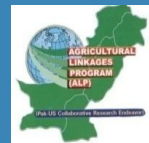
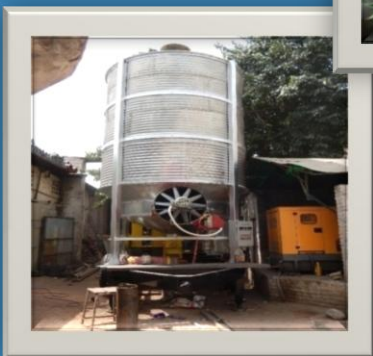




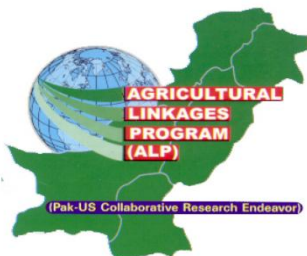
**14<sup>TH</sup> ANNUAL PROGRESS REPORT  
AGRICULTURAL LINKAGES PROGRAM**



**2015 -16**



**ALP SECRETARIAT  
PLANNING & DEVELOPMENT DIVISION  
PAKISTAN AGRICULTURAL RESEARCH COUNCIL  
ISLAMABAD-PAKISTAN**



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# **14<sup>th</sup> Annual Progress Report of Agricultural Linkages Program 2015-16**

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**ALP Secretariat  
Planning & Development Division  
Pakistan Agricultural Research Council  
Islamabad – Pakistan**

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## FOREWORD

Agriculture is the lifeline of Pakistan's economy as it provides raw materials to down the line industries and it is the prime source of foreign exchange earnings helps in reducing the poverty. Majority of the population is directly or indirectly, dependent on this sector. Agriculture sector contributed 19.8 percent to GDP in 2015-16 and it remains the largest employer absorbing 42.3 percent of the country's total labour force.

During FY 2015-16, the performance of agriculture sector as a whole remained dismal. It witnessed a negative growth of 0.19 percent against 2.53 percent growth during the same period last year. The growth of crops declined by 6.25 percent, while the other sub component of Agriculture sector like Livestock, Forestry and Fishing posted positive growth of 3.63 percent, 8.84 percent and 3.25 percent, respectively.

There is a strong relationship between agriculture and climate; temperature, rainfall, floods and other aspects of weather that affect agriculture production, commodity prices and finally economic growth. The emerging challenges of national food security and climate change have shifted the policy focus globally towards the development of agriculture sector during past few years. However, the agriculture research in Pakistan is not properly funded and does not cater to the needs of modern agriculture.

ALP, financed through an endowment fund, provides an opportunity to fill the financial gap in research system to some extent through competitive grants. It provides an opportunity to the agricultural scientists from all over the country to win ALP grants for operational funding through a highly competitive grant system. The overall allocation to the operational funding under this program is over Rs. 200 million per year.

This program is fully functional since 2000 and PARC has launched seven batches of ALP for funding the research projects. 374 ALP projects have been completed and 59 are on-going all over the Pakistan. A number of technologies in 4 subsectors of agriculture have been generated from ALP funding. The success of this program is due to joint efforts of ALP Secretariat scientists, PARC across the Division.

This 14<sup>th</sup> Annual Progress Report highlights the activities and achievements made under of ALP Programe. It covers status of ALP projects, technical & financial progress of ongoing projects, their monitoring & evaluation and key findings. I do hope that the report will serve as a reference document to avoid repetition while formulating new research projects for funding and the outcome will be translated into useful technologies. I wholeheartedly appreciate the efforts of Dr. Ahmad Bakhsh Mahar DG (P&DD)/Executive Director, ALP and his team for compiling this progress report and executing the ALP program efficiently and meaning fully.

**(Dr. Yusuf Zafar<sub>TI</sub>)**  
Chairman

## ACKNOWLEDGEMENT

Pakistan's economy is still predominantly agrarian in nature. The growing population requires that the existing knowledge and agriculture related technologies be modified to meet the future challenges of food security. Agriculture has made steady progress and serves as a base for future economic development. There are, however, some technical, management and financial problems that have besieged the agriculture sector. In spite of all these constraints, agriculture sector continues to respond to the ever-increasing demand for food, fiber and exportable surpluses.

Pakistan is far behind in allocating resources for the agriculture sector and due to lack of financial resources, research sector always remained inefficient. Fortunately, since 2000 the Agricultural Research Endowment Fund (AREF) under ALP has been instrumental to fill the financial gap in research. The Government of Pakistan with financial assistance of USDA (Govt. of USA) established Agricultural Research Endowment Fund (AREF) with an amount of Rs. 1.3 billion. The challenging task of implementing this program was given to PARC. Income generated from endowment fund is being used for Agricultural development in line with Pakistan's long-term research and development goals for agricultural sector.

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

The findings/ research achievements of the projects highlighted in this report are evidence of the industrious work of the scientists engaged in ALP. It also mirrors the excellent performance of ALP Secretariat and Technical Divisions of PARC. The implementation of ALP would not have been possible without the firm commitment and substantial contribution of my colleagues namely Mr. Muhammad Asif, Director (CG&MoU), Mr. Tahir Zahoor Chohan, Deputy Director (ALP), Mr. Mushahid Raza, Assistant Director (MIS), Mr. Shujaat Yaqoob, PSO, M&E, Mr. Nouman Badar, Research Fellow and Mrs. Waqar-un-Nisa, Research Assistant (ALP).

The ALP Secretariat squad consisting of highly qualified and devoted scientists in processing, monitoring, review, evaluation and day to day management of ALP projects is deeply acknowledged. Similarly, the logistic arrangements by Mr. Muhammad Ali, Deputy Director, maintenance of files by dealing Superintendents/Assistants, Mr. M. Javed Bhatti, Mr. Amir khan, Mr. Mudassar Hussain Satti are deeply appreciated. The contribution of Mrs. Waqar-un-Nisa in typing/compiling this report is duly acknowledged.

**(Dr.Ahmad Bakhsh Mahar)**  
DG (P&DD)/Executive Director (ALP)

## **Executive Summary**

Agricultural Linkages Program (ALP) was launched in 2000 with the approval of Economic Coordinate Committee in its meeting held on 14.07.2000. Since its inception, 360 projects have been completed under seven batches. During the reporting year 42 projects were completed, 37 new projects were awarded, 49 projects continued operation, three Technical Advisory Committee meetings and three Board of Directors meeting were held during the reporting period.

The salient achievements made in ALP projects across the country by NARS are summarized below:

### ***Animal Sciences***

- It was concluded that CIDR+GnRH can be used effectively to synchronize the estrus and attain an optimum conception rate in Buffaloes during low breeding season when generally the Buffaloes can't be bred naturally. Likely, same treatment in non-descriptive Cows attains an optimum conception during low breeding season.
- It was proved that the silage treated with enzymes, reduced the cost of production in live stock due to improved feed efficiency and daily weight gain and enhanced dietary nutrient digestibility.
- Bentonite clay (BC), Distillery sludge (DS), Milk thistle (MT) and Baker's Yeast (BY) used alone or in combinations against experimental aflatoxicosis, chratoxicosis proved their moderate mycotoxins binding ability. In different combinations these proved excellent performance as mycotoxin binders and growth promoters and improved growth and immunity in poultry bird.
- It was investigated that stocking density of 2000/acre and 25% cp was the best for rearing of carp in ponds. The feed containing 35% cp found best for fry rearing of carp.

### ***Plant Sciences***

- Seeds of 113 exotic chilies germplasm were collected from local and exotic sources. The nurseries of selected lines from dandicut were evaluated at Umerkot, Kunri, Tando Allahyar, and Badin for their performance.
- Date palms off shoots were collected from Turbat, Baluchistan, D.I.Khan, KPK and local area for micropopagation. Tissue culture from off shoots of exotic varieties i.e. Sewi from Egypt, Medjool & Barhi from UAE has been Started.
- To provide true to type and healthy plants of stone fruits species (apricot, peach, plum, almond, cherry) to the growers, nurseries have been established at National Tea and High value Crops Research Institute (NTHRI) Shinkhari and on farmer's fields in three locations of District Mansehra i.e. Bajna Mera, Baffa Dorah and Dahrial. Awarded practical trainings to the growers in the raising and management of fruits nursery.
- At present more than 200 MAPs species have been documented. One thirty (130) and twenty species have been propagated in two colonial repositories. Each selected plant was studied in

its natural habit and 8-10 photographs of each plant including its all parts. For conservation point of view each herbarium was prepared in duplicate. Botanical name, local name, family, place of collection and date of collection were mentioned for each plant in herbarium specimen. During the second year of this project 100 top medicinal plants like *Cretaegus oxycantha*, *Leonurus cardiac* for heart diseases, *Podphyllum hexandrum*, *Gentiana kurroo*, *Swertia* species as antibiotics, are identified and documented.

- An Astringency Removal Chamber (ARC) was fabricated for processing of removing the astringency from Persimmon at the early stage of ripening to extend its shelf life for purpose of marketing for export purpose. Keeping in view the important parameters, astringency, weight loss, texture and taste/consumers acceptability, treated fruits for 96 hrs collected at per picking stage could be beneficial for the removal of astringency and extension of storage period. By comparison of total phenolic content of all the differently treated fruits it was evident that modified atmosphere caused reduction in total phenol/astringency. The technology was disseminated to more than 500 persimmons growers/traders through awareness workshops in the persimmon growing areas (Swat and Charsadda), Consumer's acceptability test of the treated fruits and distribution of the brochures of the technology.

### ***Natural Resources***

- Multi strain bio-fertilizer (Rhizogold) was developed and a pilot scale production unit has been installed for commercialization at UAF, Faisalabad.
- The value cost ratio (V-C-R) of 3-47 with highest net return of Rs.104950/- ha<sup>-1</sup> by the application of 75% Nitrogen from Urea and 25% from FYM ha<sup>-1</sup> indicated Economical significance for profitable rice yield.
- A prototype of humic substances (HSs) production facility at NARC has developed. (HSs) application with fertilizer formulation reduced fertilizer input by 25% vis a vis treatment fertilizer alone.

### ***Social Sciences***

- Based on farmers' information, the sophisticated bio-gas plant is the most feasible and economical alternative energy source followed by electric and diesel, but it could not be used as a sole source of energy rather it is supplemented with diesel. The Raised Bed Plantation technique, which conserves energy through reducing irrigation time from 15-20 percent as well as increases yield (5-10 percent). Laser leveling beside the energy saving increased the yield and improved soil health.
- A total of 114 scientists and educators were trained in the Technical Proposal Writing for Grants under ALP. A one day workshop was organized at University of Haripur, KPK wherein more than 50 university faculty members were trained in project proposal writing.
- Nutritional status of the 1200 farmers from Mardan district was assessed taking their anthropometry (body weight, height, mid upper arm circumference (MUAC) & triceps skinfold measurement (TSF), biochemical measurement (random blood glucose level and hemoglobin) and blood pressure. According to World Health Organization (WHO) criteria of BMI and blood Hb level, 85 (7%) and 178 (15%) of the farmers were underweight and



anemic respectively. Overall, 226 (19%) of farmers were malnourished. Overall, farmers with better nutritional status had maximum farming work capacity. Additionally higher number of malnourished than normal farmers reported to have general health problems and to get fatigue after short physical activity in the farm. malnourished farmers showed unhealthy dietary pattern than the control and malnourished farmers were likely to have lower dietary intake of protein, fiber, phosphorus, heme iron, vitamin A, riboflavin and niacin.

### ***Agricultural Engineering***

- An air classifier/cleaner for psyllium (Ispaghul) seed cleaning was developed and fabricated at ABEI prototype workshop.
- First prototype of Storage Bin Cum Seed Drying Unit was designed/developed with the help of a machinery manufacturer. Prototype unit was tested and evaluated for its performance at farm level in Gujranwala area. SMS base networking system available for measurement of Bin inside wet-bulb temperature and relative humidity. Conducted one day field seminar/demonstration of first prototype unit for awareness at Matco Rice Processing Mill for progressive paddy farmers, small seed companies/traders, extension staff, researchers and machinery manufacturers. (ABEI, NARC Islamabad)

## Achievements of ALP Secretariat

### Introduction

The Agricultural Linkages Program (ALP) was established through an agreement between the Govt. of Pakistan and United States of America signed in February, 1999. Under this agreement USA supplied wheat (200,000 tones) valued at US\$23.222 million as a grant to Pakistan in March 1999. The agreement provided that the sale proceeds of this wheat amounting to Rs.1.3 billion will be invested in banks and income generated from this investment used by Pakistan Agricultural Research Council to establish the Agricultural Linkages Program (ALP) for promotion of agricultural research and development. Agricultural Research Endowment Funds (AREF) was approved to support/implement ALP. The Economic Coordination Committee (ECC) of the Govt. of Pakistan while approving the Agricultural Research Endowment Fund for ALP in its meeting held on 14.07.2000 also approved procedures for its implementation. The Govt. of Pakistan made PARC responsible to use this Endowment Fund, establish the Agricultural Linkages Program, manage its affairs and award the grants through an approved mechanism.

So far seven batches of ALP have been launched and altogether, 360 projects have been completed in various thematic areas of Animal Sciences, Plant Sciences, Agriculture Engineering, Social Sciences and Natural Resources. Altogether, approved cost of ALP funded completed projects was Rs.1356.422 million (*Annexure-ii*) and the priority areas for 7<sup>th</sup> batch of ALP projects are at *Annexure iii*.

### Achievements

During the year 2015-16, 42 projects were completed (*Table-1*), 37 new projects were started (*Table-2*), review of 09 projects were conducted (*Table-3*), 49 projects were ongoing (*Table-4*), region and sector wise approved cost of ALP funded ongoing projects was Rs.313.200 million (*Table-5*), three Technical Advisory Committee (TAC) meetings and three Board of Directors (BoD) meeting were convened.

**Table -1:** Sector Wise Number of Projects Completed During 2015-16

<i>Item</i>	<i>Animal Sciences</i>	<i>Plant Sciences</i>	<i>Natural Resources</i>	<i>Social Sciences</i>	<i>Total</i>
Projects completed	23	11	05	03	42

**Table -2: Sector Wise Number of New Projects Started During 2015-16**

<b>Item</b>	<b>Animal Sciences</b>	<b>Plant Sciences</b>	<b>Natural Resources</b>	<b>Social Sciences</b>	<b>Total</b>
Projects started	15	16	05	01	37

**Table -3: Sector Wise Number of Projects Reviewed During 2015-16**

<b>Item</b>	<b>Animal Sciences</b>	<b>Plant Sciences</b>	<b>Natural Resources</b>	<b>Social Sciences</b>	<b>Total</b>
Projects started	07	02	-	-	09

**Table-4: Region and Sector wise Number of ALP Funded On-going Projects During 2015-16:**

<b>Region/Sector</b>	<b>ASD</b>	<b>PSD</b>	<b>NRD</b>	<b>SSD</b>	<b>Total</b>
Federal (PARC/NARC)	05	03	02	-	<b>10</b>
PARC (Outstation)	-	06	-	-	<b>06</b>
Other Federal	01	03	01	-	<b>05</b>
Punjab	05	05	-	-	<b>10</b>
Sindh	03	01	01	-	<b>05</b>
Khyber Pakhtunkhwa	04	01	02	-	<b>07</b>
Balochistan	-	-	01	-	<b>01</b>
Gilgit Baltistan	01	-	01	-	<b>02</b>
AJ&K	02	01	-	-	<b>03</b>
<b>Total:</b>	<b>21</b>	<b>20</b>	<b>08</b>	<b>-</b>	<b>49</b>

**Table-5: Region and Sector wise Approved Cost of ALP Funded On-going Projects During 2015-16:**

<b>Region/Sector</b>	<b>ASD</b>	<b>PSD</b>	<b>NRD</b>	<b>SSD</b>	<b>Total</b>
Federal PARC/NARC	71.119	40.897	21.568	-	<b>133.584</b>
PARC (Outstation)	-	29.084	-	-	<b>29.084</b>
Located in Provinces					

Other Federal	4.200	15.492	3.838	-	<b>23.530</b>
Punjab	17.950	31.043	-	-	<b>54.809</b>
Sindh	9.992	9.953	5.816	-	<b>19.945</b>
Khyber Pakhtunkhwa	15.220	2.000	10.611	-	<b>27.831</b>
Balochistan	-	-	5.960	-	<b>5.960</b>
Gilgit Baltistan	2.616	-	4.418	-	<b>7.034</b>
AJK	7.436	3.987	-	-	<b>11.423</b>
<b>Total</b>	<b>128.533</b>	<b>132.456</b>	<b>52.211</b>	<b>-</b>	<b>313.200</b>

### **Projects Recommended in 32<sup>nd</sup> TAC meeting**

- Phenotypic Characterization of Indigenous and Exotic Castor Bean (*Ricinus communis*) in Baluchistan (CS 267)
- Integrated Management of Nutrients, Water and Diseases for Growing Off-Season Vegetables in High and Walk-in tunnels in Moisture Deficit Areas of Khyber Pakhtunkhwa (NR 019)
- Nutrient and Diseases Management for Growing Off-Season Vegetables under Tunnel Farming (NARC Component-III) (NR108)
- Estimation of Protein and Productive Efficiency Profile of Locally Produced Oyster Mushroom (*Pleurotus ostreatus*) in Broiler (AS 014)
- Evaluation of Existing Water Management Strategies Adopted by Farmers in Different Agro-Ecological Zones of Punjab (SS 002)
- Capacity Building for Sustainable Agriculture Research and Development in Baluchistan (SS 024)

### **Projects Recommended in 33<sup>rd</sup> TAC meeting**

- Preliminary Therapeutic Evaluation of N-acetylcysteine Plus Vitamin C and Sodium Thiosulphate in the Treatment of Parturient Hemoglobinuria in Buffaloes and Cows in Faisalabad and Jhang Districts (AS 090)
- One Health Approach for Molecular Diagnosis, Epidemiology and Control of Brucellosis in Pakistan (Coordinated Project - NIBGE Comp. I)
- Molecular Biotyping of *Brucella abortus* Strains in Bovine Population of Selected Punjab Districts (UVAS, Lahore Component-II) (AS 044)
- DNA-Based Biodiversity Inventories of Juniper Forest Ecosystems in Ziarat, Quetta and Kalat Districts (NR010)

- Rearing and Ecological Studies of Egg Parasitoid Trichogramma for Biological Control of Lepidopterous Pests of Okra, Cauliflower and Tomato (CS 184)
- Development of Heat Tolerant Cotton Varieties Having Enhanced Resilience against Changing Climatic Scenario (CS 197)
- Characterization, Rejuvenation and Multiplication of Cross-Pollinated Vegetable Germplasm (Radish, Turnip, Cauliflower, Onion and Cucumber) and its Genepool Expansion (CS 220)
- Assessment of Rice Bacterial Leaf Blight in Sindh Province and its Management Exploring Resistant Germplasm (CS 263)
- Post Harvest Management in Deciduous Fruits of Balochistan (CS 289)
- Varietal Screening, Technology Development and Seed Production of Guar [*Cyamopsis tetragonoloba* (L. Taub)] under Rainfed Ecologies of Pakistan (Coordinated Project) (CS 303 A)
- Germplasm Screening and Production Technology Development of Guar [*Cyamopsis tetragonoloba* (L. Taub)] under Irrigated Conditions (Coordinating Project) (Component-II) (CS 303 B)

#### **Projects Recommended in 34<sup>th</sup> TAC meeting**

- Evaluation and Protective Efficacy of Different Stabilizers on Shelf Life of the Live Heterotypic Haemorrhagic Septicaemia Vaccine (AS 142)
- Studies on the Culture Prospects of Snow Trout (*Schizothorax plagiostomus*) in Dir Upper, Khyber Pakhtunkhwa (KP) to Reduce the Poverty and Food Security Risk in the Area - A Pilot Project (AS 147)
- Molecular Epidemiology, Gene Expression and Genetic Polymorphism of Host in Bovine Tuberculosis with its Public Health Significance (AS 035)
- Molecular Epidemiology, gene expression and genetic polymorphism of host in bovine tuberculosis with its public health significance (AS 087)
- Pilot Scale Treatment of Textile Effluents using Integrated Treatment Technology and its Potential Reuse for Irrigation Purpose (NR 086)

#### **Projects Recommended in 35<sup>th</sup> TAC meeting**

- Fish Breeding and Culture Technology Development in Coastal Region of Pakistan (AS 020)
- Management of Dusky Cotton Bug *Oxycarenus* sp; Lygaeidae, Hemiptera): An Emerging Threat to Cotton Crop in Pakistan (CS 095)
- Post-Harvest Grain Losses Management for Food Security (CS 097)
- Development and Genetic Characterization of Haploid Lines and Polyploidy Germplasm for Hybridization in Elite Guava Strains (CS 121)
- Rearing and Ecological Studies of Egg Parasitoid Trichogramma for Biological Control of Lepidopterous Pests of Okra, Cauliflower and Tomato (CS 184)
- Research and Promotion of Mushroom Cultivation in Malakand Division (CS 230)

- Processing, Preservation and Value Addition of Fruits and Vegetables Training in Gilgit-Baltistan (CS 346)
- Development of Asexual Propagation Techniques for Cultivation of Chilghoza Pine (CS 358)
- Induction of Heat Tolerance in Tomato (*Lycopersicon esculentum* L.) by Inoculation of Rhizospheric Bacteria: A Strategy for Mitigating Impacts of Climate Change (CS 374)
- Domestication, Conservation and Production of Medicinal Plants of Higher Altitude of Pakistan (NR 071)
- Innovation in Crop Production System to Adapt Climate Changes through Climate Smart Technologies in Spate Irrigated Areas (NR 105)
- Use of Biotechnological Approaches for Remediation of Heavy Metal Polluted Soils of Southern Areas of Khyber Pakhtunkhwa (NR 107)

#### **Projects approved in 20<sup>th</sup> BoD meeting**

- Optimization of Bt. Cotton Production Technology for Different Agro-Ecological Zones in the Face of Changing Climate through Simulation Modeling (CS-108)
- Evaluation, Identification and Multiplication of High Yielding and Disease Resistant Varieties/Cultivars of Cherry under Ecological Conditions of Gilgit Baltistan (CS-231)
- Development and Commercialization of Ispaghul (*Psyllium*) and Kalongi (*Nigella sativa*) Processing Technologies for Value Addition (CS-243)
- Evaluation of Chili Varieties for Quality, Production, High Yield and Disease Resistance in Lower Sindh (CS-292)
- Micropropagation of Superior National and International Varieties of Date Palm on Commercial Level)

#### **Projects approved in 21<sup>st</sup> BoD meeting**

- The Effect of Date Palm Fruit (*Phoenix dactylifera* L.) Extract for Oxidative Stabilization of Butter Oil (CS-018)
- Production of Quality Stone Fruits Nursery Plants for the Promotion of Fruits Cultivation in Hazara Division (CS-317-A)

#### **Projects approved in 22<sup>nd</sup> BoD meeting**

- Preliminary Therapeutic Evaluation of N-acetylcysteine Plus Vitamin C and Sodium Thiosulphate in the Treatment of Parturient Hemoglobinuria in Buffaloes and Cows in Faisalabad and Jhang Districts (AS 090)
- Genetic Improvement of Selected Indigenous Naked Neck by Crossing with Exotic Poultry Breeds of Rhode Island Red and Black Australorp (UVAS, Lahore Component-V) (AS 135)

### **Projects approved in 23<sup>rd</sup> BoD meeting**

- Preliminary Therapeutic Evaluation of N-acetylcysteine Plus Vitamin C and Sodium Thiosulphate in the Treatment of Parturient Hemoglobinuria in Buffaloes and Cows in Faisalabad and Jhang Districts (AS 090)
- One Health Approach for Molecular Diagnosis, Epidemiology and Control of Brucellosis in Pakistan (Coordinated Project- AS 123 - NIBGE Comp. I)
- Screening of Drought Tolerant Sugarcane Varieties under Different Soil Conditions (CS 004)
- Development of Heat Tolerant Cotton Varieties Having Enhanced Resilience against Changing Climatic Scenario (CS 197)
- Improvement of Chickpea for Blight and Drought Stress using Metabolomics and Genomics Assisted Breeding (CS 203)
- Characterization, Rejuvenation and Multiplication of Cross-Pollinated Vegetable Germplasm (Radish, Turnip, Cauliflower, Onion and Cucumber) and its Genepool Expansion (CS 220)
- Production Technology and Adaptability of Super-NPT Rice (CS 231)
- Assessment of Rice Bacterial Leaf Blight in Sindh Province and its Management Exploring Resistant Germplasm (CS 263)
- Post Harvest Management in Deciduous Fruits of Balochistan (CS 289)
- Varietal Screening, Technology Development and Seed Production of Guar [*Cyamopsis tetragonoloba* (L. Taub)] under Rainfed Ecologies of Pakistan (Coordinated Project) (Component-I) (CS 303 A)
- Germplasm Screening and Production Technology Development of Guar [*Cyamopsis tetragonoloba* (L. Taub)] under Irrigated Conditions (Coordinating Project) (Component-II) (CS 303 B)
- DNA-Based Biodiversity Inventories of Juniper Forest Ecosystems in Ziarat, Quetta and Kalat Districts (NR 010)
- Improving Plant-Microbe Interactions through Biochar Application for Sustainable Cropping Systems in Degraded Soil (NR 040)

During the reporting year i.e. 2015-16 three TAC meetings were held in which altogether 48 projects relating to 4 disciplines were presented to TAC out of which 28 were recommended to BoD.

