior Scientific Officer,
Water Resources Research Institute, NARC, Islamabad

Duration: 08. 01. 2010 to 07. 01. 2013

Financial Status:

Total Cost:	Rs.5.749 million
Funds Released:	Rs.3.314 "
Funds Utilized:	Rs. 3.157 "

Objectives:

- Enhance the solubility of rock phosphate by biological means and formulate Biological Phosphate Rich Organic Matter (Bio-PROM) for better crop production.
- Explore other options for effective use of rock phosphate for better crop production.
- Collect information and categorize the indigenous resources of rock phosphate on the basis of phosphorus content.

Achievements:

Rock phosphate (RP) is basically tri-calcium phosphate $[Ca_3 (PO_4)_2]$ insoluble in water and unavailable to plant. The reserves are widespread in Kakul, Guldaman, Taranawai and Legerban villages of district Abbottabad. The RP of Hazara area contains good quantity of phosphorus (P). The amount of P content decreased from south to north. In southern reserves the P content ranged from 16% to 36%, while in northern from 16% to 31%. The fixed P of the RP can be solubilized by composting with poultry litter however, inoculation with Effective Microorganisms (EM) gives significant boost to P solubilization. The P-compost (PEC) prepared from poultry litter, RP and EM showed higher P content in the compost. The P-compost applied to the rice crops gave better response and produced more grain and dry matter yields with maximum plant P uptake than single super phosphate when applied at the rate of 6 Mg ha⁻¹. The residual effect of the prepared PEC was more prominent than SSP on wheat crop grown after rice crop. It gave better yield advantage over SSP in wheat applied already to the rice crop. The soil P content and plant P uptake increased significantly in wheat as a result of the residual effect of the PEC.

Direct application of RP with farm yard manure (FYM) enhanced grain and total dry matter yield of the wheat significantly. Inoculation with EM further enhanced the efficiency of RP and FYM resulted more grain and dry matter yields of wheat with higher plant P uptake. The residual effect of RP applied with FYM and EM was more prominent on sunflower and showed better crop yield with higher P uptake and soil total P. Indigenous Hazara rock phosphate has potential for preparation of good quality single super phosphate. It can be prepared by simple process under field condition with almost half of the prevailing market

rates. Based on the results of the studies conducted during the project, it is suggested that rock phosphate of Hazara area is an indigenous, economical and environment friendly source of phosphorus and has potential to improve crop production and soil fertility through enhanced P solubility by composting with different organic materials, mixing with organic acids and with the inoculation of P-solubilizing microorganisms, which will have definitely positive effects on social and economic conditions of farming community in the country.

Name of Project: Solubility Enhancement of Phosphorus from Rock Phosphate (Agricultural University, Peshawar Component-II)

Name of PI/Institute: Dr Muhammad Sharif, Professor, Department of Soil and Environmental Sciences, the Uni. of Agriculture, Peshawar

Duration: 08. 01. 2010 to 07. 01. 2013

Financial Status: Total Cost: Rs.3.867 million
Funds Released: Rs. 3020579/-
Funds Utilized: Rs. 3020579/-

Objectives:

- Enhance the solubility of phosphorous from rock phosphate through composting with different organic materials
- Determinations of the effects of composts prepared on crops production.
- Explore other options for effective utilization of rock phosphate for better crop production.

Achievements:

To achieve the objectives of the research project; to enhance the solubility of phosphorus from rock phosphate through various biological means and determine its effect on crops production; composts of different organic materials were prepared with rock phosphate and applied to various crops (wheat, maize, sorghum mungbean and berseem in field experiments to determine their effects on yield and P uptakes. Pots experiments were also conducted under natural conditions to determines wheat and berseem yields and P uptake as affected by compost of different organic material and RP inoculated with Arbuscular mycorrhizal fungi. Based on the results of the studies conducted during he project, following conclusions could be drawn:

- Wheat yield, yield components and plants N and P uptake increased significantly by the direct application of rock phosphate (RP) mixed with poultry manure (PM) and humic acid (HA) in the area under investigations.
- Extractable P concentrations increased as 580%, 11% and 29% in sugarcane pulp, Press mud and HA, respectively when composted with RP. In experiments conducted in field, maximum wheat grains yield of 5274 kg ha⁻¹ with 178% increase over control was recorded in treatment of compost of organic wastes.
- By inoculating commercial mycorrhiza with half dose of FYM compost, maximum wheat grains yield of 3500 kg ha⁻¹ and shoot dry matter yield of 8933 kg ha⁻¹ were observed.
- In berseem, total dry matter yield of 4771 kg ha⁻¹ was observed in treatment of

full dose of organic wastes compost inoculated with commercial mycorrhiza. Maximum berseem roots dry matter yield of 1033 kg ha⁻¹ was observed in treatment of half dose of FYM compost inoculated with AMF-II.

- Highest and significantly ($P \leq 0.05$) increased mung bean grain yield, total dry matter and straw yield of 858 kg ha⁻¹, 8167 kg ha⁻¹ and 7309 kg ha⁻¹ respectively were observed with residual effect of compost of RP fed dung applied with half dose of SSP. Maximum soil N and P concentrations were recorded in the treatment of residual effect of composts of RP fed dung and full dose of SSP. Maximum plants N and P uptake of 131 kg ha⁻¹ and of 18 kg ha⁻¹ were found as a result of the residual effect of composts of RP fed dung and organic wastes with half dose of SSP, respectively.
- Maximum and significantly highest maize grain and total dry matter yield of 3161 and 9633 kg ha⁻¹, respectively were produced by the residual effects of composts of organic wastes applied with half dose of SSP, while stover yield of 6574 kg ha⁻¹ was highest in the treatments of residual effect of compost of city garbage and half dose of SSP. Significantly increased N and P uptakes by maize plants were observed as a result of the residual effect of composts and half dose SSP.
- Data analysis of field experiment conducted to determine the effect of composts on yield and plants P uptake of sorghum in slats affected soil, revealed that maximum and significantly increased total dry matter yield was recorded with N, P and K fertilizers applied at the rate of 120-90 and 60 kg ha⁻¹ followed by the significantly at par yield produced in the treatments of combined application of composts of FYM, HA and PM.
- The effect of RP mixed with different doses of HA in a field experiment was determined on the yield and P uptake of wheat plants. Data indicated that maximum and significantly increased wheat grain, total dry matter and straw yields with highest plant P uptake were observed in the treatments where Rock phosphate was applied with HA at the rate of 5 kg ha⁻¹.
- Maximum P concentration of 1.52% was observed in the treatment of oxalic acid mixed with RP followed by the treatments of RP and HA with P concentration of 0.368% in a laboratory incubation study. Maximum plant and roots dry matter yield with highest plants P uptake were recorded in the treatment of RP mixed with oxalic acid followed by the treatments of RP mixed with citric acid in a pot experiment conducted.

Based on the results of the studies, it is suggested that Rock phosphate is an indigenous economical and environment friendly source of P and has potential to improve crop production and soil fertility through enhanced P solubility by composting with different organic materials, mixing with organic acids and with the inoculation of P-solubilizing microorganisms, which will have positive effects on social and economical conditions of farming community in the country.

Four manuscripts have been published in journals while three are submitted for publication. One Ph. D, eight M. Sc (Hons) and sixteen B. Sc (Hons) students have completed studies while studies of two Ph. D and three M. Sc (Hons) are in process.

Name of Project: To Improve the Palatability and Nutritive Value of Comparatively Low Palatable Forage Species

Name of PI/Institute: Dr. Imtiaz Ahmad Qamar,
Senior Scientific Officer,
Rangeland Research Institute, NARC, Islamabad

Duration: 18. 01. 2010 to 17. 01. 2013

Financial Status: Total Cost: Rs.7.140 million
Funds Released: Rs.5293780/-
Funds Utilized: Rs.5139890/-

Objectives:

- To evaluate nutritive value of low palatable grasses at different stages of their phenological development
- To add value to less palatable grasses by mixing with waste materials left over from fruits, vegetables, green fodders, and leaves of multipurpose tree species etc.
- To conduct feeding and digestion trials of value added less palatable grasses with the livestock.
- To survey Pothwar, Balochistan and Northern Areas rangeland to assess biomass production of relatively low palatable grass species.
- To conduct economic analysis through calculation of cost/benefit ratio of the new intervention.

