

Executive Summary

1. Introduction

PARC is operating the Agricultural Research Endowment Fund (AREF), established by the Government of Pakistan in 1999 for Rs.1.3 billion for Agricultural Linkages Program (ALP). The objectives of ALP is 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 agriculture sector.

PARC is responsible for operation of ALP funds. It includes selection, processing, approval, monitoring, evaluation and coordination of projects, supported in whole or in part by the fund. The Planning Directorate of PARC is the Secretariat of ALP and Director (Planning) is the Executive Director of the fund. The ALP has its own management system and the Board of Directors (BOD) is the governing body of ALP fund responsible for the fund's program and its financial and managerial policies.

2. Progress

Since inception of the ALP, three batches of projects have been launched for funding. The 4th batch announced in July 2008 has invited research proposals in the priorities area. Research projects of 4th batch are under process of approval.

The ALP projects covers plant sciences, natural resources, animal sciences and social sciences sectors. In total 229 projects have been completed by June 30, 2009, whereas 53 were in operation as on July 1, 2009. The sector wise numbers of projects completed by June 30, 2009 in various research institutes and universities are as follows:

Completed Projects by June 30, 2009:

S.No	Name of Institutions	No of Projects				Total
		Animal Sciences	Crop Sciences	Natural Resources	Social Sciences	
Federal						
1	PARC/NARC, Islamabad	12	31	09	04	56
2	AZRC-PARC, Quetta	1	-	03	-	04
3	PCRWR, Islamabad	-	-	02	-	02
4	NIAB, Faisalabad	-	04	01	-	05
5	NIBGE, Faisalabad	02	05	01	-	08
6	NIFA, Peshawar	-	05	-	-	05
7	NIA, Tandojam	-	05	-	-	05
8	SARC-PARC, Karachi	02	05	-	-	07
9	PFI, Peshawar	-	-	01	-	01
10	TTI-PARC, Peshawar	-	-	-	01	01
11	TTI-PARC, Tandojam	-	-	-	02	02
12	TTI-PARC, Faisalabad	-	-	-	01	01
13	TTI-PARC, Quetta	-	-	-	01	01
14	TTI-PARC, Muzaffarabad, AJ&K	-	-	-	01	01
15	TTI-PARC, Gilgit	-	-	-	01	01

16	MARC-PARC, Juglot, Gilgat	01	-	-	-	01
17	CABI Bio Sciences, Rawalpindi	-	02	-	-	02
18	PARC-IPM, Sun station, Multan	-	01	-	-	01
	Total	18	58	17	11	104
Punjab						
19	University of Agriculture, Faisalabad	15	09	08	07	39
20	PMAS Arid Agri. Uni., Rawalpindi	-	06	02	01	09
21	UVAS, Lahore	05	-	-	-	05
22	AARI, Faisalabad	-	05	01	-	06
23	RRI, Kala Shah Kaku	-	01	-	-	01
24	BARI, Chakwal	-	02	-	-	02
25	SSRI, Pindi Bhattain	-	-	01	-	01
26	LPRI, Bahadurnagar, Okara	01	-	-	-	01
27	Fisheries Hatchery, Govt. of Punjab, Rawal Town, Islamabad	01	-	-	-	01
28	University of Punjab, Lahore	-	-	-	01	01
29	B.Z.U., Multan	-	01	-	-	01
30	Green Bio Tech., Lahore	-	-	-	01	01
	Total	22	24	12	10	68
Sindh						
31	Shah Abdul Latif Uni., Khairpur	-	-	01	-	01
32	University of Karachi, Karachi	03	05	-	-	08
33	Sindh Agri. University, Tandojam	01	-	-	02	03
34	ARI, Tandojam	-	02	-	-	02
35	Kundi Buffalos Farm, Rohri	01	-	-	-	01
36	Indus Dev. Resource Centre, Sehwan Sharif, Sindh	01	-	-	-	01
37	University of Sindh, Jamshoro	-	-	-	01	01
	Total	06	07	01	03	17
NWFP						
38	NWFP Agri. University, Peshawar	03	08	07	01	19
39	Gomal University, D. I. Khan	-	01	01	-	02
40	ARI, Tarnab, Peshawar	-	02	01	-	03
41	ARS, Mangora, Swat	-	01	-	-	01
42	CCRI, Pirsabak	-	01	-	-	01
43	VRI, Peshawar	02	-	-	-	02
44	ARI, D. I. Khan	-	02	-	-	02
45	BARS, Jarma. Kohat	-	01	-	-	01
	Total	05	16	09	01	31
Balochistan						
46	University of Balochistan, Quetta	01	01	-	01	03
47	ARI, Sariab, Quetta	-	03	02	-	05
	Total	01	04	02	01	08
Azad Jammu & Kashmir						
48	Agri. Department, Muzaffarabad	-	-	01	-	01
	Total	-	-	01	-	01
	Grand Total	52	109	42	26	229

The list of completed projects showing the title, name of PI/Institute, total cost, releases and expenditure is given in Annexure-I. The ongoing research projects are in operational stage and research is being continued as per objectives and plan of work. The province and institute wise detail of the ongoing projects is as follows:

On-Going Projects as on July 1, 2009

S. No	Name of Institutions	No of Projects				Total
		Animal Sciences	Crop Sciences	Natural Resources	Social Sciences	
Federal						
1	PARC/NARC, Islamabad	02	05	03	-	10
2	AZRC-PARC, Quetta	-	-	01	-	01
3	NIAB, Faisalabad	-	01	01	-	02
4	NIBGE, Faisalabad	-	01	-	-	01
5	NIFA, Peshawar	-	01	02	-	03
6	SARC-PARC, Karachi	-	01	-	-	01
7	NSCRI-PARC, Thatta	-	01	-	-	01
8	TTI-PARC, Tandojam	-	-	-	01	01
9	CABI Bio Sciences, Rawalpindi	-	01	-	-	01
	Total	02	11	07	01	21
Punjab						
10	University of Agriculture, Faisalabad	02	03	02	-	07
11	PMAS Arid Agri. Uni., Rawalpindi	-	01	-	-	01
12	UVAS, Lahore	04	-	-	-	04
13	AARI, Faisalabad	-	02	-	-	02
14	BARI, Chakwal	-	01	-	-	01
15	Shakar Ganj Sugar Res. Inst., Jhang	-	01	-	-	01
	Total	06	08	02	-	16
Sindh						
16	University of Sindh, Jamshoro	01	01	-	-	02
17	ARI, Tandojam	-	02	01	-	03
18	SHRI, Mir Pur	-	01	-	-	01
	Total	01	04	01	-	06
NWFP						
19	NWFP Agri. University, Peshawar	-	01	-	-	01
20	ARI, Tarnab, Peshawar	-	01	01	-	02
21	ARI, D. I. Khan	-	01	-	-	01
22	ARS, Karak	-	-	01	-	01
23	Sugar Crop Res. Inst. Mardan	-	01	-	-	01
24	Al-Moiz Indus. D. I. Khan	-	01	-	-	01
	Total	-	05	02	-	07
Balochistan						
25	ARI, Sariab, Quetta	-	-	01	-	01
26	University of Balochistan, Quetta	01	-	-	-	01
	Total	01	-	01	-	02
FATA						
27	Agri. Research (FATA), Parachinnar, Kurram Agency	-	01	-	-	01

	<i>Total</i>	-	<i>01</i>	-	-	<i>01</i>
	Grand Total	10	29	13	01	53

The list of ongoing projects which remain in operation as on July 1, 2009 is given at Annexure-II.

Research is being conducted under ongoing ALP research projects on improvement and standardization of vaccine for important diseases of animals, epidemiology of major animal diseases, alternate feed resources, micronutrient feed resources, cryopreservation of buffaloes semen, mastitis control, feed for intensive fish and shellfish culture, epidemiology and control of fish diseases, maintenance of genetic diversity, crop improvement, post harvest management, integrated pest management, improved technology, development of new varieties, weed management, micro-nutrient management of fruit plants, soil fertility and crop productivity, management of salt affected soil and brackish water, recycling of organic wastes and impact of sewage wastes on soil properties, water harvesting and quality management, plant growth through use of nitrogen, rhizobial inoculation & biofertilizer, economic efficiency, competitiveness and sustainability of farming systems, agricultural productivity and technology transfer etc.

3. Salient Scientific Achievements of Completed Projects

Animal Sciences

- Prepared and standardized 4 different *Staphylococcus* vaccines viz; (i) Dextran sulphate adjuvanted bacterin, (ii) plain bacterin, (iii) live attenuated vaccine, and (iv) oil adjuvanted bacterin with 100% protection in rabbits by all except 80% protection by live attenuated vaccine. (University of Agriculture, Faisalabad)
- Developed methodology for farming mud crab in the coastal earthen ponds. This will help in promoting crab aquaculture. (University of Karachi)
- Urea molasses block technology has been improved and the refined version has given better results which offer an easy and economical method of supplementing buffalo calves under low quality roughages feeding system. This has resulted in better growth rate and net benefit. (ASI, NARC)
- Two thousand fingerlings of channel catfish were imported and cultured in polyculture system with major Chinese carps without affecting the growth of carps. (Aquaculture & Fisheries Program, NARC)
- Five medicines namely Ivomec, Endectin, Dectomax, Euvectin and Projecting were found 100% effective in controlling warble fly (ASI, NARC).
- The Infectious Bronchitis Virus (IBV) has been prepared for Chicken (ASI, NARC)
- Milk Starter Bank has been developed for fermentation of milk products (Dairy Technology, NARC)
- Percentage ingredients composition of early weaning diet and milk replacer has been identified after the nutritional comparison of whole milk, milk replacer and early weaning diet (ASI, NARC)

- The national list of animal genetic resource for sheep is extended, and one of the unique resources has been added on the nation's account. The breed is exclusively the property of Pakistan and only found in Chitral. No breed similar in morphometric or performance traits was found in neighbouring regions of Pakistan and Afghanistan (NWFP Agricultural University, Peshawar)

Crop Sciences

- One hundred and fifty five grape species accessions collected and maintained at field gene bank at PGRP and HRI, NARC. 354 genotypes of *Pisum sativum* characterized for qualitative and quantitative traits. (PGRP, NARC)
- Out of 177 genotypes of *Pisum sativum* screened against powdery mildew 13 found resistant are available to breeders. (PGRP, NARC)
- After screening of drought tolerant genotypes of wheat, identified 29 genotypes /lines for wheat breeders to cope with the emerging challenge of acute water shortage by evolving drought tolerant varieties. (NIA, Tandojam)
- Four lines of wheat found heat tolerant at grain formation stage under high temperature conditions in plastic sheet tunnel, were used to develop new crosses with commercial varieties. One of the wheat advance lines, Shaaq-06 found heat tolerant was released for general cultivation. (AARI, Faisalabad)
- Crossed durum wheat with one of the salt tolerant accession *Ae. Geniculata* produced "Durugen" which combines salt and water deficiency tolerance. Durugen is a natural all oyploidy with 4 genomes. (NIAB, Faisalabad)
- Useful genetic variability (*Brassica juncea L.*) in important agronomic and quality characters was created with gamma rays induced mutations and classical breeding techniques. (NIFA, Peshawar)
- Canola Hybrid development: Fourteen stable CMS lines (A-lines) along with their maintainers (B-lines) have been developed; stable fertility restorer lines of canola such as R-26 developed and maintained and four crosses of canola (BLN-877 x R-26, CON-I x R-26, CON-II x R-26, Rainbow x R-26 and Sponsor x R-26) better in yield performance identified. (Oilseed Program, NARC)
- Twenty nine super lines having resistance towards mustard aphid and better in yield and oil content have been developed through inter and intra-specific crosses of *Brassica juncea*, *Brassica compestris* & *Brassica carinta*. (NWFP Agricultural University, Peshawar)
- Seven blight resistant chickpea genotypes with high yielding potential were identified through Molecular breeding of Kabuli Chickpea. (Pulses Program, NARC)
- Identification of resistant lines (major pulses crops) to viral diseases has been carried out and is being used by local breeders to develop virus resistant high yielding cultivars of legume crops. (Pulses Program, NARC)
- Five high yielding & flower shedding tolerant mutants/recombinants of Mungbean has been developed (NIFA, Peshawar)
- Four lines (ALP-Moth 1, ALP-Moth 2, ALP-Moth 3, ALP-Moth 4) resistant to Yellow Mosaic Virus (YMV) has been identified and under the process of registration (ARI, D.I. Khan).

- Studies on malformation of mango have lead to identification of causal organism of the disease as *F. magniferae*. Strategy of consecutive clipping and chemical spray has proved successful in minimizing the malady. (AARI, Faisalabad)
- Standardized protocols for invitro shoot proliferation and rooting (peach rootstock GF-677); and field nursery of greenhouse acclimatized plants developed. (Fruits Program, NARC)
- Protocol established for germplasm conservation & cryo-preservation of grapes, peaches, pear and potato. (PGRP, NARC)
- Seedless trait in Kinnow was correlated and plants produced by sprout/shoot apex/embryo grafts. Unique seedless Kinnow plants obtained from nucleolus callus embryogenesis. (NIAB, Faisalabad)
- Throw-in type Rice Thresher developed and successfully demonstrated to farmers and 500 units were brought in operation. (FMI, NARC)
- Multi-crop Mobile Seed Dryer Unit developed and successfully field tested. It can clean and grade grains of cereals, oilseeds and round seeded vegetables. (FMI, NARC)
- IPM model for management of fruit flies in mango, demonstrated on 450 acres in Multan and 50 acres in Kabirwala; application of MAT, BAT, Neem seed powder extract and sanitation were the major components of IPM model against the indiscriminate use of pesticides. (IPEP, NARC/CABI, Rawalpindi)
- IPM strategy for management of aphids in canola demonstrated at Multan and Bahawalpur. Strategy was based on host plant resistance, cultural, chemical and biological control methods. (Agriculture College, BZU, Multan)
- Pesticides residue contamination found in fruits and vegetables at alarming levels; maximum residue levels (MRL's) violation (35%) is in fruits and vegetables. The most common pesticides found were Endosulfan, Methamidophos, Imidacloprid, Deltamethrin, Bifenthrin, Cyhalothrin, Prophenophos, Thiophnate – Methyl and Fosety Aluminum. (SARC, Karachi)

Natural Resources

- Composted organic material; enriched with 25 % of full dose of N fertilizer increased significantly yield of maize and wheat at University of Agriculture, Faisalabad
- Potential organic waste (crop residue, fruit & vegetable), manure and municipal waste successfully converted to compost at NWFP Agricultural University, Peshawar applied on wheat and maize significantly improved the crop and yield
- Application of Humic Acid (HA) significantly increased growth and yields of wheat, sugar beet, maize, cotton and groundnut in project area at Kohat and Karak, NWFP. Indigenously developed humic acid extraction plant has been installed at NWFP Agricultural University, Peshawar is working efficiently.
- Prepared a generalized geomorphic soil map, generalized agricultural development potential map and generalized soil erosion map of pothwar. Found widespread deficiency of major plant nutrient in soil of Fateh jang and Gojar Khan area. (WRRI, NARC)
- Twelve Plant Growth Promoting Rhizobacteria (PGPR) isolates of wheat and rice acquired and added in the existing microbial gene bank at NARC.
- Recovered 250 endophytic diazotrophic isolates from wheat roots and characterized for their cultural and microscopic characters. (INRES, NARC)

The projects of social sciences sector focused on transfer of technologies to the door steps of farmers, WTO trade liberalization: study the existing situation in domestic markets and international arena and to pinpoint adverse effects of liberalization and suggest ways & means to minimize such effects, focusing on market margins of different fruits and vegetables and economic analysis of agro forest and mangrove ecosystem.

4. Other Contribution of ALP Projects

The contribution of ALP projects besides research and development are;

- Strengthened the institutes in form of research and lab. equipments, machinery and computers etc.,
- host institutes were provided operational funds and made functional to some extent,
- new knowledge and information has been generated in forms of progress reports, research papers, brochures etc. and shared with scientists through circulation, field days and seminars, workshops etc.,
- assisted students especially in agricultural universities in conducting research for their degree program,
- provided job and better training facilities to the graduate students on recruitment in projects as Research Assistants/Fellows/Associates,
- being the 1st competitive grant in field of agricultural research, enhanced the capabilities and skills of scientists to develop and win research proposals for funding, and
- established national and international linkages and coordination among various research scientists and institutes.

The tables showing human resource development, knowledge generated and transferred in forms of research papers, seminars and workshops etc. as in March 2009 is as follows:

Human Resource Development:

	<i>AS</i>	<i>CS</i>	<i>NR</i>	<i>SS</i>	<i>Total</i>
<i>Ph. D.</i>	25	35	17	05	82
<i>M/ Phil</i>	19	16	08	00	43
<i>M. Sc.</i>	36	113	92	12	253
<i>B. Sc.</i>	00	14	19	00	33

Research Papers/Publications:

	<i>AS</i>	<i>CS</i>	<i>NR</i>	<i>SS</i>	<i>Total</i>
<i>Published</i>	59	118	55	11	243
<i>Presented in Workshops/ Seminar</i>	31	38	37	05	111
<i>Papers approved for publications</i>	16	48	18	00	82
<i>In Process of Publications</i>	03	10	10	00	23

Seminars/Workshop/Field Days:

	<i>AS</i>	<i>CS</i>	<i>NR</i>	<i>SS</i>	<i>Total</i>
<i>Workshops</i>	<i>01</i>	<i>14</i>	<i>03</i>	<i>00</i>	<i>18</i>
<i>Seminars</i>	<i>05</i>	<i>09</i>	<i>01</i>	<i>05</i>	<i>20</i>
<i>Trainings</i>	<i>01</i>	<i>65</i>	<i>00</i>	<i>37</i>	<i>103</i>
<i>Field Days</i>	<i>01</i>	<i>11</i>	<i>06</i>	<i>107</i>	<i>125</i>

The progress and achievements of the projects which remain in operation during the period July 2008 to June 2009 under ALP extracted from the annual and final technical progress reports alongwith financial status is reported in the coming section.

Name of Project: Genetic Improvement of Buffaloes in Pakistan (GIBP)

**Name of PI/
Institute:** Dr. Muhammad Anwar,
Senior Scientific Officer,
Animal Sciences Institute (ASI), NARC, Islamabad

Duration: 12.11.2004 to 11.11.2008

Financial Status: Total Cost: Rs.2.287 million
Funds Released: Rs.1447200/-
Funds Utilized: Rs.1362482/-

Objectives:

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

Achievements:

Kundhi Buffalo has good potential of milk production even in the extreme seasonal conditions however there was no genetic improvement program for this breed. To initiate a breeding program basic information was needed on production performance of the breed. Time series production performance data along with pedigree of animals maintained at the Research and Development Kundhi Buffaloes Farm, Rohri from 1976 through 2004 were collected for this purpose. It included buffalo identification, date of birth, date of calving, date of drying, lactation number, sire and dam number and milk yield per lactation. Data on 961 lactation records of 237 Kundhi buffaloes maintained at Research and Development Kundhi Buffaloes Farm, Rohri collected over a period of 29 years were used in the present study. An effort was made to estimate the magnitude of various environmental and genetic sources of variation in milk yield. The average milk yield in this herd was 1356.48 kg per lactation. The length of lactation and dry period averaged 218.72 days and 347.64 days respectively. The average age at first calving and calving interval were 1123.18 days and 556.15 days respectively. A three-titer (Open Nucleus, Multiplier and Commercial producers) breeding programs was proposed to enhance milk yield through production and use of frozen semen of performance tested Kundhi buffalo bulls. The field staff of Sindh component was trained for selection of farmers, milk recording, and animal registration procedures.

Name of Project: **Development of Database on Minerals Profile of Feedstuffs, their Availability and Strategic Supplementation of Minerals Block to Dairy Animals**

Name of PI/Institute: **Dr. Atiya Azim,**
Principal Scientific Officer,
Animal Sciences Institute, NARC, Islamabad

Duration: 17. 09. 2005 to 16. 09. 2008

Financial Status: Total Cost: Rs.2.513 million
Funds Released: Rs 2141400-
Funds Utilized: Rs 2036056/-

Objectives:

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

Achievements:

Samples of feedstuffs i.e. green, dry roughage and concentrate feed ingredients collected from various farms were analyzed for macro and micro minerals.

Green Fodder:

- Mineral contents were higher in rabi fodder than kharif
- Legume fodders were better source of Ca, Mg and K as compared to cereal fodders. Micro minerals were also higher than legume fodder.
- Fodders cultivated in irrigated area had high mineral contents as compared to rain-fed fodders.
- Turnip (both leaves and tubers) and sugar beet leaves were good sources of calcium having higher value i.e. 1.15 and 1.60%
- Mott grass was poor source of minerals.

Dry Roughage:

- Calcium and P were higher in sorghum stover as compared to wheat straw. Na was higher in wheat straw than sorghum stover and sugar cane bagass.
- Micro minerals (Cu and Fe) were higher in wheat straw than sorghum stover and others (Co, Mn and Zn) were higher in sorghum stover.

Concentrate:

- Calcium and Mg were higher in oilseed meal than cereals and their by products. Grains (maize and wheat) were the poor source of Ca. However, P was higher in cereals and their by-products.
- Micro-minerals were also higher in oilseed meal and cakes.
- Among the meals Ca and Mg were maximum in sunflower meal.

- Molasses was a good source of minerals Ca, Na, Mg.

Commercial available mineral components analyzed for Ca, P, Cu, Zn, Fe and Mn indicated that maximum (38%) Ca was found in bone ash followed by di-calcium phosphate, bone meal and minimum in mono calcium phosphate. However, maximum P was available in mono calcium phosphate. Copper, Zn, Fe and Mn contents in their respected sulphate were within normal range i.e. Cu 25%, Zn 35%, Fe 30% and Mn 32%.

Machinery for mineral mixture and blocks was designed, fabricated and installed at AN program. Different types of mineral mixture and blocks were formulated, prepared and acceptability by animals was determined. Blocks having molasses and guar gum as binding agent were economical and better in acceptability.

Survey for quantification of minerals availability to buffalo and cattle of different public and private farms indicated that lactating animals diets are deficient in minerals.

Supplementation of mineral to lactating animals increased daily milk yield, milk fat, total solids. Milk yield increase was about 10 to 20% by mineral supplementation. At private farms milk yield was increased from 0.5 to 1.5 l/day with only mineral supplementation as per 100% NRC requirement in cattle.

Hundred percent conception rate was achieved in buffaloes within 60 to 75 days of mineral supplementation. Service per conception was also minimum in buffalo fed mineral supplementation at 120% NRC level. Supplementation of minerals enhanced reproductive performance by including early oestrous and pregnancy in buffaloes.

Digestibility of nutrients improved with minerals supplementation.

Name of Project: **Studies on Epidemiology of Peste des Petites Ruminant (PPR) in Pakistan**

Name of PI/Institute: **Dr. Aamer Bin Zahur,**
Senior Scientific Officer,
Animal Sciences Institute, NARC, Islamabad

Duration: 17. 09. 2005 to 28. 02. 2009

Financial Status: Total Cost: Rs.5.969 million
Funds Released: Rs.4245000/-
Funds Utilized: Rs.4252722/-

Objectives:

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

Achievements:

Sixty two outbreaks were investigated through out the country. Presence of PPRV confirmed by Ic-ELISA, c- ELICA, Virus Isolation, RT-PCR. Epidemiological parameters were estimated as per table below:

<i>Animals</i>	<i>Morbidity</i>	<i>Mortality</i>	<i>Case fatality</i>
Goats	76.54%	23.90%	31.22%
Sheep	51.54%	16.73%	32.46%
Overall	69.18%	21.79%	31.49%

Determined Temporo-Spatial distribution of PPR in Pakistan. Factor responsible for Transmission/Persistence of PPR ascertained (Population Density, Animal Movement, Livestock Markets & Lack of Awareness). Economic impact estimated worth Rs. 20.52 billion/annum to be saved by controlling the PPR. Overall sero-prevalence estimated to be 50.24% (Goats = 55.34%, Sheep = 37.67%). Basic case reproduction number (Ro) (Goats = 2.24, Sheep = 1.60). Herd immunity threshold (HIT) (Goats = 55%, Sheep = 38%). PPRV isolated from 7 outbreaks (first isolates in Pakistan, isolates identified techniques and catalogued for patency of PARC, virulence profile of local isolate established in goats and genetic characterization of local isolates). A cost effective diagnostic essay (Haemagglutination (HA) test) developed for PPR. Seventeen training workshop organized successfully in all provinces, AJK and NAs to sensitize the field staff and farmers about the disease. A brochure in Urdu on “Transboundary animal diseases and their control in Pakistan” was written and printed for distribution among farmers and users. .

Name of Project: **Studies on Breeding and Seed Production of Channel Catfish (*Ictalurus Punctatus*) in Pakistan**

Name of PI/Institute: **Dr. Abdul Rab,**
Senior Scientific Officer (Fisheries),
Animal Sciences Institute, NARC, Islamabad.

Duration: 19. 07. 2007 to 18. 07. 2010

Financial Status: Total Cost: Rs.3.704 million
Funds Released: Rs.1895900/-
Funds Utilized: Rs.1766937/-

Objectives:

- To study the breeding biology of channel catfish under the local environmental conditions.
- To develop sustainable technology for channel catfish breeding, larval rearing (on both natural and artificial diets) and seed production for promotion of channel catfish farming in the country.

Achievements:

Brood stock of channel catfish (*Ictalurus punctatus*) was developed from locally bred fish of 2007 and growth of fingerlings observed during study period. The study revealed that channel catfish attained sexual maturity within two years of age in local environmental conditions. For breeding of channel catfish specifically designed spawning nests made from tin, plastic and wood were placed in ponds. Two pairs of channel catfish successfully bred naturally in these spawning containers and experiments were conducted.

The channel catfish culture technology was successfully transferred to the fish farmers and locally bred 100 channel catfish fingerlings and 4 pairs of brooders were transported live to the private fish farmer at Thatta, Sindh with a 100% survival.

In order to study the effect of different feeding ratios to body weight and effect of enzyme supplementation in diet on growth of channel catfish fry, two feeding experiments were conducted. No significant ($P>0.05$) effect on growth was recorded when channel catfish fry were fed to different body ratios of 3%, 4% and ad-libitum, however, fish fed @ 3% of body weight showed comparatively better growth. The same diet was supplemented with different concentrations of protease and laccase enzymes @ 1 ml, 2 ml and 3ml/kg and offered to channel catfish fry @ 3% of their body weight. The channel catfish fry shows a significantly ($P<0.05$) higher growth when fed a diet supplemented with 3 ml/kg protease enzyme, compared to other concentrations of protease and laccase enzymes.

Channel catfish fingerlings grew better when stocked in earthen ponds @ 3000 fish/ha compare to a stocking density of 2000 and 4000 fish/ha. Further at this stocking ratio, fish

attained a maximum weight of 239 g as compared to their initial weight of 50 g. The mean weight gain of 190 g in five months from January to May 2009 and daily weight gain of 1.26 g/day was recorded during the study.

Name of Project: Evaluation of Indigenous Medicinal Plants for the Isolation of Steroid Hormones or Like Substances for Veterinary Usage

**Name of PI/
Institute:** Dr. Nazir Ahmad,
Associate Professor,
Dept. of Animal Reproduction, University of Agriculture,
Faisalabad

Duration: 08. 09. 2005 to 07. 09. 2008

Financial Status: Total Cost: Rs.5.046 million
Funds Released: Rs.3361000/-
Funds Utilized: Rs.3287896/-

Objectives:

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

Achievements:

The main objective of the project was evaluation of various medicinal plants for their estrogen, progesterone, testosterone or like activity and isolation of the biologically active compound showing such activity. During the past three years, ethanolic and aqueous extracts of various plants were prepared and evaluated for their sex hormonal or like activity through animal bioassays. The salient findings are summarized below:

- Ethanolic or aqueous extracts of roots, branches and leaves of *Calotropis procera* did not show any estrogenic or like activity in immature rats. However, leaves and branches of this plant showed mild progesterone like activity.
- Aqueous as well as ethanolic extracts of *Tribulus terrestris* exhibited testosterone or like activity in immature rates. The activity of ethanolic extract was higher than the aqueous extracts.
- The ethanolic extracts of *Medicago sativa* increased serum progesterone concentrations in immature female rats.
- The ethanolic as well as aqueous extracts of seeds of *Mucuna prureins* increased serum testosterone concentration in immature male rats. Evaluation of aqueous-methanol extracts of flex seeds for their hormonal activity is in progress.

Name of Project: Mott Grass as a Potential Source of Dietary Forage for Lactating Sahiwal Cows

Name of PI/Institute: Dr. Muhammad Qamar Bilal,
Assistant Professor,
Dept. of Livestock Management, University of Agriculture,
Faisalabad

Duration: 14. 09. 2005 to 13. 09. 2008

Financial Status: Total Cost: Rs.1.660 million
Funds Released: Rs.1559100/-
Funds Utilized: Rs.1459769/-

Objectives:

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

Achievements:

Low quality forages coupled with the reduction in forage area are the main constraints. Abundant of fodder is not only wastage of fodder but also wastage of land. To improve quality and quantity of roughage, introduction of high yielding fodder varieties such as Mott grass (*Pennisetum purpureum*) is one of the best options in this regard. Silage making of surplus grass at the time when it is abundantly available can cover the other feed scarcity period (November to January) and can bridge the gap between supply and demand.

