Agricultural Innovation Program for Pakistan (AIP)

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DISCLAIMER

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ACRONYMS

AR Farms	Adaptive Research Farms
AARI	Ayub Agriculture Research Institute
AAUR	Arid Agriculture University, Rawalpindi
AI	Artificial Insemination
AIP	Agricultural Innovation Program
AJK	Azad Jammu And Kashmir
AR Farms	Adaptive Research Farms
ARI	Agriculture Research Institute
ARS	Agronomic Research Station
AR4D	Agricultural Research for Development
ASI	Animal Science Training Institute
ASLP	Australian Sector Linkages Project
ATI	Agriculture Training Institute
AVRDC	The World Vegetable Center
AWD	Alternate Wetting And Drying
AZRI	Arid Zone Research Institute
BARDC	Baluchistan Agricultural Research and Development Center
BARI	Barani Agricultural Research Institute
BLB	Bacterial Leaf Blight
BUITEMS	Balochistan University in Information Technology, Engineering and Management Sciences
CA	Conservation Agriculture
CCRI	Cereal Crops Research Institute
CGIAR	Cumulative Group of International Agricultural Research
CGS	Competitive Grants System
CIMMYT	International Maize and Wheat Improvement Center
COs	Community Organizations
CRI	Citrus Research Institute
DAP	Diammonium Phosphate
DAR	Directorate of Agriculture Research
DG	Director General
DSR	Direct Seeding of Rice
DSS	Decision Support System
DVC	Dairy Value Chain
ETV	Enterotoxaemia Vaccine
FAO	Food And Agriculture Organization of the United Nations
FEAST	Feed Assessment
FMD	Foot and Mouth Disease
FSC&RD	Federal Seed Certification and Registration Department
FGDs	Focus Group Discussions
GB	Gilgit Baltistan
GS	Green Seeker

Ha	Hectares
HEC	Higher Education Commission
HRD	Human Resource Development
HS	Hemorrhagic Septicemia
ICARDA	International Center for Agricultural Research in the Dry Areas
ICI	Imperial Chemical Industry
ICT	Information and Communication Technology
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IPM	Integrated Pest Management
IRD	Informal Research and Development
IRRI	International Rice Research Institute
IRS	Internationally Recruited Staff
KP	Khyber Pakhtunkhwa
KSK	Kala Shah Kaku
L&DDD	Livestock & Dairy Development Department
LCC	Leaf Color Chart
LDDDB	Livestock and Dairy Development Department of Balochistan
LSOs	Local Support Organizations
M&E	Monitoring and Evaluation
MEW	Mega Environment for Wheat
MMRI	Maize And Millet Research Institute
MR	Moderately Resistant
MS	Moderately Susceptible
MSF	Mission Strategic Framework
NAC	National Advisory Committee
NARC	National Agricultural Research Centre
NARS	National Agricultural Research Scientist
NE	Nutrient Expert^{tm}
NRS	National Recruited Staff
NRSP	National Rural Support Program
NSTHRI	National Sugar and Tropical Horticulture Research Institute
NUYT	National Uniformity Yield Trial
ODK	Open Data Kit
OPV	Open Pollinated Variety
PARB	Pakistan Agricultural Research Board
PARC	Pakistan Agricultural Research Council
PARD	Pakistan Academy for Rural Development
PAU	Punjab Agriculture University, Ludhiana, India
PIASA	PARC Institute for Advanced Studies In Agriculture
PPR	Peste-Des-Petits Ruminants
PVS	Participatory Varietal Selection
QAARI	Quaid-E-Awam Agriculture Research Institute
QPM	Quality Protein Maize

RA	Research Associate
RCA	Roberts Cotton Associates Ltd.
RCBD	Randomized Complete Block Design
RRI	Rice Research Institute
SARS	Summer Agricultural Research Station
SB	Super Basmati
SD	Seed Dealers
SDS	Sodium Dodecyl Sulfate
SEP	Socio Economics Program, CIMMYT
SOP	Sulfate of Potash
SS	Sorghum Sudan
SSNM	Site Specific Nutrient Management
SSRI	Social Sciences Research Institute
TAC	Technical Advisory Committee
TEVTA	Technical Education and Vocational Training Authority
TMK	Tando Muhammad Khan Seed Corporation
UAF	University Of Agriculture, Faisalabad
UC	Union Council
UC Davis	University of California, Davis
USAID	U.S. Agency for International Development
USDA	United States Department of Agriculture
VG	Vegetable Growers
VO	Village Organizations
WRI	Wheat Research Institute
WRIS	Wheat Research Institute Sindh
ZT	Zero Tillage

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SUMMARY

In this reporting period (October 2014-March 2015) 'Agricultural Innovation Program for Pakistan' (AIP) continues to contribute to the agricultural sector of Pakistan and made significant progress to achieve targets of the 2014-15 program work plan. The activities are being implemented which focus on four cross-commodity key themes namely new varieties and seeds, new technologies (mechanization), value chain development (durum wheat, rice, vegetables, perennial horticulture and livestock), human resource development and introducing competitive grants system through the creation of provincial Agricultural Research for Development (AR4D) Boards.

The commissioned projects are progressing in consonance with the AIPs' objectives i.e. sustainable livelihood opportunities of the smallholder farmers through the involvement of agricultural extension workers, scientists, researchers and all other relevant stakeholders. The public and the private sector partnerships established under the project have contributed in the development of the agricultural sector. These partnerships have been instrumental for wheat seed dissemination to more than 9000 families; the establishment of 310 demonstrations on relay crop, zero tillage and ridge planting of wheat, enabled the farmers to improve the milk productivity through balanced diet and water access, testing of biofortified maize, demonstration of drip irrigation systems for more efficient fertigation under protected vegetables cultivation, dissemination of postharvest fruit dehydration, and evaluation of new mango cultivars.

Under the HRD component, in December 2014, a pre-departure workshop was conducted to orient the AIP scholars about student life in the U.S., cultural norms and expectations. As of March 2015, 11 out of the 14 AIP scholars have reached the U.S. to commence their studies.

In February and March 2015, AIP presented the latest advances in agricultural technology and provided a platform for local industry to explore innovative technologies, products and services at two national level expositions namely the Pakistan Agricultural Conference and Expo 2015 and the DAWN Sarsabz Pakistan Agri Expo-2015 held in Islamabad and Lahore, repectively.

The first call for invitation of applications for competitive grants was announced in Punjab which closed on March 25, 2015. A total of 157 preliminary proposals from Punjab for competitive grants were received and are being analyzed.

To contribute to the USAID gender objectives, AIP has been sensitizing its primary and national partners to reduce gender disparities and increase capabilities of women by increasing the participation of women in dissemination of the activities such as field days and training. This has been made a part of the new sub-grant agreements.

The mission strategic framework (MSF) indicators were refined in relevance with AIP interventions. Monitoring and Evaluation Plan (M&E) is revised in consultation with USAID. Reporting templates and beneficiaries tracking sheet were developed agreed to by the project management for data collection on the USAID's MSF indicators and shared with primary partners.

A collaborative effort of CIMMYT and its primary partners resulted in successfully dealing with the external factors and risks such as volatile security situations, slow administrative processes of the public sector organizations and unfavorable climate which delayed some of the AIP operational activities.

BACKGROUND

The 'Agricultural Innovation Program for Pakistan' (AIP) works to increase agricultural productivity and incomes in the agricultural sector through the promotion and dissemination of modern practices in the following sectors: cereals (wheat, maize, and rice), livestock and horticulture (fruits and vegetables). Project management is vested in a unique consortium of CGIAR Centers and the Pakistan Agricultural Research Council (PARC), led by the International Maize and Wheat Improvement Center (CIMMYT). AIP aims to foster the emergence of a dynamic, responsive and competitive system of science and innovation that is 'owned' by Pakistan and will catalyze equitable growth in agricultural production, productivity and value. AIP is rooted in the principles of AR4D, with particular emphasis on building partnerships between public research and those it serves, including farmers and the private sector; increasing investments; generating, sharing and making use of agricultural knowledge for development; and demonstrating and building awareness of the development impacts and returns from agricultural innovation.

AIP operates through three Activity Windows: commissioned projects, a competitive grants system and human resource development (HRD). Work within these activity windows addresses complex agricultural systems which is divided into four 'Science Windows' – cereals and cereal systems, livestock, vegetables and perennial horticulture. The key indicator of AIP's success will be the number of smallholder farmers who adopt or benefit from productivity or value-enhancing technologies.

CIMMYT is the primary implementing partner and prime grantee; managing and taking overall responsibility for AIP and providing direct oversight of the agronomy, wheat and maize commissioned projects within the cereals and cereal systems science window. Four international partners (the International Livestock Research Institute, or ILRI; University of California, Davis; The World Vegetable Center, or AVRDC; and the International Rice Research Institute, or IRRI) lead on commissioned projects in livestock, tree fruits, vegetables and rice, respectively, while PARC serves as both the hosting partner and the lead on a province-inclusive competitive grants system. Combined, those organizations are CIMMYT's "primary partners."

I. TECHNICAL AND WORKPLAN UPDATE

1. Cereals and Cereal Systems

1.1. Wheat

1.1.1. Increasing Wheat Production through Rapid Diffusion of new High Yielding, Rust Resistant Wheat Varieties

AIP-Wheat conducted three participatory wheat seed value chain workshops from June to September 2014 in Khyber Pakhtunkhwa (KP), Punjab and Sindh provinces. The major findings from workshops have already been reported in previous report. Following are the gaps and opportunities identified by the workshops that are strongly related to wheat seed systems.

- Limited access of new seed varieties in remote rural areas and improved agronomic practices by the smallholder farmers
- Predominance of informal seed systems and a few old and rust susceptible wheat varieties in various parts of Pakistan
- Lack of coordination and linkages between public and private sector organizations.

Gaps identified by participatory wheat seed value chain workshops were systematically addressed through the following activities during the wheat growing season of 2014 and 15.

1.1.1.1. Creating New Innovation Platform, Developing Partnership and Networks

Developing partnership and networks is vital in closing the knowledge gap between scientists and farmers and other actors of wheat value chain. One of the major achievements in AIP-Wheat is creating new platforms for innovation, developing partnership and networks between public and private sector to fast track deployment of wheat technologies. AIP-Wheat entered an important new partnership with National Rural Support Program (NRSP) [1] on November 7, 2014 for wheat varietal evaluation, popularization and deployment, as well as on-farm agronomic interventions and village-based seed production enterprises. In addition to NRSP, 28 partners were engaged for implementing the AIP-Wheat activities. These partners' includes 14 national private sector companies and 2 multinational private sector partners while 12 partners are from public sector organizations (Appendix 1, Figure 1).

[1] NRSP is a not-for-profit development organization established in 1991 that fosters a countrywide network of more than 200,000 grassroots organizations, NRSP enables rural communities to plan, implement and manage development programs for employment, poverty alleviation and improved quality of life. Through direct linkages with some 400,000 smallholder farming families, the organization will help extend the reach of the CIMMYT led Agricultural Innovation Program for Pakistan (AIP). Taking advantage of NRSP's gender-responsive approach, the partnership will work directly with and seek to empower women farmers, identifying wheat varieties and technologies that help increase their food security and incomes.

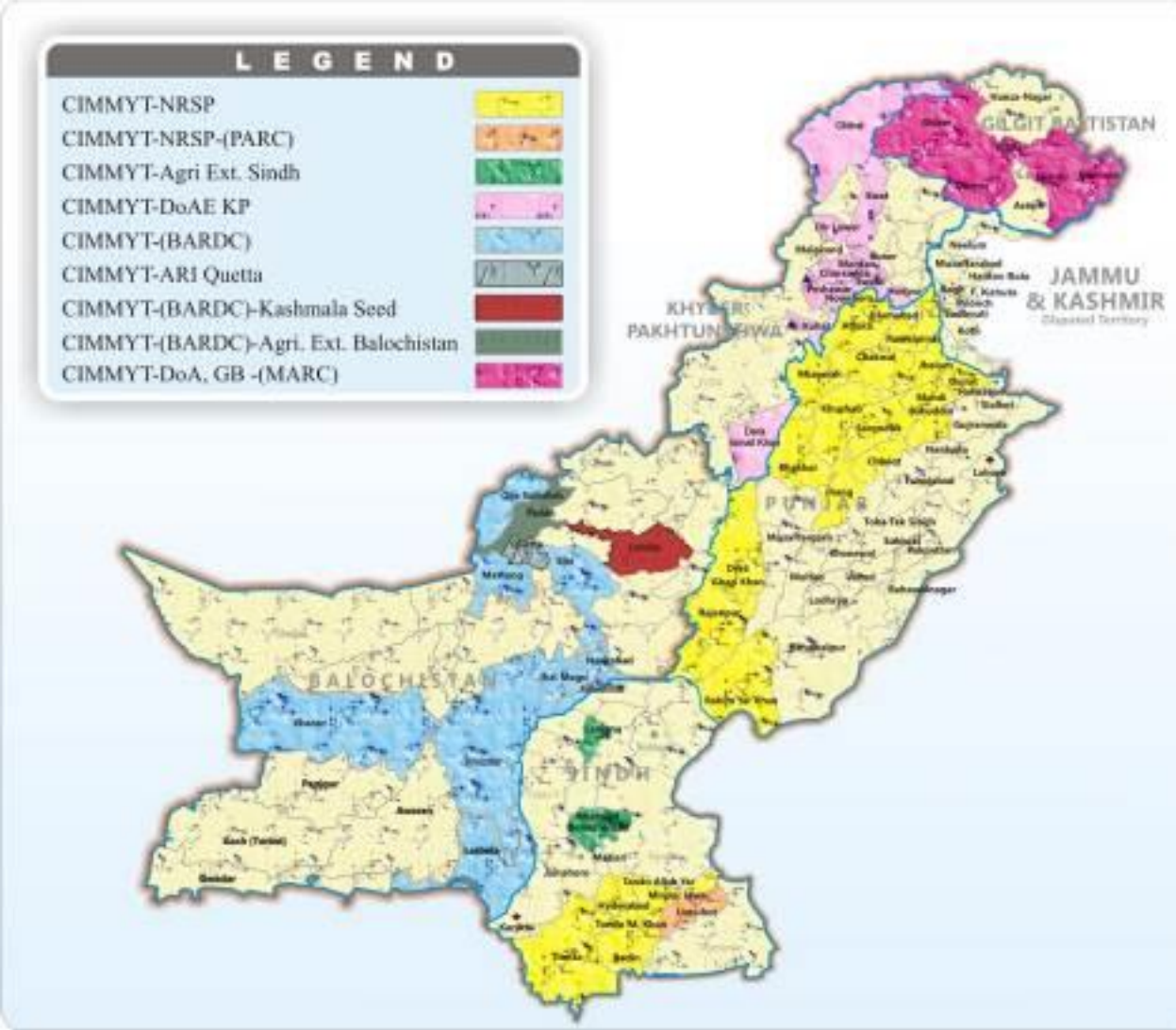


Figure 1 Public and private sector partners (legend) for wheat commissioned projects

1.1.1.2. Selection of Project Area and Collaborating Farmers

The area for the intervention of AIP-Wheat activities was selected using a combination of criteria but mainly based on acute food security analysis map that has one to five phases (Figure 2). Districts with food security phases of 2 or 3 with more area under wheat were selected for AIP-Wheat intervention. Not selecting acutely food deficit districts with phases of 4 and 5 was either due to a lack of agricultural lands suitable for growing wheat or due to security concerns.

Majority of wheat seed variety deployment and associated activities were carried out by NRSP through a systematic process for selection of sites, identification, verification, confirmation of beneficiaries and post distribution. Within any identified district, two Union Councils (UCs) were selected on the basis of food insecurity and other development factors. Preference were given to the UCs in far flung areas having less presence of private or public sector service providers, limited access of farmers to new seed varieties and improved agronomic practices. These UCs are also away from the urban market centers. Smallholder farmers with less than five acres land holding were selected following the steps outlined below:

- Orientation of rural communities about various activities of AIP wheat through Social network of NRSP-Community. Organizations (Cos), Village Organizations (VOs) and Local Support Organizations (LSOs).
- Selection of farmers through community-networks with focus on Smallholder farmers, landless farmers/tenants' women headed households and widows, vulnerable people and flood affected households in Punjab with a maximum of five acres land.
- Selection of distribution points accessable to farmers.
- Verifying the identity of farmers through a copy of CNIC and a seed distribution token issued to beneficiaries by NRSP.
- Thumb impression and photograph of farmers was ensured at the time of receiving. .
- Term and conditions are signed by each farmer.

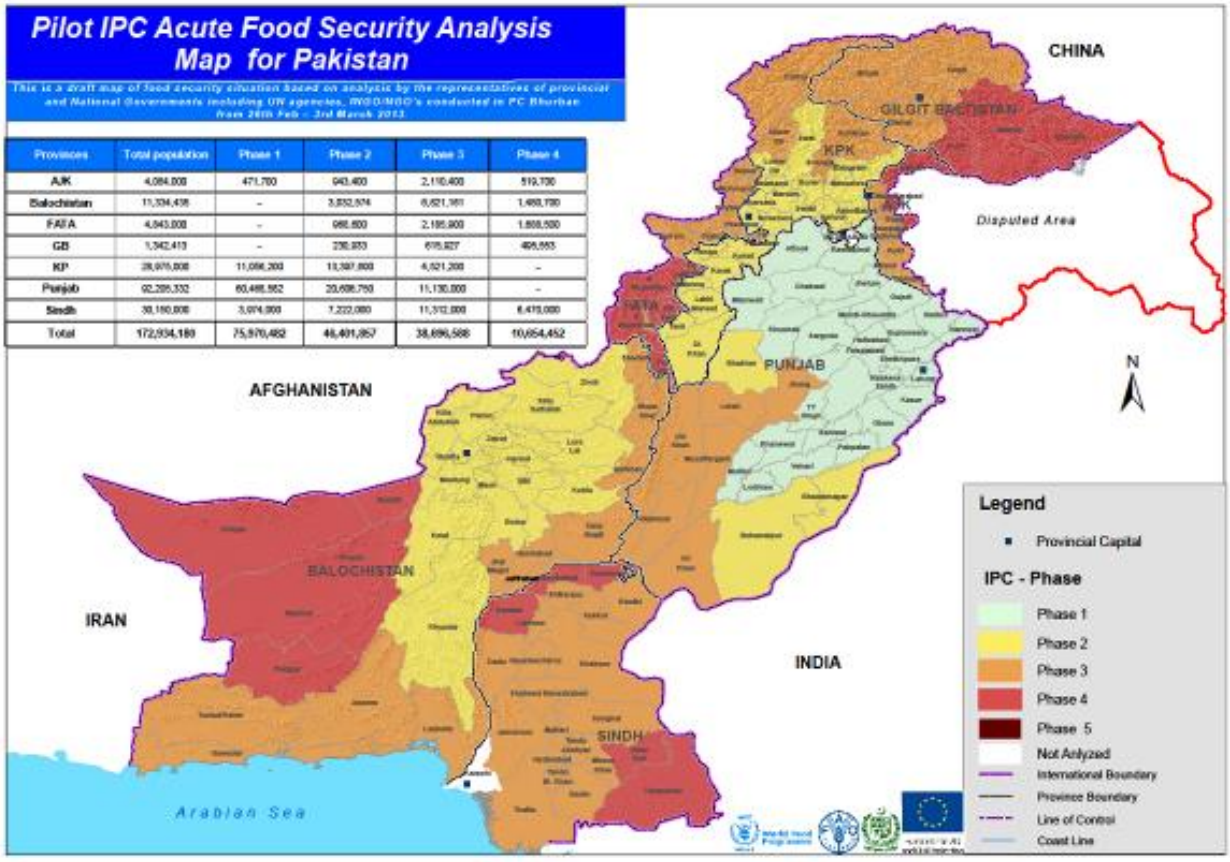


Figure 2

Figure 2 Pilot IPC acute food security analysis map for Pakistan

1.1.2. Fast Tracking Deployment of Wheat Varieties for Buffering Possible Incidence of Wheat Rust

A total of 297 ton seeds of 17 new high yielding and rust resistant wheat varieties (Appendix 2) were deployed to over 9000 farmers in 56 districts across Pakistan. Each farmer obtained a bag of 25 kg seed of one of the 17 varieties included in the project to plant next to their most widely grown wheat

variety. This simple paired plot comparison is called an Informal Research and Development (IRD; Figures 3 - 5). These would offer several benefits to farmers and to wheat production systems at large. Some of those are stated below:

- Informal varietal evaluation by farmers would identify most appropriate wheat varieties for the specific regions. This will also create knowledge and demand for new varieties in the villages.
- Increasing access of new high yielding, rust resistant wheat varieties in food deficit and rural areas of Pakistan that will help replace old and obsolete varieties by new ones.
- By a conservative estimate, 290 tons of wheat seeds deployed this season can produce more than 9,000 tons of seeds. Considering that only 50 percent of this is available for seed, it will cover more than 35,000 ha by new seed varieties in the rural remote areas that are generally grown with farm saved seeds of old and obsolete varieties that are the recipe for wheat rust epidemics.
- Informal flow of new seed varieties in the villages through a farmers-to-farmers network. Assuming that each farmer gives out seeds to 3 fellow farmers, nearly 27,000 additional farmers can have access to new seed varieties in the remote villages through informal seed flow for no extra cost.

This was big and challenging operation in making sure that quality wheat seeds are delivered to the target beneficiaries at the right time. Most of this seed was used for on farm participatory research, demonstrations, variety, agronomic trials and seed multiplication.

Figure 3 Handing over a bag of 25 kg wheat seeds to a participating farmer for experimentation, Badin, November 2014

Figure 4 Farmer carry over a bag of 25 kg wheat seeds November 2014

Figure 5 Handing over a bag of 25 kg wheat seeds to a participating farmer for experimentation, Badin, November 2014

Official data for wheat indicate experimental yield of 85 to 90 maunds per acre (8.5 to 9 t ha^{-1}), progressive farmers' yields between 60 to 65 maunds per acre (6 to 6.5 t ha^{-1}), national average yield of around 30 maunds per acre (3 t ha^{-1}), while farmers in rainfed areas are just harvesting around 15 maunds per acre (1.5 ha^{-1}). There is a huge yield gap across wheat production systems. Rapid diffusion of new high yielding and rust resistant wheat varieties was given the top priority. In addition, agronomic trials and seed multiplication were also conducted to increase the synergy and complementarity with each other. All these activities will contribute to varietal validation, agronomic practices, creating knowledge anddemand for new seed varieties (Appendix 3).These activities have been implemented in many villages across the country. A summary of wheat seed deployment is given in Figure 6. It is expected that these interventions will be sustainable and establish a basis for public-private partnership in future (Appendix 4).

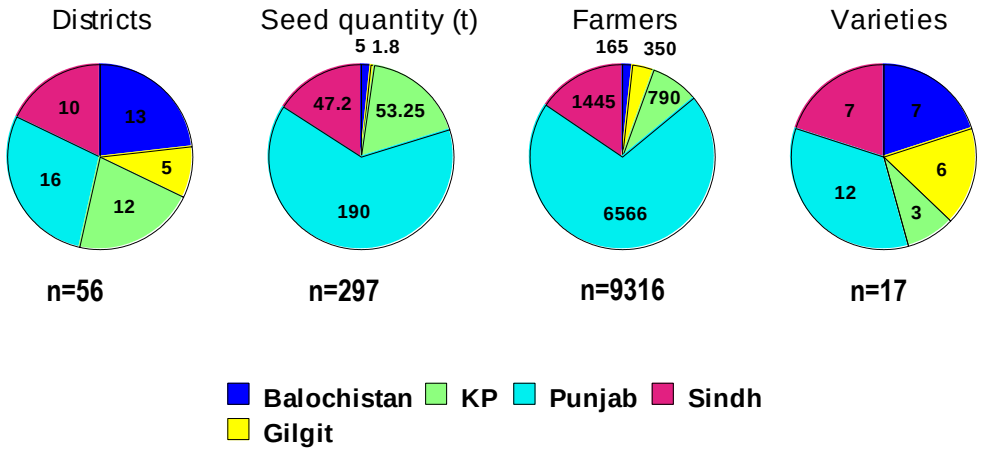


Figure 6 Summary of wheat seed delivery for various activities during 2014-15 in AIP wheat

Mother and Baby trials: A total 17 wheat varieties were included in these trials to validate and popularize all recently released wheat varieties in various parts of Pakistan. Any collaborating farmer on Mother Trial tested between 5 to 10 varieties on his or her own farm using farmers' level of inputs and management (Figures 7 to 9). This covered parts of 56 districts of Pakistan. Mother and Baby trials on wheat were conducted this season with the direct participation of 425 farmers which will help in identification of most appropriate wheat varieties in various districts of Pakistan (Appendix 2). Apart from varietal trials, several varieties by agronomic trials were also carried out in various parts of Pakistan (Appendix 2). The details will be covered under Agronomic component of this report.

Figure 7 Varietal evaluation from a mother trial at Larkana in Sindh province, March 13, 2015

Figure 8 A mother trail at famer's field at Umerkot in Sindh province, March 12, 2015

Figure 9 A farmer giving his preference to Benazir 13 variety in a baby trail

1.1.3. Strengthening Wheat Seed Systems through Seed multiplication

On farm research and demonstrations on wheat varieties and agronomy were supported by basic and certified seed production initiatives in the villages. Based on the learning from three participatory wheat seed value chain workshops conducted last year, the project put concerted efforts to develop public-private partnership for the production and marketing of basic and certified seeds. Following several rounds of discussions, 12 private seed companies (in four provinces which are one in Balochistan, two in KP, one in Punjab and nine in Sindh) have initiated the production of basic seeds and certified seeds of newly released wheat varieties (Figures 10 to 12). Based on the available data,

a summary of wheat seed multiplication during the current season is given in Appendix 5. Since, the seed crop is yet to be harvested the final quantity of quality seeds available will depend on weather conditions during harvesting and threshing operations, hence the final reliable figures can only be reported in the next reporting period.

Figure 10 Famer seed production plots at Larkana in Sindh province

Figure 11 Wheat Seed production plots of AIP near to desert at Umerkot in Sindh province, March 12, 2015.

Figure 12 Seed production plot of Amber variety at Farmer field, Umerkot in Sindh province, March 12, 2015

1.1.4. Effective Fungicides Introduced, Evaluated and Registered for Controlling Wheat Rusts

Wheat production systems in Pakistan are dominated by a few widely grown varieties namely Seher06, Faisalabad08, TD1, Punjab11, Pirsabak05 and Pirsabak08 which are increasingly becoming susceptible to rust diseases. As a preparation for protecting wheat crop in the event of sudden outbreak of rust diseases, effective fungicides against wheat rust need to be evaluated and registered in the country with assured local supply. Two seed dressing fungicides namely Hombre and Raxil and four spray fungicides namely Amistar, Folicur, Nativo and TILT are approved by US Federal law for crop protection have been evaluated at six locations during the current season. These locations include Cereal Disease Research Institute at Nowshera in KP province and Crop Crops Research Institute (CDRI) at NARC in Islamabad for stripe rust, Regional Agricultural Research Institute (RARI) and Wheat Research Institute (WRI) at Faisalabad district of Punjab province for leaf rust and CDRI at

Karachi and WRI at Sakrand in Sindh province for stem rust. These trials will provide basic data needed for registering the most effective fungicides.

In addition, five on farm demonstrations on reducing yield loss of wheat due to rust on most susceptible wheat varieties using Folicur and TILT have also been conducted combining irrigated and rainfed wheat production systems.

1.1.5. Development of Durum Wheat Value Chain

First national durum wheat workshop in Pakistan organized in September 2014 was instrumental in bringing together seven actors of possible durum wheat value chain in Pakistan (assessing durum wheat in field Figure 13-14). Workshop identified a few important action points to be included in the on-going research. The workshop also built consensus to initiate National Uniform Yield Trial (NUYT) on durum wheat by including already available varieties with best combination yield and other agronomic traits, disease resistance and acceptable grain quality traits identified during the first national workshop. The NUYT is being conducted in nine locations across Pakistan starting October-November 2014. These locations include ARI and BARDC Quetta in Balochistan province, CCRI and NIFA in KP province, NARC in Islamabad, BARI, WRI Faisalabad and RARI Bahawalpur in Punjab province and WRI Sakrand in Sindh province.

Figure 13 Wheat Breeders taking observations in National Durum Wheat Yield Trial at Barani Agricultural Research Institute, Chakwal, April 27, 2015

Figure 14 National Durum Wheat Yield Trial at NARC Islamabad

The project will generate data on yield, agronomic performance and diseases for new durum wheat varieties through NUYT as well as make use of existing agronomic and yield data from previous trials to fulfill the release requirements.

In addition to NUYT, partner research institutes have started multiplying seeds of all the varieties during the current year.

Jointly with Socioeconomics Program (SEP), AIP-Wheat is giving continuity to dialogue with business communities for exploring the possibilities of installing durum wheat milling units to help complete durum wheat value chain in the country.

AIP Socioeconomic and wheat program, with business communities, are exploring possibilities of installing durum wheat milling units to strengthen the value chain in Pakistan.

1.1.6. Capacity Building

This is one of the major themes of AIP. Major approach adopted was experimentation and demonstration. To provide hands-on skills to farmers, issue focused trainings, use of interaction fora and meetings in the villages were organized while more structured and formal trainings were targeted to train the staff members. Following trainings were held in the reporting period.

1.1.6.1. Training on On-Farm Research Methodology

In the year 2014, two sets of training targeting on-farm research methodology were conducted to impart hands-on skills to the staff of NRSP on November 10 and December 12. These trainings covered the methodologies for participatory varietal selection (PVS), varietal deployment through an approach IRD local level seed production and marketing. Similarly topics related to variety and agronomic research methods such as seed priming, fertilizer trials and ridge planting were covered (the details provided by AIP-Agronomy). Available data indicates that a total of 2988 individuals including farmers and NRSP staff members were trained as of March 2015 (Figure 15, Appendix 2).

1.1.6.2. New Technologies and Training Farmers on Various Aspects of Wheat Improvement

AIP-Wheat in collaboration with NRSP organized training and discussion fora on practices to improve the overall wheat productivity and returns to wheat crop through crop management, crop protection, maintaining wheat seed quality. These sessions were followed by demonstration of technology and exposure visits to the field. A total of 1,884 farmers including men and women from Punjab province and Sindh province were trained (Figure 15).

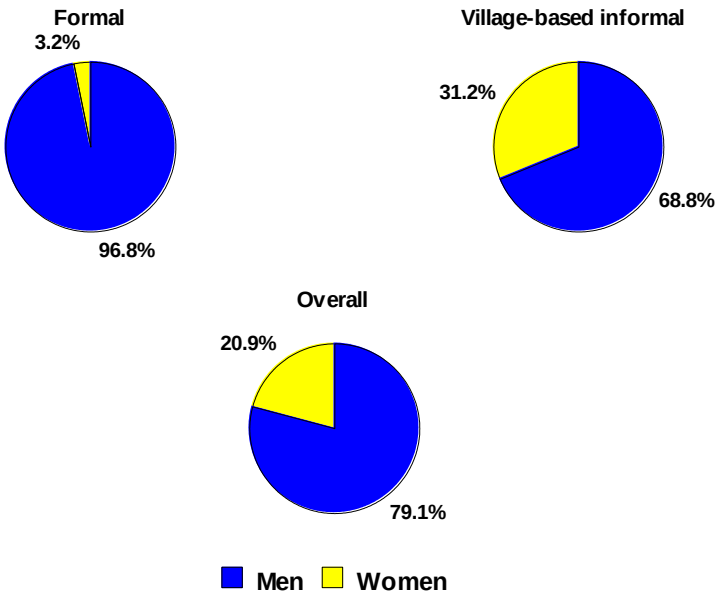


Figure 15 Participation of men and women (n=2988; 2365 male and 623 women) farmers and staff members in various formal and informal training, awareness creation meetings, and interactions, organized by Community Organizations (Cos), Village Organizations

1.1.6.3. Training seed growers on wheat seed quality management

A total of 11 trainings were organized for 300 farmers growing wheat for seed production across four provinces of Pakistan which includes one in Balochistan, four in KP, five in Punjab and two in Sindh (Figures 16-18). An innovative and cross-cutting curriculum was used for wheat seed quality management training. Resource persons for these trainings were drawn from CIMMYT and Federal and Provincial Wheat Breeding Institutes and Federal Seed Certification and Registration Department (FSC&RD). These interactive trainings linked the wheat seed value chain stakeholders including farmers, wheat breeders and seed Inspectors from FSC&RD. This also supported AIP-Wheat to build functional relationships between the value chain actors to help strengthen seed systems in the remote areas and promote the use of quality wheat seeds of new varieties by smallholder farmers in the rural remote areas.

A very important aspect of these trainings was wheat seed production awareness which will help the farming community to develop seed business in the rural remote areas where access to new seed varieties is very limited.

As a follow up of these trainings, AIP-Wheat has planned field inspections in collaboration with its national partners to check for any off types and other field standards.

Figure 16 Group photo of the participants of one day training on wheat seed quality management training held by CIMMYT in collaboration with NRSP at Hyderabad in Sindh province, March 09, 2015.

Figure 17 Group photo of the participants of one day Wheat Seed Quality Management Training held

Figure 18 A glimpse of one day wheat seed quality management training at ARI, Quetta, March 17, 2015

1.1.6.4. Training Private Sector Companies on Producing High Quality Wheat Seed through Public Private Partnership

Access to basic seeds of new wheat varieties has been identified as one of the major bottlenecks in fast racking newly released wheat varieties. The first amendment bill to Seed Act of 1976 allows private seed companies to produce and market basic seeds of all the recommended varieties. However, only a limited private seed companies have been getting pre-basic or basic seeds from wheat research institutes through personal contacts which needs to be institutionalized through proposed amendments in 1976 Seed act.

Trainings organized for private seed companies focused on producing quality basic seeds by engaging concerned wheat breeders, personnel from FSC&RD and CIMMYT Scientists. These events were instrumental not only for training purposes but also for developing closer relationship between wheat breeding institutes, private seed companies & FSC&RS. Basic seed plots both at government and private seed farms will be jointly inspected by the representatives from FSC&RD, wheat breeding institutes and farmers at least once before harvesting the seed crop.

Apart from these trainings, meetings, and other interactions on the use of mobile phones was done to pass on the important messages on wheat crop production and seed quality management (Appendix 5a).

1.2. Maize

1.2.1. Introduction of Climate Resilient Maize:

CIMMYT's maize breeding program developed germplasms with improved tolerance to water and heat stress. Several varieties are available that can withstand high temperatures that is more than 45^0C. The AIP-Maize is introducing such materials to Pakistan where maize growing farmers faces problem of acute water shortage and terminal heat in the peak months of May-July. The availability of such climate smart varieties both hybrids and OPVs will enhance maize productivity and reduce household poverty.

These introduced materials were evaluated across the different ecologies and seasons in Pakistan (Figure 19) with the objective to identify suitable areas for future production and to classify candidate varieties according to growing seasons and ecologies. During this reporting period the evaluation and data compilation of the following climate resilient variety/hybrid trials were completed:

- Evaluation of 332 white maize climate resilient hybrids sourced from CIMMYT's Latin America and Southern Africa regional offices (Mexico and Zimbabwe).
- Evaluation of 30 white maize climate resilient open pollinated varieties (OPVs) sourced from CIMMYT's Southern Africa regional office (Zimbabwe).
- Evaluation of 28 yellow maize climate resilient hybrids sourced from CIMMYT's Latin America regional offices (Mexico and Colombia).
- Seed micro increase of 137 elite parental inbreds introduced from CIMMYT regional offices (Mexico, Colombia and Zimbabwe).

During the reporting period all the trials that were planted during 2014 (both in spring and winter) were harvested and performance data collected and analyzed. The analysis results from the full set of trials have been shared to partners to help select best performing entries (Analyzed data of the top performing entries from selected trials Appendix 6).

The trials, planted during spring and winter of 2014, were harvested during reporting period. The project collected and analyzed productivity (yield) data, and shared the results from the full set of trials with partners to select best yielding/performing entries (Appendix 6).

Figure 19 AIP-Maize varieties evaluation sites in Pakistan

Figure 20 AIP-Maize varieties evaluation at NARC in Islamabad

Figure 21 AIP-Maize varieties evaluation at UAF, Faisalabad

The maize hybrids and open pollinated varieties introduced under the AIP-Maize showed a good selection potential for future wider cultivation in the country (Appendix 6-8). The evaluation of the diverse germpalsm under different environments helped to identify ideal growing regions and seasons. The introduced materials also proved their resilience to the extreme environments of maize growing areas in Pakistan where it can be seen from the competitive grain yield. In most of the trials the AIP-maize materials out yielded the best adapted local check in a range of 2.0 to 2.5 t ha^{-1}. In general most of the AIP-Maize trials showed an average of 8 tha^{-1} which is 100 percent yield advantage as compared to the national average yield of maize which is 4.3 t ha^{-1}.

Based on the performance of the introduced materials, AIP-Maize partners have selected best performing entries for further testing and registration process. Three hybrids which are shortlisted based on performance and adaptability are included under the national uniformity yield trials in 2015 spring season. Another 15 to 20 maize varieties will be included in the upcoming Kharif season NUYT. The data from spring and winter season NUYT will help to identify best growing regions and future areas for seed production.

The seed micro increase of the parental lines is another important activity of the AIP-Maize which will help to check the seed productivity potential of the parental lines and will ensure the availability of adequate parental seed for subsequent seed production. The seed of four parental lines including two hybrid maize varieties is being multiplied at micro level at NARC in Islamabad. In addition, 137 inbred lines are also planted at this spring season to get enough quantity of seed for hybrid production and widen genetic pool of national programs. A schematic diagram to show the program pathway of AIP-Maize is presented under Appendix 10.

Figure 22 Rural women farmers harvesting the AIP-Maize trail at JPL farm, Arifwala in Punjab province

Figure 23 AIP maize spring planting activities at different partners' sites, Feb/March, 2015

1.2.2. Development or Introduction of Bio fortified Maize:

Attaining food and nutritional security is one of the main targets of AIP in general and that of the maize component in particular. CIMMYT germplasms that have proven quality of protein and enriched with pro vitamin-A which is beta-carotene are being evaluated in Pakistan for use as food and feed. During the reporting period the evaluation of the following trials was completed:

Based on the field performance data, five Pro vitamin-A hybrids were selected which includes two quality protein yellow maize varieties under the NUYT evaluation. This evaluation process will help to identify best bio fortified maize varieties for wider cultivation in Pakistan. Upon release, AIP-Maize will be the first program in Pakistan to avail bio fortified maize varieties in Pakistan. The comparison of grain yield performance of some of the bio fortified maize hybrids and normal check entries was done (Appendix 9). The bio fortified varieties are higher in grain yield as compared to the normal maize counterparts. This result is very encouraging and many farmers prefer grain yield over food quality. High grain yield and enhanced nutrition of the maize varieties will help to fast track the deployment of bio fortfied maize varieties in Pakistan. By the end of the project AIP-Maize is targeting health benefits for at least 5,000 families in areas where these bio fortified maize varieties will be grown.

Figure 24 Field evaluation of Vitamin A enriched maize at NARC, Nov, 2014

1.2.3. Introducing/Developing Maize Resistant to Biotic Stress

Pests and diseases cause major loss on maize productivity. In some cases maize stalk borer only can cause a 40 percent yield loss and such loss will not only reduce total maize production and quality but also affects the livelihood of small holder farmers.

Apart from identifying stem borer screening site, AIP-maize is also in the process of introducing 13 stem borer tolerant maize varieties developed by conventional method by the International Institute of Tropical Agriculture (IITA), located in Nigeria. The varieties will be evaluated in three locations in the coming Kharif crop season. Based on performance results, partners will identify best entries to further check adaptation and registration for wider cultivation. Best varieties from these entries will help farmers to save their produce from pest attack and reduce production cost by avoiding chemical spray. Avoidance or reduction of chemical spray to control maize stem borer will have positive environmental impact. A customized training on mass rearing of maize stem borer and related techniques is planned in the upcoming quarter where maize entomologists will have chance to gain knowledge from subject matter specialists.

1.2.4. Enhancing the Maize Seed Sector

Access and availability of quality seed is the most important factor to enhance agricultural productivity. In this regard, the Pakistan maize seed industry is not robust enough to mitigate the high demand of maize seeds. More than 85 percent of the hybrid seed is imported costing approximately 50 million USD annually which makes the price simply $8/kg that is unaffordable for smallholder farmers. As a result farmers are forced either to recycle seed or to use substandard seeds available in the market and resolving the maize seed issue related to price and quality through the participation of public and private institutions will help to unlock the potential of maize productivity in Pakistan. The project aims to achieve this through provision of inred lines (parents) of approved hybrid to public and private sector partners.

During this reporting period, one private seed company namely Zamindara Seeds Pvt. joined the AIP-Maize network and is currently evaluating the trials of introduced materials. (See Appendix 15 for updated list of AIP-Maize partners).

1.2.5. National Maize Workshop of Pakistan

AIP-Maize in partnership with Pakistan Agricultural Research Council (PARC) organized the first national maize workshop of Pakistan under the AIP project on November 19 and 20, 2014 in Islamabad. The workshop aimed to review annual progress and discuss future activities with stakeholders. The event created an opportunity to develop shared objectives and priorities that could help boost Pakistan's maize production and productivity. The workshop was an excellent opportunity for experience sharing and enhances synergies among public and private partners working on maize research and development at various levels in Pakistan. A total of 45 participants who are involved in the maize seed value chain at various levels in Pakistan have participated in the workshop.

The workshop was followed by a field visit at NARC experiment station, where participants got opportunity to visit the performance of various maize hybrids and varieties introduced under AIP. The field visit helped partners to compare and contrast the performance of the maize varieties at NARC against those planted in other sites. In addition, subject matter specialists on maize shared their expertise during the workshop. The list of number of participant and their institutions is listed under Appendix 16.

Figure 25 Participants of national maize workshop of Pakistan

Figure 26 Award giving ceremony for best performing partners

1.3. Rice

1.3.1. Breeding Program for Improved Indica and Basmati Rice

1.3.1.1. New Generation of High-Yielding, Stress-Tolerant, High-Quality Indicia and Basmati Varieties and Hybrids

For the last few years, heavy floods caused substantial yield losses to rice crop in different rice ecologies of Pakistan. Under this sub-activity, AIP-Rice planned to evaluate submergence tolerance advanced lines for agronomic and quality traits in replicated yield trials at IRRI headquarter. During this reporting period, the following were accomplished.