Achievements:

Overexploitation and overgrazing has resulted in the low cover of most palatable grasses and undesirable species have become dominant. The unpalatable species are generally low in nutritive value and succulence especially crude protein content. The value addition of less palatable grasses result in increasing palatability and nutritive value of the livestock feed. The project was, therefore, designed focused on utilizing less palatable grasses as forages, adding value to relatively poor valued forages and conserving them for feed deficit periods. To achieve objectives, different studies were conducted in forage field pasture area and Animal Nutrition Lab, NARC. Studies on digestibility were conducted at Livestock Research Station, NARC. Weight gain studies were conducted at Livestock Research Station, Tomagh (AZRC), Balochistan and value addition of low palatable grasses with fruit was carried at the Mountain Agricultural Research Centre (MARC), Juglot.

The results of the studies revealed that full flowering stage is best stage for harvesting these grasses as quality and yield is at a best compromise at thus stage. The study revealed that the mixture not only produced highest dry matter (DM) but also gave highest protein and low crude fiber (CF) yields than alone grasses. Mixing tree leaves of ipile ipile

with low palatable grasses improves feed quality and digestibility. Mixed feed prepared by treating low palatable grasses with Urea, Molasses and effective microorganisms (EM) enhances feed quality and digestibility. Mixture gave highest protein and low crude fiber yields than grasses alone. Also increase in DM was observed in the mixture compared with grasses alone. EM further decreased the CF in mixtures. Supplementation with EM had positive effects but the results were not highly significant. Supplementation of low palatable grasses with Urea, Molasses and EM can enhance livestock production by improved digestibility. The implementation of the outcomes of the study will help to solve the feed deficiency by including low palatable grass into the existing feed resources and the profits of the farmers could be increased by reducing the cost of production.

The results of the studies leads to the conclusion that that, forage yield at pre flowering stage is low. However quality is better especially in terms of crude protein content and fiber. Full flowering stage is best stage for harvesting these grasses as we take into consideration forage yield and quality together. Maturity stage has adequate yield but quality is poor (less crude protein content and higher fiber). Elephant and Blue panic are high yielding grasses with 5.90 and 4.85 tons/ha dry matter yield respectively. Buffel and Blue panic grasses have high crude protein content. Mixing tree leaves of iple iple with low palatable grass improves feed quality and gave highest protein and low crude fiber yields than alone grasses. Silage and value added hay proved to be the most economical terms of economic returns especially when utilized during feed deficit periods.

The supplementation of low palatable grasses with Urea, Molasses and Microorganism is a good way of including the less palatable grasses in to the existing feeding of the ruminants. Also digestibility data shows that supplementation may result in enhanced production and better returns for peasant farmers.

Name of Project: Seed Production of Multi-purpose Trees and Forage Species (RRI - NARC, Islamabad Component-I)

Name of PI/Institute: Dr. Sarfraz Ahmad,
Principal Scientific Officer, Rangeland Research Institute,
NARC, Islamabad

Duration: 02. 02. 2010 to 01. 02. 2013

Financial Status: Total Cost: Rs.3.242 million
Funds Released: Rs.2025000/-
Funds Utilized: Rs.2008577/-

Objectives:

- To ensure supply of quality seed of multipurpose trees and forage species of foothills and moist temperate zone of Murree for research and development activities.
- To generate baseline data regarding tree phenology, seed viability, and germination percentage of different plant species.
- Develop guidelines for seed collection and utilization for better seedling production.

Achievements:

During the year 2012-13, 500 kg good quality seed of more than 30 different multi-purpose trees (MPT) and forage species was collected and stored properly for research and ecology restoration. Germination percentage of 34 MPT and forage species was tested in the nursery conditions. Viability percentage of 13 tree species was also checked by floating, cutting and tetrazolium chloride tests. About 200 kg seed of different species was sold to the end users including NGOs, GOs, delegates, farmers and collaborators for research plantation forestry. One international collaborator, the Aga Khan Foundation (AKF), Kabul, Afghanistan also purchased seed from the project. Furthermore, 50kg seed was also delivered free of cost to different collaborating Institute of PARC and Universities for research development activities.

Different pretreatments, i.e. soaking in normal tap water for 24 hours, hot water soaking for 2 to 6 hours, nicking and acid scarification for 5, 10, 15, 30 minutes were applied in laboratory conditions for breaking seed coat dormancy of five legume trees of Islamabad area. The treatments improved seed germination with faster germination rate of these tree species. Keeping in view the results, nicking for *Acacia modesta*; acid scarification for 15 minutes for *Albizia lebbeck*; nicking and acid scarification for 30 minutes for *Cassia fistula*; and nicking for *Leucaena leucocephala* seeds are recommended for enhancing speed and percentage of the germination process. In case of *Dalbergia sissoo*, no treatment is recommended for attaining good germination. The mixture of KNO₃ and GA₃ in the ratio of 1:1 is the most effective treatment for breaking dormancy of white clover.

Developed progeny of promising grass species over one ha at RRI field, NARC, Islamabad to conserve precious forage germplasm resources. Protected for long time seed of 59 plant species at the seed Bank of IABGR, NARC, Islamabad for biodiversity conservation. Two M. Phil students of Biotic Resource Science, Department of Natural Resource Management, PIASA, NARC, Islamabad completed multipurpose trees and forage species of Pakistan

Name of Project: Seed Production of Multi-purpose Trees and Forage Species (MARC, PARC, Gilgit Component-II)

Name of PI/Institute: Mr. Munir Hussain,
Principal Scientific Officer, Mountain Agricultural Research Centre (MARC), PARC, Gilgit

Duration: 02. 02. 2010 to 01. 02. 2013

Financial Status: Total Cost: Rs.1.320 million
Funds Released: Rs. 954300/-
Funds Utilized: Rs. 9276050/-

Objectives:

- To ensure supply of quality seed of multi-purposes trees and forage species of dry temperate zone of Gilgit-Biltistan for research and development activities.
- To generate base line data recording trees phonology, seed viability and germination percentage of different plant species.

Achievements:

Quality seed has a major influence on the success or failure of plantation as well as outcome of research and development activities. The project to collect quality seeds of indigenous multi-purpose trees and fodder/forage species in Gilgit Baltistan was initiated in February, 2010 to make seed available along with relevant information to the interested public and private sector in the country. During the project duration, a total of 1124 kg quality seed of eleven different multipurpose trees and forage species were identified, collected, dried, cleaned and stored properly at Mountain Agricultural Research Station (MARS), Chilas, for research and development activities. In addition, different research studies were conducted on different aspects of locations, species, flowering time, maturity and harvesting, germination, viability and seed dormancy breaking methods.

Selected Multi-Purpose Trees and Forage Species for Seed Collection

Sr. No.	Common Name	Scientific Name
1	Kiker	<i>Acacia nilotica</i>
2	Russian Olive	<i>Eleagnus hortensis</i>
3	Shesham	<i>Dalbergia sisso</i>
4	Parkinsonia	<i>Parkinsonia aculeate</i>
5	Mulbery	<i>Morus alba</i>
6	Junipar	<i>Juniperus excelsa</i>
7	Chalghoza (Pin nut)	<i>Pinus gerardiana</i>
8	Deodar	<i>Cederus deodara</i>

9	Oak (rin)	<i>Quercus Incana</i>
10	Hounus	<i>Fraxinus xanthoxyloides</i>
11	Seabuckthorn	<i>Hippopheae rhamnoides</i>

Seed samples of all the 11 different plant species were provided to the gene bank of the Institute of Agricultural Biotechnology and Genetic Resources (IABGR), NARC, Islamabad for proper conservation.

Name of Project: Seed Production of Multi-purpose Trees and Forage Species (AZRC - Quetta Component-III)

Name of PI/Institute: Mr. Muhammad Afzal,
Senior Scientific Officer,
Arid Zone Research Centre - PARC, Quetta

Duration: 02. 02. 2010 to 01. 02. 2013

Financial Status: Total Cost: Rs.1.320 million
Funds Released: Rs.983100/-
Funds Utilized: Rs.897075/-

Objectives:

- To collect quality seed of important multipurpose trees, shrubs and grasses from different ecological zones of Balochistan.
- To generate baseline data regarding tree phenology, seed viability, and germination percentage of different plant species.

Achievements:

During project period, a total of 4859 kg seed of various multipurpose trees, shrubs and grasses collected from various ecological zones of Balochistan was cleaned and stored after applying vita vex. Out of collected seed, 416 kg seeds of 11 species was shifted to Islamabad and sold to NGO working in Afghanistan. One hundred and fifty five kg seed were used for research purpose at AZRC, Quetta and NARC. Fifty four major species of multipurpose trees and forage species were collected, cleaned, dried and stored. Baseline data of tree phenology, seed viability and germination percentage was also collected.