Research studies conducted under the project indicated that; proper stage of cut for Mott grass after its cultivation is 45 days. Mott grass cut at 45 days stage of maturity is the best/more nutritious as compared to 60 days cut for feeding as protein contents decreased and fiber contents increased with the advancement of stage of maturity. For making quality mott grass silage, addition of additives is necessary because mott grass is low in water soluble carbohydrates and additives facilitate the efficient fermentation. For this purpose molasses @ 3% was found to be the adequate. Silage for feeding can be started after 35 days fermentation period.

It was observed that cows fed on mott grass in green form resulted in maximum intake when supplemented with molasses. Statistical analysis indicated that there was no significant difference among digestibility of mott grass/silage based diets in which molasses was used but these differed significantly from mott grass/silage where no molasses was used. Feeding of mott grass did not affect milk yield in cows.

Based on the findings of the study, it can be concluded that mott grass silage is the best substitute of green mott. Mott grass silage alone or in combination can be used in dairy animals without any negative impact on dry matter intake, milk production, milk composition and digestibility. However, enlisting mott grass @ 3% fodder dry matter and feeding mott grass/silage in combination are beneficial.

Name of Project: **Studies on the Reproductive Physiology of One-Humped Camel (*Camelus dromedarius*) in the Natural Ecology of Pakistan**

**Name of PI/
Institute:** **Dr. Anas Sarwar,**
Chairman/Associate Professor,
Department of Veterinary Anatomy, University of Agriculture,
Faisalabad

Duration: 21. 10. 2005 to 20. 10. 2009

Financial Status : Total Cost: Rs.5.000 million
Funds Released: Rs.3100500/-
Funds Utilized: Rs.3350456/-

Objectives:

- The main purpose of this study is to promote an efficient, ecologically sound, economically viable camel production system in Pakistan.
- To describe the reproductive physiology of camels kept in traditional management system.
- To study the reproductive events of camel in traditional management system and delineate those are amenable to intervention.
- To describe the natural ecology and the pattern of traditional herding of Pakistani camels.
- To make recommendations on improved methods of production based on manipulations of reproductive physiology.

Achievements:

Six trials were conducted on male and female dromedaries during four different seasons of the year in three different ecological zones viz., irrigated plains (Faisalabad district), Thal desert (Bhakkar district) and Pothwar (Attock).

This study established that female dromedaries manifest optimal behavioral and physical signs of estrus during winter and spring seasons. However, these signs gradually diminish by the commencement of summer and remain inactive till the end of autumn. These trials showed that the reproductive activity might be augmented in female dromedaries by the administration of pregnant mare serum gonadotropin (PMSG Folligon) in off-season which resulted in variable number of ovarian follicles within five days following treatment and moderate estrus signs commenced to appear along with the secretion of sex steroids. By and large similar findings were recorded in autumn. When follicles matured (15-20 mm in diameter) in response to PMSG injection, ovulation was induced with the help of 20 µg GnRH analogue, buserlin, for experimental purpose which resulted both in ovulation and formation of corpora lutea along with rise in progesterone secretion. These results indicated

that dromedaries are seasonally induced ovulator, however, sexual activity and ovulations may be induced/augmented in dromedaries during off-season by the hormonal intervention along with the proper climatic and nutritional management. Structural response of the gonads will further help to understand the ovarian kinetic mechanism responsible for this ovarian response.

Among males, serum testosterone profiles at three different experimental sites clearly indicated that testosterone levels are mainly depended upon the ecological conditions. Contrary to female dromedaries, trials on males proved that the rutting by the exogenous administration of testosterone hormone can not be attained. It indicates that probably the relationship between hormone pattern and climatic factors among males is more stringent. Moreover, morphological changes in testes (Ultrasonographic, caliper and water displacement methods, histological examination) are positively correlated to the climatic changes.

Name of Project: **Clinical and Biochemical Studies on Genital Prolapse in the Buffalo**

**Name of PI/
Institute:** **Dr. Laeeq Akbar Lodhi,**
Professor/Chairman,
Dept. of Clinical Medicine and Surgery, University of
Agriculture, Faisalabad

Duration: 25. 08. 2005 to 24. 08. 2009

Financial Status: Total Cost: Rs.4.794 million
Funds Released: Rs.3139500/-
Funds Utilized: Rs.2494643/-

Objectives:

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

Achievements:

During the year 2008-09, collection of blood samples from the buffaloes suffering with genital prolapse for biochemical studies in District Faisalabad and Bhakkar continued and remained in progress. Analysis for hormonal profile of samples collected from district Multan, Sialkot and Chakwal also remained in progress.

Initial processing of serum samples remained in progress. Analysis of serum samples conducted. At the same time compilation and analysis carried out.

Project has been completed in June 2009. Final conclusion drawn on the basis of 3 years study to be reported in the final technical progress report is yet to be provided.

Name of Project: **Development of Supplementary Feed Based on Apparent Nutrient Digestibility of Different Feed Ingredients for *Labeo Rohita* Fingerlings**

**Name of PI/
Institute:** **Dr. Muhammad Salim,**
Assistant Professor,
Dept. of Zoology & Fisheries, University of Agriculture,
Faisalabad

Duration: 14. 09. 2005 to 13. 09. 2008

Financial Status: Total Cost: Rs.2.137 million
Funds Released: Rs.1439000/-
Funds Utilized: Rs.1394711/-

Objectives:

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

Achievements:

The research project was carried out to evaluate the apparent nutrient digestibility of twenty feed ingredients (animal source and plant source) for *Labeo rohita* fingerlings. Feed ingredients were:

- i) fish meal, ii) meat meal, iii) blood meal, iv) feather meal, v) wheat bran, vi) soybean meal, vii) rice polish, viii) wheat, ix) rice broken, x) sunflower meal, xi) canola meal, xii) corn gluten 30%, xiii) corn gluten 60%, xiv) cottonseed meal, xv) dry bread, xvi) rapeseed meal, xvii) guar meal, xviii) corn, xix) coconut meal and xx) barley

The experiments were conducted in V-shaped tanks, specially designed for the collection of fecal material of fish via sedimentation technique. This developed system titled UA system was attached with water supply and aeration system. The feed ingredients were analyzed for chemical composition prior to the formulation of experimental diets. The reference diet was prepared to supply adequate levels of required nutrients for normal fish growth. Each test diet was formulated by mixing 70 % reference diet and 30 % test ingredient. After acclimation, fingerlings *Labeo rohita* were stocked into 60L V-shaped tanks (UA system) with assigned to reference and test diets randomly. The fingerlings were fed with experimental diets at the rate of 2 % of live body weight twice a day. After feeding session of two hours, the tanks were completely cleaned from feed ingredients and then feces were collected repeatedly from each replicate. The collection of feces was lasted for ten weeks. The samples of diets and feces were analyzed for chemical composition by standard methods of AOAC.

The apparent digestibility values of twenty test ingredients determined during 1st year were verified in 2nd year of the research project. The test ingredients with higher digestibility values were used for the formulation of four experiments diets for *Labeo rohita* fingerlings i.e. fish meal, rice broken, wheat bran, wheat, corn, corn gluten, sunflower meal, soybean meal, dry bread and soybean meal. The apparent nutrient digestibility and growth performance of fish were better on test diet-1 (fish meal based diet) and test diet-4 (sunflower meal based diet). Carboxy methyl cellulose was added as binder to increase the integrated period of experimental diets.

Name of Project: **Inter-relationship of Mycotoxin Levels in Feed, Organs/Tissues and Health of Poultry and Livestock**

**Name of PI/
Institute:** **Mr. Muhammad Zargham Khan,**
Chairman/Associate Professor,
Dept. of Veterinary Pathology, University of Agriculture,
Faisalabad

Duration: 25. 07. 2006 to 30. 06. 2009

Financial Status: Total Cost: Rs.9.345 million
Funds Released: Rs.9106900/-
Funds Utilized: Rs.8236142/-

Objectives:

- Determination of aflatoxins and ochratoxins levels in poultry livestock feed/ feed ingredients, organs/ tissues of poultry and livestock as well as in milk produced for human consumption.
- Establishment of relationship between:
 - Dietary mycotoxins levels and its tissues/ organ contents.
 - Dietary/ tissue mycotoxins levels and pathological alterations.

Achievements:

Samples collected from 133 broiler and 53 desi farms, from liver, kidney and muscles of each bird from each farm. Gross lesions on the organs recorded from 112 (84.21%) farms contained aflatoxins (B₁, B₂, G₁ & G₂) in different proportions. Aflatoxins B₁ was determined in samples from 106 (79.69%) liver, 72 kidneys (54.13%) and 43 muscles (32%) samples. Aflatoxins B₁ residues were not detected in 27, 61 and 90 samples of liver, kidney and muscles respectively.

Out of 133 broiler farms, 93 (70%) farms contained OTA in different organs. OTA was detected in 70 livers (52.63%), 92 kidneys (69.17%) and 41 muscles (30.82%) samples. OTA residues could not be detected in 63 (47.36%), 41 (30.82%) and 92 (69.17%) samples of liver, kidney and muscles.

Histopathological findings in the tissues included necrosis, fatty changes, bile duct proliferation, cellular infiltration, severe to moderate congestion and haemorrhages while in kidneys tubular epithelial cell necrosis and degeneration along with proliferation of connective tissues in parenchyma was evident.

In desi birds, out of 53 poultry farms, samples from 40 farms contained aflatoxins (B₁, B₂, G₁ & G₂) in different combinations. Aflaoxin B₁ and residues of aflatoxins were determined in tissues.

Name of Project: **Application of PCR Technology for the Detection of Avian Mycoplasma in Poultry Birds and Farm Environment**

**Name of PI/
Institute:** **Dr. Sajjad-ur-Rahman,**
Associate Professor,
Dept. of Vet. Microbiology, University of Agriculture,
Faisalabad

Duration: 22. 02. 2006 to 21. 02. 2009

Financial Status: Total Cost: Rs.2.939 million
Funds Released: Rs.2734000/-
Funds Utilized: Rs.2546292/-

Objectives:

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

Achievements:

A total of 481 field specimens (trachea, lungs, oral, cloacal, nasal & air sac swabs etc.) were collected for isolation of avian mycoplasma from total 150 birds including breeder, layer and broiler flocks, showing respiratory distress signs. Flocks were preliminary examined for screening test using RSA (Rapid Serum Agglutination Test). Those farms showed more than 50% positive results were selected for further studies.

Out of 17 flocks, 52.9% were found positive by RSA with more than 50% positivity. A total of 79 specimens were found positive by culture examination indicating 16.4 percent occurrence of Mycoplasma spp.

The data collected out of total sixty poultry flocks, a total of 24 poultry flocks consisting of 53500 birds, were found with respiratory distress problem. Serum sampling was completed from 9 broilers, 8 layer and 7 broiler breeder flocks.

Sero-positivity of 702/762 (92.1%) in broilers, 152/189 (80.4%) in layers and 62/95 (65.3%) in breeders was recorded through Rapid Serum Agglutination (RSA) test with specific *Mycoplasma gallisepticum* (MG) antigen. Moreover, confirmed MG sero-positivity (more than 1:20 titer) was revealed through Haemagglutination Inhibition (HI) test with (62.5%) in broilers, (64.5%) in layers and (46.8%) in breeders. Overall true sero-prevalence of *M. gallisepticum* as obtained through both the tests were found as 57.6%, 51.9% and 30.5% in broiler, layer and breeder flocks respectively. Sero-positivity of 601/762 (78.9%) in broiler, 139/189 (73.5%) in layers and 83/95 (87.3%) in breeders was recorded through Rapid Serum Agglutination (RSA) test with specific *Mycoplasma synoviae* (MS) antigen. Moreover, confirmed MS sero-positivity (more than 1:20 titer) was revealed through Haemagglutination Inhibition (HI) test with (53.9%) in broilers, (55.8%) in layers and (64.7%) in breeders. Overall true-prevalence of *M. synoviae* as obtained through both the tests were found as 42.3%, 40.7% and 55.7% in broiler, layer and breeders flocks respectively.

Clinical specimens from all RSA positive cases were also included for culture examination with special reference to MG and MS. For MG isolation, PPLO broth base medium, supplemented with 15% horse serum was found successful in recovery of isolates.

PCR running conditions were optimized to detect MG and MS from the isolates samples instead of experimentally infected birds and later on from the direct specimens from clinical cases. Multiplex PCR was also standardized for the simultaneous detection of MG and MS as envisioned during the last phase of the project.

These studies conclude that: i) Phenol extraction method for DNA isolation was successful for the culture isolated and extraction from specimen samples, ii) Conditions for PCR of MG and MS were separately accomplished and PCR product of 185 bp for MG and 214 bp for MS were recovered from standard cultures as well as from specimen samples, iii) Optimization of multiplex PCR method for MG and MS simultaneous detection were successfully completed which give rise to specific amplicon product of 732 bp (MG) and 207 bp (MS) and iv) The Standard Operating Procedure (SOP) was prepared to perform Multiplex PCR method for the simultaneous detection of MG and MS from the specimen samples.

Name of Project: **Studies on Mineral Imbalances in the Livestock of Canal Irrigated Districts of the Punjab**

**Name of PI/
Institute:** **Dr. Talat Naseer Pasha,**
Professor,
Dept. of Animal Nutrition, University of Veterinary and Animal
Sciences, Lahore

Duration: 21. 09. 2005 to 20. 09. 2008

Financial Status: Total Cost: Rs.8.596 million
Funds Released: Rs.6665800/-
Funds Utilized: Rs.6413538/-

Objectives:

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

Achievements:

A sampling protocol was developed for ten districts of Punjab province i.e. according to agricultural division. Each district was divided in to 5 sub-locations on the basis of topography, soil type and availability of livestock and five sites were randomly selected for sampling in each district. Samples of soil, water, available feed resources and blood of farm livestock were taken from each sub-location. Samples were taken once in summer and once in winter season. The sampling sites were marked by GPS device for accurate mapping of the findings of the analyses. Sampling of available forage like maize, millet and sorghum in summer and berseem, lucern and oat in winter were taken manually with stainless steel scissors from each sub-location. Representative samples of other available feed resources including concentrates (cottonseed cake, cotton seed meal, rape seed cake, canola meal etc) and dried roughages (wheat straw, rice straw, corn stover etc) were taken. A stainless steel soil auger was used for soil sampling. Three representative samples were taken from each sub-location. Three representative water samples that is offered to the animal for drinking as well as used for irrigation of the forages at the selected sites were collected from each sub-location. Blood samples of large and small ruminants were collected from each sub-location in both seasons i.e. summer and winter. The macro and micro minerals were analyzed by Atomic Absorption Spectrometer, Flam photometer and Spectrophotometer.

It was concluded from the studies that there is variation in mineral profile of livestock in different canal irrigated districts/zones of Punjab province. In order to fulfill the nutritional requirements of livestock to increase productivity, different strategies should be devised to improve mineral profile of soil to overcome mineral deficiencies.

Name of Project: **Synchronization of Estrus in Buffaloes to Enhance Herd Fertility Using Various Protocols**

Name of PI/Institute: **Dr. Nasim Ahmed,**
Professor/Chairman,
Department of Theriogenology,
University of Veterinary & Animal Sciences, Lahore

Duration: 23. 07. 2007 to 22. 07. 2010

Financial Status: Total Cost: Rs.4.938 million
Funds Released: Rs.3659900/-
Funds Utilized: Rs.3601427/-

Objectives:

- To determine the effect of various synchronization protocols during breeding & non-breeding season on ovarian dynamics (Follicle and CL) hormone profiles (Estradiol and progesterone), interval to estrus, ovulation, estrus behavior, fertility, pregnancy wastage and farm economics
- To enhance the reproductive efficiency by 20-25 %, milk production potential by 10-20% and farmer income by 10% in the buffalo herd where synchronization protocols are used

Achievements:

Several experiments were designed and conducted both at the experimental and at commercial dairy farms. The results from the first experiment indicated that New CIDR devices and previously Used CIDR devices are equally effective to induce estrus and ovulation synchronization with comparable PR (Pregnancy rate) in buffaloes during low breeding season. In second experiment, it was found that the administration of Estradiol Benzoate after 48 hours of PGF₂ α results in tighter synchrony (less variability) and better estrus behavior in buffaloes. However, the fertility was low because of low body condition of the animals at experimental farm. In the third experiment, cyclic buffaloes responded very well in terms of estrus to PGF₂ α treatment, showed less variability in behavioral estrus due to this hormone (estradiol dipropionate). In the fourth experiment, it was observed that the treatment of hormones (FSH following CIDR removal) resulted in increase serum estradiol-17 β level accompanied increase follicles development in Nili-Ravi buffaloes during low breeding season. It is hoped that through this project comprehensive information on physiology of estrous synchronization in buffaloes will be generated which will be helpful to enhance the fertility and productivity of dairy buffaloes. Most interestingly, majority of the above project work has been done at commercial dairy farms, therefore, it is directly applicable and benefits are being harvested.

Name of Project: **Feeding Management for Optimum Growth, Early Maturity and First Lactation Performance in Sahiwal Cattle**

**Name of PI/
Institute:** **Dr. Muhammad Abdullah,**
Professor,
Dept. of Livestock Production, University of Veterinary & Animal
Sciences, Lahore

Duration: 23. 07. 2007 to 22. 07. 2010

Financial Status: Total Cost: Rs.6.382 million
Funds Released: Rs.2964800/-
Funds Utilized: Rs.2916281/-

Objectives:

- To evaluate the capacity of whole milk replacer feeding for economical / optimum growth in Sahiwal calves.
- To compare different level of starter and concentrate mix for the growth and sexual maturity of Sahiwal heifers.
- To suggest a feeding system for decreasing age at puberty and age at first calving.
- To demonstrate a short term feeding management system for increase milk production from the existing dairy cattle and resources.

Achievements:

Research work conducted at Livestock Experimental Station, Jahangirabad, Khanewal on Milk and milk replacer feeding management trial (Expt-I), Growing calves supplementation study (Expt-2), Growing heifers feeding trial (Expt-3) & Pregnant heifers (Expt-4). The data has been collected, analyzed and reported.

The calves during milk feeding (Expt-1) period showed maximum growth in treatment II fed whole milk and starter ration as compared to calves on whole milk and milk replacer. Low cost to gain ratio were observed in the treatment VI fed milk replacer alongwith starter ration.

The Sahiwal calves on supplemented diets (Expt-3) alongwith green fodder feeding during the phase 1 (9-12 months age) and 2 (16-20 months) showed significant differences in the following parameters than the calves on green roughage (control):

- Higher DMI.
- Better growth rate.
- Improved body condition score.
- Significant difference in blood constituents.
- Showed early heat symptoms and some conceived at body weight of 270±5 kg (2 years age). In LES, Jahangirabad farm management was improved by extending project support to increased fodder availability through improved cultivars, harvesting,

- conservation (Silage and Hay) and feeding management practices.
- Appropriate health management measures.
- Better housing of calves.
- Better data handling and reporting system and
- Better cost to gain ratio of the supplement @ 1% body weight.

The study conducted under the project showed that the early feeding management of calves on least cost replacer and starter rations can improve their health, increase in growth and early start of rumination process on economical basis. The best performance in terms of increased dry matter intake, feed efficiency, weight gain, body measurements and for good body condition score was observed in the calves and heifers on treatment III fed on green fodder alongwith the starter @ 1%. On the basis of the data so far processed, it is also concluded that overall performance of calves on treatment III fed on 1 % starter supplement was better than the control (fed green fodder *ad-libitum* only). Better daily gain with improved feeding efficiency in calves can be achieved as compared to simply raising calves on traditional fodder feeding. The cost to gain ratio was comparatively low in the calves/heifers on the treatments supplemented with 1% concentrate and starter diets.

Name of Project: **Microbiological Studies on Caprine Mycoplasma in Balochistan**

**Name of PI/
Institute:** **Dr. Mohammad Arif Awan,**
Veterinary Officer,
Center for Advanced Studies in Vaccinology and Biotechnology
(CASVAB), University of Balochistan, Quetta.

Duration: 11. 03. 2006 to 10. 03. 2009

Financial Status: Total Cost: Rs.4.800 million
Funds Released: Rs.3069600/-
Funds Utilized: Rs.2791795/-

Objectives:

- To study the clinical manifestations and pathology in the mycoplasma suspected affected animals.
- To carry out the isolation and identification of caprine Mycoplasma particularly Mccp.
- To reproduce an experimental disease in the susceptible goats using the local field isolates of *Mycoplasma* Spp.
- To prepare an effective vaccine from the suitable local field isolates of mycoplasma species.
- To attempt the development and use of Latex agglutination test using the Mycoplasma field isolates.

Achievements:

Strengthened the existing Mycoplasma laboratory with all the facilities to handle Mycoplasma field samples, isolation procedures, purification techniques, characterization of isolated Mycoplasma spp based on biochemical and serological parameters, freeze-drying of the isolates. Work on the production of experimental mycoplasmosis in goats and standardization of Latex agglutination test conducted. Further many of the advanced techniques employed in the world have also been learnt during the visit of VLA, UK by PI.

The representative Mycoplasma field isolates were found pathogenic in goats and have been re-isolated successfully. The process for the standardization of Latex test has been started. Various types of vaccines against caprine pleuropneumonia have been prepared by using the local field isolates of Mycoplasma.

Final completion report of the project is yet to be provided by the PI.

Name of Project: **Development of Health, Nutrition and Breeding Management Package for Increased Output from Range-Sheep/Goats Production Operations in Balochistan**

**Name of PI/
Institute:** **Dr. Abdul Razzaq,**
Scientific Officer,
Arid Zone Research Center, PARC, Quetta.

Duration: 27. 04. 2006 to 26. 04. 2009

Financial Status: Total Cost: Rs.3.867 million
Funds Released: Rs.2808200/-
Funds Utilized: Rs.2647534/-

Objectives:

- To ascertain the fattening potential of native lambs/kids for increased mutton production under intensive feedlot research studies for economic modulation of these activities in Quetta, Loralai and Kharan or Kalat areas.

Achievements:

A total of nine lamb/kids fattening experiments were conducted; four on feed lot operation compared with grazing and minimal supplemental feeding at AZRC, Quetta, three farmer lambs/kids flocks from Tomagh/Loralai and two from Pishin were involved for fattening experiments and offered supplemental ration besides the normal range/orchard grazing. Sheep breed lambs were Harnai, Babrik, Shinwar, Rakhshani, Balochi and Goat was Khurasani and Lehri. Afghan Shinwar breed popular in local community were also involved for fattening experiments. Among the local breeds Babrik lambs gained higher weight than others. However, Shinwar Afghan breed was more than Babrik breed. Animals on grazing and minimal supplemental gain very low body weight (2-5 kg) than concentrated feeding animals (6-22 kg). Among the local breeds Babrik was found more profitable than others.

The prevalence of internal parasite was assessed in sheep and goats flocks involved from AZRC, Tomagh Station and farmers flocks from Pishin and Loralai. Microscopically eight types of internal parasites i.e. *Eimeria*, *Moniezia benedeni*, *Moniezia expansa*, *Fasciola hepatica*, *Protostrongylus rufescens*, *Tricuris ovis*, *Strongyloides* and *Dictyocaulus* were identified. Five anthelmintic i.e. Nolan plus, Bended, Oxide, Albensil and Ivermectin were tested against different internal parasite of sheep. Albensil (Albendazol) found effective and economical against internal parasites of sheep.

The studies led to the conclusion that lambs/kids fattening and timely health coverage (i.e., vaccination, de-worming) increased livestock production from 20-50% in terms of increase live-weight gain, wool, skin etc. Lambs/kids fattening with different ration showed encouraging live-weight gains (up to 22 kg) compared with grazing (5 kg) in 130-140 days. Subsequently higher profit up-to (Rs.2000/-) can be earn through fattening than grazing (Rs.800/-).

Name of Project: **Production of Thermo-Stable Newcastle Disease (ND) Vaccine for Rural Poultry**

Name of PI/ **Dr. Shakeel Babar,**
Institute: Associate Professor,
Centre for Advanced Studies in Vaccinology and Biotechnology
(CASVAB), University of Balochistan, Quetta

Duration: 11. 09. 2006 to 30. 09. 2009

Financial Status: Total Cost: Rs.3.459 million
Funds Released: Rs.1691000/-
Funds Utilized: Rs.1685467/-

Objectives:

- Availability of thermo-stable vaccine for rural poultry/ backyard chicken rearing villagers.
- Trials to adopt the thermo-stable strains of ND on permanent cell line like vero and others.
- To develop an easy, more convenient way of administration of vaccine.
- Development of ND control booklet in national and local languages.

Achievements:

Newcastle disease is a serious problem of poultry in Balochistan. Efforts are being made on the preparation of Thermostable vaccine for ND virus for rural poultry in Balochistan, which will be of great benefit for poultry owners who can not maintain the cold chain of the live vaccines due to lack of facilities and awareness.

Working seed has been produced from the master seed of Thermostable Newcastle Disease Virus obtained from Australia. Hemagglutination Test (HA) has been standardized in the laboratory for the rapid and preliminary detection of the ND virus. After the preparation of the working seed of the Thermostable virus trials are under way for the test production of the Thermostable vaccine. Field efficacy testing in different geo-locations of Balochistan: Limited studies in Quetta and around Quetta district done while for other districts, studies are initiated.

Overall the Thermostable Newcastle Disease Virus has been successfully propagated in cell culture system and ready to be used for vaccine production.

Name of Project: **Epidemiological Survey of Mastitis and Evaluation of Economic Losses Due to Clinical and Sub clinical Mastitis in NWFP**

**Name of PI/
Institute:** **Dr. Mirza Ali Khan,**
Senior Research Officer,
Veterinary Research Institute, Peshawar

Duration: 08. 09. 2005 to 07. 09. 2008

Financial Status: Total Cost: Rs.3.248 million
Funds Released: Rs.2833100/-
Funds Utilized: Rs.2709996/-

Objectives:

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

Achievements:

Epidemiological survey was conducted in 23 districts of NWFP and 4 agencies of FATA. The survey revealed that most of the farmers were unaware of mastitis especially sub-clinical mastitis and its losses. Farmers were utilizing veterinary hospital services but lacking laboratory facilities. General condition at the farms was not proper and majority of the farmers were neither adopting proper husbandry and hygienic practices at farms nor they milked healthy animals before the mastitis animals. Amongst the lactating animals (cows and buffaloes) 8.95% were affected with clinical mastitis of one or more quarters while 34.95% with sub-clinical mastitis.

High prevalence clinical and sub-clinical mastitis was recorded in cows and buffaloes throughout the project area. Managerial and husbandry practices for presentation and control of disease at the farms are poor. The farmers are unaware about the disease, its losses and control/diagnosis. Due to clinical and sub-clinical mastitis the annual loss in terms of milk loss, early animal replacement, reduced animal sale value, cost of treatment and veterinary services, extra labor etc is estimated to be Rs.15.05 billion/year in NWFP and FATA (the milk price taken @ Rs.20/litre). Somatic cell count has a strong correlation with mastitis which may be implied as immediate screening tool for early alertness about mastitis at the farm. Managerial, hygienic and husbandry practices, therefore, needs to be improved at the dairy farms.

Name of Project: **Enhancing Milk Yield of Kundhi Buffaloes through Production of Performance Tested Bulls. (Component-II)**

**Name of PI/
Institute:** **Dr. Alam Solangi,**
Veterinary Officer,
Breed Improvement and Development Centre (SPU), Kundhi
Buffalo Farm, Rohri

Duration: 14. 09. 2005 to 13. 09. 2008

Financial Status: Total Cost: Rs. 3.556 million
Funds Released Rs. 1976700/-
Funds Utilized: Rs. 2172300/-

Objectives:

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

Achievements:

Three hundred and twenty one (321) buffaloes were registered in 18 villages of Rohri, Sukkur and suburbs area and 373 buffaloes from Hyderabad and its suburbs. About 114 farmers from different villages were convinced and registered under the project. The milk production of all the registered buffaloes was recorded once in a month and 105 buffaloes were inseminated timely. The registered farmers were advised regularly to achieve better results.

Five bulls (3 of BIC Unit and 2 of KBF) have been selected & registered. About 9000 semen doses have been collected and are being used in the registered buffaloes, at Rohri and Hyderabad. Surplus doses of semen have been supplied to the Livestock Production Officers of Sindh. 17 high yielding buffaloes male calves based on record, has been purchased and raring as candidate bulls for further semen production. Out of these, four have started jumping.

Two A.I. Sub Centers at Old Cattle Colony and New Cattle Colony have been established to give advices to registered farmers as well as common farmers. The information/data regarding calving interval, milk yield, lactation period, dry period etc. of all registered buffaloes have been collected/ recorded.

Name of Project: **Induced Breeding and Fry Rearing Techniques of Indigenous Catfish, *Rita rita* (Hamilton) in Cemented Cistern**

Name of PI/Institute: **Dr. Naeem Tariq Narerjo,**
Professor,
Dept. of Fresh Water Biology & Fisheries,
University of Sindh, Jamshoro

Duration: 23. 07. 2007 to 22. 07. 2010

Financial Status: Total Cost: Rs.1.124 million
Funds Released: Rs.680000/-
Funds Utilized: Rs.680000/-

Objectives:

- To study the breeding biology of commercially important catfish.
- To study the reproductive potential.
- To develop artificial propagation and culture of *R. rita* in cemented cisterns.
- To develop induced breeding and fry rearing techniques of *R. rita*.
- To study the effect of water quality parameters on growth and survival rate of experimental fishes.