# **ANIMAL SCIENCES**

## **Introduction**

At National level, livestock contributed approximately 58.6 percent to the agriculture value added and 11.6 percent to the overall GDP during 2015-16. There are about 42.8, 36.6, 29.8, 70.3, 1.0 & 1016 million heads cattle, buffalo, sheep, goat, camels and poultry, respectively in Pakistan (Pakistan Economic Survey 2015-16) that produced 54.328 million tonnes milk, 3.873 million tonnes meat, 15.886 million hides, 54.278 million skins, 45.1 thousand tonnes wool, 26.5 thousand tonnes hairs, 852.3 thousand tonnes bones, 271 thousand tonnes fat, 1207 thousand tonnes dung, 3940 thousand tonnes edible offals during 2015-16. A total of 46.242 thousand tonnes of red meat was exported during 2015-16 (July-March). The export of meat fetched US \$ 144.864 million. There are many issues contributing to decrease the livestock production including of climate change, low availability of water, prevalence of diseases, shortage of feeding resources, low potential of native breeds, small number of animal holdings.

The objective of this ASD is to set priorities of research according to the needs of the Provinces and monitor research activities being conducted at the Federal and Provincial level and eventually finding solutions to the burning issues confronting livestock sector in the Country. The major focus of Animal Sciences research activities is to improve production potential of national herd through improvement in animal genetic and feeding resources available in the Country and control of animal infectious diseases. In addition, the research addresses areas like Animal Reproduction, strengthening diagnostic capacity in Poultry diseases, Dairy meat Technology, Breeding of Small and Large Ruminants and Aquaculture and Fisheries. However, shortage of funds is major constraint to achieving research goals.

The Agriculture Linkage Program (ALP) at PARC is playing very important role while granting research based funding throughout the country. In Livestock Sector 36 projects are in the process of implementation at various stages under ALP funding. Out of these, 31 continued from previous years, whereas 05 new projects were also awarded during last year.

During 2015-16 significant achievements in research relating to enhancing the productivity of livestock, poultry and fisheries have been made. Research efforts were focused to control major diseases of economic importance such PPR, FMD, Avian diseases, improvement in reproduction through estrous synchronization following by Artificial Insemination in cows/buffaloes, goats breed improvement, cross of Naked Neck chickens, fish culture etc.

The annual progress reports submitted by the P.Is comprised achievements/mile stones which are summarized under each project.



**Name of Project:** Development of Models for the Control of PPR in Pakistan and PPR Vaccine Using Local Isolate (Coordinated Project: NARC-Islamabad, VRI-Lahore Punjab, L&DD-Sindh Hyderabad, L&DD-Khyber Pakhtunkhwa Peshawar, L&DD-Balochistan Lasbela, L&DD-Gilgit-Baltistan, Dept. of A.H-AJ&K, Muzaffarbad)

<b>Name of PI/Institute:</b>	Comp.-I:	Dr. Aamer Bin Zahur, PSO, ASI, NARC, Islamabad.
	Comp.-II:	Dr. Muhammad Asim, Biological Production Officer, Veterinary Research Institute, Lahore
	Comp.-III:	Dr. Zahid Iqbal Rajput, Associate Professor, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences, Skrand, Sindh
	Comp.-IV:	Dr. EhsanUllah Khan, Director, Animal Health, L&DD Deptt. Khyber Pakhtunkhwa, Peshawar.
	Comp.-VI:	Dr. Aziz Ur Rehman, Dy. Director, Livestock & Dairy Development, Deptt., Gilgit –Baltistan.
	Comp.-VII:	Dr. Adnan Rashid Malik, Asstt. Dir (Tech), Deptt. of Animal Husbandry, AJK, Muzaffarabad

<b>Duration:</b>	Comp.-I:	12.11.2012 to 11.11.2015 Extend up to 31.12.2017
	Comp.-II:	06.05.2014 to 05.05.2017 Extend up to 31.12.2017
	Comp.-III:	19.12.2012 to 18.12.2015 Extend up to 18.12.2016
	Comp.-IV:	20.11.2012 to 19.11.2015 Extend up to 19.11.2016
	Comp.-VI:	20.11.2012 to 19.11.2015 Extend up to 19.11.2016
	Comp.-VII:	20.11.2012 to 19.11.2015 Extend up to 19.11.2016

<b>Financial Status:</b>	Total Cost	Total Release	Total Expenditure
	(Rs.million)	(Rs.million)	(Rs.million)
Comp.-I:	23.5485	15.231	14.795
Comp.-II:	2.616	0.700	0.700
Comp.-III:	2.616	2.537	1.885
Comp.-IV:	2.616	0.801	0.738
Comp.-VI:	2.616	2.115	2.116
Comp.-VII:	2.616	1.311	1.327

**Objectives:**

- Development of 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 program.
- Monitoring of viral activity in target districts with special emphasis on the changes in

virulence of PPR virus circulating in small ruminant's population.

- Development of PPR vaccine using local isolate.
- Awareness campaign and capacity building of field staff.

### **Achievements:**

***Objective-I: Develop Models for the Control of PPR Virus Infection through Vaccination among Sheep and Goats Population in High Risk Tehsils of the Country.***

### ***Stakeholder's Workshops***

Five stakeholder workshops were successfully organized in each selected target tehsil to sensitize major stakeholders (livestock farmers and field veterinary staff) and identify other small ruminant's health issues prevalent in the areas.

### ***Establishment of vaccination teams and vaccine bank in target tehsils.***

- Vaccine bank were established in each target tehsil by supplying 200,000 doses of PPR vaccine along with diluent. Vaccination teams comprising field veterinary staff were created and vaccination schedule was tailored according to the lambing and kidding seasons and annual turnover rate with respect to sheep and goat population in each area.
- Age specific vaccination was conducted in subsequent years (2015 and 2016) to maintain critical flock immunity. Details are given in table-1

**Table 1. Number of Sheep & Goats Vaccinated in each of the Target Tehsil of PPR Project**

S. No	Province	Target tehsils	No. of small ruminants vaccinated	
			2014-15 <sup>1</sup>	2015-16 <sup>2</sup>
1	Sindh	Umerkot	2,00,000	80,000
2	KPK	Chitral	2,00,000	80,000
3	Balochistan	Lasbella	2,00,000	
4	Gilgit Baltistan	Chillas	2,10,000	80,000
5	AJK	Barnala	1,50,000	80,000
6	Punjab	Liaquatpur		3,20,000
7	Attock	Jand & Pindi Gheb	5000	5000
8	At the face of outbreaks	Across the country	20,000	15,000

- Establishment of vaccine bank and mass vaccination conducted in target tehsils
- Vaccination (Age specific and newly introduced animals) after mass vaccination
- Vaccination (Age specific and newly introduced animals) to maintain herd immunity in target tehsils.
- More than 90% of animals sampled seroconverted (of 480 sera samples collected from vaccinates in each target tehsil) with diagnostically positive titres; indicating efficacious vaccination.

***Objective-2: Systematic Socio Economic Impact Assessment and Economic Analysis of PPR Vaccination Programme***

- Field surveys were conducted in tehsil Barnala, AJK and tehsil Chilas, GilgitBaltistan
- Total estimate of economic losses averted in targeted tehsils is Rs.5,226.72 million per annum.
- Data of the survey conducted in 2 target tehsils for socio-economic impact of PPR is under analysis.

***Objective 3: Monitoring of Viral Activity in Target Tehsils and/or Districts with Special Emphasis on the Changes in Virulence of PPR virus***

- Rapid response teams comprising of field veterinary staff under veterinary officer were created in each target tehsil.
- These teams were equipped with sample collection kit and were trained in field diagnosis of PPR and appropriate sample collection and dispatch to AHP, ASI, NARC.
- Proforma was designed for outbreak investigation and epidemiological data collection.
- A total of 117 outbreaks were investigated throughout the country including 39 in KPK, 11 in GilgitBaltistan, 9 in Sindh, 27 in ICT, 24 in Punjab and 7 in AJK under the project.
- Clinical examination was conducted in each of the outbreak and postmortem examination was conducted where dead animals were found.
- Outbreak control measures were implemented and emergency vaccination was conducted in an epidemiological unit (infected area).
- A standardized panel of diagnostic assays was developed and used for the confirmation of the field outbreaks.
- 16 cytopathic PPRV isolates recovered on cell culture (Vero Cells).
- The isolates were identified using RT-PCR and lyophilized for storage. These isolates are available at AHP repository.
- The 16 PPRV local isolates were processed for full genome sequencing to study the molecular epidemiology of PPR in the country. A total of 4 libraries (including PPR virus isolates) were generated using SISPA technique at CIRAD, France and sent to MACROGEN for sequencing.
- Developed quantitative Reverse Transcriptase Polymerase Chain Reaction (qRT-PCR)
- Optimized direct detection of PPRV by RT-PCR (without RNA extraction) using samples collected on filter paper during field outbreaks
- Optimized Reverse Transcriptase Loop mediated amplified RT-LAMP assay
- Optimized serum neutralization test (SNT) (Gold standard) for sero-diagnosis of PPR.
- Developed Hemagglutination Inhibition (HI) assay for serodiagnosis of PPR
- Spatial distribution of PPRV based upon lab confirmed reports during 2012-16 was determined and mapped.
- Factors responsible for persistence and transmission of PPR in the country ascertained
- Sequence data analysis for molecular epidemiological studies is in process.

***Objective 4: Development of PPR Vaccine Using Local Isolate***

A local PPRV isolate (PAK-Fjg-07/NARC4) was selected for attenuation on the bases of Genotyping, Thermo stability potential and Immunogenicity.

- The selected isolate was serially passaged on Vero cells for attenuation at cell culture lab AHP. To date 54 serial passages have been completed.

- Attenuated virus was confirmed by HA test and RT-PCR using primers designed for the purpose after every 10 passage at virology lab AHP.
- The attenuated virus was processed for full genome sequencing after every 10 passages at world reference lab for PPR, CIRAD, France. One of the scientists from AHP visited CIRAD and standardized the protocols of Next Generation Sequencing (NGS).
- Trials to ensure successful attenuation will be conducted after 60 passages of selected PPRV on Vero cells.
- A vaccine will be developed and tested after pathogenicity trial.

#### ***Objective 5: Awareness Campaign and Capacity Building of Field Staff***

- A total of 05 awareness workshops were successfully organized under the project to sensitize major stakeholders (livestock farmers and field veterinary staff of provincial L&DDs). The details regarding the venues, number of field veterinary staff trained and number of sheep and goat producers sensitized.
- Project team contributed in capacity building of provincial field veterinary staff and sensitizing livestock farmers in 12 awareness workshops organized under FAO implemented project “Progressive control of PPR in Pakistan”. The details regarding the venues, number of field veterinary staff trained and number of sheep and goat producers sensitized.

#### **Significant Achievements:**

- Animal Health Program is serving as **National Reference Lab** for molecular diagnosis and PPR virus isolation under FAO implemented project.
- A **national seminar** on “Progressive Control and Eradication of Pesticides Petites Ruminants (PPR) in Pakistan” was successfully organized under the project. The major stakeholders (higher management of provincial/ regional L&DDs) and scientist were briefed about the achievements of the project and a National Strategic Plan for Control and Eradication of PPR in Pakistan by year 2030 was also discussed.
- It has been demonstrated to the stakeholders that PPR can be controlled efficiently by conducting strategic vaccination in high risk areas and proper implementation of biosecurity measures at the face of an outbreak.
- Increased awareness of stakeholders resulted in enhanced disease reporting, efficient field diagnosis, appropriate sample collection and timely implementation of outbreak control measures.
- An estimated loss of Rs. 5,226.72 million per annum was averted in target tehsils due to project activities.
- A standardized panel of diagnostic assays developed to monitor the PPR virus activity in the country (Haemagglutination test, Haemagglutination Inhibition test, competitive ELISA(c-ELISA), Immuno-capture (Ic- ELISA), RT-PCR, qRT-PCR, RT-LAMP, Virus Isolation (VI) and Serum Neutralization Test (SNT).
- Linkages developed and strengthened with international, national organizations and academia.
- A total of six research articles, three abstracts and two extension articles are published so far during the life of the project.



**The Team Members are engaged in investigation**



**Project teams are collecting the sample for investigation**

**Name of Project:** **Surveillance Pathogenesis and Management Strategies against Major Emerging Avian Diseases (Coordinated Project: NARC-Islamabad, PRI-Rawalpindi, PRI- Karachi, Disease Investigation Lab.-Peshawar, Disease Investigation Lab.-Quetta, Disease Investigation Lab.-Gilgit)**

**Name of PI/Institute:**

Comp.-I:	<b>Dr. Athar Abbas, SO, NRLPD, ASI, NARC, Islamabad</b>
Comp.-II:	<b>Dr. Abdul Rahman, SRO, PRI, Rawalpindi</b>
Comp.-III:	<b>Dr. Rashid Farooq, SRO, PRI, Singer Chorangi, Korangi, Karachi</b>
Comp.-IV:	<b>Dr. Syed Asad Ali Shah, Director General (Extension), Livestock &amp; Dairy Development KPK, Charsada road Peshawar</b>
Comp.-V:	<b>Dr. Abdul Bari, Disease Investigation Officer, Disease Investigation Lab, Quetta</b>
Comp.-VI:	<b>Dr. Muhammad Muslim Sahar, SRO, Disease Investigation Lab, Gilgit</b>

**Duration:**

Comp.-I:	24.10.2012 to 23.10.2015 Extended up to 30.06.2016
Comp.-II:	01.10.2012 to 30.06.2016
Comp.-III:	24.10.2012 to 23.10.2015 Extended up to 30.06.2016
Comp.-IV:	24.10.2012 to 23.10.2015 Extended up to 30.06.2016
Comp.-V:	24.10.2012 to 23.10.2015 Extended up to 30.06.2016
Comp.-VI:	24.10.2012 to 23.10.2015 Extended up to 30.06.2016

<b>Financial Status:</b>	<b>Total Cost (Rs.million)</b>	<b>Total Release (Rs.million)</b>	<b>Total Expenditure (Rs.million)</b>
Comp.-I:	24.041	21.467	2.049
Comp.-II:	1.957	1.435	1.429
Comp.-III:	2.730	1.820	1.818
Comp.-IV:	2.880	1.858	1.857
Comp.-V:	2.460	1.015	1.011
Comp.-VI:	1.740	0.722	0.711

**Objectives:**

- Identification of training needs and organization of training for establishment of major avian disease surveillance and lab information management system at federal and provincial levels.

- 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 the selected avian pathogens.

#### **Achievements:**

**NARC, Islamabad:** Poultry Disease Surveillance System was reactivated for the selected diseases under the project. Various trials for standardization and validation of biological reagents prepared at NRLPD against IBV, NDV, AIV-H9 and Salmonella were conducted. Seroprevalence of Highly pathogenic Avian Influenza/Bird Flu was determined through serological analyses of samples received from throughout the country. SOPs for various diagnostic tests were prepared according to the requirements and protocols provided by OIE. Sequencing was done for analysis of NDB and AIV isolates from NRLPD repository. AntibioGram of E.coli and Salmonellae isolated from field samples was determined and it was observed that most of the strains are highly resistant to usual antibiotics practiced in poultry production. Further capacity building of the provincial field and lab staff was accomplished on harmonization of diagnostic procedures, participation in proficiency testing, and outbreak handling and reporting. The project team also conducted onsite and requested training workshops for the provincial lab staff on disease diagnostics and isolation and identification of bacterial pathogens for KPK, Baluchistan and Sindh provinces. Further the LIMS/DRS software was developed and evaluated; however, the problems faced were discussed with the manufacture and will be implemented after the final lab version received.

- Multi drug resistance was observed in the bacterial isolates of poultry origin especially in E.coli evaluated under the project.
- A new variant of IBV was isolated from the field samples of vaccinated poultry flocks (characterization under process).
- Isolations of AIV-H9N2 subtype from all type of poultry and widely spread in the country.
- Establishment of new highly virulent genotype VII-F of NDV in field in all type of commercial poultry.
- Seroconversion against AIV-H9N2 and NDV in the field in all type of poultry is an indication of endemic situation of AIV-H9N2 and NDV in the country.
- Some sporadic mild seroconversion against HPAI H5 and H7 were observed in poultry samples received from LBM and non vaccinated flocks however, no wide spread seroconversion against HPAIV H5 detected during the reporting period.

**PRI, Rawalpindi:** Poultry disease surveillance system was established for the selected disease in different areas of Punjab. Seven regional disease surveillance offices were established depending upon poultry population of regions. The SOPs for Surveillance of selected poultry diseases were obtained from the NRLPD and distributed amongst the regional surveillance officers designated under the project. Earlier established disease reporting system under NPCPAI was revived under the project. Samples were collected from different areas of Punjab and processed at Disease Diagnostic Section, PRI, and Rawalpindi. Considerable shares of samples were sent to NRLPD for confirmation of results. Training workshops were conducted for capacity building of officers and officials of Directorate of Poultry



Research Institute working all over Punjab. Laboratory diagnostic protocols were harmonized with that of NRLPD, for this purpose antigens were procured from NRLPD.

- Poultry Disease Surveillance system was re-activated through this project in the region and currently 7 designated surveillance units are working under this project.
- 57,732 Samples were collected and analyzed for seroconversion/isolation/detection of selected poultry pathogens at provincial laboratory and NRLPD respectively indicating non seroprevalence/detection of HPAI in the province, however, LPAI and NDV were detected through seroconversion in some flocks.
- The status of HPAI/Bird Flu free Country since last outbreak of bird flu in July 2008 still achieved at international level as communicated by NRLPD
- During the project duration bird flu free status helped us in restore exports of poultry and poultry products.
- Vaccination schedule was modified for effective prevention and control of diseases.
- Laboratory diagnostic protocols were harmonized throughout the Punjab as per recommendations of NRLPD.

***PRI, Korangi, Karachi:*** Poultry Disease Surveillance System was established for the selected diseases in and five regional surveillance units were selected for the activities of the project in Sindh Areas. The SOPs for Surveillance of selected poultry diseases were obtained from the NRLPD and distributed amongst the regional surveillance officers designated under the project. Earlier established disease reporting system under NPCPAI was revived under the project in Sindh. A total number of 34350 Samples were collected during the reporting period from different areas of the province and either tested at provincial level at Karachi or sent to National Reference Laboratory for Poultry diseases, Islamabad. Capacity building of the field staff and laboratory personnel's was made in discipline of sample collection, outbreak handling, disease surveillance, and Data Management and Laboratory techniques. During the project period ND was a great problem in all Avian species. ND vaccination strategy was adjusted in coordination with NRLPD Islamabad.

- Poultry Disease Surveillance system was re-activated through this project in the region and currently 5 designated surveillance units are working under this project.
- 34,530 Samples were collected and analyzed for isolation of bacteria (salmonella) and seroconversion/isolation/detection of selected poultry pathogens at provincial laboratory and NRLPD respectively indicating non seroprevalence/detection of HPAI in the province, however, LPAI and NDV were detected through seroconversion in some commercial, backyard and pet's poultry flocks.
- The status of HPAI/Bird Flu free Country since last outbreak of bird flu in July 2008 still achieved at international level as communicated by NRLPD.

***Disease Investigation Lab., Peshawar:*** Surveillance setup was established in six districts of the province. Surveillance strategies and sampling methodology were determined. A total number of 17,044 samples were collected during the reporting period from different areas of the province and either tested at provisional DIL Peshawar or sent to National Reference Laboratory for poultry diseases, Islamabad

Capacity building of the field staff and laboratory personnel was made in discipline of sample collection, outbreak handling, disease surveillance, and Data Management and Laboratory techniques. New vaccination strategy was introduced against ND in coordination with NRPLD, Islamabad.

- Six regional surveillance units were established in the KP province to carry out the poultry disease surveillance activities.
- High mortality infection of ND and IB.
- 17044 samples were collected from all types of the poultry birds in the province and these samples were tested for sero-conversion/isolation/detection of selected poultry pathogens at provincial laboratory and NRPLD, Islamabad.
- LPAI and NDV were detected through sero-conversion in backyard and commercial poultry flocks.
- *Salmonella SPP.*, were also isolated from different parts of province.
- New vaccination schedule against ND was introduced and results are encouraging.
- No sero-conversion against HPAIV H5 or H7 was observed during the reporting period.

***Disease Investigation Lab., Quetta:*** Poultry Disease Surveillance System was established for the selected diseases in Baluchistan Areas.

- The SOPs for surveillance strategies of selected poultry diseases were obtained from the NRLPD and distributed amongst the provincial surveillance officers designated under the project.
- Earlier established disease reporting system under NPCPAI was revived under the project in Baluchistan.
- A total number of 14,669 samples were collected during the reporting period from different areas of the province and either tested at provisional DIL Quetta or sent to National Reference Laboratory for poultry diseases, Islamabad.
- Capacity building of the field staff and laboratory personnel was made in discipline of sample collection, outbreak handling, disease surveillance, and Data Management and Laboratory techniques
- New vaccination strategy was introduced against ND in coordination with NRLPD, Islamabad
- Poultry Disease Surveillance system was re-activated through this project in the region and currently 3 designated surveillance units are working under this project.
- 14669 samples were collected and analyzed for isolation of bacteria (*salmonella*) and sero-conversion/isolation/detection of selected poultry pathogens at provincial laboratory and NRLPD respectively indicating no sero-prevalence/detection of HPAI in the province, however, LPAI and NDV were detected through sero-conversion in some commercial poultry flocks.
- The status of HPAI/Bird Flu free Country since last outbreak of bird flu in July 2008 still achieved at international level as communicated by NRLPD.