Name of Project: Seed Production of Multi-purpose Trees and Forage Species (AZRI, Bahawalpur Component-IV)

Name of PI/Institute: Mr. Bashir Ahmad
Senior Scientific Officer, Arid Zone Research Institute - PARC,
Bahawalpur

Duration: 02. 02. 2010 to 01. 02. 2013

Financial Status: Total Cost: Rs.1.320 million
Funds Released: Rs. 540300/-
Funds Utilized: Rs. 519231/-

Objectives:

- To ensure supply of quality seed multipurpose trees and forage species of Cholistan desert of Bahawalpur for research and development activities.
- To generate baseline data regarding tree phenology, seed viability, and germination percentage of different plant species.

Achievements:

During the year 2010-2013, 695.4 kg (Check this figure from final report) good quality seed of more than 23 different multi-purpose trees (MPT) and forage species was collected and stored properly for research and ecology restoration. A grass progeny stand established at both the research farms of Arid Zone Research Institute, Bahawalpur (AZRI, Bahawalpur and Cholistan) as a germplasm source for the promising grass species of Cholistan area.

A checklist of plants of Cholistan area with information on scientific name, local name and economic importance of the plant was made. Seed viability testing of different plant species was carried out in the laboratory by physical method applying floating and cutting depending upon suitability of the method to seed size and structure. Depending upon size and structure of the seed, germination was tested either in the laboratory or nursery conditions. For small seed like that of grasses *Cenchrus ciliaris*, etc. laboratory test was applied. For large and hard seeds of *Prosopis cineraria*, *Acacia nilotica*, and *Ziziphus mauritiana*, etc. germination was tested in the nursery.

The significant outcomes of the project were; conserved seed samples of 23 different plant species in the Seed Bank established at Arid Zone Research Institute, Bahawalpur and maintained Grass Progeny Stand at Arid Zone Research Institute, Bahawalpur, established last year as a source of promising grass species of Cholistan area.

Name of Project: Seed Production of Multi-purpose Trees and Forage Species (AZRI, D. I. Khan Component-V)

Name of PI/Institute: Mr. Aman Ullah Khan
Senior Scientific Officer, Arid Zone Research Institute - PARC,
D. I. Khan

Duration: 02. 02. 2010 to 01. 02. 2013

Financial Status: Total Cost: Rs.1.320 million
Funds Released: Rs.1062800/-
Funds Utilized: Rs.1045701/-

Objectives:

- To ensure supply of quality seed of multipurpose trees and forage species of arid zone of D. I. Khan for research and development activities.
- To generate base line data regarding tree phenology, seed viability, and germination percentage of different plant species.

Achievements:

Almost three thousand (3000) nursery plants of siris, kikar, sufed kikar, bakain, neem and farash were developed through seed and stem cutting in polythene bags at AZRI, farm D. I. Khan. The nursery was supplied to growers during tree plantation period.

1.5 tones seed of eleven (11) tree species that being vanished in the area have been collected. Samples of some of the important species have been sent to NARC, Islamabad for preservation in gene bank.

A complete data on morpho-phenological studies and yield of all the three species have been documented which is available as ready reference for foresters, researcher and farmers as well.

The protocols for determination of seed viability of germination percentage have been developed which can help for nursery growers and foresters.

Name of Project: Seed Production of Multi-purpose Trees and Forage Species (AZRI, Umerkot, Sindh Component-VI)

Name of PI/Institute: Mr. Muhammad Waseem Kalaroo,
Scientific Officer, Arid Zone Research Institute - PARC,
Umerkot.

Duration: 02. 02. 2010 to 01. 02. 2013

Financial Status: Total Cost: Rs.1.320 million
Funds Released: Rs. 930200/-
Funds Utilized: Rs. 912154/-

Objectives:

- To collect quality seed of important multi purpose trees, shrubs and grasses from different ecological zones of Pakistan.
- To generate base line data regarding trees phonology, seed viability, and germination percentage of different plant species.

Achievements:

About 1806 kg seed of 38 species of multipurpose trees & forage species have been collected from different locations of Thar, i.e. Chhore, Mithi, Nangarparkar, Islamkot, Chelhar, Khokhrapar and AZRI Farm Umerkot. About 32 kg seed have been handed over to RRI, NARC for sale purpose and 56 kg seed distributed free of cost among local and international NGO's, Govt. Departments, Army Cantt. Chhor, District, Government and different PARC institutes. About 770 kg seeds of multipurpose tree and forage species has been distributed free of cost to local NGOs, Forest Department Umarkot, Mirpurkhas, local farmers, different institute of PARC and Arid Agriculture University, Rawalpindi.

Collected seed were cleaned by manual method i.e. sieving, fanning, winnowing, beating and hammering. The cleaned and sun dried seed treated with insecticide and fungicide were packed in the plastic and cloth bags of 10 kg and placed in well ventilated dark room. During the processing of seed collection, information on phonology was recorded such as name of species, local name, flowering time and maturity of seed. The seeds of multipurpose trees and forage species have been sent to PGRI, NARC, Islamabad for preservation and future needs, stored seed for use in future.

Name of Project: Management of Rawal Watershed under Changing Landuse

Name of PI/Institute: Mr. Muhammad Saleem Pomee,
Scientific Officer, Water Resources Research Institute, NARC,
Islamabad

Duration: 28. 09. 2010 to 27. 09. 2013

Financial Status: Total Cost: Rs. 21.722 million
Funds Released: Rs. "
Funds Utilized: Rs. "

Objectives:

- Organization of Rawal Watershed users through a process of social organization and social engineering at selected sub-watersheds.
- Participatory assessment of current state of Rawal watershed at selected sub-watershed in terms of changing landuse and infrastructural development.
- Develop integrated strategy for cost effective management of Rawal Watershed based on experimental interventions in selected sub-watershed for sustainable yield and livelihood.

Achievements:

The project activities to demonstrate improved watershed management practices in Rawal Watershed area were designed and implemented through participatory mod at representative Subwatersheds at upper, middle and lower reaches of Rawal Catchment. The issues of unorganized communities, urban encroachments, suboptimal land and water productivities, increased erosions, poor locale capacities for innovative agro-based technologies and uncertainties in predicting hydrological behaviors of Rawal Catchments due to lacking of scientific information were considered as major constraints. To address these issues, different interventions/ scientific studies were planed and executed at selected Subwatersheds during project period and results have been compiled in final technical report.

The objective to organize Rawal Watershed user was achieved through social integration of communities with project activities since beginning through structured organizations. The issues of anthropogenic landuse change within Rawal Watershed on temporal scale were estimated by using GIS/RS applications. It was concluded that since 1994, about 53 % of landuse has been changed and rate of change was higher in recent times. Urban encroachments were increased by 231%, while agriculture grew by 32 % meanwhile. The implications of rapid urbanization in Rawal Catchment were also investigated in-terms of wastewater production and its untreated mixing into fresh water streams by monitoring largest urban setting of Barakaho. The study area was subdivided into five Subcatchments

and it was found that Col. Kiani Road Subcatchment was most pollutant. Moreover, detailed statistical analysis was carried out using One-Way NOVA technique to conclude that temporal variability was more profound rather than spatial perspective in terms of selected pollutants. Seasonality was another key variable affecting quality and quantity of waste productions from study area.

Perennial spring waters managed at Aarokus to command over 12 acres of previously barren terraced land by developing innovative by low-tech Contour Based Surface Irrigation System (CBSIS). Once the water was made available, studies were planned to demonstrate improved water productivities for major cereal crops of the study area. Similarly, land and water productivities were also improved under purely rainfed farming systems of the Rawal Catchment. Rooftop rainwater harvesting systems were introduced to increase domestic water supplies and demonstrated efficient use of scarce water for kitchen gardening activities to engage gender particularly at upper reaches. Innovative system was designed and demonstrated at Aarokus, where, precious roof water was used through drip irrigation system without any external, energy. Similarly, selected high efficiency irrigation systems were introduced in the study area to cover wider range agricultural applications. The concept of supplemental irrigation was induced in project areas to harvest more returns from given rainfed-farming system.

Different innovative and high rewarding agricultural practices (like tunnel farming, honey farming and fish farming) were introduced in project areas and necessary capacity buildings were accomplished for promoting adaptations on regular basis. Various available biological covers were evaluated for their potential of soil and water conservation under Watershed conditions through detailed statistical applications. Likewise the impacts of agricultural practice Vs uncultivated landscape were also investigated to estimate soil and water conservation aspects. Different low-cost soil and water conservation interventions were also designed and executed at critical locations to reduce erosions. Moreover, different types of monitoring systems were installed at study area to estimate key meteorological parameters at selected Sub-catchments, while rainfall-runoff interactions were also monitored to develop hydrological database. Based upon rainfall analysis, it was concluded that water harvesting were essential to support crop productivities though there was more rainfalls than ET needs due to rainfall distributional issues. Research infrastructure developed under the project also helped in supporting thesis requirements of various postgraduate and graduate level students.