Achievements:

For induced breeding experiment, 10 pairs of mature male and female were collected from the stock maintained in cemented cisterns of the Department of Fresh Water Biology and Fisheries, University of Sindh, Jamshoro. After acclimatization mature male and females (brooders) were sorted and transferred to cemented holdings tanks. Selected brooders were exposed to low dose of ova prime-C injection (1.0 ml/kg body for female and 0.5ml/kg body weight for male) in the month of July 2009. It has been observed from the findings that the catfish, *Rita rita* breeds once in a year during the month of May to July with peak in July. The values of both ova diameter and GSI were found to be high during the month of July. The induced breeding experiment started in the 2nd week of July 2009 and data being recorded.

Name of Project: **Role of Steroid Hormone in Regulation of Ovarian Follicular Development in *Tor Putitora***

Name of PI/Institute: **Mr. Zafarullah Bhatti,**
Dy. Director (Fisheries),
Fish Hatchery & Research Center, Rawal Town, Islamabad

Duration: 27. 09. 2005 to 26. 09. 2008

Financial Status: Total Cost: Rs.8.500 million
Funds Released: Rs.6482400/-
Funds Utilized: Rs.6171175/-

Objectives:

- To generate information which would enable us to better understanding of hypophyseal and steroidal regulation of the ovarian follicle in *Tor putitora*
- Determination of maturation of inducing steroids *T. putitora*
- Development of techniques for artificial manipulation of fish in aquaculture and fish farming in the country.

Achievements:

Different sites such as Wah Garden, Simly Dam, Mangla Dam, Rawal Dam and also different sites in district Attock like Jand & Ziarat (Indus River), Hattian Nursery Unit Attock, Fateh Jang area, Shah Pur Dam and Shakar Dara Dam have been visited for checking the availability of live *Tor putitora*.

Preliminary work on ovarian cycle and gonadomatic index of female *Tor putitora* was carried out. Extraction of steroid hormones from blood has been started and is in progress. Histology of ovarian tissue of the fish was carried out.

The macroscopic analysis reveals that the ovaries in *Tor putitora* are quiescent immediately following spawning (Oct-Nov). Recrudescence of the ovary begins in January and batches of oocytes pass asynchronously through primary growth and secondary growth phase in sucking months during which time vitellogenesis occurs by March. Yolk sequestration is completed in the largest oocytes and maturation progress (germinal vesicle migration and also its breakdown) become evident, marking reinitiation of meiotic progress in preparation for spawning season in late March. During spawning season, batches of secondary and tertiary stages follicles that would ultimately under maturation, sequentially, also exist in the ovaries of this species. The result is based on field observation as well as on macroscopic analysis of ovaries of the species.

Name of Project: Trout Farming in the Mountains of Northern Areas. A Research Project at TRMC Juglote

Name of PI/Institute: Mr. Faridullah Khan,
Scientific Officer,
Karakoram Agricultural Research Institute for Northern Areas,
PARC, Juglote, Gilgit

Duration: 19. 10. 2005 to 18. 10. 2008

Financial Status: Total Cost: Rs.5.713 million
Funds Released: Rs.3972100/-
Funds Utilized: Rs.3972100/-

Objectives:

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

Achievements:

An experiment regarding feed formulation was conducted for a period of thirty (30) months. Initially five experimental feeds were designed with different protein levels and conducted for a period of twelve months with a stock of 600 in each feed formulae/treatment in one replication. After that, the stock of fish was reduced to 300 and this experiment was continued for a period of six months. Necessary data was collected and analyzed.

The studies of feed formulation, prevalence of diseases and affect of silt on growth of trout fish revealed that F1 (A) gives higher growth, low mortality, low FCR and low cost is recommended for further multiplication. Regarding disease, without proper diagnosis, from aquaculture laboratory diseases of fish cannot be treated properly. However, some of the diseased were identified by external and internal symptoms on visual basis and, it was known that precautionary measurement is the best way to combat disease.

Name of Project: Growth Response of Broilers to Ideal Amino Acids Ratio

Name of PI/Institute: Dr. M. Aslam Mirza,
Associate Professor,
Dept. of Animal Nutrition, University of Agriculture, Faisalabad

Duration: 11. 10. 2007 to 10. 10. 2010

Financial Status: Total Cost: Rs.1.595 million
Funds Released: Rs.434500/-
Funds Utilized: not reported

Objectives:

- To establish an ideal set up of indispensable amino acid for improved nutrient utilization and protein accretion in broilers.
- To determine indispensable amino acids level for optimizing feed conversion/improve feed efficiency or to decrease feeding cost per kilogram of gain.
- Hot environment management in broilers through nutrient manipulation and dietary amino acid supplementation.

Achievements:

Since the project has been started in October 2007, the PI of the project has not reported progress of the project. Financial and technical progress reports have not been provided. The PI also did not attend review meeting in March 2009 and failed to highlight his achievements

Name of Project: **Pond Culture and reproductive performance of Seengharee, *Aorichthys aor* (Hamilton, 1822)**

Name of PI/Institute: **Mr. Muhammad Ramzan Ali,**
Scientific Officer,
Aquaculture & Fisheries, NARC, Islamabad.

Duration: 22. 08. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.5.628 million
Funds Released: Rs.2501500/-
Funds Utilized: Rs.2124716/-

Objectives:

- To study performance of Seengharee, *Aorichthys aor* in pond culture system.
- To study reproductive cycles and breeding performance of Seengharee, *Aorichthys aor*.

Achievements:

Survey of different water bodies of Punjab, Sindh and AJK conducted to identify various habitats of Seengharee. It was found that this fish can be collected from Head Baloki and Head Rasool in Punjab, Sajawal in Sindh and Mangla Dam in AJK.

Collection of fingerlings and adults of Seengharee from above mentioned areas were tried with the help of drag nets, gillnets and cast nets. Dragnets and gillnets were successful for the collection of fish; however it was found that Seengharee can not be collected with caste net. Physico-chemical parameters of water were also examined at the collection site.

After collection of Seengharee from natural habitats of Punjab and AJK, it was transported using hauling tanks with aeration system to AFP, NARC, Islamabad. Before transportation fish was sedated using different doses of MS222. Seengharee collected with drag net showed 100% survival and those collected with gillnet showed 50% survival as they got injuries. Fish was air lifted from Sindh, using oxygen filled polythene bags showed 50% survival.

The fish were successfully acclimatized in the captive condition both in indoor fiberglass circular tank and outdoor concrete raceways in AFP. The fish (mean weight 150 g) were stocked in earthen pond in the month of February 2009 to study their growth performance in ponds. The fish have attained weight of 263 g in five months.

Fingerlings of fish with an average weight of 11.3 g and 10.9 g were stocked in nursery pond and experimental pond respectively for different feeding trials. Fingerlings in nursery ponds have gained an average weight of 19.7 g and length 18.6 g in 20 days. Morphometric and meristic studies were conducted and fish was identified as *Aorichthys seenghala*. Dress out of the Seengharee was 75% which is better than carps (61%) and American channel catfish (60%).

Name of Project: Identification of Molecular Markers for Fecundity in Goat Breeds of Pakistan

Name of PI/Institute: Dr. Masroor Ellahi Babar,
Professor,
Dept. of Livestock Production, University of Veterinary and Animal Sciences, Lahore

Duration: 24. 07. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.7.080 million
Funds Released: Rs.4408000/-
Funds Utilized: Rs.4408000/-

Objectives:

- To find Single Nucleotide Polymorphisms (SNPs) in BMPRIB gene.
- To test the SNPs in BMPRIB gene as markers for fecundity in local goat breeds.
- Screening of goat populations available at Govt. livestock farms to identify more prolific animals.

Achievements:

The main focus of the research project was to find single Nucleotide Analysis of reported association as well as novel SNPs in exotic and native breeds. Plan of work for first year was the selection of high and low prolific animals in different breeds of goat by checking the performance records available at all the government farms and by observing the performance of selected animals and extraction of DNA from blood. According to the proposed plan, the work was started with blood sampling of different goat breeds throughout Pakistan. The breeds of goat were selected initially for the blood sampling from various locations in Punjab, NWFP and Balochistan provinces. Special emphasis was given on the purity of the breed and non relationship of the sampled individuals. Pedigree information was also collected, wherever, it was possible.

Ten ml blood was collected aseptically from the Jugular vein of each selected animal into vaccontainer tubes containing anticoagulant i.e. Ethylendiamine tetra-acetic (0.5 M EDTA). Proper record was prepared containing the information regarding the breed, animal ID, age, sex and location of animal. Field blood samples were placed on ice immediately after their collection and brought to the Molecular Cytogenetics and Genomics Laboratory, UVAS, Lahore and stored temporarily in freezer at -20° C. Seventeen pairs of primers were designed. PCR optimization conditions have successfully been completed.

Name of Project: **Phenotypic and Genetic Characterization of Indigenous Breeds of Caprine and Ovine Species in Punjab**

Name of PI/Institute: **Dr. Khalid Javed,**
Associate Professor,
Dept. of Livestock Production, University of Veterinary and
Animal Sciences, Lahore

Duration: 28. 07. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.5.061 million
Funds Released: Rs.2818000/-
Funds Utilized: Rs.2570549/-

Objectives:

- Phenotypic characterization of the goat and sheep breeds of the Punjab province.
- Genetic characterization of the goat and sheep breeds of the Punjab province.
- Estimate genetic and phenotypic correlation between various productive traits.
- Phylo-genetic relationships among different breeds and development of breed specific molecular genetic markers for identification of different breeds from various population in different areas in the Punjab province.

Achievements:

Phenotypic Characterization: A total of 2660 animals were phenotypically characterized, Goats Breeds: Beetal (711), Teddy (567), Angora (327), Daira Din Panah (86), Nachi (47), Sheep Breeds: Kacchi (124), Thalli (473) and Lohi (422). The data have been analyzed and presented in the progress report. For the first time these breeds of both species have been characterized phenotypically and it will be helpful to fix different breed standards.

Genetic Characterization/Blood Sampling: Blood samples of unrelated representative animals from approximately equal number of males and females have been collected for both species. More blood samples are to be collected. DNA from these samples will be extracted for further analysis to characterize these species through genetic analysis. After genetic characterization of our native breeds of sheep and goats they can be got registered.

Name of Project: Investigation on Barley Yellow Dwarf Virus (BYDV) in Wheat Crop in Pakistan. (Component- II)

Name of PI/Institute: Dr. Shahid Hameed,
Senior Scientific Officer,
CDRP, IPEP, NARC, Islamabad

Duration: 01.01.2004 to 31.12.2007

Financial Status: Total Cost: Rs.3.892 million
Funds Released: Rs.2691700/-
Funds Utilized: Rs.2526396/-

Objective:

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

Achievements:

The overall incidence on the basis of ELISA based survey conducted during 2004-05 to 2006-07 indicates that year 2005-06 has high incidence of BYDV in NWFP, then in Punjab, Sindh and Balochsitan. The serological diversity studies show that BYDV-PAV/MAV was more prevalent than CYDV-RPV like isolates during the year 2005-06.

The experimental host range shows that other than wheat, *Zea mays* (maize), *Avena sativa* (oats) *Triticum aestivum* (wheat), *Saccharam officinarum* (sugarcane), *Sorghm halepense*, *Echenocloa colonum*, *Eragristis mino* were found to be susceptible to BYDV-PAV under controlled conditions which were confirmed by DAS-ELISA.

All the commercial wheat varieties were screened to confirm the presence of Bdv1 and Bdv2 genes by PCR based molecular markers. Out of 98, in 86 varieties a product of 250bp was amplified, confirming the presence of Bdv1 gene, which confers field resistance, while in 12 varieties no product was amplified indicating the absence of gene. Some varieties were subjected for the presence of Bdv2 gene which gives true resistance by restricting the cell to cell movement of virus. None of the varieties has expected size of amplified product indicating the absence of this gene.

The ICARDA bread wheat nurseries 2004 and 2007 comprised 30 lines. All of them found susceptible to BYDV with different level of tolerance both under natural and controlled conditions when analyzed by DAC-ELISA. Only two lines (No.2 & 9) showed moderate tolerance to BYDV.

Only TC-14 and Mackellar were found resistant against BYDV under local conditions. As the Bdv1 gene induces slow yellowing but does not provide any resistance to varieties, so it is essential to incorporate Bdv2 gene available in TC-14 and Mackellar into commercial wheat varieties to provide true resistance against BYDV and CYDV.

Name of Project: **Integrated Weed Management in Wheat, Cotton, Rice and Pulses in Punjab (Component-III)**

**Name of PI/
Institute:** **Dr. Abdus Sattar,**
Director,
Agronomic Research Institute, AARI, Faisalabad

Duration: 26.08.2004 to 29.08.2007

Financial Status: Total Cost: Rs.2.120 million
Funds Released: Rs.1505000/-
Funds Utilized: Rs.1218432/-

Objective:

- To establish authentic weed spectra for Wheat, Cotton, Rice and Pulses in Punjab based on survey.
- To find out effective cultural and chemical weed control methods for various weeds of Wheat, Cotton, Rice and Pulses in Punjab.
- To impart training to extension workers and farmers about weed control methodology of Wheat, Cotton, Rice and Pulses.

Achievements:

Wheat:

From weed survey of wheat in different crop zones, it was found that *Avena fetua*, *Phalaris minor*, *Chenopodium album*, *Chenopodium murale* and *Convovulus arvensis* were major weeds in cotton-wheat cropping system and central mixed crop zone. On the basis of average 56 trials, wheat grain yield was increased by 24 to 38 % depending upon the herbicide used. Combined application of Puma Super @ 1250 ml/ha and Buctril Super @ 750 ml/ha gave the best results.

Cotton:

Itsit, Deela, Madhana grass and Tandla are problem weeds of cotton. On the basis of average seed cotton yield data of 39 farmer field trials, cotton seed yield increased by 42 to 74 % by adopting weed control. Stomp 330 EC sprayed @ 3 liter/ha and Dual gold 960 EC @ 2.0 lit/ha increase the maximum seed cotton yield (62 to 66%).

Rice:

Deela, Dhiddin & Goin are problem weeds of rice. On the basis of average data of 10 farmer field trials, paddy yield was increased 9-25% by adopting weed control. Macheta 60 EC sprayed @ 2 liter/ha and Acetore 50 EC @ 0.25 lit/ha increases the paddy yield by 15 and 9% respectively.

Pulses:

In Mung bean, the problem weeds found are Itsit, Deela and Tandla. In Lentil and Gram in irrigated areas, Wild oat, Sitti botti, Bathu and Piazi in Thal area are major problem weeds.

Transfer of Technology:

To demonstrate the weed control technology of pulses, 5 trials were laid out at farmer fields in Thal area of the Punjab. These trials have proved good source of transfer of weed control technology to the farmers.

Forty research workers were trained regarding lay out of herbicides trials, calibration of water for spray & adjustment of nozzle, precaution for herbicidal spray. 1110 Extension workers were trained regarding weed control technology. 1030 Farmers were provided information regarding losses due to weeds and weed control technology of Wheat, Cotton, Rice and Pulses. Eight Radio talks and one T.V. talk were recorded about weed control practices. A weed bank was established at research area of Plant Physiology Section, in which 30 weeds were grown.

Checklist of weeds of Wheat, Cotton, Rice and Pulses was prepared and got published, enlisted about 200 weeds.

Name of Project: **Characterization to Determine the Adaptive Role of Dehydrance under Drought Stress in Wheat, (*Triticum Aestivum*)**

**Name of PI/
Institute:** **Dr. Rehana Asghar,**
Professor,
Department of Botany, Pir Mehar Ali Shah Arid Agriculture
University, Rawalpindi.

Duration: 30. 04. 2006 to 29. 04. 2009

Financial Status: Total Cost: Rs.2.943 million
Funds Released: Rs.1987000/-
Funds Utilized: Rs.1821363/-

Objectives:

- Characterization of dehydrins in the promising cultivars of wheat using immunoblots.
- Isolation of dehydrin genes using Dhn gene probes in genome.
- Determination of adaptive role of dehydrins under drought stress.
- Use of dehydrin antibodies for screening the drought tolerant varieties of wheat.

Achievements:

Wheat seeds of 15 selected cultivars (Chakwal-97, Zarghoon-79, Wafaq-2001, GA-2002, Inqilab-91, Pavon, Rawal-87, Sariab-91, Punjab-85, Haider-2002, Tatar, Saleem-2000, Zameendar-80, Ufaq, Iqbal-2000) were germinated in a growth chamber at 20°C for 10 hours photoperiod. Seeds were germinated on filter paper moistened with Polyethylene glycol (PEG) solutions of variable osmolarities up to three-leaf stage. Sample tissues (whole seedlings) were taken and stored at -20°C. Frozen samples were used for protein extraction. The amount of protein was estimated using Bradford Reagent. 5µg protein was loaded on Polyacrylamide Gel Electrophoresis (PAGE). Immunoblotting with dehydrin antibody permitted the detection of dehydrin bands at MW ranging from 169 to 29 kDa.

Name of Project: Survey of Midges and their Natural Enemies Associated with Mango and to Develop Non Pesticides Measures for their Control in Pakistan (Component-I)

**Name of PI/
Institute:** Mr. Riaz Mahmood
Senior Scientific Officer,
Regional Biosciences Centre, CABI Rawalpindi.

Duration: 01. 07. 2007 to 30. 06. 2010

Financial Status: Total Cost: Rs.4.715 million
Funds Released: Rs.2497500/-
Funds Utilized: Rs.882499/-

Objectives:

- Identification of midges and their natural enemies associated with mango in Pakistan
- Study biology and ecology of important midges pest and their natural enemies.
- Assessment of yield losses incurred by midges to mango
- Development of biological control based IPM with integration of bio-pesticides as short term and long term strategies for management of midges.

Achievements:

The mango midges, due to their multifarious mode of feeding have become a serious threat to mango production in Pakistan. More than 20 species of midges cause damage to various parts of mango plant including bark, shoots, leaves (14 types of galls have been reported on the leaves), pre-flowering shoot buds, inflorescence buds, axis of inflorescence panicles, flowers, newly formed mustard sized fruit and post flowering shoot buds in various parts of the world.

A temporary laboratory at Rahim Yar Khan was established for studies on midges and their natural enemies. The midges and parasitoids reared during the report period were sent to Natural History Museum, U.K, for identification. Two each of the midges (*Procontarinia mangifera* and *Dasineura amaramanjarae*) and parasitoids (*Synopeas mangiferae* and *Synopeas procon*) have been identified while identification of two other species of midges and their parasitoids is awaited.

Other studies initiated on midges and their parasitoids included their vertical distribution on a tree, distribution on different parts of a branch, biology, phenology, population trends and losses occurred by the midges in sprayed and unsprayed orchards at Rahim Yar Khan to ensure the continuous supply of fresh newly formed leaves for the oviposition and further breeding of midges in controlled conditions.

Name of Project: Survey of Midges and their Natural Enemies Associated with Mango and to Develop Non Pesticides Measures for their Control in Pakistan (Component-II)

**Name of PI/
Institute:** Dr. Ghulam Jilani,
Sr. Director,
IPEP NARC, Islamabad.

Duration: 01.07.2007 to 30.06.2010

Financial Status :

Total Cost:	Rs. 2.547 millions
Funds Released:	Rs. 737000/-
Funds Utilized:	Rs. 393098/-

Objectives:

- Assessment of role of bio-pesticides and integration of bio-pesticides in short and long term strategies for management of midges and effect on their parasitoids.
- Development of IPM models and implementation in collaboration with coordinating units.

Achievements:

Neem seed extract in 2% concentration was evaluated against midges attack in tender mango nursery plants. Batches of untreated five plants of about one month and those treated with 2% neem seed extract at 15 days interval were kept under the canopy of mango trees having midges infestation during October to December, 2007. Midges infestation of 0.2 galls/plant was observed on untreated plants as compared with 0.08 galls/plant on December, 2007. Effect of different concentrations of neem seed extract on midges infestation in mango inflorescence was studied during March-May, 2008. There were 2.2 punctures of mites in the panicles of untreated inflorescence which were significantly higher than 1.48, 1.38 and 1.40 punctures recorded where 2.0, 1.0 and 0.5% neem seed extract was applied. Reduction in midges infestation 32.73, 37.27 and 36.36% in 2.0, 1.0 and 0.5% neem seed extract as compared with control.

Name of Project: Survey of Midges and their Natural Enemies Associated with Mango to Develop Non Pesticides Measures for their Control in Pakistan (Component-III) ARI, Tandojam, Sindh

**Name of PI/
Institute:** Dr. Abdul Sattar Buriro,
Entomologist,
ARI, Tandojam, Sindh.

Duration: 01. 07. 2007 to 30. 06. 2010

Financial Status: Total Cost: Rs.2.632 millions
Funds Released: Rs.1303000/-
Funds Utilized: Rs.1208559/-

Objectives:

- Identification of midges and their natural enemies associated with mango in Pakistan
- Study biology and ecology of important midges' pests and their natural enemies.
- Assessment of yield losses incurred by midges to mango.
- Testing of bio-control agents and bio-pesticides to develop short term and long term strategies for management of midges and develop capabilities in farmer communities.

Achievements:

Survey and monitoring of midges were carried out only on leaves and flowers. For this purpose, ten (10) orchards of Hyderabad, Tando Allahyar and Mirpukhas districts were surveyed for gall midges on the nine varieties (Early, middle and late).The observation, collected from these districts on gall midges indicated that variety Langra and Sindhri are susceptible while the variety Began pali found resistant to mango leaf gall midges.

In un-manage garden the over all mean attack leaves were observed 2.97/branch on variety Sindhri followed by 2.76/branch on variety Langra. The over all gall midges/leaves were 35.00/ leaf on variety Sindhri followed 33.19/leaf on variety Langra. In managed garden the over all mean attacked leaves/branch were observed 1.22/branch on variety Sindhri followed by 1.00/ branch on variety Langra while over all gall midges/ leaves were found 5.33/ leaves on variety Sindhri followed by 4.66/ leaves on variety Langra.

The data indicated that the variety Langra and Sindhri were found susceptible while, the variety Began pali found resistant to mango gall midges (circular gall midges). The overall mean gall were 14.75/ leaves in variety Langra followed by 13.57/ leaves on variety Sindhri. The overall gall damage percentage of leaves was 15.14% on variety Langra and 13.14% on variety Sindhri. The gall infested leaves were brought in the Laboratory for emergence of parasitoids and adult.

The phonological study was carried out on susceptible variety Langra. The gall infestation was found on variety Langra. The 15-20 years old garden with good management and regular spray had less infestation of mean gall 14.75/ leaves, while in un-managed 40-50 years old garden with no spray had 23.69 galls per leaves. Similarly, in intercropping with mango has low infestation of mango midges. This may be due to availability of more moisture. This will be further investigated.

In the month of June the red colour larvae were collected from the infested inflorescences and kept them with infested inflorescence in the jars and cages for the hatching purpose of the mango gall midges in the lab conditions. The larvae were pupate in the jar and adult emerged.

Name of Project: Investigation of Viral Diseases of Sugarcane in Pakistan with Special Emphasis on Sugarcane Mosaic Virus (SCMV) Characterization and Identification of Resistant Sources

**Name of PI/
Institute:** Dr. Tahira Yasmin,
Senior Scientific Officer,
Crops Diseases Research Program, IPEP, NARC

Duration: 01. 07. 2007 to 30. 06. 2010

Financial Status: Total Cost: Rs.5.436 millions
Funds Released: Rs.2121000/-
Funds Utilized: Rs.1421398/-

Objectives:

- To conduct surveys of major sugarcane growing areas of Punjab and NWFP to know the occurrence, distribution and prevalence of viral diseases.
- Indexing of survey collected samples against major viruses infecting sugarcane through ELISA.
- Characterization of SCMV on the basis of serological and biological properties.
- Screening of available sugarcane germplasm against SCMV for identification of resistance.
- Development of management strategies for SCMV.

Achievements:

Field surveys of major sugarcane growing districts of NWFP and ten districts of Punjab were conducted. The samples collected were tested through DAS-ELISA against four major viruses viz. Sugarcane Mosaic Virus (SCMV), Maize Streak Virus (MSV), Maize Dwarf Mosaic Virus (MDMV) and Sugarcane Bacilliform Virus (SCBV). SCMV was found almost equally prevalent throughout the sugarcane growing areas except Peshawar in NWFP and Sargodha & Toba Tek Singh in Punjab province.

In NWFP (Mardan, Peshawar, Charsada & Dargai), relative incidences of SCMV, MSV, MAMV and SCBV in random samples were 15, 22.5, 26.25 & 16.25% respectively while in non-random samples, the incidences were 40, 13.75, 18.75 & 15% respectively. Among viruses, the highest incidence (in random samples) was found for MDMV (60%) in Mardan district. In Punjab (Mandi Bahaudin, Sargodha, Faisalabad, Jhang, Toba Tek Singh, Okara, Rehim Yar Khan, Bahawalpur) the relative incidences of SCMV, MSV, MDMV & SCBV in random samples were 35.26, 68.12, 39.37 & 63.75% respectively while in non-random samples 36.875, 75, 42.5 & 36.87% respectively. In Punjab, Sargodha and Toba Tek Singh districts seemed to be free of SCMV infection while the highest incidence among viruses in random samples was found of SCBV (95%) in Toba Tek Singh district.

Two representative isolates of SCMV one from each province are being maintained under glasshouse conditions. The number of isolates of SCMV, MSV, MDMV & SCBV (obtained from survey collection) preserved from both provinces were, 29, 25, 19 & 29 respectively.

For SCMV host range studies, wheat (Chakwal-97, NARC No.1542 & Barani-73, Sorghum (JS-62), Millet (MB-87, Super-1 & Acc. No.8808), Oats (PD2LV65), Maize (EU-5098, Rakaposhi, Islamabad Gold & Islamabad white) & Barley (Soorab-96) were tested by mechanical inoculation using the isolates of NWFP & Punjab under glass house conditions. The only crop varieties MB-87, Super-1, Acc. No.8808 (millet) & EU-5098, Rakaposhi, Islamabad Gold and Islamabad white (Maize) were found positive for SCMV through ELISA.

SCMV was successfully transmitted by mechanical inoculation as well as through two aphid species. Aphid species (*Sitobion sp.* & *Macrosiphum euphorbiae*) were collected from sugarcane field of NARC, Islamabad, identified and were reared on healthy plantlets of Maize, Millet, Sorghum and Oats in separate cages under glasshouse conditions. Adult form of both non-viruliferous vectors were provided acquisition-feeding period of 5 minutes each on SCMV-infected sugarcane plants in Perspex cages separately. At least 25 viruliferous vectors of each insect species were given inoculation feeding periods of 1, 3 and 5 minutes each separately to test plants viz. Millet (MB-87, Acc. No.8808) Oats (PD2V65), Maize (Islamabad white, Islamabad Gold, EU-5098), Sorghum (JS-62) and Barley (Soorab-96). In the case of *Sitobion sp.* 1, 3 and 5 minutes inoculation feeding periods, Islamabad Gold (Maize), MB-87 (Millet) and Islamabad white & EU-5098 (maize) were found SCMV-ELISA positive respectively while in the case of *Macrosiphum euphorbiae*, 1.3 and 5 minutes inoculation feeding period, Islamabad Gold (Maize), Islamabad white (Maize) & Acc. No.8808 (Millet) and EU-5098 (Maize) were found SCMV-ELISA positive respectively.

Field days/awareness seminars were organized on “Viral diseases of sugarcane crop and their management” at Sugarcane Research Institute, AARI, Faisalabad on 23rd June 2008 and Sugar Crops Research Institute, Mardan on 21st June, 2008.

Name of Project: Management of Date Palm Insect Pests in Sindh

**Name of PI/
Institute:** Muhammad Usman Shar,
Entomologist,
Agriculture Research Institute, Tandojam, Sindh.

Duration: 01. 07. 2007 to 30. 06. 2010

Financial Status: Total Cost: Rs. 3.616 millions
Funds Released: Rs.1691500/-
Funds Utilized: Rs.1597248/-

Objectives:

- To conduct studies on life table of major insect pests i.e, Red-palm weevil and Fruit borer of date palm.
- To study the effect of ecological factors, natural enemies and alternate host plants on date palm pests.
- Field observations on date palm varieties for comparative resistance to pests' i.e. Red palm weevil and fruit borer and extent of damage.
- Screening of environmentally safe pesticides against major insect pests.
- Development and dissemination of IPM techniques on the basis of results to the date palm growers.

Achievements:

Survey was carried out for red palm weevil insect pest from four different locations/Taulkas viz. Kotdiji, Kingri, Rohri and Pano Akil. Five acres from each location/taulka were selected for pest scouting infestation. From each location 25 trees were observed and different stages (egg, larva, pupa and adult) of the pest were recorded visually.

The maximum percent (11.8%) of RPW was recorded at Panoakil and lowest (8.6%) at Kingri. The monthly mean temperature ranged between 26.93°C to 30.5°C favored the pest attack. The mean attack (10.25+6.66%) remained higher due to removal of suckers. During survey and lab studies, no natural enemies of RPW and lesser date moth were found. In life table study more mortality (73.0%) from egg to pupae was recorded in RPW in laboratory conditions.