***Disease Investigation Lab., Gilgit:*** There was no proper system for the poultry Disease Surveillance in the Department of Livestock & Dairy Development Gilgit-Baltistan. The Surveillance System was reactivated for the selected Poultry Diseases, especially for the highly pathogenic Avian Influenza/Bird Flu, under the ALP Project. Various samples were collected from seven Districts of GB and sent them to

NRLPD Islamabad. Results were compiled. There was no seroconservation or virus isolation reported from all over GB. However Vaccination Program against ND has planned and requested NRLPD Islamabad to share their recommendations with the Department. Research proposals are under process.

- Poultry Disease Surveillance system was re-activated through ALP project in GB and currently 07 designated functional surveillance units are working under this project.
- 1022 poultry origin samples were collected and sent 483 qualified samples to NRLPD Islamabad for analysis, indicating no seroprevalence/detection of HPAI in the region, however NDV is endemically prevalent in the region.
- Mass vaccination of backyard poultry has been planned in near future to control high mortality and to minimize the economic losses of poor farmers in the region.
- The status of Bird Flu free Country since last outbreak of bird flu in July 2008 still achieved at international level as reported by NRLPD.

**Name of Project:** **Improving Reproductive Efficiency of Cows and Buffaloes through Oestrus Synchronization and Timed Artificial Insemination (Coordinated Project: NARC Islamabad, UV&AS-Lahore, SAU Tandojam, L&DD-Peshawar, MARC-PARC-Juglot)**

**Name of PI/Institute:**

Comp.-I: **Dr. Syed Murtaza Hussain Andarabi, Principal Scientific Officer/PL (ARGP), Animal Sciences Institute, NARC, Islamabad**

Comp.-II: **Prof. Dr. Aqeel Ahmed Memon, Asstt. Professor, Dept. of Animal Rep., Sindh Agri. Uni., Tandojam**

Comp.-IV: **Mr. Faridullah Khan, SSO, Mountain Agri. Research Centre (MARC), Juglote, Gilgit**

Comp.-V: **Prof. Dr. Nasim Ahmad, Faculty of Vet. & Animal Sciences, Dept. of Theriogenology, Uni. of Veterinary & Animal Sciences, Lahore**

Comp.-VI: **Dr. Rahimullah, Director Planning, Livestock & Dairy Development Department, Khyber Pakhtunkhwa, Peshawar**

**Duration:**

Comp.-I 15.10.2012 to 14.10.2015 Extended up to 14.10.2016

Comp.-II 16.10.2013 to 15.10.2015

Comp.-IV 15.10.2012 to 14.10.2015

Comp.-V 24.04.2013 to 23.03.2016

Comp.-VI 14.06.2013 to 13.06.2016 Extended up to 30.06.2017

<b>Financial Status:</b>	<b>Total Cost</b>	<b>Total Release</b>	<b>Total Expenditure</b>
Comp.-I	8.100	6.033	6.036
Comp.-II	6.040	2.217	2.193
Comp.-III	6.680	0.560	0.510
Comp.-IV	5.670	4.938	4.937
Comp.-V	9.849	9.451	9.445
Comp.-VI	4.505	0.739	0.725

### **Objectives:**

- Improve reproductive efficiency of cows and buffaloes through oestrus control and AI.
- Compare hormonal protocol (including progestagens, GnRH and PGF2 $\alpha$ ) and management factors (biostimulation, wallowing and housing) for induction of fertile estrus in Nili-Rav and Kundi buffaloes, during peak and low breeding seasons.
- Compare hormonal protocol (including progestagens, GnRH and PGF2 $\alpha$ ) and management factors (biostimulation) for induction of fertile estrus in cows [Sahiwal, Cholistani, Thari/ Red Sindhi,

Achai and Non-descript (Gilgit)].

### **Achievements:**

Use of modern scientific reproductive and genetic tools has started in Pakistan to improve reproductive and productive potential of cattle and buffaloes. Artificial insemination (AI) has dramatically affected the world wide dairy industry by reducing the risk of venereal disease transmission, increasing the rate of genetic change in dairy breeds, and in particular, increasing the milk yield of dairy cattle. Benefits of AI have not reached in a big way in far flung areas of the country due to the lack of infrastructure, scattered and small sized farms in those areas. Control of estrus cycle and fixed time insemination may be used as a tool to overcome this problem. The coordinated study was taken up to carry artificial insemination technology to small dairy farmers scattered in far flung areas on large scale over a period of time using oestrus synchronization and improved management at national level in October, 2012.

**NARC, Coordinating Unit, Islamabad:** There was a trend for improved conception rates in buffalo heifers and adult buffaloes that were exposed to bull during oestrus synchronization although the differences were not significant. A conception rate of 50 and 56% with frozen semen in buffalo seems encouraging to popularize AI in this important dairy animal.

- During low breeding season when buffaloes are mostly acyclic, a conception rate of  $\geq 30\%$  seems satisfactory especially in animals that were in average body condition and that had remained non cyclic after calving and even over peak breeding season.
- Bull exposure along with GnRH may be used to attain an improved conception rate in buffaloes synchronized for heat with CIDR during low breeding season, however a good management, good body condition of animals and balanced feeding seems a prerequisite for the best fertility.
- More than 35% conception rate may be achieved in cows after oestrus synchronization and timed insemination with frozen thawed semen during winter (reported as a low breeding season for cows in Pakistan)
- A good conception rate ( $>70\%$ ) may be achieved in cows after oestrus synchronization and timed insemination with frozen thawed semen during summer.
- CIDR alone can be used effectively to synchronize oestrus and attain an optimum conception rate in non descript cows during peak breeding season.
- CIDR+GnRH may be used effectively to synchronize oestrus and attain an optimum conception rate in non descript cows during low breeding season.
- CIDR+GnRH may be used effectively to synchronize oestrus and attain an optimum conception rate in buffaloes during low breeding season.
- Biostimulation along with CIDR synchronization significantly enhances pregnancy rate in Nili-Ravi buffalo during peak breeding season.

To study oestrus response and pregnancy rate in 22 buffaloes treated with GnRH + CIDR or CIDR alone during low breeding season. After application of the two protocols i.e., CIDR alone and CIDR + GnRH, the buffaloes were inseminated with frozen thawed semen after 24hrs heat induction. Conception rate was higher ( $P = 0.193$ ) in CIDR + GnRH treated buffaloes (54.5 vs. 27.2%). In conclusion, CIDR + GnRH can be used effectively to synchronize oestrus and attain an optimum conception rate in buffaloes during low breeding season when generally the buffaloes cannot be bred naturally.

Another experiment was carried out on induction of fertile oestrus in non-descript cows during low breeding season (winter). For this purpose eighty non-descript cows were treated for oestrus synchronization and timed artificial insemination around Kot-Adu (District Muzaffargarh). Two protocols *viz-a-viz* CIDR + GnRH and CIDR alone were tested under field conditions. The cows were inseminated after 54-60 hours of CIDR removal with frozen thawed semen of Sahiwal bull. Animals were examined for oestrus behavior after 12 hrs of CIDR removal until insemination (at 12 hour interval). The results showed that CIDR + GnRH treatment (52.5%) provided better pregnancy outcomes as compared to CIDR alone (42.5%). In conclusion CIDR + GnRH can be used effectively to synchronize oestrus and attain an optimum conception rate in non-descript cows during low breeding season.

**UVAS, Lahore:** Following three experiments were completed to Study of the effect of various synchronization protocols on estrus response and fertility in Cholistan cows.

- Effect of synchronization protocol (OVS vs. CIDR) on estrus response, follicle size, ovulation rate and fertility in Cholistan cows.
- Follicular dynamics during the estrous cycle in Cholistan cows.
- Effect of Ovsynch vs. Prostaglandin F2 $\alpha$  protocol on estrus response, ovulation rate, timing of ovulation and pregnancy per A1 in Cholistan cows.

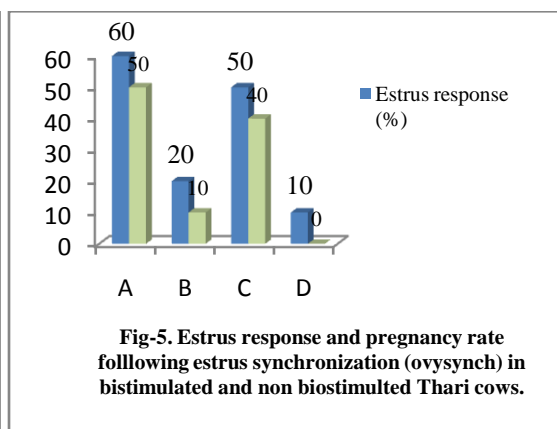
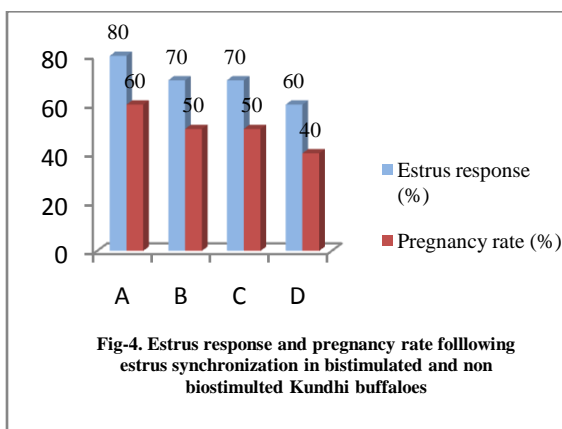
Following six experiments were conducted to determine pattern of ovarian blood flow, plasma progesterone levels, size of CL and their relationship during different phases of estrus cycle in Sahiwal cows.

- Effect of PGF2 $\alpha$ , Ovsynch and CIDR synchronization protocols on estrus response, ovulation rate, timing of ovulation and pregnancy per A1 in Repeat Breeder Sahiwal cows.
- Effect of Ovsynch vs. prostaglandin F2 $\alpha$  protocol on estrus response, ovulation rate, timing of ovulation and pregnancy per A1 in Sahiwal cows.
- Follicular dynamics during the estrous cycle in Sahiwal cows.
- Technique development of Doppler ultrasound in Sahiwal cows
- Measurement of resistance index of Uterine Artery with Doppler sonography during Estrous Cycle in Sahiwal cows.
- Effect of timing of artificial insemination in relation to onset of standing heat on pregnancy rat in Sahiwal cows.

Livestock sector is progressing at high pace and it has a big share in economic development of Pakistan since past few years. A large number of investors are adopting commercial dairy farming for profitable production. More efficient reproduction is necessary for sustainable production. Native cows like Sahiwal and Cholistan are more suitable in our local condition. 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.

**MARC, Juglote, Gilgit:** Procurement of all capital and consumable stores items required for project implementation was completed. Insemination work conducted in Juglote, Damote, Barmas, Bargin, Chamogarh padi, Jalal abad, haramosh of Gilgit District, Chilas Town area, Gas pain, Goner farm Upper and Goner Farm pathan mahalla, Lacher and Bonerdas of District Diamer while Bunji, Astore Chongra Geno Mahalla and Gorikot of District Astore were included in the insemination trail. About three hundred and eighty six cows of above mention farmers were included in insemination trails. One hundred and forty nine cows show heat sign they were inseminated. Calving was observed in Sixty three (63) cows. Sixty cows in natural heat were subjected to AI during the project life. Thirty eight cows performed calving. Eight hundred and sixty two (862) cows were naturally served with jersey and Frisian Bulls maintained at MARC Juglote, MARS Chilas, Research Station Goner farm and MARS Skardu. Four hundred and fourty five cows naturally served with bulls & gave birth to calf while the remaining cows are pregnant. Over all eighty (80%) of all calvings are female crossed with jersey while 30-40 % female are from Frisian bull.

**Sindh Agriculture University, Tandojam:** In the present study it was observed that the estrus response and pregnancy rate was higher in the bull-exposed group as compare to non-exposed group and controls. Onset of estrus differ significantly among bull exposed and non-exposed group ( $p < 0.05$ ). While primiparous animals showed longer estrus duration as compare to multifarious animals. Highest number of animals showing milk progesterone  $> 1\text{ng/ml}$  in ovsynch bull exposed group as compare to other groups at day 18 these animals were pregnant animals. The results of current study showed that ovsynch with biostimulation is better estrus synchronization protocol as compare to ovsynch without biostimulation in Kundhi buffaloes and Thari cows.



***L&DD Department, Khyber Pakhtunkhwa:***

Under the project, the following three trials have been conducted, including one each at Achai Cattle Conservation & development Farm Munda District Dir Lower, with local farmers in District Malakand and at Cattle Breeding & Dairy Farm Hrichand District Charsada.

- Comparison of heat incidence two synchronization protocol in Achai cows at Achai Cattle Conservation and Development Farm Munda Dir Lower.
- Comparative efficacy of two synchronization protocols in Achai cows with local farmers in District Malakand.
- Comparative study of two synchronization protocol in Achai Cows at Cattle Breeding and Dairy Farm Harichand District Charsadda.

Control of oestrus cycle and fixed time insemination may be used to overcome the problem of low artificial insemination coverage of cattle population in the remote areas as with synchronization of oestrus a team of few AI technicians can inseminate a large number of cows in the district.



**(a) CIDR placement in progress with farmers' cows near Mandra (Gujar Khan)**

**(b) timed artificial insemination being carried out in the field after oestrus synchronization**





**(a) Intravaginal CIDR insertion in buffaloes is in progress at LRS (NARC)**



**(b) Homosexual behavior in female buffaloes at LRS (NARC)**



Glimpses of the “One-Day National Seminar” held on May 30, 2016 at NARC.

**Name of Project:**      **Intensification of Fish Culture to Increase per Unit Area Fish Production in Farm Ponds Using Different Managerial Inputs (Coordinated Project: NARC-Islamabad, BZU-Multan, Uni. of Sindh-Jamshoro, Uni. of Peshawar-Peshawar, Inland Fisheries-Dera Murad Jamali)**

<b>Name of PI/Institute:</b>	Comp.-I	<b>Dr. Muhammad Afzal Bhatti, PSO, Aquaculture and Fisheries, Animal Sciences Institute, NARC, Islamabad</b>
	Comp.-II	<b>Mr. Khalil Ur Rehman, Dy Director, Inland Fisheries, Govt of Baluchistan, Fisheries Complex Ward No 8, Dera Murad Jamali</b>
	Comp.-III	<b>Mr. Zaigham Hassan, Asstt Prof., Dept of Zoology, Uni. of Peshawar, Khyber Pakhtunkhwa</b>
	Comp.-IV	<b>Prof. Dr. Naeem Tariq Narejo, (Fisheries), Dept. of Fresh Water Biology &amp; Fisheries, Uni. of Sindh, Jamshoro</b>
	Comp.-V	<b>Dr. Muhammad Naeem, Asstt. Prof. (Fisheries), Inst. of Pure &amp; Applied Biology, Bhauddin Zakarya Uni., Multan</b>

<b>Duration:</b>	Comp.-I	16.10.2012 to 15.10.2015 Extended up to 15.10.2016
	Comp.-II	12.11.2012 to 11.11.2015
	Comp.-III	20.11.2012 to 19.11.2015 Extended up to 19.11.2016
	Comp.-IV	18.10.2012 to 17.10.2015
	Comp.-V	17.12.2012 to 16.12.2015 Extended up to 16.12.2016

<b>Financial Status:</b>		<b>Total Cost (Rs.million)</b>	<b>Total Release (Rs.million)</b>	<b>Total Expenditure (Rs.million)</b>
	Comp.-I	12.375	10.753	10.431
	Comp.-II	4.839	2.397	2.396
	Comp.-III	4.839	3.216	3.145
	Comp.-IV	4.434	1.945	1.944
	Comp.-V	4.360	2.988	2.470

**Objectives:**

The objectives of project are:

- To enhance existing level of carp fish production from 1000-1200 kg/acre to an extent of 1500-2000 kg/acre through artificial diet/ supplementary feeding.

- To work out proper managerial inputs (organic, inorganic fertilizers and artificial diet) for intensive carp fish culture by using different managerial inputs for increasing the fish production.
- To determine the specific species combination and stocking density in intensive fish culture system.
- To study the effect of artificial feed on the meat quality of experimental fish.
- Dissemination of intensive fish culture technology to the fish farmer in the country.

#### **Achievements:**

Aquaculture is relatively low but rapidly expanding activity in Pakistan as it increases the domestic supply of quality protein in the country. In order to get maximum fish yield from confined water it is essential to use artificial feed along with fertilizer and organic manure. Judicious use of inputs, artificial diets and adoption of the intensive fish culture technology can easily enhance the fish production. The coordinated project initiated in October, 2012 to; enhance fish production, reduce fish growing period, through use of artificial diets in public and private sector within the country.

**NARC, Coordinating Unit, Islamabad:** Experiment on effects of balance fish feed on the growth of carps with varying levels of crude protein formulated from locally available feed ingredients was conducted with 20%, 25% and 30% CP feeds. The feed with 25% CP was proven better feed for growth of fish.

- Experiment on intensive culture of Tilapia under different stocking densities viz. 8000/acre, 10,000/acre and 12,000/acre. The best production was observed in treatment 3 i.e. 12,000 fish/acre.
- Experiment to evaluate the production performance of carps stocked at various stocking densities in fish farmer's ponds was conducted in Ramkey, Alipur Chatta, Gujranwala. The data indicated that the production level was better at high stocking density @ 2100 fish/acre i.e. 2054 kg/acre with artificial feeding.
- In another experiment comparison of efficiency of balanced fish feed formulated from locally available feed ingredients having 25%, 30% and 35% crude protein for the growth of fry. The feed were offered @ 5% body weight fish fry stocked. The trial was carried out in replication in earthen ponds for a period of 6 months. After 06 months data showed better growth in treatment 3 i.e. 35% CP.
- It is concluded from present study that judicious use of inputs, artificial diet and adaptation of the intensive fish culture technology can easily enhance fish production from present level of about 1000-1200 kg/acre to about 1800-2500 kg/acre per year.
- Regarding growth performance of *Catla catla* fry and production, the average weight gain of *Catla catla* was 187.92 g, 1950.2g, 218.62 g and 150.12 g in treatments having 25% CP, 30% CP 35% CP and control respectively. The six months trials *Catla catla* fry showed best growth in treatment 3 which is 35% CP Feed.
- Coordination units in Punjab, Sindh, Baluchistan and KP also conducted research on intensification of fish culture on feed development, evaluation of better stocking densities of carp, effect of different protein levels on fry and fingerlings of carps on farmer's ponds and at centers. It

was investigated by them that stocking density of 2000/acre and 25% CP was best for rearing of carp in ponds. It was also investigated that feed containing 35% CP found best for fry rearing of carp.

**University of Peshawar, Khyber Pakhtunkhwa:** All the carps showed a good capability to cope with supplementary diets. In comparison to control diet. Carps fed with diets of high incorporation level of protein sources showed better growth performance. The results of the current study has shown the acceptable nutritional value of the experimental diets having 15%, 20%, 30% and 35% crude protein (CP). Similarly, diet formulation from locally available ingredients having 25% w/w CP could be recommended for the best growth performance of carps fingerlings. Among the five treatments of different crude protein feed (15%, 20%, 25%, 30% and 35%) the carps have shown the best performance of growth against 25% CP feed. Grass carp gained better growth as compared to other carps because the ponds were full of natural feed (grasses). At high density, the growth performance was not better as compared to low density of fish. The water quality parameters were in normal range and productive for fish.

**Institute of Pure and Applied Biology, Bhauddin Zakarya University, Multan:** The initial survey was conducted during December 2012 to March 2013 to identify the potential fish farmers of various districts to conduct research. The farmers have very weak knowledge regarding modern techniques of fish farming (Fish nutrition, Fish diseases and Farm Management).

- Four trials were conducted at farmers field at Bhauddin Zakariya University, Multan; Nursery Unit, Shujabad Road, Multan and Muradabad, Muzaffargarh to evaluate the growth performance of carps by feeding different crude protein (CP) level i.e. 30 %, 25% and 20 % CP. The results indicated that the diets containing 25% CP is best for carp growth.
- The carps (*L. rohita*, *C. catla* and *C. carpio*) fed with experimental diet containing 15, 20 and 25% crude protein (CP) indicated best growth with 25% of CP with the stocking density 2000 fish per acre. Thaila (*Catla catla*) indicated the best growth in this experiment, followed by Rohu (*L. rohita*) at all three experimental sites.
- When *Labeo rohita* and *Cirrhinus mirigala* stocked in earthen ponds in polyculture system and fed diets containing 25%, 30 % and 35 % CP, the results indicated that an artificial fish diet containing 25% CP is enough and economical in carp culture in southern Punjab, Pakistan. Moreover, *C. mirigala* showed better growth than *L. rohita* in this experiment.
- It is concluded from activity “To evaluate the production performance of carps stocked at various stocking densities” that at low stocking densities the fish growth, SGR, PER, %age weight and length gain showed maximum values with low FCR but net production is minimum. As the stocking densities increases the inverse results were obtained. So for a profitable culturing it is recommended to stock maximum number of fish in a pond to get maximum weight.
- The results of the project indicated that the diets containing 25% CP can be considered to be appropriate feeding level which fulfill all the nutritional requirements and have low cost in comparison with rest of the other two treatments. Moreover, high stocking in T4 (2000 fish/acre) produces maximum mass but with less average size of the fish which may not be acceptable to the consumer.



**Department of Fresh Water Biology, Fisheries, University of Sindh Jamshoro:** 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 department of Fresh water Biology and Fisheries, 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 of (1200fish/pond) might be suitable for the culture of (L. rohita, C. catla and C. mrigala) under polyculture system with high density.

The meeting regarding 2<sup>nd</sup> year plan and implementation was organized in the month of April 2014 by Fisheries and Aquaculture division (NARC), Pakistan Agriculture Research Council, Islamabad Pakistan. The following targets were set for Sindh Province.

- To study the growth performance of carps fed with supplementary feed containing 15%, 20%, 25% Crude Protein (CP) for six months in mud pond.
- To study the effect of high stocking density @ 20, 000/acre Rahu and Morakhi for the period of six months with 30% CP.

To study the growth performance of carps fed with supplementary feed containing 15%, 20%, 25% Crude Protein (CP) for six months in mud pond. The two sites were selected one at Chilya, Thatta and another at Sarkrand, the experiment was carried out in one acre mud pond in both sites respectively.

The results of the various growth parameters like suitability of crude protein requirement, specific growth rate, mean total weight gain, percentage weight gain, feed conversion rationed survival rate of the experimental carps (Rahu, Thaila, Morakhi) for the period of six months starting from May- October showed significantly ( $P < 0.050$ ) highest growth and production was observed in feed 20% CP followed by feed 25% CP while significantly ( $P < 0.050$ ) lowest growth and production was recorded from feed A (15%CP). It is therefore concluded that the feed with 20% crude protein found to be ideal for the growth of carps. Overall the Rahu showed highest growth in terms of weight gain ( $485.0g \pm 3.0$ ) and SGR (0.74) the water quality parameters were recorded throughout the study period from both the sites and were found within the suitable ranges of fish culture.

To study the effect of high stocking density @ 20,000 thousand fish/acre 10,000 thousands each Rahu and Morakhi for the period of six months fed with 30% CP reared at Sakrand mud pond.