Name of Project: Commercialization of Biofertilizer (Inoculant) for Important Crops

Name of PI/Institute: Dr. M. Ehsan Akhtar,
Principal Scientific Officer/PL, LRRI, NARC, Islamabad

Duration: 25. 10. 2010 to 24. 10. 2013

Financial Status: Total Cost: Rs.10.818 million
Funds Released: Rs. "
Funds Utilized: Rs. "

Objectives:

- Commercialization of multipurpose synthesized biofertilizer through private sector.
- Technical backstop support to private sector: Build capacity of private sector for mass propagation of microbial inoculants, field testing, impact monitoring.
- Provide feedback to production team for improvement of the quality of Biofertilizer.
- Up-scaling of the existing pilot production facility.

Achievements:

Field experiment was conducted in collaboration with Jaffer Brothers for wheat crop in November 2012. Their product was urea and DAP coated with microbes to be applied directly with different treatments of chemical fertilizer. Biozote was applied in comparison, with 76% and 100% use of chemical fertilizer. Data showed that Biozote 100% NP has significantly higher yield with Biozote 75% NP at second. Lowest was observed in treatment D (U+DAP). Results showed that Biozote performed far better than Jaffar Brothers product.

Demonstrations were conducted in collaboration with Hussain Sugar mill and Kamalia Sugar mill, Jaranwala, Lahore. Fauji fertilizer sugarcane research and multiplication farm, Sindh have also conducted demonstration of Sugarcane Biozote.

For collaboration with private sector, a senior management meeting was held with Fauji Fertilizer, Pvt. Ltd. for research and development of Biozote. Meeting proves to be very healthy towards collaboration in future and they have demanded Biozote for trials at their farms. Trials were conducted for sugarcane, wheat and rice, in collaboration in Tando Muhammad Khan, Sindh specially. They were highly satisfied with the performance of the product and demanded to keep the collaboration for longer terms.

Couples of meetings were held with Auriga chemicals and negotiations are in process for marketing Biozote in Central Punjab. Some other companies are also showing interest.

Mass production of Biozote was completed successfully for wheat crop, Rabi 2012-13 in

collaboration of Private dealers, companies, farmers and researchers. Due to excellent response of Biozote to wheat crop last year, the production has to be increased to fulfill the demand of farmers and dealers. About 4000 packets of Biozote was produced and distributed for demonstration and commercialization purpose.

For Kharif, 2012-13 production of Biozote continued on large scale. Demand was received for cotton, rice, mungbean, groundnut, sugarcane, and sugar crops. Packets were produced and distributed successfully.

Three cases of Bio-fertilizer products with commercial names Biozote-Max, Biozote-P and Biozote-N were submitted for registration with Department of Agriculture Punjab through Directorate of Soil Fertility & Research, Lahore.

For up-scaling of biofertilizers (bio-inoculants) production unit at Innovative Technology Yard, NARC, two large scale fermenters of 60 liter capacity were installed there. Repair of sterilization room and installation of UV light is done at Bard Yard Lab. Laminar flow, fermenter and autoclaves are being repaired and in working condition.

Name of Project: **Formulation and Quality Improvement of Biofertilizers (inoculants) for Crop Production**

Name of PI/Institute: **Dr. Tariq Sultan,**
Principal Scientific Officer, Soil Biology, LRRI, Islamabad

Duration: 27.10.2010 to 26.10.2013

Financial Status: Total Cost: Rs.9.988 million
Funds Released: Rs. "
Funds Utilized: Rs. "

Objectives:

- Isolation and identification of beneficial bacteria from roots and rhizosphere soil of sugarcane and cotton.
- Selection of isolates showing high nitrogen fixing, phosphorous solubilizing activity and/or producing higher amounts of phytohormones.
- Evaluation and selection of the promising strains and their combinations showing beneficial effects on their respective host crop under lab. greenhouse as well as field conditions.

Achievements:

Plant samples were collected for onion, peas, garlic, canola, sesbania, potato and cotton crop along with root & rhizosphere soil samples from different crop ecologies of Punjab and KPK. Isolations from rhizosphere, rhizoplant and endorhizosphere were performed in the lab and isolates were characterized on the basis of morphological characters and biochemical tests.

Among the sugarcane isolated strains (Mixture and ES-17 Watery) promoted growth and agronomic traits of sugarcane. The better performance of plants can be attributed to the availability of essential nutrients such as N and P. In addition, production of certain growth regulators by bacteria and their subsequent uptake by the plant has promoted growth of sugarcane.

Rhizobium and Plant Growth Promoting Rhizobacterial (PGPR) isolates have pronounced ability to enhance plant growth through direct/indirect mechanism by nitrogen fixation, P-solubilization, siderophores and phytohormone production.

Production of IAA by PGPR strains (ranging 71.22-91.21 $\mu\text{g ml}^{-1}$), while Rhizobium strains IAA production ranged from 10.50-14.25 $\mu\text{g ml}^{-1}$. Solubilization index of the PGPR is from 2.56-3.16. In broth culture the pH goes down due to Phosphorus Solubilizing Bacteria ranging from 7-3.2.

P-solubilized in the broth culture was 55-103 $\mu\text{g ml}^{-1}$ by PGPR and 18-24 $\mu\text{g ml}^{-1}$ by Rhizobium. In the selected isolates only 5 strains were proficient to produce HCN, while remaining 2 isolates were unable to produce HCN.

Among the seven selected PGPR strains six strains showed positive results for siderophore production but one isolate RS.P3-D was unable to produce siderophore while among seven rhizobium isolates only four strains were able to produce siderophore. All the Rhizobium and PGPR strains augmented growth of pea significantly.

Effect of co-inoculation of plant growth promoting rhizobacteria (PGPR) and phosphate solubilizing bacteria (PSB) on growth, yield and nutrient uptake of maize at low levels of nitrogen and phosphorus (90 and 50 mg kg^{-1}) was studied in pot and field experiments. Application of microbes in conjunction with chemical fertilizers had significant influence on morphological characters and yield parameters of maize.

A study was conducted with objective 'isolation, characterization of PGPR and PSB from Onion rhizosphere and check their effect on Onion seedling'. A total 320 PGPR and PSG were isolated from onion rhizospheric soil of district Upper Dir. Out of 320 isolates only six PGPR and four PSB were selected for further study based on various characters like Indole acetic acid production, P-solubilization, Siderophore production, Proteolytic activity, Antifungal activity, Hydrogen Cyanide and Ammonia production. The conclusion from investigation revealed that the isolated strains of PGPR and PSB from onion rhizosphere have strongly effect plant growth through direct and indirect processes.

Combined inoculation of plant growth promoting rhizobacteria (PGPR) and PSB along with reduced levels of nitrogen and phosphorus resulted in increased growth and yield of maize compared to un-inoculated control. Chlorophyll content, plant height, number of leaves plant⁻¹, cob ear leaf area, ear inter-node girth and flag leaf area increased significantly due to simultaneous application of PGPR and phosphate solubilizing bacteria compared to un-inoculated control. Physical and chemical properties i.e., soil texture, pH, electrical conductivity, nitrate- N, available phosphorus, and available Potassium were also determined.

As a conclusion of the studies conducted under project, about 115 PGPR isolates of each, cotton, sugarcane, onion, potato, peas, rapeseed and maize crop have been acquired. These isolates have been characterized colony morphology, cell morphology, gram staining (-ve & +ve) and few strains were identified at genetic levels and remaining are under process. These isolates have reasonable abilities to produce IAA growth hormone. 37 isolated PGPRs also have phosphate solubilizing ability. The strains tested on sugarcane & maize showed clear indication that microbes are crop specific. The best combinations of strains were evaluated and yield increased was 15-25%. The best combination PGPRs & PSB also saved about 25% NP fertilizers.

Four students conducted research work under the project for their M. Phil thesis writing while two students Ph.D research is in process.

Name of Project: Evaluation and Commercialization of Rhizogold - A Multi Strain Biofertilizer Developed in the ALP Project

**Name of PI/
Institute:** Dr. Zahir Ahmad Zahir,
Professor, Institute of Soil & Environmental Sciences,
University of Agriculture, Faisalabad

Duration: 12.04.2012 to 11.04.2015

Financial Status: Total Cost: Rs. 6.361 million
Funds Released: Rs. 3.738 "
Funds Utilized: Rs. 3.611 " (up to 31.05.2013)

Objectives:

- Evaluation of different carrier materials to select most economical and efficient carrier material for the Rhizogold.
- Evaluation of shelf life of the product.
- Demonstration trials on farmer's fields in different regions for the awareness of the farmers.
- Farmer/field days in different areas for the awareness of the farmers.
- Extensive evaluation of Rhizogold at farmers' fields.