IR6-Sub1 lines developed using a combination of phenotyping and marker-assisted selection for submergence were evaluated in backcross observational yield trial (OYT) to compare putative IR6-Sub1 lines with the recipient and donor parents. A total of 80 entries were included out of which 30 IR6-Sub1 lines were selected for further testing based on submergence field screening and agronomic data including yield, flowering time and plant height comparing to IR6 recipient parent. During the early 2015 dry season, field submergence screening was repeated using three replications. DNA marker genotyping for Sub1 was also conducted to confirm the genotype of the Sub1 locus. A total of 21 lines had strong submergence tolerance scored at four, seven and 15 days after de-submergence (Appendix 18). The lines IR105469:43-51-16 and IR105469:72-22-1 possessed the strongest submergence tolerance comparable to the most tolerant checks Swarna-Sub1, IRRI 119 and IR64-Sub1. Of the 21 plants, 15 were homozygous for Sub1 and Sub2 were heterozygous. The remaining four plants did not possess the Sub1 allele but appeared to have field tolerance. These phenotyping and genotyping results will be confirmed next season.

Selections of elite IRRI material were made during 2014 and early 2015, which are under process to dispatch for Pakistan. A total of 73 elite lines were selected from the irrigated OYT possessing high yield potential and disease insect resistance.

Of the 25 BLB resistant advanced lines of Super Basmati x IRBB57, developed at IRRI, three best lines – BR1*(Xa4, Xa21)*, BR18 *(Xa4, Xa21)* and BR23 *(Xa5)* were selected by NIBGE, Faisalabad for higher yield, resistance to 90 percent of the local BLB virulent and grain quality in comparison with parent which is Super Basmati. A set of field trial was conducted at Muridke Sheikhupura by Engro Eximp for field evaluation against BLB. The results revealed that over all BLB resistant line, BR1 performed well in the field and produced significantly higher yield than other lines including parent variety Super Basmati. The yield gain is attributed to higher number of filled grain, less sterility due to comparatively more resistant to BLB.

Figure 27 Crop stand of BR1 and Super Basmati under farmer's field condition at Muridke in Sheikhupura district of Punjab

- Five locally developed rice hybrids namely MH114, MH115, MH116, MH 117 and MH118 were evaluated for heat tolerance in comparison with the established rice variety IR-6 at Rice Research Institute (RRI) Dokri in Sindh province. The yield data revealed that all the hybrids produced yielder than IR-6. However, rice hybrid MHK-145 produced 39.4 percent higher yield than IR-6.

1.3.1.2. Up-scaling of High-Yielding Basmati 515 Variety in Punjab and NIAB IR-9 in Balochistan province

- Under this activity, 600 kg of certified seed of Basmati 515 was distributed among 30 farmers during the planting season for planting on 120 acres in Sheikhupura, Gujranwala, Hafizabad and Sialkot districts of Punjab province. Along with seed, farmers were provided with information about maintaining optimum plant population management (OPPM). These farmers established one acre demonstration on OPPM by random transplanting to compare with their own practices. The yield advantage data varied among the farmers. On an average, seven percent higher paddy yield was obtained by 30 farmers using Basmati 515 with maintaining OPPM as compared to their conventional practices. Maximum 13 percent higher yield was achieved.

- During rice season 2014, farmers were given 100 kg of NIAB IR-9 with the collaboration of Directorate of Agriculture Research, Jafarabad district of Balochistan province. Two acres were also planted at the Seed Farm in Usta Muhammad using direct seeding (Appendix 21). The data revealed that there was no yield advantage of NIAB IR-9 over IR-6. However, farmers gained higher price of Rs.100/ in case NIAB IR-9. A total of 3,040 kg and 6,840 kg seed was produced by Seed Farm and farmers, respectively, for distribution among the other farmers in Usta Muhammad during rice season 2015.

1.3.2. Improved Crop Management

1.3.2.1. Extension of Direct Seeding and AWD Technology in Different Rice Ecosystems

1.3.2.1.1. Demonstration of Dry Seeding of Rice (DSR)

Dry Seeding of Rice (DSR) technology was demonstrated on 243 acres of 59 farmers in different rice ecologies during rice season 2014 with the support of public sector namely NARC, RRI, Kala Shah Kaku, Agricultural Extension Department in Punjab province, RRI, Dokri, ARI, Tandojam in Sindh, Agricultural Research, Jafarabad in Balochista and private sector companies from Punjab Engro Eximp, Sheikhupura district and Emkay Seeds, Farooqabad district. In Punjab, mainly Basmati 515 was used for DSR followed by Super Basmati and PK-386. In Sindh province, IR-6 and rice hybrid Guard 53 was sown. NIAB IR-9 was planted in Balochistan province. The crop was harvested in November 2014.

The yield difference in case of DSR varied from farmers to farmers using different DRS sowing methods. Some had complained that paddy yield was higher with broadcasting than drill. However, over all yield increments of DSR plots with new machine were 12 to 20 percent higher vs. conventional plots sown through transplanting. Achieved average benefit of Rs. 3000 to 6000 per acre, in addition of water saving of Rs. 3500 to 5000 per care and cost saving of Rs. 4000 on land preparation, puddulling, transplanting. Benefits of time saving and environment friendliness are in addition. The yield advantage was attributed to more number of plants per square meter which is 80 to 115 in DSR vs. 16-22 plants per square meter in transplanted plots. In another set of DSR demonstration on 15 acres in Gujranwala area, 10-12 percent yield increase was obtained over conventional planting and on an average Rs. 15,000 to 20,000 per ha monitory benefit was gained with DSR.

In Thatta area, on an average 6.6 t/ha paddy yield of IR-6 was obtained with DSR as compared to 5.4 t/ha with conventional planting achieving an extra Rs. 25000/ha (Appendix 22)

1.3.2.1.2. Direct seeding and land leveling

Field trials were implemented at Muridke comparing different planting techniques, rates and land leveling. Three different seeding rates using the new seed drill were compared with transplanting on both leveled and non-leveled fields. The results revealed that land leveling increased the average yield by 23 percent which is 790 kg per ha (Figure 28). These results demonstrate the importance of land leveling and also suggest that planting rates 30 to 40 kg per ha of good quality seed is sufficient to maximize yield potential.

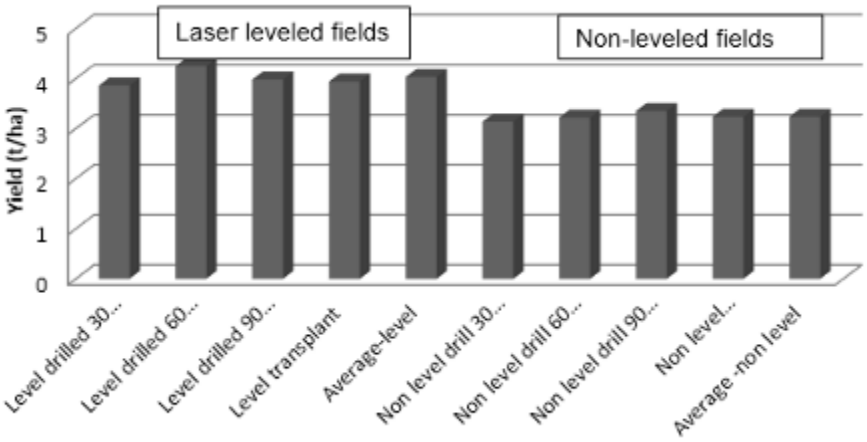


Figure 28 Effect of Leveling and Seeding Technique

1.3.2.2. Demonstration of Alternate Wetting and Drying (AWD)

To popularize alternate wetting and drying (AWD)'s water-saving technology, perforated water measuring tubes were demonstrated on more than 50 locations which includes Basmati 515 growers in the Sheikhupura, Hafizabad, Gujranwala and Sialkot districts of Punjab during rice season 2014. The results showed that there was a substantial reduction in water use with AWD as compared to farmer's conventional practice. Water saving varies between locations and a maximum 36 percent water saving was measured with AWD. However, on average, 19 percent water reduction was recorded in AWD plots. Farmers saved Rs.3000 to 4000 per acre by reducing the cost of fuel and electricity. In AWD plots, the crop did not lodge and incremental paddy yield from 100 to 150 kg per acre was obtained. The results revealed that on an average farmers earned an extra Rs 25,000 per ha with DSR and AWD in four districts of Punjab namely Gujranwala, Hafizabad, Sheikhupura and Sialkot (Appendix 23).

1.3.3. Improved Post-Harvest and Quality Control

1.3.3.1. Evaluation of hermetic storage bags

IRRI with the support of post-harvest experts and in collaboration with GrainPro Inc. developed a special super bag called hermetic storage bag for small-scale rice farmers to protect the viability and quality of rice stored at their homes. The hermetic storage bag reduces post-harvest losses and helps preserve the freshness and quality of commodities. It reduces the flow of both oxygen and water between the stored grain or seed and the outside atmosphere. When properly sealed, respiration of grain and insects inside these bags reduce

oxygen levels from 21 percent to five percent. This reduction reduces live insects to less than one insect per kg of grain without using insecticides - often within 10 days of sealing.

An experiment for the evaluation of hermetic bags was established in December 2014 at NARC Islamabad, Rice Research Institute (RRI) Kala Shah Kaku and Engro Eximp, Sheikhupura districts of Punjab province. The details are:

Grain moisture: Ranged from 13-14 percent.

Storage system: Three different storage bags (Jute, Polythene, hermetic)

Storage regimes: Four different storage regimes:

- Paddy for stored for six months
- Brown rice stored for six months
- Paddy stored for two months and brown rice for four months
- Paddy stored for four months and brown rice for two months

Tests: Aroma, aflatoxin contamination, pests and grain quality both physical and chemical

Figure 29 Evaluation of IRRI Super bags

Five different rice varieties are being used at Engro Exipm site at Sheikhupura district of Punjab province (Appendix 24 for Sample details).

Initial Parameters of Samples

The experiment is still in progress (see Appendix 25 for Initial observations of samples)

1.3.3.2. Establish the Level of Losses and Contamination in Post-Harvest Processes

The paddy being harvested in 2014 contained many green and immature grains which indicate that the crop is not technically ready for harvest. On the tested samples, grain moisture was more than 25 percent and green and immature grain more than 15 percent. When tested in the mill, this resulted in head rice recovery of brown rice being less that 50 percent. In many cases this can be reduced significantly if the crop was allowed to mature for at least one more week. Farmers are paid on fresh crop weight rather than a standard 14 percent.

Paddy also contains very high percentage of skinned and broken grains (more than five percent) which suggest that the combine harvesters are operating with very high drum speeds. There is also a lot of second cut material which may be caused when harvesting lodged crops and may also suggest that the reel speeds are not being correctly matched to ground speeds of the harvesters.

1.3.3.3. Evaluation of Combine Harvesters

There were many complaints from millers and farmers that the combine harvesters cause excessive grain damage and harvest losses. It was also being claimed that harvesting losses and grain quality were much better with the Kubota rice combine harvesters than the converted New Holland wheat combines. Keeping in view, AIP–Rice evaluated the wheat combine "New Holland" along with rice combine "Kubota" for various parameters in basmati growing areas of Sheikhupura district of Punjab province during November 2014 (Appendix 26). A protocol was established to measure the performance of combine harvesters in the rice field. To measure the grain loss, flat pads (25 cm x 20 cm) were placed in line with the combine front to catch the spilt grain and counted the number of filled grains on each pad. On the center pads, one grain is approximately grain loss is equivalent to 2.5kg/ha. The drum and reel speed was also measured. It was observed that the drum speed of wheat combine was 600 rmp with the reel speed 50 percent faster as compared to ground speed which was higher than 10 percent as recommended. Due to the reason, higher percentage of grain shattering, de-husking and breakage of grains occur in case of using wheat combines. As the crop harvested by the New Holland was lodged, the comb front was often touching the soil surface and in some cases collected soil on the comb platform. It is estimated that by adopting new improved harvesting machines about Rs. 4 to 6 billion could be saved annually from losses in quality paddy.

Protocols for monitoring the performance of combine harvesters were developed for both Engro but as yet performance data is not available.

Figure 30 Rice Harvester (Kubota)

Figure 31 Wheat Combine (New Holland)

Figure 32 Shatterd grains

Figure 33 Quality of paddy with wheat combine

Figure 34 Quality of paddy with Kubota combine

1.3.3.4. Assessment of Metals Contamination in Rice Soils

Natural and anthropogenic pollutants threaten the quality of life by entering the food chain due to uptake and accumulation by crops. Arsenic (As) is a chemical matter present in the environment from natural and anthropogenic sources and received worldwide attention due to their toxicity.

Further, release of soluble As species into groundwater is a serious problem in many areas of the world. Pakistan Council for Research in Water Resources reported that a large percentage of analyzed water samples collected from rice areas had excess Arsenic more than permissible limits. Rice accumulates the highest amount of As of all grain crops, largely because of the high bio-availability under reduced soil conditions. It is considered that the As concentration in rice grown in As contaminated soils using contaminated irrigation water is much above the WHO recommended permissible level of 1.0 mg kg^{-1}. Arsenic contamination thus represents a severe health risk and strategies should be adopted to reduce its accumulation in rice.

A study was planned in collaboration with Land Resources Research Institute at NARC to assess As concentration in rice soils, irrigation water and paddy in Sheikhupura district of Punjab province. A total of 84 site samples of soil and paddy were collected for determination of heavy metal including arsenic concentrations. Prepared and digested water, soil and paddy straw and paddy samples for Cd, Cr, Pb, Ni Cu and As concentrations. The work is still in progress and results will be available during next quarter.

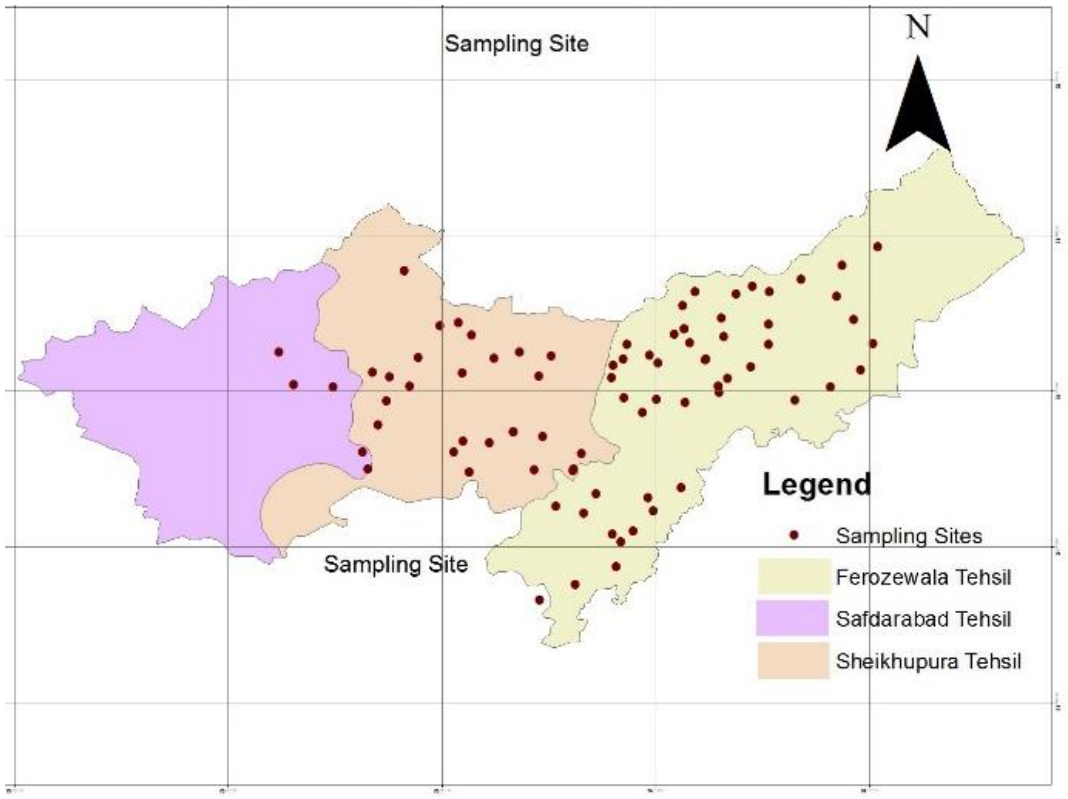


Figure 35 Sample sites in Sheikhupura district.

1.3.4. Capacity Building for Rice Researchers and Extension Officers

1.3.4.1. Training on Harvest and Post-Harvest Paddy Handling

On November 12 and 13, 2014, AIP-Rice in collaboration with Engro Eximp has organized two days training on "Harvest and Post-Harvest Paddy Handling" at four locations in rice growing areas in Punjab namely Gujranwala, Sheikhupura, Hafizabad and Sialkot districts. A total of 225 farmers and machine operators benefitted from this training which covered these topics: importance of quality paddy, time of harvesting, selection of good harvester, handling of paddy during transportation, maintenance of combine and replacement of kit and machine operation.

Figure 36 Glimpse of the training

- Based on the 2014 field experience, AIP-Rice is continuing to work with RPL and Engro field technicians to further develop the Rice Crop Check systems for 2015. Rice Crop Check was refined based on 2014 crop experience.

1.3.4.2. Impacts of Training on Farmer's Yield and Paddy Quality

It has been evaluated that around 20 to 24 percent of grain has lost during harvesting of rice paddy. The bifurcation of this loss is 12 to 14 percent grain loss and remaining percentage is breakage of grain within the machine (Appendix 28).

AIP-Rice has trained harvesting resource; machine owners, drivers, mechanics and helpers on optimum operation of machine for not only improving yield but also controlling fuel consumption and reducing break and planned maintenance. Also raised awareness among farmers on how to select a qualitymachine for getting quality grain through properly maintained harvesters and engage experienced operators.

AIP-Rice has studied that 50 percentage of grain loss and breakage can be avoided via existing harvesters with trained operators and properly maintained machines.

Saving of farmer per acre with improved machines:

Average rice paddy per acre: 40 x 40 = 1,600 Kg
Current grain loss (20 percent): 1,600 x 20 percent = 320 kg
Grain loss with improved machines: 1600 x 10 percent = 160 Kg
Price of Rice Paddy per 40 Kg: Rs. 1,500 (Average of 2014 Crop)
Rice Paddy saved by improved machines: 160 Kg
Cost Saving via improved machines: (160/40) * 1500 = Rs. 6,000
Saving of machine owners:
Fuel Consumption per acre harvesting: 5.5 liter (Average of season)
Cost of fuel per liter: Rs. 80

Fuel cost per Acer: Rs. 440
Fuel saving by trained drivers: 1.5 Liters per acer
Cost saving per acre: Rs. 120
Breakdown maintenance: reduced by 70 percent
Planned maintenance: Time increased by 40 percent
Machine utility: increased by 30 percent
Machine availability: increased by 20 percent
Challenges:

- Farmers pay same fair for quality machine against inferior ones
- Quality machines are not available at the time of harvesting, as crops are mature approximately same time.
- No driving license required for operating these machines
- Original spare parts are not available
- No training school available for the coaching of these machines like other technical institutes. A suggestion is Technical Education & Vocational Training Authority (TEVTA) should start this type of training like solar technology.
- No Literature, like knowledge about crops, is present for the understanding of farmers and harvesting resources.

1.4. Agronomy

1.1.7. Dissemination of Conservation Agriculture Technologies

AIP-Agronomy has developed partnership for dissemination and demonstration of technologies with 12 national partners namely Wheat Research Institute (WRI) Sakrand in Sindh province, Barani Agriculture research Institute (BARI) Chakwal, WRI Faisalabad, AR Farms, Agronomic Research Station (ARS) Bahawalpur and Arid Zone Research Institute (AZRI) Bhakkar in Punjab , Agriculture Research Institute (ARI) D.I. Khan and Cereal Crops Research Institute (CCRI) Pirsabak in KP, Directorate of Agriculture Research (DAR) Jafarabad in Balochistan and Engro Eximp and National Rural Support Programme (NRSP). During this reporting period, National partners were instrumental in the establishment of 310 demonstrations that includes nine on relay crop of wheat, 55 on zero tillage (ZT) wheat, 73 on ridge planting of wheat, 122 on seed priming of wheat and 51 on nutrient management. In addition, a total of 200 stakeholders which includes NRSP staff members and farmers were trained on conservation agriculture techniques. In the project area, 11 field days were conducted to observe the demonstrations and those were attended by 1200 farmers. These trainings enabled farmers to practice Conservation Agriculture (CA) techniques on their farms and demonstrations helped participating farmers to have better understanding regarding adoption and benefits of CA techniques at their farms.

1.4.1.1. Development of AIP Platform for Dissemination of Technologies

Partnership has been extended to three public sector and two private sector national partners. These partners are in addition to the seven existing partners who were already collaborating in dissemination of CA technologies in the project area (Appendix 29). AIP - Wheat has developed collaboration with NRSP for the improvement of wheat productivity of smallholder farmers in the project area through improved seed use. AIP agronomy/ Conservation Agriculture component also joined hands to demonstrate improved agronomic practices such as balanced fertilizer application, wheat seed priming and ridge planting. This partnership helped in dissemination of CA technologies on larger scale in seven districts in Punjab namely Attock, Chakwal, Rawalpindi,

Jhelum, Bhakkar, Mianwali and Khushabthat. This included four districts of rain fed area of low wheat productivity.

1.4.1.2. Demonstration of CA Technologies

During wheat Rabi season 2014 and 15, AIP-Agronomy established 310 on farm demonstrations in collaboration with its national partners namely CCRI Pirsabak, WRI Sakrand, BARI Chakwal, WRI Faisalabad, AR Farms, ARS Bahawalpur, ARI D.I. Khan, DAR Jaffarabad, AZRI Bhakkar, Engro Eximp and NRSP. The demonstrations included ZT planting of wheat, ridge planting of wheat, nutrient management for rainfed as well as irrigated wheat, wheat seed priming and relay cropping of wheat in standing cotton in 12 districts of Pakistan (Appendix 30).

Dissemination ZT wheat planting has been initiated in Jaffarabad district that is part of major rice and wheat growing area in Balochistan province of Pakistan. In this region, the predominant cropping system is fallow – wheat that is followed by rice – wheat on small area. Land preparation after rice harvesting in these poor drainage soils make it difficult to plant wheat in November and thus late planted wheat when exposed to heat stress at grain filling time results in reduced grain yield. ZT drill was provided to national partner namely Directorate of Agriculture Research in Usta Muhammad which enabled 12 farmers to plant wheat under ZT conditions after rice crop (Figure 37) (Appendix 30). ZT wheat planting was also initiated in collaboration with ARI DI khan which facilitated six farmers to plant ZT wheat on 27 acres of land in rice-wheat system. These farmers were able to timely plant the wheat using a ZT drill as compared to the old practice i.e. land preparation and broadcasting of wheat seed. With this new practice, the farmers were also able to save land preparation cost which is Rs. 5000 per acre.

Figure 37 DG Agriculture Balochistan in zero tillage wheat field at Usta Muhammad, Balochistan

The efforts were also made to demonstrate ZT planting of wheat after mung, guar and maize crop on 21 acres of land at 19 sites in four districts. Under this activity, ZT wheat has been planted on seven sites after maize in Nowshera and on 12 sites after mung and guar in two districts of Punjab namely Bhakkar (Figure 38) and Chakwal and in DI Khan districts of KP province. It had helped the farmers to plant wheat without land preparation and saved cultivation cost of Rs. 3500 per acre.

Figure 38 Zero Till planted wheat after guar at AZRI, Bhakkar

Ridge planting of wheat in irrigated wheat was carried out on 73 sites in six districts including Bhakkar, Mianwali, Khushab and Bahawalpur in Punjab province and DI Khan, Nowshera in KP province that help in saving of irrigation water and improve grain yield (Figure 39). Relay cropping of wheat in standing cotton in comparison with the farmer practice was demonstrated at nine sites in the two districts of Punjab province namely Faisalabad and Bahawalpur. Farmer timely planted wheat in standing cotton and saved cost of land preparation of Rs. 5000 peracre.

Figure 39 Ridge planted wheat at farmer field in Bhakkar

Seed priming with water and Zinc sulphate solution was demonstrated at 122 sites in rain fed area and saline area of P.D. Khan district of Punjab province. This technique helped the farmers to have better crop stand, early growth; however, yield advantage will be measured at the harvest of the crop.

Use of nitrogen (N) fertilizer is high in comparison with other nutrients like phosphorus (P) that resulted in wider N & P ratio of 3:1. For better wheat productivity, N & P ratio of 1:1 or 1.5:1 is desirable. Use of fertilizer is minimal in rainfed area wheat production. Improving farmer awareness regarding balance use of fertilizer (N, P and K) in irrigated as well as in rain fed cropping system would result in 25 percent increase in wheat yield. To achieve this objective, 51 demonstrations on use of balanced fertilizer application were done in six districts (Appendix 30).

During autumn season–Kharif crop 2014 in Faisalabad district of Punjab province, direct seeding of rice (DSR) and maize hybrid with better agronomy was demonstrated. The results of this activity are summarized below:

In Punjab province, the farmers practiced direct seeding of rice (DSR) on 15 farms covering an area of 25 hectares in districts of Jhang, Faisalabad and Sialkot districts. The DSR was also demonstrated at Adaptive Research Farms in Sheikhupura and Gujranwala districts. These demonstrations resulted in 20 percent water saving. The crop was affected by the flood in later stage; however, yield estimation from farmers' fields showed six percent yield increment over old practice and saving in transplanting labor cost. In province of KP, a total of 20 on farm demonstrations of hybrid maize Babar with improved production technology were carried out by national partner (CCRI, Pirsabak) on 12 hectares in five districts namely Peshawar, Charsada,

Nowshera, Swabi and Mardan. In 18 plots, maize was hand planted after wheat crop with seed rate of 10 kg per acre during the season. The farmers applied two bags of diammonium phosphate (DAP), one bag of sulfate of potash (SOP) at planting and one bag of urea after 20 to 25 and 35 to 45 days after crop emergence. Farmer obtained grain yield of five t/ha with the use of hybrid seed and balanced fertilizer as compared to three t/ha with local varieties and farmer practice (not applying balanced fertilizer; Appendix 31).

1.4.1.3. Training of Stakeholders on conservation agriculture technologies:

During November 12-26, 2014, AIP-Agronomy in collaboration with NRSP organized one day trainings on conservation agriculture technologies. CIMMYT provided technical support by demonstrating all steps involved in these techniques. Under this activity, 200 farmers which also include NRSP local staff were trained on various conservation agriculture techniques such as seed priming, fertilizer management and ridge planting of wheat in seven districts of the project area before and during wheat planting (Appendix 32).

1.4.1.4. Dissemination of CA Technologies through Field Days

During this reporting period, 11 farmer's field days on improved agriculture techniques were organized in district Nowshera in KP province, Bahawalpur, Sheikhupura (Figure 40), Vehari and Gujranwala in Punjab province, Jaffarabad in Balochistan province and Shaheed Benazir Abad in Sindh province. These field days provided an opportunity to farmers learn through best practices of other farmers and agriculture professionals (Appendix 33). Out of these 11 field days, five events were held at farmers' fields which attracted more than 1200 participants includes farmers, agricultural experts, agricultural extension and representatives of private seed companies.

Figure 40 Mir Jan Muhammad Jamali addressing farmers on field day in Usta Muhammad, Balochistan

1.1.8. Pilot Testing and Refinement of New CA-Based Implements and Technologies

Pilot testing of multi-crop bed planter for wheat planting on raised bed continued with seven national partners. In addition, five partners initiated testing and demonstration of ZT Happy seeder for wheat planting under heavy rice residue in rice-wheat area in Punjab province (Appendix 34). National partners demonstrated wheat planting using multi-crop bed planters at 25 sites in two districts of Sindh province namely Shaheed Benazir Abad and Hyderabad, Nowshera district in KP province, four districts of Punjab province namely Vehari, Sahiwal, Faisalabad, Chakwal and Islamabad in Islamabad capital territory areas on more than 12 hectares

of land. Out of these 25 sites, bed planting of wheat under ZT conditions after maize was carried out in Nowshera district. National partners demonstrated planting of wheat with ZT happy seeder under heavy rice residue on more than 65 hectares of land at 33 sites in districts of Gujranwala, Sheikhupura, Sialkot and Faisalabad in Punjab province (Appendix 34). In Sheikhupura district of Punjab province, CIMMYT in collaboration with RRI – Kala Shah Kaku and Engro Eximp organized one day training on operation of ZT happy seeder and calibration of seed and fertilizer. A total of 58 representatives of national partners were trained in two training events includes agricultural experts, operators and field staff.

1.4.1.5. Partnership to Pilot Test New Seeders

During the autumn season–Kharif crop in 2014, pilot testing of multi-crop raised bed planters was initiated for cotton and maize planting which is now being done for wheat with seven partners (Appendix 34). These new bed planters were used for planting of wheat can also be used to make beds and planting of various crops like cotton, maize, mung bean and soybean under zero tillage conditions, whereas local planters can only plant one crop. For pilot testing of ZT happy seeder for wheat planting in rice residue, four national partners from agriculture extension, research and private were provided happy seeders (Appendix 34).

1.4.1.6. Pilot testing of Zero Till Happy Seeder in rice-wheat area

In basmati rice-wheat area of Punjab province, rice residue burning combined with heavy tillage is a common practice for wheat planting on 70 to 90 percent area. Farmers face many issues among which waste of resources on heavy tillage and environmental pollution are of serious concern. With the import of ZT happy seeder from India, AIP-Agronomy initiated pilot testing for direct drilling of wheat in heavy residue combine harvested fields in collaboration with four national partners organization namely Adaptive Research Farm Sheikhupura and Gujranwala, WRI Faisalabad, RRI Kala Shah Kaku and private sector partner Engro Eximp (Appendix 34).

The national partners have demonstrated the planting of wheat with ZT happy seeder at 33 sites including 28 farmer and five national partners' farms in four districts namely Gujranwala, Sheikhupura (Figure 41), Sialkot and Faisalabad on 163 acres which is 66 hectares of land (Appendix 34). This technology enabled the farmers to plant wheat without burning of rice residue. This reduces number of tillage operations from six to one and reduces the cost of cultivation which is about Rs. 6,000. Preliminary findings showed that farmers are satisfied with emergence and growth of wheat crop planted using ZT happy seeder.

Figure 41 Wheat planting with Zero Tillage Happy in Satyana, Faisalabad

Ghulam Mustafa Watto is a farmer and service provider from Faisalabad district used ZT happy seeder for planting wheat in his own field and also facilitated others farmers

(Figure 42). In Sheikhupura district, the farmers who have their own tractor used this planter for planting of wheat in rice residue. By adopting these approaches, 21 farmers planted wheat with ZT happy seeder on 120 acres in districts of Sheikhupura and Faisalabad.

Figure 42 Wheat emergence in Zero Tillage Happy seeder planted field in Sheikhupura

Initial data collection showed that wheat emergence was 30 to 35 percent higher using ZT happy seeder planted wheat as compared to broadcasted wheat and at par with ZT drill plots (Figure 43). The planter has managed the Basmati rice residue at four to five t/ha which created mulch on the soil, reduced bird damage to seed and improved crop emergence. The farmers were able to cut tillage operation from six to one with the use of happy seeder and saved them Rs. 6000 per acre.

Figure 43 Wheat planted on beds under Zero Till conditions at Pirsabak, Nowshera

Gulshad Nabi is a farmer from Mureedke Sheikhupura district. He received technical training on the use of ZT happy seeder through AIP in collaboration with Engro Eximp. He planted wheat on eight acres of land without burning of rice residue using ZT Happy Seeder. It saved him 33 liters of diesel per acre and time by reducing number of tillage operations from seven to one. Just in single operation, he was also able to plant wheat and apply fertilizer. AIP-Agronomy has initiated collaboration with the local manufacturers for the fabrication and refinement of ZT Happy Seeder in the country during this year.

1.4.1.6.1. Pilot testing of Multi – crop bed planter for cotton:

During autumn season–Kharif crop in 2014, multi-crop bed planter was evaluated for cotton planting at ARS-Bahawalpur and farmer fields. It was observed that emergence of cotton was 22 percent lower than hand planted cotton on ridges that resulted in lower cotton yield (Appendix 35). Lower plant emergence was due to missing of seed in this seeding system. The bed planted cotton required gap filling through manual labor that increased the cost of planting. Farmers also thought that height of the bed using multi-crop bed planter was also lower than local bed shaper.

1.4.1.6.2. Pilot testing of multi-crop bed planters for maize

Pilot testing of multi-crop bed planter for maize was also carried out in two provinces namely Punjab and KP during autumn 2014. In Punjab province, most of maize area is under hybrids and hybrid maize seed which cost approximately RS. 7000 to 8000 per acre. In this area, farmers preferred hand planting of maize on beds by experienced women farm labor which ensures maximum emergence that is between 95 to 100 percent and costs approximately Rs. 600 per acre. Whereas, bed planted maize had plant population of 75 percent and requires gap filling to manage population from 85 to 90 percent. In farmer's old practice plant population was 100 percent and better yield with planting labor cost of RS. 600 per acre. Farmer also faced row to row distance issue in turnaround passes as they like to plant on the side of the bed/ ridge. Because of ZT lines in bed planter, bed does not stay intact and it might need to have disc with press wheel for planting of maize.

In Nowshera district of KP province and Islamabad, the farmers are growing open pollinated varieties (OPV) maize and the cost seed was not higher than hybrid. They were satisfied with the bed planting of maize and crop stand. During first maize season, multi-crop bed planter was tested at six farmers' fields for maize. The yield using this planter was 0.18 t/ha which is 5 percent higher than the old practice (Appendix 36). It helped the farmers in saving and ease in irrigation with bed planting and earthing up of the maize crop is not required. Farmer's old method included making row with bullock driven desi plow / using row maker and placing seed at desired distance in the row. Later in the season, earthing up is done to make ridges. After this successful experience with maize planted on beds, wheat was planted using multi crop bed planter under ZT conditions on bed (Figure 43) at three farmers' sites and two plots at CCRI Pirsabak. This practice of wheat planting saved the cost of land preparation which is approximately RS. 3500 per acre (Figure 44).

Figure 44 Wheat planting with bed planter under Zero Till conditions at Pirsabak, Nowshera

1.4.1.6.3. Training of Stakeholders on New Seeders (Zero Tillage Happy seeder)

In October 2015, CIMMYT in collaboration with RRI Kala Shah Kaku organized a training on operation and maintenance of ZT happy seeder at RRI Kala Shah Kaku (Figure 45). Dr Ken Sayre is CIMMYT's consultant has shared his experiences with 18 participants includes agriculture professionals and operators. Atraining on operation of happy seeder and its calibration was also organized in collaboration with Engro Eximp Agri products at Engro Farm in Sheikhupura district of Punjab province. This training attracted 40 trainees including field staff, farmers and tractor drivers.

Figure 45 Ken Sayre explaining ZT happy seeder operation at Kala Shah kaku

1.4.1.6.4. Feasibility Study for Evaluation of Small Two-Wheel Machinery in the Hilly Regions

Details shared under AIP-Socioeconomics

1.1.9. Evaluation of Conservation Agriculture-Based Crop Management Technologies / Methods in Different Cropping Systems

Under this activity AIP-Socioeconomics in collaboration with national partners, completed a baseline survey of 950 farmers. For this activity, five long-term trials and seven medium-term trials/ production-scale plots on planting methods and residue management techniques have been established in rice-wheat, cotton-wheat, maize-wheat and rain-fed wheat.

1.4.1.7. Identification of Productivity Constraints and CA Adoption in Wheat-Based Cropping System

The activity was carried out under the lead of AIP-Socioeconomics. Survey results from KP province proved that high cost, affordability and lack of awareness about ZT drill, laser leveler, happy seeder, bed planter, residue management and reduced tillage were the main constraints in adoption of these technologies. The response form Sindh province was not different where unavailability of modern technology for conservation agriculture such as happy seeder, laser leveler and zero tillage etched out as the foremost constraint in the adoption of such technologiesAwareness and the use of such technologies didn't appear across Balochistan province. The situation is somehow different in Punjab province as majority of the sampled farmers are found aware of and practicing laser leveler. However, information and adoption of other conservation practices didn't evoke significant response from the study farmers of the province.

1.4.1.8. Long-Term Evaluation of Planting Techniques and Residue Management Techniques under Different Cropping Systems in the Country

The trials were initiated at five sites in rice-wheat, maize-wheat, cotton-wheat and rain fed wheat cropping systems in the project area in partnership with national partners namely ARS Bahawalpur, BARI Chakwal, RRI Kala Shah Kaku, WRI-Faisalabad and CCRI Pirsabak Nowshera. Initial or preliminary results after the harvest of autumn season–Kharif crop are as under:

1.4.1.9. **Evaluation Of Different Planting Methods/Techniques In Cotton-Wheat System at ARS Bahawalpur District of Punjab Province**

Higher emergence was achieved that is approximately 95 percent of cotton seedling and yield with hand planting method which was followed by 85 percent with hand drill method and 75 percent with mechanized bed planted cotton. During wheat season, the wheat crop was planted according to the trial plan. Wheat planting was possible early in relay planted treatments in three different plots such as hand planted, line planted and bed planted. However, wheat planting was late in plots using conventional methods of planting which requires land preparation after cotton sticks removal.

1.4.1.10. Long-Term Effect of Planting Techniques and The Productivity of Different Rain-Fed Cropping Systems at BARI Chakwal District of Punjab Province

In this trial, ZT for permanent wide beds, permanent narrow beds and conventional tillage were established in fallow-wheat, mung-wheat and green manure – wheat cropping systems. The research study was laid out in Randomized Complete Block Design (RCBD) with split-split arrangement of treatments in two replications. Initial results showed that summer crop particularly mung bean and soybean yield was better on raised bed in comparison with flat planting. Wheat crop was been planted on November 16, 2015 and data will be collected at harvesting of wheat crop.

1.4.1.11. Evaluation Of Different Residue Management and Planting Techniques Under Heavy Residue Environment Of Rice-Wheat Cropping System at RRI Kala Shah Kaku District of Punjab Province

In this trial, evaluation of five different combinations of planting systems and residue levels including burning of residue, partial retention and full retention have been initiated from rice growing season. Rice variety Basmati–515 was planted using transplanted and DSR method. First season result showed that paddy yield was 19 percent lower with ZT – DSR in comparison with CT–DSR and transplanted rice. After rice harvesting, wheat crop was planted with conventional planting and ZT and ZT happy seeder as planned.

1.4.1.12. Effect Of Planting Techniques such as ZT, Bed Planting and Farmers' Practice on The Productivity of Irrigated Maize-Wheat Cropping System at CCRI Nowshera District of KP Province

In this study, four planting techniques namely ZT, fresh bed, permanent bed and farmers' practice in combination with two levels of residue namely no residue and 20 cm residue have been established from the maize season. This was the first year and all beds were freshly made after land preparation. In all planting techniques, row to row distance and plant to plant distance of 75cm and 20cm was maintained, respectively. First yield of crop maize was higher with raised beds compared to ZT and conventional planting. After the harvesting of maize, ZT conditions were established and wheat was planted on beds.

1.4.1.13. Evaluation of Double No-Till of DSR and ZT Wheat in a Low Residue Environment of Rice-Wheat System at WRI Faisalabad district of Punjab province

In this study, a combination of rice planting methods namely transplanting, direct seeding with tillage and direct seeding with ZT with wheat planting methods using farmers' practice and ZT are being evaluated in hand-harvested fields. Rice crop was harvested and wheat was planted according to treatment plan. The results from the rice crop showed that paddy yield with direct seeding at 2.6 t/ha and transplanted at 2.5 t/ha were non significantly different.

1.4.1.14. Strengthening of CA research partners through capacity building and information sharing.

1.4.1.14.1. Two scientists trained on conservation agriculture:

In Asia and especially in Pakistan, CA is a relatively new introduction and capacity development on CA is vital for the development, adaptation and scaling-out in Pakistan. In October2014, CIMMYT under AIP sponsored two scientists Drs. Muhammad Nasrullah, Assistant Agronomist, Agronomy Research Station Bahawalpur and Nadeem Iqbal, Assistant Research Officer, Rice Research Institute, Kala Shah Kaku to receive training on CA in South Asia. The training was was organized by CIMMYT and Borlaug Institute for South Asia (BISA) under the aegis of CGIAR Research Programs on WHEAT, CCAFS, and in close collaboration with Indian NARS at BISA-PAU Ludhiana, India. This course provided an opportunity to have better understanding of conservation agriculture practices, synthesize and apply the information and knowledge related to CA technologies, improve their skills for planning long-term CA research, data management and understand pathways for up scaling of these technologies.

1.4.1.14.2. Two day training on Conservation Agriculture:

On October 28 and 29, 2014, a training on conservation agriculture (CA) based crop management practices for farmers was held at NARC in Islamabad which was attended by 18 agronomists from the agriculture research, extensionists and Engro Eximp. The focus of the training was on CA-based crop management practices for farmers and strategies to develop, fine-tune, validate and deliver CA-based technologies to farmers with farmer participation using the CA-based applied research and delivery hub. Training also covered these topics: on the set-up, use and calibration of the imported, Indian zero till seeder and the multi-crop bed planter.

1.4.1.15. Medium-Term Cropping Systems Production-Scale Plots with Residue Management Techniques to Collect High-Quality Data on Key Indicators of Systems Performance

Seven trials/production-scale plots have been established in partnership with national partners; initial / preliminary results from these plots as follows:

- **Diversification through legumes and oilseed crops in rice-wheat system at RRI Kala Shah Kaku District of Punjab Province**

  In this trial, the impact of the inclusion of canola, berseem, Dhaincha (Sesbania cannabina Poir) and mungbean in traditional rice-wheat system is being observed. During first season, paddy yield of transplanted rice in all five cropping systems was none significantly different. Wheat crop in three systems, canola in one and berseem in one has been planted during this Rabi crop season.

- Effective control of weeds such as Leptochloa chinesis (Kallar grass) and Dactyloctenium aegyptium (Madhana grass) in DSR through old practice and fungicides. In this trial, five different weed control strategies were evaluated to control weeds in direct-seeded Basmati rice. Use of one stale seed bed technique (daab) coupled with Bispyribac sodium (clover) spray at 24 DAS had 95 percent control of weeds and resulted in maximum yield of 4.35 t/ha.