During survey of date orchards of different talukas, all orchards were infested with fruit borer. The maximum mean infestation (13.4-16.8%) was recorded in the months of May - June in the immature fruits and maximum temperature favored the pest attack.

Name of Project: **Development of High Yielding and Powdery Mildew Resistant Varieties in Peas**

**Name of PI/
Institute:** **Nausherwan Nobel Nawab,**
Scientific Officer,
Vegetable Research Institute, AARI, Faisalabad

Duration: 01.07.2007 to 30.06.2010

Financial Status: Total Cost: Rs. 1.474 millions
Funds Released: Rs. 660600/-
Funds Utilized: Rs. 436640/-

Objectives:

- To develop varieties in peas having high yield and powdery mildew resistance.

Achievements:

The basic objective of the project is to develop powdery mildew resistant varieties with high yield potential. Pea is an important winter season crop of high nutritional value being grown in Pakistan. The normal sowing season for this crop in Punjab is October to November. Green pods become ready during February through March. This sowing time becomes more essential as most of the seed production in peas is practiced during this period. This is the crucial time when the crop is badly affected by the powdery mildew disease, affecting the seed crop in particular.

Under the present circumstances, there is no commercial variety resistant to powdery mildew disease available with the farming community for general cultivation. Some resistant and tolerant germplasm is available, from which the gene for powdery mildew resistant/tolerant could be utilized for the development of powdery mildew resistant varieties in peas.

The project activity is in initial stage. Pedigree method was followed and F0, F1, F2 and F3 were studied to advance the next generations. Three fresh crosses were attempted. Three F1 were planted along with parents to check the purity of the crosses. One cross in F2 and two crosses in F3 were planted and high yielding and powdery mild disease resistant/tolerant plants were selected to proceed the next generations.

Name of Project: **Enhancement of Quality & Storage Stability of Dhakki Dates using Advanced Technology**

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

Duration: 01.07.2007 to 30.06.2010

Financial Status: Total Cost: Rs.4.099 millions
Funds Released: Rs.401917/-
Funds Utilized: Rs.382605/-

Objectives:

- Study of maturity indexing and artificial ripening using different ripening accelerators.
- Shelf life extension of Dhakki date using different drying and other preservation methods.
- Storage studies of date with respect to different temperatures, environment and relative humidity etc.

Achievements:

The specific area was selected at the sites where most of Dhakki dates activities exists namely Dhakki, Paharpur, Rangpur & Paniyala. Survey completed and data regarding the amount of produce, area under date cultivation was collected. Causes of quality deterioration were assessed to find out the extent of damage to the produce. The attention was focused to examine the problems faced by the date growers regarding post-harvest losses, availability of appropriate storage and transportation facilities, technical know how about preservation methodology and technology.

The methodology for the evaluation of moisture, pH, acidity, total soluble solids water activity and browning determination was standardized. The procedure for maturity indexing was also established. The experiments on artificial ripening were set and required salt and acetic acid solutions were prepared to treat the Doka of Dhakki dates treated for stimulated ripening, colour, firmness, total soluble solids, fruit ripening %, fruit pulp and weight of the fruits determined.

Name of Project: Identification and Evaluation of *Gossypium arboreum* genes for Cotton Leaf Curl Virus Resistance

Name of PI/Institute: Dr. Aftab Bashir
Principle Scientist,
Plant Bio Technology Division, NIBGE, Faisalabad.

Duration: 01.07.2007 to 30.06.2010

Financial Status: Total Cost: Rs.4.273 millions
Funds Released: Rs.2304700/-
Funds Utilized: Rs.1715320/-

Objectives:

- Construction of leaf cDNA libraries from CLCuV resistant and susceptible cotton lines (year-1).
- Identification of differentially expressed genes (year-2).
- Evaluation of isolated genes for CLCuV resistance in a model plant system (year-3).
- Establishment of gene pool resource for development of Transgenic CLCuV resistant cotton lines (overall output).

Achievements:

During the first year of project execution, resources of gene pool from cotton leaf curl (CLCu) virus resistant and susceptible cotton varieties have been generated. *G. arboreum* is a diploid cotton species and is naturally resistant to CLCu disease. The CLCu virus is transmitted through whiteflies which feed on the cotton leaves and transmit the virus to phloem tissues. The virus resistance genes are expressed in leaf tissues and provide the best source for isolation of virus resistance genes. Therefore, leaves from *G. arboreum* were used to construct cDNA library from this CLCu disease resistant cotton variety. In addition, cDNA library from CLCuV susceptible cotton line (*G. Hirsutum* var. coker) was also developed to cross check and confirm the expression of potential CLCuV resistance genes selected from *G. arboreum*. The transformation efficiency and average insert size of the libraries has been determined. The glycerol stocks of the libraries and the purified clones are preserved at -80°C for further use.

Identification of differentially expressed genes can also be facilitated by constructing subtractive cDNA libraries between the resistant and susceptible cotton varieties. *G. hirsutum* var. coker is reported to be highly susceptible to CLCu disease. The cDNA's synthesized from the leave mRNA of green house grown (CLCu disease free) *G. hirsutum* var. coker were used for subtraction from the field grown *G. arboreum* leaf cDNA's. the forward and reverse subtractive libraries were constructed using "PCR Select cDNA's subtractive library construction kit". (Clontech, USA). Each of the clones obtained from this libraries has been purified and preserved in glycerol at -80°C. The generation of gene pool was included in the first year of the project and has been accomplished.

Name of Project: Insecticide Resistance Management of key Pests of Vegetable

Name of PI/Institute: Dr. Mushtaq Ahmad
Dy. Chief Scientist,
Plant Protection Division, Nuclear Institute of Agriculture and Biology (NIAB), Faisalabad

Duration: 01.07.2007 to 30.06.2010

Financial Status: Total Cost: Rs. 2.293 millions
Funds Released: Rs. 1025500/-
Funds Utilized: Rs. 628721/-

Objectives:

- Monitor the level of resistance in field strains of various vegetable pests compared with the laboratory-reared susceptible strains.
- Determine cross-resistance spectra as to what chemicals can be substituted in the wake of resistance development
- Find out mechanisms responsible for the resistance in question
- Evaluate if the existing pesticide mixtures are potentiating, additive or antagonistic, and if some mixtures can be used in counteracting resistance.
- Devise appropriate insecticide resistance management strategies to combat resistance.

Achievements:

With the increased use of pesticides in Pakistan, there has been a progressive development of genetically-acquired resistance of vegetable pests to insecticides. This is resulting in control failures of vegetable pests and the problem is aggravating day by day. Mealybug (*Phenacoccus solani*) was found highly resistant to endosulfan, profenofos, bifenthrin and deltamethrin. Mineral oil was also not effective against mealybug. Potato aphid (*Myzus persicae*) seemed to have developed resistance to all the major chemicals such as organophosphates, carbamates, pyrethroids and neonicotinoids. Cabbage aphid (*Brevicoryne brassicae*) showed no resistance to insecticides, whereas resistance in whitefly (*Bemisia tabaci*) has started developing to the new chemistry insecticides. The commonly-used insecticides for insect pests proved highly toxic to predatory coccinellids *Menochilus sexmaculatus* and *Hippodamia variegata*. However, a few insecticides were found safe against a parasitoid *Trichogramma chilonis* and a predator *Chrysoperla carnea*.

Name of Project: **Development of Wheat Heat Tolerant Breeding Material during Grain Fill Period**

**Name of PI/
Institute:** **Muhammad Ashraf Mian,**
Assistant Botanist,
Barani Agricultural Research Institute, Chakwal.

Duration: 01.07.2007 to 30.06.2010

Financial Status: Total Cost: Rs.1.557 millions
Funds Released: Rs.1001600/-
Funds Utilized: Rs.831129/-

Objectives:

- Extensive screening of germplasm resources for heat tolerance during grain filling period.
- Incorporation of heat tolerance into otherwise desirable genotypes.
- Development of wheat germplasm that can tolerate high temperature during grain filling period
- Multi-location screening/testing of breeding material developed.

Achievements:

One hundred genotypes were grown (two sets) in earthen pots under normal conditions. After complete anthesis one set of 100 genotypes was shifted in glass house where temperature was maintained 2 to 3 degree higher than that of hottest temperature of the Punjab during that period. Data were recorded under both normal and heated conditions. The genotypes which showed better performance under heated conditions were selected for hybridization.

Name of Project: **Sustainable Control Measures for Rose-ringed Parakeet-*Psittacula krameri* on Maize, Citrus, Guava, Sunflower and Mango in some Selected Agro-ecosystems in Central Punjab**

**Name of PI/
Institute:** **Dr. Hammad Ahmad Khan,**
Assistant Professor,
Department of Zoology and Fisheries, University of
Agriculture, Faisalabad.

Duration: 01.07.2007 to 30.06.2010

Financial Status: Total Cost: Rs.1.629 millions
Funds Released: Rs.522000/-
Funds Utilized: Rs.338080/-

Objectives:

- To carry out a detailed survey of the agricultural crops in the selected agro-ecological systems throughout Central Punjab to assess the potential parakeet roosts and nests, likely to cause the depredations on food croplands.
- To make an assessment regarding the foraging, feeding, roosting and nesting rhythms (activities) of the rose-ringed parakeets, in particular to calculate their numbers in different roosts. This will provide an approximation of the standing parakeet population throughout Central Punjab.
- To evaluate the level of damage caused by the rose-ringed parakeet on maize, sunflower, citrus, mango and guava in the proposed studies in varying seasons.
- To employ various mechanical/biological control devices viz, repellents, bird nets, chemo-sterilants along with some others for sustainable management of rose-ringed parakeet populations in various habitats in central Punjab, and to present a strategic package to the farmers, the end users, the proposed methodology in a simplified way.

Achievements:

A detailed survey of rose-ringed parakeet population has been carried out around seven well distributed roosting/breeding sites. The results have shown that the bird population at these study sites ranged between 170 to 330 individuals and found to co-relates with position of tree cover at each roost, frequency of feeding sites in the locality, condition of feeding site with respect to food availability around the year, use of pest repellent or control devices in the vicinity and poaching stress at breeding sites.

Being fruit eating bird, rose-ringed parakeet has been regarded a serious universal fruit pest. During first year, damage assessment experiment has been carried out on two fruit crops i.e. Guava and Mango. Data was collected twice a day and the number of incoming and outgoing position of the birds was noted and accordingly damaged/fallen fruits were collected to

assess the volume of damage done at respective site. Guava crop was ready in the area therefore maximum data is given in the data sheets relates to this crop. Mango fruit crop is at early growth stage and immature fruit falling is natural phenomenon at this time. However, it has been observed that in some cases parakeets have started feeding on some developed fruits. Further studies on maize, sunflower and citrus will be completed successively with the sowing or fruit setting of the crops.

Name of Project: Genetic Biodiversity Improvement of Nuts (Almond and Walnut in FATA)

**Name of PI/
Institute:** Dr. Syed Asghar,
Senior Research Officer (Horticulture),
Agricultural Research, FATA, Kurram Agency,
Parachinar.

Duration: 01.07.2007 to 30.06.2010

Financial Status: Total Cost: Rs.1.495 million
Funds Released: Rs.233500/-
Funds Utilized: Rs.221850/-

Objectives:

- To collect promising varieties of walnut and almond
- To conduct primary selection in the species
- To preserve superior germplasm by in vivo techniques to use as scion wood for future regeneration
- To multiply the outstanding varieties in the nurseries to produce disease free, true-to-type plants of the species.

Achievements:

The general survey of the area shows that there is diversification in the indigenous material of almond and walnut, and there is great need for conservation of this material through conventional methods of multiplication. Similarly, the observations recorded through the field experiments have revealed that there are great variation in the germination data of hard, semi hard and thin shelled nuts of almond and walnut. These observations are not enough to draw a conclusion and, therefore, long-term experimentations are needed for the final recommendation of seed type as a root

Name of Project: Development of Botanical Pesticides from Traditionally used Plant Derivatives Against Stored Grain Pests

Name of PI/Institute: Dr. Ghulam Jilani,
Senior Director,
Institute of Plant and Environmental Protection, NARC,
Islamabad.

Duration: 21.07.2005 to 31.12.2008

Financial Status: Total Cost: Rs.3.385 million
Funds Released: Rs.2208000/-
Funds Utilized: Rs.1635000/-

Objectives:

- Determination of pest control properties of indigenous plant derivatives.
- Preparation of effective formulations based on active plant extracts/fractions.
- Demonstration of botanical pesticide based Integrated Pest Management of stored grain insects.

Achievements:

A. Repellency Studies: (i) Repellency of plant extracts against *Triboleum castaneum*: Out of the Seven promising plants (viz roots of "Kuth" *Saussurea lappa*, "Balchar" *Valeriana jatamansi*, seeds of "Harmal" *Peganum harmala*, "Neem" *Azadirachta indica*, rhizomes of "Turmaric" *Curcuma longa*, "Sweetflag" *Acorus calamus* and leaves of "Ner" *Skimmia laureola*). *Acorus calamus* showed the highest average repellency of 76.54 percent at 1000 $\mu\text{g}/\text{cm}^2$ followed by 64.21 and 62.23 percent at 500 and 250 $\mu\text{g}/\text{cm}^2$ respectively against *Triboleum castaneum* (for a material to be promising repellent, it should have 40 percent or higher average repellency over 8 weeks test period against *T. castaneum*). It was followed by *Azadirachta indica* which had 61.58, 55.86 and 51.17 percent repellency at 1000, 500 and 250 $\mu\text{g}/\text{cm}^2$ respectively.

(ii) Repellency of plant extracts against *Rhizopertha dominica*: The highest average repellency of 49.38% was shown by *Saussurea lappa* at 500 $\mu\text{g}/\text{cm}^2$, *Valeriana jatamansi*, *Acorus calamus* and *Azadirachta indica* also showed high repellency. Petroleum ether was better than acetone and ethanol for preparing repellent extracts. The repellency was dose-development and time-dependent. It was high in the first week and decreased progressively in the fourth and eighth weeks.

B. Growth Inhibition Studies: (i) Oviposition Inhibition: The lowest number of 50.75 eggs was laid by *T. castaneum* fed on wheat flour treated with extracts of *C. longa* at 1000 ppm which were significantly lower than 87.67 in control. However, highest egg hatching inhibition of 27.76 percent was shown by *A. calamus* at 1000 ppm. There was no significant difference in plants and solvents used for extraction on oviposition and hatching.

(ii) Larval Inhibition: All the plants had significant effect on larval development as compared with control except *S. laureola* at 250 ppm. Minimum number of larvae were 32.42 at 1000 ppm of *A. calamus* followed by 33.08 in *A. indica* at 250 ppm as compared with 67.58 in control.

(iii) Pupal inhibition: Maximum pupal inhibition of 46.20 percent was recorded in *A. indica* at 250 ppm. It was followed by 45.00 percent inhibition in *C. longa* at 1000 ppm and *V. jatamensi* at 500 ppm.

(iv) Adult Inhibition: Minimum number of 19.58 adults were recorded in *A. indica* at 250 ppm followed by 20.33 in *A. calamus* at 1000 ppm as compared with 59.75 in control which was significantly higher. All the plants had significantly lower number of adults than in control. Among solvents, ethanol exhibited 7.22 percent inhibition as compared with significantly lower 5.05 and 2.99 percent inhibition in acetone and petroleum ether extracts.

C. Chemical Studies: *A. calamus* being the most promising repellent against *T. castaneum*, its petroleum extract was further selected for chemical fractionation by thin layer chromatography and column chromatography. Out of six fractions obtained, F1 had the highest average repellency of 91.38 percent which was not significantly different from 80.13, 76.88 and 85.00 percent in F3, F5 and petroleum ether extract of *A. calamus*. All the fractions persisted well for eight weeks except F2 showing 37.00 percent repellency in the eighth week. Highest average repellency of 83.31 percent was exhibited in the first week followed by 78.25 percent in the second week. There was no significant decrease in repellency in the second week. However, it dropped significantly to 69.13 and 54.44 percent in the fourth and eighth weeks.

D. Field Studies: Being a promising repellent and growth inhibitor, petroleum ether extract of *P. harmala* was evaluated as grain protectant in the public sector food grain godowns. It was applied to 100 Kg gunny bags before storage of grains and compared with *A. indica* oil-the standard and PEPF Technology (Polyethylene enclosure and Phosphine fumigation). During fortnightly sampling infestation of *T. castaneum*, *R. dominica*, *Oryzophilus surinamensis*, *Trogoderma granarium* and *Sitophilus oryzae* was recorded in the grain samples. Population of these pests in the bags treated with *A. indica* oil and petroleum ether extract of *P. harmala* were almost at similar level but prominently lower than that of control. However, their population was slightly higher in *P. harmala* than that of *A. indica* oil especially after September. Insect population in the bags applied PEPF was the lowest but close to that of *A. indica* oil. Population level remained higher in control than those in the treated bags. Generally pest population remained lower due to disturbance in inventory of godowns because of wheat flour crisis.

Five research papers have been published in scientific journals from project work. Two students have completed their research in the project for their master degree program.

Name of Project: **Sustainable Approaches toward Adaptation of Sorghum and Millet Improved Varieties for Grain and Fodder Purpose in Rainfed Areas of Kohat Division**

**Name of PI/
Institute:** **Mr. Mirza Hassan,**
Research Officer,
Barani Agricultural Research Station, Jarma Kohat, NWFP.

Duration: 10.04.2006 to 31.03.2009

Financial Status: Total Cost: Rs.1.476 million
Funds Released: Rs.1196500/-
Funds Utilized: Rs.1077400/-

Objectives:

- Collection and Introduction of Germplasm from local and exotic sources.
- Screening and selection of high yielding Genotypes under agro-climatic conditions of Kohat and their dissemination in the farming community.
- Dissemination of new high yielding and drought tolerant varieties in the area.
- Development of better production technology and its dissemination among the farmers.

Achievements:

Sorghum varieties/lines RARI-S-4, CSL-13, RS-29, SV-15, No.1863 and DS-03 were found the highest grain yielding varieties with grain yield of 5100, 4723, 4666, 4300, 3150 and 2806 kg per hectare respectively. Sorghum varieties/lines Hegari, JS-2002, Sandalbar, JS-263 and Johar were the highest fodder producer with 28850, 28666, 28000, 27778 and 23583 kg per hectare respectively. Millet varieties/lines DB-03, No.786, KG-98 and Supper-1 produced grain yield of 2383, 2066, 1900 and 1685 kg per hectare respectively, while fodder No.786, Supper-I and DB-03 produced fodder yield of 39583, 39266 and 33800 kg per hectare respectively. The above mentioned varieties/lines performed well in the agro-climatic conditions of Kohat and are being recommended to farmers for cultivation.

Name of Project: **Molecular Marker Facilitated Pyramiding of Bacterial Blight Resistance Genes In Super Basmati Rice**

**Name of PI/
Institute:** **Dr. Muhammad Arif,**
Principal Scientist
Plant Biotechnology Division, NIBGE, Faisalabad

Duration: 16.08.2005 to 31.12.2008

Financial Status: Total Cost: Rs.3.458 million
Funds Released: Rs.3206600/-
Funds Utilized: Rs.2690949/-

Objectives:

- Evaluation and identification of IR24 based near isogenic lines with single major gene or gene combinations effective against virulent Xoo strains in Pakistan.
- Incorporation of four bacterial blight resistance genes into high yielding commercial Super Basmati rice variety.

Achievements:

Twenty two plants were selected from 58 BC3F1 genotypes as a result of foreground selection for three BB genes i.e. Xa-4, Xa-5 and Xa-13 by using STS-SSR markers and phenotypic field performance. Artificial inoculation of IRBB lines and 58 BC3 F3F1 plants was also accomplished for their response against bacterial blight disease. No disease symptoms were developed due to non conducive environment for the disease. At maturity, selfed seed of the desired plants were harvested for their studies in the subsequent year. Off-season genotypic and phenotypic studies of 9 BC3.

F2 populations enabled us to select 54 plants for their further evaluation. Seedlings of these 54 plants were raised for further studies.

Molecular survey for targeted 3 BB resistance genes have been initiated to select the seedlings having our desired genes. The rice nursery of 26 IRBB lines possessing different BB resistance genes and approved rice varieties including Super Basmati were transplanted in the field at three locations i.e; Faisalabad, Gujranwala and Kala Shah Kaku to document the disease response of these genotypes against different pathogen strains prevalent in Pakistan. Further results are awaited.

Name of Project: Screening of Citrus Cultivars Grown in Pakistan against Citrus Canker and its Management

**Name of PI/
Institute:** Dr. Shahbaz Talib Sahi,
Assistant Professor,
Department of Plant Pathology, University of Agriculture
Faisalabad

Duration: 25.07.2006 to 30.06.2009

Financial Status: Total Cost: Rs.2.952 million
Funds Released: Rs.1577600/-
Funds Utilized: Rs.1055854/-

Objectives:

- To screen out the citrus cultivars against various isolates of the causal bacterium for resistance.
- To study the ecology of citrus canker with respect to incidence, distribution, losses and relationship with meteorological factors.
- To study the cultural and physiological requirements of citrus canker pathogen and to differentiate the pathovars on molecular basis.
- To develop integrated management strategy for citrus canker.

Achievements:

During the period under report, the infection index of citrus canker disease was recorded from the three districts (Faisalabad, Sahiwal and Sargodha) of Punjab province and three districts (Nawabshah, Sanghar and Naushehro Feroz) of Sindh province. The disease ranged from 12 to 31 and 25 to 39.21 in Sahiwal and Sargodha districts, respectively, while, the range of infection index of disease was 16.21 to 26.25, 15 to 20.45 and 17.26 to 23.25%, from Nawabshah, Sanghar and Noshero Feroz, respectively.

In addition, the spots selected for continuous recording of data were visited on weekly basis. The disease infection index in Faisalabad, Sahiwal and Sargodha ranged from 7 to 18.5, 5.5 to 19.3 and 5 to 20.4%, respectively. It was observed that a temperature range of 29-39, 23.5-38.5 and 24.5-37°C was the most favourable for disease development at Faisalabad, Sahiwal and Sargodha districts, respectively, while 31-37% of relative humidity was found to be the most favourable for disease development in the three districts.

Regression analysis of disease infection index versus different environmental factors (in all possible combinations) was done for the data from all the eight localities. The rate of disease development was significant in most of the combinations at all the localities (The R² values being significant in most of the cases). Moreover, the maximum and average temperature has a significant and positive correlation with the disease infection index at almost all the localities, but the relationship of minimum temperature was significant at five out of eight

localities. The relative humidity also had a significant but negative correlation with disease infection index at all the localities.

A large number of diseased specimens were collected from the orchards visited for the purpose and the causal bacterium has been isolated from these specimens. The bacterial isolates have been stored and their cross reactivity on various citrus cultivars/varieties and studies on various physiological and biochemical characters has been started, which will be reflected in the next report.

Name of Project: Evaluation of Chickpea Germplasm against Aggressive Isolates of *Ascochyta Rabiei* Identified by Biological and DNA Molecular Marker Techniques and Disease Management through Induced Systemic Resistance (ISR)

**Name of PI/
Institute:** Dr. Nighat Sarwar,
Chief Scientist,
Nuclear Institute for Agriculture & Biology (NIAB),
Faisalabad.

Duration: 25.07.2006 to 30.06.2009

Financial Status: Total Cost: Rs.3.909 million
Funds Released: Rs.2324200/-
Funds Utilized: Rs.2258936/-

Objectives:

- Characterization of pathotypes/races of *Ascochyta rabiei* through biological pathotyping and genetic analysis.
- Identification of virulent *A. rabiei* isolates from different chickpea growing areas and Screening of Chickpea germplasm against them to identify chickpea germplasm having durable resistance.
- Enhance resistance in high yielding, good quality chickpea cultivars by inducing systemic resistance with safe chemicals/reagents.

Achievements:

Reappearance of *Ascochyta* blight during 2007 indicated that the disease still persists as a major challenge to sustainable crop production. It also confirmed the existence and viability of the inoculum which can result in disease epidemic under conducive environmental conditions. Pathotyping of eleven selected isolates of *A. rabiei* revealed that two isolates were highly virulent (A-45 & P-22) and nine isolates moderately virulent (C-64, C-66, I-92, P-18, SP-1, SP-3, M-12, M-14). The isolates identified as highly virulent are used for host resistance studies. Screening of pathogen population for identification of virulent strains is prerequisite for reliable screening of host population to determine whether prevailing varieties of host will remain resistant or there is need to introduce new resistant to changing pathogen population. Out of 68 tested genotypes, 51 were tolerant, 12 were moderately susceptible and 5 were susceptible. Tolerant genotypes can be used in further breeding programs based on their agronomic traits. Studies on induced systemic resistance revealed that treatment of plants with low concentrations of environmentally safe chemicals have reduced blight disease under controlled and field conditions. Bion and SA showed highest reduction in the disease under both environmental conditions and had synergistic effect on reduction of blight disease under growth room conditions. These results indicate that ISR technology will be helpful in *Ascochyta* disease management.

Name of Project: **Integrated Control of Root Rot of Pepper in Peshawar and Malakand Divisions**

**Name of PI/
Institute:** **Dr. Shokat Hussain,**
Associate Professor,
Department of Plant Pathology, NWFP Agricultural
University Peshawar

Duration: 27.01.2007 to 26.01.2010

Financial Status: Total Cost: Rs.2.622 million
Funds Released: Rs.1537520/-
Funds Utilized: Rs.1802000/-

Achievements:

Characterization of Isolates: Isolates were significantly different with respect to radial growth. Isolates ranged from 3.68 - 7.75 cm in colony diameter. No clustering was observed for isolates collected from adjacent locations. Variability exists in the population structure of *Phytophthora capsici* based on this phenotypic marker. Significant differences were found among the isolates with regard to metalaxyl sensitivity. Isolates formed two distinct groups referred to as resistant and sensitive. Resistant isolates showed 40% or more growth as compared to the known standard. Isolates showing less than 40% or more growth as compared to the known standard. Isolates showing less than 40% were rated as sensitive. 94% of the isolates were resistant and 6% were rated as sensitive. Only the sensitive isolates were collected from Talash (Lower Dir). Significant differences were observed amongst the collected isolates of biocontrol agent, *Trichoderma harzianum*. Isolates clustered into three different groups in checking the growth of the pathogen. These were rated as excellent, good and poor. Variability exists in the population structure of the pathogen and is suggestive of sexual recombination and re-assortment of alleles. Screenings of both *P. capsici* and *T. harzianum* has yielded promising candidate isolates of both pathogen and biocontrol agent. Such results will be further tested and authenticated in subsequent field trials.

Name of Project: **Studies on IPM with Reduced Chemical Beekeeping Approach to Avoid Related Treatment Resistance of Parasitic Mites, Honeybee Diseases and Pests**

**Name of PI/
Institute:** **Dr. Elizabeth Stephen Waghchoure,**
Senior Scientific Officer
Honey Bee Research Program, INRES, NARC,
Islamabad

Duration: 07. 11. 2006 to 06. 11. 2009

Financial Status: Total Cost: Rs.3.517 million
Funds Released: Rs.2818000/-
Funds Utilized: Rs.2747885/-

Objectives:

- Identification of parasitic mite distribution and behavior.
- To develop reduced Chemical Beekeeping (RCB) management system.
- Breeding of resistance honeybee colonies.
- Assess the combination of Integrated Pest Management (IPM) control methods.
- Train beekeepers / workers for the management of honeybee colonies with modern techniques to obtain maximum yield by exploiting the mite resistant vigor in the colonies.
- Using the results of the above to devise an Integrated Pest Management Strategy for brood mite control. This information could be produced as a leaflet for distribution for beekeepers.

Achievements:

Two surveys were conducted on mites and disease incidence in beekeepers apiaries in Chakwal, Dhudial (December 2006 to January 2007), Peshawar, Swat and Attock areas (May-June, 2007). Produced 42 quality queens for resistance against mites and diseases. Increased the number of colonies from 24 to 42.

Evaluated chemical and non-chemical control measures against honeybees' parasitic mites. Introduced integrated use of quality queen with *Varroa* screens, formic acid and thymol for effective management of parasitic mites. Established laboratory for mite, pests and disease identification. Identified two haplotypes of mites, *Varroa destructor* (Korean type) in *Apis mellifera* and *Varroa destructor* (Pakistani type) in *Apis cerana*. There are many genotypes of *Varroa* mites naturally parasites of the Asian honeybee *Apis cerana*, only two genotypes can breed on European bees, Korean and Japanese. The genotype of the *Varroa* mite which arrived in Pakistan in 2002 was identified to be Korean genotype.

Organized a national workshop in first year for progressive bee-keepers in IPM techniques for mite and disease control. 21 progressive farmers participated in the workshop. A 4 days Second National Training Workshop on “IPM of Parasitic Mites & Disease of Honeybees for Sustainable Beekeeping” during April 15-18, 2008 attended by 23 participants was also organized.

The PI participated in International APIMONDIA Congress in Melbourne, Australia from September 9-14, 2007 and presented a seminar on “Status of beekeeping in Pakistan” described the occurrence, effect and control of *Tropilaelaps mite* and *Varroa destructor* in Pakistan at the CISRO world lead honeybee research laboratory in Canberra, Australia.