The growth parameters of fish in high stocking density in terms means weight gain, SGR %/day, FC Rand survival (%) were calculated. Growth of Rahu in mud pond indicated that the growth rate varied and showed significant ( $p<0.05$ ) highest growth rate and survival rate in relation to morakhi. The net weight gain of individuals' fish was higher ( $560.5g\pm3.55$ ) than those of morakhi ( $390.6g\pm3.40$ ) respectively. The survival and specific growth rates were also found highest in Rahu (100%, 0.65) and followed by Morakhi (90%, 0.58). The survival and specific growth rates were also found highest in Rahu (100% and followed by Morakhi (90%).

It was observed from the results of the present investigations that the highest growth rate and survival of Rahu was observed from the mud pond of Sakrand. The results of the present study indicated that a stocking density of (20, 000 fish/pond) might be suitable for the culture of (*L. rohita*, and *C. Mrrigala*) under polyculture system with high density.

- 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 department of Fresh Water Biology and Fisheries, 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 of (1200 fish/pond) might polyculture system with high density.
- It is therefore, concluded that the fed with 20% crude protein found to be ideal for the growth of carps. Overall the Rahu showed highest growth in terms of weight gain ( $485.0\pm3.0$ ) and SGR (0.74) respectively from Sakrand pond. The water quality parameters were recorded throughout the study period from both the sites and were found within the suitable ranges of fish culture.
- It was observed from the results of the present investigations that the highest growth rate and survival of Rahu was observed from the mud pond of Sakrand the results of the present study indicated that a stocking density of (20, 000 fish/pond) might be suitable for the culture of (*L. rohita*, and *C. mrigala*) under polyculture system with high density.

**Directorate of Fisheries, Balochistan, Dera Murad Jamali:** The experiment design in Different fish pond under level of same supplementary feed 25% CP in public and private sector at Dera Murad Jamali Naseerabad District. The study of different carps rohu 40%, catla catla 20%, mori 7%, silver carp 23% and common carp 10%. All the water parameters were study during the experiments PH level, oxygen conductivities and salinity etc under control system. To follow the growth performance of carps in 1600 and 2000/acre.

**Name of Project:** **Generation of Reference Values on Amino Acid Availability in Local Feedstuffs for Poultry and Capacity Building at NARC/ PIASA on Amino Acid Analysis (ASI, NARC, Islamabad)**

**Name of PI/Institute:** **Dr. Agha WaqarYunus.**  
SSO, AN, Animal Sciences Institute, NARC, Islamabad.

**Duration:** 25.09.2014 to 24.09.2017

**Financial Status:** Total Cost: Rs. 4.995 million  
Funds Released: Rs. 3.295 million  
Funds Utilized: Rs. 3.079 million

**Objectives:**

- Determination of available amino acid profile in the locally available feed stuffs for poultry with involvement of industry.
- Orientation of feed industry towards amino acid analysis.
- Economization and productive enhancement of the small/medium poultry entrepreneurs.
- Reduction on nitrogen emissions from poultry manure to the environment.
- Capacity building at the NARC/ PIASA and helping industry in amino acid analysis.

**Achievements:**

This project is aimed at analyzing the poultry feedstuffs for their available amino acid content and capacity building of the Animal Nutrition Program, NARC by functionalizing the amino acid facility. Targets regarding capacity building and establishment of the analytical facility have been met. About 85% of the required broiler feeding trails has been completed. Also, collection of the samples of feed ingredients and their analysis regarding gross nutrient composition has been accomplished. The 10% remaining feeding trails are expected to be completed in next 3 months. The amino acid analyzed for straight amino acid composition. The feed and digesta samples from animal feeding trail have yet to be analyzed.



**Name of Project:** Genetic Improvement of Selected Indigenous Naked Neck by Crossing with Exotic Poultry Breeds of Rhode Island Red and Black Astralorpe (Coordinated Project: NARC-Islamabad, PRI-Korangi Karachi, The Uni. of Agri.-Peshawar)

**Name of PI/Institute:** Comp.-I Dr. Abdul Ghaffar, Coordinator/PSO,  
Animal Sciences Institute, NARC, Islamabad  
Comp.-III Dr. Sarzamin Khan, Professor/Chairman,  
Department of Poultry Science, University of  
Agriculture Peshawar.

**Duration:** Comp.-I 25.02.2015 to 24.02.2018  
Comp.-III 14.05.2015 to 13.05.2018

<b>Financial Status:</b>	<b>Total Cost (Rs.million)</b>	<b>Total Release (Rs.million)</b>	<b>Total Expenditure (Rs.million)</b>
Comp.-I:	14.337	5.138	3.168
Comp.-III:	4.309	2.798	2.257

**Objectives:**

- Conservation and development of pure genetic resource of NN, RIR and BAL breeds.
- Crossbreeding of Naked Neck with RIR and BAL to develop dual purpose high producing scavenger chicken.
- Multiplication and distribution of improved dual purpose NN breed in rural areas.

**Achievements:**

Our poultry production is mostly dependent on exotic commercial lines. No attention has been given to the indigenous chickens and rural backyard poultry. The indigenous chicken population in Pakistan is mainly composed of a number of breeds/ type i.e. non-descript desi, Naked Neck and Aseel. Efforts under the coordinated project initiated in February and April, 2015, were made to develop Naked Neck breed as dual purpose rural breed in different countries.

**Coordinating Unit, NARC:** Poultry production is the most efficient and economical system of animal protein production. The Naked Neck (NN) condition is characterized by complete absence or reduced feathers in the neck region of chicken controlled by an autosomal incomplete dominant gene. The NN chicken has the ability to adopt, survive, perform and reproduce under harsh, hot and humid climatic conditions better than the normal feathered birds. During the period under report 1530 eggs were set in a private hatchery in 10 batches. The hatchability and inside shell mortality varied from 50 to 100% and zero to 34% respectively. Mean fertility percentage for all 10 batches was recorded as 41.96%. The average day old chick weight was 37.9 grams. Currently one hundred NN birds are laying eggs at the poultry section. The feed conversion ratio for brooding and growing period was 3.54 and 5.59

respectively. Thirteen egg quality traits of NN eggs were also studied including HgH units; egg shape index, yolk index and egg weight. The protein quality of NN hens ranked as AA quality.

The data in this report leads to the following conclusions:

- i. There is a great variation among the birds of the same breed reflecting the scope of genetic improvement through selection.
- ii. The body weight gain, FCR, age at sexual maturity and egg production recorded of NN breed are good



indicators for further selection and improvement.

### **Experimental flock of NN Chicken at NARC**

***Poultry Science, the University of Agriculture, Peshawar:*** The reporting period is the year II of the project. The year I was only three months where very limited work could have been done. The capital assets, including a solar egg incubator, bird's cages, poultry house humidity and temperature recorder along with drinkers and feeders for poultry were procured. Among animal assets Exotic birds Black Australop (BAL) and Rhode Island Red (RIR) were procured. Foundation stock of Necked Neck was established. Foundation stock of NN chicks (421 birds are in hand Vs 360 required) have been developed and will soon be ready for the development of GI. The exotic breeds were successfully propagated in local environment and the required number of males were produced and grown under local environment. These included the major activities of the reporting period. Which have been successfully achieved.

A total number of 1000 eggs were collected from the different parts of the province and hatched for the development of Naked Neck foundation stock. Unfortunately, only a few eggs hatched and very few Naked Neck chicks were received (26 chicks out of 1000 eggs). To avoid further wastage of time 120 Naked Neck laying hens were procured from local market. These hens produced fertile eggs, and were set for hatching. Power failure was a big problem on campus; therefore solar incubator was procured under the project. Consequently eggs were hatched and purified 421 Naked Neck chicks were produced. Out of them 195 birds are having age of 18 weeks and are near to production while the remaining birds having different ages will start production in late September and early October. Thus total 300 females and 60 males will be in hand for development of GI which to be crossed with Black Astralope (BAL) and Rhode Island Red (RIR). The extra eggs and some culled chicks were sold out and the revenue of approximately Rs. 15000/- generated was deposited as bank draft in the name of Executive Director ALP. The Ph.D

research synopsis of Mr. Naseer Ahmad on title “Comparative growth performance, Immune Status, Carcass and egg quality traits of Naked Neck, Rhode Island Red (RIR) and Black Astralop (BAL) Chicken” has been approved in January 2016 and research work is in progress.

Four varieties were identified in Naked Neck foundation stock on the based on plumage color

All the four varieties were found with no significant difference in their morph metric traits. But were significantly different for their sexes. Black astrolope performed comparatively better for its body weight, production and hatchability.

**Name of Project:** **National Coordinated Project for the Genetic Improvement of Goat Breeds in Pakistan (Coordinated Project: NARC-Islamabad, L&DDD-Hyderabad, L&DDD-Paharpur D. I. Khan, MARC PARC-Juglot)**

<b>Name of PI/Institute:</b>	Comp.-I	<b>Dr. Muhammad Fatah Ullah Khan, PSO/Director, Animal Sciences Institute, NARC, Islamabad.</b>
	Comp.-III	<b>Dr. Najeeb-Ul-Rehaman, Station Director, Livestock Research and Development Station, Pahar Pur, Dera Ismail Khan, Khyber Pukhtunkhwa</b>
	Comp.-V	<b>Mr. Faridullah, PSO/PI, Mountain Agriculture Research Center (MARC), Gilgit</b>

<b>Duration:</b>	Comp.-I	13.05.2015 to 14.05.2018
	Comp.-III	04.06.2015 to 03.06.2018
	Comp.-V	14.05.2015 to 13.05.2016

<b>Financial Status:</b>	<b>Total Cost (Rs.million)</b>	<b>Total Release (Rs.million)</b>	<b>Total Expenditure (Rs.million)</b>
Comp.-I:	7.763	0.475	0.213
Comp.-III:	3.597	0.321	0.312
Comp.-V:	1.172	0.257	0.225

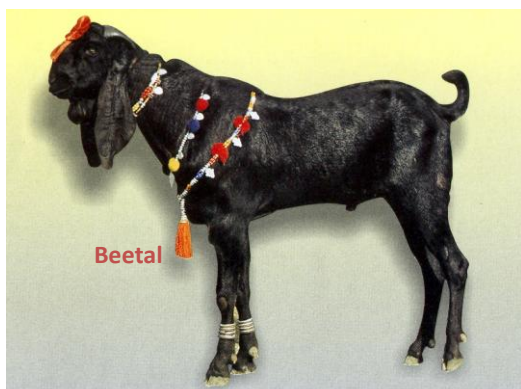
**Objectives:**

- Productivity enhancement through genetic improvement of small ruminants and thereby increasing the livelihood of poor goat farmers.
- Establishment of nuclear flocks of Saanen crossbreed goat at NARC, Islamabad.
- Improvement in milk production of Dera Din Panah goat in Punjab, Damani goat in Khyber Pakhtunkhwa and improvement in meat production of Pateri goat in Sindh and study of dairy traits in Saanen crossbreds at NARC, Islamabad
- Survey of small ruminants at Gilgitbaltistan.

### **Achievements:**

In Pakistan majority of sheep and goats are kept primarily for meat production. Some breeds of sheep and goats are maintained at government farms including Lohi&Kajli sheep and Beetal &Kamori goats. Genetic improvement programs involving private farmers have never been targeted. The coordinated project aimed at improving the dual purpose breeds of goat for mutton and milk production in the country by improving the native small ruminant breeds through application of scientific techniques like selective breeding, feeding, disease control and better management.

**NARC Coordinating Unit, Islamabad: four bucks are fully trained.** Overall semen volume was  $0.70 \pm 0.17$  ml, concentration  $2.59 \pm 0.31$  billions /ml and motility  $39.34 \pm 3.04$ . Artificial insemination in both Nukri and Jatal showed 40% and 25% pregnancy rate however overall pregnancy rate remained 32.5%. Mean body weight of Nukri male was 35.1 kg while in female was 36.20 Kg. mean body weight Jatal goats was 27.00 Kg.



**Fig 17.Beetal Goat (Male)**



**Fig 18.Beetal Goat (Female)**

Procured animals are being used trials. Breeding goats/bucks are maintained with standard care. Necessary deforming and vaccination is provided with schedule as per body requirement with predefined formulation.

**Livestock Res. & Dev. Station/ Damani Sheep and Goat Farm, Paharpur, D. I. Khan:** Damani goat is raised in both the irrigated as well as in the arid area of Tehsil, Paharpure, Parova and Kulachi in district D.I.Khan, for mild and mutton purpose, since long. Conservation and genetic improvement of this breed under ALP project is necessary as this breed is in risk. A lot of issues/ problems were observed during tours to villages of the above mentioned areas.

### **Research Problems**

- Lack of awareness among majority of livestock farmers about real phenotypic picture of their local damani goat breed.
- The current flocks observed in the area contain 5-7% of pure damani goats as per the total herd strength.
- It is difficult and impracticable for the farmer to cull all the un-descriptive animals from the flock due to high strength, also it was a matter of personal like and dislike.

- Majority of farmers are illiterate and it is therefore difficult to convince them on data recording and keeping at their animal house.
- Majority of damani goats are raised in the arid area of DAMAN where
- The grazing area is rain fed so the possibility of drought conditions sometimes prevail which badly effect the production capability of damani goats.
- Drinking water is mostly made available either in the form of ponds where the risk of contamination is evident, or carried along with the flock in canes which do not fulfill the actual requirement. The blank colored damani goats are rare in the area and the farmers are now convinced that they will be provided black pure breed damani bucks on cost share basis, if they fulfill the criteria of keeping at least 10 damani goats having black body coat. The completion of results is totally dependent upon the co-operation of registered farmers, therefore, their awareness and interest is pre-requisite to obtain required data. It is expected that farmer's participation will be sure if the incentive of free of cost vaccination, de-worming, feed supplementation and provision of feeding troughs, watering troughs and pure breeding males is assured.

**MARC-PARC, Juglot Gilgit:** Collect the goats' number in herds from some project area. Growth traits, reproductive traits, feeding methods/trait of goats from some project side were collected. Key herds owners of goats in p roject sites are identified. Census report of goats in Gilgit Baltistan is available. Published and unpublished reports/information regarding the breed of goats in mostly collected.

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

**Name of PI/Institute:** Dr. Mubarak Ali,  
Asstt. Prof., Inst. of Animal Sciences, Uni. of Agri., Faisalabad

**Duration:** 27.07.2012 to 26.07.2015 Extended up to 30.06.2016

**Financial Status:** Total Cost: Rs. 6.480 million  
Funds Released: Rs. 4.156 million  
Funds Utilized: Rs. 3.896 million

**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:**

**Oat Fodder Sowing:** The 15 acres of oat fodder were sown in the last week of September, 2015. In the first week of January, 2016, the fodder crop will be harvested, chopped and treated with fibrolytic enzymes and thereafter will be ensiled for 20 days. The ensiled will be used for lactation trial.

**Lactation Trail:** Lactation trial will be conducted in April-June 2016. Based upon the performance of growing and fattening trials, 4 diets possessing 50 to 50 and 50 to 60 concentrate to forage ratios with and without enzyme supplementation will be formulated to examine their effect on nutrient intake, digestibility, milk production and composition of early lactating buffaloes. These 4 diets will be designated as ES50, ES60, EU50 and EU60. Sixteen early lactating *Nili Ravi* buffaloes will be divided in four groups. The diets will be *fed adlibitum*. The experiment will last for 90 days. The first 15 days will allow for dietary adaptation and remaining 75 days as experimental period.

**Name of Project:** **Improved Utilization of Beetal Goats through Open Nucleus Breeding Scheme (University of Agriculture, Faisalabad)**

**Name of PI/Institute:** **Dr. Muhammad Sajjad Khan,**  
Prof., Dept. of Animal Breeding and Genetics,  
Uni. of Agri., Faisalabad

**Duration:** 17.05.2012 to 16.05.2015    Extended up to 16.05.2016

**Financial Status:** Total Cost:        Rs. 1.942 million  
Funds Released: Rs. 1.393 million  
Funds Utilized:    Rs. 1.260 million Upto 30.04.2015

**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:**

There are more than 59.9 million heads of goats in Pakistan but production per animal is very low. The sub-optimal productivity of existing flocks of goats is mainly attributed to low genetic potential, nutritional and managerial inadequacies. Beetal breeds of goat having high potential for meat and milk production. Its productivity per head can be increased to a substantial level through open nucleus breeding scheme (ONBS) which is a method of selection by using breeding animals in a nucleus, or upper tier and a large number of animals in lower tier. It permits animals from the lower tier to contribute progeny to the upper tiers. ONBS can increase the overall rate of genetic improvement. The project was designed following the strategy to improve Beetal goats' production through breed improvement efforts.

During report period several consultative meetings were organized to define breeding objective and selection criteria of breeder. Selection of two beetal goat strains viz; Makhi-Cheni and Faisalabadi were mostly based on morphological attributes followed by meat production. Training of farmers has been done regarding data recording, tagging, vaccination and deworming. Performance recording of registered farmers continued. The kids born with registered farmer's does during the reporting period have been measured. Data were computerized regularly so that elite bucks and does among those kids can be considered for selection. Performance recording of previously existing kids continued and selection process initiated. Farmers having bucks with structural problems (genetically controlled) were educated and facilitated to practice good management including disease prevention and vaccination measures which helped them to reduce the winter mortality in kids. Good numbers of kids available for selection which can increase selection intensity and better performance bucks for further dissemination to the community in future.

**Name of Project:** **Evaluation of Microorganisms, Clays and Herbs for Mycotoxin Degradation and their Effect upon Nutrient Availability in Chicken (Uni. of Agri., Faisalabad)**

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

**Duration:** 27.07.2012 to 26.07.2015

**Financial Status:** Total Cost: Rs. 7.081 million  
Funds Released: Rs. 5.932 million  
Funds Utilized: Rs. 5.616 million

**Objectives:**

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

**Achievements:**

- Mycotoxins produced by toxigenic species of fungi frequently contaminate the agricultural products and by-products used as feed ingredients for poultry and livestock. Aflatoxins (B1, B2, G1, G2, M1 and M2) are highly potent toxins causing various disease syndromes in poultry, livestock and human. OchratoxinA (OTA) another mycotoxin occurring in cereals, beans, ground nut, spices, dried fruits and milk. Poultry and livestock fed on OTA contaminated feed may harbor this toxin in their tissues. Binding/inactivation of mycotoxins in poultry feed has been reported by incorporation of various clays including calcium aluminosilicates, bentonites and zeolites. The project was formulated with aims to study the toxin binding potential of locally available bentonite ore in poultry feeds and evaluate their ameliorative effects in toxin contaminated feeds upon poultry health and immune system.
- Experiments were conducted during the report period to “evaluate the possible ameliorative effects of dietary addition of yeast in OTA fed birds” and “assess the possible ameliorative effects of dietary addition of Baker’s yeast in AFB1 fed birds”. In this trial different parameters were evaluated including mortality, clinical signs, body weight gain, organ weights, gross and histopathology; different immunological parameters.
- The preliminary results showed that baker’s yeast showed an ameliorative effect when fed in combination with different dietary levels of Ochratoxin and Aflatoxin to the broiler chicks. However, the final conclusion will be made upon the completion of the study.
- Two M. Phil thesis; ‘A study of possible ameliorative effects of dietary addition of Baker’s Yeast in OTA fed birds by Qasim Altaf’ and ‘A study of possible ameliorative effects of dietary addition



of Baker's yeast in AFB1 fed birds by Zain-ul-Abadin' has been produced as a result of project work.

# **NATURAL RESOURCES**

## **Introduction:**

Sustainable agriculture primarily focuses on conservation and pragmatic utilization of Natural resources including land, water, rangelands and forests. Natural Resources (NR) has diverse issues in different agro-ecologies of the country i.e. coastal belts to glacial mountains. The research in thematic areas to generate knowledge and develop technologies to conserve and improve productivity of land, water, range and forest resources. The major confronting issues to natural resources base are inequitable land distribution, land degradation, water scarcity & low water productivity, depletion of rangelands & forests. In the 7<sup>th</sup> Batch of ALP, research priorities were set to address of climate change, food safety and energy crisis. Additionally, integrated nutrient management, water productivity enhancement and improvement of range-livestock productivity were also given priority while finalizing the priority areas for research in NR.

The funding through competitive grants under ALP has a major role to address the financial constraint to undertake crucial research. During the reporting period 05 projects were completed and 05 initiated to address the priority areas of research in NR.

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

**Name of PI/Institute:** **Dr. M. Zameer Khan,**  
PSO, Land Resources Research Inst., NARC

**Duration:** 31.10.2012 to 30.10.2015 Extended upto 30.10.2016

<b>Financial Status:</b>	Total Cost:	Rs. 14.149 million
	Total Release:	Rs. 11.896 million
	Total Expenditure:	Rs. 11.564 million

### Objectives:

- Improving the extraction efficiency and reducing the cost of production of humic acid (HA)/ fulvic acid (FA).
- Characterization of humic substances (HS) extracted from coal, crop residues and organic industrial wastes.

### Achievements:

- Produced formulation for crops to be used as soil conditioner and plant nutrients. Humic substance from rice and sugar industries waste material be utilized for crop to study their role in plant growth and yield. The formulated products will be used as soil conditioner as well as plant nutrients which ultimately result in
- Improvement of soil health
- Increase crop production
- Increase nutrient use efficiency
- Reduction in cost of production
- The applied HSs and HSs based products on field grapes and vegetable. The result showed
- An increase of about 10-15% in wheat, 10% in onion, 10% in tomato and 12% in potato yield was recommend.
- HSs applied along with fertilizer formulations reduced fertilizer input by 25% vis a vis treatment receiving fertilizer alone.
- <http://dx.doi.org/10.1080/01904167.2016.12453522> Taylor & Francis online. The land resources research institute (LRRRI), NARC Islamabad established a prototype of humic substances (HSs) production facility at NARC campus under the financial support provided by ALP secretariat and nutrient products have been developed. Products were tested on different crops and soils. The preliminary results are encouraging indicating the validity of products under variety of soils and crops in the country having arid and semi arid climate. The use of this technology will help to improve soil health and crop productivity, ultimately increase farm income and reduce production cost. Marketing of the products through different marketing channels is needed to strengthen this activity on regular basis. In this regard the products can be produces and the technology developed under this project need to be disseminated and diffused to farmers for obtaining maximum yields from crops, vegetables and fruits. The products are effective for kitchen

gardening, fertilization of lawns, ornamental plants grown in houses, grasses; etc. the production unit has been established and there is need to make it operative, the labor and raw material is required which is nominal (0.250 million) per month and the production unit have capacity to produce 20,000 tons liquid HSs and HSs based products packets, as four products have been formulated and put on PATCO sale point for display for introducing to farming community.

		
Humic Substances Production Unit	Coating of NPK fertilizer with HA by coating	Effect of HSs based formulation on wheat

**Name of Project:** Nutrient Management for Cotton Productivity by Conjoint Use of Organic and Inorganic Fertilizers under Extended Cultivation Regimes (Coordinated Project: NARC-Islamabad, CCRI-Multan & ARI-Tandojam)

<b>Name of PI/Institute:</b>	Comp.-I	<b>Dr. Ejaz Rafique,</b>  <b>Principal Scientific Officer, LRRI, NARC, Islamabad</b>
	Comp.-II	<b>Dr. Fiaz Ahmad,</b>  <b>Scientific Officer/PI, Physiology/Chemistry Section, CCRI, Multan</b>
	Comp.-III	<b>Mr. Mukhtiar Ali Channa,</b>  <b>Soil Fertility Officer, Soil Fertility Section, Agri. Research Institute, Tandojam (repot pending)</b>

<b>Duration:</b>	Comp.-I	01.04.2013 to 31.03.2016 Extended upto 31.10.2016
	Comp.-II	30.01.2014 to 29.01.2016 Extended upto 31.12.2016
	Comp.-III	21.08.2013 to 20.08.2016

<b>Financial Status:</b>	<b>Total Cost (Rs. million)</b>	<b>Total Release (Rs. million)</b>	<b>Total Expenditure (Rs. million)</b>
Comp.-I:	7.500	6.931	6.879
Comp.-II:	3.838	3.268	2.206
Comp.-III:	3.978	2.202	1.800

**Objectives:**

- Improve and sustain cotton productivity as well as soil health under cotton belt.
- Determine appropriate nutrient requirement of Bt cotton as well as traditional non-Bt cotton under extended cultivation regimes using organic and inorganic sources.
- Study soil nutrients/budgets [Input – (Removal + Losses) = Balance] as a consequence of manuring and cropping.