- **Residue Management Trial in Cotton-Wheat Cropping System at ARS Bahawalpur District of Punjab Province**

  In this trial, bed planting of cotton in standing, incorporated and no residue conditions are being evaluated. Multi-crop bed planter was used to plant wheat crop after cotton and cotton will be planted under ZT conditions in standing crop residue.

- **Mechanization for convenient adaptation of relay cropping of Bt cotton in Standing Wheat Crop at ARS Bahawalpur District of Punjab Province**

  A study has been initiated to adjust the Bt cotton crop in standing wheat as a relay crop. Results from cotton crop suggested that dibbling of cotton on two lines of 150 cm apart ridges have better cotton yield. In this technique, wheat was already planted in 6-row strips in between 150 cm ridges. This technique helped to obtain good yield from wheat and Bt cotton.

- **Bed planting of maize and wheat under different residue management at AR Farm Vehari District of Punjab Province**

  In this production-scale plot, bed planting with and without residue is being compared in maize-wheat and maize-maize cropping systems. Autumn maize has been harvested and wheat was planted with bed planter in standing residue particularly under ZT conditions and after land preparation.

- **Residue Management in Rice-Wheat Cropping System at AR Farm Sheikhupura and Gujranwala Districts of Punjab Province**

  In these production-scale plots, rice crop has been planted with transplanting and direct seeding techniques. After harvesting of the rice crop, wheat planting was carried out with a ZT happy seeder under full- and half rice residue.

- **ZT and permanent bed planting in maize-wheat cropping system at CCRI Pirsabak Nowshera District of KP province**

  In these production-scale plots, maize variety Jalal was planted with ZT, bed planting and conventional methods. Maize yield was 4.8 t/ha with bed planting in comparison with 4.2 and 4.0 t/ha in zero tillage and conventional practice, respectively. After maize, wheat has been planted with bed planted and zero tillage drill under zero tillage conditions that has saved cultivation cost in comparison with farmer practice.

1.1.10. Nutrient Management

In this activity, a survey involving 950 farmers was completed on the use of fertilizer and farmer's access to related services. Validation of Nutrient Expert™ (NE) for wheat was initiated at 27 sites in seven wheat growing districts of Punjab province. For validation of Green Seeker use for sensor based N management in wheat, trials / demonstrations were initiated with five national partners namely WRI Faisalabad, ARS Bahawalpur, RRI Kala Shah Kaku, NARC and CCRI Pirsabak at 22 sites. In addition, training on use of Green Seeker for N management in wheat was held in which nine partners scientists were trained on operation and data recording using Green Seeker in wheat crop.

1.5.1. Extent of Fertilizer (Nutrient) Use and Related Services (Extension, Soil Fertility Laboratory) Use and Their Impact on Productivity of the Different Cropping Systems of Pakistan:

AIP- SEP completed a baseline survey majority of the sample farmers i.e. 53 percent had good quality soil, 24 percent had medium and 23 percent had poor soil quality soils. Overwhelming majority which is 94 percent of the sample farmers did not include legumes in crop rotation and only six percent of the sample farmers cultivated legumes in crop rotation in the survey area. Access to soil laboratory or the soil extension services was only limited to 33 percent of the farmers. Majority of the farmers have applied the macro nutrients in the optimal quantity where both macro and micro nutrients are essential. About three fourth of the sample farmers had no information regarding micronutrients.

1.5.1.1. Nutrient Management Trials in Wheat Cropping System:

- **Nutrient management under different rain fed cropping system:** During autumn season Kharif crop 2014, a trial was initiated to study Nitrogen fertilizer management for wheat after fallow, mung bean, green manure (guar and cowpea) and fodder guar at BARI in Chakwal district of Punjab province. After the harvesting of summer crop, each main plot has been subdivided into four sub-plots and nitrogen was applied following experimental treatments: Control with no Nitrogen application, 1/3rd of Recommended Nitrogen dose that is 26 Kg N/ha; 2/3rd of Recommended Nitrogen dose that is 52 Kg N/ha and full dose of Recommended Nitrogen that is 80 Kg N /ha.
- **Nutrient management for rain fed wheat crop at farmer fields:** The trial has been initiated at five farmers' fields in medium rainfall area of Chakwal district of Punjab province and Nowshera district of KP province from wheat season. In this trial, three different fertilizer management strategies are being evaluated which includes farmer's practice, recommended fertilizer application as basal dose which is 80 Kg N and 58 Kg P/ ha) and split application (DAP applied as basal and Urea with first rainfall).

1.5.2. Evaluation of Decision Support Systems/ Site-Specific Nutrient Management Techniques

Nutrient Expert™ is a new nutrient decision support system (DSS) based on the principles of site-specific nutrient management (SSNM) that offers solutions for providing field-specific fertilizer recommendations to improve the yield and economics of maize growing famers in the region. During the autumn 2014, farmer's field trials were carried out at 10 locations in hybrid maize growing districts in Punjab province particularly Sahiwal, Pakpattan, Vehari and Faisalabad. In these trials, three fertilizer management practices namely farmers' practice, Agriculture Extension Punjab and NE recommendation were compared. In maize hybrid, the farmers applied more nitrogen and phosphorus and less potash as compared to NE recommendations (Appendix 37). Data from six on farm trials showed that farmer applied nitrogen in three to five doses whilst NE recommended the application at V6 to be done 25 to 30 days after planting and at V10 to be done 35 to 40 days after planting that also reduced the cost of fertilizer application. The farmers applied potash as basal whereas NE recommended K application at planting and at V10 growth stage. On the basis of NE recommendations, there was saving of Rs. 3163 per ha from fertilizer cost and additional yield of 386 Kg/ha on average basis as compared to farmer's practice (Appendix 37). These results will be validated in the next maize autumn season on more farmer fields.

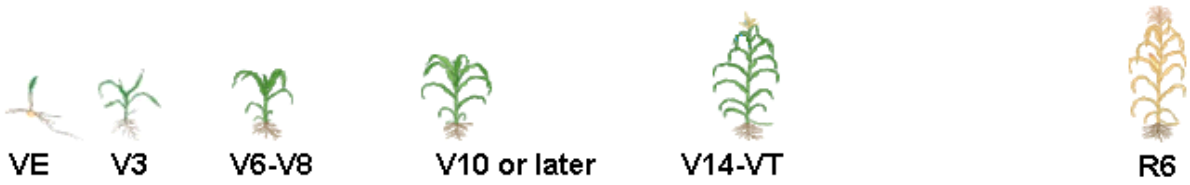


Figure 46 various growth stages of maize crop

Validation of Nutrient Expert™ for wheat crop has also been initiated from wheat season 2014-15 in collaboration with seven national partners. Under this activity, farmers' field trials/ demonstration have been established at 27 locations in seven wheat growing districts of Nowshera, DI Khan, Shaheed Benazir Abad, Bahawalpur, Faisalabad, Sheikhupura and Bhakkar. In these trials, three fertilizer management practices – farmer's practice, Agriculture Extension and NE recommendation – are being compared. NE based recommendations generated considering yield response and targeted agronomic efficiency in addition to quantifying the contribution of nutrients from indigenous sources of targeted field. Trials were established and fertilizers were applied according to recommendations. After harvesting, yield data will be collected and results will be shared in the next reporting period.

1.5.3. Green Seeker Use for Nitrogen Management in Wheat

Evaluation of Green Seeker for N (nitrogen) management in wheat has been initiated with the collaboration of following national partner institutes in various cropping systems:

- Agronomic Research Station, Bahawalpur: Cotton – Wheat
- Rice Research Institute, Kala Shah Kaku: Rice – Wheat
- Wheat Research Institute Faisalabad: Mixed crop – Wheat
- Cereal Crops Research Institute, Pirsabak, Nowshera: Maize – Wheat
- Wheat Programme, NARC, Islamabad: Rain fed Wheat

During this wheat season 2014-15, field trials have been planted in various parts of the country. These trials would be helpful in evaluating this technique and its dissemination to farming community. Successful validation of the technique would help the farmers to apply nitrogen according to wheat crop requirement that might result in saving of nitrogen fertilizer.

i. Relationship between Optical Sensor Reading and Wheat Yield Potential

Field experiments have been planted at five different locations including three districts in Punjab province namely Bahawalpur, Sheikhupura (Kala Shah Kaku) and Faisalabad, one each in district Nowshera in KP province and at Islamabad. The treatments include application of nitrogen at the rate of 0, 40, 80, 120, 160, 200 Kg perhectare at the time wheat planting as a basal dose. This trial has been laid out in Randomized Complete Block Design (RCBD) with three replications. Green seeker readings from these plots have been collected from jointing to booting stage.

ii. Evaluation of Sensor Based N Management at Partner Institutes

Under this activity, five treatments have been established at various research institutes mentioned in Table 1. At second irrigation wheat growth stages (Feeks 5-6/ Feeks 7-8, green seeker reading from each plot and rich N strip would be collected and GS managed N will be calculated with the use of Indian model. Each strip / subplot will be divided in to two sections and N will be applied according to farmer's practice and GS recommendation. At maturity, data of yield and yield component will be collected from N-rich strip, farmer practice and GS managed area.

iii. Evaluation of Sensor Based N Management at Farmer Fields

Under this activity, 27 plots of ½ - 1 acre have been selected and rich N strip has been developed on these fields i.e. 5 x 10 m strip in which 2 Kg of Urea has been applied at planting or at first irrigation. At second irrigation wheat growth stages / Feeks 5-6/ Feeks 7-8, green seeker reading from the plot and rich N strip were collected and GS managed N was calculated with Indian model. Fields were divided in to two sections and N applied according to farmer practice and GS recommendation. At maturity, data of yield and yield components will be collected from N-rich strip, farmer's practice and GS managed area that would help in validation of the technique. .

iv. Training on the Use of Green Seeker

AIP-Agronomy has provided Green Seekers to four national partners namely ARS - Bahawalpur, CCRI Nowshera, BARI Chakwal and RRI Kala Shah Kaku for N management for wheat and its use for agronomic data in other trials. On December 23, 2014, training on operation and uses of Green Seeker for N management in wheat was held at CIMMYT Pakistan office. The training was a mix of presentation and hands on training of green Seeker (Figure 47) which was attended by nine scientists from partner institutes namely WRI Faisalabad, ARS Bahawalpur, RRI KSK, NARC Islamabad and CCRI Pirsabak.

Figure 47 Participants of Green Seeker training with AIP project leader Muhammad Imtiaz in Islamabad

1.5.4. Dissemination of Site-Specific Nutrient Management Techniques at the Farm Level

Leaf color chart is Site-Specific Nutrient Management Techniques (SSNM) helps the farmers to save nitrogen fertilizer and improve rice crop yield. During autumn season–Kharif crop 2014, data from LCC managed nitrogen demonstration in Faisalabad and Gujranwala showed rice yield of 3.7 t/ha that was at par with farmer practice. However, there was saving of 40 Kg N/ha in LCC managed plots that were equal to 90 Kg urea per ha or 36 Kg of urea per acre. In Faisalabad sites, saving of nitrogen with LCC was 57 Kg N/ha that was higher than 32 Kg N/ha observed in Gujranwala. By using LCC, farmers were able to achieve same yield with less nitrogen application that could also have beneficial effect on the environment. Detail results on these LCC managed rice demonstrations are given in Appendix 38.

1.6. Socio-Economics

1.6.1. Maize Baseline Surveys

AIP-Socioeconomics successfully completed maize baseline surveys in four provinces namely Punjab, Sindh, Balochistan and KP and Gilgit-Baltistan (GB) and Azad Jammu & Kashmir (AJK) with an objective to have a comprehensive understanding of current agricultural farming especially maize production in the target areas. The survey was carried out primarily focusing on prevailing cropping patterns, adopted production practices for maize, existing awareness, access to and extent of Hybrid and OPV maize production, evaluate comparative productivity, cost and revenue

analysis of Hybrid vs. OPV maize. In addition to identify existing constraints in adoption of Hybrid maize as well as possible pathways for enhanced maize productivity.

Based on the survey findings, maize is an emerging crop in Sindh province. Although maize hybrid cultivation started only four years back, it was a rising trend across the province with aggressive involvement of both multinational seed companies and processing industry. Currently, the farmers prefer to cultivate OPV maize for fodder purposes and hybrid varieties as grains and green cobs to selll to processing industry and wholesalers, respectively. The maize growers selling maize as fodder were earning better to that of hybrid maize growers in lower Sindh province. While the situation is quite different in upper Sindh province where hybrid maize growers significantly earn more profit to that of OPV growers. The predominant reason for differential amongst net earnings of lower and upper Sindh province farmers is low productivity of hybrid maize in former than later region, as 6300 kg/hectare and 10700 kg/hectare, respectively. Soaring demand for milk and meat necessitates more production of maize fodder on one hand and buy-back guarantee for maize grains by hybrid seed supplying companies or processing industry on the other hand indicates the huge potential for maize in Sindh province. But significantly higher hybrid-seed prices enhance production-cost on one hand, and limited number of market players on demand-side on the other, put a serious question on marketability, price stability and likelihood of buyers' exploitation.

In the existing cropping pattern of AJK and GB, maize is the prime crop of both study regions.

Weed's infestation, insects attack and disease prevalence intensity ranges from medium to high, however, with adopted control measures by the farmers are almost non-existence. On average, the maize growers are harvesting 29 mounds grains per acre while those cultivating for fodder purposes obtain 109 mounds forage per acre.

Considering proportional area allocation to a crop as yard stick, maize etched out as the second most important crop after wheat in Punjab province. Adoptability of maize in different cropping zones of the province looks similar except in advanced agronomic practices like ridge and bed planting, appropriate application of fertilizers and pesticides, use of laser leveler to save water, etc. Hybrid maize cultivation is almost across the province except in Barani zone where farmers still continue to grow OPV maize primarily for fodder purposes. The hybrid maize varieties cultivated in both seasons have marvelous yield potential and the sampled farmers have obtained per acre average yield of 50 to 65 mounds and 80 to 120 mounds from Kharif and Rabi maize crops, respectively. The maize farmers are also facing serious problem of the stem bollworm.

1.6.2. Two-Wheel Tractor Feasibility Study in Hilly Areas of Pakistan

Appended with maize baseline surveys, a study to assess the current state and future prospects of two-wheel tractor adoption in northern hilly areas of Pakistan was successfully completed, covering AJK and GB regions. In total 100 farmers were interviewed from three districts of GB and seven districts of AJK. The objectives of this study were to assess the adopted types of farm machinery, existence and usage of two-wheel tractor, farmer's cost estimation and willingness to buy or hire two-wheel tractor, existing potential and constraints in adoption of two-wheel tractor. The study reveals minimal use of farm machinery with non-existence of two-wheel tractor. Further, more than 90 percent of the farmers were not aware about two-wheel tractor (Appendix 42). Due to inaccessible plots, the farmers have to use bullock or hand operated tools. Despite of

less affordability, strong willingness to purchase two-wheel tractor exists amongst the farming community of both regions.

1.6.3. Baseline Progress and Results Sharing Meeting

On December 17, 2014, a meeting to share results and progress of baseline was organized by AIP-Socioeconomics in Islamabad. The meeting was attended by 80 participants including AIP primary partners namely ILRI, IRRI, AVRDC, UCDAVIS, PARC, national partners, representatives of USAID and colleagues from CIMMYT. In addition, the provincial partners namely SSRI, Faisalabad, Peshawar, Tandojam and Quetta also participated. The purpose of the meeting was to update the status of ongoing baseline surveys and share results of already completed surveys with all AIP partners and stakeholders. The meeting helped to get feedback, address shortcomings and suggestions for planning future surveys.

1.6.4. Private Wheat Seed Sector in Pakistan

A study was conducted to assess strength of existing private seed companies in terms of available infrastructure, use of machinery and equipment, storage and processing capacity, human resource deployment, marketing channels and outreach, business volumes, wheat seed business share, and wheat seed business trends. The survey revealed that the private sector is investing in building infrastructure, investing in innovative production and processing machinery, employing technical staff and participating in national and international agriculture forums. Majority of the sampled entrepreneurs reported increasing trend of seed business and demanded more cooperation from the public sector in provision of pre-basic and basic seed in desired quantity. After aggressive expansion in the last two decades, the consolidation in terms of mergers and joint business ventures has commenced in the private seed companies. Moreover, a significant proportion of business community (Seed Companies) participated in workshops, seminars, meetings and trainings at national level and few of them also have access to international exposure.

1.6.5. Rural Seed Enterprise Development Trainings

In partnership with AIP-Wheat, AIP-Socioeconomics significantly contributed in building the capacity of the local seed companies and community based organizations to run and establish sustainable rural seed enterprises across four provinces. A total of 15 trainings were conducted out of which three trainings were held in Sindh province, six in KP province, five in Punjab province and one in Balochistan province (Appendix 42). These trainings enabled the participants to understand the overtime private seed companies' registration, seed availability vs. requirement, wheat seed sources, projected wheat demand and population of the country, existing private wheat seed sector, concept of community based seed enterprise development, formulating business plan, conducting financial analysis, possibility of different community based seed enterprise models.

2. Livestock

2.1. Dairy Value Chain (DVC)

2.1.1. Stakeholder Consultation Workshop on Dairy Value Chain Rapid Assessment

AIP- Livestock conducted a Stakeholder consultation meeting on Dairy Value Chain (DVC) Rapid Assessment with experts on October 12-13, 2014 in Islamabad. The findings of the previously conducted Focus Group Discussions (FSG) with dairy farmers in six villages in Jhang and Bahawalnagar districts of Punjab province were shared with the experts in working groups. Dairy

sector has site specific problems, thus FGD in the target villages of AIP was necessary to identify problems faced by DVC stakeholders in those villages.

The working groups presented recommendations which can be taken as possible intervention in DVC, are summarized below:

- Improvements in dairy shed (floor and roofing) and amenities (watering and feeding facilities), which can be done by setting-up model farms with volunteers/ progressive dairy farmers.
- Capacity building of smallholder dairy farmers on improved dairy husbandry practices, nutrition, feeding, improvement in fodder availability and conservation techniques, animal health, reproduction and breeding.
- Group marketing of milk by catalyzing the information of dairy farmer associations

2.1.2. Constraints for Dairy Farming in Urban, Peri-urban and Rural Areas in Lahore District of Punjab Province

During September-December 2014, a study was carried out to assess the dairy production system and constraints for dairying in urban (Harbans Pura Cattle Colony), peri-urban (Saggian Village) and in rural areas (Villages; Ratney Wala and Burj Kalan) in Lahore district of Punjab province. The AIP-Livestock team interviewed 31 farmers using a structured questionnaire that focused on feeding dairy cattle, buffaloes and production characteristics. The main findings are summarized below:

- Urban dairy farmers are completely dependent on purchased feed/ ration from market while mostly farmers from peri-urban and rural areas have their own land for fodder cultivation.
- Dairying is part of their agricultural activity for the rural dairy farmers, whereas for urban and peri-urban farmers dairying is business enterprise.
- Cotton Seed Cake is the main concentrate feed and is only fed to milking animals.
- Mostly farm animals are kept tethered which limits their access to water and thus their daily water requirements are not met.

Figure 48 Ratney Wala Village (Kasur)

Figure 49 Saggain Village (peri-urban)

Figure 50 Saggain Village (peri-urban)

In the light of above constraints, a model farm was developed for demonstration at farmer's field that enables the farmers to improve the milk productivity through balanced diet and water access. In addition to this, AIP-Livestock team is raising awareness among rural dairy farmers to take dairying as a business enterprise by establishing inflow-outflow account of all their livestock related activities.

2.1.3. Strengthening Dairy Value Chain through Capacity Building in Punjab and Balochistan Provinces

To strength the DVC, AIP-Livestock organized trainings for students, academia and professionals working in the livestock sector from Punjab and Balochistan province. The objective of these trainings was to provide a better understanding of dairy value chain (DVC) and its analysis to the trainees, which will enable them to learn the processes though which chain affects the profitability of dairy enterprises with main focus on the livelihoods of smallholder dairy farmers.

Such capacity building process of national agriculture research staff (NARS) through trainings will help to sustain the growth of livestock sector even after the project ends. Since, these NARS are responsible to run the national system and could play an immense role to keep the new innovations introduced through AIP-ILRI withhold

On November 5, 2014, a one-day training on the concepts and analyses of Dairy Value (DVC) was organized at the University of Agriculture Faisalabad *(*UAF*),* which attracted 103 students of animal husbandry including 83 men and 20 women, who were trained on the concepts and analyses of DVC.

On November 17-18, 2014, a two day workshop on 'Livestock Dairy Value Chain: Concepts and Tools for Analyses and Rapid Assessment' was organized in at Balochistan University in Information Technology, Engineering and Management Sciences (BUITEMS), Quetta in Balochistan province. The BUITEMS provides platform to conduct training and in this case majority of the participants were from livestock department and agriculture universities; for example the project 8 participants from Lasbela University of Agriculture, Water and Marine Sciences instead of organizing this training in Lasbela university. The training attracted 29 participants, which included 20 men and 9 women teaching staff and postgraduate (MSc and PhD) students from Balochistan province.

Figure 51 Two day workshop on Livestock Dairy Value Chain: Concepts and Tools for Analyses and Rapid Assessment held in Quetta, Balochistan province

On November 19, 2014, a training on the concepts of DVC to enhance profitability of dairy sector was conducted at the Animal Science Training Institute (ASI), Quetta in Balochistan province. The event was jointly organized by AIP-Livestock and the Livestock and Dairy Development Department of Balochistan (LDDDB). This training attracted 30 veterinary officers, management and staff of ASI and dairy farm managers.

Figure 52 Training on the concepts of DVC held in Quetta in Balochistan province

2.1.4. Empowering the smallholder from KP farmers to adopt innovative practices

On October 23, 2014, an exposure visit was organized to familiarize the members of the dairy farmer associations of KP province to observe new livestock technologies and innovative practices. The exposure visit group included 23 smallholder dairy farmers, 5 members of the dairy associations in Nowshera and Mardan, and 4 Livestock and Dairy Development Department (L&DDD) officers from KP province. The group visited the International Livestock Research Institute (ILRI) and National Agricultural Research Center (NARC) in Islamabad. This enabled the participants to learn the new practices of feed silage making from maize also known as bale silage, concentrated feed preparation, improved methods of calf rearing and animal housing with feed trough and watering points.

Figure 53 Demonstration on silage making

As a result of this activity, the dairy farmer associations (Nowshera and Mardan) ordered 100 silage bales from NARC through AIP-Livestock for distribution among their member farmers. One of the progressive farmers from Mardan has shown interest in purchasing the necessary equipment for harvesting and silage making. AIP-Livestock provided technical guidance about silage machine and its business model.

2.1.5. Improving Dairy Farming Practices of Farmers in Aasal Par Village in Nankana Sahib District of Punjab province

The dairy farmers from Aasal par village in Nankana Sahib district of Punjab province faced many issues while rearing their milk producing animals. These progressive dairy farmers are keen in improving their dairy farming practices for better animal productivity. AIP-Livestock furnished their request to support them in improving their skills and impart knowledge though experiential learning.

A training on new dairy farming practices was organized on February 4-6, 2015 by the Livestock & Dairy Development Department (L&DDD, KP) with technical support from AIP-Livestock at Pakistan Academy for Rural Development (PARD), Peshawar which was followed by an exposure visit to Nowshera Dairy Association in Nowshera district of KP province. This training was attended by 22 dairy farmers from Aasal par village in Nankana district of Punjab province.

On March 8, 2015, AIP-Livestock held a group discussion with these trainees at their village as a follow up of the training. Farmers requested assistance from AIP-Livestock to form a Dairy Association, training on various aspects of modern dairy husbandry and on marketing of dairy products. AIP-Livestock team advised them to organize themselves in groups to carry out activities such as vaccination of the animals. The response was positive and they are willing to organize themselves for the vaccination campaign.

Some of the constraints faced by dairy farmers includes low milk sales price, lack of proper marketing system, poor animal health facilities and no artificial insemination services. Farmers are keen in improving their dairy farm for better animal productivity, livelihoods opportunities and are agreeable to work as a community.

2.1.6. Foot and Mouth Disease (FMD) – awareness and prevention campaign

Foot and mouth disease (FMD) has severe implications for dairy farming; it is highly infectious and is likely to spread by infected animals through aerosols, contact with contaminated farming equipment, vehicles, clothing, and feed by domestic and wild predators. Its containment demands considerable efforts in vaccination, strict monitoring of animal movements, trade restrictions, quarantines, and occasionally the killing of animals. However, at the village level dairy farmers believe in myth that prevents the containment of the disease or its spread, which includes the use of animal bones as garland around the neck of animals, use of amulets and chanted nails (religious person who recite some verses and blow on some nails, which is placed at different corners of the village).

In the DVC operational villages in Jhang and Bahawalnagar districts of Punjab province, in the previous year's FMD has affected 30-40 percent of the large ruminants, resulting in immense economic loss to the smallholder farmers. This information was documented by AIP- Livestock field staff Mr. Zeeshan during interview with farmers. In these villages, the mortality rate of FMD affected calves below 5 months of age was more than 80 percent and in 5-12 months old calves was 60 percent. During FMD pre-vaccination campaign with farmer groups revealed that last year the milk production reduced by 75-90 percent in disease affected animals. Some farmers claimed FMD resulted in financial loss of about Rs. 100,000 (which is US$ 1000).

USAID funded dairy projects intervined in different study sites than those selected by AIP-livestock; however, to control FMD in the AIP mentioned target villages the project co-ordinated with FAO to vaccinate the animals against FMD and PPR. Vaccination against different diseases helps to control huge mortality loss and need to develop awareness among farmers about them in each village of Pakistan.

From March 11-14, 2015, AIP-Livestock raised FMD awareness with the assistance of the provincial livestock line departments in all six project dairy villages and successfully vaccinated all large ruminants. On cost sharing basis, the split dose vaccine was acquired from FAO on a cost sharing basis. A total of 7,594 animals which includes 4,071 cattle and 3523 buffaloes belonging to 890 dairy farmers were provided with the first dose of vaccine. This will be followed up with second booster dose in mid-April and third in mid-June. This activity will result in increasing farmers' profitability from livestock enterprise.

2.1.7. Training for enumerators to capture and monitor interventions using Open Data Kit (ODK)

Five day training was conducted from March 15-20, 2015, on capturing and monitoring using open data kit (ODK) software for enumerators in Islamabad. Ms. Jane Poole and Mr. Harrison, from Research Methodology Unit ILRI Nairobi, conducted the training for 22 enumerators. For the first time in Pakistan the Samsung Tablet with ODK software in which a 34 pages questionnaire was successfully introduced. Training included the use of both printed questionnaires and the programmed in ODK software using tablets. The training was followed up by a field visit to a project's village in Chakwal district of Punjab province. The execution of the survey started on March 24 which will be completed by April 15. Data from 350 households from all 10 project villages in Chakwal, Jhang, Bahawalpur and Bahawalnagar districts of Punjab province will be collected and stored in the ILRI server for analysis and reporting.

2.1.8. Snap-shot survey on watering, feeding and housing facilities for milking animals

From February 22 – 27, 2015, a snap-shot study to identify the current practices affecting milk production and milk quality such as housing, feeds and feeding, animal management and health was conducted. AIP-Livestock team interviewed 680 dairy farming households including 247 dairy farmers in two districts Malakand and Nowshera in KP province and 450 dairy farmers in Jang and Bahawalnagar districts in Punjab province. The study revealed that:

- Less than five percent of the farmers have access to proper housing facilities for the milking animals such as feed manger, waterers, proper flooring, roofing, milking area and calf pens. The poor hygienic conditions, limited access to water, feed wastage results inbothlow milk quality and production.

- Approximately 10 to 20 percent of the dairy farmers are landless and rely heavily on purchased feeds both forages and concentrates and the situation in summer season worsened due to the shortage of forage feed supply.

- 95 percent of the farmers practice intensive system of management where animals are kept tethered (neck or legs). Full 100 percent of the dairy farmers feed water once or twice a day and are unware of the importance of water for milk production. Milk constitute 85 percent water which has to be supplied daily either via feed consumed or drinking water, hence farmer collaborated trails and awareness campaigns on importance of unrestricted availability to dairy animals needs to be undertaken.

- Full 100 percent of the farmers are unaware of feeding balanced ration to obtain desired levels of production. This rise the need for capacity building on strategic feeding practices. In winter season, farmers owning land grow berseem which is the main source of feed in cold weather. However, in summer season farmers rely on maize stover and wheat straw. Hence, there is a need to address the issue of feed availability during summers by propagating high yielding multi-cut fodder varieties such as Mott grass, Rhodes grass, forage sorghum etc. In this aspect, one of the constraints identified by farmers was the lack of good quality seed of high yielding fodder varieties.
- Calf mortalities has increased due to diseases such as Hemorrhagic septicemia (HS), FMD and mastitis since farmers are not practicing routine deworming.
- Lack of proper linkage between farmers for milk marketing and cold chain facilities to safeguard milk quality.

2.1.9. Demonstration on importance of water for milk production

In response to the information collected on insufficient feeding of water to animals, a preliminary farmer participatory demonstration was setup in Bahawalnagar district of Punjab province to show the importance of water to milking animals. AIP did not simply aware farmers about the importance of water in milk production rather conducted the experiment by selecting farmers' animals at their fields to show them the impact of water on milk productivity. Therefore, learning by doing is an important tool to introduce innovations and the target sites were differenct from Dairy project. This demonstration was trialed with six cows was conducted over a period of six days with Cattle which includes Cholistani and Sahiwal x Friesian crossbreds and Nili-Ravi buffaloes.

The Figure 54 shows the effect of ad libitum water intake on milk production in cattle and buffaloes. The response of Cholistani breed was the highest in milk production after six days which is up to four liters per day as compared to Sahiwal × Friesian cross breed which was 2.5 liters per day milk increase. In Nili-Ravi buffalo three liters per day increase in milk production was observed.

A similar study with cows at similar stage of lactation was initiated at Jhang district of Punjab province where the importance of ad libitum feeding of both water and forages are tested with larger number of cattle and buffalo cows. The experiment is entering in its last stage and finding will be shared after data analysis.

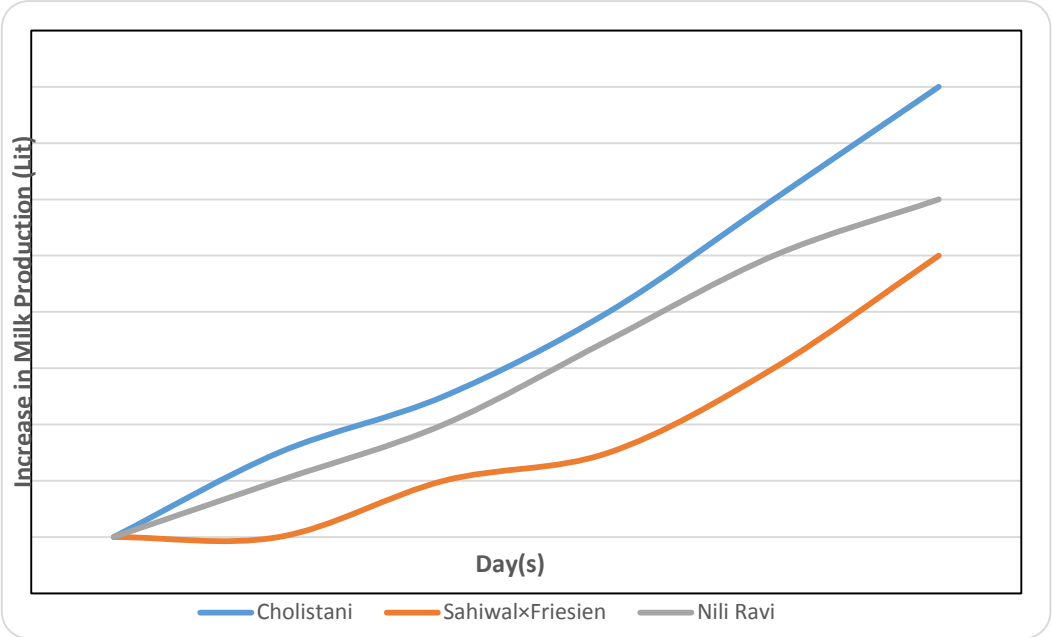


Figure 54 Effect of unrestricted water availability on milk production

2.2. Small Ruminant Value Chains (SR VC)

2.2.1. Small Ruminant Value Chain Rapid Assessment

The Social Sciences Research Institute (SSRI) and NARC initiated the Focus Group discussions with farmers in Chakwal district of Punjab province in October 2014 and Bahawalpur district of Punjab province in February 2015. A detailed report is being compiled. Based on problems identified by farmers during face to face discussion, interventions has already been started to introduce. The main issues identified by the farmers are listed below:

1. High disease infestation
2. Low coverage of qualified veterinary services (semi-skilled and unqualified private veterinary services)
3. Limited extension and advisory services especially gender specific as women are mainly involved in management of small ruminant at household level and no specific extension and advisory services available to address this target audience.
4. Traditional management and poor housing conditions for small ruminants
5. Nutrient deficiency and cyclical supply of feed
6. Shortage of clean drinking water for livestock
7. Fodder and forage is targeted only for large ruminants which ignores the need of the small ruminants
8. Lack of concentrate feed supply in the market formulated for small ruminants (large ruminants wanda and poultry feed is fed to small ruminants which is kept for Eid purpose)
9. Low coverage of vaccination and very limited deworming is done at farm level
10. Limited clinical services available and less awareness for their use for disease diagnosis
11. Limited supply of medicines at government veterinary dispensaries and health centers
12. Veterinary medicines are sold without prescription and no quality check is done

2.2.2. Healthy Goat Kids Produced Through AI in Goats

The Beetal goat semen was processed at the semen processing units (SPU) in KP province through training and technical backstopping from L&DDD-KP and AIP-Livestock. Since October 2014, two goat SPUs Harichand Government Farm, Charsada district and a private farm in KP province are producing Beetal goat semen in straws. As of March 2015, 1,035 Beetal semen in straws have been distributed to the trained AI technicians in KP.

More than 300 technicians and 246 students from different universities have been trained for AI in goats. Artificial insemination (AI) of goats owned by dairy farmers from KP province was done using Beetal goat semen. The conception rates of 65 percent was achieved which has resulted in successful kidding.

The goat kids produced using Saanen and Boer semen were showcased at PakExpo held in February 2015 in Islamabad.

Figure 55 Live goat kids produced through AI of Beetal semen in goats

2.2.3. L&DDD-KP and AIP-Livestock caters to the demand for AI training in KP

In December 2014, three trainings on AI in goats for 85 veterinary officers and assistants were conducted using the AIP-Livestock training protocols in three districts of KP province namely Kark, Lakki Marvat, and DI Khan.

On December 4, 2014, a training on AI in goats was imparted among 246 students which includes 221 men and 25 woman who are pursuing their Veterinary degree at Gomal University of Veterinary Science, Gomal University, DI Khan, KP province.

The AIP-Livestock with the support of of L&DDD in KP province, is planning to monitor the progress made in the field by these trained private AI technicians and also monitor the quality and health of the goat kids produced though AI.

2.2.4. Animal Health interventions in Chakwal District of Punjab Province

2.1.9.1. Anthelmintic efficacy trial

Six groups of ewes/does (n=20/30 each group) between 2-5 years of age were randomly selected from Begal and Dhulli sites in Chakwal district of Punjab province for trial. These animals were found to be naturally infected with multiple parasites including *Paramphistomum*, *Moniezia*, *Strongyloides*, *Ostertagia*, *Trichostrongylus*, *Chabertia ovina*, *Oesophagostomum*, *Haemonchus*, *Trichuris ovis* with a mean of 2000 eggs per gram of faeces (epg). These infected animals were divided into six groups namely A, B, C, D, E and F. The

animals in group A and B were administered with synthetic anthelmintics namely Nilzan plus and Ivermectin, respectively; while group C, D and E were administered with herbal anthelmintics Deedani, Atreefal Deedani and Kirmar, respectively. Group F was kept untreated. All the groups were kept under the usual farmer practices. The results showed that the Nilzan plus treatment controlled parasitic infection most efficiently which is 93-100 percent, followed by Atreefal deedan at 88-96 percent , Ivermectin at 90-92 percent , Deedani at 76-53 percent and Kirmar 36-46 percent . This shows that the herbal anthelmintic Atreefal deedan provides a good alternative to Nilzan. Further investigations of its efficacy against multiple parasites infestation with different doses are being carried out before its recommendation to the farmers.

A program on control of the most important infectious diseases like Pox, FMD, Anthrax and Enterotoxaemia including awareness raising was launched with 18 farmers in Chakwal district of Punjab province at the beginning as pilot site. Since then more poor farmers are being trained to control these deadly diseases.

2.1.9.2. The Peste-des-Petits Ruminants (PPR)

The Peste-des-Petits Ruminants (PPR) is an acute highly contagious viral disease in small ruminants characterized by fever, loss of appetite, stomatitis, gastroenteritis, and pneumonia leading to death.

In 2013, FAO under USDA funded project has launched a country wise program on 'Progressive control of PPR in Pakistan'. AIP-Livestock team carried out a vaccination campaign from 25 to 27 February 2015 with the support of the FAO PPR project staff assisted 228 farmers from Dhulli and Beghal village in Chakwal district of Punjab province. A total 2,504 small ruminants which includes 1081 sheep and 1423 goats were immunized. In addition, 39 farmers were trained on control of PPR. All costs related to this PPR vaccination and campaign was borne by the FAO-USDA PPR project.

Figure 56 PPR vaccination and campaign

2.3. Feed, Fodder and Rangeland

2.3.1. Herd Management: Seasonal breeding, availability of feed & fodder and survival of new born lambs/kids

In December 2014, ewes/does between two to five years old out of which mostly were pregnant belonging to 16 farmers were randomly selected from two sites at Beghal and Dhulli in Chakwal district of Punjab province. Physical examination revealed that these animals were underweight due to poor feeding. All animals were ear tagged, vaccinated against Enterotoxaemia (ET) and

their live weight was recorded. Animals were divided into four groups namely A, B, C and D. Three supplemental rations were formulated based on locally available feed such as cotton seed cake, rape seed cake, soybean meal, maize grain, wheat bran, rice polish, maize gluten, molasses, di-calcium phosphate and common salt. The animals were fed at 500 grams per head per day for 50 days in the first three groups, whereas the last group was kept on the old feed. The rations contained 17 to 17.5 percent crude protein, 10.87 to 11.72 MJ kg^{-1} ME and dry matter of 80 to 85 percent.

Figure 57

The results showed that the sheep and goats which were fed the three supplemental rations showed increase in productivity by 20 to 30 percent regarding live weights during dam, lamb/ kid at birth and at weaning, lamb/kid birth ratio and its survival. In addition, farmers were also advised on improved husbandry practices during this experimental period. The framers have shown keen interest in improving their husbandry practices.

Figure 57

2.3.2. Assessment of fodder production systems in Chakwal District of Punjab Province

In Chakwal district of Punjab province, two fodder production seasons winter which is Rabi fodder grown from October to April and summer which is Kharif fodder grown from May to September were observed for assessment. The aim of this fodder production assessment is to recommend more suitable options for higher productivity. These are the normal fodder production practices recorded through farmers perception followed by field and market observation. These fodders are available in turn of one to another round the year for animal feeding (details in Appendix 43).

Rain-fed and irrigated fodder production practices are adopted. In addition to fodder, the farmers also offer crop residues during the different seasons depending on availability. According to

farmers' perceptions, rain fed fodders are available round the year except November, December and January while irrigated fodders are available in different crop rotations throughout the year. It seems that the problem is not the potential for fodder production in the different seasons but rather the quantity of fodder produced. Consequently, AIP-Livestock team made following recomendations to local farmers at Chakwal to fill the gaps in feed supply:

- Sorghum Sudan (SS) Grass Hybrid is recommended as fodder providing four to five cuttings with higher biomass production. Recommended sowing date is first week of March and it will provide green fodder from end of April till October.
- The dual purpose wheat and local oat should be replaced with high yielding Oat varieties given their higher biomass and potential for multi-cuts. Recommended sowing time is October and fodder will be available from November till April.
- Mixed fodders such as Oat, gram and Brassica are also suitable for high biomass production; recommended sowing time is October and fodder will available from November to March.
- Alfalfa and oats mix is also good fodder. It can be sown in October and mixed fodder will be available from November to March. Alfalfa will be available around the year on the same field.
- Maize fodder variety is another option and can be planted either in spring or during monsoon under irrigation.
- A mix of Guar, sorghum and millet is another option. Sowing is recommended in May and June and fodder will be available till October and November.

Detailed seasonal calendars for fodder production were prepared based on farmers' perception for the two sites Dhulli and Beghal in Chakwal district of Punjab province. The seasonal fodder calendar will be prepared and distributed among the farmers for wider adoption.

2.3.3. Training of Facilitators on Farmer Centered Diagnosis Using the Feed Assessment (FEAST) Tools

The Feed Assessment (FEAST) tool was developed by ILRI and has been propagated in Africa and in some S & SE Asian countries. AIP-Livestock provided an excellent opportunity to introduce the feed assessment package to Pakistan scientists and academia. In simple, the FEAST tool matches the feed resource availability to types and number of animals the farmers rear under village conditions.

Dr. Ben Lukuyu, an ILRI scientist (Animal Nutritionist) from Nairobi and Prof. M.N.M. Ibrahim, focal person AIP-Livestock conducted a training on FEAST tools for facilitators from November 6-9 2014 in Islamabad. A total of 32 national scientists and representatives of academia from all provinces of Pakistan participated in the training. The training also included an exposure visit to Beghal village in Chakwal district of Punjab province where the trainees were provided the opportunity to collect data from farmers. The trainees conducted focus group discussions with 59 farmers and also conducted individual farmer interviews. Based on the collected information the trainees presented their reports.

2.3.4. Promotion of Improved Rabi Season Fodder Crop varieties in Chakwal District of Punjab Province

2.3.4.1. Oat

In Chakwal district of Punjab province, rain-fed cereal livestock systems are wide spread. These systems are threatened by the marked insufficiency of high protein feedstuff, the overexploitation of pastoral resources, the increasing cost of green feed, limited availability of irrigation water, change in rainfall pattern and drought. The existing feed resources are

unable to furnish the growing needs of livestock. The worsening of grazing lands has resulted in a feed shortage especially in the month of May and June and also in winter season. In winters, the farmers are growing multipurpose wheat which is low yielding. This deficit can be overcome by introducing high yielding fodder varieties. In this regard, comparison of high yielding variety of oats with their local wheat was done (Figure 59).