Achievements:

- A Biofertilizer Production Unit has been purchased and installed for the production of Rhizogold.
- Locally available carrier materials were collected, prepared and tested with Rhizogold for mung bean, chickpea and lentil under pot conditions.
- On the basis of performance of carrier materials to improve the performance of Rhizogold for promoting nodulation, growth and yield of mung bean, chickpea, and lentil under pot conditions, efficient carrier materials (Press mud, peat, and compost) have been selected for further evaluation under field conditions.
- The significance outcome of the project is the peat, press mud, and compost selected as a carrier material for formulation for further evaluation in field.

Name of Project: **Improving productivity of Some Major Crops Through Integrated Plant Nutrient Management (IPNM) in FATA Kurram Agency.**

**Name of PI/
Institute:** **Mr Iqrar Hussain,**
Research Officer, Soil & Water Testing Lab., Parachinar,
Kurram Agency

Duration: 01.07.2012 to 30.06.2015

Financial Status: Total Cost: Rs. 4.979 million
Funds Released: Rs. "
Funds Utilized: Rs. "

Objectives:

- To investigate the nature, extent and severity of nutrient disorder in Kurram Agency
- To improve and sustain soil fertility as well as crop productivity under wheat-rice cropping system of the area through integrated plant nutrient management
- To build capacity of laboratory staff, agricultural extension workers and farmers in plant nutrient management and create awareness among farming community by ensuring a steady flow of applied research results through field days, trainings/workshops and pamphlet/brochures

Achievements:

Two hundred and twenty soil samples were collected from farmers' fields of Kurram Agency. These were dried, ground sieved and analyzed for soil Ph, electrical conductivity, organic matter content, calcium carbonate (lime), phosphorus, potash, zinc, copper, iron and manganese. Organic matter, phosphorus and potash were low in 26, 40 and 37% soil samples respectively.

Experiments were conducted on the effect of integrated plant nutrient management (IPNM) on the yield and yield components of rice and wheat crops. The results showed that highest grain yield of rice and wheat (5415 and 4795 kg ha⁻¹) was recorded in the treatment receiving 75% nitrogen from urea and 25% nitrogen from FYM. Total dry mass (TDM), straw yield and 1000 grain weight showed almost similar response as that grain yield of rice and wheat.

Value Cost Ratio of 3.20, 1.51 with highest net return of Rs.91575 and 21275 ha⁻¹ for rice and wheat crops respectively by the application of 75% from urea and 25% from FYM indicated economical significance for profitable rice and wheat production.

One week training was organized for the capacity building of the staff of Soil and Water Testing Laboratory at Parachinar. The staff was trained in soil analysis and field data collection. Three field days were organized at the research experimental sites during the maturity of rice and wheat crops to show the results of IPNM for awareness raising of farming communities. Eighty four farmers participated in the field days. Four trainings were organized for the farmers of different villages of Kurram Agency on the role of IPNM. in crop production, importance of soil

and plant analysis for the evaluation of soil fertility and role of organic fertilizers.

Name of Project: **Production of Humic Substances Based Plant Nutrient Products for Improving Crop Productivity**

Name of PI/ **Dr. M. Ehsan Akhtar,**
Institute: Director, Land Resources Research Inst., NARC

Duration: 01.10.2012 to 30.09.2015

Financial Status: Total Cost: Rs. 14.149 million
 Funds Released: Rs. "
 Funds Utilized: Rs. "

Objectives:

- Improving extraction of humic acid from lignite coal, crop residues and low grade industrial wastes.
- Formulation and characterization of humic acid based fertilizer products.
- Testing of humic acid based products under laboratory, greenhouse and field conditions.
- Promotion of farm use of efficient humic acid based plant nutrient products.

Achievements:

The research work undertaken during the reporting period can be divided into following three categories:

- a. Laboratory Investigations
- b. Pot experiment
- c. Field experiments (Research and demonstrations)

In the laboratory investigations, humic substances were extracted from the coal samples collected from Chakwal area of Punjab and Quetta of Balochistan. Two types of humic substances were extracted, humic and fulvic acids. The amount of these substances varied widely and ranged from 2% to 37%. Humic acid extracted from coal with NaOH extracted was more as compared to that of extracted with KOH. The elemental and mineral composition of the extracted material was determined using standard techniques. The result showed that they have variable chemical composition and contain N; from 0.12-1.53%; P 0.04-0.1%; K 0.3-0.84%; Fe 0.24-0.88%; Zn 31-59 mg kg⁻¹; Cu 2.6-19 mg kg⁻¹, and Mn 22-79 mg kg⁻¹ and they also contained Pb, Cr, Cd and Ni in trace amounts. The different functional groups like hydroxyl, alcoholic, carboxylic, amide etc. were also present in the extracted material as detected by FTIR technique. Recovery of coal derived fulvic acid ranged from 5 to 7% and that of humic acid 10 to 35% when these compounds were extracted with NaOH and KOH.

Humic substances were also extracted from plant waste material i.e., maize stovers, sunflower heads, rice husk and cotton waste etc. and the composition of humic substances by Minisatellite Variance Resonance (MVR) and high presser liquid chromatography (HPLC) techniques. The results showed that the plant waste materials under investigation had variable quantity of humic substances. They contain humic substances ranging from 2200 to 45000 mg kg⁻¹ humic acid (HA) depending upon the nature and type of waste material and extracting agent whether NaOH

or KOH used for extraction.

Two hydroponic experiments were conducted to study the role of humic substances on growth and nutrient concentration of plant. The study was aimed to investigate the role of humic substances as source of nutrients and compare with that of the standard nutrient solution (Hoagland solution). The result showed that these compounds can be used as source of nutrient to support plants up to 25 days after transplantation under hydroponic conditions. They have ability to support the plant growth in supplying nutrients under hydroponic conditions.

The result of a pot experiment conducted on sugar beat in soil culture to study the response of sugar beat to applied humic substances alone and in combination with micronutrients revealed that plant biomass and nutrient absorption by plants increased with use of humic substances applied as foliar sprays.

Field experiments were conducted on wheat, sugar beat, onion, lentil and mung bean in different climatic conditions. Three experiments were on wheat to study the role of humic substances applied as soil amendment and foliar sprays. Two of them were research experiments and one demonstration. The humic substances were applied alone as well as in combination with the micronutrients as foliar sprays. Result showed that wheat grain yield increased up to 10% with use of humic substances when applied in combination with chemical fertilizers. In the demonstration plot where Integrated Plant Nutrient Management (IPNM) practiced with humic substances applied, about 600 kg ha⁻¹ grain yield increase was recorded. Two experiments on pulses one each on lentil and mung bean at adaptive Research Farm Karor, District Layyah and NARC research farm, respectively were conducted. The results showed that tested combination of organic and synthetic fertilizers increased the lentil yield by 16% over that of control. The demonstration on lentil revealed that a significant increase in yield can be realized through judicious use of organic and inorganic sources and fertilizers.

The experiment on the mung bean was aimed to enhance the phosphate (P) use efficiency by judicious use of humic acid. Results of the study indicated that P use efficiency increased over control treatment under field conditions and use of humic substances increased the yield by about 400 kg ha⁻¹ with applied humic acid @ 50kg ha⁻¹ over control and P use efficiency by plant increased by 15% as compared to control treatments.

A field experiment was conducted on sugar beet at two different ecologies i.e. at Chak # 99 TDA and Sugar Crops Research Institution (SCRI), Mardan, Khyber Pakhtunkhwa Province. The study was aimed to evaluate the role of humic substances on enhancing the beat yield and sugar contents in sugar beet. Foliar spray/Feeding of humic substances gave the maximum yield when they were applied in combination with micronutrients.

Another field experiment was conducted to study the role plant derived humic substances on growth bulb yield of onion. Four humic substance levels (0, 20, 40 and 60 mg/kg) were applied. A significant increase in bulb yield was recorded with the use of humic substances derived from maize stovers. Not only yield was increased but also nutrient concentration in plant was increased.

Based on the studies undertaken under the umbrella of humic acid Project, following

conclusions can be drawn:

- i. Humic substances have the ability to improve soil properties and can be used as soil conditioner to enhance nutrient use efficiency
- ii. Humic substances stimulated the plant growth and increased crops yield, so their use can boost up the crop productivity by maintaining plant vigor and soil health
- iii. It is need of the time to increase crop production there by reducing cost of production for fulfilling the increasing population food demand so that use of these substances can help this regard to some extant.