**Achievements:**

**NARC, Islamabad:** A 3-year (medium-term) permanent layout field experiment was conducted at four sites. i.e., Alwardi Khan (Bagh soil series; Fluventic Camborthids), Harappa (Lyallpur soil series; Fluventic Camborthids), Chak 6/11-L (Qadirabad soil series; Typic Halorthids) and Chak 142/9-L (Gamer soil series; Halic Camborthids) in Shiwal division for determining appropriate nutrient requirement of BT cotton as well as traditional non-BT cotton using organic and inorganic sources

with special emphasis on crop productivity, nutrient uptake, yield trends, selected soil physic-chemical properties, and apparent soil nutrient balances.

Summarized finding of the study are;

- Balanced/integrated nutrient treatment effects on seed cotton yield, boll weight and boll bearing of both cultivars were significant at all (four) field sites across the years. On an average, achievable potential of BT cultivar in all treatments was relatively higher compared with traditional non BT cultivar. Highest seed cotton yields at all four field sites were obtained consistently with  $T_4$  (where 25% N was supplied through FYM) since inception of the experiment. While the lowest seed cotton yield of both cultivars was obtained with farmers' fertilizer use practice ( $T_1$ ).
- For example, at Alwardi Khan site, application of recommended fertilizer dose (i.e.,  $T_2$ ) increased seed cotton yield by 24% for BT and 22% for non-BT cultivar during the first year to 28% for BT and 24% for non-BT cultivar during the third year, with mean increase of 26% for BT and 23% for non-BT cultivar over  $T_1$  yield, i.e., 3516 kg ha<sup>-1</sup> for BT and 2905 kg ha<sup>-1</sup> for non-BT during the first year, 2340 kg ha<sup>-1</sup> for BT and 2150 kg ha<sup>-1</sup> for non BT during the third year, with a mean of 3185 kg ha<sup>-1</sup> for BT and 2758 kg ha<sup>-1</sup> for non-BT cultivar. Mean increase in seed cotton yield obtained with BNM ( $T_3$ ) was 23% for BT and 22% for non-BT cultivar over control. The highest mean increase in seed cotton yield was obtained with  $T_4$ , i.e., 27% for BT and 23% for non-BT cultivar over control. However, seed cotton yields were not significantly different amongst  $T_2$  to  $T_4$  treatments. There was a considerable increase in seed cotton yield with  $T_5$  that was 17% for BT and 16% for non-BT cultivar. Almost similar yield patterns were observed were at other three sites. However, yield potential and crop response to applied treatment varied amongst field locations depending upon native soil nutrient level, climate conditions etc.
- Significant positive relationship of seed cotton yield with boll bearing ( $R^2=0.72$ ) and boll weight ( $R^2=0.53$ ) at  $\alpha = 0.05$  indicated that improvement in these yield attributes, with improved nutrient management, was a major factor in enhancing the quantum of seed cotton yield.
- The nutrient concentrations of N, P, K, Zn, and B in diagnostic leaves of both cotton cultivars varied as a consequence of nutrient treatment (at  $\alpha = 0.05$ ) without following any particulars trend across the year. Leaf nutrient concentrations in plant tissues receiving  $T_1$  were significantly lesser than those exhibited with other treatments. Highest nutrient concentrations were observed with  $T_4$  treatment for both cultivars. Generally, a little lesser nutrient concentrations were observed in BT as compared to non-BT cultivar. For example, at Alwardi Khan site, average leaf nutrient concentrations in BT and non-BT cultivars with  $T_1$  were; N, 3.14 and 3.20%; P, 0.21% and 0.24%; K, 2.16 and 2.26%; Zn, 19 and 20 mg kg<sup>-1</sup>; and B, 39 and 40 mg kg<sup>-1</sup>. The corresponding concentrations with  $T_4$  were the highest, i.e., N, 3.59 and 3.66%; P, 0.31 and 0.33%; K, 2.51 and 2.60%; Zn, 29 and 31 mg kg<sup>-1</sup>; and B, 52 and 55 mg kg<sup>-1</sup>. However, mineral composition of cotton cultivars varied across the locations depending upon yield potential, crop sensitivity and initial nutrient level.
- Nutrient uptake pattern by both cultivars tended to closely resemble those of yield trends. However, mean nutrient uptake by both cultivars was relatively higher at Chak 142/9-L because of greater yield and higher nutrient concentrations in diagnostic in diagnostic plant parts.

- At all field sites, over 3 years, the seed cotton yield trends varied non-significantly with all of the tested treatments and the rate of yields change was negative with the treatment. For example, at Alwardi Khan Site, with treatment  $T_1$ , seed cotton yield declined  $1.08 \text{ t ha}^{-1} \text{ year}^{-1}$  for BT and  $1.28 \text{ t ha}^{-1} \text{ year}^{-1}$  for non-BT cultivar. However, the magnitude of decline that occurred in  $T_4$  was lesser compared with  $T_1$  for both cultivars, i.e.,  $0.91 \text{ t ha}^{-1} \text{ year}^{-1}$  for BT and  $1.01 \text{ t ha}^{-1} \text{ year}^{-1}$  for non-BT cultivar indicating that nutrient treatments  $T_2$ - $T_6$  maintained crop productivity and soil quality to some extent. This was because cotton crop during the third year was affected badly by extreme weather conditions and high intensity of pest infestation. Hence, the yield potential of both the cultivars could not be optimally conquered. Consequently, drastic reduction in crop yield during the year, affected yield trends severely.
- INM resulted in an apparent soil N and P balances at all field sites. However, negative apparent K balances were observed in all treatments, which were greater at Chak 142/9-L than at other sites.
- Mean agronomic efficiency of cotton varied from  $2.18 \text{ kg seed cotton kg}^{-1} \text{ nutrient}$  applied in  $T_2$  to  $8.23 \text{ kg seed cotton kg}^{-1} \text{ nutrient}$  applied in  $T_4$  at Alwardi Khan, from  $1.82 \text{ kg seed cotton kg}^{-1} \text{ nutrient}$  applied in  $T_2$  to  $6.93 \text{ kg seed cotton kg}^{-1} \text{ nutrient}$  applied in  $T_4$  at Chak 2/10-L, from  $1.61 \text{ kg seed cotton kg}^{-1} \text{ nutrient}$  applied in  $T_2$  to  $6.18 \text{ kg seed cotton kg}^{-1} \text{ nutrient}$  in  $T_4$  at Chak 6/11-L and from  $1.66 \text{ kg seed cotton kg}^{-1} \text{ nutrient}$  applied in  $T_2$  to  $6.43 \text{ kg seed cotton kg}^{-1} \text{ nutrient}$  applied in  $T_4$  at Chak 142/9-L site.
- The mean gross profit from nutrient management was highest with  $T_4$  (Rs.  $149,644 \text{ ha}^{-1}$ ), followed by  $T_3$  (Rs.  $139,083 \text{ ha}^{-1}$ ) at Alwardi Khan Site. At Chak 2/10-L site, mean gross profit from nutrient management expense was highest with  $T_4$  (Rs.  $145,758 \text{ ha}^{-1}$ ), followed by  $T_6$  (Rs.  $138,081 \text{ ha}^{-1}$ ). Similar trend was observed at Chak 6/11-L and Chak 142/9-L.
- Mean marginal rate of return due to fertilizer/manure inputs in  $T_4$  at Alwardi Khan Site was greater than 1.0, revealing that this treatment was more cost-effective. Highest marginal rate of return was observed with  $T_4$ , i.e. 1.22 at this site.
- The treatment  $T_4$  (INM) in spite of having less chemical fertilizers than  $T_2$  ( $400 \text{ kg N ha}^{-1}$ ,  $150 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$  and  $125 \text{ kg K}_2\text{O ha}^{-1}$ ) also resulted in an apparent positive balance of N and P. This nutrient management practice brought considerable improvement in soil extractable  $\text{NO}_3\text{-N}$ , P, K, Zn and B status and OM. It appeared sufficient to maintain optimum productivity levels of both cultivars over the years.
- In this 3-year study, integrated nutrient management appeared convincingly beneficial and can play a vital role in increasing farmer's income for better livelihood. INM holds great promise in achieving not only a high level of soil fertility and crop productivity, but also against emergence of multiple nutrient deficiencies and deterioration of soil physics health and leads to sustainable cotton productivity.
- The INM treatment [ $T_4$ , i.e.,  $225 \text{ kg N ha}^{-1}$  ( $170 \text{ kg N}$  from inorganic source &  $56 \text{ kg N}$  from FYM) +  $80 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$  +  $70 \text{ kg K}_2\text{O ha}^{-1}$  +  $5 \text{ kg Zn ha}^{-1}$  +  $1 \text{ kg B ha}^{-1}$ ] increased seed cotton yield (mean of 3-years) by 18-27% for BT and 15-23% for non-BT cotton over  $T_1$  (FFU). The mean increase in seed cotton yield with this treatment (having substantially less chemical fertilizers), was at par or even a little better compared with increase in yield recorded with

recommended dose ( $T_2$ , as per Agri. Deptt., Govt. of Punjab), i.e.,  $400 \text{ kg N ha}^{-1} + 150 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1} + 125 \text{ kg K}_2\text{O ha}^{-1}$  that varied from 17 to 26% for BT and 14 to 23% for non-BT cultivars.

- The INM also yielded an appropriate apparent positive balance of N and P, by and large, appeared sufficient to maintain the optimum yield levels of both cultivars over a number of years. This nutrient management practice brought considerable improvement in soil extractable  $\text{NO}_3\text{-N}$ , P, K, Zn and B status and OM, appeared sufficient to maintain optimum productivity levels of both cultivars over the years.
- Inclusion of humic acid and biozote with chemical fertilizers also helped in increasing crop productivity and reducing the fertilizers use. Considering gross profits and marginal rates of return of fertilizer/manure use, the INM proved to be most cost-effective.

**CCRI, Multan:** During project 20,000 plants of following stone fruit species will be produced for the growers.

- Apricot: 5,000 plants
- Peach: 5,000 plants
- Plum: 4,000 plants
- Almond: 4,000 plants
- Cherry: 2,000 plants
- The easy availability of quality fruit plants contribute in the promotion of fruits cultivation in the project area. The plantation of high yielding fruit cultivars will supplement in the income of the growers from their farm lands.
- The growers are easily getting true to type and disease free plants of various fruit species for commercial plantation.
- Bud wood/graft wood of high yielding selected fruit cultivars are obtained for the production of plant of different fruit species.
- The suckers of the recommended rootstocks will be used for production of plants of apple, pear and cherry.
- Production of trained manpower in fruit nursery raising will promote the Horticulture industry in the area.
- Standard and disease free root will be selected for the production of quality plants of stone and pomes fruits species.





***Agricultural Research Institute, Tandojam:*** During the, experiments of first year to determine appropriate nutrient management for Bt and non Bt-cotton continued at various locations in Hyderabad, Tandoallahyar, Mirpurkhas and Sanghar area. Data regarding plant nutrient status by sampling diagnostic plant tissues at recommended crop growth stage, analysis of plant/soil/water samples for selected parameters and actual crop yield and total nutrient uptake recorded.

**Name of Project:** Climate Change Implication for Water Management and Application Strategies (Coordinated Project: NARC-Islamabad, Sindh Agri. Uni.-Tandojam & KIU, Gilgit)

**Name of PI/Institute:**

Comp.-I	<b>Dr. Arshad Ashraf,</b> <b>SSO, CAEWRI, NARC, Islamabad</b>
Comp.-II	<b>Dr. Haleem Zaman Magsi,</b> <b>Chairman, Department of Mountain Earth Sciences,</b> <b>Karakoram International University (KIU) Gilgit</b> <b>Baltistan</b>
Comp.-III	<b>Dr. Muhammad Saffar Mirjat,</b> <b>Professor, Facility of Agriculture Engineering Sindh</b> <b>Agriculture University (SAU) Tandojam</b>

**Duration:**

Comp.-I	22.12.2014 to 21.12.2017
Comp.-II	26.02.2015 to 25.02.2018
Comp.-III	20.03.2015 to 19.03.2018

<b>Financial Status:</b>	<b>Total Cost (Rs. million)</b>	<b>Total Release (Rs. million)</b>	<b>Total Expenditure (Rs. million)</b>
Comp.-I:	7.419	2.568	2.382
Comp.-II:	4.418	0.726	0.000
Comp.-III:	5.816	1.186	1.171

**Objectives:**

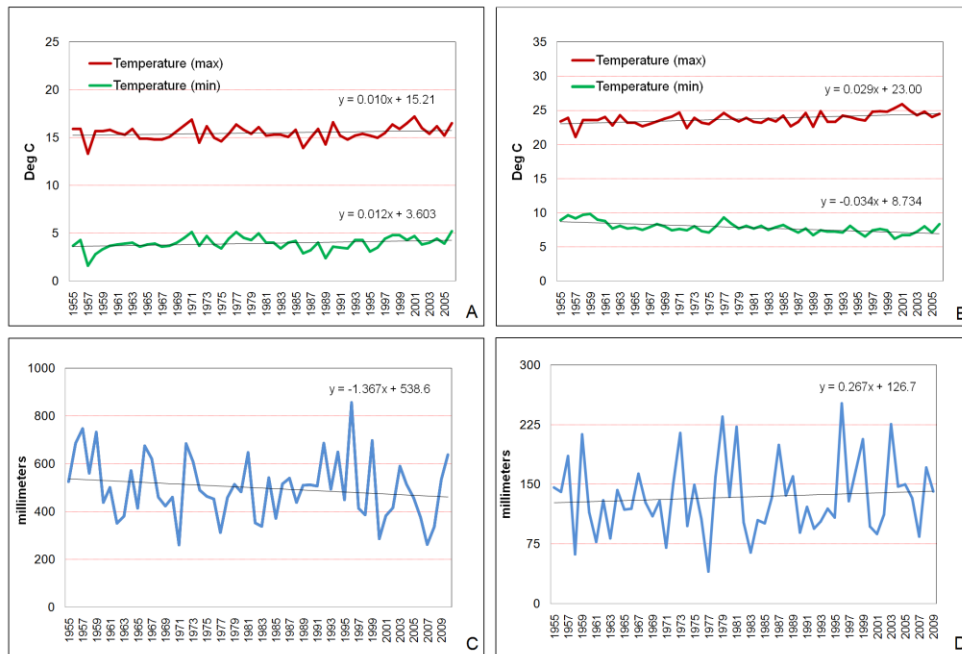
- To assess climate change and its implications on water resources and irrigation management in the selected ecologies of the country in order to provide base for effective decision support and developing adaptation strategies for the area in future.
- To identify local adjustments to climate change and identify proper adaptation measures to minimize the impacts of climate change.

**Achievements:**

**CAEWRI, NARC:** The study was conducted in two regions: 1) Mountain region (Astore, Gilgit basins) and 2) Hilly region (Soan river basin). Base maps of the selected river basins were prepared which include administrative boundaries (districts, tehsils), elevation, and drainage network using analytical tools of GIS.

- Three trainings were organized under the project to share key geo-informatics techniques and application in water resource management to strengthen on-going and future decision making process.
- Review of literature about climate change and its implications in different regions was carried out.
- Climate variability and trend analysis was performed at Astore and Gilgit station.
- The snow cover area (SCA) maps on monthly times scale were prepared for Gilgit river basin.
- The land use/land cover map of the Soan basin was prepared that indicated agriculture over 33% and rangeland over 27% area (with soil/rocks as degraded rangeland in moist condition over 50% of the basin area). Scrub forest was estimated in about 8.2% area mainly over slopy, dissected and gully areas.
- On an average the annual rainwater potential from the basin is about 4 billion cubic meter (BCM) and only 80 million cubic meters (about 2%) has been harnessed through small dams, mini dams and ponds.
- The soil erosion was estimated at an average rate of about 8.4 tons/ha/yr in the river basin. About 6.5% area collectively falls under high and very high risk of soil erosion. The severity of soil erosion was also assessed in 20 sub-basins of the study area under various land use and climate change scenarios.
- FAO Penman-Montheith Equation was applied to determine ETo in the Rawal watershed which represents high rainfall zone in the Soan basin.

Remote sensing (RS) based observations prove to be critical for the monitoring and assessment of landuse/landcover and land degradation in mountainous terrain where routine data collection is often hampered by inaccessible terrain and harsh climate. The landuse/landcover map indicated agriculture over 33% and rangeland over 27% area (with soil/rocks as degraded rangeland in moist condition over 50% of the basin area). Scrub forest is distributed over 8.2% area comprising slopy, dissected and gully areas. The soil erosion was estimated at an average rate of about 8.4 tons/ha/yr in the Soan river basin. About 6.5% area collectively falls under high and very high risk of soil erosion. The scenarios were developed to analyze response of soil erosion to changes in landuse and rainfall conditions in order to plan future risk mitigation measures. On an average, the annual rainwater potential from the basin is about 4 billion cubic meter (BCM) and only 80 million cubic meters (about 2%) has been harnessed through small dams, mini dams and ponds. The mean maximum temperature at Astore and Gilgit meteorological stations indicated an overall rising trends during 1955-2005 period. The mean minimum temperature had shown a declining trend at Gilgit. The trend of annual rainfall was on the negative side at Astore while it was on the positive side at Gilgit meteorological station. A complex pattern of lake area change has been observed in this region that seems to confirm the influence of changing climate on the glacial environment.



**Time series of mean maximum & minimum temperatures at Astore (A) and at Gilgit (B), and annual time series of rainfall at Astore (C) and at Gilgit meteorological station (D).**



**a**



**b**

**Erosion due to deforestation and intense rainfall is common on the mountain slopes (a); Sedimentation exaggerated in Korang stream during monsoon season (b)**



**Training session at CAEWRI committee room    Field visit at Satrameel research station**

***Sindh Agriculture University, Tandojam:*** The research study aimed to evaluate the climate implications with reference to water management strategies and adaptation to cope up or address the future climate change hazards. The study developed for conducting field of canal commands at five districts of lower Sindh. A questionnaire was developed for conducting field survey. Farmers of all five districts were interviewed on sample basis regarding their awareness about climate change and its implication and issues affecting the agriculture and irrigation water management practices. Besides this, the secondary data about crops, meteorology, irrigation delivers were obtained from line departments the field results obtained through questionnaire reveals that farmers of the study area were well acquainted about climate change. They know its effects on agriculture. Further results show that there was considerable effect of climate change factors on irrigated agriculture. Cropping pattern and intensity of the area has been considerably changed due to changed irrigation supplies and other climate relevant factors. The present cropping pattern and intensity of the area was compared with 10 years before. The floods due to heavy rainfall and river flow during 2010-2011 have also affected the crops and soils in the area. Overall climate change has affected the livestock, human health and economy of farmers while liking the irrigation practice. Farmers were practicing surface irrigation methods like basin, flooding and furrows. They were quite reluctant to adopt micro irrigation due to high cost.

This research is continuing hence no final conclusion could be made. However, based on preliminary results of research conducted in the study area following conclusions have so far been drawn:

- There is considerable effect of climate change on varieties of issues related to agriculture in lower Sindh. These effects are visible on water delivery from irrigation canal, floods, low cropping intensity, lower yield, diseases in livestock, saline ground water and decreased soil fertility due to salinity and water logging.
- Cropping pattern of the study area has changed due to climate change effects. The cultivation of sugarcane and rice has reduced.
- Yield of major crop has also decreased as compared to one decade before
- The groundwater has become saline due to it's over exploitation and rotation in canal supplies.
- The soil fertility has also been reduced due to water logging and salinity.

- Ultimately, the farmer's economy has declined due to climate change effects.

**Karakoram International University, Gilgit** Initial work and activities started under the project.

**Name of Project:** **Farm Productivity Improvement through Management of Artesian Wells in Piedmont Plains of Suleiman Ranges of Dera Ismail Khan, Khyber Pakhtunkhwa (AZRI-D. I. Khan)**

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

**Duration:** 20. 12.2012 to 19.12.2015 Extended upto 30.06.2016

**Financial Status:**

Total Cost:	Rs. 5.938 million
Total Release:	Rs. 5.346 million
Total Expenditure:	Rs. 5.272 million

#### **Objectives:**

- Creation of comprehensive database on artesian wells of D. I. Khan district.
- Devise appropriate water management interventions for artesian wells for enhanced agricultural productivity.
- To quantify the water potential of artesian wells 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:**

Draban command area D. I. Khan is stretched over an area of about 490 sq. km between longitudes 70°12' to 70°40'40"E and latitudes 31°37'44" to 31°49'44" N. it lies in the western part of D. I. Khan District of KPK province. In the west, it is bounded by Suleiman mountain range and in the east by Chashma Right Bank Canal (CRBC) emerging from Chashma barrage near Kalabagh. It has a mean length of about 45 km in west to southeast direction. The command area is linked through a metalled road with D. I. Khan and other major cities and towns of the country. The elevation of the command area ranges between 180 to 417 meters above mean sea level, which gradually increases from the flood plain in the east towards mountainous area in the west. Major land use of the area is Road-kohi agriculture practiced through diverting hill torrent water for irrigation. Some barren land and rain fed agriculture also exist in different part of the area. Well-irrigation using artesian groundwater is practiced in the southwestern part near head of the Draban command area.

Before commencement of the project general survey of the command areas regarding the artesian wells were carried out. Identified almost 16 wells with different discharge and select 03 different wells as where project activities were adopted. The discharges varied from 1 lit/sec to 4 lit/sec at different locations within the command area. This is a step towards quantification of water potential of these wells and help in evaluating the impact of seasonal fluctuation. The data of discharges were recorded on daily basis at different locations within the command area. Economic analysis of water potential of these wells were also be done, which help in evaluating the impact of seasonal fluctuation. Pressure gauges were installed at the well of Nasib Gul and Mir Ajab sites. Both the farmers were cooperative and adopt all the instructions regarding the well. Major activities of the project were carried out at these two locations. Water pressure measured with gauges was 2, 2.5 & 4 psi of different wells. Rainfall data of the command area has been recorded. The data will be helpful for finding out the rainfall pattern & climatic variability. Meetings have been arranged on weekly basis and discussed the various problems/issues of the farmers. Strong linkages have been developed among the farmers and scientific community. With the help of this project most of the problems were solved at their door step. Wheat and rapeseed crops were sown at two locations and all the relevant data were see such a bumper crop. A two (02) kanal fish pond has been prepared. Excavated due to this activity the farm production has been increased and also improve the livelihood of dependent household. PCPS lining of water courses of the farm of Gul Naseeb and Mir Ajab were completed during the project tenure. Due to PCPs lining, seepage of water was minimized and also improved the soil condition.