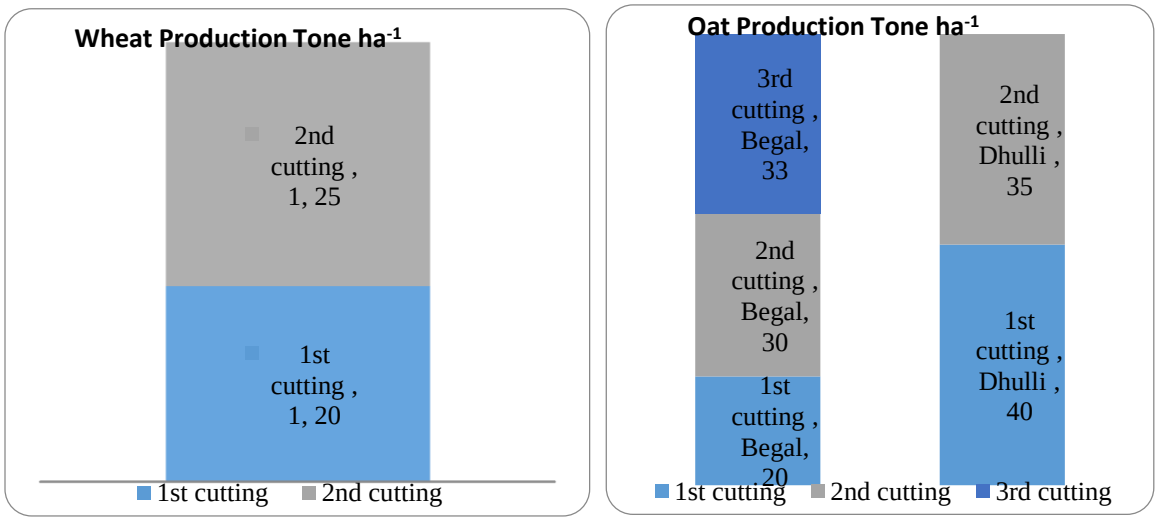


Figure 58 Comparison of fresh biomass of local wheat (farmer practices) with improved variety of NARC Oat

Improved variety of NARC Oat was provided to nine farmers at Dhulli and 13 farmers at Beghal in Chakwal district of Punjab province. Results indicate that NARC Oat produced 38 tons which is 46% more green fodder in Beghal, and 30 tones which is 40% at Dhulli as compared to local wheat used for green fodder. The retail price for Oat is Rs. 180 (US $ 1.8) per Mound in cities. If the farm gate price of Oat is estimated at Rs. 100 (US $ 1) per mound, the farmers earn Rs. 98,000 (US $ 980) and Rs. 75,000 (US $ 750) at Beghal and Dhulli, respectively. Oat green fodder increased the availability of green fodder and improved their incomes of farmers.

2.3.4.2. Alfalfa and Berseem

Pakistan has often faced food crises despite having world's largest irrigation system, abundant land and enormous human resources. To feed people and their large number of livestock requires combined efforts of policy makers, agricultural experts, extension workers and the farming community. To cope with these crises, multiple cropping is becoming popular in Pakistan which makes effective use of inputs such as soil, water, fertilizer etc. In this technique, farmers are still facing problems such as the availability of good quality seed to enhance their production. In November 2014, in Chakwal district of Punjab province high yielding Berseem that is super late variety was planted on four farmers' fields at Dhulli, Alfalfa that is Sarghoda Lucerne on four farmers' fields at Dhulli and eight farmer's field at Beghal. In last five months, farmers harvested berseem four times at Dhulli and produced 105 tons of green biomass, while farmers cultivating Alfalfa harvested twice at Dhulli and four times at Beghal and produced 57 and 61 tones fresh biomass at Dhulli and Beghal respectively, shown in Figure 60.

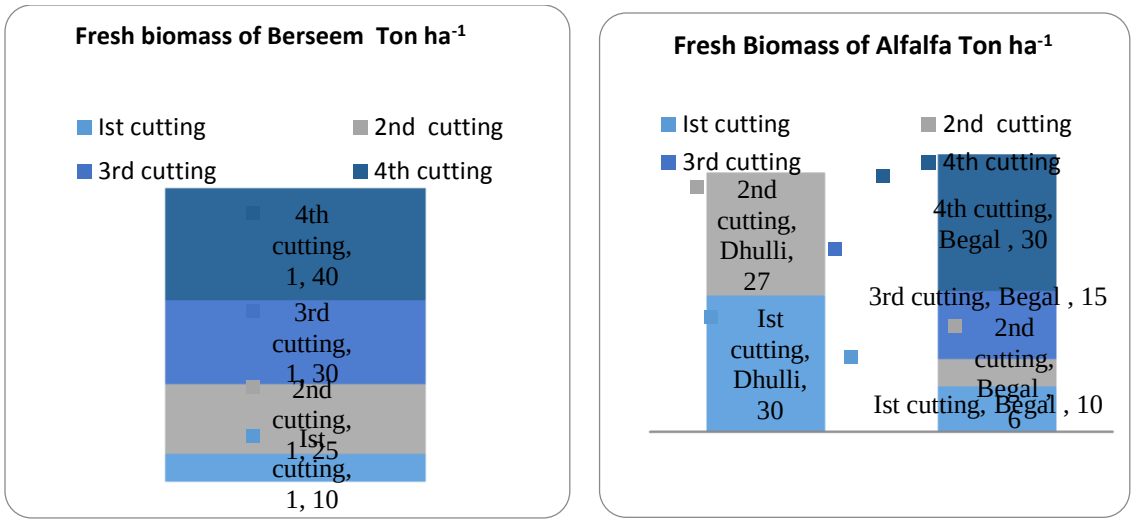


Figure 59 Comparison of Berseem and Alfalfa

2.3.4.3. Wheat and Barley

In October 2014, improved wheat varieties such as Chakwal-50, Dharabi, NARC 2009 and 2013 planted on 3 ha and the high yielding, cold and drought tolerant barley varieties such as Sanober-96 and Rakhshan 2010 were planted on 1.5 ha at Dhulli and Beghal villages in Chakwal district of Punjab province. Rainfall was timely in the season and the vegetative growth of all cereal crops was good. The data on grain and straw yield, as well as quality of straw will be collected in May or June 2015 to include in supplement feed of small ruminants.

Barley variety "Rakhshan 2010"

Wheat variety NARC 2013

Figure 60 Barley and wheat grown in Chakwal district of Punjab province

2.3.5. Promotion of Canola Hybrid for Oil Extraction and the Residue as Concentrate Feed

Rapeseed (Brassica rapa and B. napus) and mustard (B. juncea) are the important oilseed crops in Pakistan. Rapeseed and mustard seed contains 44 to 46 percent oil. In addition, its meal has 38 to 40 percent protein, with a complete profile of amino acids including lysine, methionine and cystine. The oil of canola varieties is free from erucic acid and is nutritionally more desirable for

human health. The meal from canola quality rapeseed is an excellent feed for small and large ruminants.

Canola hybrid obtained from NARC was planted on 10 farmers' fields in Dhulli and Beghal villages in Chakwal district of Punjab province. Almost 90 percent pods have been developed and it will be ready for harvest in May 2015. The data on grain yield, oil quantity and amount of canola cake will be measured and it will be linked with the supplemental feed of small ruminants.

Figure 61 Mustard crop grown at Chakwal district of Punjab province

2.3.6. Promotion of Village Based Seed Enterprises:

In Pakistan, generally the non-availability of good quality cereals and fodder seeds is a major problem, faced by the farmers to get better yields and biomass production. In this regard, the concept of Village Based Seed Enterprise has been introduced among the farmers to produce good quality seed at their own field and distribution and sales among the village community. In this regard, in October 2014 two farmers were engaged. Oats was planted in one hector in two villages Dhulli and Beghal in Chakwal district of Punjab province.

The crop stand is good and the field is regularly monitored by AIP-Livestock and NARC scientists.

Figure 62 Oats field in Chakwal district of Punjab province

2.4. Rangeland Activities

2.4.1. Cholistan desert

The Cholistan desert covers an area of about 2.6 million hectares, constituting the southern part of Bahawalpur Division in Punjab province. It is situated between latitudes 27^{o} 42` and 29$^{o}$ North and longitudes 60$^{o}$ 57`East. The length of the desert is about 480 km and breadth is from 32 to 192 km. Rainfall in this area is erratic and ranges from 100 to 200 mm. Mean minimum and maximum temperatures are 2^{o}C and 40^{o}C, respectively. The main source of income is rearing of livestock depends upon what nature can provide them in the surroundings. The local inhabitants are mostly nomads, leading pastoral way of life, with few permanent settlements in the whole desert. Water is a limiting factor and rain water is harvested in the "Tobas", which provides the fresh water to humans and livestock.

The soils of Cholistan desert are formed mainly from two types of materials i.e. River alluvium and aeolian sands. The satluj and abandoned Hakra Rivers, most probably during different stages deposited the alluvium material in the sub recent period.

In March 2015, AIP-Livestock scientists, social scientists of NARC and resource persons from livestock department Bahawalpur visited the dessert site. A detailed discussion on rangeland productivity and future improvement plan was held with the local communities in target village in Chalk No 93 DB Yazman district of Punjab province.

During AIP-Livestock visit in March 2015 it was observed that the dominant vegetations of the desert are Tamarix aphylla, Zizyphus nummularia, Haloxylon salicoricum, salsola vermiculata, Cenchrus ciliaris, Cynodon dactylon, Cymbopogon jwarancusa, Eragrostis barrelieri, Lasiurus scindicus, Panicum and Sporobolus species and the biomass at different places in the desert was found to be in the range of 50 to 120 kg ha^{-1}.

Figure 63 Livestock in Cholistan desert

2.4.2. Cactus Plantation

Introduction of cactus is being promoted as one option to cope with more frequent droughts. The succulent pads of Opuntia species serve as a source of water for livestock in dry regions and provide an important source of fodder. The Opuntia plant provides water, vitamins, carbohydrates, and calcium which is essential for animal nutrition. In March 2015, at Bahauddin Zakariya University with the collaboration of Forestry department cactus (Opuntia ficus-indica L.) was planted, with two meter row to row and one meter plant to plant distance on one acre, to test its adaptation and productivity in hot areas of Pakistan where temperature ranges between 40 to 48^{o}C in summer season.

row to row cactus plantation plant to plant distance of cactus plantation

Figure 64 Cactus plantation at Bahauddin Zakariya University

3. Vegetables

3.1. Protected Cultivation of Vegetables

3.1.1. Identify and Promote the Best Varieties of Crops Commonly Grown under Protected Cultivation

In Pakistan, the varietal development process is very slow. The main reason is a lack of germplasms, the capacity of the local public sector research institutes and the focus of the private seed sector on seed trading rather than breeding. The claimed yields of lines developed by the public sector are often not achieved in practice in farmers' fields, and so they are not widely cultivated. The farming community largely depends on old varieties and imported hybrids. These imported hybrids are being used on-farm without adequate evaluation. AIP-Vegetables is working on both variety improvement work and on-farm performance appraisals. Advanced lines were imported from AVRDC headquarters and are being tested across the country both on station and on-farm along with selected imported high yielding hyjbrids.

3.1.1.1. On Station Validation Trials

3.1.1.1.1. Protected Cultivation

3.1.1.1.1.1. Tomato

Off-season tomato production started in October 2014 with nursery raising followed by transplanting in the first week of November. Plants started bearing by mid-February 2015. Protected cultivation of tomato is losing popularity in Pakistan because of the high cost of imported hybrid seed. AVRDC has provided AVRDC advanced lines of tomato, pepper, onion, bitter gourd and vegetable soybean for testing and these have been distributed across Pakistan. AIP-Vegetables provided technical and financial assistance to commercialize improved public sector hybrid lines. This will provide low cost tomato seed to farmers.

A total of 14 hybrid lines (All imported except Sallar & Sandal) are being tested for yields under plastic tunnels in collaboration with the Vegetable Research Institute, Faisalabad. So far these research trials are progressing well and no major insect or disease attack has been observed (Figure 66).

Figure 65 Local hybrids tomato Sandal and Salaar under observation

3.1.1.1.1.2. Sweet pepper

Sweet pepper cultivation is gaining popularity in Pakistan. Colored varieties of capsicums are widely grown under protected cultivation and harvested at the immature green stage. There is a need to introduce those that are meant to be harvested green to increase the yields of the crop. Off season on-farm research validation trials of four imported sweet pepper hybrids namely Coral, Alina, Super globe and Capino are in progress in collaboration with the Vegetable Research Institute, Faisalabad. The crop is in the vegetative stage and initial observations suggest that super globe has higher relative vigor.

3.1.1.1.1.3. Chili

Protected cultivation of Chili has recently become popular in Punjab province of Pakistan. Commercially available Chili cultivars/hybrids need to be screened for their performance under cover. In the second year of the project the screening of 16 imported Chili hybrids is in progress at the Vegetable Research Institute, Faisalabad under protected cultivation. Initial observations suggest that Forever F1 and Gourd 11-19 perform better in the vegetative stage. Seven exotic Chili varieties obtained from AVRDC were also tested at high altitude in collaboration with the Agriculture Research Station-Baffa (Mansahra). The results of the study showed that AVPP-0206 gave the highest per plant yield of 0.55 kg followed by AVPP-0514 (0.54 kg), whereas, the lowest yield was recorded in AVPP-0506 (0.51 kg). Eleven AVRDC advanced Chili lines are under observation by the Arid Zone Research Institute, Umerkot-Sindh. A nursery of these varieties has been established and as soon as the weather improves, transplanting will be done.

3.1.1.1.1.4. Bitter gourd

Bitter gourd is important vegetable and very few local high yielding varieties of bitter gourd are available in Pakistan. AIP-Vegetables in collaboration with six public sector research institutes namely the Agriculture Research Institute in Mingora district and the Arid Zone Research Institute in DI Khan district of KP province, the Vegetable Program, NARC- Islamabad, the Vegetable Research Institute, Faisalabad district of Punjab province, the Arid Zone Research Institute (AZRI), Umerkot district of Sindh province and the Balochistan Agriculture Research Center, Quetta district of Balochistan province are testing of six AVRDC advanced lines of bitter gourd across the country. This crop has already been planted at AZRI, Umerkot. Germination data showed that AVBG-1304 was best, with a germination rate of 86.7 percent, followed by AVBG-1334 at 83.3 percent and lowest was the local check at 5.67 percent. In other areas, sowing will be started as soon as the temperature and other environmental conditions improve.

3.1.1.1.2. Natural off Season

3.1.1.1.2.1. Tomato

A total of 11 varieties advanced AVRDC lines were tested in collaboration with the Institute of PIant Introduction, Southern Agricultural Research Center-Karachi in Sindh province. The line AVTO-1418 gave the highest yield of 24 t/ha, followed by AVTO-1424 at 23.7 t/ha and the lowest yield was from AVTO-1405 which was at 5.0 t/ha. These figures compare to the average national yields of tomatoes under open

field conditions that range from 8.5 to 10.5 t/ha, according to Fruit, Vegetables and Condiments Statistics of Pakistan in 2012-13. The trials of the same 11 tomato AVRDC advance lines are being replicated in collaboration with three public sector research institutes namely the Agriculture Research Institute Mingora-Swat in KP province, the National Agriculture Research Center-Islamabad, and the Arid Zone Research Institute-Umerkot district of Sindh province.

3.1.1.1.3. Normal Growing Season

3.1.1.1.3.1. Tomato

A total of eight advanced tomato varieties were tested under high altitude temperate conditions in collaboration with the Agriculture Research Station, Baffa-Mansahra District of KP province. The results of the study showed that AVTO-9803 gave the highest per plant yield of 1.9 kg, followed by AVTO-9601 at 1.6 kg and lowest yield was at 0.5kg for AVTO-1130. A total of nine advanced tomato varieties were tested in collaboration with the Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad district of Punjab province. Unfortunately, due to severe rainfall and a hail storm in March 2014, the crop was damaged. However seeds were harvested from the remaining stock and trials will be repeated this year. Moreover, 10 AVRDC advanced lines of tomato did not perform well at the Arid Zone Research Institute-Bahawalpur district of Punjab province. There was no germination in four lines and remaining showed less than 8 percent germination.

3.1.1.1.3.2. Onion

Onions are widely grown in Pakistan, but only five Pakistan's promising varieties namely Phulkara, Nasarpuri, Chiltan-89, Saryab Red and Swat-1 have been available for cultivation in different agro climatic zones for many years. Under the AIP program two public sector research institutes, the Arid Zone Research Institute (AZRI), Bahawalpur in Punjab province and AZRI, Umerkot in Sindh province planted five advanced varieties / lines of onion last year. Their germination rates are given in Appendix 44.

Moreover, ten AVRDC advanced onion lines namely AVON 1073, AVON 1301, AVON 1013, AVON 1014, AVON 1016, AVON 1037, AVON 1028, AVON 1027, AVON 1067, AVON 1056 are being tested by the Vegetable Program, NARC under Islamabad conditions.

3.1.1.1.3.3. Vegetable soybean

A total of 15 vegetable soybean germplasm advance lines received from AVRDC were tested at the National Agricultural Research Center, Islamabad. Out of which 13 were vegetable soybean and only two were grain soybean. While of these 13, six had basmati flavor. One of the entries VI043922 did not germinate and some had poor germination. The results of the study showed that the maximum seed yield was obtained from AVSB0101 at 2.4 t/ha, followed by AVS B0102 at 2.2 t/ha and lowest yield was recorded in AVSB0701 at 0.1 t/ha. The same trial will be repeated in June and July 2015.

3.1.1.2. On Farm Adaptability Trials

3.1.1.2.1. Protected Cultivation

3.1.1.2.1.1. Tomato

The evaluation of nine tomato hybrids (seven imported and two local) has been undertaken at Sheikhupura, Nurpur Thal and Chakri-Rawalpindi in Punjab province, DI Khan and Haripur in KP province and Dhadar in Balochistan province under protected cultivation. The tomato hybrid Sahil gave the highest yield at 1.9 t/ha, followed by Kimia at 1.3 t/ha from four pickings. Two more hybrids were tested at the high altitude of Mansahra in KP province in collaboration with the National Tea and High Value vegetable Research Institute (NTHRI) in Shinkiari district of KP provine Tomato Hybrid F1 gave a yield of 19.0 t/ha in a farmer's field, followed by Beldar at 3.7 t/ha. Total Six tomato hybrids were tested at Rind Ali-Dhader district of Balochistan province in collaboration with the Directorate of Vegetable Seed Production, Quetta district of Balochistan province. Salaar gave highest yield at 82.0 t/ha, followed by Yanki at 76.6 t/ha and lowest yield was recorded with Denar at 42.6 t/ha at the end of the long growing period.

3.1.1.2.1.2. Cucumber

The current yield potential of cucumber open pollinated varieties is low and there is a need to introduce high yielding varieties and hybrids. Three public sector research institutes namely the Vegetable Research Institute in Faisalabad district of Punjab province, the Agricultural Research Institute in D. I. Khan district of KP province and the Vegetable Program at NARC in Islamabad have been evaluating ten cucumber hybrids imported by mulyi-national companies under different names. These trials are in progress in farmers' fields in five clusters in Faisalabad and Rawalpindi district of Punjab province and D. I. Khan district of KP province based on four to six pickings. So far the early maturing hybrid Noble have given the best yield of 4.1 t/ha in a demo plot at Shiekhupura district of Punjab province and completed its growing period while the three hybrids Jalal, 2833 and Abdullah have also started early fruiting. Initial data collection showed that hybrid 2833 is high yielding, early maturing and disease resistant, and the first picks have had very positive impact on farmer incomes (Figure 67).

Figure 66 Cucumber picking by female workers is in progress at Chevanda-Faisalabad district of Punjab province

3.1.1.2.1.3. Sweet Pepper

In Punjab province, the evaluation of three sweet pepper imported hybrids namely Orebellea, Extra 2 and Bonus is in progress at Sheikhupura and Faisalabad. Similarly at the high altitude of Mansahra three hybrids of sweet Pepper have also been evaluated. Of these, Sky F1 gave a yield of 2.1 t/ha, followed by Caption F1 at 1.0 t/ha and lowest yield was recorded from Early Marlin at 0.9 t/ha.

3.1.1.2.1.4. Chili

The narrow choice of low yielding cultivars limits farmer options. The average national yield of Chilies is 2.3 t/ha according to Fruit, Vegetables and Condiments Statistics of Pakistan in 2012-13. The evaluation of three Chili imported hybrids namely Arif-410, Red Revil and P6 plus a local check is in progress at two districts Faisalabad and Sheikhupura in Punjab province. Trials are progressing well and plants are flowering heavily. However, due to rain and hail storms late flower setting has delayed fruit setting in Bhikhi- Sheikhupura.

3.1.1.2.1.5. Bitter Gourd

A limited choice, low yields and the different taste of hybrid varieties have affected bitter gourd cultivation in the country. Five bitter gourd hybrids (four imported and one local) namely Palee, Parachi, TS-222, 485 and Bejo-034 and a local variety locally known as Kala Karela are under observation at two districts Sheikhupura, Faisalabad in Punjab province and one district DI Khan in KP province. All plots are healthy and no major threat has been reported yet.

3.1.1.2.1.6. Vegetable Marrow

Vegetable marrow is a relatively new crop with a narrow choice of available low yielding varieties. Therefore, the evaluation of eight vegetable marrow imported hybrids with local name given as Komal, Farid, Shehryar, Sanam, Liza, Ezra, Zarra and Chrisma is in progress at two districts Sheikhupura and Faisalabad in Punjab province and two districts Mingora and D. I. Khan in KP province. The crop is healthy and flower setting has started.

3.1.1.2.2. Natural Off-Season

There are vegetable-producing pockets that are frost-free in different part of the country. The growing season is the same as for under cover cultivation also known as plasticulture and natural off-season production.

Tomato

Tomato is cultivated on a large scale in Sindh province due to favorable environmental conditions. Local varieties are low yielding and susceptible to disease. Farmers prefer to cultivate hybrid tomatoes to minimize their loss. Various tomato hybrids were evaluated in farmers' fields in Badin, Mirpurkhas, UmerKot districts of Sindh province and Khushab and Chakwal districts of Punjab province. The results are shown in Appendix 45.

3.1.1.3. Demonstration Plots

3.1.1.3.1. Early Cucumber Cultivation under Nets

Due to the high market potential of early season cucumber farmers prefer cucumber cultivation sunder nets. This type of cucumber cultivation is expensive and its management is also time consuming. In Punjab province, a demonstration tunnel was setup at Bhikhi- Sheikhupura to aware the farming community about the benefits of early

cropping of cucumber. It will also educate farmers about the management of net tunnels. The Hybrid Noble was used due to its company's claim that it is more resistant to downy mildew attack which is a serious threat to the early cucumber crop. The demo plot of Noble yielded 4.1 t/ha in six pickings with potential for more pickings to follow, before downy mildew attack subsequently damaged the crop.

3.1.1.3.2. Cucumber and Tomato Cultivation with Drip Irrigation System in Protected Environment

Cucumber is susceptible to downy mildew attack when grown under plastic. In order to introduce better integrated pest management (IPM) practices to control the diseases, a demonstration plot of cucumber using drip irrigation was established at Sheikhupura district of Punjab province. This produces lower humidity in the tunnel than furrow irrigation. After consultation with seed companies and farmers, the cucumber hybrid namely Termoses was used in this demonstration. Another cucumber demonstration plot was established at the Vegetable Program at NARC in Islamabad. Both demonstration plots are in the vegetative stage and visual observation suggests that the disease attack was comparatively less in drip irrigated plots than in furrow irrigated ones. Water and fertilizer were applied directly to the root zone of crops which will help in minimizing the humidity and the need for hoeing for weed control in the tunnel. Four tomato demonstration plots were also established in collaboration with three partner institutes namely the Vegetable Research Institute in Faisalabad district of Punjab province, the Agricultural Research Institute in D. I. Khan district of KP province and the Vegetable Program at NARC in Islamabad (Results are shown in Appendix 46).

3.1.2. Improved Insect and Disease Management to Reduce Pesticide Use in Protected Cultivation

Plasticulture provides partial climate control and is a manually operated way of growing vegetables to avoid frost and low night temperatures during winter season from mid-November to mid-February. However, these dates can change according to the local environmental conditions. In Punjab province, climatic conditions appear to have changed over the last decade. From the start of January, foggy days occur which usually decrease the temperature and this condition persists for three to four weeks. During these days the humidity level increases by up to 80 percent inside the plastic tunnel. This is a very favorable environment for diseases like downy mildew and powdery mildew to attack plants. To avoid loss of the crop, fungicide applications are needed. Due to a lack of scientific knowledge farmers apply an indiscriminate amount of fungicides and pesticides to control diseases and insects without knowing the health implications. This also increases the cost of production beyond the reach of small holder farmers.

Therefore, IPM techniques were introdued to vegetable growers. To encourage large scale adaptation, the AIP-Vegetables organized 11 trainings on healthy vegetable production, off-season vegetable production and control of diseases using IPM techniques (Appendix 47).

A total of 239 farmers which includes 28 women were trained in collaboration with partner research institutes. The training contents include lectures and practical demonstrations of nursery bed preparation, tunnel constructions, planting layout for different vegetables, identification of diseases, insect and pests and IPM techniques to avoid their spread, suitable fungicide and chemicals and fertilizer requirement of vegetables at different stages (Figure 68, 69, 70, 71).

Figure 67 Traditional nursery Bunch

Figure 68 Compost Preparation

Figure 69 Healthy vegetable nursery production method in tray

Figure 70 Single healthy plant ready for transplantation

3.1.3. Evaluate and Identify Summer Crops for Protected Cultivation with Higher Economic Returns

The study was conducted on coriander, spinach and bunching onion over the last season. A high amount of additional income i.e. Rs. 70,000 per ha was recorded from growing spinach under green shade netting in Islamabad. Given the success of spinach, this season we plan to promote spinach and coriander in different plasticulture clusters of the AIP-Vegetables. A total of six sites which includes Sheikhupura, Faisalabad, Noorpur Thal districts of Punjab province, Haripur district of KP province and ICT region Rawalpindi have been selected to demonstrate the production of spinach, coriander and bunching onion under shade technology. Farmer selection of the demonstration plot sites is in progress and suitable varieties of spinach, bunching onion and coriander is being done in consultation between the AIP-Vegetables partners and Punjab Agriculture University (PAU) in Ludhiana in India. In March 2015, a team of protected cultivation scientists from PAU visited two project sites in Sheikhupura and Faisalabad districts of Punjab province.

3.1.4. Identify and Promote Improved Protected Cultivation Systems

Demonstration plots of different vegetables were established in various clusters out of which five were provided with simple drip irrigation systems for more efficient fertigation and better control of diseases. Different layout plans for crops such as vegetable marrow were demonstrated in

farmers' fields. A meeting was held to determine means of improving the design, structure and geometry of tunnels in which the AVRDC Regional Director and experts from PAU also participated. AIP-Vegetables planned to introduce 50mm transparent sheet to cover the tunnel. In the next season, mulching will also be put below the ridges instead of on top to improve the operation of the tunnels. This technology is very popular in Indian Punjab and will be replicated in Pakistan. Polynet houses is another suitable technology which is practiced by farmers in the Indian Punjab. Polynet houses increases the length of the growing season, increases the quality of the produce and provides better control of diseases and insects. The agriculture engineer will be sent to PAU for training on the construction of polynet houses. Similarly, two Horticulturists will also be trained in PAU, Ludhiana in crop management in polynet houses. One demonstration polynet house will then be constructed in Pakistan with the help of a local fabricator before the next season in a vegetable project area.

3.1.4.1. Drip Irrigation System for Tunnel Farming

Five demonstrative drip irrigation systems have been installed in covered production systems covering areas of 10 to 20 Marla which is 250-500 m^2. Two of these systems were set up in partner institutes which are in Punjab province at the Vegetable Research Institute in Faisalabad and in KP province at the Agriculture Research Institute in D. I. Khan. The remaining three systems were installed in farmers' fields at Mr. Suleman's field at Mang in Haripur district of Punjab province and in Punjab province at Mr. Munawar Hussain's field at Chevanda-Gojra and Ch. Hakim Ali's field at Bhikki-Sheikhupura. These farmers acclaim that the new system has saved the time and resources (quatified in the coming six montly) spent on weeding/hoeing and disease/insect management.

The drip irrigation system that was installed in Islamabad is also working well. The tomato crop was transplanted in the tunnel on October 8, 2014. Since then, 2000 liters of water has been applied during five irrigations and three pickings have been completed. The drip irrigation system and use of mulchjing sheeting has helped them to cut down the time and resources spent on weeding/hoeing. Growing awareness of such savings have inspired a number of farmers to contact us to extend the area irrigated under drip irrigation systems and some farmers are interested installing drip irrigation systems themselves. Demonstrations to operate and maintain such systems were provided to farmers and AIP-Vegetables Research Associates (Figure 72 and 73).

Installation of a replica of the system at the Agriculture Research Institute, Quetta in Balochistan province will be completed soon. A summary of the assistance provided to project beneficiaries is included in Appendix 48.

Figure 71 Tomato planted and irrigated with drip irrigation system at NARC, Islamabad

Figure 72 Ag Engineer demonstrating a drip irrigation-system to visiting Balochistan's farmers

3.1.4.2. Market Potential of Off-Season Cucumber

In Pakistan, the normal off season production of cucumber under plastic tunnels starts in November and ends in May. However, it was observed that an additional crop harvest of cucumbers can be obtained by providing a tissue sheet cover to the crop from September to November and a plastic cover in December in place of the tissue sheet. This practice can make cucumbers ready for market one and half months before the normal off-season crop. During the months of December and January the cucumber market price is very high. Market observations were recorded at two locations in the Bhikhi-Sheikhupura and Chevanda-Gojra markets in Punjab province. In the Bhikhi market farmers sell their first picking at a price of Rs. 22 per kg. The graph in Figure 74 shows an increasing trend in prices until the farmer makes a fourth picking, and then a decreasing trend in prices, until a final rise in prices at the end of the season. The maximum price obtained by farmers at the Bhikhi-Sheikhupura market was Rs. 60 per kg. However, farmers in the Chevanda-Gojra area face a very different local market situation there the price in December 2014 was Rs. 58 per Kg for the first picking, and thereafter the price declines as the season progresses. The last and sixth picking sold at Rs. 22 per kg. During the normal growing season the price of cucumber is usually not more than Rs. 2-5 per kg at the farm gate.

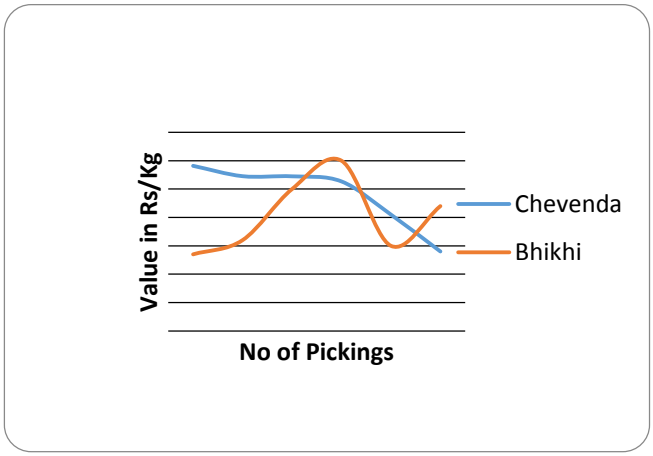


Figure 73 Market potential of off season Cucumber at Two Different Location

3.2. Improved Mungbean Production

This sub-project started during the last year with the objectives of increasing mungbean yields and also to expand the cropping area and explore new niches for production. It involved introduction of mungbean into various cereal cropping systems, as well as intercropping in sugarcane. Six partner institutes were selected to participate in project activities. NARC in Islamabad and Barani Agriculture Research Institute (BARI) in Chakwal were selected for double-cropping trials in the Pothwar region of Punjab province. The partners selected for the rice-wheat cropping system in Punjab and Sindh provinces are Ayub Agriculture Research Institute (AARI), Faisalabad and the Quaid-e-Awam Agriculture Research Institute (QAARI) in Larkana district, respectively. The responsibility for testing mungbean intercropping with sugarcane was assigned to AARI and to the National Sugar & Tropical Horticulture Research Institute (NSTHRI) in Thatta district of Sindh province. The Arid Zone Research Institute (AZRI) in Bhakkar was selected for this task in the traditional mungbean area of Punjab province that accounts for more than 90 percent of country's mungbean production. Recently intercropping in citrus has also been initiated. For this purpose, the Citrus Research Institute (CRI) in Sargodha district of Punjab province is taking part in this activity which started in the last week of March 2015. A summary of major activities under each priority is given below:

3.2.1. Identify opportunities to improve mungbean production as part of the traditional and rice-wheat cropping system as well as through inter-cropping (irrigated); and double cropping in wheat-fallow areas of the Pothwar region (rainfed)

This is the most important activity of this sub-project and the interventions were made in four different cropping systems:

3.2.1.1. Mungbean Production in the Traditional Area

This sub-activity was carried out by AZRI in Bhakkar in the traditional mungbean area where it is a major crop. The cropping season of this activity will start in May 2015.

3.2.1.2. Mungbean Production in the Rice-Wheat Cropping System

This sub-activity was carried out by AARI in Faisalabad of Punjab province and QAARI in Larkana district of Sindh province during the last cropping season. The next crop will start in April-May 2015 after the wheat harvest.

3.2.1.3. Mungbean Production through Intercropping With Sugarcane

The two institutes, NSTHRI at Thatta district in Sindh province and Pulses Research Institute (PRI) *A*ARI in *Faisalabad* in Punjab province are involved in Mungbean production through intercropping with sugarcane. The planting season in Sindh province is earlier compared to Punjab province which started in February 2015. The intercropping of mungbean has completed in Sindh but could not be started in Punjab so far due to some cold and rainy weather conditions. The institute has selected 26 new farmers along with the previous ones to expand the activity and to meet the target for 2015 (Appendix 49 (b)).

In the two districts of Sindh province, mungbean intercropping has been carried out at 22 farmer's field sites. The earlier planted crop showed good germination and emergence, the seeds were sown by broadcasting, thinning was carried out at some of the sites. A partial burning or complete killing of mungbean seedlings was observed due to the effects of unusual cold weather conditions which hit some of the sites in Thatta district of Sindh during the month of February, 2015 (Figure 75 and 76).

Figure 74 Mungbean intercropping with sugarcane in Sajawal district (Sindh) at the early stage. The AVRDC Agronomist is sharing his knowledge with the NSTHRI Agronomist about the effect of a dense broadcast crop in reducing potential yield.

Figure 75 A partial burning or complete killing of mungbean seedlings noticed where unusual cold winds hit the crop in Thatta district (Sindh) during the month of February, 2015 at some of the sites.

3.2.1.4. Mungbean Production through Double Cropping in Pothwar Region

The responsibility for trialing mungbean production through double cropping in Pothwar region of Punjab province was shared by NARC in Islamabad and BARI in Chakwal district of Punjab province. Demonstration plots of high yielding varieties NM-11 and AZRI-06 were planted in seven clusters where the wheat-fallow system was followed. The improved production practices implemented including line sowing, application of rhizobium + PSB-Phosphorus Solubilizing Bacteria, post-emergence chemical weed control and IPM to control insect pests. The mean yields based on location ranged from 600 to 1,300 kg/ha and net profits of Rs. 13,000 to 65,500 were earned by the farmers as compared to the last 60 years national average of 600 to 700 kg/ha (Figure 77 and Appendix 51.).

Figure 76 a bumper crop of mungbean variety NM-11 in Attock district of Punjab

3.2.1.5. Improving the Tolerance of Mungbean Varieties to Abiotic Stresses

More intensive cropping rotations and expanding mungbean production to new areas that may not be ideally suited to the crop can challenge the performance of existing varieties. Work has been continuing in India to select mungbean lines with better heat, drought and salinity tolerance. Work over the last year in two collaborating universities has identified 11 accessions with high heat tolerance and 11 lines with high salinity tolerance.

3.2.2. Evaluate the Efficiency and Effectiveness of the National Seed Supply System and Assess the Opportunity to Develop "Seed Villages" For Production of High Quality Seed of Improved Varieties

This activity was undertaken by AZRI in Bhakkar district of Punjab province and the seed produced during last cropping season through this activity has been retained by the 48 growers. This seed will be shared with their fellow farmers for sowing in the next cropping season starting in May 2015.

3.2.3. Evaluate Methods Including Resistance Breeding for Improving Postharvest Storage to Reduce Bruchid Damage

3.2.3.1. Training of beneficiaries to minimize postharvest storage losses

The AIP-Vegetables' partner institutes demonstrated chemical control of bruchid in the stores to farmers at each location where the demonstration plots were planted. On January 20, a post-harvest training on Bhakkar to show them how to minimize post-harvest losses of their recently harvested crop of 16 farmers was conducted by the Arid Zone Research Institute (AZRI) in Bhakkar district of Punjab province (Figure 78). These trained farmers will act as trainers in their villages to reduce the postharvest losses of the other farmers in that area. It will help them to maintain good quality seed for their next crop and their marketing of quality produce. It was focused on the effective control of stored grains' insect pests, particularly bruchids in order to maintain high quality seed of approved varieties of mungbean and to enhance regional productivity. The farmers were made aware of preventive and curative measures for insect pests of stored mungbean seed also known as Khapra, Red flour beetle (*Trogoderma granarium*), Dhora beetle (*Callosobruchus maculatus*) as these cause 20 to 30 percent losses in storage. The advanced new methods and old practices of the farmers were compared to enhance their understanding of the control measures. Farmers need to produce their own high quality seed, maintain seed quality in the store and share seed with their neighbors.

Figure 77 Farmer participants are learning the Post-harvest technology of mungbean, AZRI, Bhakkar, January 20, 2015

3.2.3.2. Bruchid resistance breeding in Pakistan

A total of eighteen mungbean advanced lines including 14 with improved resistance and four improved varieties from Pakistan were assessed for resistance against C. maculatus which is the prevalent bruchid species in Pakistan. This was done under controlled conditions in collaboration with the Integrated Pest Management Program at NARC in Islamabad. The design was a randomized complete block with three replications. Data on the number of adults emerged and the percentage of damaged grains were recorded. The line VI001802 B-

G showed the lowest percentage of grain damage at 0.7 percent followed by the line VI001709 B-G and AVMU 8901 with 1.3 percent and 11.5 percent grain damage, respectively. These three lines were found to be resistant against C. maculatus. The experiment will be repeated to confirm the findings.

3.2.3.3. Hybridization between Bruchid Resistant and Susceptible but High Yielding Mungbean Varieties

The three putative bruchid resistant lines namely AVMU 8901, VI001709 B-G and VI001802 B-G and four lines unconfirmed by NARC but initially confirmed by AIP-Vegetables namely VI06322 A-G, AVMU8902, AVMU0401 and AVMU40002 were used as resistant parents in the hybridization program during the spring season in 2014. The unconfirmed bruchid resistant lines will be tested in due course. Crosses were made between seven bruchid resistant lines and four susceptible but high yielding varieties namely NM-11, NM-06, AZRI-06 and NCM-2013. Total 24 cross combinations were attempted out of which only 15 were successful. The F_1 generation of these 15 cross combinations were planted during summer 2014. During the summer season, the crossing block was also planted for hybridization between nine bruchid lines which are resistant and susceptible. Seed obtained from nine F_1 combinations and the parents are being tested for bruchid resistance under laboratory condition.

3.2.3.4. Bruchid Resistance Breeding in Taiwan and Hyderabad

3.2.3.4.1. Bruchid Resistant Lines Developed Using Resistant Mungbean Accessions V2709 and V2802

Bruchid resistant mungbean accessions namely V 2802 and V 2709 were hybridized with NM 94. Phenotyping of the F3 generation was carried out in Taiwan for resistance to Callosobruchus chinensis and in Hyderabad district of Sindh province for resistance to C. maculatus.

3.2.3.4.2. Resistance Using V 2802

Resistant lines (F4) were grown in the field in Taiwan and lines with good agronomic performance were selected. The progenies of the selected plants (F5) were further screened for bruchid resistance. Out of 150 lines, 30 showed no damage (Appendix 52 (a)). Out of 55 F3 families screened in Hyderabad, 20 sustained no damage (Appendix 52 (b)).

3.2.3.4.3. Resistance using V 2709

Out of 150 F_3 families, 17 families showed less than 26 percent damage (Appendix 52 (c).).

3.2.4. Identify opportunities for adoption of IPM practices in mungbean cultivation

Since no crop was in the field during most of the reporting period, no activity took place. No insect pests were observed on the recently intercropped mungbean with sugarcane in Sindh province.

3.2.5. Assess the opportunities for Mechanical Harvesting of Mungbean

Mechanical harvesting of mungbean has never done in Pakistan. During 2014, a small combine harvester was modified and tried on chickpea and mashbean harvesting as a first step. It harvested chickpea successfully, while for mungbean crops it was not successful as the crop remained green after the pods are mature. Different chemical desiccants were evaluated to dry the crop and finally Paraquat, a dessicant at the rate of 3.0 l/ha was found the most effective in drying the crop within four to five days of application. It was applied to mungbean seed production blocks planted on 5.0 ha at NARC. At first the modified small combine Heigy harvester

was used and later a large wheat combine harvester with a few adjustments was used on a large area of mungbean at NARC. It is a big breakthrough towards making complete mechanization for mungbean production possible in Pakistan (Figure 79 and 80).

Figure 78 Small Heigy combine harvester was made functional and successfully experimented on a small scale to harvest a chemically desiccated mungbean field at NARC, October 2014

Figure 79 The success on a small scale led to the use of a large wheat combine harvester after a few adjustments on desiccated mungbean field at NARC, October 2, 2014

3.3. Vegetable Value Chains

In 2014, AIP-Vegetables initiated vegetable value chains sub-project started which focused on the two serious problems of lack of quality vegetable seeds at affordable prices which contributes to the country's heavy reliance on imports which is estimated at 64 percent of seed requirements and the high postharvest losses of fresh vegetables estimated at 15 to 40 percent of total production. Both problems reduce producers' incomes, limit the supply of vegetables to consumers and contribute to poverty and food insecurity in Pakistan. This sub-project follows the revised work program developed during a project workshop on postharvest strategies for value chain improvement on September 17-18, 2014 in Islamabad. The workshop also redefined the overall and specific end-of-project vision and activity targets. It has two main activities responding to the above two problems relating to the seed vegetable value chain and the fresh-market vegetable value chain.