Name of Project: Farm Productivity Improvement through Management of Artesian Wells in Piedmont Plains of Suleiman Ranges of Dera Ismail Khan, Khyber Pakhtunkhwa

Name of PI/Institute: Engr. Noman Latif Sadozai,
SSO, WRII - NARC Field Station D. I. Khan

Duration: 01. 12. 2012 to 30. 11. 2015

Financial Status: Total Cost: Rs. 5.938 million
Funds Released: Rs. "
Funds Utilized: Rs. "

Objectives:

- To quantify the water potential of artesian well in the piedmont plains of Suleiman ranges in D. I. Khan.
- To delineate the possible command area under each well for optimized cropping pattern.
- Introduce improved water management and application techniques for efficient utilization of precious water without any energy input.
- Analyze feasibility of low-cost storage of slack period surplus water and carry over to peak water requirement periods.

Achievements:

To develop strategies for improved water management and application techniques for resource poor area, 14 potential locations in D. I. Khan were identified with different discharges of artesian wells. Pressure gauges were installed at two sites of artesian wells at Daraban. Water pressure measured with gauge was 2, 2.5 & 4 psi of different wells. The data of discharge water was recorded on daily basis at different locations within the command area. Economic analysis of water potential of these wells will be done to help in evaluating the impact of seasonal fluctuation. Rainfall data of command area has also been recorded which will help to find out the rainfall pattern and climate variability.

In order to introduce rice crop in command area, rice crop was sown at 01 acre area at Haji Toorak artesian well. Rice crop was harvested and data recorded. Good rice crop with 2567 kg ha⁻¹ of paddy yield was obtained. Wheat and rapeseed crop was also sown at two locations of project at Daraban area under artesian well for demonstration purpose. A two kanal surplus water fish pond and plastic lining has been prepared/ excavated to enhance the farm productivity and improve the livelihood of developed households.

Meetings were arranged and discussed various problems/issues with farmers for developing strong linkages among farmers and scientific community.

Name of Project: **Synthesis and Production of Hybrid Silkworm Strains at Pakistan Forest Institute for Promoting Sericulture in Pakistan**

Name of PI/Institute: **Dr. Ghulam Ali Bajwa,**
Coordinator Sericulture, Sericulture Division, Pakistan Forest Institute, Peshawar

Duration: 15.04.2013 to 14.04.2016

Financial Status: Total Cost: Rs. 6.938 million
Funds Released: Rs. "
Funds Utilized: Rs. "

Objectives:

- Synthesis/evolution of bivoltine hybrid silkworm strains.
- Assessment of heterosis/hybrid vigour.
- Assessment of field performance of newly synthesized hybrid strains.
- Production of silk seed for different stakeholders.

Achievements:

Establishment of Mulberry Gene Bank: A mulberry gene bank was established at Bhurban (3246808 N latitude, 1088360E longitude at 1832 m above sea level), using local and exotic germplasm, for providing mulberry propagating material to different stakeholders from Khyber Pakhtunkhwa, Punjab and Azad Jammu and Kashmir. The plantation showed good survival rate including exotic provenances.

Table 1: Mulberry provenances and their sources

S. #	Mulberry variety	Origin	Plants (No.)	Survival (%)
1.	Kanmasi	Japan	90	79.0
2.	<i>Morus latifolia</i>	Japan	70	80.0
3.	PFI-1	Pakistan	52	83.3
4.	Qumji	Korea	45	76.7
5.	Husang	China	30	78.0
6.	Karyansuban	Korea	13	79.5
		Total	300	79.4

Synthesis of Hybrid Silkworm Strains: Ten hybrid bivoltine silkworm strains were synthesized during spring (March-May) rearing season 2013. The F₁ was tested for heterosis and hybrid vigour during autumn (September-November) rearing season 2013. The highest cocoon weight of 1.32±0.06 g was achieved in hybrid 205POx J101, while the lowest cocoon

weight was 1.02 ± 0.04 g in hybrid C102xJ101. The highest cocoon shell ratio was $21.71 \pm 0.84\%$ in pure strain C102 followed by $20.66 \pm 0.40\%$ in hybrid C102x206MKD.

Table 2: Economic cocoon characters of F₁ pure and hybrid silkworm strains during autumn rearing season

Strains	CWF (g)	NCW (g)	FW (G)	%F	SW(g)	CSR (%)
205 PO	1.07±0.04	1.07 ±0.04	0.01± 0.00	0.66±0.27	0.21±0.01	20.08±0.76
206 PO	1.12±0.05	1.10±0.05	0.01±0.00	1.18±0.36	0.22±0.01	19.81±0.87
205 MKD	1.15±0.05	1.14±0.05	0.01±0.00	0.89±0.25	0.22±0.01	19.25±0.76
206 MKD	1.23±0.04	1.23±0.04	0.01±0.00	0.69±0.18	0.24±0.01	19.53±1.14
J-101	1.29±0.24	1.28±0.24	0.00±0.00	0.53±0.43	0.24±0.04	18.98±0.96
C-102	1.24±0.03	1.23±0.03	0.01±0.00	1.02±0.13	0.26±0.01	21.71±0.84
205POx206MKD	1.10±0.09	1.09±0.09	0.00±0.00	0.50±0.34	0.19±0.02	17.56±1.47
205POxJ101	1.32±0.06	1.30±0.06	0.02±0.00	1.75±0.34	0.25±0.01	19.74±0.57
205MKDx205PO	1.06±0.05	1.05±0.05	0.01±0.00	1.05±0.21	0.20±0.01	19.21±0.59
205MKDx206PO	1.24±0.07	1.22±0.06	0.01±0.00	1.09±0.18	0.24±0.01	19.48±0.55
205MKDxC102	1.08±0.05	1.07±0.05	0.01±0.00	0.94±0.18	0.22±0.01	20.21±0.54
206MKDxC102	1.12±0.01	1.11±0.11	0.01±0.01	1.26±0.80	0.22±0.03	20.02±0.78
C102x205MKD	1.15±0.04	1.13±0.04	0.01±0.00	1.07±0.20	0.22±0.01	19.41±0.60
C102x206MKD	1.30±0.04	1.29±0.04	0.01±0.00	0.68±0.15	0.27±0.01	20.66±0.40
C102xJ101	1.02±0.04	1.01±0.04	0.01±0.00	0.68±0.19	0.19±0.01	18.14±0.67
J101x205PO	1.10±0.05	1.07±0.05	0.03±0.01	1.21±0.26	0.22±0.01	19.95±0.33

In addition to assessment of heterosis and vigour, following activities were also conducted:

- Impacts of temperature on economic cocoon characters studied. Data compilation is in process
- Silk seeds were also provided to Directorate of Non-Timber Forest Produce, Forest Department, Government of Khyber Pakhtunkhwa
- A survey was conducted in Haripur districts for assessing consumption of silk seed and problems of silk worm rearing farmers
- A growth chamber was constructed for rearing young age larvae (I-III instars)
- Produced 243 egg laying (75.6 g), both of pure and hybrid strains, for spring rearing seasons, as well as for distribution among different stakeholders.

Name of Project: **Nutrient Management for Cotton Productivity by Conjoint Use of Organic and Inorganic Fertilizers under Extended Cultivation Regimes (Component-I)**

**Name of PI/
Institute:** **Dr. Ejaz Rafique,**
Principal Scientific Officer, LRRI, NARC, Islamabad

Duration: 15.03.2013 to 14.03.2016

Financial Status: Total Cost: Rs. 7.500 million
Funds Released: Rs. "
Funds Utilized: Rs. "

Objectives:

- Determine/ appropriate nutrient requirement of Bt cotton as well as traditional non-Bt under extended cultivation regimes using organic and inorganic sources.
- Study soil nutrient balances/budgets [Inputs-(Removal + Losses) = Balance] as a consequence of manuring and cropping- *knowledge on farm in-gate nutrient balance sheets helps determine wise and economical fertilizer use strategies, with enhanced productivity.*

Achievements:

Cotton being relatively practiced as long duration crop, is highly exhaustive with regard to plant nutrients - fairly large quantities of nutrients are required. To explore the potential yield and for achieving higher yields, optimum nutrient through different sources (inorganic and/or organic) is required.