Name of Project: **Determination of Soil Moisture Movement and Salinity Buildup Patterns Under Different Sizes of Bed Furrow Irrigation Systems; Component-1 of Umbrella Project “Soil Salinity Monitoring Under Various Resource Conservation Technologies (RCTs) Adopted in Various Agro-ecologies”**

Name of PI/Institute: **Mr. Muhammad Yasin,**
Director/PSO,
Water Resources Research Institute, NARC, Islamabad

Duration: 20. 07. 2007 to 30. 06. 2010

Financial Status: Total Cost: Rs.3.049 million
Funds Released: Rs.1539000/-
Funds Utilized: Rs.1376036-

Objectives:

- Determine optimum size of bed furrow irrigation system for wheat-maize cropping system.
- Adopt suitable computer model for moisture distribution and salinity buildup pattern in the bed furrow.
- Develop management guidelines for sustained operation and management of bed furrow irrigation system.

Achievements:

During 2008-09, after harvesting maize crop, wheat crop was grown on three sizes of furrow beds and compared with basin method of irrigation. The bulk density was determined at sowing and harvesting of wheat crop. The bulk density has an increasing trend from sowing to harvesting and soil moisture used from root zone indicated that less water was used in large beds followed by medium beds, small beds and basin method of irrigation. Similarly, water use efficiency is the highest for large beds followed by medium beds, small beds and basin, although more grain wheat yield was obtained from medium beds followed by small beds, large beds and basin method of irrigation. Soil moisture behavior before irrigation was found more in edges than centre of beds. Moreover, moisture content in beds was more than basin due to compactness of beds. The soil moisture after irrigation and rainfall was also monitored. More moisture was found in basin as compared to furrow beds.

Name of Project: **Studies on Rice-Wheat Cropping System in Sheikhupura and Maize-Potato in Okara District; Component-II of Umbrella Project “Soil Salinity Monitoring Under Various Resource Conservation Technologies (RCTs) Adopted in Various Agro-Ecologies”**

Name of PI/Institute: **Dr. Arshad Ali,**
Senior Scientific Officer,
Land Resources Research Institute, INRES, NARC, Islamabad

Duration: 20. 07. 2007 to 30. 06. 2010

Financial Status: Total Cost: Rs.4.605 million
Funds Released: Rs.3138600/-
Funds Utilized: Rs.3063956/-

Objectives:

- Study the impact of resources conservation technologies (RCT) on salt build up in various soils under rice-wheat cropping system in Punjab province.
- Devise strategies for appropriate soil salinity management under such practices to ensure sustainable production

Achievements:

Different planting methods (broadcasting, zero tillage, happy seeder and raised bed plantation) were compared to investigate the efficient planting method under saline-sodic conditions in Sheikhupura districts. Data indicated that zero tillage planting technique attained the highest value cost ratio (34:1) followed by raised beds sowings. No significant salt build up was noticed in any planting methods.

Efficacy of residue incorporation with and without starter N on wheat productivity was studied. Cost of crop residue and plantation varied with control, incorporation of chopped residue (Rs.1200/acre), incorporation of chopped residue + 25 kg N ha⁻¹ (Rs.1645/acre) and incorporation of chopped residue + 50 kg N ha⁻¹(Rs.2190/acre). Among different treatments, chopped residue alone attained the 6.43 marginal rate of return. The application of chopped paddy straw saved the fertilizer input, increased soil fertility and saved the environment from chemical pollution. Increase in soil electrical conductivity (ECe) was noticed with the passage of time in all the treatments in the months of February and April indicating salt accumulation. It seems that salt accumulates in upper layer from the lower layers due to net upward water movement brining salt in upper layers during wheat growth period.

A study was conducted to see the effect of wheat straw incorporation on paddy yield. The most economical treatment 10 tons wheat ha⁻¹ gave 17.26 marginal rate of return as compared to 12.28 in case of 5 ton ha⁻¹ residue incorporation. Addition of starter N in case of wheat straw

incorporation seems uneconomical.

Maximum net benefit attained by wheat yield was recorded from treatment receiving paddy residue incorporation and 50 kg N ha⁻¹. However, marginal rate of return was the maximum (8.68) from treatment receiving residue incorporation followed by residue incorporation + 50 kg N ha⁻¹ (5.78). Crop residue increased the soil organic matter by decomposition with the process of microbial activities.

Maize-Potato rotation is being grown on ridges in Okara district requiring heavy input like fertilizer, irrigation, pesticides etc. Heavy and frequent irrigations are made to fulfill the crop requirement. As a result, more salts tend to accumulation on top of ridge. Keeping in view, salinity monitoring was started selecting 13 farmers in Tehsil Dapalpur and Okara districts during 2008. Electrical conductivity of the soil from top of the furrow ranged from 3.70 to 27.2 dS/M. E_ce of bottom of the furrow ranged from 3.2 to 8.5. Three sites out of 13 were below threshold value. Ten sites have E_ce above salinity a threshold value which is 4 dS/m. This is an indication of the presence of soluble salts at alarming level accumulating especially on top of the ridge where maize seed and potato tubers are being placed. It was noticed that sodium accumulation was considerably higher on top of furrow as compared to bottom of the ridge. Data indicates low sodium contents at bottom.

In Okara surveyed area, soils have mainly soluble salts coming from tubewell water. There is no sodicity problem, mainly due to low sodium soil contents and high Ca+ Mg salts contents. To manage such soils, following can be done to lower down salts from root zone:

- i. Canal irrigation may be followed by tubewell irrigation.
- ii. To leach down soluble salts, 10 % extra tubewell irrigation may be applied as leaching fraction.
- iii. After harvest of maize and potato crops, heavy canal water irrigation may be applied since soils are medium textures having no drainage problem.

Name of Project: Management and Improvement Potential of Rangelands of Balochistan with Community Participation

Name of PI/Institute: Dr. Sarfraz Ahmad,
Senior Scientific Officer, AZRC, PARC, Quetta

Duration: 23. 07. 2007 to 30. 06. 2010

Financial Status: Total Cost: Rs.5.303 million
Funds Released Rs.2814500/-
Funds Utilized: Rs.2828372/-

Objectives:

- To document the existing traditional range management practices and productivity of rangelands.
- To test the range improvement potential by protection, grazing range fertilization, and integrated rainfed crop-livestock management with community participation
- To test the establishment of suitable grasses/shrubs species in potential range areas with community participation
- Assessment of rangeland dynamics with particular scenario of changing species composition of grasslands and declining of shrub lands.

Achievements:

Different range management and improvement trials are under progress at various sites. Trial on grazing response of perennial bunchgrasses (*Cymbopogon jwarancusa* & *Chrysopogon aucheri*) was conducted at Tomagh, Ziarat. Three months (March- May) rest period was provided to the vegetation for recovery and again total above ground biomass production was monitored. The results indicate that at least three months rest period during active growth period of natural perennial bunchgrasses are required for recovery of vegetation. Winter season burning has positive impact on growth, forage production and nutritive value of *Saccharum grifithii*. Fresh and dry forage production of burned treatment was recorded 2316 and 1548 kg/ha compared with 466 and 309 kg/ha, respectively of un-burned treatment. Growth response of perennial grasses to defoliation intensity and season in Balochistan indicate that heavy utilization of grasslands during winter season when grasses are in dormant period have no determinable affect on growth and production. The grassland management strategies should be focused on heavy utilization of available resources during the winter season and restriction to grazing during the active growth period of grasses.

The degraded community rangelands showed good recovery potential for forage production. Therefore, range management strategies must focus on recovery potential of degraded range areas and proper grazing for sustainable range-livestock production.

Name of Project: Management Strategies for Metal Contaminated Soil Receiving City Waste Effluent for Sustainable Crop Production and Food Security

**Name of PI/
Institute:** Dr. Abdul Ghafoor,
Professor,
Institute of Soil and Environmental Sciences, University of
Agriculture, Faisalabad.

Duration: 01. 07. 2005 to 31. 12. 2008

Financial Status: Total Cost: Rs.4.211 million
Funds Released: Rs.3393500/-
Funds Utilized: Rs.3360187/-

Objectives:

- Quantification of metal uptake and accumulation in different parts of cereal and fodder crops grown on contaminated soil.
- Identification of plant species from areas receiving sewage having hyper-accumulation capabilities for metals.
- Effectiveness of organic and inorganic amendments to retard the bio-availability of metals in contaminated soils.

Achievements:

A series of experiments were conducted during the project period from July 2005 to December 2008. On the basis of results from these studies, it could be concluded that:

- There is a wide variation in shoot concentration of several metals (Cd, Ni, Pb, Zn, Cu, Mn) in a large number of agronomic crops, fruit plants, higher trees, natural shrubs and grasses found in the raw sewage irrigated areas. This bio-diversity needs to be quantified more precisely for practical utilization of promising plant species for phyto-remediation of contaminate soils and waters.
- In general, roots retained major share of the absorbed metals and less were transported to shoots and economic plant parts. The mechanisms of selective transport need controlled condition studies on plants to help plants breeding programs to develop metal resistant and tolerant plant species for safe food production for human and animal consumption.
- Among the agronomic crops, maize owing to high biomass production seems better in crop rotation as fodder crop in metal contaminated soils and/or raw sewage receiving areas.
- For in-situ remediation of metal contaminated calcareous alkaline soils, application of P- and Ca- containing materials proved very useful, particularly MAP and gypsum. But gypsum proved the most cost-effective. Since gypsum is easily available in the local

market, it should be recommended for commercial scale treatment of metal contaminated soils. Even continuous use of ammonium sulphate and single super phosphate as source of N and P should be practiced in metal contaminated soils for producing relatively low metal crop produce.

- Organic manures from several sources remained effective for crop yields, to decrease phytoavailable metals in soils and consequently affected low metal concentration in shoots, therefore, addition of organic matter as green manuring, poultry manure, press mud, farm yard manure or plant residues must be promoted in metal contaminated or raw sewage irrigated areas.
- Both the available and total metal concentration was the highest in surface than that in the subsoils but still within safe limits for general cropping. The higher metal concentration in flowing water indicated raw sewage input into these rivers and later soil contamination.

Name of Project: **Micronutrients Management in Apple and Citrus Orchards in Swat Valley**

Name of PI/Institute: **Dr. Zahir Shah,**
Professor, Dept. of Soil and Environmental Sciences, NWFP Agricultural University, Peshawar

Duration: 22. 08. 2006 to 30. 06. 2009

Financial Status: Total Cost: Rs.3.829 million
Funds Released: Rs.3495700/-
Funds Utilized: Rs.3531740/-

Objectives:

- To determine the soil fertility status of apple, citrus, peaches and apricot orchards in Swat Valley and nutrients status of plants especially the micronutrients, and prepare their maps.
- To evaluate the effect of deficient micronutrients on the yield of apple and citrus fruits by field trials and formulate fertilizer recommendations on the basis of soils and plant tissue analysis and field trials.

Achievements:

Soil and plant analysis for micronutrients and other soil fertility parameters from previous surveys (peach and apricot) were completed. Relationship between soil and plant micronutrients determined and very poor correlations were observed for the same. Similarly, micronutrient contents in soil or leaf were poorly correlated with soil organic matter. However, strong correlations were found between the surface soil (0-15 cm) and cumulative micronutrient contents of profile (0-45 cm). Surface soil micronutrients contents seem to be an acceptable indicator of pattern in micronutrients fertility in the profile (0-45 cm). Regression analysis of cumulative profile micronutrients contents with surface soil contents showed that R^2 approached unity with a slope of greater than one. This trend can be used to estimate micronutrient levels in profile (0-45 cm) using regressions equations parameters developed in this study. This estimation in future will save time, labour and chemicals by using surface soil (0-15 cm) micronutrients in the said equations. It is important to point out that similar results were obtained in our earlier surveys of apple and citrus orchards conducted in same program.

Field experiments on effect of micronutrients application on citrus orchards started earlier/last year continued at three sites (farmers' fields) in Malakand Division. The main objective of the experiment is to study the effect of Zn and B application on yield and quality of citrus (sweet orange) and to assess which method of micronutrient application may be more effective. Data on citrus fruit yield obtained in December, 2008 revealed positive response of fruit yield to both Zn and B application. The response was better for foliar (22-27%) than soil application (15-18%). Data was also obtained on certain quality parameters of citrus fruits. However, micronutrients did not show any significant effect on any quality parameter in first year.

Name of Project: Microbial ACC-deaminase Biotechnology for Sustainable Production of Legumes

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

Duration: 22. 08. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.4.289 million
Funds Released: Rs.2020500/-
Funds Utilized: Rs.2382900/-

Objectives:

- Isolation and screening of rhizobacterial cultures carrying ACC-deaminase enzyme.
- Isolation and screening of effective rhizobial cultures for different legumes.
- Evaluation of the growth promoting and nodulation potential of the rhizobacterial/ rhizobial cultures.
- Evaluation of the co-inoculation of rhizobia and rhizobacteria for improving growth and yield of legumes.

Achievements:

In the present study, PGPR containing ACC-deaminase and rhizobia were isolated from the rhizosphere soil samples and nodules of lentil, chickpea and mung bean plants (collected from different districts of the Punjab) on DF-minimal salt media containing ACC-deaminase as sole N source and yeast extract manitol agar media, respectively. The most efficient isolates of rhizobacteria and rhizobia were screened on the basis of their growth promoting and nodulation potential in legumes by conducting experiments under axenic conditions. A summary of the research findings from first year studies are:

A total of twenty five rhizobacterial isolates each from lentil, chickpea and mung bean plants were isolated by dilution plate technique using salt minimal medium containing ACC as sole nitrogen source (enrichment technique). Similarly, twenty five rhizobial isolates were isolated each from lentil, chickpea and mung bean nodules by using yeast extract manitol medium.

Laboratory experiments were conducted on lentil, chickpea and mung bean separately under controlled conditions to screen rhizobacteria containing ACC-deaminase and rhizobial isolates for their growth promoting activity under axenic conditions. On the basis of growth promoting activities of different growth variables (shoot length, root length and fresh weight of root and shoot), under axenic conditions, five most effective rhizobacterial isolates from each, lentil (LB5, LC3, LC4, LM4 and LV2), chickpea (B2, B5, J1, J3 and L4) and mung bean (R6, K6, M2, F2, F6) were selected for further experimentation.

Similarly, experiments were conducted in the growth room for screening of the rhizobial isolates under axenic conditions. On the basis of growth promoting activities and nodulation potential under controlled conditions, five most effective rhizobial isolates of each lentil (LLR3, LBR2, LCR1, LMR3 and LVR2), chickpea (BK2, BK4, KS1, JH4 and LY4) and mung bean (FS2, MN3, MN6, MG6 and KH6) were selected for further experimentation.

Name of Project: **Carbon Sequestration through Tillage, Organic Matter and Mulch: Managing the Soil Quality for Sustainable Crop Production**

**Name of PI/
Institution:** **Dr. Anwar-ul-Hassan,**
Professor,
Institute of Soil & Environmental Sciences, University of
Agriculture, Faisalabad

Duration: 28. 07. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.4.881 million
Funds Release: Rs.2179000/-
Funds Utilized: Rs.1567362/-

Objectives:

- To assess the potential of soil carbon sequestration in Pakistan with different farm manure and mulch rates and tillage methods.
- To determine the effects of tillage systems, farm manure and mulch for enhancing soil quality to meet the food demands of the country.
- To determine the effect of deficit irrigation on growth and yield of crops.

Achievements:

Experiments were carried out under field conditions for achieving the objectives. Two trials were conducted on maize-wheat crop rotation, keeping tillage methods i.e. deep, conventional and minimum tillage while manures was applied at their respective rates. Plant height, total plant biomass and grain yield of maize and wheat were recorded at crop maturity. A significant increase in soil organic carbon was observed with the application of dairy manure and the residual soil organic fertility after crop harvest was proportional to the level of dairy manure used. The results of maize crop indicated that integrated application of manure with inorganic fertilizer increased plant height, total plant biomass and grain yield of maize crop while increased soil organic contents of soil was its additional benefits. Residential effect of manure application was also found significant on wheat crop, increasing the plant height, total plant biomass and grain yield of wheat crop. Integrated application of manure and mineral fertilizer also improved soil physical properties. Deficit irrigation had a significant effect on growth and yield of maize and wheat crop. There was a significant decrease in plant height, total plant biomass and grain yield of maize and wheat crop with reducing irrigation depth, but with application of mulch this reduction was minimized. Soil organic carbon concentration was significantly increased with the application of mulch. Application of mulch significantly increased the water use efficiency of maize and succeeding wheat crop.

The results of the studies showed that there was decrease in yield and yield contributing parameters with decreasing irrigation depth (deficit irrigation) but negative effect on yield

was minimized by applying mulch. Mulch also increased water use efficiency (WAE) of wheat and maize. With minimum tillage yield obtained was comparative to conventional but increased soil organic contents at 0-10 cm were its additional benefit. Integrated application of manure along with mineral fertilizer not only increased the maize yield; it increased the organic matter of the soil, so its residual effect on succeeding wheat crop yield was found significant.

Name of Project: Evaluation of Nitrogen Inhibitors for Reducing Nitrogen Loss under Irrigated Cotton- Wheat System using ¹⁵N-Balance Technique

**Name of PI/
Institution:** Dr. Tariq Mahmood,
Principal Scientist,
Soil Biology & Plant Nutrition Division, NIAB, Faisalabad

Duration: 28. 07. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.5.557 million
Funds Release: Rs.3265000/-
Funds Utilized: Rs.2957382/-

Objectives:

- To assess the potential of soil carbon sequestration in Pakistan with different farm manure and mulch rates and tillage methods.
- To determine the effects of tillage systems, farm manure and mulch for enhancing soil quality to meet the food demands of the country.
- To determine the effect of deficit irrigation on growth and yield of crops.

Achievements:

Research work started as per first year work plan to achieve the objectives. Laboratory experiments with eight compounds tested as nitrification inhibitors, revealed 4-amino-1, 2, 4-triazole (ATC) as an effective nitrification inhibitor under high soil temperature such as those prevailing during the cotton growing season. Further experimentation to work out effective ATC concentration required for blending with urea fertilizer indicated that ATC blended with urea at 2% of urea-N could slow down nitrification for more than 4 weeks. A greenhouse experiment with cotton to study the effects of ATC on the fate of ¹⁵N-urea applied to cotton is in progress. It is envisaged that much less amount of ATC will be required under winter temperature; experiments on this aspect are in progress. Out of three commercial urease inhibitors tested, N-(n-butyl) thiophosphoric triamide (NBPT) was found to be effective under high temperatures and this compound is also being evaluated in greenhouse experiments with cotton employing ¹⁵N-labelled urea. Probing experiments were also conducted to compare the efficiency of two methods of urea application viz. surface broadcast versus point injection. While maize or wheat yields were not affected by urea application method, point injection substantially increased the recovery of ¹⁵N-urea in plant-soil system (32-51% increase) and significantly reduced the fertilizer – N loss (50-55% reduction). Accordingly, the aspect of urea application method will also be addressed in greenhouse and field experiments.

Name of Project: **Assessment of Toxic Metals in Agriculture Products and their Relation with Nutritional Status in NWFP- Pakistan**

**Name of PI/
Institution:** **Dr. Ihsanullah**
Dy. Chief Scientist,
Food Sciences Division, Nuclear Institute for Food and
Agriculture, Tarnab, Peshawar

Duration: 28. 07. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.2.926 million
Funds Release: Rs.1352000/-
Funds Utilized: Rs.1220800/-

Objectives:

- To assess the levels of toxic heavy metals in agricultural foods in various location around Peshawar consumed in the region and to determine circulatory level of toxic elements from selected site in Peshawar.
- To measure the nutritional status of population using anthropometric (BMI) procedures and to collect data for various parameters through food frequency questionnaire.
- To develop relationship between toxic metals and nutritional status of the population and to create awareness in the social sector through training workshops.

Achievements:

Sector-wise sampling of drinking and sewage irrigation water, soil and the selected vegetable from various location of Peshawar, Nowshera and Manshera district was carried out. Heavy metals content of dietary components like vegetables and drinking water samples were analyzed for the quantification of essential and toxic trace elements (Pb, Cd, Cu, Ni, Cr etc.) using Atomic Absorption Spectrophotometer (AAS) in order to find out the antagonistic and synergistic effect of heavy metals in soil and vegetables.

The data of first year revealed that sewerage and canal water had high levels of heavy metals compared to tap water. The soil irrigated with sewerage and canal water had also showed high concentration of these metals. Similarly, vegetables/ crops contained high contents of trace elements. Leaves of vegetables and crops accumulated high contents of nine examined elements. In general the levels from high to low of different metals were in order of leaves roots, fruits and stem.

Name of Project: **Enhancing Stone Fruits (Peach, Plum and Apricot) Orchards Productivity through Integrated Nutrients (NPK) Management; A Component of the Coordinated Project “Stone Fruits Productivity Enhancement through Appropriate Nutrient Management” (NIFA, Peshawar, Component – II)**

**Name of PI/
Institution:** **Dr. Syed Mahmood Shah,**
Dy. Chief Scientist,
Nuclear Institute for Food and Agriculture (NIFA)
Tarnab, Peshawar

Duration: 28. 07. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.4.743 million
Funds Release: Rs.2358000/-
Funds Utilized: Rs.2205779/-

Objectives:

- To improve the yield and quality of stone fruits (peach, plum and apricot) through balance nutrition.
- To sustain orchards fertility and fertilizer use efficiency through integrated use of mineral and organic manures.

Achievements:

Six experiments, two each on plum, peach and apricot of different farming communities were selected in Peshawar and Nowshera districts. Leaf and soil samples were collected from these orchards before imposition of experimental treatments. Leaf samples were analyzed for NPK and soil samples were analyzed for various physico-chemical parameters.

In soil profile of peach orchard, nitrogen ranged from 0.025% to 0.06%, phosphorus ranged from 3.0 to 7.0 ppm and potassium ranged from 150 to 160 ppm. Organic matter in these soils was less than one percent. In soil profile of plum orchards, nitrogen ranged from 0.04% to 0.06%, phosphorus ranged from 3.3 to 6.8 ppm, potassium ranged from 150 to 170 ppm. Organic matters in these soils were below one percent. Similarly in soil profile of apricot orchard, nitrogen ranged from 0.02% to 0.043%, phosphorus ranged from 3.0 to 6.9 ppm, potassium ranged from 150 to 160 ppm. Organic matter in these soils ranged from 0.29 to 0.97%.

The pre treatment of leaf samples analysis of the experimental orchards indicates that they were deficient in nitrogen, phosphorus and potash contents.

Results on fruit yield indicated that in case of peach, the highest yield of 85.3 and 84.6 kg/tree was given by treatment received NPK @ 1.0-0.05-0 and 1.0-0.75-0.5 respectively. In

apricot, the higher yield 62.0 kg and 63.0 kg were obtained in treatment received NPK @ 0.75-0.75-0.5 and 1.0-0.75-0.5 respectively and in case of plum this year due to climatic factors the fruit yields was very minimum throughout NWFP.

The studies revealed that in the pre treatments analysis the soils and leaf samples were found deficient in nitrogen, phosphorus and marginally deficient in potash. The fruit yield indicated that in case of peach the highest yield of 85.3 and 84.6 kg/tree was given by treatment received NPK @ 1.0-0.5 -0 and 1.0-0.75 -0.5 respectively. In apricot, the higher yield 62.0 kg and 63.0 kg were obtained in treatment received NPK @ 0.75-0.75-0.5 and 1.0 - 0.75 -0.5 respectively.

Name of Project: **Micronutrients Studies on Stone Fruit Orchards in Peshawar Valley; A Component of Coordinated Project “Stone Fruit Productivity Enhancement through Appropriate Nutrient Management” (ARI, Tarnab, Peshawar, Component-I)**

**Name of PI/
Institution:** **Mr. Mir Abbas Khattak,**
Agricultural Chemist,
Agricultural Research Institute, Tarnab, Peshawar

Duration: 29. 01. 2009 to 28. 01. 2012

Financial Status: Total Cost: Rs.3.166 million
Funds Release: Rs.1115000/-
Funds Utilized: Rs.1066301/-

Objectives:

- To study the existing level of macro and micronutrients in the soils and leaves of stone fruit orchards.
- To improve the yield and quality of stone fruits (peach, plum and apricot) through balance nutrition.
- To recommend proper doses of macro and micronutrients based on soil test values, leaf analysis and field trials.
- To sustain orchard fertility through integrated use of mineral and organic manures.

Achievements:

Diagnostic survey of the orchards (apricot in various locations of Peshawar & Nowshera district and Peach & Plum at various places of Peshawar, Nowshera, Charsada and Mardan district was carried out during the reporting period.

Collected 388 soil samples from orchards at two depths (0-15 cm and 15-45 cm). The soil samples have been analyzed for texture, organic matter, nitrogen, phosphorus, potash, pH, ECx10-3 and TSS. The majority of these soil samples were found deficient in organic matter, NPK and high in pH (more than 7.5). Micronutrients analysis of these soil samples is in progress. Leaf samples will be collected from these orchards during the months of July and August.

Name of Project: **Micronutrients Studies on Stone Fruit Orchards in Balochistan; A Component of the Coordinated Project “Stone Fruits Productivity Enhancement through Appropriate Nutrient Management” (ARI, Sariab, Quetta, Component-III)**

**Name of PI/
Institution:** **Mr. Muhammad Nasim,**
Horticulturist
Agricultural Research Institute,
Sariab, Quetta

Duration: 24. 07. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.2.126 million
Funds Release: Rs.789500/-
Funds Utilized: Rs.534603/-

Objectives:

- To create awareness in farming community about the use of NPK and micronutrients in the stone fruit orchards.
- To find out the best optimal dose of NPK and micronutrients for the benefit of growers to enhance the productivity of apricot.

Achievements:

A detailed survey was conducted in the targeted areas (Khuzdar, Pishin, Khanozai and Loralai) and sites were selected for conducting experiments. The apricot fruit orchards were selected in districts, Loralai, Pishin, Mastung and Kalat. Soil and water samples were collected and analyzed. Leaf sample could not obtain due to dormant season. In the start of leaf formation trees were fertilized with certain fertilizers according to the experimental plan. Apricot fruit trees production increased dramatically almost three times according to the farmers’ statement. The trees not only increased production, it also rejuvenated and the problem of shoot tip drying controlled as compared to the previous year.

The data revealed that the apricot fruit orchards in different districts of Balochistan are low in essential nutrients and needs chemical fertilizer application at appropriate rate. Soils are high in salt and require balancing agent and frequent irrigation to leach down the salts.

Name of Project: **Diagnosis and Control of Leaf Reddening in Cotton**

**Name of PI/
Institution:** **Dr. Jawed Akhtar Memon,**
Soil Fertility Officer,
Agricultural Research Institute, Tandojam, Sindh

Duration: 24. 07. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.3.643 million
Funds Release: Rs.1508000/-
Funds Utilized: Rs.729632/-

Objectives:

- Survey and identify the areas and the possible causes of growth stunting, wilting of the plants and reddening of cotton leaves.
- To develop a package of technology to overcome the problem of reddening in cotton leaves.
- Effective and efficient transfer technologies for controlling cotton leaf reddening disseminated to the cotton growers.

Achievements:

Survey of the affected areas of leaf reddening in cotton conducted during August–September, 2008 and 24 locations of Sanghar, Mirpurkhas and Tando Allah Yar districts. Soil and leaf samples were collected and analyzed for physico-chemical properties. The problem was found higher in plants sown in March than plants sown in May. Water stress at early sown crop coupled with high temperature damaged tendery root system and development of plant was checked. It further created disturbance in nutrient uptake.

Old leaves of cotton were more affected than young leaves. It could be postulated that accelerated ageing was due to impairment metabolism caused by lack of nutrients and hormones in old leaves.

High temperature and wind velocity coupled with drought resulted leaf reddening. Symptom of potash deficiency were clearly observed and caused reddening in cotton leaves.

Foliar application of 1% KNO₃ at the interval of 10-15 days showed better results in partly red leaves. The growth stunted plants, small leaves with reduced leaf production improved with foliar application of 0.1% ZnSO₄ at the interval of 10-15 days.

Name of Project: **Effect of Different Irrigation Intervals and Mulching Materials on the Growth, Yield and Quality of Onion under Agro Climatic Conditions of Southern Regions (NWFP)**

**Name of PI/
Institution:** **Mr. Muhammad Suleman,**
Assistant Vegetable Botanist, Agricultural Research Station,
Ahmad Wala, Karak, NWFP

Duration: 28. 07. 2008 to 30. 06. 2011

Financial Status: Total Cost: Rs.3.554 million
Funds Release: Rs.1199000/-
Funds Utilized: Rs.193533/-

Objectives:

- To study the effect of different irrigation intervals and mulching material on the yield of onion.
- To demonstrate the use of mulching materials to the farmers.
- To come up with solid recommendation on various mulching materials, moisture conservation and culture practices for onion crop.

Achievements:

In order to see the effect of irrigation intervals and mulching materials on growth and yield of onion, two experiments were conducted at ARS, Ahmad Wala, Karak and ARS, Serai Naurang, Bannu. Ten numbers of adaptive plots were also laid out at farmer's field. It was observed that irrigation at interval of 5 days was the most suitable interval for high production of onion at the Research Stations, as well as at farmer's field. Gram straw mulching material gave encouraging result at all the locations and prolonged the availability of moisture for onion growth. Combination of gram straw and 5 days irrigation interval supercede all the treatments and gave high production. The gram straw was easily fermented in the soil after application and improved the soil structure. Ten numbers of farmers were trained on application of mulching material and irrigation of onion in the vicinity of each plot. Two field days were also arranged for this purpose.