3.3.1. Increased National Vegetable Seed Production to Improve Supplies and Reduce Prices to Farmers

3.3.1.1. Baseline Study and Seed Value Chain Analysis of At Least Four Major Vegetables including Onion and Tomato

The final report of the vegetable value chain baseline study has been completed in this reporting period. Highlights of the report relating to seed value chains are as follows:

- The survey was conducted in four provinces of Pakistan, which included Quetta in Balochistan province, Kunri and Karachi in Sindh province, Bahawalpur, Gujranwala, Faisalabad and Lahore in Punjab province and Swat and Tamirgra in KP province. The total number of respondents was 146, which includes 74 vegetable growers (VGs) and 72 seed dealers (SDs). Focus group discussions (FGDs) were also carried out for similar groups of respondents at several locations in the four target provinces to assess, clarify, and confirm some of the information gathered from the survey.
- Most VGs were dependent on external sources of seeds because hybrid varieties can only be sourced from SDs or seed companies. There is a lack of high yielding open pollinated

varieties (OPVs), a lack of expertise in vegetable seed production, low confidence in regard to available OPVs and poor quality of OPV seeds.

- Only three to 19 percent of VGs grew vegetables for seeds. The total areas of tomato, onion, chili, okra and cucumber grown for seeds usually ranged from about 1,000 to 2,000 square meters.
- VGs were keen to help in meeting the seed requirement of fellow farmers. Seed production technologies, a better marketing system, collaboration and partnership with private and public sector agencies were recommended. This indicates a high potential to increase the seed production of major vegetables.
- Among SDs, only about 23 to 32 percent had business registration or seed sales permits; a pre-requisit to sell seeds. About 87 percent of SDs were selling both hybrids and OPVs vegetable seeds, particularly tomato, onion, chili and cucumber. Their operations were either at the local, national or international level.
- Most SDs sold seeds of tomato, onion, chili, and cucumber hybrids and OPVs. The average quantity of seeds sold ranged from four to 403 kg in the last season. The quantities of OPV seeds were higher than those of hybrids.
- SDs found it difficult to classify hybrids and OPVs. A total of 16 cultivars/varieties of tomato were sold by seed dealers last season namely Raja, Fransis, Moon Star, Rachna, GVS1010, Sahil, M55, E1359, Poni Express, Green Gold, Quartz, Yakki, Larika, Dollar, Holland and Rio Grandi. The latter five tomato varieties were popular among VGs with Rio Grandi being most popular. For onion, 10 cultivars/varieties were sold namely Tikki, Recita, Naserpuri, Red Commander, Flat Globe, Phulkara, and Swat-1. Where Swat-1 is the most popular variety. Five chili varieties were sold namely Sky-2, P-6, 410-S, Sun Valley, and Rosy F1. More VGs planted Sky-2. Total 13 cucumber varieties were sold which includes Edna, Deep Heat, Yousuf, Internet, March, Alpha, Mehran, Abdullah, Waleed, Saeed, Bilbio, Market More, and Long Red. Out of these Mehran is the most popular.
- Most SDs sourced their seeds from local farmers and seed companies or from imports. A small number of SDs obtained seeds from government agencies. They were satisfied with the quality of seeds. Most of them promoted seed sales through various means which includes media, exhibitions, and personal contacts. SDs also indicated their satisfaction with seed storage and available seed supplies to meet farmer demands.
- Losses of seeds were experienced by about 51 percent of SDs, at an average of Rs. 132,879 in last season. The maximum loss amounted to Rs. 1,000,000 due to poor weather conditions.
- More than 88 percent of SDs were involved in transferring technology to vegetable growers particularly information about the variety. However, most had no knowledge of production technologies, sources of seeds, and other seed sale related information. In addition, most SDs were facing financial hardship and resorted to borrowing from family and friends and only 22 percent of SDs tapped credit from commercial banks.

3.3.1.2. Workshop to Validate Survey Findings, Establish a Start-Of-Project Baseline, Identify Major Bottlenecks, And Set Priorities for Interventions Including Suitable Vegetables and Locations for Seed Production

In March 2015, four stakeholders' validation workshops were conducted in Faisalabad district of Punjab province, Quetta district of Balochistan province, Kunri district of Sindh province and Swat district of KP province (Appendix 53). The workshops validated the findings of both the seed and fresh-market value chain surveys. Highlights of the workshop that relate to seed value chains are as follows:

Major Issues:

- The use of uncertified, mixed, poor quality and unhealthy seeds which results in production of vegetables that are vulnerable to diseases and unable to cope with environmental stresses and poor management.
- Traditional but poor harvesting and produce handling methods
- Poor quality bulk packaging

Recommendations:

- Training of farmers, traders and other stakeholders in value chain development, post-harvest management and good agriculture practices.
- Capacity building of relevant stakeholders to avoid adulterated inputs i.e. seeds, balanced use of fertilizers, and judicious use of insecticides/pesticides to avoid qualitative postharvest losses.
- AIP-Vegetables should establish a system in collaboration with the concerned public sector organizations to exercise to eliminate the sale of uncertified vegetable seeds.
- AIP-Vegetables and partners should assist in linking farmers to national and international markets.

A final workshop has been scheduled on April 8, 2015 to validate the findings of this survey.

3.3.1.3. Evaluation Trials for Improved Varieties of At Least Two Major Vegetables Particularly Onion and Tomato in KP, Punjab and Islamabad

Evaluation trials for high yields and long shelf life of tomato, chili and onion varieties/lines are reported under Activity III.b.

3.3.1.4. Build capacity and provide technical backstopping on improved seed production, processing, packaging, storage and marketing.

Two trainings on onion seed production were conducted in Mingora district of KP and at NARC Islamabad, training 45 farmers which include four women participants (Appendix 54). The training involved hands on activities mainly focusing on seed selection, production, threshing and storage.

3.3.1.5. Facilitate Seed Production of Improved Varieties of At Least Four Major Vegetable on 40 Ha Of Land to Meet the Seed Requirement of 2,000 Ha Production for Seed, Fresh Market and Processing

During the year AIP-Vegetables' partners in the public and private sectors (Appendix 56 (c)) were assigned areas of five crops for seed production namely onion on 3.0 ha, peas on 2.0 ha, tomato on 0.5 h, okra on 2.5 ha and chili on 2.0 ha. The partner research institutes had produced basic seed of onion, peas, okra, tomato and chili which has been provided to farmers for further bulking up. The private sector partners planted seed crops on the farms of their contract growers and the public sector partner institutes either planted seed crops on their own land or on that of contract farmers provided through seed dealers. The field work for most crops was started in October 2014 and for summer vegetables in the beginning of March 2015 (Appendix 57).

3.3.1.5.1. Onion

An area of 0.5 ha of the onion variety Swat-1 was planted for seed production in two districts Swat and Bunir of KP province by ARI, Mingora (Figure 81 and 82). Understanding

the postharvest value chain for onion is a key interest of this sub-project. The Vegetable Program at NARC had also planted Swat-1 for seed production in the Pothwar region of Punjab province. Swat-1 is suitable for upper Pakistan as it is high yielding, pink in color and is an officially approved variety. The plots were in good condition at all places and flowering has already started**.** Weeding, hoeing and irrigation practices are underway.

Figure 80 Onion seed crop at Agricultural Research Institute, Mingora-KP

Figure 81 Onion seed field of farmer at Gokand Valley, Bunir-KP

In Sindh province, the onion variety Phulkara has been planted on two hectare of farmer's land for seed production at Shah Farm, Kot Ghulam Muhammad in district Mirpurkhas and in Pathanabad Farm at Kunri in district Umerkot (Figure 83 and 84). In Pathanabad, the onion seed plot was attacked by thrips and downy mildew and the crop was water stressed for two weeks. However, the farmer was advised to apply repeated sprays of lorsban at three ml/l of water and Ridomil Gold at three g/l of water. The crop at Shah Farm is in excellent condition. Complete umbel formation has taken place at both the sites. This variety is high yielding and comparatively disease resistant and is suitable for both storage and export.

Figure 82 Farmer's onion bulbs shifted to storage at Kot Ghulam Muhammad- Sindh

Figure 83 Onion seed crop at Shah Farm, Kot Ghulam Muhammad-Sindh

These varieties are high yielding and highly suitable for this dry region. Freezing temperatures have caused crop stress in the uplands of Balochistan province, the crop

has now recovered (Figure 85 and 86). The overall condition of the crop was excellent with minimal problems from insect pests and diseases. So far, no pesticides were applied on these plots. The dry climate in the province provides great opportunity for the private sector to expand the production of vegetable seeds.

Figure 84 Field discussion with farmer and provincial partner regarding onion seed crop at Quetta-Balochistan

Figure 85 Onion seed crop on farmers field at Pringabad, Dasht-Balochistan

3.3.1.5.2. Peas

Seed crops of peas were also planted in districts of Swat and Bunir in Khyber Pakhtunkhwa and in four districts Pakpattan, Chiniot, Tandlianwala and Faisalabad of Punjab province on 2.8 hectare land (Figure 87 and 88). Meteor, Climax and Peas 2009 varieties have been planted. Climax is a high yielding variety, which is suitable for early and midseason plantings. It is the most popular variety in the high hills in the off-season and is also popular in the plains of Malakand division in KP province in the normal season. Peas 2009 has recently been approved and released by Vegetable Research Institute (VRI) at AARI in Faisalabad district of Punjab province for general cultivation. This is a medium stature, mid-season and high yielding variety. Meteor is a short stature and short season variety and fits in well to the cropping pattern of Punjab province. However, it is low yielding. The plots are all in excellent condition and crop was in the flowering and fruit setting stage.

Figure 86 Peas seed crop at flowering stage at Chiniot

Figure 87 Peas seed crop at early flowering stage at Tandlianwala-Faisalabad

3.3.1.5.3. Tomato

The tomato variety namely Naqeeb has been planted for seed production on 0.5 hectares of land in Tandlianwala area in Faisalabad district of Punjab province. Naqeeb has recently been approved and released by VRI, AARI, Faisalabad, for general cultivation in Punjab due to comparatively high yield compared to the imported Rio Grande variety. The crop is at the flowering stage.

3.3.1.5.4. Chili

In March 2015, the chili variety namely Loungi also known as dandicut has been planted for seed production at Kot Ghulam Muhammad in Mirpurkhas district of Sindh province on one hectares of land. This is an old local variety from Sindh province is popular for its unique taste. However, its yields have been declining partly due to poor quality seed.

The Federal Seed Certification and Registration Department in Islamabad has been involved in the certification of seed of approved varieties and promoting the true labeling system for unapproved ones. The seed produced will be properly packaged and marketed through seed dealers in the country. Negotiations are underway with the packaging industry.

3.3.1.6. Link Farmer-Seed Producers with Key Private Seed Companies, Seed Markets, Technology Providers and Business Development Services for Increased Profitability and Sustainability

Consultation meetings with seed producers and seed dealers have been conducted in Karachi, Kunri and Umer Kot districts of Sindh province (Appendix 58).

3.3.1.7. Establish Seed Villages in Punjab, Sindh, Balochistan and KP Provinces.

Activities will start in the next reporting period.

3.3.1.8. Consultation with Government Line Agencies Involved In Seed Production & Supervision and Policy Makers in Public Sector, Seed Producers and Seed Companies in Private Sector for Making Seed Policies and Regulations Favorable To Farmers

Activities will start in the next reporting period.

3.3.1.9. Conduct periodic planning and review workshops; prepare reports & publications

During the reporting period, internal planning meetings and progress review workshops were conducted with the institutes to establish partnerships (Appendix 59).

3.3.2. Evaluate Value Chains for Major Horticultural Crops to Assess and Promote Improved Post-Harvest and Value Adding Technologies

3.3.2.1. Value Chain Surveys for At Least Two Priority Vegetables such as Chili, Tomato, Onion Conducted In One Major Growing Area in Each of the Four Provinces and Major Constraints and Priorities for Intervention Identified

The baseline studies of the three sub-projects of the AIP-Vegetables in all the four provinces were conducted. In this reporting period, the final draft of the baseline survey was completed. Highlights of the report relating to fresh-market value chains are as follows:

- Vegetable growers (VG) were smallholders with less than five hectares of landholdings and they grew selected vegetables for local and wholesale markets. Tomato, onion, chili, okra and cucumber were grown on areas ranging from 6,000-8,000 square meters. There is a potential to increase the production area with viable interventions without making a major shift in the cropping system.
- Half of the VGs planted vegetables for wholesale markets while the other half grew fresh vegetables for their own consumption. High yielding varieties have great scope to produce surplus vegetables for the fresh market without increasing the current area under production. It will also provide the indirect benefit of increasing vegetable consumption by household members.
- Most VGs graded their produce and acknowledged that grading increased the price of their produce. Two classes in grading were used. The firstl class produce was usually sold in markets at a higher price than second class produce. However, awareness about proper grading is still inadequate.
- Packing is one of the important value chains activities. Various packing materials were used which includes plastic boxes, plastic sheets, plastic bags, plastic nets, wooden boxes, and cardboard boxes. Less than half of the VGs used any kind of packing. Plastic bags are popular among the farmers, followed by wooden boxes. Improving packaging, such as using plastic crates has huge potential to increase farmers' income through reducing postharvest losses.
- VGs incurred about 25 percent losses due to pre-harvest factors, particularly insect pest and disease damage, bad weather conditions, and disasters. Also, most of them incurred losses during harvesting mainly due to labor constraint while only about 18 percent had losses during the postharvest period which were attributed to transport problems.
- Commission Agents (CA) had an average business experience of 21 years, indicating the profitability and viability of the commissioning business. They operate at several levels, mostly at the local and inter-district levels, but a few were engaged in inter-provincial, national and international operations.
- CAs played many roles – they sold the produce of VGs; facilitated the provision of technical information in regard to VGs cash requirements, seeds, new/improved varieties, fertilizer supplies, pesticides awareness, vegetable information and non-farm issues**.** They met the needs of VGs in several aspects at the wholesale markets and providing sanitation facilities, sufficient resting places, and display space for their vegetables. CAs maintained regular formal and informal contacts with the VGs through personal and mobile contacts.
- CAs signified that women labor is not in demand in the commissioning business.
- There are several kinds of markets where VGs sell their produce. One of the important markets is the wholesale vegetable market, which mainly operate in towns and cities. Most VGs transport their fresh vegetables in these markets and usually sell the produce to retailers in an open bidding process managed by CAs which received a commission fee of about 5 percent.
- Most VGs indicated that they have difficulty in accessing markets due to financial, transport and time constraints. However, they were satisfied with the procedures and facilities available to them at the wholesale market.
- The marketing system is complex and has poor market to farm infrastructure, improper handling, high transportation costs, a lack of refrigerated transportation, high cost of packing materials, poor grading, and packing. Assembly, wholesale, and terminal markets are three main outlets. Key market players were VGs, contractors, CAs, wholesalers, inter-market traders/retailers, processors, and exporters.

3.3.2.1.1. Validation Workshops

Total five validation workshops in four provinces namely Punjab, Sindh, Balochistan and KP were conducted to evaluate the validity and reliability of the information collected during the national survey (Figure 89 and 90). This will identify the needs and priorities for intervention and involve other groups who were not directly surveyed.

Figure 89 Validation Workshop in Faisalabad.

Figure 90 Validation workshop in Kunri.

In March 2015, four workshops have been conducted in Faisalabad district of Punjab province, Quetta district of Balochistan province, Kunri district of Sindh province and Swat district of KP province (Appendix 53). Each workshop included a group discussion on the survey findings and gave suggestions to improve the value chain of fresh vegetables (Highlights summarized in Appendix 60).

3.3.2.2. At Least Six Postharvest And Value Adding Technologies for the Priority Vegetables Developed

3.3.2.2.1. Identify and Introduce New Varieties of At Least Two Major Crops for Testing for Improved Quality, Shelf Life and Processing Attributes

In Pakistan, vegetables such as tomatoes, chilies and onions are of great economic importance. A total of 11 tomato and 13 chili varieties were imported from AVRDC Taiwan and trialed under field conditions at ARI in Mingora district of KP province (Figure 87) and at Vegetable Program at NARC in Islamabad (Appendix 61). The objective if these trials was to promote high yielding varieties with a longer shelf life. The actual yields of these varieties will be evaluated and their performance will be compared with the existing varieties. These varieties will be planted in August at AZRI in Umerkot district of Sindh province to avoid hot weather in the preceding months.

At the end of December 2014, eight landrace and exotic onion varieties namely Swat-1, Saryab Surkh, Chiltan 89, Phulkara, NARC-1, NARC-2, Brown Spanish and River Hunter were transplanted in a RCB design at ARI in Mingora, Swat district of KP province.

At ARI, Quetta, a nursery was raised with 13 exotic and land race onion varieties namely Chiltan-89, Saryab Red, Quetta Red, Swat 1, Phulkara, Nasarpuri, Trich Mir, NARC-1, NARC-2, Tarnab Red, Yaqoot, Lucky and Rota Hybrid, which will be transplanted at the start of April 2015.

In AZRI, Umerkot, Sindh, a nursery of 13 chili varieties was raised in the beginning of March 2015, which will be transplanted in the field by the mid of April in a replicated trial (Appendix 62).

Figure 88 Nursery of AIP-Vegetables tomato germplasm at ARI, Mingora

3.3.2.2.2. Review Postharvest and Value Adding Technologies Available Locally and From Other Countries and Assess Their Applicability to Local Situation

The global experience in postharvest technology of vegetables was reviewed from print and online sources. This information together with the recommendations from the value chain surveys and validation workshops will serve as basis in the technology generation activities.

3.3.2.2.3. Build Research and Development Capacity of Partners on Postharvest Research and Establish Postharvest Lab with Basic Apparatus

A Postharvest Laboratory will be established at Horticulture research Institute (HRI) at NARC in Islamabad and will be equip with all the required apparatus. It will be tapped to undertake postharvest research and development to optimize technologies.

A three member project team participated in the AVRDC-USAID postharvest project's training programs on tomato variety evaluation for quality and postharvest traits and on postharvest research techniques, experimental design and data analysis held on February 9-12, 2015 in Phnom Penh, Cambodia.

3.3.2.2.4. Adapt and Optimize Available Low-Cost Postharvest Technologies and Develop New Technologies Including Fresh Produce Handling such as Packaging and Storage and Processing such as Dried Product/Powder, Sauce and Juice

Activities will start in the next reporting period.

3.3.2.2.5. Reports

The vegetable value chain survey report has been completed.

3.3.2.3. Trainings on Postharvest Management for More Than 200 Future Trainers, 2,000 Farmers and Other Value Chain Actors in Four Provinces

Activities will start in the next reporting period.

3.3.2.4. Uptake of postharvest technologies evaluated

This is the final activity to be started six months after the training programs.

4. Perennial Horticulture

4.1. Perennial Horticulture Post-Harvest Systems

AIP-Perennial Horticulture has made significant progress in the last six months with ongoing research in 14 funded projects and organized eight farmer/student trainings. For more details about the trainings, see Appendix 58 It is expected that 12 out of 14 currently funded projects will be completed by September 2015 which includes three mango, two value added and seven citrus projects. The UC Davis initiated two projects those are field evaluation of multiplied mango accessions at UAF and development of a model vineyard at AAUR will be continued in the next year.

During this reporting period, multiple trainings were conducted by AIP-Perennial Horticulture in which 167 growers and 55 students were trained. These trainings include two trainings on citrus orchard management at Sargodha on December 5, 2014 and February 24, 2015, one training on commercialization of new mango accessions at Multan on February 21, 2015 and two vineyard development trainings at AAUR on March 12-14, 2015. These trainings were developed and presented by the grantees. CRI-Sargodha and UAF also participated in the Dawn Sarbabz Agri Expo in Lahore on March 19 and 20, 2015. The taste test of UAF's improved natural mango leather candy was particularly popular with Expo attendees and provided valuable consumer feedback to the principal investigator, Dr. Moazzam Rafiq Khan of the Food Science and Technology Department.

In addition, as a result of AIP support of his mango postharvest research and contact facilitated by Dr. Carlos Crisosto, one grantee, Dr. Aman Malik of UAF Department of Postharvest Technology, was awarded a Fulbright Fellowship with UC Davis.

4.2. Postharvest and Value Added Projects: AAUR

- Farmer Training in Postharvest Technology
- Dissemination of Postharvest Fruit Dehydration

The information disseminated in these two projects has been developed by Dr. Ahmeds' students supported with HEC funding. Under these two projects a total of six trainings will be conducted in 2015 with a special focus on women participation. Please see Appendix 59 for more details about the planned trainings.

4.2.1. Grapes: AAUR

Demonstration Model of a Vineyard Trellising System

The I-shape RCC trellis supports have been established and three trainings have been conducted. Further trainings are scheduled at key points in vineyard development.

4.2.2. Mango: UAF

4.2.2.1. Multiplication, Accession and Evaluation of New Mango Cultivars

The ten cultivars selected in a five year Pakistan Agricultural Research Centre Grant, along with four commercial cultivars have been propagated and established in a mother block at UAF as well as at selected growers' fields for horticultural evaluation. Two commercial nurseries have been selected to further propagate additional trees for release to growers for further evaluation. A meeting was held to introduce new mango accessions to 55 growers in the Multan region on February 21, 2015. Growers were very positive about the adoption of these new accessions in their orchard during the coming mango plantation season (Appendix 58). Additional farmer meetings are planned for Punjab and Sindh provinces during 2015.

4.2.2.2. Inline Automated Maturity Assessment System for Commercial Mango Cultivars

The principal investigator's research continues to offer promising progress and will continue into the next reporting period. This preliminary study was designed to test the potential of the AWETATA firmness sensor (AFS) technology for maturity determination and fruit firmness changes during ripening in three Pakistani commercial mango cultivars (Sindhri, Samar Bahisht Chaunsa and White Chaunsa). The final goal is the development of an inline automated maturity sorting system that can determine the time to ripening and direct inline fruit sorting into uniformly ripening lots. The final objective is to pack and deliver boxes of uniformly ripening mangos.

4.2.2.3. Processing Mango Kernel Seed Waste as a Substitute for Cocoa Butter

The mango kernel waste extraction and processing has been completed. The next step is evaluating the fat extracted from the kernel waste for oxidative stability. Mango kernel waste requires adequate storage life both before incorporation into a product and later as an ingredient and to make it viable substitute for cacao butter.

4.2.2.4. Processing Mango Pulp as a Fruit Leather

The methods for processing the pulp into a natural candy substitute have been completed. The shelf stability and packaging methods will be developed**.** Consumers who visited the stall at the Dawn Sarbabz Agri Expo in Lahore during March 19-20, 2015 were the first to taste the fruit leather. They were very pleased with the taste and texture of the product.

4.2.3. Citrus: CRI-Sargodha

Under AIP-Perennial Horticulture, seven coordinated projects for citrus which includes four production projects namely citrus demonstration block, citrus rootstocks, nursery growing media and citrus IPM and three postharvest projects namely harvesting and handling practices, standardizing packinghouse techniques and pilot plant for Small Scale Citrus Postharvest Technologies, focused on packaging. In this reporting period, two trainings on improved pruning practices were held at two different villages in Sargodha district of Punjab province. Total 25 growers received training on December 5, 2014 while the second training on February 24, 2015 attracted 49 growers (Appendix 58). At both trainings information relevant to the seasonal production calendar was presented while pest management and pruning was practically demonstrated in the citrus field. These trainings have enabled the growers to implement improved pruning practices and management of their orchards against disease and insect attacks. Finally, preparations for two major trainings in spring 2015 were completed. While these seven projects will be completed in 2015, CRI-Sargodha in cooperation with the local citrus growers and packers will continue using the developed materials for their annual Farmer Field Schools.

4.2.4. Olives, Pistachio and Guava

Based on local feedback and gaps and needs identified during field visits and meetings with key stakeholders, the Perennial horticulture component will shift focus to the underserved crops particularly olives in KP province, pistachios in Balochistan province and guavas in Sindh province. As a result of these meetings, AIP-Perennial Horticulture in collaboration with Agriculture Research Institute (ARI) Quetta, ARI Tarnab and AT Sakrand identified the major challenges in the olive, pistachio and guava industries. Each Commodity-specific gaps and opportunities were discussed in the following section. The team has identified cooperators who have developed plans to start addressing these problems. For example, in Sindh, a model postharvest teaching laboratory will be developed for training of Students at ATI-Sakrand as well as for local farmers.

On February 18 and 19, 2015, an action planning workshop was organized in Islamabad where Dr. Mark Bell trained 21 participants including three new potential grantees from ATI-Sindh, ARI- This workshop resulted in attendees submitting very well prepared training proposals for olive, pistachio, guava and postharvest. Proposals have been submitted and funding decisions for all proposals will be made by April 15, 2015.

4.2.4.1. Olives: ARI Tarnab

On December 2, 2014, AIP-Perennial held a meeting with ARI Tarnab scientists, extension staff and representatives of Federal Seed certification and Registration Department (FSCRD) and identified the issues faced by olive industry such as poor nursery practices, failure to set fruit and poor quality olive oil. In Punjab province, AIP-Perennial held similar meetings at BARI Chakwal and three olive fields within the Chakwal district. Three olive proposals are currently being evaluated for April 2015 funding.

4.2.4.2. Pistachio: ARI Quetta

In this reporting period, series of activities such as farmer meetings, field visits, and meetings with the technical RI staff, processors and exporters enabled AIP-Perennial to identify the challenges and opportunities of the small local pistachio industry which is fewer than 50 growers and less than 500 hectares. These activities revealed that the growers lack the knowledge to grow and produce pistachios, there is an opportunity to learn from already established pistachio industries, particularly Iran and Afghanistan, to avoid the mistakes they have made and evaluate their cultivars and rootstocks for the Pakistan pistachio industry. In addition, there is an opportunity to develop a strong pistachio growers association which can direct the development of this industry. The process has already started. On December 10, 2014, AIP held a Pistachio Grower Meeting where local growers shared their perspectives on the industry. In addition, the AIP-Perennial team visited the local nut processing facility. On February 15 and 16, 2015 the team hosted a strategy meeting which was followed by a visit to two pistachio research station orchards in Quetta and Mastung and also a local grower's orchards in Mastung . By April 2015, evaluation of four proposals addressing pistachio nursery development, establishment of a model orchard, rehabilitation of the old orchard on the field station, and development of a pistachio growers association will be completed.

4.2.4.3. Guava: ATI- Sakrand

In December 2014 and February 2015, AIP-Perennial Horticulture held meeting to discuss the problems faced by the guava industry in Sindh province with Mr. Youssef Channa, ATI Sakrand Director. Key issues included lack of any production and postharvest information, and lack of postharvest extension program. As a result of these meeting ATI Sakrand submitted two proposals to address the issues. The first proposal is a guava value chain assessment and development of a model Farmer Field School guava training that can be shared with other ARIs in Quetta. The second proposal seeks to develop a pilot postharvest training facility at ATI Sakrand. The facility would be used to train the students as well as local farmers in applied postharvest production practices such as field harvesting techniques, grading, transport, and storage conditions. A related proposal from the Postharvest Technology Department at UAF encompasses curriculum development and training for the local instructors.

On February 19, 2015, in anticipation of funding approval two sets of basic laboratory postharvest equipment were delivered to ATI Sakrand for establishing a basic lab at ATI Sakrand.

5. Human Resource Development (HRD)

5.1. Graduate Studies

On December 2014, Dr. Tom Rost from UC Davis conducted a pre-departure orientation workshop for the AIP scholars. This one day workshop was attended by 13 finalists including seven women and six men scholars at NARC in Islamabad, Pakistan. These scholars were scheduled to travel to the US to commence their MS and PhD studies. The purpose of this workshop was to orient the scholars about the program the student life in the US, cultural norms and expectations and ways to learn from each other. The Pre-departure workshop for the HRD scholars was jointly organized with the vocational training team.

As of March 2015, total 11 of 14 scholars have reached the US to attend their classes and initiate their research projects. These students are located at the University of California, Davis –two PhD and one MS, Texas A and M University –three MS, University of Missouri –one MS, University of Minnesota – one PhD, Mississippi State University –one PhD, University of Massachusetts –one MS, and Washington State University –one MS. The three remaining MS students will arrive in May 2015 and will attend Purdue University, Mississippi State University and the University of Minnesota.

5.2. Vocational Training

Dr. Mark Bell visited Pakistan in February 2015 and conducted two trainings during this visit. On February 18 and 19, an action planning workshop was held at NARC in Islamabad involving 16 men and 5 women from the three new potential grantees from ATI Sindh, ARI Tarnab and ARI Balochistan provinces. As a result of this workshop, the attendees resulted in submitting very well prepared training proposals for olive, pistachio, guava and postharvest.

On February 23, Dr. Bell conducted a workshop on running effective meetings at UAF training three women and 27 men. The workshop used participatory and adult learning techniques to engage the audience. The evaluation for this was also very positive: 4.6 out of 5.

An online statistics course was conducted for young researchers of all AIP collaborators from from November 10 to December 1. This course attracted 24 participants including five participants from AIP partners. The course covered topics including experimental design terminology, multiple comparisons, introduction to factorial experiments, and introduction to random and fixed effects models. In addition, participants gave enthusiastic feedback on the draft statistics modules and the usefulness of the Stats “R” App.

The vocational training working group has identified the next set of topics to be addressed which includes scientific writing, statistics, ICT in Ag extension (material development), seed technology, effective meetings Part II.

6. e-Pak Ag

e-Pak Ag website is focused on the use of ICT in agricultural extension. Thus, it looks at how ICT can be better used to integrate with traditional approaches and better deliver information to farmers. This includes how the information needed is validated, developed, packaged and delivered. A major emphasis of e-Pak Ag is how information can be better packaged to lead to action.

On January 8, 2014, a Stakeholder’s workshop on ICT based agricultural technology transfer: issues and challenges were held at NARC in Islamabad. The workshop was attended by 43 participants including five women and 38 men, where Dr. Babar Shahbaz presented a background paper on the challenges faced by the agricultural extension system of Pakistan and possible ways forward. Participants also had lively

discussions in four small groups: Provincial Extension Department, Academia, NARC and Independent group. The groups were requested to respond on following key questions:

- Who is your target audience? How their problems are identified? How information can be made according to farmers' needs?
- How do you think that farmers' interests are addressed by your organization?
- How can we make information more credible?
- How to enhance coordination between different agri. service providers?

On February 25, 2015, another stakeholder's workshop organized in Lahore which attracted 45 participants including three women and 42 men. This meeting raised the following points:

- Negative consequences of decentralized extension system.
- Lack of Cooperative extension.
- Lack of the use of ICT as a tool for outreach.
- No attention on future outreach/extension.
- Less focus on Youth and women in agriculture.
- Limited emphasis on Impact oriented extension, business oriented approach.
- Less Effective technology transfer techniques and impact assessment.
- Poor service structure and incentives for extension workers.
- There are very poor linkages between different service providers, researchers and academicians.
- Poor linkage of students with farms and industry.
- Use ICT tools to enhance linkages.

These workshops were led by Dr. Babar Shahbaz from UAF. The results will be used to gather an evolving set of priorities and opportunities. The enthusiasm of participants and AIP partners alike has set the stage for a National Conference on ICT in Agriculture, likely to take place in the next reporting period.

In this reporting period, the review of ICT and extension flow in Pakistan report has been drafted. After further review and refinement, it will be finalized and provide the basis for e-Pak Ag activities. In addition, four students at UAF are researching specific aspects of ICT to better inform the goals of e- Pak Ag. These topics include farmer information sources –PhD Syed Kashan Haider Gilani, the role of public and private sector in information access –PhD Muhammad Asif Navaz, assessing information reliability –Short term Muhammad Rafaz Muzamil and Information and market access –Short term Muhammad Hammad Raza. These students presented their initial findings to Dr. Bell in February 2015. Likewise, Dr. Aneela Afzal from AAUR will conduct a study on the role of women in ICT for agriculture in the next funding cycle.

The e Pak Ag website (http://epakag.ucdavis.edu/) is fully functional. It serves as a repository for existing materials including 75 videos on post-harvest management selected by Dr. Dianne Barret –UC Davis and other resource material from the AIP. The site continually evolves as needs and priorities shift. Finally, in order to ensure complementarity and leverage resources, e-Pak Ag is developing synergies with the newly funded CAS project of UC Davis.

7. Competitive Grants System (CGS)

7.1. Progress on Opening of Assignment Account for AIP in the Reported Period

On March 12, 2015 the State Bank of Pakistan authorized the National Bank of Pakistan (NBP), Head Office in Karachi to transfer the AIP funds received from CIMMYT into AIP Assignment Account. On March 19, 2015, the main branch of NBP in Islamabad confirmed transfer of funds in AIP Assignment Account No. 007792-9.

7.2. Activities of Competitive Grants System under AIP

The PARC is responsible for the creation and implementation of a transparent and province-endorsed competitive grants system (CGS) in a deliberate manner, creation and establishment of Provincial Agricultural Research for Development (AR4D) Boards in Balochistan, KP and Sindh provinces and strengthening of the existing Punjab Agricultural Research Board (PARB). Progress on the activities of CGS during the reported period is summarized below:

- A mechanism for CGS management and its operation was developed. Composition and terms of reference (ToR) of Technical Advisory Committee (TAC) and National Advisory Committee (NAC) were developed, approved and notified.
- Advertisement for the first call for invitation of applications for competitive grants was developed and finalized. Punjab Agricultural Research Board (PARB) advertised the first call for proposals in Punjab. PARB has received 157 preliminary proposals (list Appendix 60) as on closing date which was March 25, 2015 (Appendix 61). For the other three provinces, the PARC created a link on the official website and advertised it in the leading newspapers nationwide. The Last Date for Receipt of Preliminary Proposals to AIP Secretariat at PARC is April 15, 2015.

7.3. Creation and Establishment of Provincial AR4D Boards

PARC is also entrusted with the responsibility to create and establish Provincial AR4D Boards in Balochistan, KP and Sindh provinces. The boards are patterned after the Punjab Agricultural Research Board (PARB) in the Punjab province.

- This activity involves the creation of boards and then channeling funds through them to provinces. The rationale behind this activity is to bring more integration and help provinces to establish sustainable research funding bodies.
- PARC is responsible to coordinate and support the relevant departments in Balochistan, KP and Sindh provinces for necessary legislation to be carried out to create and establish provincial boards in these provinces.

The details of the correspondence made and meetings held with the provincial stakeholders since March are given below:

- PARC is pursuing the establishment of provincial boards and has consulted the provincial stakeholders in Balochistan, KP and Sindh provinces but the response was not very much encouraging. Therefore, the AIP Secretariat requested Chairman PARC to approach the Federal Secretary to call a brain storming meeting of the Provincial Additional Chief Secretaries.
- The Federal Secretary convened the meeting of Provincial Additional Chief Secretaries on January 16, 2015. Due to some pressing engagements of the Provincial Additional Chief Secretaries were unable to attend the meeting. Taking it as an opportunity, the Federal Secretary took presentations on AIP and the Proposed Provincial Boards. Dr. Md. Imtiaz, Country Representative CIMMYT Pakistan and Dr. M. Shahid Masood, Focal Person AIP presented the overview and progress of AIP. Dr. Mubarik Ali, Consultant International Food Policy Research Institute (IFPRI) presented the PARB model and the proposed Board Structure.

- On February 2, 2015, on the request of AIP Secretariat, Chairman PARC approached the Federal Secretary to write to the Chief Secretaries of Balochistan, KP and Sindh provinces to constitute an interim Provincial Competitive Grants System Management Committee to receive the yearly budget allocated for establishment of the Board and approved projects for implementation and execution of the projects in the province.
- On March 12, 2015 during a meeting of the Federal Minister with Chief Secretary, Govt. of Balochistan and Chairman PARC discussed the establishment of the BARB with Chief Secretary and Secretary Agriculture, Balochistan.
- On March 17, 2015, Chairman PARC requested the Chief Secretary, Govt. of Balochistan, to direct the concerned authorities to expedite the establishment of BARB.
- On March 25, 2015, the Govt. of KP notified the Interim Provincial CGS Management Committee.
- In Sindh province, due to replacement of the Chief Secretary in March 2015 there is no progress.

II. PERSONAL/ MANAGEMENT UPDATE

An M&E specialist Mr. Gohar Iqbal for AIP has filled in the position in March 2015. Two research associates (RA) for AIP-Wheat were hired during this period. Mr. Attiq Ur Rehman has joined as RA in Islamabad office while Mr. Amanullah Baloch has been appointed as RA Wheat for Sindh and Balochistan provinces.

During the reporting period, AIP-Maize carried out the performance assessment of two research associates was carried out. Annual work plan was reviewed and objectives and activities for the year 2015 were been set.

AIP-Rice supported Mr. Zulqarnaian Haider, Assistant Research Officer at Rice Research Institute Kala Shah Kaku, to attend two weeks training course on “Rice Breeding” from March 16-27, 2015 at IRRI, Philippines.

AIP-Agronomy invited Dr. Ken Sayre, Consultant CIMMYT, to visit Pakistan from October 24 to November 03, 2014. He conducted three trainings held at Kala Shah Kaku and Islamabad where he shared his experiences and suggestions on trials and CA planters. He also visited, BARI Chakwal, CCRI Nowshera, NARC Islamabad and PMAS-University of Arid Agriculture Rawalpindi and manufacturer in Daksa. Under AIP-Agronomy, two scientists have received training on CA from India and 18 scientists attended in country training on CA held at Islamabad.

The AIP-Livestock office was established one year ago has been functional throughout the year. The team frequently visited by NGO’s, farmers, Progressive farmers and donor agencies across Pakistan. In order to execute the snap-shot survey in KP and Punjab provinces, and the model dairy farm activities in Bahawalnagar, Haroonabad and Jhang districts of Punjab province, four field staff were appointed on short term basis (daily paid category) and their work is continuously monitored by AIP-Livestock team.

Under AIP-Vegetables, a team of 10 Research Associates which includes three women staff members was hired to undertake the vegetable activities and to work closely with collaborating farmers. They were placed at the project locations in clusters in three districts Swat, Haripur and D.I. Khan in KP province, four districts Rawalpindi, Sheikhupura, Faisalabad, Khushab in Punjab province, Mirpurkhas and Umerkot districts of Sindh province, district Quetta of Balochistan province and Islamabad. A

short term Post-harvest consultant Dr. Mustaq Ahmad was also hired to define development priorities for improving post-harvest management practices and the value chains of targeted vegetables sourced from clusters of open field and covered production systems. ATrainingExpert/Ag. Extensionist Mr. Sheeraz Ahmad was recruited to identify the project's main target audiences, assess their training needs and design training modules and an evaluation system in Pakistan for training in protected cultivation, mungbean production and value chains. In January 2015, a communications officer positioned at India Mr. Sreeram Banda. He has already developed brochures and news stories for the AIP-Vegetables. In March 2015, AIP-Vegetables has appointed professional staff in India to assist the AIP activities in Pakistam. Dr. Sameena Shaik is appointed as plant breeder to assist in the mungbean and tomato breeding work, Dr. Arshad Pal as postharvest specialist to provide technical backup to the value chains team and Ms. PVL Bharathi as part time senior trainer to strengthen the overall training work. Teleconferences on regular basis are held every four to six weeks between the Pakistan leadership and the AVRDC regional office in India. Two combined visits were also organized during the reporting period, one to India and the other to Pakistan. During October 8 to 10, 2014, three AIP-Vegetables team members from Pakistan led by Dr. Mansab Ali joined more than 30 staff members of the Punjab Agriculture University (PAU) in Ludhiana, India and three members from the AVRDC-South Asia regional office including Dr. Warwick Easdown at PAU, Ludhiana, India met in India for joint planning work and outlining sub-contracted work for PAU. In addition to this, the group also visited research facilities and farms growing vegetables under protected cultivation across Punjab. Dr. Mansab Ali, Team Leader AIP-Vegetable and Dr. Asghar Ali, Legume Agronomist attended the AVRDC Global Strategic Planning Meeting in Taiwan from November 8 to 21, 2014. Three postharvest staff involved in the Value chains component joined a week-long USAID Postharvest project training course from February 9 to12, 2015 on tomato varietal evaluation for quality traits and postharvest research techniques, experime ntal design and data analysis in Phnom Penh, Cambodia. Mr Mazullah Khan, Mr Bashir Ahmed, Director of vegetable seed production at ARI in Balochistan province and Dr. Mushtaq Ahmad, Post-harvest Consultant, joined 22 other participants from Bangladesh, Nepal and Cambodia which includes 10 women and 12 men to share their experiences and to learn from postharvest experts. A short-term socio-economist was recruited in 2014 to conduct the baseline studies of the three sub-projects of the AIP-Vegetable Component in all the four provinces.

On October 13, 2014, Ms. Ayesha Arif assumed her duties as which includes project monitoring, networking, identifying project needs, facilitating events, representing UC Davis, public relations, reporting, and commissioned project monitoring and evaluation.

AIP-Perennial Horticulture is supporting a faculty member of ATI Mr. Allah Rakih Keerio to attend a short course on Postharvest Production which will be held from June 15– 26, 2015 in UC Davis, California.

PARC has established an AIP Secretariat for competitive grants system which is based in Islamabad, Pakistan. This is led by Member Plant Sciences and One Senior Scientific Officer has been placed in the Secretariat for assistance.

III. LESSONS LEARNED

1. Cereals and Cereal Systems

1.1. Wheat

- Provision of quality seed and training for smallholder farmers could be a huge boost in agriculture production.

- Farmers from different parts of the country now understand value of using healthy seed of new and improved varieties to harvest high-quality crop. Farming community are willing to learn more on new wheat varieties and agronomic interventions.
- Few farmers in Khushab and Bhakhar districts of Punjab province are highly satisfied with germination and crop vigor in ridge planting.
- Brochures on wheat crop should be provided in local language covering crop management and seed production practices.
- Exchange of seed with other farmers can directly contribute to widespread adoption process.

1.2. Maize

- Overwhelming interest for CIMMYT derived maize varieties, particularly from the private sector.
- The importance of fast tracking the deployment of the selected maize varieties.
- The need for proper allocation of selected maize varieties to partners based on capacity of the partners.
- The importance of technical trainings on the various aspects of maize value chain.
- The importance of seed laws and its enforcement so that partners can be encouraged for maize product development.