For developing nutrient management strategies for Bt and non-Bt (traditional) cotton, short-term field experiment was initiated on farmers' fields at 4 sites (Harappa, Chak 37/12-L, Chak 6/11-L and Alwardi) in Sahiwal division. Soil series were characterized with technical assistance of Soil Survey of Pakistan. All the sites were low to medium in fertility. Experimental sites were generally alkaline as pH varied from 8.14 to 8.25. Soils were generally medium textured as varied from loam to silty clay loam. The soils were deficient in NO₃-N, deficient to adequate in P and K. The soils were also deficient in B and Zn.

In experiment (consisted 30plots arranged in a split-split-plot design with three replications) two cotton varieties, i.e. Bt and non-Bt (traditional) were used as test crops. Cotton varieties were in main plots and following five nutrient management treatments were in sub-plots:

- T₁: Farmers' Fertilizer Use (FFU) - N, 180 kg ha⁻¹
- T₂: Balance Nutrient Management (BNM) - N, 270; P₂O₅, 75; K₂O, 60, Zn, 5; B, 1 kg ha⁻¹
- T₃: Integrated Nutrient Management (INM) - As per T₂ (75% N from fert. + 25% from FYM)
- T₄: INM - 75% of T₂ + HA
- T₅: INM - 75% of T₂ + Biozote

All nutrients except N were applied during final land preparation. Nitrogen was applied in splits. The recommended diagnostic plant parts, i.e. 4th leaf from the top at flower initiation stage were collected from experimental plots. The plant samples were processed and analyzed for N, P, K, Zn and B.

Diagnostic Leaf Nutrient Composition as Affected by INM:

- The concentration of N, P, K, Zn and B in cotton leaves varied as a consequence of INM.
- Leaf concentrations in plant tissues receiving T¹ were lesser than the nutrient concentrations exhibited with other treatments.
- Higher nutrient concentrations were observed with T₃ - T₅
- At Harappa site, cotton leaf nutrient concentrations with T₁ were: N, 3.30%; P, 0.19%; K, 1.64%; Zn, 21 mg kg⁻¹; and B, 44 mg kg⁻¹. The correspondence concentrations with T₃ were much higher, i.e. N, 3.66%; P, 0.30%; K, 2.06%; Zn, 28 mg kg⁻¹; and B, 66 mg kg⁻¹
- At Chak 6/11-L site, cotton leaf nutrient concentrations with T₁ were: N, 3.50%; P, 0.24%; K, 1.58%; Zn, 25 mg kg⁻¹; and B, 50 mg kg⁻¹. The correspondence concentrations with T₃ were much higher, i.e. N, 3.77%; P, 0.34%; K, 2.12%; Zn, 35 mg kg⁻¹; and B, 68 mg kg⁻¹
- Almost, similar variation trends in nutrient composition of diagnostic cotton leaf at the two sites, i.e., Chak 6/11-L and Alwardi (Pakpattan) were observed.

Name of Project: Nutrient Management for Cotton Productivity by Conjoint Use of Organic and Inorganic Fertilizers under Extended Cultivation Regimes (Component-II)

**Name of PI/
Institute:** Dr. Fiaz Ahmad,
Scientific Officer/PI, Physiology/Chemistry Section, CCRI,
Multan

Duration: 15.03.2013 to 14.03.2016

Financial Status: Total Cost: Rs. 4.989 million
Funds Released: Rs. "
Funds Utilized: Rs. "

Objectives:

- Determine/ appropriate nutrient requirement of Bt cotton as well as traditional non-Bt under extended cultivation regimes using organic and inorganic sources.
- Study soil nutrient balances/budgets [Inputs-(Removal + Losses) = Balance] as a consequence of manuring and cropping- *knowledge on farm in-gate nutrient balance sheets helps determine wise and economical fertilizer use strategies, with enhanced productivity.*

Achievements:

Name of Project: Nutrient Management for Cotton Productivity by Conjoint Use of Organic and Inorganic Fertilizers under Extended Cultivation Regimes (Component-III)

Name of PI/Institute: Mr. Mukhtiar Ali Channa,
Soil Fertility Officer, Soil Fertility Section, Agri. Research Institute, Tandojam

Duration: 15.03.2013 to 14.03.2016

Financial Status: Total Cost: Rs. 4.950 million
Funds Released: Rs. "
Funds Utilized: Rs. "

Objectives:

- Determine/ appropriate nutrient requirement of Bt cotton as well as traditional non-Bt under extended cultivation regimes using organic and inorganic sources.
- Study soil nutrient balances/budgets [Inputs-(Removal + Losses) = Balance] as a consequence of manuring and cropping- *knowledge on farm in-gate nutrient balance sheets helps determine wise and economical fertilizer use strategies, with enhanced productivity.*

Achievements:

Social Sciences

Name of Project: Model Women Network of Livestock Farmers for Poverty Reduction

Name of PI/Institute: Mr. Manzoor Ali Memon
Principal Scientific Officer, Social Sciences Research Institute (SSRI) - PARC, Tandojam

Duration: 18. 01. 2010 to 17. 01. 2012

Financial Status: Total Cost: Rs.7.933 million
Funds Released: Rs.4.701 million
Funds Utilized: Rs.1.274 million (up to 31. 12. 2010)

Objectives:

- Capacity Development of Livestock Farmers (men & women)
- Strengthening Public Private partnership
- Facilitating Livestock
- Research and Development
- Formation of Women Livestock Farmers Groups

Achievements:

Name of Project: Establishment of Milk Cooperative Marketing Systems in Tehsil Fateh Jang

Name of PI/Institute: Mr. Noor-ul-Hassan Tehseen,
General Manager, IDARA-E-KISAN, Lahore Milk Plant,
Lahore

Duration: 09. 09. 2010 to 08. 09. 2013

Financial Status: Total Cost: Rs.27.100 million
Funds Released: Rs.10.060 "
Funds Utilized: Rs.10.326 "

Objectives:

- To provide alternate improved cooperative milk marketing facilities and infrastructure for better returns to producers of milk in the project area
- To provide sustainable livestock services such as veterinary health, artificial insemination and fodder production to the member farmers of the cooperatives
- To provide meat marketing initiatives by calves fattening
- To provide development and social facilities to member farmer's women for their empowerment.

Achievements:

Name of Project: **An Analysis of the Adoption and Impact of Cultivation of Hybrid Seed on Selected Crops in Pakistan**

Name of PI/Institute: **Dr Ali Muhammad Khushk,**
PSO, SSRI, (PARC), Tandojam

Duration: 10.04.2012 to 09.04.2014

Financial Status: Total Cost: Rs 1.949 million
Funds Released: Rs "
Funds Utilized: Rs "

Objectives:

- Identification of pocket cultivating hybrid varieties and tracing how these pockets were developed;
- To estimate the productivity gains and financial profitability of commercially cultivated hybrid varieties of selected crops;
- To assess the factors affecting the farmers' decisions to adopt hybrid varieties of selected crops;
- To analyze farmers' perceptions about constraints to the large scale adoption of hybrid varieties;
- To suggest various recommendations to stakeholders in agricultural R&D Systems and policy makers for promoting up-scaled cultivation of successful hybrid in Pakistan.

Achievements:

Mounting population pressure, decreasing areas of cultivable land and stagnating yield growth of food crops in the country, challenging agricultural research to shift the crop yield frontier outward. Including in marginal areas that were often neglected in the past. Hybrid seed technologies, which exploit heterosis and generally achieve higher yields than open pollinated varieties (OPVs) are seen as one approach to address this challenge. Now a days hybrid crops including rice, maize, sorghum, millet, canola, sunflower, potato, tomato, and okra are under cultivation in the country.

There is need to assess the impact of hybrid seed of selected crops to analyze whether adopting farmers particularly small holders are benefited from the use of hybrid seed in a given farmers conditions and to provide to the policy makers, researchers and other stakeholders. Farmers' price preferences are particularly important because it can be a decisive factor in the future strategies that aim to facilitate farmers' access to new seed technologies.

Informal survey of selected crops of Sindh and Punjab has been conducted. During informal survey pockets of different crops regarding hybrid seed adoption in Pakistan were identified

through discussion of various stakeholders.

Pockets of Hybrid Crops Identified

<i>Crop</i>	<i>Pockets</i>	
	Sindh	Punjab
Sunflower	Golarchi, Thatta, Mirpurkhas, Umerkot, Kunri etc.	Multan, Bahawalpur and Lodhran
Rice	Golarchi, Larkana, Qambar-Shahdadkot, Jacobabad, Shikarpur etc.	Chiniot, Okara
Canola	Umerkot, Nawabshah, Sanghar etc.	Jhang, Faisalabad
Tomato	Kot Ghulam Muhammad, Badin, thatta etc.	Muzafargarh, Melsi
Okra	Khawaja Goth, Pano Aqil, Sakro etc.	Lahore, Faisalabad, Melsi
Maize	Tando Adam, Odero Lal	Chiniot, Okara

After identification of pockets, formal survey for data collection on hybrid sunflower, canola, okra, tomato, rice and maize in Sindh and Punjab provinces has been completed.