The results of the 1st year studies showed that mulching material (gram straw) was found most suitable for maximum production of onion bulb. Gram straw and irrigation interval of 4 days proved the best combination for high production for this shallow rooted crop. Mulching material improved the soil structure and moisture retention of soil and decreased evaporation.

Name of Project: Economic Analysis of Intercropping in Sugarcane in Sindh: Implications for Research and Extension

Name of PI/Institute: Dr. Ali Muhammad Khushk,
Director,
Technology Transfer Institute, PARC, Tandojam, Sindh

Duration: 25. 08. 2008 to 24. 08. 2010

Financial Status: Total Cost: Rs.1.953 million
Funds Released: Rs.1890000/-
Funds Utilized: Rs.1897378/-

Objectives:

- To ascertain extent of adoption of major intercropping practices followed by the growers in sugarcane production.
- To undertake economic analysis of major intercropping practices in sugarcane.
- To determine the cost structure, gross margin of major intercropping practices in sugarcane.
- To identify the improved farmers practices for obtaining high yield of sugarcane in Sindh.
- To recommend policy measures and program initiatives for sustainable development of sugarcane production.

Achievements:

Review of literature has been completed and questionnaire for the compilation of data has been developed and pre tested in the field. Informal survey to determine the cost structure, gross margin of major intercropping practices in sugarcane in six districts of Sindh has been completed. Following district wise intercropping practices were found:

Badin: Sugarcane and Sunflower.

Thatta: Sugarcane-Sunflower and Sugarcane-Tomato.

Tando Allah Yar: Sugarcane-Onion, Sugarcane-Onion-Wheat, Sugarcane-Barseem, Sugarcane-Cauliflower and Sugarcane-Cauliflower-Wheat.

Mirpur Khas: Sugar Cane-Onion and Sugarcane-Wheat.

Naushahro Feroze: Sugarcane-Rape Mustard and Sugarcane-Wheat.

Khairpur: Sugarcane-Rape Mustard and Sugarcane-Wheat.

Formal survey has been completed in selected six districts of Sindh. It was found that Sugarcane-Onion, Sugarcane-Onion-Wheat, Sugarcane-Berseem, Sugarcane-Cauliflower, Sugarcane-Cauliflower-Wheat, Sugarcane-Rape, Mustard, Sugarcane-Tomato and Sugarcane-Sunflower were the common intercropping practices in the selected areas.

Annexure-I**List of ALP Projects Completed as on June 30, 2009:****(Rs.)**

S. No	Name of Project	PI/Institute	Duration	Total Cost (million)	Release	Expenditure
Animal Sciences:						
1	Protection of Buffaloes Against Brucellosis	Dr. Rukshanda Munir, Sr. Scientific Officer, Animal Sciences Institute (ASI), NARC, Islamabad	09.05.2002 to 08.05.2005	2.458	2438000/-	2185536/-
2	Ovarian Follicular Dynamics and Endocrine Activity in Postpartum Anoestrus Buffaloes	Dr. Nemat Ullah, Principal Scientific Officer, ASI, NARC, Islamabad	08.05.2002 to 07.05.2005	2.985	2985000/-	2929000/-
3	Studies on the Prospect of Introducing American Channel Cat fish (<i>Ictalurus punctatus</i>) in Pond fish Culture System of Pakistan	Mr. Abdul Rab, Sr. Scientific Officer, AFRI, NARC, Islamabad.	10.05.2002 to 09.05.2005	3.035	3062000/-	2915784/-
4	Molecular Characterization of Pakistani Infectious Bronchitis Virus Variants and Development Recombinant Vaccine	Dr. Khalid Naeem, Sr. Scientific Officer, ASI, NARC, Islamabad	03.04.2002 to 02.04.2005	2.967	2967000/-	2084095/-
5	Development of Local Starter Culture Technology for Preparation of Fermented Milk Products.	Dr. Tariq Aziz, Sr. Scientific Officer, ASI, NARC, Islamabad.	14.04.2004 to 13.04.2007	3.75	3329100/-	3135463/-
6	Genetic Improvement of Buffaloes in Pakistan (GIBP)	Dr. Muhammad Anwar, Sr. Scientific Officer, ASI, NARC, Islamabad.	12.11.2004 to 11.11.2008	2.287	1447200/-	1362482/-
7	Effect of Civic Pollution on Fish and Fisheries in the Reverine System	Mr. Muhammad Afzal, Sr. Scientific Officer, Fisheries, NARC, Islamabad	21.05.2004 to 20.05.2007	1.996	1993100/-	1913538/-
8	Studies on Biology & Mapping of Warble Fly Infested Areas.	Dr. M. Qasim Khan, Sr. Scientific Officer, ASI, NARC, Islamabad	21.05.2004 to 30.06.2008	6.072	3400500/-	3383295/-
9	Development of Milk Replacer and Early Weaning Diets for Sustainable Calf Rearing.	Dr. Attiya Azim, Sr. Scientific Officer, ASI, NARC, Islamabad	24.08.2004 to 23.08.2007	6.076	4978400/-	4869960/-
10	Development of Database on Minerals Profile of Feedstuffs,	Dr. Attiya Azim, Sr. Scientific Officer, ASI, NARC,	17.09.2005 to 16.09.2008	2.513	2141400/-	2036056/-

	their Availability and Strategic supplementation of Minerals Block to Dairy Animals.	Islamabad				
11	Refinement of Multi-Nutrient Urea-Molasses Blocks Technology through Research and Development	Dr. Imdad Hussain Mirza, Pr. Scientific Officer (Animal Nutrition), ASI, NARC, Islamabad	10.08.2002 to 09.08.2005	0.952	711000/-	650000/-
12	Studies on Epidemiology of Peste des Petites Ruminant (PPR) in Pakistan	Dr. Aamer Bin Zahur Sr. Scientific Officer ASI, NARC, Islamabad	17.09.2005 to 28.02.2009	5.969	4245000/-	4252722/-
13	Development of Health, Nutrition and Breeding Management Packages for Increased Output from Range - Sheep/ Goats Production in Balochistan	Mr. Abdul Razzaq Scientific Officer, Arid Zone Research Centre, (PARC), Quetta	27.04.2006 to 26.04.2009	3.867	2808200/-	2647534/-
14	Role of Steroid Hormone in Regulation of Ovarian Follicular Development in <i>Tor Putitora</i>	Mr. Zaffarullah Bhatti, Dy. Director (Fisheries) Fish Hatchery & Res. Center, Rawal Town, Islamabad	27.09.2005 to 26.09.2008	8.500	6482400/-	6171175/-
15	Immunobiology and Immunoprophylaxis of Coccidiosis in Chickens	Dr. Masood Akhtar, Asstt. Prof., Deptt. of Parasitology, Uni. of Agri., Faisalabad	03.04.2002 to 02.03.2005	1.463	797800/-	786429/-
16	Studies on Tilapia Culture through Controlled Breeding in Saline Areas	Dr. Iftikhar Ahmed, Asso. Prof., Fisheries Res. Farms, Dept. of Zoology and Fisheries, Uni. of Agriculture, Faisalabad	03.04.2002 to 02.04.2005	0.898	688100/-	688100/-
17	Characterization of Tannins in Feeds and Forages of Pakistan and their Evaluation for Anthelmintic Activity	Dr. Zafar Iqbal, Asso. Prof., Uni. of Agriculture, Faisalabad	13.08.2002 to 12.08.2004	0.968	872850/-	871232/-
18	A Comparison of Concentrate and Fodder Based Finishing Diets on the Performance, Carcass Composition and Meat Quality of Lohi and Sipli Lambs.	Dr. Muhammad Iqbal Mustafa, Asstt. Prof., Department of Livestock Mgt., University of Agriculture, Faisalabad	08.09.2004 to 07.09.2006	1.779	1464500/-	1428562/-
19	Genetic Characterization of Native Cattle and Buffaloes Breeds of Pakistan.	Dr. Safdar Ali, Asst. Prof., Uni. of Agriculture, Faisalabad	22.05.2004 to 21.05.2007	4.628	3651800/-	3599143/-
20	Influence of Altering Dietary Cation Anion Difference on	Dr. Muhammad Sarwar, Associate Prof., Department of	28.05.2004 to 27.05.2007	5.058	4837200/-	4794360/-

	Productive and Reproductive Efficiency of Buffaloes.	Animal Nutrition, University of Agri., Faisalabad.				
21	Development of Milk Recording and Genetic Evaluation Models in Sahiwal Cattle.	Dr. Muhammad Sajjad Khan, Asso. Prof., Dept. of Animal Breeding & Genetics, Uni of Agri., Faisalabad.	22.05.2004 to 21.05.2007	3.695	2811800/-	2704485/-
22	Evaluation of Indigenous Medicinal Plants for the Isolation of Steroid Hormonal Activities for Veterinary Usage	Dr. Nazir Ahmad, Prof./Chairman, Department Animal Reproduction, University of Agriculture. Faisalabad	08.09.2005 to 07.09.2008	5.046	3361000/-	3287890/-
23	Mott Grass as a Potential Source of Dietary Forage for Lactating Sahiwal Cows	Dr. Muhammad Qamar Bilal, Assistant Prof., Dept. of Livestock Mgt., University of Agriculture, Faisalabad	14.09.2005 to 13.09.2008	1.660	1559100/-	1459769/-
24	Development of Supplementary Feed Based on Apparent Nutrient Digestibility of Different Feed Ingredients for <i>Labeo Rohita</i> Fingerlings	Dr. Muhammad Salim, Assistant Prof., Department of Zoology & Fisheries, University of Agriculture, Faisalabad	14.09.2005 to 13.09.2008	2.137	1439000/-	1394711/-
25	Pharmacokinetics and Dosage of Flouroquinolones in Animals	Dr. Faqir Hussain Khan, Asso. Prof., Dept. of Physiology and Pharmacology, University of Agriculture, Faisalabad	11.02.2006 to 10.02.2008	3.100	2623300/-	2432306/-
26	Preliminary Studies on the Efficiency of Locally Prepared <i>Staphylococcus Aureus</i> Vaccine in the Control of Mastitis in Dairy Buffaloes	Dr. Ghulam Muhammad, Asso. Prof. & Chairman, Dept. of Clinical Medicine and Surgery, Faculty of Vet. Sci., Uni. of Agri. Faisalabad	25.04.2002 to 24.04.2004	0.754	452000/-	446556/-
27	Inter-relationship of Mycotoxins Levels in Feed Organs/Tissues and Health of Poultry and Livestock.	Mr. Muhammad Zargham Khan, Chairman/ Asso. Prof., Dept. of Veterinary Pathology, University of Agri., Faisalabad.	25.07.2006 to 30.06.2009	9.345	9106900/-	8236142/-
28	Application of PCR Technology for the Detection of Avian Mycoplasma in Poultry Birds and Farm Environment.	Dr. Sajjad-ur-Rahman, Asso. Prof., Dept. of Vet. Microbiology, University of Agri., Faisalabad	22.02.2006 to 21.02.2009	2.939	2734000/-	2546292/-
29.	Clinical and Biochemical Studies on	Dr. Laeeq Akbar Lodhi, Prof./ Chairman,	25.08.2005 to	4.794	3139500/-	2494643/-

	Genital Prolapse in the Buffaloes	Dept. of Clinical Medicine & Surgery, Uni. of Agriculture, Faisalabad	24.06.2009			
30.	Molecular Characterization and Pathogenicity of Avian Adeno-Viruses Causing HPS	Dr. Mansur-ud-Din Ahmad, Asso. Prof., Dept. of Microbiology, University of Vet. & Animal Sciences (UVAS), Lahore.	02.04.2003 to 30.03.2006	2.746	2474600/-	2046377/-
31.	Immuno-Prophylaxis of Foot and Mouth Disease (FMD) in Bovines	Dr. Khushi Muhammad, Chairman, Department of Microbiology, UVAS, Lahore	22.07.2003 to 21.07.2006	5.945	4549700/-	4480068/-
32.	Effect of Long Term use of Bovine Somatotropin (bST) Hormone on Milk Production, Reproduction, Health and Various Physiological Parameters in Nili- Ravi Buffaloes	Dr. Makhdoom Abdul Jabbar, Associate Prof., Department of Animal Nutrition, UVAS, Lahore.	17.07.2004 to 16.07.2007	3.464	3113200/-	3098669/-
33.	Epidemiology of Helminthiasis in Sheep	Dr. Haji Ahmad Hashmi, Associate Pro./Chairman, UVAS, Lahore	21.09.2005 to 20.09.2007	0.547	432100/-	275429/-
34.	Studies on Mineral Imbalances in the Livestock of Canal Irrigated Districts of the Punjab	Dr. Talat Naseer Pasha, Prof., Dept. of Animal Nutrition, Uni. of Vet. & Animal Sciences, Lahore	21.09.2005 to 20.09.2008	8.596	6665800/-	6413538/-
35.	Hyper-Secretion of Xylanase &/or <i>Cellulase Thermophile</i> for its Application in Poultry Feed Industry	Dr. Farooq Latif, Principal Scientist, National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad	09.08.2002 to 08.08.2005	1.743	1583080/-	1454059/-
36.	Application of Molecular Techniques for Differential Diagnosis of Rinderpest and Related Diseases	Dr. Qaiser Mahmood Khan, Principal Scientist, NIBGE, Faisalabad	19.07.2004 to 18.07.2007	2.76	2529975/-	2353032/-
37	Production of Breeding Bulls to Improve Milk Production of Nili Ravi Buffaloes in Rural Area	Dr. Muhammad Rafique, Research Officer, LPRI, Bahadar Nagar, Okara	20.12.2004 to 19.12.2007	3.764	3731000/-	3698113/-
38	The Status of Shrimp's Fisheries in Sonmiani Bay Lagoon, Balochistan Pakistan	Dr. Naureen Aziz Qureshi, Asstt. Prof., Centre of Excellence in Marine Biology, Uni. of Karachi, Karachi.	28.07.2004 to 27.07.2007	4.471	3682300/-	3405819/-
39	Aquaculture of Fin Fishes (Snappers and	Syed Makhdoom Hussain, Prof., Centre	17.04.2004 to	4.679	4090700/-	4083909/-

	Groupers) in Ponds Along Hub River Estuary/ Gharo Creek	of Excellence in Marine Biology, Karachi University, Karachi,	30.06.2008			
40	Farming of Mud Crab (<i>Scylla serrata</i>) in the Coastal Earthen-Ponds	Prof. Dr. Javed Mustaqim, Prof., Center of Excellence in Marine Biology, Uni. of Karachi	06.05.2002 to 05.05.2005	2.386	1984300/-	1961587/-
41	Strategic Breeding of Red Sindhi Cattle (SBRSC)	Dr. U. N. Khan, DG., Southern Zone Agri. Research Center (SARC) - PARC, Karachi	23.04.2002 to 22.04.2005	2.785	2740000/-	2656118/-
42	Polyculture of Freshwater Prawn, <i>Macrobrachium</i> with Indian Major and Chinese Carps at Farmers Ponds in Pakistan.	Dr. Rafia Rehana Ghazi, Director (VPCI), SARC, Karachi,	22.04.2002 to 21.04.2005	1.984	1983000/-	1982734/-
43	Studies on the Effect of Bovine Somatotropins (rbST) on Productive and Reproductive Parameters of Kundhi Buffaloes in Sindh	Dr. Saghir Ahmed Sheikh, Associate Prof., Sindh Agriculture University, Tandojam-Sindh	26.08.2004 to 31.09.2007	2.975	2898500/-	2893674/-
44	Promotion of Animal Balanced Feed in Farmer Community.	Mr. Abdul Rehman Soomro, Technical Coordinator, Indus Resource Center Haji Allam Channa Colony, Sehwan, District Dadu, Sindh	29.05.2004 to 28.05.2006	2.376	2344685/-	2263090/-
45	Enhancing Milk Yield of Kindhi Buffaloes through Production of Performance Tested Bulls	Dr. Alam Solangi, Breed Improvement and Development Centre (SPU) Kundhi Buffalo Farm Rohri, Sindh.	14.09.2005 to 13.09.2008	3.556	1976700/-	2172300/-
46	Implementation of NIR Technique for the Evaluation of Animal Feeds.	Dr. M. Mohsin Siddiqui, Asso. Prof., Dept. of Livestock Mgt., NWFP Agri. University, Peshawar	27.04.2002 to 26.04.2005	1.946	1555000/-	1542711/-
47	Efficient Utilization of Local Feed Resources for Sustainable Increase in Livestock Production.	Dr. Ghulam Habib, Asso. Prof., (Animal Nutrition), NWFP Agri. Uni. Peshawar	13.08.2002 to 12.08.2005	1.854	1700000/-	1698861/-
48	Maintaining Genetic Diversity of "Kari" Sheep Breed, for Sustained Development of Chitrali Patti Cottage	Mr. Sohail Ahmed, Lecturer, Veterinary Sciences, NWFP Agri. University, Peshawar	24.08.2004 to 23.08.2006	3.15	2849500/-	2789132/-

49	Taxonomical Studies of the Prevalent Ticks Species on Different Livestock Hosts throughout NWFP	Dr. Raheem Ullah Shah, Research Officer, Veterinary Research Institute, NWFP, Peshawar	25.04.2006 to 30.06.2008	2.629	2217500/-	2135023/-
50	Epidemiological Survey of Mastitis and Evaluation of Economic Losses due to Clinical & Subclinical Mastitis in NWFP	Dr. Mirza Ali Khan, Research Officer, Veterinary Research Institute, Peshawar.	08.09.2005 to 18.10.2008	3.248	2833100/-	2709996/-
51	Trout Farming in the Mountains of Northern Areas. A Research Project at TRMC Juglote.	Mr. Faridullah Khan, Scientific Officer, Karakoram Agril. Res. Institute for Northern Areas, (PARC), Juglote, Gilgit	19.10.2005 to 18.09.2008	5.713	3972100/-	3972100/-
52	Microbiological Studies on Caprine Mycoplasma in Balochistan.	Dr. Mohammad Arif Awan, Asstt. Prof., Centre for Advanced Studies in Vaccinology & Biotechnology, Uni. of Balochistan, Quetta,	11.03.2006 to 10.03.2009	4.800	3069600/-	2791795/-
Crop Sciences:						
1	Development of High Yielding and Well Adaptive Indigenous Canola Hybrids.	Dr. Naazar Ali, Chief Scientific Officer, Oilseed Res. Program, NARC, Islamabad	18.07.2002 to 17.07.2005	1.869	1575000/-	1485687/-
2	Integrated Management of Fruit Flies in Pakistan, NARC, (Component-I)	Dr. Ghulam Jilani, Senior Director, IPEP, NARC, Islamabad	21.03.2002 to 31.12.2005	3.675	2972400/-	2513114/-
3	Mass Scale Production of Disease Free True-to-Type Peach Rootstock (GF-677) Plantlets through Tissue Culture for Productivity Enhancement/ Economic Self reliance.	Dr. Hafeez Ur Rahman, Sr. Scientific Officer, HRI, NARC, Islamabad	21.03.2002 to 30.06.2005	2.129	1511000/-	1483886/-
4	Adaptation and Commercialization of Throw-In-Type Rice Thresher	Mr. Abdul Waheed Zafar, Pr. Engineer, FMI, NARC, Islamabad	29.03.2002 to 30.06.2005	2.332	2291000/-	2261066/-
5	Development and Commercialization of Mobile Seed Processing Unit.	Dr. Tanveer Ahmed, Pr. Engineer, FMI, NARC, Islamabad	29.03.2002 to 30.06.2006	2.679	2154400/-	2076000/-
6	Development of Energy Efficient Wheat Thresher	Mr. M. Tahir Anwar, Sr. Engineer, FMI, NARC, Islamabad	29.03.2002 to 30.06.2005	2.558	1644000/-	947999/-
7	Studies on Viral Diseases of Major Pulse Crops and Identification of Resistant Sources.	Dr. Muhammad Bashir, Pr. Scientific Officer, CSI, NARC, Islamabad	22.03.2002 to 30.06.2005	2.701	2527000/-	2408079/-

8	Collection, Conservation, Evaluation and Documentation of Horticultural Crops Germplasm and its Wild Relatives.	Mr. Muhammad Afzal, Sr. Scientific Officer, ABGRI, NARC, Islamabad	18.07.2002 to 30.06.2006	3.000	2266010/-	2112691/-
9	In Vitro Conservation and Crypreservation of Plant Germplasm of Vegetatively Propagated Crops.	Dr. G. Mustafa Sajid, Sr. Scientific Officer, PGRI, NARC, Islamabad	15.05.2002 to 30.06.2005	2.100	1608000/-	1509973/-
10	Acquisition, Screening and Utilization of Peas Germplasm for Development of Superior Cultivars.	Dr. Abdul Ghafoor, Sr. Scientific Officer, PGRI, NARC, Islamabad	15.05.2002 to 30.06.2005	2.100	1665000/-	1576556/-
11	Study on Genetic Variation in <i>Xanthomonas campestris</i> pv. <i>Oryzae</i> in Relation to Resistance in Rice.	Dr. M. Afzal Akhtar, Pr. Scientific Officer, CDRI, NARC, Islamabad	21.03.2002 to 30.06.2005	4.821	2680500/-	2599989/-
12	Molecular Breeding of Kabuli Chickpea for Ascochyta blight Resistance and High Yield Potential.	Dr. Ahmad Bakhsh Maher, Sr. Scientific Officer, Pulses, NARC, Islamabad	22.03.2002 to 21.03.2006	2.701	1374773/-	1374773/-
13	Studies on the Pphysiological Race Analysis of Fusarium moniliforme Inciting Bakanae/Foot Rot in Rice	Dr. M. Afzal Akhar, Sr. Scientific Officer, CDRI, NARC, Islamabad	01.07.2005 to 31.05.2007	3.543	1387100/-	1206944/-
14	Development of Botanical Pesticides from Traditionally used Plant Derivatives Against Stored Grain Pests	Dr. Ghulam Jilani Sr. Director, IPEP NARC, Islamabad	01.07.2005 to 31.12.2008	3.385	2208000/-	2167646/-
15	Propagation of Sparsely Seeded/Seedless Kinnow Mandarin Using Cell and Tissue Culture Techniques.	Dr. Mrs. Nafees Altaf, Principal Scientist, NIAB, Faisalabad.	04.04.2002 to 30.06.2005	1.328	919000/-	861798/-
16	Integrated Management of Fruit Flies in Pakistan (NIA, Tandojam, Component – V)	Mr. Nazir Ahmed, Principal Scientist, NIA, Tandojam.	26.04.2002 to 30.06.2005	2.012	1225500/-	1219540/-
17	To develop drought resistant wheat (<i>Triticum aestivum</i> L.) genotypes under water stress condition.	Shaikh Muhammad Mujtaba, Principal Scientist, NIA, Tandojam.	26.04.2002 to 30.06.2005	1.070	784000/-	683644/-

18	Development of Canola Quality Mustard (<i>Brassica juncea L.</i>) Genotypes.	Syed Anwar Shah, Principal Scientist, NIFA, Peshawar.	22.03.2002 to 21.03.2005	1.350	1262000/-	1262000/-
19	Integrated Management of Fruit Flies in Pakistan (NIFA, Peshawar, Component - III)	Dr. Sana Ullah Khan Khattak, Head/ Principal Scientist, NIFA, Peshawar.	22.03.2002 to 30.06.2005	2.368	2079200/-	2074250/-
20	Integrated Management of Fruit Flies in Pakistan (CABI -Biosciences Component – II)	Dr. M. Ashraf Poswal, Director, CABI, Rawalpindi.	22.03.2002 to 30.06.2006	4.254	4235500/-	4255377/-
21	Morphological and Biochemical Variability of the Genus <i>Trichogramma</i> (Hymenoptera: trichogrammatidae) in Pakistan.	Mr. Riaz Mehmood, Sr. Scientific Officer, CABI, Rawalpindi	21.03.2002 to 30.06.2005	4.166	3114500/-	3039370/-
22	Some Physiological Studies on Vegetative Growth Pattern and its Impact on Productivity and Malformation of Mango (<i>Mangifera indica L.</i>)	Dr. F. M. Tahir, Prof., Dept. of Horticulture, Univ. of Agriculture, Faisalabad.	22.03.2002 to 21.03.2005	1.384	1027000/-	962502/-
23	Exploitation of forage legume diversity endemic to salt range in the Punjab.	Mr. Farrukh Javed, Asstt. Prof., University of Agriculture, Faisalabad.	06.04.2002 to 30.06.2005	1.095	510048/-	493160/-
24	Genetic improvement of brassica oilseed by integrative use of conventional and molecular biological approaches.	Dr. Zahoor Ahmed Swati, Prof., Inst. of Biotech. & Genetic Eng., NWFP Agri. University, Peshawar.	22.03.2002 to 21.03.2005	1.919	1291000/-	1280474/-
25	Management of parasitic weeds in rapeseed, onion and legume crops in NWFP.	Dr. Khan Bahadar Marwat Prof., Dept. of Weed Sci., NWFP Agri. University, Peshawar.	22.03.2002 to 30.06.2005	1.753	1730531/-	1726651/-
26	Investigation of mechanism for weed seed dormancy in rice based cropping system.	Dr. Gul Hassan Prof., Dept. of Weed Sci., NWFP Agri. University, Peshawar	22.03.2002 to 21.03.2005	4.000	405000/-	402921/-
27	Investigation of role of germin-like proteins (GLPS) during germination/early development by construction of rice plants engineered for sense and anti-sense expression of rice GLP.	Dr. Saqlain Naqvi, Prof., Dept. of Bio Sciences, University of Arid Agriculture, Rawalpindi.	22.03.2002 to 30.06.2005	2.473	2103000/-	2099530/-

28	Resource conservation technology for rice-wheat system in CRBC command areas.	Dr. Inayatullah Awan, Faculty of Agri., Gomal University, D. I. Khan.	04.04.2002 to 31.12.2003	2.750	1157000/-	1068085/-
29	Iron fortification of wheat flour in Pakistan: a step that needs critical evaluation.	Dr. M. Masoom Yasinzai, Prof., Dept. of Biochemistry, University of Balochistan, Quetta.	26.04.2002 to 30.06.2005	1.100	420500/-	405659/-
30	Integrated Pest Management of aphids in Canola.	Dr. Muhammad Aslam, Asso. Prof., University College of Agriculture, BZU, Multan.	01.07.2002 to 30.06.2005	1.346	899000/-	749649/-
31	Studies on malformation of mango	Dr. Ahmed Saleem Akhtar, Dir., Plant Protection Inst., AARI, Faisalabad.	29.03.2002 to 28.03.2005	2.241	1544000/-	1526160/-
32	Increasing production of Kabuli chickpea for its import substitution.	Dr. Muhammad Afzal, Dir., Pulses Res. Inst., AARI, Faisalabad.	06.04.2002 to 28.02.2006	1.328	898500/-	848085/-
33	Post harvest research on perishable fruits (guava, peach) and vegetables (tomatoes) in NWFP.	Mrs. Manzoor Nazli, Food Technologist, ARI, Tarnab, Peshawar.	22.03.2002 to 30.06.2005	1.637	1477000/-	1476742/-
34	Integrated management of fruit flies in Pakistan (ARI, D.I Khan, Component – IV)	Dr. Abdul Latif, Entomologist, ARI, D. I. Khan.	22.03.2002 to 30.06.2006	2.063	2060500/-	1958241/-
35	Survey and integrated pest management of cotton insect pests in Balochistan.	Mr. Muhammad Karim Shawani, Entomologist, ARI, Sariab, Quetta.	01.03.2003 to 28.02.2006	1.200	1077775/-	1025918/-
36	Integrated management of fruit flies in Pakistan, (ARI, Sariab, Component – VI)	Mr. Muhammad Karim Shahwani, Entomologist, ARI, Sariab, Quetta.	01.03.2003 to 28.02.2006	2.031	1674900/-	1543412/-
37	Utilization of Genetic Variation in Yield Response to Drought Stress for the Development of Improved Wheat Germplasm	Dr. Muhammad Yaqoob Mujahid, PSO, Wheat Program, NARC, Islamabad	08.09.2005 to 07.09.2008	3.861	3211900/-	3109820/-
38	Investigation of Citrus Decline and Preliminary Management Studies in Punjab	Me. Khurshid Burney, Sr. Scientific Officer, IPEP, NARC, Islamabad	01.07.2005 to 30.06.2008	2.801	2501600/-	2430477/-
39	Biochemical and Molecular Approaches to Study the Effect of Pesticide on Nitrogen Fixing Bacteria in Legumes	Mr. Sohail Hameed, PSO, Plant Microbiology Division, NIBGE, Faisalabad	01.07.2005 to 30.06.2008	1.650	1204000/-	978211/-
40	Selection of Zinc Efficient Wheat	Dr. Muhammad Imtiaz, Principal Scientist,	01.07.2005 to	1.705	997600/-	997071/-