1.3. Rice

- In Punjab, most of the farmers are recipients of improved crop management practices like DSR and AWD. However, some farmers are reluctant to establish their rice crops through DSR due to the issue of weeds. Post–emergent herbicides are available in the market, but cannot control all weeds like Crowfoot grass also known as Madana grass. Timely application of herbicides is very important for effective weed management. There is a need for laser land leveling before DSR for uniform irrigation and germination of rice seed.
- Training of researchers/extension staff and farmers in areas of Sindh and Balochistan on DSR and AWD is needed.
- More modified DSR drills are required, especially in Sindh and Balochistan.

1.4. Agronomy

- CIMMYT under AIP- Agronomy established partnerships with private sector organizations namely and Engro Eximp Agri products to disseminate CA techniques. This was made possible because of flexible working environment of private sector.
- In pilot testing of ZT happy seeder, working with one of service provider through the involvement of private sector partner helped in demonstrating technology to more farmers.
- In pilot testing of multi crop bed planter, crop emergence in cotton and maize crop in Punjab was 75 percent that was lower than manual planting which is 95 to 100 percent. For efficient use of these bed planter, training of partners and modifications might be needed. Purchase of double disc and single disc openers from India through CIMMYT's office in India has been processed and manufacturing of these parts is underway.

2. Livestock

At the onset of activities, it is important to understand the social structure of populations as that might impede during the implementation stage.

3. Vegetables

- Two new sub contracts with Punjab Agriculture University-Ludhiana, India have been signed to provide a stronger basis for technical cooperation with AIP-Vegetables in protected cultivation and mungbean production. This will help to bring innovative net houses and mungbean harvesting technologies to Pakistan and trial innovative mungbean herbicide treatments developed by Pakistan in India.

  Training of farmers as master trainers is very useful for improving their skills in vegetable seed production, and with addition of two new training specialists to the team will help in significantly in this area of work.
- Compact tunnel foundation and solid structure are pre-requisite to avoid crop and structural damaged happen due to storms.
- When controlling fungal diseases, avoiding the use of same fungicide over long period of time is a prerequisite in preventing emergence of resistance of the disease causal agents.
- High humidity is a big problem in tunnel farming. Proper control of humidity is required by opening tunnels in the daytime in sunny days for a few hours.
- Application of fertilizer in soluble form and drip irrigation is beneficial in tunnel farming.
- Continuous visits of researchers are warmly welcomed by the farmers, and this has encouraged them to adopt new trends in protected cultivation.
- Provision of extension messages via leaflets or brochures for selected vegetable crops
- Demonstrating techniques for onion seed production was very much appreciated by farmers in the Bunir district of KP province and in the Pothwar region of Punjab province.
- Harvest of mungbean intercropped with sugarcane needs to be mechanized to minimize the damage of sugarcane plants caused by manual harvesting to continue this system.

4. Perennial Horticulture Post-Harvest Systems

Coordination and communication between the component leads has contributed to improved training designs and better networking with all other AIP partners.

5. Human Resource Development (HRD)

Obtaining visas for the 14 AIP scholars was a complicated process sometimes required students to redo their medical checks and various required forms because of the 120 day expiration date on those USAID forms. These delays all increased costs and caused unnecessary stress to the students. Since the AIP scholars are at different land-grant universities and each university has its own budgeting system, each student's expenses such as tuition, stipend and living expenses will occur at a different frequency depending on academic term timing at each university. As the funding for these students represents a significant amount of the overall total budget, it is important to be mindful of these budget fluctuations and how they will affect the overall burn rate.

IV. EXTERNAL FACTORS

During the reporting period, various external factors has impacted AIP to achieve the objectives which includes security situation, slow administrative processes of the public sector organizations and climatic factors. Some of the details are stated below:

1. Cereals and Cereal Systems

1.1. Wheat

- Consumption of seed by poor families may not serve the purpose of seed dissemination. Though it was conveyed to the beneficiaries that production from this year varietal deployment should not be consumed and must be used as seed, but it will be hard to achieve this unless seed exchange is being coordinated during the Community Organization's meetings.
- To ensure varietal purity during harvesting, communities are educated in the CO meeting and also through text messages.

1.2. Maize

Delay in getting visa for the subject specialist from other countries visiting Pakistan affect planned training activities and target achievements.

1.3. Rice

Field visits were affected due to security concerns, particularly in Sindh and Balochistan.

1.4. Agronomy

For improvement of multi crop bed planter, import of double and single disc openers with press wheel has been initiated. These parts would be ready for delivery by mid-April via Wahga border through rail route of Punjab. Any delay or issue in import will cause delay in the activities such as planting in the autumn season–Kharif crop.

1.5. Socio-Economics

Due to security concerns, it was difficult to conduct baseline in Balochistan province and GB. The local Social Sciences Research Institutes have been involved to reach out to the populations.

2. Vegetables

- Climatic factors such as frost which damage the crops in area of open field off-season production in Katha Saghral in Khushab district of Punjab.
- Tunnels and crops in Punjab affected by storm in February and March 2015.
- Heavy rains at some sites caused flooding which resulted in damaging the mungbean crop.

3. Perennial Horticulture Post-Harvest Systems

Security issues in Balochistan province make it difficult for Dr. Louise Ferguson to see all aspects of the various tree crop industries.

V. RISKS

1. Cereals and Cereal Systems

1.1. Wheat

There may be security concerns while implementing various research and dissemination activities on wheat in Baluchistan, parts of KP and Sindh provinces. Since, AIP-Wheat has developed partnership with national organizations having presence in these areas which could help in achieving projects outputs.

- This year almost continuous showers are common close to crop maturity time that may damage wheat crop. Delay in harvest may also result in poor seed and grain quality due to germination and rotting.
- Damage of crop due to hailstorms at several locations.
- It is predicted that the famers will use the produced wheat yield for food purposes in few areas where NRSP has recently started working.
- Mixing of wheat crop while harvesting and threshing.
- Disease & pest attack in some areas.

1.2. Maize

Security risks hindered the activities particularly in Sindh and Balochistan provinces.

1.3. Rice

- Difficulty in acquiring rice germplasm from IRRI, Philippines due to additional conditions imposed by the Department of Plant Protection, Karachi to import seed for research purposes and to be used in developing a new generation of stress-tolerant varieties for future release and adoption by farmers in stress-prone environments in Pakistan.
- Hiring of NRS is critical, which causes difficulty to perform various activities in time. Furthermore, the budget allocated is also being under spent. The IRRI IRS hired under AIP needs to expediate these processes to make timely delivery on the agreed targets.

1.4. Agronomy

In Balochistan, AIP-Agronomy has established partnership with Directorate of Agriculture Research, Usta Muhammad to disseminate conservation agriculture technologies. However, there are security concerns to reach out to partner institute for monitoring of the activities.

1.5. Socio-Economics

In some parts of Sindh province, the research team was limited to carry out Maize baseline study in Sindh due to security situations. In parts of GB, the movement of research team restricted without the support of public sector organization.

2. Livestock

Staff movements and carrying out the activities curtailed due to security measures. Sometime limited co-operation of farmer also make the output risky.

3. Vegetables

- The bulk arrival of produce from the main season crop or from imports into the market will lower the price, and it will not cover the costs spent on protected cultivation.

- The slow adoption of protected cultivation among vegetable growers due to high initial cost needs which to be addressed.
- Building sustainable linkages between local seed producers and seed dealers as dealers want to earn money in the shortest possible time.
- Limited participation of women in agricultural production in parts of KP and Balochistan is one of the challenges.
- The dissemination of information, extension and communication material in some remote areas of Balochistan and KP is a security challenge for the staff.
- It is always a challenge to introduce new crops in any area.
- Lack of awareness of seed threshing machinery is one of the major hurdles in boosting vegetable seed production by farmers.
- Mechanization of the planting and harvesting of mungbean intercropping with sugarcane is a big challenge.
- Chemical weed control in intercropping is also a challenge.

4. Competitive Grants System (CGS)

Three provinces of Pakistan namely KP, Balochistan and Sindh still require time to plan the structure of these boards. The major concern is that establishment of another organization similar to the board with dedicated staff and requires legislation from the respective assembly. Additional resources will be required at the end of the project.

VI. CONTRIBUTION TO USAID GENDER OBJECTIVES

To contribute to the USAID gender objectives, AIP has been sensitizing its primary and national partners to reduce gender disparities and increase capabilities of women through the participation of women in the activities such as field days and training. This has been made a part of the new sub-grant agreements.

1. Cereals and Cereal Systems

1.1. Wheat

AIP-Wheat is promoting equitable access of women to new wheat seeds and agronomic technologies and equitable capacity development. AIP-Wheat's partner NRSP was instrumental in contributing to meet USAID gender objectives by promoting women participation in various activities of wheat component which is summarized in Figure 90. Of the various activities, access of women to new wheat varieties through IRD was maximum followed by their participation in training and capacity building. While women involvement in research and seed multiplication activities was still low and would need to be addressed subsequently.

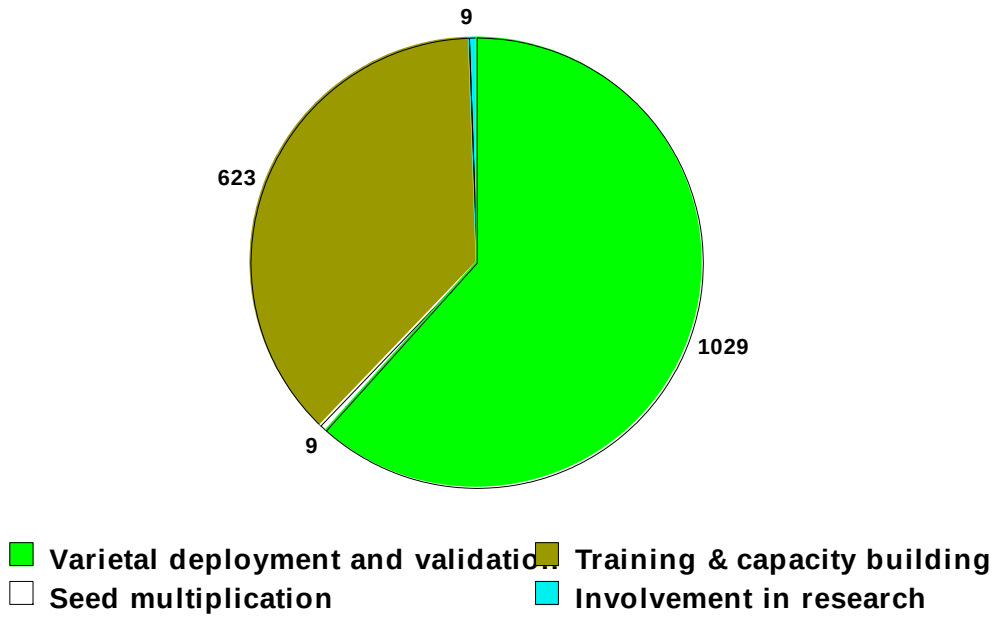


Figure 89 Women participation on various activities of wheat component of AIP, 2014-15

In Punjab province, during the process of distribution main focus was on women farmers especially on widows responsible for livelihoods of their famillies. In Sindh province, the land is mostly owned by menwhile women are only engaged during harvesting.

1.2. Maize

Under AIP-Maize, CIMMYT is evaluating Quality Protein Maize (QPM) germplasm and Pro vitamin-A varieties which is a good source of weaning food for nursing mothers. It will help to reduce under five mortality rate once it is popularized in Pakistan.

1.3. Agronomy

Partners are sensitized to increase the participation of women in activities such as field days and training. Woman engineer was also trained on CA technologies during this reporting period.

1.4. Socio-Economics

In Sindh province, nine women farmers were trained on rural seed enterprise development.

2. Livestock

In Pakistan agricultural sector is men dominated, leading to extremely low participation of women. This also appears in our beneficiary list where women's participation is less than one percent.

3. Vegetables

- Three women researchers were appointed to the AIP-Vegetables component to provide field level services to collaborating farmers.
- Two senior women staff members have been appointed to the AIP-Vegetables team in India to provide additional support for training work and breeding work.
- Women workers are involved in sowing and harvesting operations of vegetables, and hands on trainings are being planned on safe handling of chemicals.

- In KP province, a training was organized on healthy vegetable seedling production and trained 21 women farmers in Kohat, Malam Jabba and Haripur, while two women were trained as resource persons by ARI at Mingora in Swat district of KP province.
- As mungbean is included as an extra crop in a various cropping system, farmers are convinced to provide this extra income from mungbean to the women in their households and are willing to provide full control of mungbean crop production to them. This is because of manual picking of beans from intercropped mungbean which is mainly done by women.

4. Perennial Horticulture Post-Harvest Systems

The Perennial horticulture component will have some post-harvest trainings that specifically focus on women's participation.

5. Human Resource Development (HRD)

Graduate Studies

HRD is contributing to higher education opportunities/ scholarships for academically talented women. Of the 14 scholars accepted by the AIP program, eight of them are women.

Vocational Training

Vocational trainings continue to reach the women participants, although it is in small numbers. As stated above in the lessons learned section, the team will re-double its efforts to ensure increased participation. E Pak Ag will conduct a study on Women in ICT for Agriculture that will better inform the approach and priorities as they relate to women.

VII. ENVIRONMENTAL COMPLIANCES

1. Cereals and Cereal Systems

1.1. Wheat

All the wheat varieties under AIP are thoroughly evaluated and released in Pakistan and few are being developed locally. AIP-Wheat component will be only popularizing newly released, rust resistant and high yielding wheat varieties which will minimize the use of pesticides.

Some of the on-farm varieties by agronomic practices evaluated and popularized this year such as seed priming, fertilizer trials and ridge planting. This will help to improve plant stand establishment and judicious use of fertilizers and planting methods for positive impact on the environment. There will no adverse environmental impact of growing these wheat varieties in Pakistan.

1.2. Maize

Most of CIMMYT's maize germplasm are climate smart varieties which can best perform under stressed environments. CIMMYT's germplasm which are tolerant to heat and water stress will benefit the farmers in water scarce environments. In addition, CIMMYT materials which are under evaluation in Pakistan are developed through conventional breeding techniques and do not require additional inputs or extra environmental or biosafety care as compared to germplasms developed through non-conventional ways. The effort to introduce maize tolerant to maize stem borer from International Institute of Tropical Agriculture (IITA) will have a positive impact on environment as it will reduce the use of chemical pesticide to control the insect.

1.3. Rice

DSR and AWD are resource conservation technologies and environmentally friendly as omission of methane gas is lower compared to transplanted crops.

1.4. Agronomy

The technologies that are being evaluated and disseminated are resource-conserving and has positive impact on the environment. Use of ZT and happy seeder in rice-wheat areas has reduced the burning of crop residue in those plots which is environment friendly.

2. Vegetables

- To avoid any mishaps and unforeseen events due to natural calamities like strong wind and hail storms precautionary measures needed regarding weak tunnel structures.
- Minimum use of environment friendly herbicides and insecticides in mungbean is recommended.

VIII. MONITORING AND EVALUATION

For the collection of consistent data on the USAID's mission strategic framework (MSF) indicators, reporting templates were prepared and shared with all the AIP primary partners. In addition, the beneficiaries tracking sheet was finalized which covers basic information of beneficiaries and type of assistance provided under AIP. This was also shared with all the AIP partners.

The data from all the primary partners was collected by AIP M&E and USAID's website PAK INFO was updated. Furthermore, incorporated the comments received from USAID on uploaded data (PAK INFO). Appendix 62 provides the summary of beneficiaries by commodities/themes and partner organization.

A comprehensive M&E plan was prepared and refined following the feedback by Mr. Nazim from USAID. The manual for data collection is in progress.

After discussion with USAID, mission strategic framework (MSF) indicators were refined. The policy indicators were dropped as it had less relevance with AIP interventions.

IX. COMMUNICATIONS

In this reporting period, AIPs' Communications proactively highlighted the AIP's interventions which include arranging successful events, writing persuasive stories, producing engaging documentary, designing creative info-graphics and maintaining digital presence (Appendix 63). Under AIP, due emphasis has been given to communicate the project activities to local and international stakeholders following the branding and markingguidelines of USAID. The following mediums were utilized to communicate the AIP activities:

- AIP-newsletter
- Flickr
- Expositions
- Publications
- Video
- CIMMYT's Blog and e-newsletter
- Events

1. Publications

Infographic one pager of AIP both in English and Urdu were developed during this reporting period. Moreover, two post cards with success stories were developed for AIP-Agronomy and AIP-Rice which were disseminated at various events such as expos, trainings and meetings etc.

2. Flicker

In this reporting period, actioned based photographs of AIPs activities were uploaded on USAID Pakistan's flickr and CIMMYT Pakistan's flickr account.

3. Social media

AIP activities were highlighted using various social media tools such as flickr, facebook etc. CIMMYT's corporate twitter handler **#CIMMYT** was used to tweet AIP activities. From time to time tweets were also shared with USAID Pakistan DOC to highlight the achievements particularly at the event of AIP during Dawn Agri Expo 2015.

4. CIMMYT's Blog and e-newsletter

CIMMYT's informa is wide read newsletter across all Consortium of International Agricultural Research Centers (CGIAR) in the world. Regular Contribution were made to CIMMYT's weekly e-newsletter informa and online blog for highlighting the activities of AIP globally (Appendix 64).

5. Video

A six minutes infographic video profile was developed, which was played during the two expositions in Islamabad and Lahore.

6. Events

6.1. Pakistan Agri Expo-2015

In February 2015, AIP presented the latest advances in agricultural technology and provided a platform for local industry to explore innovative technologies, products and services at the Pakistan Agricultural Conference and Expo 2015 held in Islamabad.

The main attractions were the goats bred through artificial insemination; alternate wetting and drying in rice, Zero Tillage Happy Seeder, durum wheat, biofortified maize, hermetic bags for rice storage ad protected vegetable cultivation models. The AIP exhibit attracted many visitors including farmers, policy makers, agriculture experts and scientists from both public and private sector. This has opened new avenues for AIP to connect with target groups and explore agricultural opportunities in Pakistan (Figure 91).

Figure 90 Glimpse of AIP display at Pakistan Agricultural Conference and Expo 2015 held in Islamabad.

6.2. DAWN Sarsabz Pakistan Agri Expo-2015

On March 19 and 20, 2015, AIP exhibited its commissioned projects interventions in Pakistan's largest agricultural exposition "The DAWN Sarsabz Pakistan Agri Expo-2015", which enabled the AIP's lead CIMMYT and its primary partners to develop partnerships with the key market players that can drive their relevant businesses forward. The Deputy Director of USAID Lahore, Ms. Maggie Schoch visited the AIP display which enabled the AIP team and the beneficiaries to describe the good work they are doing in agricultural development in Pakistan (Figure 92).

7. Success Story

Happy Seeder Happy Farmers

Gulshad Nabi is a progressive farmer from Chak Dahir, Tehsil Muridke in District Sheikhupura of Punjab province in Pakistan. He cultivates wheat and basmati rice, which is the only source of livelihood for his family. In basmati rice - wheat area of Punjab province rice residue burning coupled with heavy tillage is common practice for wheat planting on 70 to 90 percent area. The farmers face many issues among which waste of resources and environmental pollution are of serious concern.

"AIP helped us, improved farming practices. The crop growth is great. Planting wheat using is a new experience - a very modern practice that saves my time and resources."

AIP brought conservation agriculture practices to Pakistan for sustainable agricultural development with introduction of zero tillage happy seeder – a planter used for direct drilling of wheat in heavy residue combine harvested fields. The technique resolves late planting issues in rice- heat cropping systems.

CIMMYT in collaboration with its national partners, under AIP, has initiated pilot testing of the zero tillage happy seeder. CIMMYT in collaboration with Engro Eximp is this technology among 13 progressive farmers in Punjab province in Pakistan.

Gulshad obtained technical training from Engro Eximp under AIP, where he learnt the latest practices and positive impact of conservation agriculture based techniques. He learnt the usage of zero tillage happy seeder without burning of rice residue. After training, he planted wheat on eight acres of land without burning of rice residue using Zero tillage Happy Seeder. It saved him 33 liters of diesel per acre and time by reducing number of tillage operations from seven to one. Just in single operation, he was also able to plant wheat and at the same time applied fertilizer.

"Nobody ever thought of strengthening the farmers beyond old practices. I am thankful to the American People, USAID, CIMMYT and Engro Eximp, who have given new perspective of farming."

X. APPENDICES

1. Cereal and Cereal Systems

1.1. Wheat

Appendix 1. Partners collaborating in various activities of wheat component of AIP.

Partner organization	***Type of organization***	***Province***	***Number of districts covered***	***Activity***
1. Ajrak Seed Corporation	Private	Sindh	1	Basic seed production
2. Bughio Seed Corporation	Private	Sindh	1	Basic seed production
3. Harvest Seed Corporation	Private	Sindh	1	Basic seed production

4. Hyderabad Seed Corporation	Private	Sindh	1	Basic seed production
5. Kasmala Seeds	Private	Balochistan	1	Basic & certified seed production
6. Lakyari Seed Corporation	Private	Sindh,	1	Basic seed production
7. Match Seed Company	Private	Sindh,	1	Basic seed production
8. Miankhail Seed company	Private	KP,	1	Basic & certified seed production
9. National Rural Support Program (NRSP)	Private	Punjab Sindh	24 (16 Punjab) (8 Sindh)	Participatory Varietal Trial-Mother Trials Varietal deployment of new varieties through Informal Research and Development (IRD) Certified seed production Seed priming trial Fertilizer trial Ridge planting trial
10. Pride seed company	Private	KP; 1	1	Basic & certified seed production
11. RCA Seeds	Private		3	Basic & certified seed production
12. Tassco Seed Company	Private	Sindh	1	Basic seed production
13. TMK Seed Corporation	Private	Sindh	1	Basic seed production
14. Zarkhez Seed Corporation	Private	Sindh	1	Basic seed production
15. ARI Quetta	Public	Balochistan	1	Varietal Deployment and popularization
16. AZRI Ummurkot	Public	Sindh		PVS and varietal deployment
17. BARDC	Public	Balochistan	11	Varietal Deployment and popularization Basic and certified seed production
18. BARI Chakwal	Public	Punjab	2	NUYT Durum wheat Capacity building of private seed companies in producing basic seeds
19. CCRI	Public	KP	1	Yield loss assessment of wheat due to rust using fungicides

				Diamond trial, varietal deployment and popularization Capacity building of private seed companies in producing basic seeds
20. CDRI NARC Islamabad	Public	ICT	1	NUYT durum wheat Yield loss assessment of wheat due to rust using fungicides
21. CDRI Karachi	Public	Sindh	1	Yield loss assessment of wheat due to rust using fungicides
22. Department of Agricultural Extension Balochistan	Public	Balochistan	2	Varietal Deployment and popularization
23. Department of Agricultural Extension, KP	Public	KP	12	Varietal Deployment and popularization Basic and certified seed production
24. Mountain Agricultural Research Centre	Public	GB	5	Varietal Deployment and popularization Basic and certified seed production
25. RARI Bhawalpur	Public	Punjab	1	NUYT, durum wheat Yield loss assessment of wheat due to rust using fungicides
26. WRI Faisalabad	Public	Punjab	1	Yield loss assessment of wheat due to rust using fungicides Diamond Trial Capacity building of private seed companies in producing basic seeds
27. WRI Sakrand	Public	Punjab	3	Yield loss assessment of wheat due to rust using fungicides Diamond Trial Varietal Deployment and popularization Capacity building of private seed companies in producing basic seeds
28. Syngenta	Multi-national	KP, Punjab & Sindh	6	Collaborating in yield loss assessment of wheat due to rust using fungicides;

				providing free samples of the fungicides used in this trial
29. Bayar Crop Sciences	Multi-national	KP, Punjab & Sindh	6	Collaborating in yield loss assessment of wheat due to rust using fungicides; providing free samples of the fungicides used in this trial

Appendix 2. Recently released wheat varieties included in varietal deployment in Pakistan with their rust reactions.

					Rust scores		
Wheat variety	***Year of release in Pakistan***	***Parentage***	***Pedigree***	***Genes for rust resistance***	***Yellow rust***	***Leaf rust***	***Stem rust***
AAS11	2011	PRL/PASTOR//2236 (V6550/SUTLEJ86)	BR-4489-3B-6B-1B-0B	LR-18/YR-34	5MR	TMR	20MR
AARI11	2011	SHALIMAR 88 / 90A204 // MH.97			MR/MS	MSS in Sindh and R in Punjab	
Millat11	2011	CHENAB.2000/INQ.91	E-17 Inqalaab-E2337-E32276-E40267-E50705E-60137	Yr27? Yr9?	R	MSS in Sindh and R in Punjab	70M
Punjab11	2011	AMSEL/ATTILA//INQ.91/PEW 'S'	E-409-E2211-E31409-E40169-E50364-E60096-V-05066		R to MR	MSS in Sindh and R in Punjab	40MS
Dharabi11	2011	PRL/PASTOR//2236 (V6550/SUTLEJ86)	CMSS97Y03676S-040Y-		R	MSS in	TMSS

			050YM-040SY-030M-21SY-010M-0Y-0SY			Sindh and R in Punjab	
Pakistan13	2013	MEX94.27.1.20/3/SOKOLL//ATTILA/3*BCN	PTSS02B00132T-0TOPY-0B-0Y-0B-38Y-0M-0SY				
NARC11	2011	OASIS/SKAUZ//4*BCN/3/2*PASTOR	CMSS00Y01881T-050M-030Y-030M-030WGY-33M-0Y	Sr2; Sr25		TMSS	TMR
NARC09	2009	Inqalab*2/Tukuru	CGSS99B00015F-099Y-099M-099Y-099M-29Y-0B-0ID	Yr27? Yr9?		MSS in Sindh	5MSS
Pirsabak13	2013	CHINESE SPRING/TH.SCIRPEU		Lr37/Yr17/Sr38	10 MRMS	TMS	60MRMS
Shahkar13	2013	CMH84.3379/CMH78.578//MIL	CMSS93Y006285-7Y-010Y-010M-010Y-010M-0Y-3KBY-0KBY	Lr37/Yr17/Sr38	0	5MSS	70MS
Benazir	2012	CHEN/AEGILOPS SQUARROSA	CMSS 93B01854T-040Y-08Y-010M-010Y-010M-8Y-0M-5KBY		10MRMS	10MSS	30MR
Lalma	2012	PASTOR/3/ALTAR84/AEGILOPS SQUARROSA(TAUS)//OPATA (SOKOLL)					
NIA-Amber	2010	VEE#5 'S'/SARA//Soghat90		Sr2, Sr31	15MR-MS	0	0
NIA-Sundar	2012	Sarsabz /Sunco*2			0	0	0
NIA-Saarnag	2013	SHA4/Weaver//Skauz*2/SRMA			0	0	0
NIA-Sunhari	2010	Cham4//Ures/Bow 'S'		Sr2, Sr31	0	0	0

Tijaban 10	2010						

Appendix 3. Summary of various research and seed multiplication activities conducted under AIP Wheat, 2014-15.

Activity	**Beneficiary**		**Total**
	Male	**Female**	
Wheat varietal deployment using Informal Research and Development (IRD)	7675	1029	8704
Mother Trial	285	1	286
Baby Trial	137	2	139
Wheat variety and seed priming	118	4	122
Wheat variety and fertilizer trials	45	2	47
Wheat variety and ridge planting	60	0	60
Village-based seed multiplication (basic and certified seeds)	252	16	137
Training	2365	623	2988
Total	10937	1677	12614

Appendix 4. Addressing sustainability of interventions in the project

Developing new innovation platform with NRSP has a good basis for addressing the sustainability of the interventions as it provides vast social capital developed in the form of community groups (COs, VOs and LSOs) by the organizations over the decades. Beauty of this partnership is that there is no extra layer between NRSP and COs and this allows farmers to get direct access for quality seeds and inputs and first-hand knowledge about new technologies through their Male, female and mixed COs, that are integral part of NRSP operation. This innovation platform also provides ample opportunity to engage women farmers as well as much the males. It is very encouraging to note that all the on farm research, demonstration and seed multiplication activities were fully managed by the COs with technical backstopping from NRSP. This meant that this huge operation was not only instrumental to new seed varieties, agronomic practices in the rural, remote areas but also imparting important skills for managing on farm research, development and seed multiplication and marketing.

Second element contributing to sustainability comes from public-private partnership. Basic seed production in the farmers' field by private seed companies in close collaboration with Wheat Breeding Institutes is a new innovation that will help improve the supply of basic seeds that are generally in short supply and this will also improve the access of farmers to new seed varieties in the rural areas.

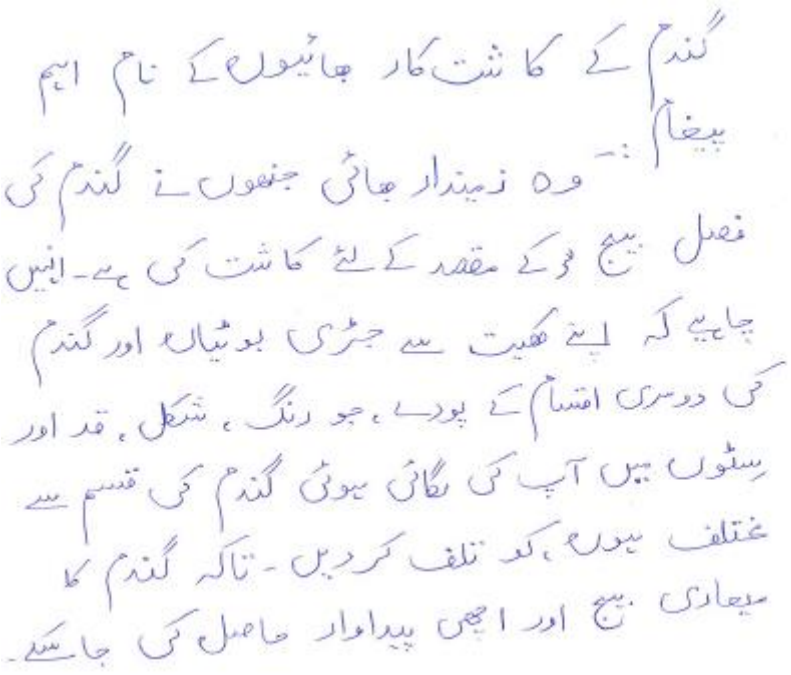
Appendix 5. Summary of wheat seed multiplication through public private partnerships in 2014-15.

Province	**Seed category under production**	**Tentative area (ha)**	**Estimated production (t)**
Balochistan	Basic	40	140

KP	Basic	105	370
KP	Certified	37	125
Punjab	Basic	2	7
Punjab	Certified	160	560
Sindh	Basic	53	180
Total		397	1382

Appendix 5a *Passing on important messages to farmers using mobile phones*

Project has attempted to pass on important messages to the farmers and including seed growers for producing and maintaining high quality wheat seed. This was done by NRSP through their networks of growers. The following message is an example of the various messages shared with the farmers using mobile phones.


گندم کے کاشت کار بھائیوں کے نام اہم
پیغام :- وہ زمیندار بھائی جنھوں نے گندم کی
فصل بیج کے مقصد کے لئے کاشت کی ہے۔ انہیں
چاہیے کہ اپنے کھیت سے جڑی بوٹیاں اور گندم
کی دوسری اقسام کے پودے، جو رنگ، شکل، قد اور
سٹوں میں آپ کی لگائی ہوئی گندم کی قسم سے
مختلف ہوں، کو تلف کر دیں۔ تاکہ گندم کا
معیاری بیج اور اچھی پیداوار حاصل کی جا سکے۔

English translation

Important message for wheat growers:

Wheat farmers and seed growers in particular, please make sure to remove all kinds of weeds from your wheat crop, plants of other crops and plants of other wheat varieties which differ in shape, color, height and spike characteristics from the wheat variety grown for seed production. This will ensure high quality seed production and better and quality grain yield.

1.2. Maize

Appendix 6 Performance of the top 10 white maize varieties introduced from CIMMYT Zimbabwe under AIP as compared to local checks single site analysis from the results of spring 2014 trial.

	Early maturing open pollinated varieties		Intermediate maturing hybrids		Late maturing hybrids		QPM		Early maturing hybrids	
	Total no. of entries 30		Total no. of entries 60		Total no. of entries 40		Total no. of entries 10		Total no. of entries 60	
	Name	T/ha	Name	T/ha	Name	T/ha	Name	T/ha	Name	T/ha
1	TP1217	9.10	CZH131011	10.47	CZH131007	12.10	SA2146-75	9.96	11C 11501	8.70
2	PAN413	8.94	CZH1221	9.68	CZH132074	10.65	SA2146-38	9.81	WM2251	8.16
3	CZP132001	7.92	KKS4611	9.20	CZH132070	10.62	SA2125-23	9.37	CZH1247	7.66
4	CZP132006	7.87	CZH1218	9.08	Local Check	10.59	SA2146-40	8.97	SC301	7.57
5	SC513	7.70	Local Check	8.69	CZH132064	10.50	SA2125-25	7.89	CZH132136	7.53
6	CZP132002	7.47	KKS4663	8.49	CZH132075	10.44	SA2146-39	7.77	CZH132134	7.49
7	CZP132005	7.34	CZH131015	8.44	CZH122	10.29	Local Check	7.51	Local Check 1	7.41
8	ZM309	7.29	CZH1227	8.44	CZH131006	10.28	SA1988-5	7.36	CZH132165	7.32
9	TP1219	7.29	CZH132058	8.39	CZH132073	10.28	SA2125-24	7.02	CZH1262	7.24
10	TP1220	7.25	CZH132043	8.35	CZH132065	10.21	SA2125-21	5.31	10C4234	7.20
Mean		**6.30**		**7.13**		**8.50**		**8.10**		**5.99**
LSD (0.05)		**1.41**		**2.17**		**2.18**		**2.24**		**2.39**
MSe		**0.68**		**1.73**		**1.71**		**1**		**2.13**
CV		**13.12**		**18.47**		**15.40**		**14**		**24.38**
p		**0.000**		**0.000**		**0.000**		**0**		**0.010**
p		***		***		***		**		*
Min		**2.11**		**2.18**		**2.23**		**5.31**		**3.30**
Max		**9.10**		**10.47**		**12.10**		**9.96**		**8.70**

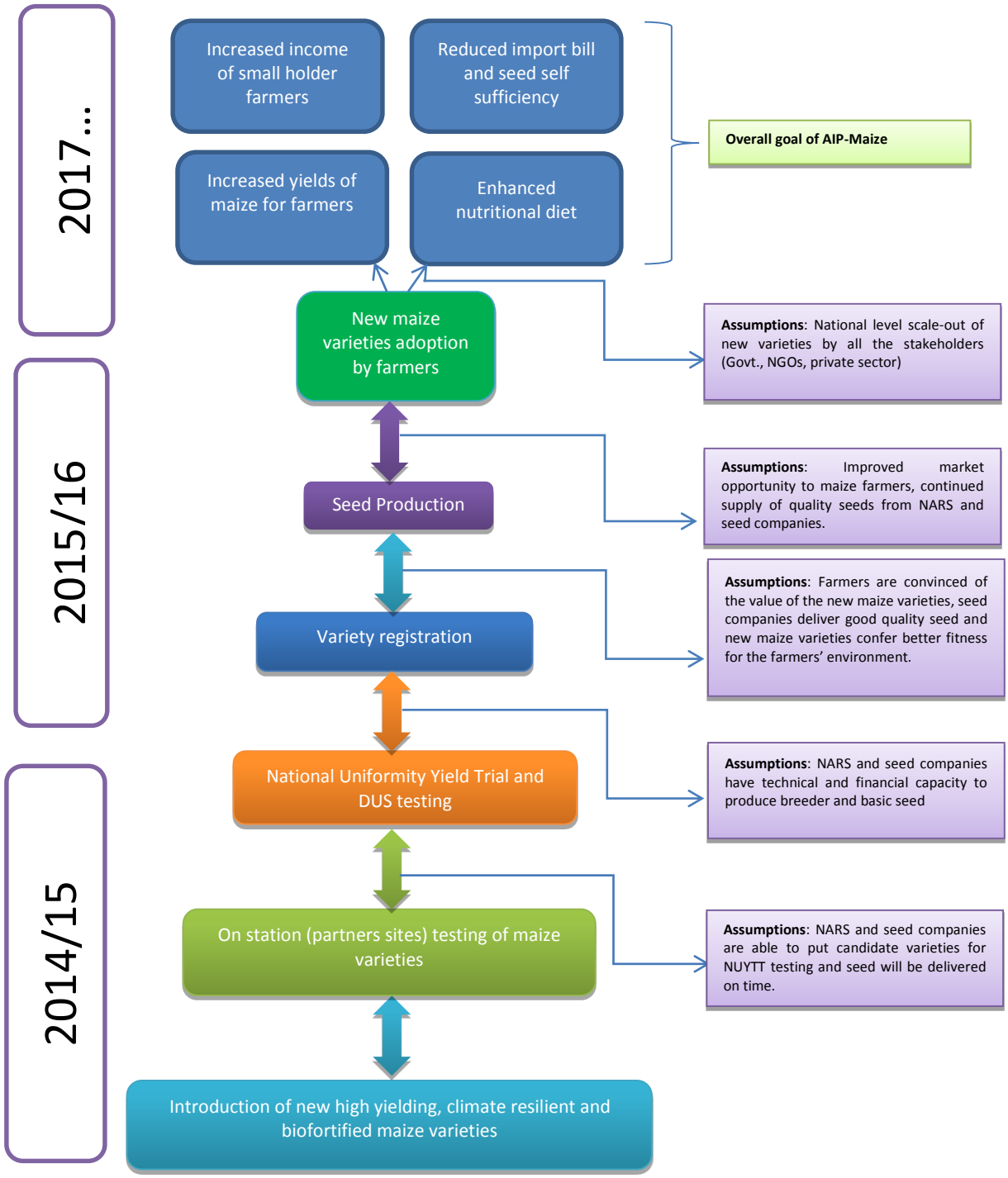
Appendix 7 *Performance of the top 10 bio fortified maize hybrids as compared to local checks single site analysis from the results of spring 2014 trial.*

	Quality protein maize (site 1)		ProVitamin A (Orange maize)		Quality protein maize (site 2)	
	Total no. of ent. 10		Total no. of ent. 24		Total no. of ent. 10	
	Name	T/ha	Name	T/ha	Name	T/ha
1	SA2146-75	9.96	HP1060-8	9.55	SA2146-75	10.47
2	SA2146-38	9.81	HP1060-6	9.44	SA2125-23	10.25
3	SA2125-23	9.37	HP1060-1	9.30	SA1988-5	10.09
4	SA2146-40	8.97	HP1060-22	9.21	SA2146-40	9.76
5	SA2125-25	7.89	HP1060-9	8.88	SA2146-39	9.68
6	SA2146-39	7.77	HP1060-15	8.81	SA2125-24	9.29
7	Local Check	7.51	HP1060-5	8.57	SA2146-38	9.08
8	SA1988-5	7.36	HP1060-14	8.56	SA2125-25	9.04
9	SA2125-24	7.02	HP1060-4	8.28	LOCAL CHECK	8.41
10	SA2125-21	5.31	HP1060-11	8.11	SA2125-21	8.13
Mean		**8.10**		**7.76**		**9.42**
LSD (0.05)		**2.24**		**1.96**		**0.95**
MSe		**1**		**1**		**0**
CV		**14**		**12**		**5**
p		**0**		**0**		**0**
p		**		**		***
Min		**5.31**		**5.22**		**8.13**
Max		**9.96**		**9.55**		**10.47**

Appendix 8 *Performance of Yellow Maize Hybrids Introduced From CIMMYT-Mexico under AIP As Compared To Local Checks (Yellow Cells) Single Site Analysis from the Results of Kharif 2014 Trial.*

Rank	Islamabad		Sahiwal		Pisabak	
	Name	T/ha	Name	T/ha	Name	T/ha
1	AF13A-463-3/7	10.77	Local Check-1	9.98	Local Check-1	10.01
2	AF13A-465-3/8	10.33	AF13A-463-4/7	9.36	AF13A-463-3/7	9.95
3	AF13A-463-4/7	9.92	AF13A-465-3/8	9.30	AF13A-465-3/8	9.81
4	AF13A-463-2/1	9.86	AF13A-465-4/9	9.17	AF13A-463-2/1	9.60
5	AF12A258-2/8	9.64	AF13A-463-2/1	9.10	AF12A258-2/8	9.39
6	AF12A-424-5/12	8.65	AF13A-465-2/7	8.73	AF13A-465-2/7	9.25
7	AF13A-465-5/10	8.52	AF12A-424-5/12	8.69	AF13A-463-4/7	9.25
8	AF13A-465-4/9	8.47	AF13A-463-3/7	8.64	Local Check-2	9.21
9	AF13A-465-2/7	8.11	AF13A-465-6/11	8.61	AF13A-465-5/10	8.87
10	AF13A-465-6/11	7.89	Local Check-2	8.27	AF13A-465-6/11	8.78
11	Local Check-1	7.04	AF13A-465-5/10	8.16	AF13A-465-4/9	8.70
12	Local Check-2	6.50	AF12A258-2/8	7.79	AF12A-424-5/12	7.86
Mean		**8.81**		**8.82**		**9.22**
LSD (0.05)		**2.20**		**1.37**		**1.37**
MSe		**2**		**1**		**1**
CV		**14**		**8**		**8**
P		**0**		**0**		**0**
P		**		+		+
Min		**6.50**		**7.79**		**7.86**
Max		**10.77**		**9.98**		**10.01**

Appendix 9 *A schematic diagram showing program pathway of AIP-maize.*



Appendix 10 *List of AIP-maize trials distributions and partners involved during Kharif-2014 trial.*

No	Collaborator	Ownership	Trial code	Status
1	Jullundur Private Limited	Private	PK14A923/13ASA18HY20	Completed
			PK14A934-13BEARHQPMY14	Completed
			14TTWCYL37	Completed
2	4B group	Private	IHYB1411	Completed
			EPOP1487	Completed
			PK14A931-13BEARHQPMY11	Completed
			LHYB1411	Completed
3	Ali Akbar Pvt	Private	14TTWCYL39	Completed
			14TTWCWL28	Completed
			PK14A923/13ASA18HY26	Completed
4	ICI-Pakistan	Private/Multinational	14TTWCYL40	Completed
			14TTWCWL29	Completed
			PK14A923/13ASA18HY22	Completed
			PK14A931-13BEARHQPMY11	Completed
5	Tara Crop Sciences	Private	PK14A923/13ASA18HY24	Completed
6	Kanzo Seeds Pvt	Private	PAKTCLATE1	Completed
			PAKTCINT1	Completed
7	Tassko Seeds	Private	PAKTCINT3	Completed

8	National Agricultural Research Center (NARC)	Public	14TTWCWL26	Completed
			14TTWCYL38	Completed
			14CHTPROA4	Completed
			14HPLET4	Completed
			PK14A932 13BEARHQPMY12	Completed
			PAK14A/13ASA18HY23	Completed
9	Cereal Crops Research Institute (CCRI)	Public	PK14A934-13BEARHQPMY9	Completed
			14TTWCYL41	Completed
			14TTWCWL27	Completed
10	Maize and Millet Research Institute (MMRI)	Public	14TTWCWL25	Completed
			PAK14A933-13BEARHQPMY13	Completed
11	University of Agriculture Faisalabad (UAF)	Public	ADVQPM1454	Completed
			EPOP1489	Completed
			PAKTCLATE3	Completed
12	University of Agriculture Peshawar (UAP)	Public	14CHTPROA5	Completed
13	Agricultural Research Institute (ARI) Sindh	Public	PK14A923/13ASA18HY25	Completed
			EPOP1490	Completed
14	Agricultural Research Institute (ARI) Gilgit Balristan	Public	EPOP1477	Completed
15	Agricultural Research Institute (ARI) Balochistan	Public	EPOP1475	Completed

Appendix 11 *Status of spring season (2015) trials evaluation at different centers.*

Partner institution/center	**Institution name in short**	**No. of trials**	**Status**
Maize and Millet Research Institute (MMRI)	MMRI	6	Seedling
Cereal Crops Research Institute (CCRI)	CCRI	9	Seedling
National Agricultural Research Institute (NARC)	NARC	8	Seedling
Jullundur Private Ltd	JPL	5	Seedling
Four brothers seed company	4B	5	Seedling
Ali Akbar Group	AA group	4	Seedling
ICI Pakistan Ltd	ICI	7	Seedling
Kanzo Quality Seed	KQS	3	Seedling
Tara crop sciences	TCS	2	Seedling
Agricultural Research Institute (ARI)-Sindh	ARI-Sindh	1	Seedling
Tascco Seeds	TaS	2	Seedling
University of Agriculture Peshawar	UAP	1	Seedling
	Total	**53**	

Appendix 12 *List of biofortified maize varieties evaluated for grain yield in Pakistan*.