<i>Crop</i>	<i>Sindh</i>		<i>Punjab</i>		<i>Total</i>
	Pocket	Sample	Pocket	Sample	
Sunflower	Badin	60	Lodhran	60	120
Rice	Badin, Jacobabad	30 30	Chiniot Okara	30 30	120
Canola	Sunghar, S. Benazirabad	30 30	Jhang Faisalabad	30 30	120
Tomato	Mirpurkhas Thatta	30 30	Muzafargarh	60	120
Okra	Tando Allahyar Thatta	30 30	Faisalabad	60	120
Maize			Chiniot Okara	30 30	60
Total:		300		360	660

The total sample size 300 from Sindh and 360 from Punjab has been completed. All collected data of the project were entered in SPSS software for analysis.

Name of Project: Investigation into Effectiveness of the Concept of Farmer's Field School (FFS) in Agricultural Development in Districts Malakand, Swat and Charsadda

Name of PI/Institute: Dr Khalid Nawab,
Prof. Dept. Agri. Ext. Education and Communication, The Uni.
of Agri., Faisalabad

Duration: 01.12.2012 to 30.11.2014

Financial Status: Total Cost: Rs 1.654 million
Funds Released: Rs 0.432 "
Funds Utilized: Rs 0.212 "

Objectives:

- To find out that how for FFS approach contributes toward the innovation/ refinement of the appropriate targeted technologies.
- To determine increase in per acre yield of the same crop.
- To find out reduction in per acre input cost.
- To assess increase in profit margin per acre.
- To critically examine the farmers' selection process, their profile and FFS implementation.
- To understand gender specific interests with implications for the FFS program.
To identify the factors influencing knowledge, attitude and practice on management of various field and horticultural crops in the target areas.

Achievements:

Visits of project area in Malakand district were made and discussions were held with extension personnel on adoption of FFS approach. In total 100 respondents were selected for collection of data on questionnaire. The data was collected from 100 respondents in project area, entered into computer into spreadsheet and analyzed using computer software SPSS.

The farmers of the study area were asked about the adoption of FFS approach in future that is whether they will adopt FFS approach or not. It was found that 89 respondents were willing to adopt FFS approach in future, while the respondents not in the favor of adopting FFS approach in future were 11 in number. It is clear from the results of the study that the FFS approach has a positive effect on the respondents of Malakand district. The FFS approach efficiently increased the farmers' efficiency in maize production and helped them to gain more production and more income by providing them knowledge about the modern and better techniques of maize production through both formal and non formal methods in the study area. This study is a useful effort to help the researchers in future for such studies about FFS.

Name of Project: **Economics of Using Alternative Energy Sources and Adoption of Energy Saving Practices by the Farmers under Current Energy Crisis in Pakistan**

Name of PI/Institute: **Mr. Nadeem Akmal,**
Senior Scientific Officer, SSRI, NARC, Islamabad

Duration: 01.10.2012 to 30.09.2014

Financial Status: Total Cost: Rs 3.596 million
Funds Released: Rs "
Funds Utilized: Rs "

Objectives:

- To study the economics of alternative energy sources currently used in the agriculture sector in selected ecologies of Pakistan.
- To study the adoption of energy saving practices by the farmers in different cropping systems.
- To carry out the comparative analysis of electric and diesel tube wells in different ecologies of Pakistan.
- To study the effects of switching from conventional to new energy sources at farm level.
- To suggest measures for rapid promotion of use of alternative energy sources.

Achievements:

Data collection tool/comprehensively structured questionnaire for collecting required information from all stakeholders about alternative energy sources like solar water pumps, biogas and biodiesel being used in agriculture sector of Pakistan formulated. The information collected on the questionnaire will be helpful in addressing the study goal on empirical data basis. Identified sites across the country wherein the farmers are practicing alternative energy sources and energy saving practices for collecting information and data.

Name of Project: Participatory Development of Tea Value Chain around Mansehra Areas

Name of PI/Institute: Mrs. Sajida Taj,
SSO, SSI, NARC

Duration: 01.07.2012 to 30.06.2015

Financial Status: Total Cost: Rs 7.275 million
Funds Released: Rs "
Funds Utilized: Rs "

Objectives:

- To analyze field situations for developing tea production clusters through interdisciplinary planning and implementation.
- To assess gender roles for targeting skill development in tea production and value chain activities.
- To conduct on-going evaluation during different phases of tea production and value chain development processes.
- To develop strategic plans for achieving national goals of progressive self-sufficiency in tea production.

Achievements:

The project focused on mobilizing the local communities for tea cultivation around Mansehra areas. After the project was started in September, 2012, several visits to Mansehra were made by a team of scientist of Social Sciences Research Institute (SSRI), NARC. Meetings for exploring the potential and willingness of local communities for tea plantation in different villages in Union Council; Summ, Batang Saeedan, Dairi Khan Khel, in Dahryal and also other villages of Noor Maidanm UC Bugar Mang, Ichrian, UC Thar Kanal, Kuligah, Silbandi and Chitta Bata were held with the community.

After soil test (pH) of potential sites for suitability for tea plantation at four sites namely Kuligah, Silbandi, Chitta Bata and Bugar Mang, three sites viz; Kuligah, Silbandi and Chitta Bata were found suitable for tea plantation. 500 tea saplings were planted at each site through community participation in October, 2012.

After winter season the site were visited again by the SSRI, NARC and NTHRI, Shinkiari scientists and found that the sites selected for tea plantation were not accessible for further plantation. Meetings were again held with the community and discussed other possible sites accessible for transportation. Other places for plantation in consultation of the community has been decided for plantation in this season.

Name of Project: Capacity Building on Writing Technical Proposals for Grants

Name of PI/Institute: Dr. Muhammad Kamal Sheikh,
PSO, Planning & Development Division, PARC

Duration: 01.10.2012 to 30.09.2014

Financial Status: Total Cost: Rs 14.420 million
Funds Released: Rs "
Funds Utilized: Rs "

Objectives:

- Scientists' capacity building in writing skills for technical proposals for competitive grants.
- Production of seventy technical research proposals for submission to ALP.
- Develop a culture of quality technical proposal writing.

Achievements:

- One training workshop module/manual prepared.
- Equipment procured and tested.
- Resource persons and trainees are being and schedule training program is prepared to be followed after Ramadan.

Name of Project: **Agricultural Productivity in Relation to Farmer's Nutritional Status of Mardan**

Name of PI/Institute: **Dr. Zia ud Din,**
Assistant Professor, Department of Human Nutrition,
The Uni. of Agri., Peshawar

Duration: 01.05.2013 to 30.04.2016

Financial Status: Total Cost: Rs 4.676 million
Funds Released: Rs "
Funds Utilized: Rs "

Objectives:

- To assess nutritional status of farmers by taking their anthropometric biochemical and dietary measurements.
- To assess general health status and life quality of farmers by taking their blood pressure, blood hemoglobin and random blood glucose level; agricultural productivity, income and life quality of farmers will be assessed filling specific questionnaire through personal interviews.
- To assess dietary pattern and nutritional intake of farmers.
- Regular follow up of interventional and non-interventional groups for outcomes measurements (dietary intake, biochemical and physical measurements) and compare them to evaluate the effect of nutrition education in the farming community.

Achievements:

The project started in June, 2013 on releases of funds in last week of May, 2013. During the period under report i.e. upto June, 2013, five visits were made to district Mardan (study site) and collected updated information on geographical divisions (agricultural area) and population distribution from district Mardan Census Office. Sites visits were also made to agricultural areas of district Mardan to asses the suitability for enrolment in the study based on location, farming population and general accessibility. Baseline data on farm income, expenditure, socio economic status and nutritional status to screen the farmers will be gathered through team under the supervision of PI in selected Union Councils of Mardan district

Out of 75 Union Councils (UC) in district Mardan (60 UCs are in the rural areas), 20 UCs were randomly selected based on agricultural areas and population to represent the farming community of district Mardan. The selected UCs were visited to assess accessibility to the local farming community through developing links with local supporting/ welfare organization and area leaders. Questionnaire to gather data on farm income & expenditure, socio-economic status and nutritional status of the farmers developed. These questionnaires will be used to gather baseline data to screen the farmers in the next half of year-II. The questionnaire will be standardized before using in the field.