**Name of Project:**                      **Synthesis and Production of Hybrid Silkworm Strains at Pakistani Forest Institute for Promoting Sericulture in Pakistan (PFI-Peshawar)**

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

**Duration:**                              22.04.2013 to 21.04.2016    Extended upto 31.12.2016

**Financial Status:**                      Total Cost:                      Rs. 6.938 million  
Total Release:                      Rs. 6.934 million  
Total Expenditure:                      Rs. 6.867 million

### **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:**

A mulberry gene bank/Research garden was maintained at PFI field station Bhurban (Murree). The mulberry plantation at PFI was pollard in August 2015 and January 2016. The potential of carbon stocking by four mulberry varieties including: PFI-I Kanmasi and Karyansuban and *Morus Latifolia* was assessed. A total of 26 macro agronomic and biomass parameters of wood density, leaf, shoot, carbon contents and carbon dioxide equivalent were estimated. Allometric equations were also used to assess the biomass and carbon tables. The results showed a highly significant variation in basic wood density major agronomic and biomass parameters. The highest number of leaf per shoot (NLS) and leaf yield per plant (LYP) was recorded in variety PFI-1, while the lowest NLS and LYP was found in Korean variety Karyansuban. The leaf of *M. latifolia* was the largest, while PFI-1 and Kanmasi have had the smallest leaf. The heaviest fresh and dry leaf (SLW) and moisture retention capacity was found in Karyansuban, while the lightest fresh and dry leaf was in Kanmasi. The highest fresh leaf biomass was recorded in PFI-1. The lowest fresh leaf biomass was recorded in Karyansuban. The dry leaf biomass per plant followed the pattern of fresh leaf biomass. PFI-1 produced  $53.73 \pm 1.29$  ton fresh leaf biomass per hectare. The highest total number of shoots per plant and the longest shoot was recorded in *M. latifolia*. The highest fresh and dry shoot weight was recorded in *M. latifolia*. The overall mean dry shoot biomass was 116.98 ton per hectare. *M. latifolia* gave the highest total carbon contents of  $82.38 \pm$  ton per hectare. The mulberry plants sequestered about 254.27 CO<sub>2</sub>eq tons per hectare per annum. The highest CO<sub>2</sub>eq was  $302.34 \pm 2.96$  ton sequestered by *M. latifolia*, while the lowest CO<sub>2</sub>eq was  $173.86 \pm 4.19$  tons sequestered by Karyansuban. Four allometric equations were tested for predicting biomass production and carbon tables. Among the tested independent variables, diameter at breast height (DBH) proved the most reliable with reasonable statistical validity for dry mass prediction. The ratio between the variance explained by the model validity for dry mass prediction. The ratio between the variance explained by the model and the



total variance ( $R^2=0.87$ ) showed a good fit of the model. The regression equation produced accurate estimated and controlled the bias well. The silkworm rearing was conducted in autumn and Spring Silkworm Rearing Seasons 2015-16. General disinfection of silkworm rearing sheds, rearing stands, incubation rooms, coupling rooms and appliances was conducted using formaldehyde containing 37% formalin and slack lime before and after conducting each silkworm rearing season. Similarly eggs were disinfected with formalin before chilling. Genetic relatedness in eighteen silkworm strains was assessed. The results showed a high degree of genetic diversity among 18 silkworm strains. The similarity genetic distance was between 0.110 and 0.991. The mean genetic similarity distance among the inbred lines was between 0.124 and 0.991. The mean genetic similarity distance among the inbred lines was between 0.124 and 0.943, while the mean genetic similarity distance among the hybrids was relatively greater compared to inbred lines. The genetic diversity was in corroboration with commercial traits of the silkworm strains. The superior commercial parameters of hybrids compared to inbred lines were in conformity of greater genetic diversity unraveled in this study. The dendrogram based on squared Euclidean distance matrix indicated divergent genotype of the silkworm strains. Among the four clusters, Cluster-I was the smallest which comprised two strains including a hybrid J101\*205PO and a double hybrid lined and six hybrids. The hybrid 206MKD\*205PO and J101 were at the distant ends in cluster-II. The Cluster-III contained three strains, one inbred line and two hybrids. The Cluster-IV was the 2<sup>nd</sup> largest and contained five strains. The cluster analysis showed that 206MKD\*205PO and J101 were remotely related. All the strains grouped into two clusters at 33% similarity level.

Growth performance of a tetra hybrid ( $H_{1X}KK_XG_{2X}V_2$ ), two double hybrids ( $H_{1X}KK$  Japanese origin &  $G_{2X}V_2$ , Chinese origin) and three inbred lines ( $KP_4P_1$ , Jam-120  $K_1P_1$ , local races) was assessed. An overall mean fecundity obtained was 524.03 eggs per female. The highest fecundity was recorded in the tetra hybrid strain. The highest egg hatchability larval body weight, whole cocoon weight and cocoon yield was  $98.21 \pm 8.51\%$ ,  $5.30 \pm 0.08$ g/larval,  $2.33 \pm 0.06$ g and  $26.31 \pm 0.75$ kg/10k larvae, respectively in  $H_{1X}KK_XG_{2X}V_2$ . Multiple Evaluation Index (MEI) for hybrids and inbred lines was ranged from 40.17 to 59.07, both tetra and double hybrids produced mean MEI>50. Among quantitative traits, fecundity resulted in the highest MEI. The MEI for individual traits was superior in the tetra hybrid followed by double hybrids.

The commercial traits of cocoon and raw silk were assessed in 10 strains. The results showed a highly significant variation these traits. In hybrids, the heaviest dry whole and deflossed cocoon was found in PFI-15. 206PO\*J101 produced the lightest deflossed cocoon among the hybrids. The mean cocoon shell weight including inbred lines and hybrids was 0.32g. The cocoon shell weight in hybrids was relatively superior to inbred lines. Among the inbred lines, the Chinese strains resulted in heavier cocoon shell weight compared to Japanese strains. The overall mean cocoon shell ratio was 18.34%. The mean cocoon shell ratio was comparable with that of international Standard. Among the hybrids, the highest cocoon shell ratio was found in PFI-14. The highest raw silk weight was  $0.32 \pm 0.02$  g per cocoon obtained in PFI-15. The results indicated Superior raw silk production in hybrid compared to inbred lines. The longest silkworm filament was  $1216.6 \pm 31.01$  m per cocoon. The mean boiling and processing loss was 9.44%. Among the inbred lines the B/P loss was lower in Chinese lines compared to Japanese lines. The overall mean Denier of silk filament measured was 2.16. The highest Denier measured was  $2.38 \pm 0.16$  in PFI-15, while the lowest Denier was  $1.91 \pm 0.06$  measured in J-101. The cocoon shell reeling percentage (CSR%)

was ranged from  $80.30 \pm 0.66\%$  to  $91.82 \pm 0.64\%$ . All the hybrids resulted in better CSRP compared to inbred lines. The Reeling Discount of Dry Cocoon varied from  $184.93 \pm 2.72$  to  $215.35 \pm 1.21\%$ . The four hybrids resulted in MEI of Denier  $> 50.0$ , while only one inbred line resulted in MEI  $> 50$ . The mean evaluation index of Reeling Discount of Dry Cocoon (RDDC) and Percentage Reel able Cocoon (PRC) was 49.53 and 48.90, respectively. The four hybrids showed positive Mid Parent Hitrosis effects over parental performance for 11 quantitative traits. The highest MPH positive effect for 11 traits was found in PFI-14. Two hybrids showed positive Better Parent Heterosis (BPH) effect for 11 quantitative cocoon and raw silk traits. Contrarily, two hybrids showed negative BPH effect for the tested traits. The highest Cumulative Sub-ordinated Function (SF) was 9.83% for PFI-15. There was a marginal difference in Cumulative SF between PFI-14 and J101\*205PO. The Sub-ordinate function was negative for four quantitative traits. Based on MEI and cumulative Sub-ordinate Function the hybrid PFI-15 was ranked first.

A correlation was established between female pupal body weight and fecundity. The results showed that hybrid PFI-14 has had a significant linear function of female pupal body weight with fecundity. While inbred lines C-102, and PO and 206 MKD have had significant 2<sup>nd</sup> degree function between female pupal weight and fecundity. A study was conducted to control microbial diseases using antibiotics and also assess their impacts on economic cocoon characteristics. The antibiotics used were included: amoxicillin, Chloramphenicol and Streptomycin sulphate @ 0.5% concentration. The results showed that besides diseases control, Amoxicillin and Streptomycin have had positive impact on economic cocoon characteristics.

During this reporting period, a total of 400 diseases free layings (DFLs) were produced. The silk seed was processed thermally and disinfected with 2% formalin. The eggs were chilled at 2.5°C. One MSc thesis research was completed and two BSc internee students were trained in silkworm rearing. Three research papers were written and submitted for publication. Two documentaries were made with the cooperation of Samaa TV and Geo Television Network and the same were telecasted by the respective TV Channels. (Documentaries are attached herewith). Based on the results of different studies conducted during this period, it is concluded that mulberry has great potential for carbon stocking. Thus it should be included that mulberry has great potential for carbon stocking. Thus it should be included in forest plantation programmes to mitigate the adverse impacts of climate change. Furthermore, hybrid silkworm strains have shown potential to increase cocoon production and subsequently enhance livelihood of the silkworm rearing farmers. In autumn Silkworm Rearing Season 2016, hybrids will be reared for assessing hybrid vigor further and producing silk seed for different stakeholders. The mulberry gene bank/research garden will be maintained.



**Silkworm rearing for assessing hybrid vigour**



**Cocoons of hybrid C102\*206MKD**

# **PLANT SCIENCES**

## **Introduction:**

Plant Sciences Division (PSD), PARC spear head the research and development activities related to crop improvement/ production, plant protection, and promotion of high value crops for sustainable agriculture and food security. The major research activities focus on post harvest management and adoption of resource conservation technologies for better crop management. Agriculture Linkage Program (ALP) is a good source of competitive grant to provide opportunity to the scientists to resolve the priority issues of national interest.

In order to achieve the targets for the year 2015-16 PSD got approved 15 research projects from ALP funding while 01 on-going projects were completed during the reporting period. In another projects identification of genotypes of chili is in progress at Umerkot, Sind research on Seeds of Guar, Fennel, Fenugreek, Ispaghol, NARC-Kalonji, Linseed and Taramira was conducted to popularize these crops among farming community. A medicinal and aromatic plant for sustainable utilization was also funded at NARC and Azad Jammu & Kashmir (AJK). Mother blocks and nursery of Cherry and Pistachio were established at MARC, Gilgit for an easy access to local growers. While mobile facility for removal of astringency and improve shelf life of persimmon was established and demonstrated at NIFA, the work done in the research projects during 2015-16 is briefly summarized in the report.

**Name of project:** **Development of Market Life Enhancement Technology to Persimmon and its Dissemination to Growers**

**Name of PI/Institute:** **Mrs. Nizakat Bibi,**  
Dy. Chief Scientist,  
Nuclear Institute for Food & Agriculture (NIFA) Tarnab, Peshawar

**Duration:** 01-07-2012 to 31-12-2015

**Financial Status:**

Total Cost:	Rs.4.737 million
Funds Released:	Rs.1,274,500/-
Funds Utilized:	Rs.1,069,848/-

**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:**

- It was concluded from the study of the fruits picked at the picking stage from agricultural university Peshawar, KP that this treatment was slightly beneficial even at the picking stage of the fruit. Improvement in the treated fruits was not up-to the mark probably because of the fact that the chamber used was not totally air-tight.
- Keeping in view both the important parameters, astringency and weight loss for Charsada fruits the storage period could be one week after treatment for fruits picked from the orchards by the end of September.
- Delayed (if possible) picking time from end of September to end of October would be more beneficial for longer storage period.
- Regarding the fruits collected from swat orchards, the storage period may be extended by storing the fruits in the same environment after treatment.
- This treatment is more useful for value addition of export quality fruit purchased from fruit mandi, Peshawar as modified atmosphere treatment can reduce astringency to some extent as well as extended marketable life of persimmon fruit.
- The chamber was brought to NIFA in September, 2014.
- R&D was conducted for optimization parameters of the chamber's conditions on commercial scale application:
- Keeping in view the important parameters, astringency, weight loss, texture and taste/consumers acceptability, treated fruits for 96 hrs collected at per picking stage could be beneficial for the removal of astringency and extension of storage period.
- By comparison of total phenolic content of all the differently treated fruits it was evident that modified atmosphere caused reduction in total phenol/astringency.

- The technology was disseminated to more than 500 persimmons growers/traders through awareness workshops in the persimmon growing areas (Swat and Charsadda), Consumer's acceptability test of the treated fruits and distribution of the brochures of the technology
- The awareness programme was extended to general public through press release and radio talk on 2<sup>nd</sup> and 3<sup>rd</sup>, November, 2015.



**Persimmon Astringency Removal Chamber (ARC)**

**Name of project:** **Evaluation of Chilies Varieties for Quality, Production, High Yield, and Disease Resistance in Lower Sindh (CS-292)”.**

**Name of PI/Institute:** **Dr. Attaullah Khan,**  
Principal Scientific Officer/Director,  
Arid Zone Research Institute (PARC), Umerkot

**Duration:** 03-03-2015 to 02-03-2018

<b>Financial Status:</b>	Total Cost:	Rs. 7.881 million
	Funds Released:	Rs. 1,633,000/-
	Funds Utilized:	Rs. 1,284,406/-

**Objectives:**

- To study the integrated Nursery Management techniques in chilies varieties cultivated at lower Sindh.
- To identify elite genotypes of chilies and to select/develop varieties from evaluated material.
- To develop integrated Management (ICM) model to reduce insects' pest and disease.
- To investigate Postharvest Management techniques in chilies to maintain the export quality.

**Achievements:**

- 13 genotypes acclimatized and multiplied for further testing.
- Seeds of 113 exotic chilies varieties are available for nursery raising. The nurseries of these collected seeds have been planted at AZRI farm and Mian Muhammad Saleem farm near umerkot on recommended practices i.e 1) preparation of nurseries on virgin soil or on sub – soil, 2) sterilization of nurseries, 3) use of diseases free seed material 4) field sanitization and 5) use of recommended fungicides.
- Seeds of 16 selected Dandicut varieties are available for nursery raising. The nurseries of these collected seeds have been planted at 16 different farmers of Umerkot, Kunri, Tando Allahyar, and Badin to evaluate their performance.
- These demo plots are further blocked for inputs trials i.e. fertilizer application date of sowing plant spacing and irrigation interval etc. the fields have been established and prepared for inter-variety comparison i.e. to evaluate different cultural practices for crop management.









**Chilies Varieties in Farmers Field at Kunri**

**Name of Project:** **Micro propagation of Superior National and International Varieties of Date Palm on Commercial Level**

**Name of PI/Institute:** **Prof. Dr. Ghulam Sarwar Markhand,**  
Director, Date Palm Research Institute (DPRI), Shah Abdul Latif University, Khairpur, Sindh.

**Duration:** 01.05. 2015 to 30.04.2018

<b>Financial Status:</b>	Total Cost:	Rs.9.953 million
	Funds Released:	Rs.5,522,500/-
	Funds Utilized:	Rs.5,483,183/-

**Objectives:**

- Production of 20-30 thousand in vitro date palm plantlets from 6 marketable cultivars. i.e. 3 local (Dhakki, Shandhkand and Aseel) and 3 international varieties (Medjool, Barhee and Sewi). This will support date's industry in Pakistan with high quality varieties whose fruit for processing.
- Study the appropriate time for inflorescence excision for each cultivar and develop micro propagation protocol.
- Study the effect of Abiotic factors particularly temperature and light length & intensity on shoot proliferation, rooting and acclimatization.
- Comparative study among mother, in vitro and ex vitro plants by latest fingerprinting technique like AFLP.
- Results and outputs dissemination by publishing 2 papers, conducting a Seminar and submitting progress reports.

**Achievement:**

- Date palm off shoots collected from Turbat, Baluchistan, D.I.Khan, KPK and local area for
  - micropropagation. Culturing process started.
- Surface sterilization factors of Explants studied.
- Regular sub culturing at interval of 3-4 weeks is going on.
- The Inflorescence culturing of Aseel, Dhakki and Shandishkand varieties started.
- Sub culturing of cultures established from the off shoots (Dhakki, Aseel, Shandishhkand, Sewi, Medjool and Barhi var). and Inflorescence (Aseel, Dhakki and Shandishkand) is a continuous venture of Lab.
- Green/Net house constructed.
- Initiation from off shoots of exotic varieties i.e. Sewi from Egypt, Medjool & Barhi from UAE has been done.
- Experimental work is going on very satisfactory. Good numbers of cultures from off shoots and inflorescence of different varieties are growing well in the Lab.
- PI visited UAE for collection of plant material of varieties Medjool and Barhi.

- Overseas Co-Operative Scientist (Dr. Adel Ahmed Abul Soad) from Egypt visited DPRI, Pakistan and brought source material (offshoots/Initiated cultures) of Sewi variety.



**Review Team Visit at Tissue Culture Lab. and Green House at Date Palm Research Institute Salu Khairpur Sindh**



**Review Team Visit at Tissue Culture Lab. and Green House at Date Palm Research Institute Salu Khairpur Sindh**

**Name of project:** **Production of Quality Stone Fruits Nursery Plants for the Promotion of Fruits Cultivation in Hazara Division**

**Name of PI/Institute:** **Mr. Fayaz Ahmad,**  
Principal Scientific Officer, National Tea & High Value Crops Research Institute, Shinkiari, Mansehra

**Duration:** 21.09.2015 to 20.09.2018

**Financial Status:**

Total Cost:	Rs.4.885 million
Funds Released:	Rs.1,610,871/-
Funds Utilized:	Rs.1,604,476/-

**Objectives:**

- Production of 20,000 quality nursery plants of stone fruits for the growers.
- Introduction of improved cultivars of stone fruit species in the project area.
- Impart trainings to 180 growers in stone fruit nursery raising and management techniques.
- To produce quality nursery plants of stone fruits for the promotion of Horticulture sector in the area.
- To study the standard & disease free root stocks for production of stone fruits nursery plants.
- To introduce new high yielding cultivars of stone fruits.

**Achievements:**

To provide true to type and healthy plants of stone fruits species (apricot, peach, plum, almond, cherry) to the growers, nurseries have been established at National Tea and High value Crops Research Institute (NTHRI) Shinkiari and on farmer's fields in three locations of District Mansehra i.e. Bajna Mera, Baffa Dorah and Dahrial. Budding of peach seedling rootstock is in progress and 5670 plants have been budded with promising cultivars of stone fruits species. Awarded practical trainings to the growers in the raising and management of fruits nursery. Provided plants of different fruit species i.e. apricot, peach, plum, almond, cherry, walnut, fig and pomegranate produced in NTHRI fruit nursery to the growers for promotion of fruit cultivation in the area. Managed the Mother Fruit Orchard at NTHRI for getting bud wood/graft wood of improved fruit cultivars for further propagation. Research studies on various aspects of fruits species are in progress.

**Name of project:** **Enhancing Fertilizer Use Efficiency in Wheat by Using Transgenic Approach**

**Name of PI/Institute:** **Dr. Kauser Abdullah Malik,**  
Distinguished National Professor, Biological Sciences Department,  
Foreman Christian College, Ferozepur Road, Lahore

**Duration:** 15.08.2014 to 15.08.2017

**Financial Status:**

Total Cost:	Rs. 15.813 million
Funds Released:	Rs. 11,204,343/-
Funds Utilized:	Rs. 8,055,664/-

**Objectives:**

- Selection of genes /transcription factors and promoters involved in fertilizer uptake
- Construction of an appropriate vectors and development of agro bacterium medicated transformation protocol for wheat
- Confirmation of transgenic plants having full gene expression
- Analysis of transgenic plants for phosphorus and nitrogen uptake.

**Achievements:**

In order to enhance fertilizer (nitrogen and phosphorus) use efficiency in wheat, PTFI transcription factor, *HvNHCI* gene and *Dofl* gene have been selected and synthesized. For enhancing phosphorus use efficiency two cassettes have been synthesized containing two different genes. In cassettes I *HvNHCI* gene has been selected and amplified and its transformation is under process. This gene has been cloned under 35S terminator which has already been cloned and transformed in plant transformation vector. Cassette II consists of PTFI (Phosphorus Transcription Factor) which has been cloned under 2X 35S promoter whose transformation is under process.

Nitrogen assimilation is essential to the growth and development of plants. Because of the strong influence of nitrogen-utilization efficiency on plant productivity, a vast amount of nitrogen fertilizers is poured on to fields to maximize crop yield but with considerable impacts on the global environment, especially the aquatic ecosystem. This along with increasing N fertilizers cost, has created a need for more nitrogen use efficient (NUE) crops; i.e., crops that are better able to uptake, utilize, and remobilize the nitrogen available to them. Traditional breeding strategies to improve NUE in crop plants have been reached a plateau, where increases in N application do not improve yields. Solutions are needed to increase yields while maintain, or preferably decreasing, applied N, to obtain the estimated attainable and potential yields of these planar under specific nutrient regimes. Therefore, endowing crops with and increased ability to assimilate nitrogen is crucial to both increases in improving NUE, we intend to over-express *Dofl* transcription factor in wheat to improve nitrogen uptake and assimilation. Thus for enhancing nitrogen use efficiency, *Dofl* transcription factor has been cloned in plant transformation vector, by using standard cloning techniques (restriction digestion and ligation) 35S promoter and Nos terminator have also been cloned in vector pSB219 and has been transformed in *Agro bacterium*. *Agro*

*bacterium*-mediated plant transformation protocol has been optimized. Embryo excisions and calli formation are under process. Calli have been shifted to regeneration media.

**Name of project:** Conservation Documentation and Digitization of Medicinal Flora of Poonch Area (AJK)

**Name of PI/Institute:** Sardar Irfan Mehmood,  
Lecturer, Govt Boys Degree College Abbaspur, Poonch AJK.

**Duration:** 01.09.2014 to 31.08.2017

**Financial Status:**

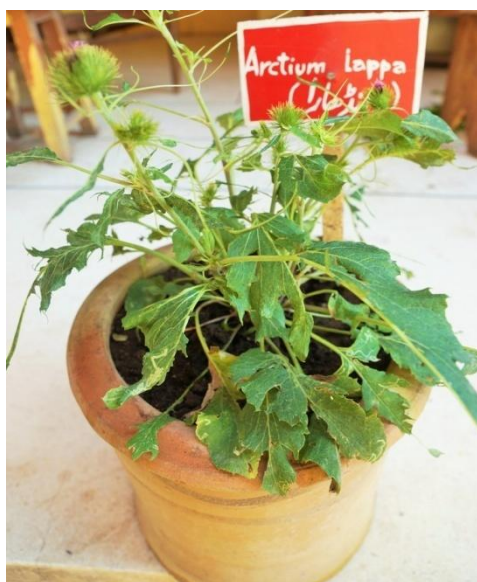
Total Cost:	Rs.3.987 million
Funds Released:	Rs.2,960,250/-
Funds Utilized:	Rs.2,435,465/-

**Objectives:**

- Collection and in-situ conservation of selected medicinal flora of poonch area.
- Study and documentation of phrenology and taxonomy of selected medicinal plants.
- Develop a digitized herbarium of targeted medicinal plants species to display at PARC website.