No.	Trial Name/code	Trial description	No of entries	No. of reps	No. of sets	Remark/Seed source	Status
1	14CHTPROA	ProA (entries enriched with VitA) of subtropical materials	24	2	2	New trials from CIMMYT Mexico	Completed
2	14HPLET	ProA lines per se evaluation of subtropical materials	75	2	1	New trials from CIMMYT Mexico	Completed
3	ADVQPM	Advanced white kernel Quality Protein Protein	50	2	6	New trials from CIMMYT Zimbabwe	Completed
4	PK14A/13BEARHQPMY	Yellow kernel QPM hybrids	10	3	6	CIMMYT Colombia	Completed

2014/15.**ppendix 13**

Did you know??

56 million $

Is the amount of money Pakistan spent for importing maize seed in 2013/14

140 million $

Is the approximate amount of money spent for importing seeds of cereals and vegetables in 2013/14

53%

From imported cereal seeds was for maize in 2013/14

< 1million $

Is the approximate budget of AIP-Maize and with this budget foundation is being laid to attain maize seed self-sufficiency in Pakistan

Source: own calculation based on FSC&RD internal reports

Appendix 14 *Updated list of Public and private Maize R&D institutions working with AIP-Maize.*

No	Institution	Ownership	Main activity/business	Geographical coverage in Pakistan	Involvement in maize variety development in Pakistan	Maize seed Production and distribution	Type of partnership under AIP maize
1	National Agricultural Research Center	Public	Research and development	Mainly in Islamabad and surrounding areas	Yes	No	Germplasm evaluation and capacity building
2	Cereal Crops Research Institute-Nowshera, KPK	Public	Research and development	KPK province	Yes	Yes	Germplasm evaluation and capacity building
3	Maize and Millet Research Institute-Sahiwal, Punjab	Public	Research and development	Mainly southern Punjab	Yes	Partially	Germplasm evaluation and capacity building
4	Punjab Seed Corporation	Public	Seed business	Punjab province and spill over to KPK and Sindh provinces	No	Yes	Seed production and seed sector enhancement
5	Agr. Research Institute (ARI)-Balochistan	Public	Research and development	Baluchistan province	Mainly variety testing	No	Germplasm evaluation and capacity building
6	Agr. Research Institute (ARI)-Sindh	Public	Research and development	Sindh province	Mainly variety testing	No	Germplasm evaluation and capacity building
7	Agr. Research Institute (ARI)-Gilgit	Public	Research and development	Gilgit Biltistan province	Mainly variety testing	No	Germplasm evaluation and capacity building

8	Univ. of Agr. Peshawar	Public	Academics and research	KPK province	Yes	No	Germplasm evaluation and capacity building
9	Univ. of Agr. Faisalabad	Public	Academics and research	Punjab province	Partly	No	Germplasm evaluation and capacity building
10	Department of Agriculture, AJK	Public	Research and development	Azad Jammu and Kashmir	Mainly variety testing	No	Germplasm evaluation and capacity building
11	Imperial Chemical industry	Private	Mixed business	Nation wide	Yes	Yes	Germplasm evaluation
12	4 brothers group	Private	Mixed business	Mainly in Punjab provinces	Mainly testing	Yes	Germplasm evaluation and seed sector enhancement
13	Jullundur Private Limited	Private	Mixed agri. business	Mainly in Punjab and Sindh. Maize OPVs in KPK	Yes	Yes	Germplasm evaluation and seed sector enhancement
14	Petal Seeds Company	Private	Mixed agri. business	Mainly in KPK province	Mainly testing	Yes	Germplasm evaluation and seed sector enhancement
15	Ali Akbar Group	Private	Mixed agri. business	Mainly in Punjab provinces	Yes	Yes	Germplasm evaluation and seed sector enhancement
16	Tara Crop Sciences	Private	Mixed agri. business	Mainly in Punjab provinces	Mainly testing	Yes	Germplasm evaluation and seed sector enhancement
17	Kanzo Seeds Pvt	Private	Mixed agri. business	Mainly in Punjab provinces	Mainly testing	No	Germplasm evaluation and seed sector enhancement
18	Tassko seeds Pvt	Private	Mixed agri. business	Mainly in Sindh provinces	Mainly testing	No	Germplasm evaluation and seed sector enhancement
19	Zamindara Seeds Plc	Private	Mixed agri. business	Mainly in Punjab provinces	Yes	Yes	Germplasm evaluation and seed sector enhancement
20	Monsanto Pakistan	Multinational	Mixed business	Nation wide	Mainly testing for adaptation	Yes	Collaborations on information sharing
21	Syngenta Pakistan	Multinational	Mixed business	Nation wide	Mainly testing for adaptation	Yes	Collaborations on information sharing
22	Pioneer Pakistan	Multinational	Mainly seed business	Nation wide	Mainly testing for adaptation	Yes	Collaborations on information sharing

Appendix 16 *list of participants of National Maize Workshop.*

No	Institutions	Ownership	No of participants
1	Agricultural Research Institute-Sindh	Public	1
2	Ali Akbar seeds	Private	1
3	Cereal Crops Research Institute	Public	2
4	Department of Agriculture Gilgit Baltistan	Public	1
5	Four Brothers Group	Private	1
6	ICI Pakistan	Private	1
7	Maize and Millet Research Institute	Public	2
8	National Agricultural Research Center	Public	6
9	Pakistan Agricultural Research Council	Public	4
10	Pioneer Pakistan Ltd	MNC	1
11	Rafhan maize products	Private	1
12	Tara Crop Sciences	Private	1
13	University of Agriculture Faisalabad	Public	1
14	University of Agriculture, Peshawar	Public	1
15	Zamindara Seeds	Private	1
16	Punjab Seed Corporation	Public	1
17	Department of agriculture, AJK	Public	1
18	Jullundur Private Limited	Private	1
19	Agricultural Research Institute-Sariab/Quetta	Public	1
20	Kanzo Quality Seed	Private	1
21	Punjab Seed Corporation	Public	1
22	CIMMYT and ILRI	Intl. org	12
23	Media (PARC, and private media)	Public/private	4

Appendix 17 *Agricultural Innovation Program for Pakistan National maize workshop of Pakistan 19020 Nov, 2014, Islamabad. (Post workshop evaluation results.)*

No	Topic	Excellent (%)	Very good (%)	Good (%)	Poor (%)	Very Poor (%)	No comment (%)
1. Pre workshop communications							
1.1	How was the announcement and communication to the workshop?	51.85	40.74	7.41	0	0	0
1.2	Was the information regarding the workshop sufficient? (Agenda, flyer, general guide...)	44.44	44.44	11.11	0	0	0
1.3	How was the period of announcement, enough?	29.63	51.85	18.52	0	0	0
2. **Organization of the workshop**							

2.1	Was it right time to conduct this workshop?	48.15	48.15	3.70	0	0	0
2.2	Was Islamabad right place for the workshop?	59.26	33.33	7.41	0	0	0
2.3	How was the venue? Meeting room, general set up, attractiveness....	51.85	37.04	11.11	0	0	0
2.3.1	Food and refreshment: Breakfast, lunch and dinner services? Both in quality and quantity?	59.26	29.63	11.11	0	0	0
2.3.2	Hotel rooms? Convenience, cleanliness, security....(if applicable)	47.62	28.57	23.81	0	0	0
2.3.2	General service of the hotel? Cleanliness, Wi-Fi access, staff hospitality...(if applicable)	36.00	48.00	16.00	0	0	0
2.4	How was the participants mix?	44.44	55.56	0	0	0	0
2.5	General organization of the workshop?	59.26	37.04	3.70	0	0	0
3. Contents of the workshop							
3.1	Were the topics addressed during the workshop relevant for you?	25.93	66.67	7.41	0	0	0
3.2	The general presentation of the topics?	18.52	66.67	14.81	0	0	0
3.3	Language and communication skills of the resource persons?	18.52	48.15	33.33	0	0	0
4. **Thematic topics covered**							
4.1	Role of PARC's coordination system in maize variety development and commercialization (Mian Abdul Majid-PARC)	16.00	52.00	32.00	0	0	0
4.2	Highlights of the Asian maize industry and lessons for Pakistan (Dr Beshir)	55.56	44.44	0.00	0	0	0
4.3	Industrial products of maize: opportunities and challenges in Pakistan (Dr. Khalid Aziz, Rafhan Co.)	18.52	66.67	14.81	0	0	0
4.4	Post-harvest technologies of maize (Dr. Irfan Afzal)	7.69	76.92	15.38	0	0	0
4.5	Dual purpose maize: Stover quality of maize as compared to other cereals (Zeeshan/ILRI)	15.38	46.15	38.46	0	0	0
5	**The field visit to NARC trials?**	11.11	62.96	25.93	0	0	0
6	**In your opinion how do you rate the progress of AIP-Maize?**	37.04	55.56	7.41	0	0	0
7	**How do you rate this first national maize workshop of Pakistan?**	51.85	44.44	3.70	0	0	0

1.3. Rice

Appendix 18. Submergence tolerance score.

ENTRY	Predicted mean Plot additional yield	SMY (percent)	RANK	FLW	PH	SUB_4d	SUB_7d	SUB_15d	Overall SUB score	Genotype
IR105469:43-51-16	2609	119.4	125	92	109.5	1.0	1.0	2.0	1.3	Sub1
IR105469:72-22-1	1659	69.5	338	124	112.1	1.7	1.7	1.7	1.7	Sub1
IR64-Sub1	2025	88.4	276	92	100.5	3.0	3.0	2.0	2.7	Sub1
IR105495:10-8	2066	90.2	271	98	102.4	3.7	3.7	1.7	3.0	Sub1
IR105469:81-6-10	1043	51.6	376	108	123.5	3.7	3.7	2.3	3.2	Sub1
IR105463:30-13-6	1029	57.7	361	107	116.8	3.7	3.7	3.0	3.4	Sub1
IR105469:74-28-2	2296	94.3	254	101	118.2	4.3	4.3	3.0	3.9	Sub1
IR105463:8-35-15	2346	98.8	240	92	109.2	5.0	3.7	3.0	3.9	Sub1
IR105469:81-3-1	1298	62.4	353	107	114.1	5.0	4.3	3.0	4.1	Sub1
IR105469:72-17-21	1482	59.5	357	108	120.5	5.7	4.3	2.3	4.1	Sub1
IR105479:35-18	1123	47.1	382	107	120.9	5.7	5.0	3.0	4.6	H
IR105469:92-12-15	1724	69.1	341	95	108.8	5.7	5.0	3.7	4.8	-
IR105469:72-42-4	1783	70.2	334	108	124.8	5.7	5.0	4.0	4.9	-
IR105462:11-14-6	1910	98.9	239	98	113.5	5.7	5.0	4.7	5.1	H
IR105479:121-23	1530	75.0	320	104	122.2	7.0	5.0	3.7	5.2	Sub1
IR105463:24-12-3	2344	97.3	248	96	107.5	7.0	5.0	3.7	5.2	Sub1
IR105479:149-10	1104	50.6	378	104	126.8	7.0	5.7	3.7	5.4	-

IR105469:81-19-8	1425	57.1	363	96	89.1	7.0	5.7	3.7	5.4	Sub1
IR105479:121-9	1337	56.7	365	107	146.2	7.0	5.7	4.3	5.7	Sub1
IR105479:149-18	2008	94.3	255	101	107.2	7.0	6.3	4.3	5.9	-
IR105479:110-22	2398	119.9	121	93	107.4	7.0	5.0	5.7	5.9	Sub1
IR105469:74-3-1	2116	89.9	273	96	116.1	7.0	5.7	5.0	5.9	Sub1
IR64	1475	78.2	308	84	103.2	7.0	6.3	4.7	6.0	check
IR6	1215	48.2	379	110	109.1	7.7	7.7	8.3	7.9	Recipient

Appendix 19 *Comparison of BLB resistant lines with Super Basmat.*

Variety/line	**Plant height (cm)**	**Tillers/plant**	**Panicle length (cm)**	**Filled grains/ panicle**	**Sterility (percent)**	**1000 grain weight (gm)**	**Yield kg (ha)**
BR 1 (NIBGE-1)	120.3	23.8	28.4	115.5	5.79	23.6	4514
BR 18	133.4	23.4	28.2	111.1	7.25	23.5	3960
BR 23	121.4	22.7	27.2	92.5	14.23	23.0	3762
Super Basmati (check)	124.3	21.7	26.8	96.5	15.98	22.8	3485

*Average of 10 observations.

Appendix 20 *Performance of rice hybrids at RRI Dokri Larkana in Sindh province*

Hybrid/ variety	**Maturity (days)**	**Panicle length (cm)**	**Grain/ panicle**	**Yield (kg/ha)**	**percent Increase**
MKH-141	94	12.5	140	9000	36.7
MKH-142	95	12.0	140	8500	32.9
MKH-143	97	12.5	145	9250	38.4
MKH-144	94	12.0	170	9000	36.7
MKH-145	97	12.5	180	9400	39.4

IR-6	95	10.5	130	5700	-

Appendix 21 *Comparison of paddy yield of NIAB IR-9 and IR-6 in Balochistan province*

Sr.	Beneficiary Name	Area (acres)	Planting method	Yield (t/ha)		Total Seed Produced (kg)
				NIAB IRRI-9	IRRI-6	
1	DAR Jaffarabad Farm	2	DSR	3.75	-	3,040
2	DAR Jaffarabad Farm	1	Transplant	4.25	5.93	1,720
3	Qurban Ali Mastoi	1.5	Transplant	4.94	5.14	3,000
4	Gulab Khan Lahri	0.5	Transplant	3.16	5.29	640
5	Muhammad Siddique	0.5	Transplant	3.58	4.89	720
6	Zaheer Abbas	0.5	Transplant	3.76	5.07	760

Appendix 22 *Benefits of DSR in Thatta area*

Particulars	Drilling	Broadcasting	Transplanting	Saving
Cost of production (Rs)	34,150	-	43,625	9,475
Yield (mds/ acre)	66	54	-	12
Income (Rs.900/ md)	59,400	48,600	-	10,800
Irrigation water *				10 percent approx.

Appendix 23 *Economic benefit of DSR and AWD in Punjab.*

Sr.	Beneficiary Name	Father/Husband Name	Village (if rural)	Union Council	Tehsil	AWD water saving	DSR cost saving	Yield Increase (per acre)	Economic Benefit (Rs)	Economic Benefit per acre (US $)
1	Shabir Ahmad	Ahmed Ali	Saroop wala	Shah Jamal	Hafizabad	10 %	N/A	2 Maunds	4600	46
2	Muhammad Ayub	Akber Ali	Kot Mubarak	Shah Jamal	Hafizabad	10 %	N/A	3 Maunds	6100	61
3	Muhammad Anis	Abdul Ghafor	Ali Abad	Kot Sayyad	Hafizabad	15 %	15000-20000	2 Maunds	20400	204

4	Baqir Ali	Afzal Husain	Lalke dehera nke	Lalke deheran ke	Hafizab ad	10 %	N/A	1 Maun ds	3100	31
5	Muhamm ad Ashraf	Subhan Ali	Kot Hasan Khan	Kasoki	Hafizab ad	15 %	N/A	1 Maun ds	3900	39
6	Muhamm ad Asif	Umer Hayyat	Saroop wala	Shah Jamal	Hafizab ad	10 %	N/A	2 Maun ds	4600	46
7	Ansar Mehmoo d	Muham mad Hanif	Bhopra Kalan	Bhopra Kalan	Nosher a	5 %	N/A	Equal as per contr ol	800	8
8	Nasir Chohan	Anyat ullah	Aduray	Aduray	Gujran wala	10-15 %	N/A	3 Maun ds	6100	61
9	Ghulam Rasool	Habib	Kila Mian Singh	Kila Mian Singh	Gujran wala	10 %	N/A	2 Maun ds	4600	46
1 0	Mukhtar Ahmed	Muham mad Mustifa	Maan	Kila Mian Singh	Gujran wala	10 %	N/A	3 Maun ds	6100	61
1 1	Shohaib Quershi	Nazir Ahmed	Pindory , Ghuma n wala	Ghuman wala	Gujran wala	15 %	Rs. 1000 0-1200 0	1.5-2 Maun ds	16000	160
1 2	Irshad Ali	Ghulam ali	Uggo chak	Uggo chak	Gujran wala	10 %	N/A	1 Maun ds	3500	35
1 3	Muhamm ad Shafiq	Saraj Din	Uggo chak	Uggo chak	Gujran wala	10 %	N/A	2 Maun ds	5000	50
1 4	Dr. M. Iftikhar	Muham mad Nazir	Nawan pind	Malkan wala	Sambria l	15 %	Rs. 1500 0-2000 0	4 Maun ds	23000	230
1 5	Skindar Goraya	Murad Ali	Bartha n wala	Lariki	Daska	15 %		2 Maun ds	5400	54

16	Amir Niaz	Niaz Ahmed	Begowala	Begowal	Sambrial	20 %		5 Maunds	10700	107
17	Muhammad Ameen	Rehmat Ali	Kotli Miani	Begowal	Sambrial	15 %	Rs. 15000-20000	6 Maunds	25100	251
18	Nawaz Bhutta	Abdul Ghani	Adda begowala	Begowal	Sambrial	20 %	Rs.20000	4 Maunds	28000	280
19	Muhammad Azeem	M.Sadiq	Kotli Joyiana	Begowal	Sambrial	10 %	Rs. 8000-10000	1 Maunds	12500	125
20	Muhammad Imran		Kuthyala Virkan	Khutiala Virkan	Sheikhupura	Flood damaged			0	0
21	Habib ur Rehman		Kuthyala Virkan	Khutiala Virkan	Sheikhupura	Flood Damaged			0	0
22	Abdur Rauf	M. Yousaf	Saranwala	Maliyan kalan	Sheikhupura	15 %	Rs. 10000-12000	4 Maunds	17500	175
23	Niamat Miran	M. Sobah	Sekhum	48 Virkan	Nosher a	15 %	Rs. 10000-12000	2 Maunds	16400	164
24	Tanveer Malik	M.Malik	Khairpur Malian	Maliankalan	Sheikhupura	15 %	Rs. 10000-12000	3 Maunds	17900	179
25	Muhammad Hussain	Rehmat Ali	Muridke		Muridke	Flood Damaged		Flood Damaged	0	0
26	Safdar Ali	Nazer Ahmed	Muridke		Muridke	Flood Damaged		Flood Damaged	0	0

27	Irfan Bhatti	Ashraf Bhatti	Bhaka Bhattian	Nanoana	Hafizabad	15 %	Rs. 10000-12000	5 Maunds	19900	199
28	Arshad	Muhammad Ashraf	Dera Balam	Maliankalan	Sheikhupura	15 %	Rs. 8000-10000	3 Maunds	17500	175
29	Pervaiz	Sardar Muhammad	Dera Saranwala	Maliankalan	Sheikhupura	15 %	Rs. 10000-12000	8 Maunds	23900	239
30	Asad Shah	Ehsan Ali Shah	Kathyala Virkan	Khutiala Virkan	Sheikhupura	15 %	Rs. 5000-7000	2 Maunds	11700	117
Average Economic Benefit / Impact of the intervention per acre in Rupees (Pakistani Rupees and Dollars)									10477	105

Appendix 24. *Hermetic Bags Experimental Study (Started on 26th of December 2014)*

Sample #	**Units**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Variety		**Super Basmati**			**Super 515**			**PS-2**			**5015**			**PK-386**		
Time of Sampling	Hours	1515			1545			1600			1630			1700		
Wt of Sample + Bags	Kg	20.1	20.1	16.4	20.1	20.1	22.5	20.1	20.1	19.2	20.1	20.1	16.3	20.1	20.1	21.3
Weight of Bags	Grams	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Weight of Sample	Kg	20	20	14.2	20	20	22.4	20	20	19.0	20	20	16.15	20	20	12.2
Moisture of Sample	percent	14.9	14.9	14.9	19.6	19.6	19.6	15.5	15.5	15.5	14.3	14.3	14.3	12.6	12.6	12.6

Appendix 25 *Initial observations of samples.*

Date	2-Jan-15	2-Jan-15	2-Jan-15	2-Jan-15	2-Jan-15
Sample	S 1-S 3	S 7 - S 9	S 10 - S 12	S 13 - S 15	S 4 - S 6
Variety	Super Basmati	PS 2	5015	Pk-386	B-515
Moisture percent	12.10	13.00	13.10	11.00	11.90
Broken percent	4.10	0.20	3.20	1.80	1.00
Contrasting Varieties percent	0.30	0.00	1.20	0.60	0.60
Superior percent	0.30	0.00	0.40	0.00	0.60
PS-2	0.30	0.00	0.00	0.00	0.00
Pk-386	0.00	0.00	0.40	0.00	0.40
B-385	0.00	0.00	0.00	0.00	0.20
Inferior percent	0.00	0.00	0.80	0.60	0.00
Ks-282	0.00	0.00	0.80	0.60	0.00
Red Rice percent	0.50	0.20	0.20	0.00	0.00
Green Grains percent	2.50	5.00	3.90	1.00	7.60
Shriveled Grain percent	12.40	7.00	2.20	1.20	3.40
Heat Damage percent	0.00	0.00	0.00	0.00	0.00
Field Damage percent	1.40	0.30	2.40	0.60	3.00
Dirt & Inert Matter percent	-	-	-	-	-
Empty Shell & Trash percent	6.40	1.00	2.70	0.70	1.30
Cracks percent	4.00	10.00	10.00	8.00	6.00
Density (gm/L)	-	-	-	-	-
Fungus Grains percent	1.80	0.00	0.20	0.00	0.60
Germinated grain percent	-	-	-	-	-
Short Grain		2.00			

Appendix 26 *Comparison of different combines on paddy quality*

Category	Kubota Combine	New Holland (wheat combine)
Trash/second cut	Clean (Nil)	High
Green grains per 100gms	75	400
De-husked grains per 100gms	None	50
Broken grains per 100gms	50	175
Grain shattering (kg/ha)	100	200
Monitory loss (Rs/ha)	3750	7500

Appendix 27 Economic benefit of DSR and AWD in Punjab.

Sr.	Beneficiary Name	Father/Husband Name	Village (if rural)	Union Council	Tehsil	AWD water saving	DSR cost saving	Yield Increase (per acre)	Economic Benefit (Rs)	Economic Benefit per acre ($US)
1	Shabir Ahmad	Ahmed Ali	Saroop wala	Shah Jamal	Hafizabad	10 %	N/A	2 Maunds	4600	46
2	Muhammad Ayub	Akber Ali	Kot Mubarak	Shah Jamal	Hafizabad	10 %	N/A	3 Maunds	6100	61
3	Muhammad Anis	Abdul Ghafor	Ali Abad	Kot Sayyad	Hafizabad	15 %	15000-20000	2 Maunds	20400	204
4	Baqir Ali	Afzal Husain	Lalke dehera nke	Lalke deheranke	Hafizabad	10 %	N/A	1 Maunds	3100	31
5	Muhammad Ashraf	Subhan Ali	Kot Hasan Khan	Kasoki	Hafizabad	15 %	N/A	1 Maunds	3900	39
6	Muhammad Asif	Umer Hayyat	Saroop wala	Shah Jamal	Hafizabad	10 %	N/A	2 Maunds	4600	46
7	Ansar Mehmood	Muhammad Hanif	Bhopra Kalan	Bhopra Kalan	Noshera	5 %	N/A	Equal as per control	800	8
8	Nasir Chohan	Anyat ullah	Aduray	Aduray	Gujranwala	10-15 %	N/A	3 Maunds	6100	61
9	Ghulam Rasool	Habib	Kila Mian Singh	Kila Mian Singh	Gujranwala	10 %	N/A	2 Maunds	4600	46
10	Mukhtar Ahmed	Muhammad Mustifa	Maan	Kila Mian Singh	Gujranwala	10 %	N/A	3 Maunds	6100	61
11	Shohaib Quershi	Nazir Ahmed	Pindory, Ghuman wala	Ghuman wala	Gujranwala	15 %	Rs. 10000-12000	1.5-2 Maunds	16000	160

12	Irshad Ali	Ghulam ali	Uggo chak	Uggo chak	Gujranwala	10 %	N/A	1 Maunds	3500	35
13	Muhammad Shafiq	Saraj Din	Uggo chak	Uggo chak	Gujranwala	10 %	N/A	2 Maunds	5000	50
14	Dr. M. Iftikhar	Muhammad Nazir	Nawan pind	Malkan wala	Sambrial	15 %	Rs. 15000-20000	4 Maunds	23000	230
15	Skindar Goraya	Murad Ali	Barthan wala	Lariki	Daska	15 %		2 Maunds	5400	54
16	Amir Niaz	Niaz Ahmed	Begowala	Begowal	Sambrial	20 %		5 Maunds	10700	107
17	Muhammad Ameen	Rehmat Ali	Kotli Miani	Begowal	Sambrial	15 %	Rs. 15000-20000	6 Maunds	25100	251
18	Nawaz Bhutta	Abdul Ghani	Adda begowala	Begowal	Sambrial	20 %	Rs.20000	4 Maunds	28000	280
19	Muhammad Azeem	M.Sadiq	Kotli Joyiana	Begowal	Sambrial	10 %	Rs. 8000-10000	1 Maunds	12500	125
20	Muhammad Imran		Kuthyala Virkan	Khutiala Virkan	Sheikhupura	Flood damaged			0	0
21	Habib ur Rehman		Kuthyala Virkan	Khutiala Virkan	Sheikhupura	Flood Damaged			0	0
22	Abdur Rauf	M. Yousaf	Saranwala	Maliyan kalan	Sheikhupura	15 %	Rs. 10000-12000	4 Maunds	17500	175
23	Niamat Miran	M. Sobah	Sekhum	48 Virkan	Noshera	15 %	Rs. 10000-12000	2 Maunds	16400	164

24	Tanveer Malik	M.Malik	Khairpur Malian	Maliankalan	Sheikhupura	15 %	Rs. 10000-12000	3 Maunds	17900	179
25	Muhammad Hussain	Rehmat Ali	Muridke		Muridke	Flood Damaged		Flood Damaged	0	0
26	Safdar Ali	Nazer Ahmed	Muridke		Muridke	Flood Damaged		Flood Damaged	0	0
27	Irfan Bhatti	Ashraf Bhatti	Bhaka Bhattian	Nanoana	Hafizabad	15 %	Rs. 10000-12000	5 Maunds	19900	199
28	Arshad	Muhammad Ashraf	Dera Balam	Maliankalan	Sheikhupura	15 %	Rs. 8000-10000	3 Maunds	17500	175
29	Pervaiz	Sardar Muhammad	Dera Saranwala	Maliankalan	Sheikhupura	15 %	Rs. 10000-12000	8 Maunds	23900	239
30	Asad Shah	Ehsan Ali Shah	Kathyala Virkan	Khutiala Virkan	Sheikhupura	15 %	Rs. 5000-7000	2 Maunds	11700	117
Average Economic Benefit / Impact of the intervention per acre in Rupees (Pakistani Rupees and Dollars)									10477	105

Appendix 28 *Impacts of training on farmer's yield and paddy quality*

Current Grain loss	Current Breakage	Grain loss Modified machines	Grain loss Modified Breakage
percent	percent	percent	percent
12 -14	8 – 10	6 - 7	4 - 5

1.4. Agronomy

Appendix 29 National partners for dissemination of conservation agriculture technologies

S#	Partner / Institute	Location
1.	Cereal Crops Research Institute (CCRI)	Pirsabak, KP
2.	Wheat Research Institute (WRI)	Sakrand, Sindh
3.	Barani Agricultural Research Institute (*BARI*)	Chakwal, Punjab
4.	Wheat Research Institute (WRI)	Faisalabad, Punjab
5.	Wheat Research Institute (RRI)	Kala Shah Kaku, Punjab
6.	Adaptive Research Farms Punjab	Vehari, Gujranwala and Sheikhupura

7.	Agronomy Research Station	Bahawalpur
8.	Agriculture Research Institute	DI Khan
9.	Directorate of Agriculture Research	Jaffarabad
10.	Arid Zone Research Institute	Bhakkar
11.	Engro Eximp Agri Products	Sheikhupura
12.	National Rural Support Program	Islamabad

Appendix 30 Demonstration of CA technologies in various districts in the project area

District	Zero tillage wheat	Ridge planting	Relay planting of wheat	Fertilizer management	Wheat seed priming
Attock	-	-	-	10	30
Bhakkar	07	24	-	09	
Chakwal	01	-	-	10	30
Khushab	-	20	-	09	15
Mianwali	-	20	-	09	-
Jhelum	-	-	-	-	17
Rawalpindi	-	-	-	-	30
Faisalabad	18	-	04	-	-
DI Khan	10	03	-	-	-
Bahawalpur	-	02	05		-
Jaffarabad	12	-	-	-	-
Nowshera	07	04	-	4	-
Total	55	73	09	51	122

Appendix 31 Details of demonstrations of twenty hybrid maize with improved crop management in KP province

S.No	Farmer Name	District	Previous crop	Grain Yield (Kg/ha)
1	Sajidullah	Nowshehra	Wheat	4625
2	Haji Rasheed	Nowshehra	Wheat	5125
3	Noor Rehman	Nowshehra	Wheat	4500
4	Ismail Shah	Nowshehra	Wheat	5625
5	Afsar Zaman	Swabi	Wheat	3750
6	Usman Khan	Swabi	Wheat	4875
7	Muhammad Javid	Swabi	Wheat	4500
8	Gulzaar Ahmad	Swabi	Wheat	4625
9	Jan Muhammad	Charsadda	Melon	4500
10	Musarrat Shah	Charsadda	Wheat	6000
11	Muhammad Ibrar	Charsadda	Wheat	5375

12	Mian Fazil Shah	Charsadda	Vegetable	6000
13	Muslim Shah	Mardan	Wheat	5625
14	Ikramullah	Mardan	Wheat	5375
15	Umar Shah	Malakand	Wheat	5875
16	Sartaj Khan	Mardan	Wheat	6375
17	Haroon Alam	Peshawar	Wheat	5000
18	Muhammad Sayar	Peshawar	Wheat	4375
19	Nazeer Ahmad	Peshawar	Wheat	4625
20	Farman	Peshawar	Wheat	6375

Appendix 32 No of persons trained on conservation agriculture techniques

District	*Ridge planting of wheat*	*Fertilizer Management*	*Wheat Seed Priming*
Khushab	*20*	*18*	*20*
Bhakkar	*17*	*11*	*-*
Mianwali	*10*	*10*	*-*
Chakwal	*-*	*10*	*24*
Jhelum	*-*	*-*	*5*
Rawalpindi	*-*	*-*	*15*
Attock	*-*	*10*	*30*
Total	*47*	*59*	*94*

Appendix 33 Field days organized for dissemination of CA technologies during October 2014 - March 2015.

S.No	National Partner	Venue	Title of the field day	Date	Persons (No)
1	CCRI - KP	CCRI, Pirsabak, Nowshera	Bed planted & zero tillage maize	02.10.2014	95
2	AR Farm Vehari	AR Farm, Vehari	Bed planted maize and field trials	06.11.2014	248
3	Engro Eximp Agriproducts	Dahr Farm, Mureedkai, Sheikhupura	Zero tillage happy seeder wheat after rice	07.01.2015	114
4	DAR - Usta Muhammad	DAR - Usta Muhammad, Jaffarabad	Zero tillage wheat plated after rice	10.01.2105	95
5	CCRI - KP	CCRI, Pirsabak, Nowshera	Bed planted & zero tillage wheat and nutrient management	11.03.2015	130

6	AR Farm Sheikhupura	Adaptive Research Farm Sheikhupura	Zero tillage Happy Seeder wheat after rice	12.03.2015	104
7	ARS -Bahawalpur	Haji Naseem Farm, Bahawalpur	Bed planting, ridge planting, relay cropping, nutrient management	19.03.2015	60
8	AR Farm Gujranwala	Adaptive Research Farm Gujranwala	Zero tillage Happy Seeder wheat after rice and trials	26.03.2015	95
9	ARS -Bahawalpur	Agronomy Research Station, Bahawalpur	Bed planting, ridge planting, relay cropping, trials and nutrient management	27.03.2015	100
10	AR Farm Sheikhupura	Syed Mubarik Ali Farm, Farooqabad	Zero tillage Happy Seeder wheat after rice	28.03.2015	85
11	WRI - Sakrand	Khan Muhammad Jalalani, Sakrand, Shaheed Benazir Abad	Bed planting of wheat and nutrient management	29.03.2015	74

Appendix 34 Detail of National partner and sites for pilot testing and demonstration of new CA seeder for wheat

Partner & District of Demonstration	Bed planted wheat sites (No)	Zero till happy seeder wheat sites (No)
CCRI – Pirsabak, Nowshera	08	
AR Farm Vehari	04	
BARI-Chakwal	02	
NARC-Islamabad	01	
WRI – Sakrand, Shaheed Benazir Abad)	06	
ARS-Bahawalpur	03	
WRI – Faisalabad	01	07
RRI – Kala Shah Kaku, Sheikhupura		06
AR Farm - Sheikhupura		03
AR Farm - Gujranwala		04
Engro Eximp - Sheikhupura		13
Total	25	33

Appendix 35 Pilot testing of multi-crop bed planter for cotton planting at ARS Bahawalpur in 2014

Technique	Emergence (%)	Fruit bearing (bolls/plant)	100-Boll weight (g)	Yield (kg/ha)
Hand planting on ridges	96	36	320	3190
Multi-crop bed planter on wide beds (2 rows on bed)	74	34	328	2588
Multi-crop bed planter on narrow beds (one row on bed)	72	37	318	2634
Ridges made and 1 row planted with bed planter	69	36	312	2114

Appendix 36 Comparison of maize planting method comparison at farmer fields in Pirsabak, Nowshera

Planting Method	**Plant per m^2**	**Ear Length (cm)**	**Grain Yield (Kg/ha)**
Bed planting	5.02 a	16.4 a	4571 a
Zero tillage planter	4.77 a	15.7 a	4036 b
Farmer Practice	4.73 a	16.3 a	4389 ab
Mean	4.84	16.1	4332
CV	7.42	10.2	7.1
Significance	NS	NS	-

Appendix 37 Performance of NE based recommendation for maize hybrid at farmer fields.

Parameter	**Unit**	**Nutrient Expert**	**Province Recommendation**	**Farmer Practice**	**NE - FP**
Fertilizer - N	Kg/ha	140-180 (169)	250	160-270 (214)	-45
Fertilizer - P_2O_5	Kg/ha	40-67 (53)	115	57-115 (79)	-26
Fertilizer - K_2O	Kg/ha	59-135 (91)	62	45-75 (62)	29
Grain Yield	Kg/ha	6242	5693	5856	386
Fertilizer Cost	RS/ha	34730	45754	37893	-3163

Appendix 38 Comparison of farmer practice and LCC based N application on rice yield and N application in Faisalabad and Gujranwala

Farmer's name	**Variety**	**Total N applied (Kg/ha)**	**Yield (Kg/ha)**

		FP	**LCC**	**FP**	**LCC**
Amanat Ali Farm- Faisalabad	KSK-515	166	109	4.40	3.98
Khalid Mehmood - Faisalabad	Basmati	189	131	3.75	4.50
Munir Hussain- Faisalabad	Kainat	138	80	4.50	4.45
Nisar Akbar - Faisalabad	Basmati	109	51	1.80	2.40
WRI - Faisalabad	KSK-515	169	112	2.49	2.41
AR Farm - Gujranwala	Basmati-super	109	80	3.43	3.49
AR Farm - Gujranwala	Basmati-super	109	51	4.62	4.56
Ijaz Ahmad, Nandipur, Gujranwala	Basmati-super	109	80	4.33	4.16
Muhammad Bashir- Gujranwala	Basmati-386	81	52	4.34	4.38
Muhammad Riaz, Gujranwala	Basmati-super	109	81	4.09	4.02
Ali Hamza, Ojla Khurd, Wazirabad,	Basmati-super	81	52	3.54	3.68
Dawood Iqbal, Gujranwala	Basmati-super	109	81	3.42	3.20
Haris AminNawan Gujranwala	Basmati-super	95	52	3.74	3.50
Malik Adnan Gujranwala,	Basmati-super	95	81	3.27	3.36
Mean		**119**	**78**	**3.69**	**3.72**

Appendix 39

CIMMYT Informa

Zero Tillage for Smallholder Wheat Farmers in Balochistan, Pakistan

Imtiaz Hussain, Mehdi Hassan and Amina Nasim Khan

Under the Agricultural Innovation Program (AIP) for Pakistan and in collaboration with Balochistan Agriculture Research, CIMMYT has begun testing and spreading with farmers the practice known as "zero tillage" to sow wheat in Balochistan, a province in southwest Pakistan that accounts for more than 40 percent of the country's land area but only five percent of the population.

▲ Participants in zero tillage wheat field. Photos: Naveed Ahmed Sheikh from Balochistan.

Jaffarabad and Nasirabad are major rice- and wheat-growing districts in Balochistan. The predominant cropping systems are either fallow or rice, followed by a crop of wheat. Soils after rice are poorly-drained and hamper tilling for wheat, so wheat is not sown soon enough to avoid the high temperatures that arrive in spring, when the crop is filling grain. This seriously reduces yields.

On 10 January, more than 100 participants gathered for a field day organized by AIP in Balochistan province to promote zero tillage for wheat. Involving the direct sowing of wheat seed into residues of the preceding rice crop, with no plowing, the practice has multiple benefits for farmers, soils and water use. These include more timely wheat planting, reduced land preparation costs, higher wheat yields and increased cropping system intensity (hence, productivity), according to agricultural experts Mr. Asmatullah Taran and Mr. Mehdi Hassan.

Intended for smallholder farmers, the event also drew progressive farmers, agricultural extension specialists and researchers from the Directorate of Agriculture Research Usta Muhammad Farm, Jaffarabad District, as well as renowned parliamentarians Mr. Khan Muhammad Khan Jamali, Mr. Changaiz Khan Jamali and Mr. Mir Jan Muhammad Jamali, Speaker, Balochistan Provincial Assembly.

Dr. Muhammad Javaid Tareen, Director General of Balochistan Agriculture Research, praised AIP and partners' efforts to promote conservation agriculture practices such as zero tillage, said the practices would improve farmers' livelihoods in the Nasirabad Zone and called on scientists to address the Province's crop productivity constraints. Mr. Changaiz Khan Jamali, former Federal Minister for Science & Technology, said that agricultural research must address small farmers' concerns and provide new techniques to the farming community.

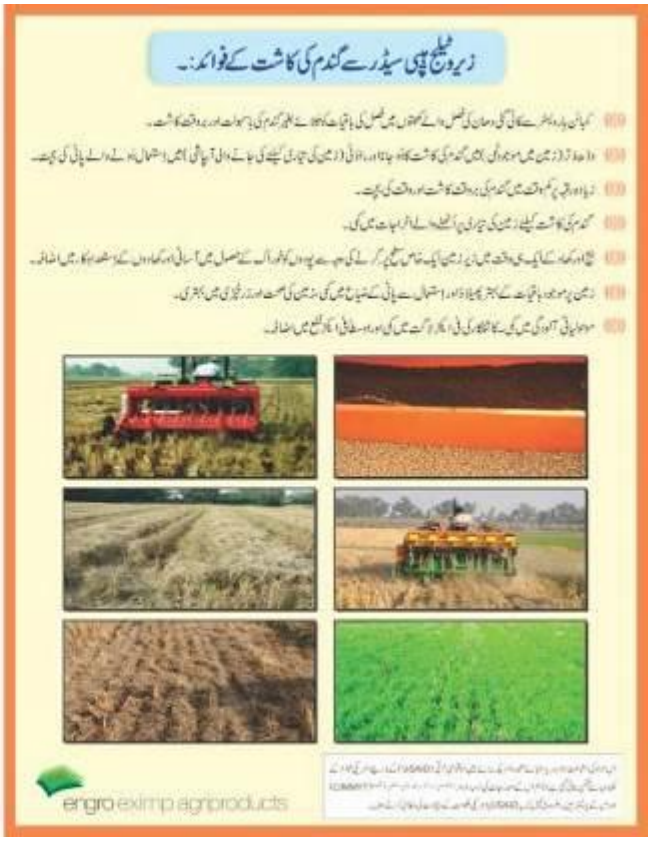
Mr. Jamali was grateful for the efforts of USAID and CIMMYT to improve smallholder famers' incomes and assured the farmers and agricultural professionals that efforts would be made to improve research facilities and access to new technologies in Balochistan.