	Genotypes for a Balance Human nutrition	Dept. of Soil Science, NIA, Tandojam	30.06.2008			
41	Adaptation and Promotion of Ultra Low Volume (ULV) Pesticide Sprayer	Dr. Abdul Rehman Tahir, Asso. Prof., Univ. of Agriculture, Faisalabad.	01.10.2005 to 30.09.2008	2.387	1009000/-	1008617/-
42	Utilization of Allelopathic Properties of Sorghum, Sunflower and Brassica for Weed Management in Some Field Crops	Dr. Zahid Ata, Prof./Dir., Weed Sciences Lab., Univ. of Agriculture, Faisalabad.	20.08.2005 to 19.08.2008	3.117	1119600/-	1117342/-
43	Mass Production of Biocontrol Agents for Field Application	Dr. Saleem Shahzad, Asstt. Prof., Dept. of Agriculture, University of Karachi	01.07.2005 to 30.06.2008	1.145	683400/-	552000/-
44	Development of High Yielding, Disease Resistant Varieties of Groundnut through Hybridization and Mutation Breeding along with Nodulation Studies for N ₂ Fixation under Rainfed Conditions	Mr. Naeem-ud-Din, Groundnut Botanist, Barani Agricultural Research Institute, Chakwal	01.07.2005 to 30.06.2008	3.221	2949600/-	2949540/-
45	Production of Double Haploids of Wheat by Using Wheat X Maize Crosses Technique	Dr. Abid Mahmood, Dir., Barani Agri. Res. Institute, Chakwal	01.07.2005 to 30.06.2008	3.817	3657400/-	3585974/-
46	Hybrid Seed Production of Rice	Dr. Muhammad Akhtar, Rice Botanist, RRI., Kala Shah Kaku	01.07.2005 to 30.06.2008	1.483	1466300/-	1452931/-
47	Investigation on Disease Control of Die Back/Citrus Decline in NWFP	Dr. Mahmood Khan, Plant Pathologist, ARI, Tarnab, Peshawar	01.07.2005 to 30.06.2008	2.838	2806600/-	2764681/-
48	In-Situ Evaluation of Indigenous Walnut Germplasm in Malakand Division, NWFP	Mr. Jamshaid Khan, Director, ARS, Mingora, Swat	01.07.2005 to 30.06.2008	7.840	673200/-	670607/-
49	Integrated Nematode Disease Management (INDM) in some cereals, fruits and vegetables of Pakistan.	Dr. Shahina Fayyaz, Director, NNRC, University of Karachi	01.05.2003 to 30.04.2006	3.435	3327000/-	3306610/-
50	Developmental Biology, Feeding Pattern and Management Strategy against Indian Crested Porcupine (<i>Hystrix Indica</i>) in Sindh and Balochistan Provinces. (C-IV)	Mr. Amjad Pervez Sr. Scientific Officer, VPCI, SARC, Karachi University, Karachi	01.07.2003 to 30.06.2006	1.962	1582300/-	1536925/-

51	Quantification of maize yield losses from leaf blights and improving maize populations for grain yield and leaf blight resistance.	Dr. Hidayat-ur-Rehman, Prof., (PBG), NWFP Agricultural University, Peshawar.	01.07.2003 to 30.06.2006	2.173	1520000/-	1215037/-
52	Production of doubled haploids wheat with longer coleoptile.	Dr. Fida Muhammad, Associate Prof., (PBG), NWFP Agricultural University, Peshawar.	01.08.2003 to 30.06.2006	1.859	1408700/-	1398904/-
53	Component 2: Investigations on Indian Crested Porcupine, Hystrix indica, Damage to Forest Flora and Development of Prevention Practices in Tarbela-Mangla Watershed Areas.	Mr. Rafiq Massih, Sr. Scientific Officer, VPCL, NARC, Islamabad.	01.07.2003 to 30.06.2006	2.866	2254600/-	2083056/-
54	Component 3: Biology and Management of Porcupine, Hystrix indica in Central Punjab.	Prof. Dr. Afsar Mian, Dean, Sciences, University of Arid Agriculture, Rawalpindi.	01.07.2003 to 30.06.2006	2.094	1916500/-	1870106/-
55	Umbrella Project Component 1: Pathobiology of Foliar Spots of Wheat and their Integrated Management.	Mrs. Shamim Iftikhar, Sr. Scientific Officer, IPEP, NARC, Islamabad	01.07.2003 to 30.06.2006	4.069	2761700/-	2756739/-
56	Component 2: Investigation on barley yellow dwarf virus (BYDV) in wheat crop in Pakistan.	Dr. Shahid Hameed, Sr. Scientific Officer, CDRI, NARC, Islamabad.	01.01.2004 to 30.09.2007	3.892	3377000/-	2526396/-
57	Component 3: Evaluation and incorporation of new genetic diversity in Pakistani wheats for stripe (yellow) rust resistance.	Dr. Iftikhar Ahmad, Dy. Director General, IPEP, NARC, Islamabad.	01.07.2003 to 30.06.2006	3	2092800/-	1712483/-
58	Component 4: Identification of sources of resistance to Karnal bunt disease of wheat.	Mr. Javed Iqbal Mirza, Sr. Scientific Officer, CDRP, NARC, Islamabad	01.07.2003 to 31.07.2007	2.54	2059000/-	1956941/-
59	Studies on mycotoxins in corn.	Dr. Yasmin Ahmad, PSO, IPEP, NARC, Islamabad	01.08.2003 to 30.06.2006	2.5	1720800/-	1579139/-
60	Introduction of soft fruit (strawberry, black berry, rasp berry, black currant) in the potential areas of Pakistan for economic returns.	Mr. Sudheer Tariq, Sr. Scientific Officer, IFHC, NARC, Islamabad.	01.07.2003 to 30.06.2006	4	3674200/-	3494648/-

61	Development of heat tolerant wheat varieties.	Dr. Muhammad Aqil, Director, Wheat Research Institute, AARI, Faisalabad.	01.10.2003 to 30.09.2006	2.955	2157000/-	2063019/-
62	Development and Promotion of Improved Technology for Sorghum and Millet Production through Participatory Research in Dryland Areas of Pakistan and AJK.	Dr. Javed Fateh, SO, Maize, Sorghum & Millet, NARC, Islamabad	28.04.2004 to 30.04.2007	2.121	1380100/-	1380095/-
63	Development of low cost plant protection technologies through integrated pest management approaches and use of sacrificial crop/ plants in Sindh.	Dr. Abdul Sattar Buriro, Entomologist, ARI, Tandojam, Sindh	29.04.2004 to 28.04.2007	2.822	2505000/-	2490773/-
64	Utilization of seaweeds in the control of soilborne pathogens and growth of crop plants.	Dr. Viqar Sultana, Professor, Biogeochemistry University of Karachi.	01.01.2005 to 31.12.2007	1.780	1220150/-	1224410/-
65	Transgenic tomato with resistance to bacterial wilt	Dr. Zubaida Ch., SO, ABP, NARC, Islamabad	25.10.2004 to 24.10.2007	4.085	3724533/-	3616723/-
66	Studies on monitoring of contaminants in exportable food commodities	Dr. Zahida Perveen, Sr. Scientific Officer SARC, Karachi.	01.01.2005 to 31.12.2007	4.997	3969900/-	3872645/-
67	Bread wheat (T. aestivum L.) improvement for late planting/ terminal stress and high yield potential.	Mr. Tila Muhammad PSO, NIFA, Tarnab, Peshawar	01.07.2004 to 30.06.2007	1.868	1690200/-	1575010/-
68	Increasing oil content in sunflower germplasm.	Mr. Makhdoom Hussain, Director, Oilseed Research Inst., AARI, Faisalabad	01.07.2005 to 30.06.2008	0.768	301500/-	301461/-
69	Developing Forage-Plus-Grain Winter Wheat Production System for the Northern Areas.	Dr. Iftikhar Hussain Associate Professor, Dept. of PBG, NWFP Agri. University, Peshawar.	26.08.2004 to 30.09.2007	1.458	1192600/-	1192609/-
70	Enhancement and Evolution of Germplasm for Stressed Environment through the Use of Agro-biodiversity.	Dr. Shafqat Farooq Pr. Scientist, NIAB, Faisalabad	01.04.2004 to 30.04.2007	4.468	4334150/-	4308614/-
71	Development of High Yielding, Long Grain Varieties of Rice for Par Boiling Purpose.	Mr. Akbar Ali Cheema Deputy Chief Scientist NIAB, Faisalabad.	11.05.2004 to 30.04.2007	1.696	1647900/-	1639688/-

72	Management of Spider Mites on Apple	Dr. Inamullah Khan, Asstt. Prof., Dept. of Plant Protection, NWFP Agricultural University, Peshawar	30.08.2004 to 30.08.2007	1.408	1150800/-	1140427/-
73	Identification of Superior Soybean Cultivars for Different Agro-ecologies of Pakistan	Dr. Muhammad Ashraf, Sr. Scientific Officer, Oilseed Program, NARC, Islamabad	30.08.2004 to 30.06.2007	2.796	2772600/-	2716800/-
74	Management of Weeds in Wheat-Maize Cropping System in Barani Areas of Potohar (Component-I)	Dr. Tahira Z. Mahmood, Pr. Scientific Officer, IPEP, NARC, Islamabad	01.04.2004 to 30.06.2007	4.036	2777200/-	2744854/-
75	Integrated Weed Control for Major Crops (Wheat & Rapeseed) and Fallow Land in Pothwar (Component-II)	Prof. Dr. M. Azim Malik, Department of Agronomy, Pir Mehr Ali Shah Arid Agri. Uni., Rawalpindi	09.07.2004 to 30.06.2007	2.236	1708350/-	1543556/-
76	Integrated Weed Management in Wheat, Cotton, Rice and Pulses in Punjab (Comp.-III)	Mr. M. Sarfraz Iqbal, Director, Agronomic Research Institute, AARI, Faisalabad	30.08.2004 to 31.12.2007	2.120	1989300/-	1988648/-
77	Integrated Weed Control in Cereals (Wheat and Maize),(Component-IV)	Dr. Nasirudin, Director Crops Research Institute, Pirsabak, Nowshera	17.08.2004 to 30.06.2007	2.154	1133000/-	980131/-
78	Weed Management Studies of Wheat and Cotton Crops in Sindh (Component-V)	Mr. Allah Ditta Jarwar, Plant Physiologist, Agriculture Research Institute, Tandojam, Sindh.	13.05.2004 to 30.06.2007	2.154	1957546/-	1955794/-
79	Integrated Weed Management in Wheat and Vegetables (Onion & Tomato) (Component-VI)	Mr. Qazi Bashir Ahmed, Director, Agricultural Research Institute, Sariab, Quetta	28.07.2004 to 30.06.2007	2.154	1807745/-	1807316/-
80	Screening of Drought Tolerant Wheat Genotypes and Estimation of Genetic Basis	Dr. M. Munir, Prof., Department of PBG, Pir Mehr Ali Shah Arid Agri. Uni., Rawalpindi	01.07.2004 to 30.06.2007	1.967	1861000/-	1858605/-
81	Nematodes of Fruit and Vegetable Crops and Their Management in Karachi and Hyderabad Districts Using Plant Extracts	Dr. Aly Khan, CDRI, SARC, PARC, Karachi	01.01.2005 to 31.12.2007	2.641	2254500/-	2177530/-
82	Sustainable Cropping Patterns for Pothwar Plateau	Dr. Shahbaz Ahmad, Prof. of Agronomy, Pir Mehr Shah Arid Agri., Uni., Rawalpindi.	04.06.2003 to 03.06.2006	3.036	1957800/-	1892571/-
83	Assessment of Suitable Sealant Material (s) for	Syed Asim Rehan Kazami, Sr. Scientific	17.05.2003 to	5.258	1523000/-	1296289/-

	Increasing the Gas-Tightness of Public Sector Warehouses and Tarpaulins used for Covering the Open-Stacks (Ganjees)	Officer, GSRI, Southern Zone Agriculture Research Center (SARC), PARC, Karachi	16.05.2006			
84	Control of Phytopathogenic Microorganisms by Bacteriocins from Indigenous Strains	Dr. Sheikh Ijaz Rasool Senior Professor, Dep. of Microbiology, Uni. of Karachi, Karachi	29.07.2003 to 28.07.2006	2.133	2024500/-	2019623/-
85	Conservation and Sustainable Utilization of Agro-biodiversity of Under-utilized Crops	Dr. Zahoor Ahmad, Principal Scientific Officer, Plant Genetic Resources Institute (PGRI), NARC, Islamabad	17.03.2003 to 16.03.2006	1.896	1697698/-	1628248/-
86	Mutation breeding for High Grain Yield, Improved Quality and Earliness in Non-Aromatic Rice (<i>Oryza sativa L.</i>)	Abdul Wahid Baloch, Deputy Chief Scientist, NIA, Tandojam,	17.10.2003 to 16.10.2006	1.112	846000/-	846000/-
87	DNA-based Genetic Characterization of Cotton Germplasm. (Component-I)	Dr. Yusuf Zafar, Head, Plant Biotechnology Div., NIBGE, Faisalabad	02.12.2004 to 01.12.2007	4.384	2931442/-	2931442/-
88	Molecular Characterization of Available Germplasm of Wheat in Pakistan (Component-II)	Dr. Iftikhar Ahmad Khan, Prof./ Chairman, Dept. of Plant Breeding & Genetics, University of Agri., Faisalabad	02.12.2004 to 01.12.2007	5.230	4129373/-	3952031/-
89	Molecular Characterization of Rice Germplasm using RAPD Analysis (Comp. - III)	Dr. M. Ashiq Rabbani, Sr. Scientific Officer, PGRP, IABGR, NARC, Islamabad.	29.10.2004 to 28.10.2007	6.561	4188967/-	4188550/-
90	DNA Marker for Wilt (<i>Fusarium oxysporum</i>) Resistant Genes in Chickpea	Dr. Mohammad Saleem Asso. Prof., Plant Breeding and Genetics, Uni. of Agriculture, Faisalabad	28.07.2004 to 27.07.2007	2.893	2838300/-	2821794/-
91	Introduction and Yield Improvement of Under-Exploited Pulses in NWFP	Mr. Mansoor Ahmad, Scientific Officer, Pulses, PARC, ARI, D. I. Khan	29.05.2004 to 28.05.2007	1.030	1023140/-	1024268/-
92	Mapping of Bacterial Diversity in Sindh Agricultural Fields and Deserts – A Molecular Level	Prof. Dr. Nuzhat Ahmad, Director, Center for Molecular Genetics, University of Karachi,	03.03.2005 to 02.03.2008	3.274	2382500/-	2554522/-
93	Better Utilization of Food for Healthy and Productive Life in Agriculture Sector	Dr. Alam Khan, Prof., Department of Human Nutrition, NWFP Agri. University, Peshawar	28.08.2004 to 27.08.2007	2.278	2277500/-	2276368/-

94	Studies on Resistance Monitoring and Insecticide Effects on Chrysopid Predators (Neuroptera)	Mr. Attaullah Khan Pathan, Senior Scientific Officer/ Incharge, PARC-IPM Sub-Station, Multan	29.07.2004 to 28.07.2008	1.986	1891100/-	1868143/-
95	Characterization of Pakistani Isolates of Chili Veinal Mottle Potyvirus (ChiVMV) and Cucumber Mosaic Cucumovirus (CMV) Infecting Chili Crop	Mr. Hussain Shah, Scientific Officer, IPEP, NARC, Islamabad	27.09.2004 to 26.09.2007	2.933	1627500/-	1367747/-
96	Quality Characterization of Oilseed Crops Through NIRS	Mr. Iftikhar Ali, Principal Scientist, Nuclear Institute for Food & Agriculture (NIFA), Tarnab, Peshawar	28.07.2004 to 27.07.2007	2.013	1762500/-	1746157/-
97	Use of RNA Interference for Genetically-Engineered Male Sterile Tomato Plants for Production of Hybrid Tomato	Dr. Shahid Mansoor, Pr. Scientist, Plant Biotechnology Division, (NIBGE), Faisalabad	28.01.2005 to 27.01.2008	3.223	1427000/-	1920649/-
98	Application of DNA Finger Printing for Drought Tolerance in Wheat	Dr. Mehboob-ur-Rehman, Sr. Scientist, Plant Biotechnology Division, NIBGE, Faisalabad	20.12.2004 to 19.12.2007	4.073	2275742/-	2275742/-
99	Evolution of Wheat Varieties for Low Water Requirements Using Conventional and Mutation Breeding Techniques	Mr. Mahboob Ali Sial, Principal Scientist, Nuclear Institute of Agriculture (NIA), Tandojam,	27.08.2004 to 26.08.2007	1.944	1479140/-	1314173/-
100	Development of Heat Tolerant, Early Maturing and High Yielding Mungbean (Vigna Radiata (L.) Wilczek) Genotypes	Dr. Gul Sanat Shah, Senior Scientists, Nuclear Institute for Food & Agriculture (NIFA), Peshawar	28.07.2004 to 27.07.2007	1.674	1494200/-	1482629/-
101	Development and Evaluation of a Mobile Flat-Bed Dryer for Sunflower and Canola	Dr. Munir Ahmad, PSO, Farm Machinery Institute (FMI), National Agricultural Research Centre (NARC), Islamabad	27.07.2004 to 26.07.2007	2.550	2330800/-	2166478/-
102	Studies on Breeding Biology and Post-Natal Development and Control Trails against Rodent Damaging Date-Palm Orchards of Tehsil Nok Kundi Distt: Chagai-Balochistan	Syed Muzaffar Ahmed, Sr. Scientific Officer, Vertebrate Pest Control Research Institute, SARC, PARC, Karachi	07.03.2005 to 06.03.2008	3.102	2621100/-	2520649/-

103	Development of Integrated Pest Management of Subterranean Termites in Agro-Ecosystem	Dr. Sohail Ahmed, Asso. Prof., Dept. of Agri. Entomology, University of Agriculture, Faisalabad	27.07.2004 to 26.07.2007	2.431	1619000/-	1572131/-
104	Molecular Marker Facilitated Pyramiding of Bacterial Blight Resistance Genes in Super Basmati Rice	Dr. Muhammad Arif, Principal Scientist, Plant Biology Division, NIBGE, Faisalabad	16.08.2005 to 31.12.2008	3.458	3206600/-	2950501/-
105	Development and Testing of a Resource Conservation Tillage implement	Dr. Jehangir Khan Sial, Prof., Faculty of Agri. Engineering & Technology, Uni. of Agriculture, Faisalabad	30.10.2004 to 30.12.2007	1.910	1083825/-	801367/-
106	Evaluation of Chickpea Germplasm Against Aggressive Isolates of <i>Ascochyta Rabiei</i> Identified by Biological And DNA Molecular Marker Techniques and Disease Management through Induced Systemic Resistance (ISR).	Dr. Nighat Sarwar, Principal Scientist, Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	25.07.2006 to 30.06.2009	3.909	2624200/-	2624200/-
107	Screening of Citrus Cultivars Grown in Pakistan Against Citrus Canker and its Management.	Dr. Shahbaz Talib Sahi, Associate Professor, Uni. of Agriculture, Faisalabad.	01.07.2006 to 30.06.2009	2.952	1577600/-	1053886/-
108	Characterization to Determine the Adaptive Role of Dehydrins under Drought Stress in Wheat (<i>Triticum aestivum</i>)	Dr. Rehana Asghar, Professor, PMAS Arid Agriculture University, Rawalpindi.	30.04.2006 to 29.04.2009	2.943	1987000/-	1916984/-
109	Sustainable Approaches Toward Adaptation of Sorghum and Millet Improved Varieties for Grain and Fodder Purpose in Rain Fed Areas of Kohat Division	Mr. Mirza Hassan, Research Officer, Barani Agricultural Research Station, Jarma, Kohat.	10.04.2006 to 31.03.2009	1.476	1251400/-	1190169/-
Natural Resources:						
1	Soil Fertility Monitoring and Management in Cotton-Wheat System Productivity (NARC, Component-I)	Dr. A. Rashid, DG, NARC, Islamabad	24.04.2002 to 30.06.2006	2.700	2396400/-	2322664/-
2	Soil Fertility Monitoring and Management in Rice-Wheat System (NARC, Component-IV)	Dr. Fayyaz Hussain, Sr. Scientific Officer, LRRP, INRES, NARC, Islamabad	27.04.2002 to 30.06.2006	2.000	1911000/-	1886583/-
3	National Coordinated Project on Management	Mr. Banarus Hussain Niazi, Pr. Scientific	17.07.2003 to	3.993	2899000/-	2704406/-

	of Salt Affected Soil and Brackish Water in Pakistan-(NARC, Component-VII)	Officer, LRRP, INRES, NARC, Islamabad	30.06.2006			
4	Increasing and Sustaining Crop Productivity of Water Eroded Lands through Rainwater	Dr. M. Shafiq, Pr. Scientific Officer, WRRP, NARC, Islamabad	27.07.2004 to 30.06.2007	7.500	4434000/-	3266743/-
5	Improving Root-association of Diazotrophs (Azorhizobium ssp, Azospirillum spp.) in Rainfed Wheat	Mrs. Shahida Nasreen Khokhar, Sr. Scientific Officer, Soil Bio. Lab. LRRP, INRES, NARC, Islamabad	27.07.2004 to 30.06.2007	2.233	1953225/-	1934958/-
6	Modeling Leaching Losses of Fertilizer Nutrients from Root-Zone and Environmental Implications	Dr. M. Mahmood-ul-Hassan, Sr. Scientific Officer, LRRP, INRES, NARC, Islamabad	17.07.2004 to 30.06.2007	2.409	1878250/-	1738438/-
7	Use of Nitrogen Fixing, Plant Growth Promoting Rhizobacteria (PGPR) for Development of Bio-Fertilizer for Crops of Economic Importance (Coordinated Project, NARC, Component - I)	Dr. Muhammad Aslam, Sr. Scientific Officer, Soil Biology & Biochemistry, LRRP, INRES, NARC, Islamabad	02.04.2005 to 01.04.2008	4.230	2397000/-	1552011/-
8	Nutrient Indexing and Integrated Nutrient Management for Sustaining Sugarcane Yields	Dr. Sagheer Ahmad, Sr. Scientific Officer, Sugar Crops Res. Program, CSI, NARC, Islamabad	25.03.2004 to 24.03.2008	5.800	5119200/-	5086113/-
9	Assessment of Productivity Potential and Utilization of Rangelands and Sown Pastures in Pothowar Plateau	Dr. Javed Afzal, Sr. Scientific Officer, Rangeland Res. Program, INRES, NARC, Islamabad	27.09.2004 to 30.06.2008	3.580	2717400/-	2665317/-
10	Assessment of Nutritional Potential and Performance of Range Species in Balochistan	Dr. Sarfraz Ahmad, Sr. Scientific Officer AZRC, Quetta	24.04.2002 to 30.06.2005	1.973	1542000/-	1529837/-
11	Soil Fertility Monitoring and Management in Dry land Cropping Systems of Balochistan (AZRC, Quetta, Component-III)	Mr. Ahmad Sami Ullah, Sr. Scientific Officer, AZRC, Quetta	02.05.2002 to 30.06.2005	1.150	1035500/-	1035940/-
12	Testing and Evaluation of Low-cost Lining Materials for Watercourse in Drought Endangered Areas of Balochistan	Mr. Nadeem Sadiq, Scientific Officer, AZRC, Quetta	01.09.2004 to 31.08.2007	2.776	1510200/-	1450000/-

13	Refinement of Skimming Well Design and Operational Strategies for Sustainable Groundwater Management	Dr. M. Ashraf, Director, Pakistan Council of Research in Water Resources, (PCRWR), Islamabad	05.05.2004 to 15.10.2007	2.100	1509000/-	1508799/-
14	Use of Low Quality Groundwater for Sustainable Crop Production	Dr. Ashfaq Ahmad Sheikh, Dy. Director PCRWR, Islamabad	05.05.2004 to 15.10.2007	1.700	1449800/-	1449039/-
15	National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan (NIAB, Component-I)	Dr. Zahoor Aslam, Coordinator, Nuclear Institute for Agriculture & Biology, Faisalabad	06.09.2003 to 30.06.2006	4.017	1276000/-	1106153/-
16	Use of Nitrogen Fixing, Plant Growth Promoting Rhizobacteria (PGPR) for Development of Biofertilizer for Crops on Economic Importance (NIBGE, Component-II)	Dr. M. Sajjad Mirza, Principal Scientist, National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad	19.03.2005 to 18.03.2008	3.254	2500300/-	2451470/-
17	Determination of Growth, Wood Properties and Water Table Control Following Afforestation of Proven Provenances/Species Under Saline and Waterlogged Conditions in Pakistan	Mr. Muhammad Khan, Sr. Scientific Officer/ Geneticist, Pakistan Forest Institute, Peshawar	28.12.2004 to 27.12.2007	2.998	1606450/-	1597649/-
18	Recycling of Organic Wastes for Sustainable Crop Productivity (Uni. of Agri., Faisalabad, Component-I)	Dr. M. Arshad, Prof., Dept. of Soil & Env. Sciences, University of Agriculture, Faisalabad	13.04.2002 to 30.06.2005	2.013	1574500/-	1577070/-
19	National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan (Univ. of Agri. Faisalabad, Comp. - III)	Dr. Javid Akhtar, Asso. Prof., Dept. of Soil & Env. Sciences, University of Agriculture, Faisalabad	06.09.2003 to 30.06.2006	4.287	3254500/-	2747881/-
20	Sustainable Rice-Wheat Farming System on Salt-Affected Soils Using Brackish Water and Amendments	Dr. Ghulam Murtaza, Asso. Prof., Inst. of Soil & Env. Sciences, University of Agriculture, Faisalabad	19.07.2004 to 30.06.2007	2.923	2113300/-	2131076/-
21	Evaluation and Formulation of Calcium Carbide Based Soil Amendment for Improving Crop Production	Dr. M. Arshad, Prof., Inst. of Soil & Env. Sciences, University of Agriculture, Faisalabad	17.05.2004 to 16.05.2007	2.993	2031900/-	2018047/-

22	Management Aspects of Surface and Groundwater Resources for Irrigated Areas	Dr. Rai Niaz Ahmed, Asso. Prof., Water Mgt. Res. Centre, University of Agriculture, Faisalabad	29.05.2004 to 28.05.2007	2.534	1915500/-	1915253/-
23	Testing and Evaluation of Lining and Control Structure Alternatives for Irrigation Channels	Dr. M. Rafiq Choudhry, Prof., Dept. of Irri. & Drainage, Uni. of Agri. Faisalabad	28.05.2004 to 27.05.2007	4.128	2047600/-	1999999/-
24	Silicon Nutrition for Enhancing Crop Productivity	Dr. Rahmat Ullah, Asso. Prof., Inst. of Soil & Env. Sci., Uni. of Agri., Faisalabad	19.07.2004 to 30.06.2007	3.431	2235052/-	2209282/-
25	Management Strategies for Metal Contaminated Soils Receiving City Waste Effluent for Sustainable Crop Production and Food Security	Dr. Abdul Ghafoor, Prof., Inst. of Soil & Env. Sci., University of Agriculture, Faisalabad	26.07.2005 to 31.12.2008	4.211	3393500/-	3360187/-
26	Recycling of Organic Wastes for Sustainable Crop Productivity (AAU, Rawalpindi, Component-II)	Dr. Mushtaq Ahmad Khan, Dean, Faculty. of Crops & Food, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi	25.04.2002 to 30.06.2005	1.642	1280000/-	1102593/-
27	Impact of Tillage Systems, Legume and Mulches on Soil Profile Moisture Dynamics and Wheat Production	Dr. Safdar Ali, Prof., Department of Soil Sciences & SWC, Pir Mehr Ali Shah, Arid Agriculture University, Rawalpindi	19.07.2005 to 30.06.2008	2.000	1310300/-	1280938/-
28	Diagnosis and Remedial Measures of Micro-Nutrient Deficiencies in Fruit Plants of Economic Importance in Pakistan (AARI, Faisalabad, Comp. - I)	Dr. M. Ibrahim, Agri. Chemist (Soils), Ayub Agricultural Research Institute, Faisalabad	13.04.2002 to 30.11.2006	2.337	1562500/-	1206595/-
29	National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan (Pindi Bhattian, Component-II)	Mr. Abdul Rasool Naseem, Agri. Chemist, Soil Salinity Research Institute, Pindi Bhattian	30.06.2003 to 30.06.2006	3.190	3060800/-	2816677/-
30	National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan (SALU, Khairpur, Comp. - IV)	Dr. A. Razak Mahar, Asso. Prof., Dept. of Botany, Shah Abdul Latif University, Khairpur,	04.09.2003 to 31.12.2006	3.513	3168937/-	3162294/-
31	Optimal Tillage Practices for Wheat-Fallow and Chickpea-	Dr. M. Jamal Khan, Prof./ Chairman, Dept. of Water Mgt., NWFP	13.04.2002 to 30.06.2005	2.500	2139000/-	2138624/-