**Achievements:**

At present more than 200 MAPs species have been documented. One thirty (130) and twenty species have been propagated in two colonial repositories. Each selected plant was studied in its natural habit and 8-10 photographs of each plant including its all parts (roots, leaves flowers, fruits, seeds) were taken for digital herbarium. For conservation point of view each herbarium was prepared in duplicate. Botanical name, local name, family, place of collection and date of collection were mentioned for each plant in herbarium specimen. During the second year of this project 100 top medicinal plants like *Cretaegus oxycantha*, *Leonurus cardiac* for heart diseases, *Podphyllum hexandrum*, *Gentiana kurroo*, *Swertia* species as antibiotics, are identified and documented. Growth of exotic species was also studied. Species like Stivea Rosemary.







**Green house Construction**



**Herbarium developments**



**Name of project:** **Evaluation, Identification and Multiplication of High Yielding and Disease Resistant Varieties/Cultivars of Cherry under Ecological Conditions of Gilgit Baltistan.**

**Name of PI/Institute:** **Mr. Muhammad Din,**  
Mountain Agricultural Research Center (MARC) Juglote Gilgit

**Duration:** 17.03.2015 to 17.03.2018

**Financial Status:**

Total Cost:	Rs. 4.402 million
Funds Released:	Rs. 2,560,000/-
Funds Utilized:	Rs. 2,315,106/-

**Objectives:**

- To introduce and select high yielding Cherry varieties to reduce poverty and food security risks by increasing profitability through production of quality fruits among growers.
- To maximize the local production of cherry to enhance the net income of the farmers in Gilgit-Baltistan.
- To propagate the grafted plants of improved varieties of cherry for commercialization among the farming communities of the region.

**Achievements:**

- Planting materials (seed & plants) of national & international were collected and established experimental orchards, stool bed block of Mahalub, seed production block of Mahalub cultivars and nurseries at MARC, Juglote and farmers field.
- The plant growth maximum height of 296.66 cm and maximum diameter of 3.93 cm per plant was found in case of Sunburst followed by using with the height of 376.00 cm and Sylvia with diameter of 3.76 cm per plant.
- 20 cultivars of Cherry raised on Mahalub rootstock at Gorikot Astore during March 2016. The cultivars hepliphin growing on Mahalub having maximum height of 183.00 cm, followed by Regina on the same root stock with the height of 155.00 cm per plant. As regard average girth maximum girth of 1.8 cm per plant was found in case cultivars Regina followed by grace star on Mahalub root stock with 1.75 cm diameter.
- Five cultivars of cherry rootstock were collected during the period and planted at MARC farm in replicated form. The maximum plant height of 53.00 cm and maximum diameter of 1.50 cm per plant was found in case of cultivars Maxima-60 which was imported from Italy followed by Mazard rootstock with height of 49.00 cm per plant and with a diameter of 1.55 cm per plant in case of rootstock Sawat local.

**Name of project:** **Cultivation of Pistachio in Gilgit Baltistan (GB)**

**Name of PI/Institute:** **Mr. Tajudin,**  
Scientific Officer, Mountain Agricultural Research Centre (MARC),  
Juglote, Gilgit Baltistan.

**Duration:** 07-11-2014 to 31-10-2017

**Financial Status:**

Total Cost:	Rs.3.492 million
Funds Released:	Rs. 2,035,000/-
Funds Utilized:	Rs. 1,930,763/-

**Objectives:**

- Introduction of improved indigenous and exotic varieties of pistachio for commercial cultivation in Gilgit Baltistan.
- Development and dissemination of area specific improved packages of crop production and management practices for successful cultivation of pistachio in Gilgit Baltistan.
- Capacity Building and awareness rising of progressive growers through formal and informal training, workshops, field days and exposure visits for adoption of pistachio on large scale in Gilgit Baltistan.

**Achievements:**

Planting materials (seed & plant) of local and national wild and cultivated relatives of pistachio were identified, collected and established orchard and nursery at MARC, Juglote. In addition field experiments for development of improved practice for successful pistachio nursery were included. Exposure visits, trainings and field days for awareness raising and information regarding pistachio were conducted. The installation of plastic tunnel implemented at MARC, Juglote.

The seeds of pistachio cultivar “Akbari” were cultivated at MARC Juglote, Gilgit to determine the effect of different dates i.e. 01-02-2016, 10-02-2016, 20-02-2016 and 01-03-2016 on germination and survival percentage of Pistachio seedling at open field temperature replicated three times.



**The Newly Established Pistachio Orchard & Managed For Irrigation, Fertility, Weeding and Insect/Pest Control at MARC.**

**Achievements:**

Improved pistachio varieties were identified and collected bud wood from Chakwal (BARI) were budded on pistachio rootstocks at MARC, Juglote for further propagation and multiplication.

The seeds of pistachio cultivars "Akbari" were cultivated at MARC Juglote, Gilgit to determine the effect of different dates i.e. D1 (20-11-2016), D2 (01-12-2016), D3 (10-12-2016), D4 (20-12-2016), D5 (01-01-2017), D6 (10-01-2017) and D7 (20-01-2017) on germination and survival percentage field temperature and replicated three times. The 100 seeds of Pistachio were cultivated under each treatment. The data revealed that the sowing of Pistachio on D1 showed the highest germination and survival respectively.

The seeds of Pistachio cultivars "Akbari" were tested to determine seed coats, (T2) semi open seed coats and (T3) closed seed coats on seedlings at open field condition for successful nursery raising and management at MARC, Juglote, Gilgit. A total of 100 seeds for each seed coat of pistachio were cultivated under each treatment and replicated three times. The collected data revealed that the open seed coat T1 of pistachio showed the highest germination percentages of 51% and survival percentages of 49% at field condition of MARC as compared to semi open seed coat T2 with germination percentages of 47% and survival rates 45% respectively. While the lowest germination 20% in closed seed coat T3 were recorded in this field study.

The budding / grafting material collected from different local and national sources were tested on different dates starting from 01-01-2017 to 30-06-2017 with a fifteen day interval to determine the most suitable date for successful budding/grafting of pistachio at MARC Juglote. Among these tested days the chip budding made on 15<sup>th</sup> February, 2017 was found the only successful date for budding/grafting of pistachio at MARC Juglote while all other dates of budding/grafting were failed to show any results.

**Name of project:** **Optimization of Bt. Cotton Production Technology for Different Agro-Ecological Zones in the Face of Changing Climate through Simulation Modeling**

**Name of PI/Institute:** **Dr. Ashfaq Ahmad,**  
Professor, Head Climate Change Cell, Department of Agronomy,  
University of Agriculture, Faisalabad

**Duration:** 15-01-2016 to 14-01-2019

**Financial Status:**

Total Cost:	Rs. 7.033millions
Funds Released:	Rs. 1,016,000/-
Funds Utilized:	Rs. 467,624/-

**Objectives:**

- Field experiment to evaluate approved Bt. Cotton varieties under different agro-ecological conditions and acquires input data set for DSSAT model calibration and validation.
- Identifying flaws in existing production technologies of BT. cotton and optimization site specific technology using decision support tool.
- To build technical capacity of stakeholder, extension worker and policy makers to use calibrated and validated DSSAT for sustainable future cotton production.

**Achievements: (3 months report)**

Data collected /recorded will be available for;

- Qualification of impact of spatial and temporal viabilities on growth, development and yield of Bt cotton
- Parameterization of DSSAT model on each site
- Evaluation and validation of DSSAT at regional level
- Climate Change impact assessment
- Development of site specific production packages in the face of changing climate
- Resultantly, country's cotton production indices will be improved and finally we shall get huge foreign reserves to help the poor man economy of the country.

**Name of project:** **Varietal Screening, Technology Development and Seed Production of Guar *Cyamopsis tetragonoloba* (L. Taub) under Rainfed Ecologies of Pakistan**

**Name of PI/Institute:** **Dr. Muhammad Yaqoob,**  
PSO, Arid Zone Research Institute, Ratta Kulachi, Dera Ismail Khan

**Duration:** 01-04-2016 to 01-03-2019

**Financial Status:**

S.#	RELEASE		EXPENDITURE	
	Date	Amount (Rs)	Duration	Amount (Rs)
1	22/04/2016	530,000	Jan to June,2016	663,478
2	06/06/2016	146,400	July to Dec, 2016	586,135
3	30/06/2016	949,50		
4	09/08/2016	488,500		
5	05/02/2017	596,700		
6	26/04/2017	82,000 (Honorarium)		

**Objectives:**

- Development of high yielding guar varieties (two to three) suitable for planting under rainfed ecologies of Pakistan.
- Guar production technology development for higher yield in rainfed areas of country.
- Seed multiplication, (1000 kg) introduction and adaptability studies of the most desirable guar varieties.

**Achievements: (3 months report)**

- Successful and profitable cultivation will be demonstrated to farming community for adopting this crop in the area.
- Desirable guar lines will be screened for further studies.
- Optimum plant population will be identified for higher guar yield.



**Irrigation to Guar crop by Centre Pivot Irrigation System**

**Name of project:** **Production Technology and Adaptability of Super-NPT Rice**

**Name of PI/Institute:** **Dr. Fida M. Abbasi,**  
Professor, Department of Genetics, Hazara University, Mansehra

**Duration:** 01-04-2016 to 01-03-2019

**Financial Status:**

Total Cost: Rs.2.00 million

Funds Released: Rs.370,000/-

Funds Utilized: Rs.142,492/-

**Objectives:**

- Molecular characterization of newly developed strains of rice.
- Formulation of production package for new strains of rice.
- Identification of potential area of its adaptability.

**Achievements: (3 months report)**

- Effect of planning distance on yield will be determined for selecting the optimum distance between and within rows.
- Effect of different fertilizer doses on yield will be determined in order to select the optimum dose of fertilizer.

**Name of project:** **Characterization, Rejuvenation and Multiplication of Cross-Pollinated Vegetable Germplasm (Radish, Turnip, Cauliflower, Onion and Cucumber) and its Genepool Expansion**

**Name of PI/Institute:** **Dr. Sadar Uddin Siddiqui,**  
PSO, Plant Genetic Resources Program (PGRP), NARC, Islamabad

**Duration:** 01-04-2016 to 01-03-2019

**Financial Status:**

Total Cost:	Rs.5.914 million
Funds Released:	Rs.1,030,500/-
Funds Utilized:	Rs.367,000/-

**Objectives:**

- To establish isolation cage facility (12 cages) for multiplication and seed production of cross-pollinated vegetable crops.
- To invigorate the stored seed of vegetable germplasm having low viability (700 accessions) and low vigor for saving it from complete loss.
- To characterize, multiply and rejuvenate cross-pollinated crops while maintaining their genetic integrity, for conservation in the genenank enabling its proper distribution and utilization.
- To acquire vegetable germplasm from local and overseas sources for gene pool expansion (300 accessions).

**Achievements: (3 months report)**

- Pollination with the placement of honey bees NUC was carried out with the collaboration of Honey Bees Research institute, NARC and it was successful. Similar NUC will be developed under this project for placement in isolation cages.
- The collected germplasm will add diversity to our collection and broaden the genetic base for breeding locally one adapted varieties. A first time collection of vegetables germplasm from plundri included local germplasm of cucumber.
- In these initial 3 months period, 60 accessions were acquired from abroad and 64 samples were collected from AJK and GB; that will add diversity to genebank collection broaden the genetic base.
- Our experiment with a prototype isolation cage revealed that rejuvenation of 3-4 crops per isolation cage (one accession each) is simultaneously possible. The current facility to be developed under the project will play a vital role in sustainability of germplasm. Area for the placement of isolation cages has been finalized.
- Pollinator bees significantly improved seed production in cages enabling to produce sufficient seed stock for conservation and utilization in R&D.



**Name of project:** **Germplasm Screening and Production Technology  
Development of Guar [Cyamopsis Tetragonoloba (L. Taub)]  
under Irrigated Conditions**

**Name of PI/Institute:** **Dr. Lal Hussain Akhtar,**  
Guar Botanist, Agricultural Research Station, Bahawalpur

**Duration:** 01-03-2016 to 01-02-2019

**Financial Status:**

Total Cost:	Rs.4.210 millions
Funds Released:	Rs.869,272/-
Funds Utilized:	Rs.855,267/-

**Objectives:**

- Screening of guar germplasm and development of high yielding guar varieties suitable for planting under irrigated areas of districts Bahawalpur, Lodhran and Cholistan.
- Guar production technology development for higher yield in irrigated areas.
- Seed multiplication and introduction of the most desirable guar varieties in irrigated areas of districts Bahawalpur, Lodhran and Cholistan.

**Achievements: (3 months report)**

- About 50 seed samples were collected from guar growing areas of Punjab, KPK, Sindh and Baluchistan Provinces and 117 accessions were obtained from PGRI, NARC, Islamabad.
- One site in each target area was selected keeping in view the soil type and availability of irrigation water.
- The trials for screening of collected and available guar germplasm were sown successfully on selected sites during the month of June.
- Collection of new germplasm of guar has enhanced genetic variability in the existing germplasm of guar of this station which will be utilized for development of new varieties of guar.

# **Agricultural Engineering**

## **Introduction**

Research in Agricultural Engineering focuses on design, development, adaptation, and promotion of energy efficient machines and precision agriculture particularly energy efficient farm machines for cereal, fruits, vegetables and other crops. The development of farm machinery for sowing/planting/transplanting and harvesting & threshing, variable rate planters, seed drills and fertilizer applicators is also prime objective of agriculture engineering. Furthermore, for performing on-farm post-harvest field operations such as grading, drying, processing and packaging of fruit & vegetables; on-farm processing and packaging of vegetables need special attention.

Agricultural Linkages Programme (ALP) project funding facility is a key source for R&D and playing a very important role in the promotion of farm mechanization in the country. Many engineering projects have successfully been completed with ALP funding so far and contributing a lot to the improvement of livelihood of poor farming community. Presently four AED research projects are in operation. Efforts are being made to coordinate and motivate provincial and national engineering institutions, research organizations, and universities involved in R&D to utilize this excellent project funding facility in order to contribute to the mechanization of agriculture in the country. ALP is an important source to fill the financial gap in agriculture research.

**Name of project:** **Design, Development and Modeling of a Scheffler Fixed Focus Solar Concentrator for the Post Harvest Processing of Different Agricultural Products**

**Name of PI/Institute:** **Dr. Anjum Munir,**  
Assistant Professor, Department of Farm Machinery and Power,  
University of Agriculture, Faisalabad

**Duration:** 02.02.2015 to 01-02-2018

**Financial Status:** Total Cost: Rs.3.917 million  
Funds Released: Rs.602,000/-  
Funds Utilized: Rs. 95,180/-

**Objectives:**

- To design and develop Scheffler fixed focus solar concentrator for processing of different perishable agricultural products.
- To develop mathematical models to predict the energy distribution from different components of solar system.
- To hybrid the solar distillation system with biomass energy to make it functional during adverse climatic conditions.
- To introduce this technology to the farmers to run their own small scale processing units at farm level using solar energy.

**Achievements:**

Prior to the initiation of this project, the PI of the project found an opportunity to visit Germany to attend a solar summer school which provided an extraordinary opportunity to have meeting and detailed discussion about activities of this ALP project with German Scientists (Prof. Dr. Oliver Hensel, Mr. Wolfgang Scheffler and Ms. Heike Hoedt). Planning regarding design and development of different components of Scheffler reflector and post-harvest technologies were thoroughly discussed and drawings were prepared accordingly and the list of material was also prepared for the development process in the next phase. Availability of material in the local market was checked and all the material was available in the local market. The local collaborative scientists regarding different post-harvest technologies and students were trained. Mathematical models were developed for pre-determination of different parameters.

**Name of project:** **Development and Commercialization of Ispaghul (Psyllium) and Kalongi (Nigella sativa) Processing Technologies for Value Addition**

**Name of PI/Institute:** **Dr Tanveer Ahmad,**  
Principal Engineer/ Director, Agricultural & Biological Engineering  
Institute (ABEI), NARC, Islamabad

**Duration:** 15.09.2015 to 15.08.2018

**Financial Status:**

Total Cost:	Rs. 34.983 millions
Funds Released:	Rs. 2,424,514/-
Funds Utilized:	Rs. 1,938,022/-

**Objectives:**

- To develop/adapt *Ispaghul* and, *Kalongi* processing technologies.
- To test and evaluate developed processing technologies for *Ispaghul* and, *Kalongi*.
- To commercialize *Ispaghul* and, *Kalongi* processing technologies.

**Achievements:**

- A survey was conducted to assess the current status of Ispaghul processing in Pakistan. It was found that in spite of a huge area suitable for psyllium seed production in Chulistan and Thar area of Pakistan, only 500 hectares in Chulistan and 1000 hectares in Thar regions are cultivated with psyllium crop because there are limited processing and market facilities for psyllium husk in Pakistan.
- The yield of psyllium seed is low and it ranges from 20kg to 350kg/acre. The market rate for psyllium seed is from Rs.6000/40kg to Rs.7000/40kg. the crop produced in Chulistan and Thar is marketed in Hasilpure, Bahawalpur. About 64 families own traditional Ispaghul processing in Pakistan for processing season of 3 month (April to June).
- An air classifier/cleaner for psyllium (Ispaghul) seed cleaning was developed and fabricated at ABEI prototype workshop.
- Specifications of psyllium (Ispaghul) processing unit were prepared and correspondence to comply with specifications is going on with manufacturers in India, China and Turkey.
- Development of Kalongi thresher is in progress.

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

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

**Duration:**                            01.03.2012 to 29.06.2016

**Financial Status:**                Total Cost:                    Rs. 38.982 million  
   Funds Released:           Rs. 29,083,144/-  
   Funds Utilized:            Rs. 27,919,891/-

**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 most types of nursery plants under shade/green house at large scale.
- To demonstrate and disseminate the technology among the local manufacturers, commercial nursery growers, Government bodies, farmers and NGOs.

**Achievements:**

- Prepared detailed specifications of floor for raw material grinding, sieving and mixing, store cum office, water storage tank, machinery shed, water and electric supply lines with the help of Directorate of works. The documents of material and cost estimates prepared as per Pakistan Institute of Cost and Contract (PICC) references but delayed till the availability of pot filling plant and earth filling at project site (land leveling).
- Continued civil work and it includes CC floor & road work, two machinery shades for pot filling and compost grinding, sieving, water storage tank, office and store, water pump, complete electrical wiring for all machinery, new separate transformer and meter connection etc. the total civil work has been completed.
- Installation of pot filling plant started after completion partially completed machinery shade and floor during report period.
- Pot filling plant installed in the month of August 2015 and its test & trial completed.
- Erection of compost plant started after finishing of floor with machinery shed and completed during the 1<sup>st</sup> week of January 2016 and its test and trials completed.
- Inaugural of a plant by Federal Secretary along with Federal Minister of MNF&S was conducted on 12 January 2016.
- Earthen floor for open sunlight plants establishment about 80% works has been completed.
- Completed cemented roads from potting plant to green houses to main road.

**Name of project:** **Development and Evaluation of an In-bin Seed Drying, Aeration and Storage Technology”. (CS-006)**

**Name of PI/Institute:** **Mr. Liaquat Ali Shahid,**  
Principal Engineer, ABEL, NARC, Islamabad

**Duration:** 01.10.2012 to 31.12.2015

**Financial Status:** Total Cost: Rs. 5.030 million  
Funds Released: Rs. 4,422,237/-  
Funds Utilized: Rs. 4,135,409/-

**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:**

Survey results revealed that most of the seed companies and traders have no bin type mechanical seed drying & storage facility. They prefer to buy manually harvested paddy having moisture content not more than 17%. They done paddy sun drying for 2-3 days and then stored the seed in jute bags. They were willing to use the in-bin seed drying and storage technology if it did not affect the quality and emergence capability of their stored seed.

Keeping in view the end-users feedback and survey results, a prototype storage bin cum seed dryer was designed and developed. The unit specifications were finalized then accordingly, the unit production drawings were prepared. In the follow-up, a potential machinery manufacturer was selected and technical assistance was provided to the manufacturer at his premises during fabrication of prototype unit. Prototype unit was delivered at ABEL, NARC during the third week of June, 2014.

The prototype unit was evaluated at farmer’s field in Gujranwala area for drying of paddy super kernel variety. Three tests were performed and field results were analyzed. Results revealed that the average seed moisture contents from 21% to 15.5% in about forty eight hours. The total and operational cost was worked out to be Rs.1513/- per ton of paddy seed.

A one day field seminar/demonstration of prototype unit was also arranged at farm level in Gujranwala area, which was attended of seed industry, traders, millers, progressive farmers. researchers, rice experts, engineers, manufacturers, and field staff.



**Prototype Unit**



**Final Unit**

# **Social Sciences**

## **Introduction**

The SSD established its network of social sciences research in 1984 by establishing Agricultural Economics Research Units (now upgraded as Social Sciences Research Institutes) at provincial and federal levels and one each at AJK and Gilgit-Baltistan. The main objective of these units was to carry out research on socio-economic aspects of grass root level farmers in Pakistan. Moreover the PARC extended a helping arm to provincial agricultural research systems. This has not only bridged an information gap on micro-level issues of farming and technology adoption as well as resulted into development of new crop, livestock and farm machinery related technologies in the country.

The research work of SSD was in the areas of diagnostic surveys, monitoring technology adoption and diffusion, prioritization of agricultural research, agricultural marketing and value chain analysis, food and nutritional security and policy impacts, etc. however, financial resources allocation by government of Pakistan has never been enough to meet the research demand. Consequently, the research output in various thematic areas has been below optimum. ALP is a good source of funding to bridge the financial gaps.

During 2015-16, total 4 projects falling under various research theme of SSD program with aggregate cost of Rs.29.967 million.

The following themes are the present focus of SSD research under ALP funding.

1. Agriculture production and resource conservation.
2. Agricultural transformations and diversification.
3. Agricultural marketing and value chains.
4. Globalization and trade.
5. Food and nutritional security.
6. Agricultural livelihoods and rural poverty.
7. Agricultural policy analysis.
8. Climate change adaptation, risk and uncertainty.
9. Smallholder agriculture.
10. Gender mainstreaming in agriculture.
11. Technology transfer and impact assessment.
12. Indigenous knowledge management, sharing and capacity building.



**Name of Project:**           **Capacity Building on Writing Technical Proposals for Grants  
PARC, Islamabad**

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

**Duration:**                   01.10.2012 to 30.09.2015

**Financial Status:**       Total Cost:           Rs. 14.420 millions  
Funds Released:   Rs. 3,425,000/-  
Funds Utilized:    Rs. 5,322,000/-

**Objectives:**

This project aims to focus on this area of capacity building of the scientist to win grant for research with following objectives:

- Scientists' capacity building in writing skills for technical proposals for competitive grants under ALP.
- Develop a culture of quality technical proposal writing.

**Achievements:**

Proposal writing is a skill which is developed to address a strategic need identified by the organization or to solve a problem and provide with the resources to accomplish these strategic goals. Good proposal writing is essential for a research organization to fulfill its mandate. PARC has been authorized to implement the Agricultural Linkage Program (ALP) having procedure for submitting, processing and approval of projects. Under the current financial situation the research grants are the dominant way for academia and researchers to get resources to focus on research in the country. However, the researchers are not well familiar with the development of research proposal resulting in failure to win funds for research from competitive sources. Therefore, there is a great need to build capacity of the NARS researchers in writing technical proposals for competitive grants.

Various training modules were prepared, tested and adopted for practical training. Three training workshops were organized; one each for scientists of Khyber Pakhtunkhwa, Azad Jammu & Kashmir and Gilgit Baltistan. Floating of network of scientists trained on face book, the facebook page of the proposal writing can be accessed at; <https://www.facebook.com/pages/Writing-Tech-Proposals-ALP/249571378578766>.