	Fallow Rotations in Southern NWFP	Agricultural University, Peshawar				
32	Recycling of Organic Wastes for Sustainable Crop Productivity (NWFP Agri. Uni. Peshawar, Comp.-III)	Dr. Zahir Shah, Professor, Dept. of Soil & Env. Sci., NWFP Agricultural University, Peshawar	25.04.2002 to 30.06.2006	1.642	1652537/-	1625050/-
33	National Coordinated Project on Management of Salt Affected Soil and Brackish Water in Pakistan (NWFP Agri. University, Peshawar, Component-V)	Dr. Izhar-ul-Haq, Prof., Dept. of Soil & Env. Sci., NWFP Agricultural University, Peshawar	26.07.2002 to 30.06.2006	3.094	2589400/-	2365118/-
34	Improving Yields and Nitrogen Use Efficiency in Cereal Based Cropping System	Dr. M. Tariq Jan, Prof., Dept. of Agronomy, NWFP Agricultural University, Peshawar	17.05.2004 to 16.05.2007	1.234	1005300/-	997364/-
35	Increasing Crops Production Through Humic Acid in Rainfed and Salt Affected Soils in Kohat Division (NWFP)	Dr. Riaz A. Khattak, Prof., Dept of Soil & Env. Sci., NWFP Agricultural University, Peshawar	28.10.2004 to 31.12.2007	4.179	3843300/-	3708743/-
36	Field Evaluation of Vesicular Arbuscular Mycorrhizal Fungi and Their Significance in Wheat-Maize Cropping System under Different Soil Series of NWFP	Dr. M. Sarirullah, Prof., Dept of Soil & Env. Sci., NWFP Agricultural University, Peshawar	20.12.2004 to 19.12.2007	1.411	1134171/-	1123554/-
37	Micronutrients Management in Apple and Citrus Orchards in Swat Valley	Dr. Zahir Shah, Prof., Dept of Soil & Env. Sci., NWFP Agri. University, Peshawar	22. 08. 2006 to 30. 06. 2009	3.829	3495700/-	3531740/-
38	Impact of Sewage Wastes (Effluent and Sludge) on Soil Properties and Quality of Vegetables	Dr. M. Qasim Khan, Prof., Dept. Soil Sci., Faculty of Agri., Gomal University, D. I. Khan	17.07.2003 to 30.06.2006	4.153	2936472/-	2890789/-
39	Improvement of Groundnut Production Through Rhizobial Inoculation in NWFP	Dr. Sabir H. Shah, Dir., Soil & Plant Nut., Agricultural Research Institute, Tarnab, Peshawar	22.05.2004 to 21.05.2007	1.701	1662200/-	1662114/-
40	Diagnosis and Remedial Measures of Micro-Nutrient Deficiencies in Fruit Plants of Economic Importance in Pakistan (ARI, Sariab, Quetta, Component –II)	Mr. M. Idris, Director, Water Management and High Efficiency Irrigation System, Agricultural Research Institute, Sariab, Quetta	31.03.2003 to 28.02.2007	1.563	715596/-	715596/-
41	National Coordinated Project on Management of Salt Affected Soil and	Mr. Shahjahan Khan, Dy. Dir., Soil Fertility, Agricultural Research	28.08.2003 to 30.06.2006	2.930	1226000/-	1224903/-

	Brackish Water in Pakistan (AARI, Sariab, Quetta, Component-VI)	Institute, Sariab, Quetta				
42	Soil Fertility Monitoring and Management in Major Cropping Systems of AJK (AJK, Muzaffarabad, Component-II)	Dr. M. Bashir Butt, Soil Chemist, Dept. of Agriculture, Muzaffarabad, AJK	13.04.2002 to 30.06.2005	1.150	1129000/-	1112896/-
Social Sciences:						
1	Application of Farm Planning Models to Analyze the Oilseed Crops at Regional and National Levels	Dr. Khalid Mahmood Aujla, Sr. Scientific Officer, SSD, PARC, Islamabad	02.09.2002 to 01.09. 2005	3.000	795000/-	781730/-
2	Structure, Conduct and Performance of the Marketing Systems, Margins and Seasonal Price Variation of Selected Fruits and Vegetables in Pakistan	Dr. Ali Muhammad Khushk, Sr. Scientific Officer, TTI, ARI, Tandojam	18.04.2002 to 17.04.2004	2.500	2095000/-	1958554/-
3	Determination of Profitability and Efficient Production Packages for Various Vegetables	Dr. Bashir Ahmad, Vice Chancellor, University of Agriculture, Faisalabad	03.04.2002 to 30.06.2006	2.500	1936500/-	1440711/-
4	Identification and Analysis of Technology Transfer for Sustained Growth in Agriculture as Used by Extension in Sindh, Pakistan	Dr. S. S. Bukhari, Professor, Dept. of Agri. Edu. Ext. & Short Courses, Sindh Agriculture University, Tandojam	01.01.2003 to 31.12.2005	0.500	276000/-	80000/-
5	WTO Trade Liberalization Move: Implication for Pakistan's agriculture with Special Reference to Sustainable Development, Poverty Alleviation and Environmental Concern	Dr. Anwar F. Chishti, Professor, NWFP Agricultural University, Peshawar	03.04.2002 to 02.04.2005	3.00	2295500/-	1862753/-
6.	Farmer's Capacity Building through Information Technology in Pakistan	Dr. M. Zakria Zakir, Chairman, Dept. of Sociology, Uni. of Punjab. Lahore	01.07.2004 to 30.06.2008	2.201	1218500/-	1223545/-
7	The Economic Valuation of Indus Delta Mangrove Ecosystem	Dr. Abida Tahirani, Director, Sindh Dev. Study Centre, Uni. of Sindh, Jamshoro	17.05.2002 to 16.05.2004	0580	571000/-	571006/-
8	Structure, Conduct, and Performance of the Marketing System, Margins and Seasonal Price Variation of	Dr. Muhammad Sharif, DDG (TT), Social Sciences Division, PARC, Islamabad	19.10.2004 to 31.12.2007	3.881	3043200/-	2113104/-

	Selected Fruits and Vegetables in Balochistan, NWFP, Northern Areas and AJK					
9	Socio-economic, Institutional and Policy issues Constraining the Productivity of Livestock in the Desert of Pakistan	Dr. Umar Farooq, Sr. Scientific Officer, Social Sciences Institute, NARC, Islamabad	01.10.2004 to 31.12.2007	3.770	1733325/-	874964/-
10	Poverty Alleviation through Increasing Agricultural Productivity by Transferring Improved and Tested Technology at the Farm Level	Dr. A. D. Sheikh, Sr. Scientific Officer, TTI, PARC, Faisalabad	18.08.2004 to 17.08.2007	5.115	4369600/-	3458814/-
11	Enhancing Agricultural Productivity through Transfer of Demand Driven Technologies to the Farmers in the Selected Districts of Sindh	Mr. Manzoor Ali Memon, Sr. Scientific Officer, TTI, PARC, Tandojam	18.08.2004 to 17.08.2007	4.360	3996800/-	3297405/-
12	Poverty Alleviation through Enhancing Agricultural Productivity by Implementing Priority Interventions in the Selected Areas of NWFP	Mr. Muhammad Ishaq, Scientific Officer TTI, PARC, Tarnab, Peshawar	18.08.2004 to 17.08.2007	5.029	4251600/-	4094373/-
13	Poverty Alleviation through Introducing Improved and Tested Technologies for Rural Agricultural Farming Communities in the Selected Districts of Balochistan	Mr. Muhammad Afzal, Director, TTI, PARC, Quetta	28.08.2004 to 27.08.2007	4.822	3253200/-	2354739/-
14	Poverty Alleviation through Enhancing Agricultural Productivity by Implementing Priority Intervention in the Selected Areas of AJK	Mr. Ghulam Sadiq Afridi, Sr. Scientific Officer, TTI, PARC, Muzaffarabad, AJK	27.08.2004 to 26.08.2007	4.279	3020000/-	2306550/-
15	Development of Agriculture from Subsistence Level to Productive Level through Transfer of Tested Technology in the Northern Areas of Pakistan	Mr. Shaukat Hayat Sadozai, Director TTI, Karina, Gilgit	18.08.2004 to 17.08.2007	3.926	3641300/-	3640243/-

16	Impact of Sanitary and Phytosanitary Agreement (SPS) on Agricultural Exports from Pakistan	Dr. Khalid Mustafa, Asso. Professor, Dept. of Agri. Marketing, Uni. of Agri., Faisalabad	17.03.2005 to 16.03.2007	1.438	911750/-	574388/-
17	Comparative Advantage and Competitiveness of Major Crops in Pakistan - Price Risk Analysis	Dr. M. Siddique Javed, Asso. Professor, Dept. of Agri. Economics, Uni., of Agri., Faisalabad	25.11.2005 to 30.06.2008	1.722	1084600/-	1082500/-
18	The Impact of Domestic Support to Punjab's Agriculture under WTO Regime	Mr. Qamar Mohy ud-Din, Asso. Prof., Dept. of Agri. Marketing, Uni. of Agri., Faisalabad	28.10.2004 to 27.10.2006	1.565	988000/-	870730/-
19	Socio-economic and Health Implication of Female Unpaid Work in Agriculture and Livestock Sector: A Study of the Cropping Zones of Punjab	Dr. Muhammad Iqbal Zafar, Asso. Professor, Dept of Rural Sociology, Uni. of Agri., Faisalabad	04.10.2004 to 03.10.2007	1.155	1017500/-	426746/-
20	Strengthening of Design and Analysis Capabilities in the National Agricultural Research System	Dr. M. Inayat Khan, Professor/Chairman, Dept. of Mathematics & Statistics, Uni. of Agri., Faisalabad	28.08.2004 to 30.09.2009	2.833	1777400/-	1107702/-
21	Economic Analysis of agro-Forestry Plantation in Sindh Province of Pakistan	Dr. Heman Das Lohano, Asso. Prof. Dept. of Agriculture Economics., Sindh Agri. Uni., Tandojam	28.10.2004 to 27. 10. 2006	1.328	8 6 7 9 1 /-	339208/-
22	Extension Interventions through Public and Private Sector in Agriculture of Balochistan	Syed Muhammad Arif, Associate Professor Dept. of Economics, Uni. of Balochistan, Quetta	13.09.2005 to 31.12.2007	1.865	2 8 9 0 0 /-	727634/-
23	Bridging the Gender Gap in Agri. Extension through Designing and Testing an Innovative and Holistic Out-Reach (Extension) Program of the University of Agriculture, Faisalabad	Dr. Tanvir Ali, Director, Department of Agriculture, University of Agriculture, Faisalabad	17.05.2005 to 16.03.2008	2.193	6 2 9 4 0 0 /-	1361070//-
24	The WTO Agreement and its Impacts on the Farm Sector with Emphasis on Small and Landless Holders	Prof. Dr. Sarfraz Ahmad, Prof./Ch., Dept. of Agri. Eco. & Sociology, PMAS Arid Agriculture University, Rawalpindi	26.08.2005 to 30.06.2009	1.621	5 8 7 0 0	1141000/-

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25	Human Resources Development (HRD) in the Changing Environment of Globalization – Collaboration with APO.	Dr. Abdul Hayee Qureshi, Sr. Scientific Officer, Social Sciences Division, PARC, Islamabad	27.04.2005 to 30.06.2009	4.735	8 5 2 3 0 0 /-	4493941/-
26.	Income Generation through Integration of National Agricultural Research System' (NARS) Technologies and Community Participation in District Lahore	Dr. Rozina Tufail, General Secretary, Green Biotechnology Management Society, Lahore	07.11.2006 to 30.04.2009	5.150	7 4 2 5 0 0 /-	1713000/-

Annexure-II**List of On-Going ALP Project as on July 1, 2009:****(Rs.)**

S. No	Name of Project	PI/Institute	Duration	Total Cost (million)	Release (30.06.2009)	Expdt. (30.06.2009)
Animal Sciences:						
1	Studies on Breeding and Seed Production of Channel Catfish (<i>Ictalurus punctuatus</i>) in Pakistan	Dr. Abdul Rab Sr. Scientific Officer, Aquaculture and Fisheries, NARC, Islamabad.	19.07.2007 to 30.06.2010	3.704	1895900/-	1766937/-
2	Pond Culture and Reproductive Performance of Seengharee <i>Aorichthys aor</i> (Hamilton 1822)	Mr. Muhammad Ramzan Ali, Sr. Scientific Officer, Aquaculture and Fisheries, NARC, Islamabad	22.08.2008 to 30.06.2011	5.628	2501500/-	2124216/-
3	Studies on the Reproductive Physiology of One-Humped Camel (<i>Camelus romedaries</i>) in the Natural Ecology of Pakistan.	Dr. Anas Sarwar Chairman/Associate Professor, Dept. of Veterinary Anatomy, University of Agriculture, Faisalabad	21.10.2005 to 20.10.2009	5.000	3100500/-	3350456/-
4	Growth Response of Broiler to Ideal Amino Acid Ratio	Dr. Muhammad Aslam Mirza, Asso. Professor, Animal Nutrition, University of Agriculture Faisalabad	11.10.2007 to 10.10.2010	1.595	434500/-	-
5	Feeding Management for Optimum Growth, Early Maturity and Fish Lactation Performance in Sahiwal Cattle	Dr. Muhammad Abdullah, Professor, Dept. of Livestock Production, University of Vet. and Animal Sciences, Lahore.	23.07.2007 to 22.07.2010	6.382	2964800/-	2916281/-
6	Synchronization of Estrus in Buffalos to Enhance Herd Fertility Using Various Protocols.	Dr. Nasim Ahmad, Professor, Department of Theriogenology, University of Vet. and Animal Sciences, Lahore	23.07.2007 to 22.07.2010	4.938	3659900/-	3601427/-
7	Phenotypic and Genetic Characterization of Indigenous Breeds of Caprine and Ovine Species in Punjab	Dr. Khalid Javed Associate Professor, University of Vet. and Animal Sciences, Lahore	28.07.2008 to 27.07.2011	5.061	2818000/-	2570549/-
8	Identification of Molecular Markers for Fecundity in Goat Reeds of Pakistan	Dr. Masroor Ellahi Babar, Professor, Uni. of Vet. and Animal Sciences, Lahore	24.07.2008 to 30.06.2011	7.080	4408000/-	4408000/-

9	Induced Breeding and Fry Rearing Techniques of Indigenous Catfish, <i>Rita rita</i> (Hamilton) in Cemented Cistern	Dr. Naeem Tariq Narejo, Professor, Dept. of Fresh Water Biology and Fisheries, University of Sindh, Jamshoro, Sindh	23.07.2007 to 22.07.2010	1.124	680000/-	680000/-
10	Production of Thermo-Stable Newcastle Disease (ND) Vaccine, for Rural Poultry	Dr. Shakeel Babar, Project Director, Center for Advanced Studies in Vaccinology and Biotechnology (CASVAB), University of Balochistan, Quetta.	11.09.2006 to 10.09.2009	3.459	1691000/-	1685467/-
Crop Sciences:						
1	Integrated Control of Root Rot of Pepper in Peshawar and Malakand Divisions.	Dr Shaukat Hussain, Asso. Prof., Dept. of Plant Pathology, NWFP Agricultural University, Peshawar.	01.01.2007 to 31.12.2009	2.622	1802000/-	1695765/-
2	Fabrication and Commercialization of a Gasifier (Operated with Crop Residues) for Sustainable Agriculture.	Dr. Manzoor Ahmad, Asso. Prof., Dept. of Farm Machinery and Power University of Agriculture, Faisalabad	01.07.2008 to 30.06.2010	2.119	829500/-	-
3	Evaluation of Sugarcane Germplasm for Frost Tolerance; A Component of the Coordinated Project "Screening of Sugarcane Germplasm and use of Induced Mutation/Callus for Frost Tolerance, high Cane and Sugar Yield" (NARC, Islamabad, Component-I)	Dr. Muhammad Zubair, PSO/Coordinator, Sugar Crops Research Program, CSI, NARC, Islamabad.	01.07.2008 to 30.06.2011	3.528	1038000/-	1045568/-
4	Screening of Sugarcane (<i>Saccharum officinarum</i> L.) Germplasm and use of Induced Mutations for Frost Tolerance, High Cane and Sugar Yield; A Component of the Coordinated Project "Screening of Sugarcane Germplasm and Use of Induced Mutation/ Callus Culture for Frost Tolerance, High Cane and sugar Yield (NIFA, Peshawar Component-II)	Mr. Roshan Zamir, Principal Scientists, Nuclear Institute for Food and Agriculture Peshawar.	01.07.2008 to 30.06.2011	2.853	1565000/-	981802/-
5	Screening of Sugarcane (<i>Saccharum officinarum</i> L.) Germplasm for Frost Tolerance, High Cane &	Mr. Sartaj Ali, Research Officer, Sugar Crops Research Institute, Mardan	01.07.2008 to 30.06.2011	2.539	711000/-	708670/-

	Sugar Yield; A Component of Coordinated Project “Screening of Germplasm and use of Induced Mutation/Callus for Frost Tolerance, High Cane and Sugar Yield. (SCRI, Mardan, Component-III).					
6	Enhance the Cane Yield, Sucrose Contents and Frost Tolerance of Genotypes using Callus Culture; A Component of the Coordinated Project “Screening of Sugarcane Germplasm and use of Induced Mutation/Callus for Frost Tolerance, High Cane and Sugar Yield” (SSRI, Jhang, Component-IV)	Dr. Shahid Afghan, Director Research, Shakarganj Sugar Research Institute, Jhang.	01.07.2008 to 30.06.2011	0.785	296000/-	296000/-
7	Use of Spectral Reflectance to Estimate Growth, Biomass and Yield of Different Wheat Cultivars under Moisture Stress Conditions	Dr. Ashfaq Ahmad, Associate Professor, Department of Agronomy, University of Agriculture, Faisalabad.	01.07.2008 to 30.06.2011	3.713	1206500/-	584183/-
8	To Determine the Optimum Maturity Indices of Various Mango Varieties (Langra, Dusehri, and Samar Bahisht) to Enhance Export and Minimize Post Harvest Losses	Mr. Abdul Rahim Khan, Assistant Research Officer, Post Harvest Research Center, Ayub Agricultural Research Institute, Faisalabad.	01.07.2008 to 30.06.2011	3.947	2005000/-	1993058/-
9	Investigations on Pesticide Residues in Fruits and Vegetables Grown under Agro Climatic Conditions of NWFP.	Dr. Barkat Ali Khan, Senior Research Officer, Agricultural Research Institute, Tarnab, Peshawar.	01.07.2008 to 30.06.2011	5.441	2450000/-	2425417/-
10	Identification and Evaluation of <i>Gossypium arboreum</i> genes for Cotton Leaf Curl Virus Resistance	Dr. Aftab Bashir, Principle Scientist, Plant Bio Technology Div., NIBGE, Faisalabad.	01.07.2007 to 30.06.2010	4.273	2720700/-	2416250/-
11	Insecticide Resistance Management of Key Pests of Vegetable.	Dr. Mushtaq Ahmad Dy. Chief Scientist, Plant Protection Div., NIAB, Faisalabad.	01.07.2007 to 30.06.2010	2.293	1422500/-	1142261/-

12	Development of High Yielding and Powdery Mildew Resistant Varieties in Peas	Mr. Nausherwan Nobel Nawab, Sc. Officer, Vegetable Res. Inst., AARI, Faisalabad.	01.07.2007 to 30.06.2010	1.474	896100/-	851552/-
13	Investigation of Viral Diseases of Sugarcane in Pakistan with Special Emphasis on Sugarcane Mosaic Virus (SCMV) Characterization and Identification of Resistant Sources.	Dr. Tahira Yasmin, Scientific Officer, CDRP, IPEP, NARC	01.07.2007 to 30.06.2010	5.436	2121000/-	2122698/-
14	Management of Date Palm Insect Pests in Sindh	Mr. Muhammad Usman Shar, Entomologist ARI, Tandojam	01.07.2007 to 30.06.2010	3.616	2324000/-	2070757/-
15	Enhancement of Quality and Storage Stability of Dhakki Dates using Advanced Technology	Dr. Shahzada Arshad Saleem, Post Harvest Technologist, ARI, D. I. Khan	01.07.2007 to 30.06.2010	4.099	3005300/-	2978168/-
16	Survey of Midges and their Natural Enemies Associated with Mango to Develop Non-Pesticides Measures for their Control in Pakistan (ARI, Tandojam, Component-III)	Dr. Abdul Sattar Buriro, Entomologist, ARI, Tandojam, Sindh.	08.06.2007 to 30.06.2010	2.632	1754000/-	1601602/-
17	Survey of Midges and their Natural Enemies Associated with Mango and to Develop Non - Pesticides Measures for their Control in Pakistan (NARC, Islamabad, Component-II)	Dr. Ghulam Jilani Senior Director, IPEP NARC, Islamabad.	08.06.2007 to 30.06.2010	2.547	1136000/-	877259/-
18	Survey of Midges and their Natural Enemies Associated with Mango and to Develop Non-Pesticides Measures for their Control in Pakistan (CABI, Rawalpindi, Component-I)	Mr. Riaz Mahmood Sr. Sc. Officer, CABI, Regional Biosciences Centre, Rawalpindi.	19.07.2007 to 30.07.2010	4.715	2497500/-	2205586/-
19	Development of Wheat Heat Tolerant Breeding Material During Grain Fill Period	Mr. Muhammad Ashraf Mian, Asst. Botanist, Barani Agri. Research Institute, Chakwal.	01.07.2007 to 30.06.2010	1.557	1191100/-	1171657/-
20	Sustainable Control Measures for Rose-Ringed Parakeet- <i>Pittacula krameri</i> on Maize, Citrus, Guava, Sunflower and Mango in Some Selected Agro-Ecosystems in Central Punjab	Dr. Hammad Ahmad Khan, Asstt. Professor, Department of Zoology and Fisheries, Uni. of Agri., Faisalabad.	01.07.2007 to 30.05.2010	1.629	805000/-	675210/-

21	Genetic Biodiversity Improvement of Nuts (Almond and Walnut) in Fata	Dr. Syed Asghar, SRO (Horticulture), Agr. Research (FATA), Parachinar, Kurram Agency	11.09.2007 to 10.08.2010	11.9	233500/-	221850/-
22	Development of Salt Tolerance in Sugarcane through Genetic Engineering	Mr. Ikram-ul-Haq, Lecturer, Institute of Biotechnology and Genetic Engineering, University of Sindh, Jamshoro	01.07.2008 to 30.06.2011	2.707	1585000/-	1375165/-
23	Establishment of a System Based on HACCP Guidelines for Drying and Storage of Exportable Chilies to Control Aflatoxin Contamination (SARC, Karachi-Component-I)	Dr. Mubarik Ahmed, PSO/Director, Grain Storage Research Institute, SARC, PARC, Karachi.	01.07.2008 to 30.06.2011	6.429	2442000/-	170789/-
24	Establishment of a System Based on HACCP Guidelines for Drying and Storage of Exportable Chilies to Control Aflatoxin Contamination (HRI, Mirpur Khas Component-II)	Syed Mukhtar Ahmad Jafferi, Horticulture Research Institute, Mirpurkhas, Sindh.	14.07.2008 to 13.07.2011	2.382	505000/-	-
25	Evaluation of Commercial Potential of Sugar beet Genotypes for their Adaptability in Different Ecologies of Pakistan (Coordinating Unit-NARC, Islamabad)	Dr. Muhammad Zubair, Pr. Scientific Officer/ Coordinator, Sugar Crop Research Program, CSI, NARC, Islamabad	01.07.2008 to 30.06.2011	0.924	129500/-	128073/-
26	Evaluation of Sugar beet Genotypes for their Adaptability under Different Soil and Environmental Conditions of Punjab (NARC, Islamabad - Component-I)	Dr. Sagheer Ahmad, Sr. Scientific Officer, Sugar Crops Research Program, CSI, NARC, Islamabad	01.07.2008 to 30.06.2011	2.426	1925500	1899709/-
27	Testing of Adaptability of Different Sugar beet Genotypes and their Agronomic Management in NWFP (Al-Moiz, D. I. Khan,-Component-II)	Mr. Karim Bakhsh Malik, Advisor R & D, Al-Moiz Industries Ltd, Chashma Road, D.I. Khan	01.07-2008 to 30.06.2011	2.962	1265000/-	934895/-
28	Introduction of Sugar beet as a Sugar Crop in Lower Sindh (NSCRI, Thatta, Sindh-Component-III)	Mr. Ghulam Mohyudin Kaloi, Sc. Officer, National Sugar Crops Research Institute, PARC, Thatta, Sindh	01.07.2008 to 30.06.2011	2.454	1044000/-	1014916/-

29	Phenotypic Plasticity of Safflower (<i>Carthamus tinctorius</i>) in response to Environment and Integrated Nutrient Management	Dr. Fayyaz-ul-Hassan Associate Professor, Dept. of Agronomy, PMAS Arid Agri., University, Rawalpindi	01.07.2008 to 30.06.2011	1.913	602000/-	599103/-
Natural Resources:						
1	Studies on IPM with Reduced Chemical Beekeeping Approach to Avoid Related Treatment Resistance of Parasitic Mites, Honeybee Diseases and Pests	Dr. Elizabeth Stephen Waghchoure, Sr. Scientific Officer, HBRP, NARC, Islamabad	07.11.2006 to 06.11. 2009	3.517	2818000/-	2747885/-
2	Determination of Soil Moisture Movement and Salinity Buildup Patterns under Different Sizes of Bid Furrow Irrigation Systems; Component-1 of Umbrella Project “Soil Salinity Monitoring under Various Resource Conservation Technologies (RCTS) Adopted in Various Agro-ecologies”	Mr. Muhammad Yasin, Director, WRRI, NARC, Islamabad	20. 07. 2007 to 30. 06. 2010	3.049	1539000/-	1376036/-
3	Studies on Rice-Wheat Cropping System in Sheikhpura and Maize-Potato in Okara District; Component-II of Umbrella Project “Soil Salinity Monitoring Under Various Resource Conservation Technologies (RCTS) Adopted in Various Agro-ecologies”	Dr. Arshad Ali, Sr. Scientific Officer, LRRP, INRES, NARC, Islamabad	20. 07. 2007 to 30. 06. 2010	4.605	3138600/-	3063956/-
4	Management and Improvement Potential of Rangelands of Balochistan with Community Participation	Dr. Sarfraz Ahmad, Sr. Scientific Officer, AZRC, Quetta	23. 07. 2007 to 30. 06. 2010	5.303	2814500/-	2828376/-
5	Evaluation of Nitrification Inhibitors for Reducing Nitrogen Loss under Irrigated Cotton-Wheat System using ¹⁵ N-Balance Technique	Dr. Tariq Mahmood, Principal Scientist, Soil Biology & Plant Nutrition Division, NIAB, Faisalabad	28. 07. 2008 to 30. 06. 2011	5.557	3265000/-	2957382/-

6	Enhancing Stone Fruits (Peach, Plum and Apricot) Orchards Productivity through Integrated Nutrients (NPK) Management; A Component of the Coordinated Project “Stone Fruits Productivity Enhancement through Appropriate Nutrient Management”	S. Mahmood Shah, Dy. Chief Scientist, Soil Science Division, NIFA, Peshawar	28. 07. 2008 to 30. 06. 2011	4.743	2358000/-	2205779/-
7	Assessment of Toxic Metals in Agriculture Products and their Relation with Nutritional Status in NWFP-Pakistan	Dr. Ihsanullah, Dy. Chief Scientist, Food Science Division, NIFA, Peshawar	28. 07. 2008 to 30. 06. 2011	2.926	1352000/-	1220800/-
8	Microbial ACC-deaminase Biotechnology for Sustainable Production of Legumes	Dr. Zahir Ahmad Zahir, Asso. Prof., Inst. of Soil & Envi. Sc., Uni. of Agri., Faisalabad	22.08.2008 to 30. 06. 2011	4.289	2020500/-	2382900/-
9	Carbon Sequestration through Tillage, Organic Matter and Mulch: Managing the Soil Quality for Sustainable Crop Production	Dr. Anwar-ul-Hassan, Prof., Inst. of Soil & Envi. Sc., Uni. of Agri., Faisalabad	22. 08. 2008 to 30. 06. 2011	4.881	2179000/-	1567362/-
10	Diagnosis and Control of Leaf Reddening in Cotton	Dr. Jawed Akhtar Memon, Agri. Chemist (Soil Fertility), ARI, Tandojam	24. 07. 2008 to 30. 06. 2011	3.643	1508000/-	729632/-
11	Micronutrient Studies on Stone Fruit Orchards in Peshawar Valley; A Component of Coordinated Project “Stone Fruit Productivity Enhancement through Appropriate Nutrient Management”	Mr. Mir Abbas Khattak, Agricultural Chemist (Soil), ARI, Tarnab, Peshawar	29. 01. 2009 to 30. 06. 2011	3.166	1115000/-	106301/-
12	Effect of Different Irrigation Intervals and Mulching Materials on the Growth, Yield and Quality of Onion under Agro Climatic Conditions of Southern Regions (NWFP)	Mr. Muhammad Suleman, Asstt. Vegetable Botanist, ARS, Karak	28. 07. 2008 to 30. 06. 2011	3.554	1199000/-	193533/-
13	Micronutrient Studies on Stone Fruit Orchards in Balochistan; A Component of the Coordinated Project “Stone Fruits Productivity	Mr. M. Nasim, Horticulturist, ARI, Sariab, Quetta	24. 07. 2008 to 30. 06. 2011	2.126	789500/-	534603/-

	Enhancement through Appropriate Nutrient Management”					
<i>Social Sciences:</i>						
1	Economic Analysis of Intercropping in Sugarcane in Sindh: Implications for Research and Extension	Dr. Ali Muhammad Khushk, Director, TTI-PARC, Tandojam	25.08.2008 to 24.08.2011	1.953	979000/-	498000/-