A one day workshop on Psychological Resilience Development for 20 senior management members (from CSO to Chairman level) was organized at PARC HQs. Two experts from United Kingdom delivered the workshop sessions

A total of 114 scientists and educators were trained in the Technical Proposal Writing for Grants under ALP. Another additional one day workshop was organized at University of Haripur, KPK where in more than 50 university faculty members were trained in proposal writing.

More than 100 proposal prepared and refined during the workshops were submitted to ALP, largest number coming from Baluchistan. More than 50% short listed for making full blown projects.

Monitoring and Evaluation Training planned and started in consultation with PSSP and ICIMOD experts to being executed under the extended period and same cost.



**Chairman PARC, DG-NARC, DGP&DD, Team Leader PSSP, Project Trainers with Trainees from GB in Opening Session of Seventh Workshop**

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

**Name of PI/Institute:** **Mr. Nadeem Akmal,**  
Sr. Scientific Officer, Social Sciences Institute Research (SSRI),  
NARC

**Duration:** 01.10.2012 to 30.09.2015

**Financial Status:** Total Cost: Rs. 3.596 millions  
Funds Released: Rs. 3,133,640/-  
Funds Utilized: Rs. 2,255,899/-

**Objectives:**

The project focuses on calculating the economics of alternative energy sources and energy saving practices on rural household livelihood in Pakistan.

- To study the economics of alternative energy sources currently used in agriculture sector in selected ecologies of Pakistan.
- To study the adoption of energy saving practices by farmers in different cropping system.
- To carry out the comparative economic 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 source.

**Achievements:**

More than two third of Pakistan's population lives in rural areas and their livelihood continue to revolve around agriculture and allied activities. Energy has become an important requisite for economic development of a country. Besides influencing other sectors of the economy, the increase in energy prices has influenced the agricultural sector of Pakistan. Due to energy crises the farmers have diverted their attentions to the use of alternative energy sources like bio gas, solar water pumps and wind energy for water pumping. The current study is the first study regarding the economics of using alternative energy sources in Pakistan.

Questionnaire was developed to ensure that no any information will be overlooked. Data was collected from respondent farmers using alternative energy sources and analyzed.

Bio-gas and Solar technology are found rare but emerging alternative energy sources at study sites. Based on farmers' information and preliminary analysis, the sophisticated bio-gas plant could be considered as the most feasible and economical alternative energy source followed by electric and diesel, but it could not be used as a sole source of energy rather it is supplemented with diesel.

Bio-slurry, a byproduct of bio-gas, is applied as an organic fertilizer through irrigation water. All the respondent farmers reported a substantial raise in crops yield (15-25 percent) and soil fertility with the application of bio-slurry. It also has reduced the use of DAP and Urea.

Another significant finding was the Raised Bed Plantation technique, which conserves energy through reducing irrigation time from 15-20 percent as well as increases yield (5-10 percent).

Laser Land leveling and dry sowing technologies are found in practiced by farmers being considered as resources saving. Based on farmers' information and preliminary analysis, the Laser leveling could be considered as the most feasible and economical way of energy and resource conservation. Beside the energy saving it also increased the yield and improvement in soil condition.

Dry sowing is practiced as water saving technology. This technology is practiced in rice wheat cropping patterns to save the irrigation water and cost. All the respondent farmers reported a substantial difference in number of irrigations as compared to traditional rice sowing practices. Beside the irrigation water it has also reduced the use of DAP and Urea. For Dry Rice sowing, it is hard to comment that this technology will be adopted in future without strong dissemination process and technical back up as farmer are convinced to some extent but proper technological backup is required.

In order to promote tea on marginal lands including hilly terrains, foot hills and grassy lands, surveyed 50 acres area in district Mansehra for site selection for developing tea demonstration plots and water infrastructure at farmer's field. On the basis of soil pH from 8 farmer's field, three intending growers were selected in union council Sum, Khaki and Tanawal in Mansehra. About 10,000 tea sapling of variety Q-men were planted at Sum and 7500 at Khaki during

February-March, 2015. To maximize fresh leaves yield and to improve profitability of existing tea gardens, growers at Sum and Battang Sydan were provided inputs (fertilizer) for 6 acres tea crop during March, 2015.

A one day training workshop was arranged on January 16, 2015 about objectives of the project, tea plantation and proper care and management of tea. Twenty five intending growers of different communities from different union councils participated in the workshop meeting.



**Tea Plantation and Irrigation System at Khaki**

**Name of Project:**            **Agricultural Productivity in Relation to Farmer's Nutritional Status of Mardan (The University of Agriculture, Peshawar)**

**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 millions  
Funds Released:    Rs. 3,628,160/-  
Funds Utilized:    Rs. 3,024,367.69/-

**Objectives:**

Objectives of the study are as follows:

- To assess the nutritional status of farmers using anthropometry, biochemical and dietary assessment tools.
- To evaluate the effect of nutritional status of farmers on agricultural productivity and farm income.
- To provide baseline information on nutritional status of farmers and use these in development of appropriate nutritional intervention.
- To assess dietary pattern of farmers in relation to their nutritional status.
- To study the effect of nutritional education on behavioral changes of farmers towards quality food intake and eating practices.

**Achievements:**

Agriculture is the backbone of Pakistan economy contributing 45% to the country's employment and provides input to the agro based industries. There is a synergistic relationship between nutritional status and physical performance, cognitive and agricultural productivity. The link between nutrition and productivity arguably provides the best documented evidence on interrelationships between health and economic prosperity. Thus farmers deserve preferential treatment because of their multiple responsibilities in agricultural and social sectors. The research project is designed to assess the nutritional status of farmers and its link with agricultural productivity and to determine the effect of nutrition education of farmer's food quality and nutritional status in district Mardan, Khyber Pakhtunkhwa.

Nutritional status of the 1200 farmers from 20 union council of Mardan district enrolled for study were assessed taking their anthropometry (body weight, height, mid upper arm circumference (MUAC) & triceps skinfold measurement (TSF), biochemical measurement (random blood glucose level and hemoglobin) and blood pressure. The data was recorded and

analyzed. The detail is provided in the progress report. Some of the major conclusions of the study are:

- According to World Health Organization (WHO) criteria of BMI and blood Hb level, 85 (7%) and 178 (15%) of the farmers were underweight and anemic respectively. Overall, 226 (19%) of farmers were malnourished.
- 'Number of working hours per day' was found a significant indicator of the farmer's working performance in the farm. Overall, farmers with better nutritional status had maximum farming work capacity. Additionally higher number of malnourished than normal farmers reported to have general health problems and to get fatigue after short physical activity in the farm.
- More than half of the farmers were owner of their agricultural farms. No difference in mean farms sizes were found between well-nourished and malnourished groups. Total of 196 (58%) farmers reported to have other than agricultural income sources as well; however farmers with and without additional monthly incomes were equally distributed among healthy and malnourished groups.
- Among the major crops, almost whole of the cohort cultivated wheat (96%) followed by tobacco (65%); vegetable were grown only by 30% of farmers. Farmers reported genuine reason for not cultivating the major cash crop frequently i.e. tobacco.
- Result on 'per acre cost' on various components of wheat crop show that malnourished farmers had on average higher 'per acre cost'. Similarly both gross and net revenues generated from wheat crop (grain and straw) were significantly different among the groups; it was significantly lower for malnourished group irrespective of the land ownership status and farm size.
- On average, mean net return from the cattle milk of malnourished group was significantly lower than those of control group,
- Malnourished group consumed most of the nutrients rich food items in lesser quantity than control group. Meat based diets and fresh fruits were consumed with small amount by the malnourished group compared to normal farmers. Similarly more malnourished farmers showed unhealthy dietary pattern than the control.
- Comparing to control group, malnourished farmers were likely to have lower dietary intake of protein, fibre, phosphorus, heme iron, vitamin A, riboflavin and niacin.





**PAKISTAN AGRICULTURAL RESEARCH COUNCIL**  
**PROCEDURES FOR**  
**AGRICULTURAL LINKAGES PROGRAMME (ALP)**

**1. INTRODUCTION**

The Government of Pakistan and Government of the United States of America recalling the close ties in scientific and technological cooperation which have developed over several decades have gone into an agreement to create an Agricultural Linkages Program (ALP) to reap the mutual benefits of agricultural research through joint research projects and exchange of scientists. The covenant of the Agreement provides that the local currency generated through the sale proceeds of the wheat will be used by Pakistan Agricultural Research Council (PARC) to establish the ALP for promoting research cooperation between Pakistan and the USA in the areas of agricultural sciences. The Government of Pakistan allowed PARC to establish an Agricultural Research Endowment Fund (AREF) where all proceeds raised from the sale of US wheat shall be transferred. Fund received will be invested in government approved schemes/institutes. The income thus generated shall be used for ALP activities/projects in line with the Pakistan's long term research/development goals for the agriculture sector. The goals focus on food security, poverty alleviation and promoting broad based equitable and sustainable agriculture.

The Fund provides for all the operational research and development expenditure including supplies and material and local travel for the research personnel to be deployed under the projects. Non-recurring expenditure on items of non-expendable equipment, capital goods, structures and transport facilities having anticipated usefulness beyond fixed duration of each project will be purchased sparingly.

**2. OBJECTIVE**

The objective of the ALP shall be to promote and support agricultural research and development activities in accordance with the Pakistan's long term development goals and to

promote long term scientific cooperation between Pakistan and the United States in agricultural sector.

### **3. SCOPE OF COOPERATION**

The scope of agricultural research and development activities, which the ALP may promote and support shall cover all scientific activities related to agriculture including production, processing, marketing and agricultural services. The ALP shall give emphasis, but need not limit to its efforts to the support of strategic research, which improves farm and animal productivity, and in the areas which directly or indirectly affect the achievement of these objectives.

### **4. POWERS OF THE ALP FUND**

The ALP Fund shall be an independent entity and shall possess all of the powers necessary to carry out its objectives including but not limited to the powers to:

- 4.1 *promote and support, by funding or otherwise agricultural research and development projects of mutual benefit;*
- 4.2 *encourage and support the exchange of agricultural scientists and other type of agricultural experts.*

### **5. FINANCIAL AND ACCOUNTING SYSTEM**

The PARC financial, accounting and auditing system will be adopted for the implementation of ALP.

#### **1. OPERATIONS**

Pakistan Agricultural Research Council shall be responsible for operation of ALP Fund. The ALP Fund's operations shall consist mainly of the selection, processing, approval, monitoring, evaluation and coordination of projects supported in whole or in part by the Fund. The primary source of such Funding shall be from the income of the Fund. The Fund shall

minimize in annual operational costs in order to permit the maximum utilization of its resources to support agricultural research and development and will do so by using effectively the existing mechanisms of PARC.

- 6.1 The Fund shall accept proposals for research and development grants from all public or private entities which demonstrate needed research and development (R&D) capabilities and financial responsibilities.
- 6.2 The Fund shall encourage project proposals to be developed and submitted jointly by the Pakistani and US scientists. The Fund will assist applicants who submit proposals singly to identify collaborators in the other country.
- 6.3 Proposals may cover any or all R&D phases including initial feasibility (pre-research and pre-development), research and development.
- 6.4 All proposals shall be submitted to the Director Planning, PARC, Executive Director, ALP.
- 6.5 All proposal for R&D projects and feasibility studies are to be judged and evaluated by the technical experts/referees in Pakistan and overseas collaborating scientists. The final ranking will be made by the Technical Advisory Committee (TAC).
- 6.6 The recommendation of TAC will be submitted to BOD for final approval and allocation of ALP annual budget.
- 6.7 The Fund shall support research and development projects generally for a period of up to 3 years. Extensions beyond three years will require approval of the Technical Advisory Committee. Each project incharge shall submit to the Director Planning, PARC an annually progress report for review. Funding of projects that do not show adequate progress may be withheld.

## **7. MANAGEMENT SYSTEM**

A management system will establish the ALP Fund's Programme and Priorities and its financial and managerial policies. Board of Directors shall be the governing body of ALP Fund and shall be responsible for the Fund's programme and its financial and managerial policies. The Board shall consist of:

### **7.1 BOARD OF DIRECTORS**

- Chairman, PARC.

Chairman

• Provincial Addl. Chief Secretaries (4)	Member
• Senior Chief (Agri. and Food Sec.) P & D Division	Member
• Agricultural Development Commissioner, MINFAL	Member
• All Members, PARC	Member
• Representation of Stakeholders (2)	Mr Afaq Ahmad Tiwana, Chief Executive, Farmers Associates Pakistan
• D.G. P&D Div./Exe. Director (ALP),PARC	Member/Secretary

### **7.1.1 Terms of Reference (TOR) of Board of Directors**

7.1.1.1 adopt bylaws, rules and procedures for the conduct of its activities;

7.1.1.2 establish the organizational frame-work of the Fund;

7.1.1.3 appoint Technical Experts and Reviewers and Technical Advisors for review and evaluation of the proposals .

7.1.1.4 accept contributions of property , funds, and services;

7.1.1.5 exercise and delegate any other powers of the Fund not otherwise specifically assigned by this document.

### **7.2 ALP SECRETARIAT**

The Planning Directorate of PARC will act as ALP Secretariat. Necessary manpower and logistic facilities will be drawn from within PARC resources and the necessary operational expenditure will be met out of ALP fund.

## **7.2.1 EXECUTIVE DIRECTOR**

*7.2.1.1 The Director Planning, PARC will be the Executive Director of ALP and will act as Administrative Officer(AO) of the Fund. The Executive Director will be responsible for the administration and operation of the Fund under the authority and powers assigned by BOD. The office of the Executive Director will be located at PARC.*

7.2.1.2 The Executive Director shall exercise all powers delegated to him by the BOD.

7.2.2 The Executive Director shall, among other things:

7.2.2.1 refer proposals submitted for ALP funding to the Technical Expert/Reviewer and TAC.

7.2.2.2 based on recommendations of the Technical Expert and TAC, prepare and submit to the Board for its approval the annual research and development program, their annual budget, and long term plans for the utilization of the Fund's resources;

7.2.2.3 compile annual reports, organize monitoring, review and evaluation of ALP projects/programmes and compile the audit/financial reports of ALP.

7.2.3 The Executive Director may organize and facilitate various activities falling under the Fund's objectives.

7.2.4 The Executive Director shall maintain an appropriate system of internal control, books and records (technical and financial).

## **8. MODE OF SUBMISSION OF SCHEMES**

Initially concept papers will be invited on the prescribed proforma through advertisement. After preliminary evaluation of the concept papers, the sponsor will be requested to submit a detailed/full blown project proposal for final evaluation and processing by the ALP Secretariat. Successful sponsor will be notified and an agreement to implement the project will be signed between the sponsor and PARC.

## **9. PROCESSING OF THE PROJECT**

The project proposals will be processed in accordance with the procedures approved by the BOD of ALP Endowment Fund. The project approval process will include.

*9.1 The concept papers will be invited from the scientists through advertisement not exceeding 3-4 pages with one page budget estimates in priority areas of national importance.*

- 9.2 Appraisal of concept papers by ALP Secretariat through technical divisions of PARC.
- 9.3 Invite detailed proposals in the light of recommendations by the technical division, PARC.
- 9.4 Review of detailed proposals by the cooperating scientists and two national referees.
- 9.5 Submission of detailed projects to TAC alongwith recommendation of national international referees for concurrence.
- 9.6 Implementation Agreement between the sponsor and PARC.
- 9.7 Issuance of Administrative approval of the project.
- 9.8 Monitoring, review and evaluation of the projects/programmes will be organized by the Planning Directorate, PARC.
- 9.9 Annual progress/review of ALP by BOD.

#### **9.10 Technical Advisory Committee.**

- |  |  |
|--|--|
| - Chairman, PARC   | Chairman                                       |
| - All Members, PARC  | Members  |
| - Provincial DG Research (4)                                       | Members  |
| - Eminent Scientists (4)   | i. Dr Naeem Iqbal Hashmi, Ex-CSO (PSD), PARC   |
|  | ii. Dr Haleem-ul-Husnain, Ex-Member(ASD), PARC |
|  | iii. Dr Syed Muhammad Iqbal Shah, Ex-V.C., UAP |
|  | iv. Dr Munir Ahmad, Ex-Member (SSD), PARC      |
| - D.G. Planning & Dev. Division/<br>Executive Director (ALP), PARC | Member/Secretary                               |

### **10. REPORTING AND DISSEMINATION OF RESEARCH RESULTS**

- 10.1 The Incharge of ALP project shall ensure timely and regular submission of financial and technical progress reports to PARC on the prescribed proforma.
- 10.2 On termination of the project, final financial report and completion report will be submitted for evaluation and settlement of accounts with ALPS, PARC.
- 10.3 Any additional information required by the ALP Secretariat shall be supplied by the concerned project Incharge.
- 10.4 The projects findings will be disseminated to all the stake- holders, public and private institutions.

### **11. RECRUITMENT IN THE PROJECT**

As a general policy, ALP does not provide for recruitment of regular staff. ALP assumes that the host institutes have sufficient trained human resources and with some essential

operational/financial support, the institute will successfully run the project. However, under specific and unavoidable situations, restricted contract appointments shall be allowed as per prevalent govt. policy.

## **12. HONORARIUM**

An honorarium equal to one month's salary will be given to the incharge of the project per year. Honorarium to other officers/project staff associated with ALP can only be allowed with the prior approval of BOD.

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## Annexure-II

### *Region and Sector wise Number of ALP Funded Completed Projects as on 31.07.2016*

<i>Region/Sector</i>	<i>AS</i>	<i>PS</i>	<i>NR</i>	<i>SS</i>	<i>Total</i>
Federal PARC/NARC	17	44	22	06	<b>89</b>
PARC (Outstation)	08	11	17	10	<b>46</b>
Punjab	34	34	15	09	<b>92</b>
Sindh	10	11	03	03	<b>27</b>
Khyber Pakhtunkhwa	08	22	12	03	<b>45</b>
Balochistan	06	06	03	01	<b>16</b>
Gilgit Baltistan	01	-	-	-	<b>01</b>
FATA	-	01	01	-	<b>02</b>
Other Federal	02	26	08		<b>36</b>
Azad Jammu & Kashmir	01	-	01	-	<b>02</b>
NGO/Other	01	01	-	02	<b>04</b>
<b>Total</b>	<b>88</b>	<b>156</b>	<b>82</b>	<b>34</b>	<b>360</b>

### *Region and Sector wise Cost Approved of ALP Funded Completed Projects as on 31.07.2016*

<i>Region/Sector</i>	<i>AS</i>	<i>PS</i>	<i>NR</i>	<i>SS</i>	<i>Total</i>
Federal PARC/NARC	81.119	182.734	151.806	33.402	<b>449.061</b>
PARC (Outstation)	29.151	46.221	87.412	41.866	<b>204.650</b>
Punjab	146.294	83.189	51.220	17.228	<b>297.931</b>
Sindh	34.771	28.080	11.134	2.408	<b>76.393</b>
Khyber Pakhtunkhwa	24.204	52.067	34.330	9.930	<b>120.531</b>
Balochistan	24.854	14.756	6.619	1.865	<b>48.094</b>
Gilgit Baltistan	1.740	-	-	-	<b>1.740</b>
FATA	-	1.495	4.979	-	<b>6.474</b>
Other Federal	4.503	72.596	27.295	-	<b>104.394</b>
Azad Jammu & Kashmir	0.750	-	1.150	-	<b>1.900</b>
NGO/Other	9.414	2.962	-	32.878	<b>45.254</b>
<b>Total</b>	<b>356.800</b>	<b>484.100</b>	<b>375.945</b>	<b>139.577</b>	<b>1356.422</b>

## **Priority Areas for 7<sup>th</sup> Batch**

### **ANIMAL SCIENCES DIVISION**

#### **Animal Production**

- Development of novel feed resources, feeding technologies and strategies for farm animals.
- Improving techniques for conservation of farm animals genetic resources.
- Improving Assisted Reproductive Techniques (ART) for enhancing productivity of farm animals.
- Improvement in production practices of highland bovine and ovine species and documenting changes in transhumance production systems of small ruminants.
- Genetic improvement for enhancing rural/ backyard poultry productivity.
- Studies to identify the potential of various geographical areas for establishment of disease free zones and organic meat production.
- Development of low cost animal housing and feeding management techniques for better output from native and exotic breeds.

#### **Animal Health**

- Diagnostic studies on feed born nutritional disorders in farm animals and poultry.
- Promoting 'one health concept' for prevention and control of zoonotic diseases.
- Patho-biology of Highly Pathogenic and Emerging Diseases (HPED) of livestock and poultry.

#### **Fisheries**

- Improving techniques for enhancing the shelf life of fish.
- Brood stock development and quality seed production of fish.
- Fish productivity enhancement through improved feeding and management techniques.

### **PLANT SCIENCES DIVISION**

- Combating emerging and re-emerging diseases and pests of the field and horticultural crops.
- Development of bio-pesticides/ herbicides for management of economic pests especially for horticultural crops.
- Post harvest management of field and horticultural crops.
- Product processing, value addition and commercial innovation in horticultural and cereal crops.
- Indigenization of techniques and procedures for developing certified fruit plant nurseries through public-private partnership.

- Development of techniques and systems for vegetable seed production and high density plantation of fruit orchards.
- Development of agronomic techniques for different ecological zones to enhance crop productivity through resource conservation.
- Optimization of kitchen gardening techniques and strategies.
- Genetic resource development, production and processing techniques for medicinal and aromatic plants.
- Utilization of marginal/cultivable wasteland for orchards management through introduction of high value horticultural crops.
- Optimization of tissue culture techniques for seedlings production in horticultural crops.
- Development of high yielding hybrids of horticultural crops through modern and conventional techniques.
- Development of saline/drought resistant varieties of multi-cut fodder crops.
- Climate change impact assessment and its mitigation to enhance resilience of various cropping systems through genetic and agronomic management.
- Development and indigenization of cost effective and energy efficient farm mechanization technology.
- Promotion of cropping system for high cropping intensity synchronized with agro-ecological conditions.
- Application of genomics, proteomics and metabolomics for crop improvement.

#### **NATURAL RESOURCES DIVISION**

- Development of management strategies for climate change impacts, declining biological resources, desertification and fragile watershed.
- Harnessing alternate energy resources for decentralized energy systems in rural areas.
- Biological and chemical approaches for management of degraded soils.
- Health risk assessment and remedial measures of contaminations in food chain.
- Integrated nutrient management and fertigation for intensive crop production.
- Agricultural productivity improvement in arid areas (Sailaba, Khushkaba, Rod Kohi & Wastelands).
- Integrated agricultural water management for increased water productivity.
- Safe use of solid waste, wastewater and low quality water in agriculture.
- Improving Range and Livestock Productivity with integrated range-livestock approach.
- Range status and trend assessments, sustainable range management and valuation of range ecosystem services.
- Genetic improvement of *Apis cerana*, quality honey production and development of value added products from honey bee colonies (bee hives).
- Arid horticulture: promotion and value addition of fruits and vegetables.
- Cultivation and value addition of medicinal, aromatic and culinary herbs.
- Sustainable development of fragile ecosystems (mangroves, dry temperate forests, riparian region etc.)

#### **SOCIAL SCIENCES DIVISION**

- Impact of technology transfer and adoption of agriculture technologies
- System based resource allocation
- Impact of climate change on agriculture
- Dynamics of comparative advantage and competitiveness of agriculture
- Food and agricultural policy analysis
- Agricultural diversification and implications
- Agricultural value chains analysis
- Agriculture pricing and trade