▲ Mir Jan Muhammad Jamali addressing the farmers.

▲ Participants in field day at Usta Muhammad.

Appendix 40


USAID
CIMMYT
منصوبہ برائے جدت زراعت، پاکستان
زیرو ٹیلج پی سیڈر سے گندم کی کاشت


زیرو ٹیلج پی سیڈر سے گندم کی کاشت کے فوائد:۔
engro eximp agriproducts

Appendix 41

Events Calendar for Meeting Held.

S#	Meeting Name	Date	Purpose	Person Responsible	Venue	Partners	Brief Outcome
1	Planning of activities	October 24, 2014	Training and trials discussed	Imtiaz Hussain	RRI – Kala Shah Kaku	RRI – Kala Shah Kaku	Trials discussion and training arrangements
2	Planter fabrication	October 26, 2014	Fabrication of new CA planters	Imtiaz Hussain	Greenland, Daska	Private manufacturer	Trials discussion and training arrangements
3	NRSP meeting on AIP activities	November 10, 2014	Training on AIP CA techniques	KD Joshi	Islamabad	NRSP	Presented on AIP CA technologies

Trainings/conferences organized

S#	Training Name	Date	Place	Purpose	No. of attendees	Brief Outcome
1	Hands on Training on Zero tillage Happy Seeder	October 25, 2014	RRI, Kala Shah Kaku	Training of national partners	18	18 trainees received training on operation and maintenance of ZT happy seeder
2	Conservation Agriculture Training	October 28-29, 2014	NARC, Islamabad	Training on conservation agriculture	18	18 agronomists trained on conservation agriculture by Dr Ken Sayre.
3	Zero till happy seeder training	October 20, 2014	Engro Farm, Sheikhupura	Training of farmers and master trainers	40	40 master trainer, operator and farmers were trained
4	Training on ridge planting of wheat	November 21,24 & 25, 2014	Mianwali, Bhakkar, Khushab	Training of farmer and NARSP	47	Farmers and NRSP staff trained
5	Training on wheat seed priming t	November 15-20, 2014	Attock, Rawalpindi, Khushab, Chakwal, Jhelum,	Training of farmer and NARSP	94	Farmers and NRSP staff trained
6	Training on nutrient management of wheat	November 18-20 & 24-26, 2014	Attock, Chakwal, Mianwali, Bhakkar, Khushab	Training of farmer and NARSP	47	Farmers and NRSP staff trained
7	Green Seeker use for Nitrogen Management in wheat	December 23, 2014	NARC, Islamabad	Training of national partners	09	09 scientists were trained on operation and use of crop sensor Green Seeker

Field days, exhibitions and fairs organized

S. #	National Partner	Place / Venue	Purpose	Date	Outcome (No)
1	Farmer / Field day	CCRI, Pirsabak, Nowshera	Bed planted & zero tillage maize	02.10.2014	95 persons attended
2	Farmer / Field day	AR Farm, Vehari	Bed planted maize and field trials	06.11.2014	248 persons attended
3	Farmer / Field day	Dahr Farm, Mureedkai, Sheikhupura	Zero tillage happy seeder wheat after rice	07.01.2015	114 persons attended
4	Farmer / Field day	DAR - Usta Muhammad, Jaffarabad	Zero tillage wheat plated after rice	10.01.2105	95 persons attended
5	Farmer / Field day	CCRI, Pirsabak, Nowshera	Bed planted & zero tillage wheat and nutrient management	11.03.2015	130 persons attended
6	Farmer / Field day	Adaptive Research Farm Sheikhupura	Zero tillage Happy Seeder wheat after rice	12.03.2015	104 persons attended
7	Farmer / Field day	Haji Naseem Farm, Bahawalpur	Bed planting, ridge planting, relay cropping, nutrient management	19.03.2015	60 persons attended
8	Farmer / Field day	Adaptive Research Farm Gujranwala	Zero tillage Happy Seeder wheat after rice and trials	26.03.2015	95 persons attended
9	Farmer / Field day	Agronomy Research Station, Bahawalpur	Bed planting, ridge planting, relay cropping, trials and nutrient management	27.03.2015	100 persons attended
10	Farmer / Field day	Syed Mubarik Ali Farm, Farooqabad	Zero tillage Happy Seeder wheat after rice	28.03.2015	85 persons attended
11	Farmer / Field day	Khan Muhammad Jalalani, Sakrand, Shaheed Benazir Abad	Bed planting of wheat and nutrient management	29.03.2015	74 persons attended

List of sub-grants – Agronomy activities (Amount, Recipient, Purpose)

Sr. No	Collaborative Institute	Amount of Funds (US$)	Period
1	Cereal Crops Research Institute, Pirsabk - KPK	1100	1/12/2014 - 1/8/2015
2	Agriculture Extension and Adaptive Research Punjab	20000	01/10/14 - 30/9/15
3	Agronomy Research Station Bahawalpur	12000	01/10/14 - 30/9/15
4	Rice Research Institute, Kala Shah Kaku	10500	01/10/14 - 30/9/15
5	Arid Zone Research Institute, Bhakkar	12500	01/10/14 - 30/9/15
6	Wheat Research Institute - Sakrand	9000	01/10/14 - 30/9/15
7	Agriculture Research Directorate, Usta Muhammad	12000	01/10/14 - 30/9/15
8	Barani Agriculture Research Institute, Chakwal	10500	01/10/14 - 30/9/15

1.5. Socioeconomics

Appendix 42 Sampling frame and sample sizes of maize baseline surveys and two-wheel tractor feasibility study

Regions/Provinces	**Activities**			
	Maize Baseline Surveys		Two-wheel tractor feasibility study in hill areas	
	Sample (No.)	Districts (No.)	Sample (No.)	Districts (No.)
Azad Jammu & Kashmir (AJK)	53	7	53	7
Gilgit-Baltistan (GB)	45	3	42	3
Sindh	51	7		
Balochistan	100	6		
Punjab	200	10		
KP	354	7		

Appendix 42a Province wise trainings detail

Province	District	Local Partner	Participants (no.)
Sindh	Hyderabad	NRSP (NGO)	89
		Govt. Agric. Research institute	
	Mirpur Khas	NRSP (NGO)	
Punjab	Islamabad	84	
	Sargodha	120	
	Jhelum	142	
Khyber Pakhtunkhwa	D.I.Khan	Govt. Agric. Extension	254
		Mian Khail seed company	
	Mardan	Pride seed company	
		Govt. Agric. Extension	
	Noshera	Govt. Agric. Extension	
	Bunir	Govt. Agric. Extension	
Balochistan	Quetta	Govt. Agric. Research Institute	46

2. Livestock

Appendix 43 *Types of fodders produced in the two main seasons in Chalwal district of Punjab.*

Fodder Rabi (winter)	Kharif (summer)
Alfalfa (*Medicago sativa*)	
Berseem (Trifolium alexandrinum) Barley (*Hordeum spp*) Lucerne or Alfalfa (*Medicago sativa*) Mustard/Rape (*Brassica spp*.) Oats (*Avena sativa*) Raya (*Brassica Juncea*)	Guar (*Cyamopsis tetragonoloba*) Maize (*Zea mays*) Millet (*Pennisetum spp)* Sorghum (Sorghum bicolor)

3. Vegetables

Appendix 44 *Germination rates of five onion advance AVRDC varieties at two different locations.*

S. No	Variety	Germination % AZRI, UmerKot	Germination % AZRI, Bahawalpur
1	AVON -1013	90	Nil
2	AVON -1014	16	Nil
3	AVON -1016	56	5
4	AVON -1056	30	5
5	AVON -1067	56	7

Appendix 45 *Tomato hybrid yield under natural off season condition at different locations.*

Location	Highest		Second highest (t/ha)		Lowest (t/ha)	
	Variety	Yield (t/ha)	Variety	Yield (t/ha)	Variety	Yield (t/ha)
IPI-Badin	Supper	3.6	T-786	3.5	Ayusman	2.8
SHRI, Mirpurkhas	1359	4.0	T-1757	3.5	Assuma	3.0
AZRI, UmerKot	1359	11.1	-	-		
BARI Chakwal	T-1757	3.4	1359	2.6	Adventa	2.2

Appendix 46 *Details of demonstration plots established and present status.*

Sr #	Institute	Farmer Field	Crop	Crop Stage	Performance	
					Improved Irrigation Drip	Farmer Practice
1		Chevanda	Tomato	Flowering	Less Disease attack	Late blight attack
2	VRI-Farm		Tomato	Fruiting	Less disease Attack	-

3	ARI-Farm		Tomato	Fruiting	Less disease Attack	-
4		Haripur	Tomato	Fruiting	Less disease Attack	Late blight attack

Appendix 47 *Details of training conducted across Pakistan (October 2014 to March 2015).*

Sr #	Title	Date 2014	Venue	Collaboration	*No. of Participants*		
					Male	*Female*	*Total*
Training organized at the start of the covered production season							
1	Open field off-season tomato production	2-Oct	Thoa Mahram, Talagang	Vegetable Program, NARC	*30*	*0*	*30*
2	Open field off-season tomato production	17-Oct	Thoa Mahram, Talagang	Barani Agricultural Research Institute, Chakwal	*25*	*0*	*25*
3	Raising of vegetables under plasticulture	14-Nov	Nikroo Shaheed Noorpur-Khushab	Vegetable Program, NARC, Islamabad	*12*	*0*	*12*
4	Open field off-season tomato production	21-Nov	Thoa Mahram, Talagang	Barani Agricultural Research Institute, Chakwal	*30*	*0*	*30*
5	Open field off-season tomato production	24-Jan	Katha Saghral, Khushab	Vegetable Program, NARC, Islamabad	*10*	*0*	*10*
Training organized at the time of transplanting							
6	Protected Cultivation of vegetables	25-Jan	Noorpur Thal, Khushab	Vegetable Program, NARC	*15*	*0*	*15*
7	Protected Cultivation of vegetables	Jan 27 & 28	Islamabad	Vegetable Program, NARC, Islamabad	*18*	*2*	*20*
8	Importance of protected cultivation in Vegetables	Jan 28	DI Khan	Agricultural Research Institute, DI Khan	*25*	*5*	*30*
Training organized at the middle of the season							
9	IPM for protected cultivation of vegetables	2-Feb	Bhikhi, Sheikhupura	Vegetable Research Institute, Faisalabad	*22*		*22*
10	IPM for protected cultivation of vegetables	12-Feb	Chevanda, Faisalabad	Vegetable Research Institute, Faisalabad	*24*		*24*
11	Healthy vegetable seedling production	March 4	Kakot Malam Jabba	Agricultural Research Institute, Mingora		*21*	*21*
Total					***211***	***28***	***239***

Appendix 48 *Assistance provided to direct beneficiaries (October 2014-March 2015.)*

Summary of Assistance Provided to Direct Beneficiaries (Farmers) under Vegetable Component (Oct 2014-March 31, 2015)					
Assistance Provided	**Unit**	**Protected Cultivation of Vegetables**	**Improved Mungbean Production**	**Vegetable Value Chains**	**Total**
On -Farm Demo	(no.)	104	96	29	229
Exposure Visits	(no.)	10	16	0	26
Training Beneficiaries	(no.)	239	16	47	302
Drip Irrigation System	(no.)	5	0	0	5
Seed	(Kg)	11830	77	0	11907
Hybrid	(No)	12000	0	0	12000
Seedling	(no.)	27950	0	0	27950
Fertilizer	(Kg)	3044	200	3298	6542
Pesticide (insecticide, fungicide, weedicide)	(Kg/ltr)	41	9	14400	14450
Growth Regulator	(Kg)	20	2	0	22

Appendix v6. (a) Target Areas, Clusters and Direct Beneficiaries in Pakistan

Sub-Component-I	Province	District	Cluster	Direct Beneficiaries
Protected Cultivation of Vegetables	AJK	Muzaffarabad	2	0
	Balochistan	Dadhar, Pishin, Quetta	3	10
	Gilgat-Baltistan	Gilgat, Diamer, Hunza Nagar, Gizer, Sakurdu	9	0
	Sindh	Hyderabad, Umerkot, Mirpurkhas, Badin	5	25
	Punjab	Faisalabad, Sheikhupura, Khushab, Chakwal, Bahawalpur	7	140
	KPK	Haripur, Dera Ismail Khan, Swat, Mansahra	11	86
	Federal	Rawalpindi/Islamabad	1	13
Total			**38**	**274**

Appendix v6. (b)

Sub-Component-II	Province	District	Cluster	Direct Beneficiaries
Improved Mungbean Production	Punjab	T.T Singh, Kasoor, Sheikhupura, Sargodha, Bhakkar, Layyah	10	26
	Federal	Chakwal, Jhelum, Attock, Rawalpindi, Islamabad	7	61
	Sindh	Larkana, Thatta, Sajawal	3	22
Total			**20**	**109**

Appendix v6. (c)

Sub-Component-III	Province	District	Cluster	Direct Beneficiaries
Vegetable Value Chains	KPK	Mingora, Bunir	1	10
	Punjab	Haripur, Attock, Islamabad/Rawalpindi, Sheikhupora, Chiniot, Faisalabad, Pakpattan	3	10
	Balochistan	Quetta, Pishin, Khuzdar, Jafferabad, Mastung	1	10
	Sindh	Mirpurkhas, Umerkot	1	3
Total			**6**	**33**

Appendix 49 *Net revenue gained from mungbean production as a double crop under rainfed conditions of Pothwar region of Punjab province of Pakistan.*

District	Clusters	Cluster Name	Farmers	Variety used	Mean Yield (kg/ha)	Value of grains/ ha @ Rs. 75/- per kg	Value of by-products (Rs./ha)	Total income (Rs./ha)	Production Cost (Rs./ha)	Net Revenue Gain/ha (Rs.)
Chakwal	11	Bhagwal	21	AZRI-06	628	47,100	11,250	58,350	43,250	15,100
Jhelum	12	P.D. Khan	20	AZRI-06	620	46,500	11,250	57,750	43,250	14,500
Attock	13	Dhokri	4	NM-11	1300	97,500	11,250	108,750	43,250	65,500
	14	Khunda	3	NM-11	1200	90,000	11,250	101,250	43,250	58,000
Rawalpindi	15	Rawat	3	NM-11	600	45,000	11,250	56,250	43,250	13,000
	16	Mandra	6	NM-11	900	67,500	11,250	78,750	43,250	35,500
Islamabad	17	ICT	6	NCM-13	700	52,500	11,250	63,750	43,250	20,500

Appendix 49 (a). *Percentage Bruchid damage of F5 mungbean lines derived from a cross between V2802 and NM94 and parents evaluated in Taiwan.*

No. of F_5 Lines	percentage of damage in bruchid
30	0
8	1-10
19	11-25
87	>26
V 2802 (female parent)	0
NM 94 (Male parent)	98

Appendix 49 (b). Percentage Bruchid damage of F3 mungbean families derived from a cross between V2802 and NM94 and parents evaluated in Hyderabad

No. of Families	percentage of damage in bruchid
20	0
6	1-10
15	11-25
14	>26
V 2802 (Female parent)	0
NM 94 (Male parent)	57

Appendix 49 (c). Percentage Bruchid damage of F3 mungbean families derived from a cross between V2709 and NM94 and parents evaluated in Taiwan

No. of Families	percentage of damage in bruchid
2	0
2	1-10
13	11-25
133	>26
V 2709 (Female parent)	17
NM 94 (Male parent)	97

Appendix 50 *Stakeholders' workshops to validate the findings of the baseline/value chain surveys.*

No.	Participants	Faisalabad 3/3/2015	Quetta 6/3/2015	Kunri 16/3/2015	Swat 24/3/2015
1	Tomato Farmers	7	13	55	12
2	Chili Farmers	6	13	55	0
3	Onion Farmers	8	13	31	12
4	Experts cum Farmers (Part Time)	6	23	18	9
5	Economist	1	1	1	0
6	Statistician cum Farmer (Part Time)	1	2	1	1
7	Financial Experts (Zarai Tarqiati Bank Ltd) cum Farmer (Part Time)	2	2	2	3
8	Commission Agents	2	2	2	2
9	Vegetable Retailers	3	0	2	2
10	Seed Dealers	2	2	4	4

Appendix 51 *Training programs on onion seed crop management.*

Title	Topics Covered	Date 2014-15	Venue	Collaboration	No. of Participants		
					Male	Female	Total
Onion seed crop Management	Onion seed production, threshing and storage including insects and diseases control	January 20, 2015	Bunir in KP province	ARI(N) Mingora	20	0	20
Onion seed crop management	Onion seed production, threshing and storage, insects and diseases control	February 3, 2015	NARC in Islamabad	ARI Mingora & Vegetable NARC	21	4	25

Appendix 52 Annexure-I *List of Provincial Partner Institutions.*

Appendix 52 (a) *Institutions for Protected Cultivation (October 2014 to March, 2015)*

1. Agricultural Research, Gilgit-Biltistan
2. Agricultural Extension, Gilgit-Biltistan
3. Agricultural Research , Muzaffarabad, Azad Jammu & Kashmir
4. Agricultural Research Institute (N) Mingora-Swat
5. Agricultural Research Station, Baffa-Mansahra
6. National Tea and High Value Crops Research Institute, Shinkiari-Mansahra
7. Vegetable Program, HRI, NARC, Islamabad
8. Barani Agricultural Research Institute (BARI), Chakwal
9. Vegetable Research Institute, AARI, Faisalabad
10. Agricultural Research Institute (S), DI Khan
11. Arid Zone Research Institute, Bahawalpur
12. Sindh Horticultural Research Institute(SHRI), Mirpurkhas
13. Arid Zone Research Institute, Umerkot
14. Institute of Plant Introduction, SARC, Karachi
15. Directorate of Vegetable Seed Production, ARI, Saryab-Quetta

Private Companies & Progressive Growers

- Soon Valley Development Project, Khushab

Appendix 52 (b) Institutions for Mungbean Production (October 2014 to March, 2015)

1. Pulses Program, CSI, NARC, Islamabad
2. Barani Agricultural Research Institute (BARI), Chakwal
3. Pulses Research Institute (PRI), AARI, Faisalabad
4. Arid Zone Research Institute (AZRI), Bhakkar
5. Quaid-e-Awam Agriculture Research Institute (QAARI), Larkana
6. National Sugar & Tropical Horticulture Research Institute (NSTHRI), Thatta

Private Companies & Progressive Growers

- Mumtaz Seed Company, Rahim Yar Khan

Appendix 52 (c) Institutions for Vegetable Value Chains (October 2014 to March, 2015)

1. Agricultural Research Institute (N) Mingora- Swat
2. Vegetable Program, HRI, NARC, Islamabad
3. Vegetable Research Institute, AARI, Faisalabad
4. Postharvest Research Center, AARI, Faisalabad
5. Directorate of Vegetable Seed Production, ARI, Saryab, Quetta

Private Companies & Progressive Growers

- Shuga Seed Growers Association, Gokand Valley, Bunir, KP
- ARCO Seed, Gujranwala, Punjab
- Beacon Seed Company, Kot Ghulam Muhammad, Sindh

Appendix 53 *Area (hectares) and crops planted for vegetable seed production in winter and summer seasons across the country in 2014-15.*

Crop	**Provinces**				**Total**
	KP	**Punjab**	**Sindh**	**Balochistan**	
Onion	0.5	0.5	2.0	1.90	**4.9**
Peas	0.5	2.3	-	-	**2.8**
Tomato	-	0.5	-	-	**0.5**
Chili	-	-	1.0	-	**1**
Okra	-	-	-	-	**-**
Total	**1.0**	**3.3**	**3**	**1.90**	**9.2**

Appendix 54 *Consultation meetings on linking farmer-seed producers with markets and service providers.*

Meeting Name	**Date (2014-15)**	**Purpose**	**Person Responsible**	**Venue**	**Partners**	**Brief Outcome**
Coordination meeting	October 28, 2014	Initiation of collaboration and coordination	Balochistan Agriculture Project (BAP)	Karachi	Representatives of BAP	Briefed each other on their respective field activities
Coordination meeting	October 30, 2014	Initiation of work with Beacon Seeds, Kunri	Mian Naeem, Owner	Kunri, Umer Kot	Partner in Private sector	Discussed future plan

Appendix 55 *Coordination meetings and workshops for collaboration in project activities.*

Meeting Name	**Date (2014-15)**	**Purpose**	**Person Responsible**	**Venue**	**Partners**	**Brief Outcome**
Coordination meeting	October 27, 2014	Initiation of collaboration and coordination	Representatives of Border Areas Project and ARI, Quetta, Balochistan	Quetta in Balochistan province	Provincial Partners	Briefed each other on their respective field work
Coordination meeting	November 17, 2015	Initiation of coordination with PHRC	Discussion on postharvest trainings	PHRC in Faisalabad in Punjab province	Provincial Partners	Discussed training on onion and tomato drying

Appendix 56 *highlights of the validation workshops in four provinces in Pakistan, March 2015.*

(see Appendix v9. For additional notes)

<table>
<tr><td>Post-harvest losses of vegetables, percentage of production</td><td>
<table>
<tr><th>Crop</th><th>Faisalabad district of Punjab province</th><th>Quetta district of Balochistan province</th><th>Kunri district of Sindh province</th><th>Swat district of KP province</th></tr>
<tr><td>Tomato*</td><td>18-20</td><td>20-25</td><td>18-20</td><td>12-15</td></tr>
<tr><td>Onion*</td><td>8-10</td><td>12-15</td><td>15-18</td><td>8-10</td></tr>
<tr><td>Chilies*</td><td>10-12</td><td>10-12</td><td>20-25</td><td>6-8</td></tr>
</table>
**Estimated losses based on experience of the different stakeholders.*</td></tr>
<tr><td>Factors contributing to losses</td><td>1. Use of uncertified, mixed, poor quality and unhealthy seeds results in production of vegetables that are vulnerable to diseases and susceptible to environmental and management stresses
2. Traditional but poor harvesting and produce handling methods
3. Poor bulk packing
4. Long distance marketing especially from Balochistan province and harsh ambient temperatures
5. Market price fluctuations
6. Lack of labor at the time of harvesting and handling
7. Open and poor bulk transport resulting in more damage to vegetables
8. Rain damage and harsh temperatures during transportation
9. Expensive and insufficient cold storage facilities
10. Attack of insects and pests
11. Poor storage practices
12. No cold/reefer container facilities</td></tr>
<tr><td>Recommendations to reduce postharvest losses</td><td>1. Provision of harvesting and post-harvest handling tools for customized picking, handling and postharvest management.
2. AIP-Vegetables must sensitize the growers and other stakeholders to adopt customized packaging materials and sizes according to the needs of modern markets. Similarly, as a matching grant, must provide packaging materials for bulk and retail packing of vegetables especially for tomatoes and chilies. In addition to reducing handling, packaging and transport losses, this will also help enhance the shelf life, provide longer availability and ultimate improve returns to growers.
3. AIP-Vegetable should introduce interventions to facilitate the provision on a cost-share basis of small to medium level processing, packaging and value addition facilities for smallholder vegetables farmers.
4. AIP-Vegetables and its partners should facilitate linkage of the smallholder farmers with microfinance institutions for credit facilities.
5. Provision of pack houses facilities for sorting, grading, packing and storing vegetables for quality control and to spread out the marketing period.</td></tr>
</table>

	6. An information campaign to increase the consumption of vegetables, which could result in increased demand for vegetables and reduction in postharvest losses along the supply chain. 7. AIP-Vegetables and its partners should assist in linking farmers to national and international markets 8. AIP-Vegetables and its partners should establish a cold chain system for consistent supply of fresh vegetables from farm to market is needed 9. Training of farmers, traders and other stakeholders regarding value chain development, post-harvest management and better agriculture practices 10. Moreover, AIP-Vegetables in collaboration with the concerned the public sector should establish a system to check the vegetable seeds certification. 11. Modern information systems such as SMS and online publishing, etc. to disseminate information regarding cultural practices, IPM, appropriate vegetable varieties etc. 12. Set in place a workable market information system to inform the farmers about market prices, demand and supply, etc. 13. Capacity building on avoid adulterated inputs i.e. seed, balanced use of fertilizers and judicious use of insecticides/pesticides to avoid qualitative postharvest losses

Appendix 57 *Tomato germplasm sent to ARI Mingora district of KP and Vegetable Program at NARC in Islamabad in December 2014.*

S. No	Name of Variety	Habit	Germination Percentage at ARI, Mingora	Germination percentage at Vegetable Program, NARC, Islamabad.
1.	AVTO1420	Semi-determinate	05*	80
2.	AVTO1418	Semi-determinate	50*	90
3.	AVTO1424	Semi-determinate	50*	76
4.	AVTO1405	Semi-determinate	87	84
5.	AVTO1409	Semi-determinate	85	82
6.	AVTO1289	Semi-determinate	90	88
7.	AVTO1288	Determinate	93	89
8.	AVTO1455	Determinate	60	70
9.	AVTO9708	Semi-determinate	85	90
10.	AVTO1456	Semi-determinate	40	61
11.	AVTO1429	Indeterminate	55	59

* The lower percentage germination at ARI Mingora was due to sowing in the open field and not using polybags /seedling trays.

Appendix v17. *Chili germplasm provided to AZRI in Umerkot district of Sindh province in September 2014.*

S. No.	New Code	Germination Percentage
1	C04878	7
2	TC06050	62
3	TC06472	36
4	AVPP 9701	52
5	AVPP 9704	35
6	AVPP 9804	46
7	VI059328, C05573	67
8	AVPP 0506	54
9	AVPP 0705	29
10	AVPP 0903	63
11	AVPP 1236	88
12	AVPP 1346	60
13	PBC 518, C05650	26
14	PBC 903, TC06245	00

4. Perennial Horticulture

Appendix 58 *Events Calendar for Meeting Held (October 1, 2014 – March 31, 2015).*

No	Meeting Name	Date	Purpose	Person Responsible	Venue	Partners	Brief Outcome
Perennial Horticulture							
1.	Citrus IPM Training	December 5, 2014	Capacity building of farmers	Louise Ferguson	Sargodha	Citrus growers	25 growers were trained using presentation and hands on training.
2.	Pistachio Growers meeting	December 10, 2014	Introductory and problem identifying meeting with all stakeholders of Pistachio	Louise Ferguson	Quetta	All Pistachio Stakeholders	28 Persons (growers, exporters, processors and researchers) attended this meeting. Idea of creating a farmers' organization was mentioned in this meeting.
3.	Multiplication and Commercialization of New Potential Mango Accessions Farmer Meeting	February 21, 2015	Introduce the 10 new selected native cultivars	Louise Ferguson	Multan	Mango growers	55 growers attended the field day and showed positive response for adoption of new varieties.

4.	Citrus Training	February 24, 2015	Farmer Capacity Building	Louise Ferguson	Sargodha	Citrus growers	49 citrus growers attended this training.
5.	Training of Grape Vines on an I Shape Trellis	March 12, 2015	Farmer/Students Capacity Building	Louise Ferguson	Rawalpindi	Horticulture students and farmers	12 farmers and students received hands on training
6.	Propagation of Grapes through Stem Cutting	March 13-14, 2015	Farmer/Students Capacity Building	Louise Ferguson	Rawalpindi	Horticulture students and farmers	14 participants were trained on actual propagation techniques
7.	Consumer taste surveys at the Dawn Ag Expo in Lahore	March 19-20, 2015	Consumer feedback about product	Louise Ferguson	Lahore	All National and International stakeholder	Very good taste test rating of the product by the consumers.
8.	Training on lay out and installation of trellising system along with weed management	March 25, 2015	Capacity Building	Louise Ferguson	Rawalpindi	Horticulture students	39 students were trained by practical work in field. Videos of the event were made for extension purpose.
Human Resource Development							
1.	Pre-departure workshop	December 9, 2014	Preparation for life and study in the U.S.	Tom Rost	Islamabad	HRD Scholars	13 scholars attended the meeting.
Vocational Training							
1.	Online statistics course	November 10-December 1, 2014	Refresher course on statistics	Mark Bell	Online	AIP partners	24 participants from 5 AIP partner institutions exposed to advanced statistics.

2.	Action Planning	February 18-19, 2015	Increase participants' understanding of project planning	Mark Bell	UAF	All AIP Collaborators	21 participants attended the workshop. UCD received well written proposals for tree research
3.	Effective Meetings	February 23, 2015	Sharing Best Practices for running effective meetings	Mark Bell	UAF	UAF Higher Management	27 participants attended the workshop
E- Pak Ag							
1.	ICT Based Agricultural Technology Transfer: Issues and Challenges	January 8, 2015	Stakeholders' discussion on topic	Mark Bell	NARC	Dr. Babar Shahbaz	43 participants exchanged ideas
2.	ICT in Agriculture	January 2015	Stakeholders' discussion on topic	Mark Bell	AAUR	Dr. Babar Shahbaz	Participants exchanged ideas
3.	Stakeholders' Consultative Workshop on *"Extension and Outreach*	February 25, 2015	Stakeholders' discussion on topic	Mark Bell	Lahore	Dr. Babar Shahbaz	45 participants exchanged ideas on the topic

Appendix 59 *Meetings Planned for Next Semi-Annual Period.*

No.	Meeting Name	Date	Purpose	Person Responsible	Venue	Partners	Brief Outcome
Perennial Horticulture							
1.	Citrus Value Chain. Nursery Management, Orchard Management and Early Season Pests and Diseases	April 9, 2015	Farmers Capacity Building	Louise Ferguson	Sargodha	Citrus growers	
2.	Farmer Training on Value Addition of Fruits and Value Added Food Production	April 16, 2015	Capacity Building	Louise Ferguson	Rawalpindi	Household Females	
3.	Farmer Training on Value Addition of Fruits and Value Added Food Production	May 2, 2015	Capacity Building	Louise Ferguson	Rawalpindi	Household Females	
4.	Education Program on Value Added Products from Citrus for Extension Educators, Teachers; the focus is on the on farm, in-home cottage industry, not	May 13, 2015	Capacity Building	Louise Ferguson	Sargodha	Extension Educators, Teachers	

	commercial production						
5.	Orchard Management	June 2015	Capacity Building	Louise Ferguson	Rawalpindi	Grape growers	
6.	Farmer Training on Value Addition of Fruits and Value Added Food Production	June 25, 2015	Capacity Building	Louise Ferguson	Rawalpindi	Household Females	
7.	On Farm Mango Growers meeting	August 2015	Introduction of new mango accessions	Louise Ferguson	Vihari	Mango Growers	Adoption of new mango verities
8.	On Farm Mango Growers meeting	September 2015	Introduction of new mango accessions	Louise Ferguson	TBD	Mango Growers	Adoption of new mango verities
Human Resource Development							
None planned as of this report							
Vocational Training							
1.	Scientific writing workshop	July 2015	To help young researchers to write scientific publications	Mark Bell	NARC-Islamabad	Young AIP researchers, especially women	
2.	Statistic 101 workshop	August 2015	Improvement in the statistical analysis abilities	Mark Bell	NARC-Islamabad	Young AIP researchers, especially women	
3.	Statistics 201	TBD	Improvement in the statistical analysis abilities	Mark Bell	NARC-Islamabad		

4.	Effective meetings Part II	August 2015	Collect feedback on specific issues encountered	Mark Bell	UAF-Faisalabad	Managerial staff	
E- Pak Ag							
1.	Material design workshop in ICT extension	TBD	Specific ICT tool Identification	Mark Bell	NARC-Islamabad		Identified technology: Develop fact sheet and consider how it might be validated, distributed and improved.
2.	National Conference	TBD	Nationwide consultation for ICT in Agriculture	Mark Bell	TBD	All stake holders	

5. CGS

Appendix 60 *Projects for AIP.*

Sr.No	Code	Receipt & Date	Projects	PI	Co-PI	Team Member	Institution	No. of years	Amount
Agriculture									
1		20-Mar-15	Enhancing Cotton Seed Germination by Addressing Multifactor impediments	Khalid Mahmood, Director, Telephone: 0321-9668139 Email: crifsd@gmail.com	N.A	1.Muammmad Riaz, Assistant Botanist (cotton) Cotton Research Institute Faisalabad. 2. Dr. Jehanzeb Farooq Assistant Research Officer, Cotton Research Institute Faisalabad.	Cotton Research Institute Faisalabad	Two & half year (30 months)	5.0 million

2		20-Mar-15	Development of Heat Tolerance in Cotton Genotypes by the use of Pollen Culture Technique and Physiological Markers	Khalid Mahmood, Director, Telephone: 0321-9668139 Email: crifsd@gmail.com	N.A	Muammmad Riaz, Assistant Botanist (cotton) Cotton Research Institute Faisalabad. Dr. Jehanzeb Farooq Assistant Research Officer, Cotton Research Institute Faisalabad.	Cotton Research Institute Faisalabad	Two years	5.0 million
3		24-Mar-15	Estimation of Genetic relationship based on DNA finger printing of OATs germplasm	Dr. Muhammad Zaffar Iqbal, Director, Agriculture Biotechnoloy Research Institute, Faisalabad. Telephone: 041-9201669 Email: dr_zaffariqbal@hotmail.com	Sundas Shahzad, Assistant Research Officer, Agriculture Biotechnoloy Research Institute, Faisalabad. Telephone: 041-9201669 Email: sundas.shahzad@yahoo.com	Fodder research institute, Sarghoda	Agriculture Biotechnoloy Research Institute, Faisalabad.	Two years	5.0 million
4		24-Mar-15	Molecular characterization of Okra and Peas for a wiseable future breeding in Pakistan	Dr. Muhammad Zaffar Iqbal, Director, Agriculture Biotechnoloy Research Institute, Faisalabad. Telephone: 041-9201669 Email: dr_zaffariqbal@hotmail.com	Sundas Shahzad, Assistant Research Officer, Agriculture Biotechnoloy Research Institute, Faisalabad. Telephone: 041-9201669 Email: sundas.shahzad@yahoo.com	N.A	Agriculture Biotechnoloy Research Institute, Faisalabad.	Two years	5.0 million
5		24-Mar-15	Association mapping in Tomato for yield and quality traits.	Dr. Muhammad Zaffar Iqbal, Director, Agriculture Biotechnoloy Research Institute, Faisalabad. Telephone: 041-9201669 Email: dr_zaffariqbal@hotmail.com	Sundas Shahzad, Assistant Research Officer, Agriculture Biotechnoloy Research Institute, Faisalabad. Telephone: 041-9201669 Email: sundas.shahzad@yahoo.com	Vegetable research institute, Faisalabad.	Agriculture Biotechnoloy Research Institute, Faisalabad.	Two years	5.0 million

6		24-Mar-15	Expression analysis of abiotic stress reponsive genes/transcription factors in wheat	Dr. Muhammad Zaffar Iqbal, Director, Agriculture Biotechnoloy Research Institute, Faisalabad. Telephone: 041-9201669 Email: dr_zaffariqbal@hotmail.com	Dr. Shahid Nazir, Assistant Research Officer, Agriculture Biotechnoloy Research Institute, Faisalabad. Telephone: 041-9201669 Email: sundas.shahzad@yahoo.com	N.A	Agriculture Biotechnoloy Research Institute, Faisalabad.	Two years	5.0 million
7		24-Mar-15	Association mapping in Sorghum for yield traits.	Dr. Muhammad Zaffar Iqbal, Director, Agriculture Biotechnoloy Research Institute, Faisalabad. Telephone: 041-9201669 Email: dr_zaffariqbal@hotmail.com	Sundas Shahzad, Assistant Research Officer, Agriculture Biotechnoloy Research Institute, Faisalabad. Telephone: 041-9201669 Email: sundas.shahzad@yahoo.com	Fodder research institute, Sarghoda	Agriculture Biotechnoloy Research Institute, Faisalabad.	Two years	5.0 million
8		24-Mar-15	Screening of transgenic sugarcane (Saccharum officinarum L.) for herbicide tolerance	Dr. Shaheen Aftab, Principal Scientist, National Institute for Biotechnology and Genetic Engineering (NIBGE) / PAEC Telephone: 041-2651475-79 Email: aftab6104@gmail.com	Dr. Muhammad Afzal, Sugarcane Specialist, Sugarcane Research Institute, AARI, Faisalabad. Telephone: 041-2657817 Email: dr.muhammad_afzal@yahoo.com	1. Dr. Zahid Mukhtar, PS. 2. Muhammad Arshad, SS	National Institute for Biotechnology and Genetic Engineering (NIBGE)	Two years	5.0 million
9		24-Mar-15	Insectiside Resistance studies for sustainable management of sucking insect pest (Jassid, Whitefly and Trips) on Bt cotton	Dilbar Hussain, Assistant Entomologist, Telephone: 03007930862, Email: roy_dilbar@yahoo.com	N.A	Mr. Muhammad Saleem, Assistant Research Officer, Mr. Muneer Abbas, Assistant Research Officer	Entomological Research Institute, Faisalabad.	Two Years	4.814 million

10		24-Mar-15	Development of CLCuV Resistance in cotton by developing horizontal resistance	Khalid Mahmood, Director, Telephone: 0321-9668139 Email: crifsd@gmail.com	N.A	Muammmad Riaz, Assistant Botanist (cotton) Cotton Research Institute Faisalabad. Dr. Jehanzeb Farooq Assistant Research Officer, Cotton Research Institute Faisalabad.	Cotton Research Institute Faisalabad	Two and quarter year	4.75 million
11		25-Mar-15	Marker Assisted pyramiding of multiple stress tolerance genes in Super Basmati rice.	Dr. Muhammad Arif, Principal Scientist, National Institute for Biotechnology and Genetic Engineering (NIBGE) Telephone: 041-2651475 Email: marif_nibge@yahoo.com	N.A	Mr. Tariq Mahmood PSA, Mr. Qaisar Zaman SA-III, Mr. Zahid Mahmood SA-IV	National Institute for Biotechnology and Genetic Engineering (NIBGE)	Two years	5.0 million
12		25-Mar-15	Development and seed production of local high yielding yellow mosaic virus resistant okra lines	Prof. Dr. Asif Ali	N.A	N.A	Department of Plant Breeding & Genetics		3.56
13		25-Mar-15	Establishing a data bank for policy studies	Prof. Dr. Muhammad Ashfaq	N.A	N.A	Institute of Agri. and Resource Economics		5
14		25-Mar-15	Vegetable nursery production and supply system for kitchen gardening	Prof. Dr. Asif Ali Khan	N.A	N.A	Department of Plant Breeding & Genetics		4.98

15		25-Mar-15	Innovative and novel approaches for the enhancement of oil seed crops growth and yield using magnetic-stimulator and LASER Technology	Dr. Muhammad Shahid	N.A	N.A	Department of Biochemistry		5
16		25-Mar-15	Risk assessment for potent mycotoxins in entire value chain of Pakistan rice	Dr. Imran Pasha	N.A	N.A	National Institute of Food Science & Technology		4.074 Million
17		25-Mar-15	Postharvest management of maize and cotton seeds by implementation climate-smart dry chain technology in Pakistan	Dr. Irfan Afzal	N.A	N.A	Department of Agronomy		4.9 Million
18		25-Mar-15	Use of value added compost enriched with plant growth promoting bacteria for vegetable tunnel farming	Dr. Sajid Mahmood Nadeem	N.A	N.A	Soil and Environmental Sciences, SUB Campus Burewala		4.5 Million
19		25-Mar-15	Acquisition and evaluation of different fruit plant species for salinity and drought affected areas	Dr. Muhammad Saqib	N.A	N.A	Institute of Soil and Environmental Sciences		4.95 Million

20		25-Mar-15	Evaluation and enhancement of yield and quality of multi-cut fodder species for salinity and drought affected areas	Dr. Muhammad Saqib	N.A	N.A	Institute of Soil and Environmental Sciences		4.94 Million
21		25-Mar-15	Production of bacteriocins from locally isolated bacteriocinogenic lactia acid bacteria and their evaluation as biopreservatives in fish	Dr. Muhammad Ashraf	N.A	N.A	Institute of Microbiology		4.4 Million
22		25-Mar-15	Iron Biofortification of lentil to combat micronutrient malnutrition	Dr. Muhammad Saeed	N.A	N.A	National Institute of Food Science & Technology		4.2 Million
23		25-Mar-15	Dynamics and Determinants of Pakistan's Agriculture Sector Competitiveness in Light of Trade with India	Dr. Abdul Ghafoor	N.A	N.A	Institute of Business Management Sciences		2.2 Million
24		25-Mar-15	Value Chain Analysis of Major Vegetables in Punjab, Pakistan	Dr. Abdul Ghafoor	N.A	N.A	Institute of Business Management Sciences		3.2 Million
25		25-Mar-15	Exploring the potential of R genes for disease-resistance breeding in chickpea against	Dr. Rana Muhammad Atif	N.A	N.A	Department of Plant Breeding & Genetics		5.0 Million

			Ascochyta blight and *Fusarium* wilt						
26		25-Mar-15	Impact of climate change on crop productivity and household food security in disaster prone areas of Indus river	Dr. Ghaffar Ali	N.A	N.A	Institute of Agri. And Resource Economics		4.73 Million
27		25-Mar-15	Capacity building and awareness of farm women regarding iron deficiency through outreach of biofortified crops	Dr. Ghaffar Ali	N.A	N.A	Institute of Agri. And Resource Economics		5.0 Million
28		25-Mar-15	Impact assessment of bed planting technology in mixed cropping zone of Punjab, Pakistan: way forward for rapid dissemination and adoption	Dr. Asghar Ali	N.A	N.A	Institute of Agri. And Resource Economics		4.35 Million
29		25-Mar-15	Scope of non-traditional rural enterprises to support rural household income: a baseline survey	Dr. Muhammad Khalid Bashir	N.A	N.A	Institute of Agri. And Resource Economics		2.40 Million

30		25-Mar-15	Enhancing the export competitive of selected vegetables	Dr. Khalid Mushtaq	N.A	N.A	Institute of Agri. And Resource Economics		3.67 Million
31		25-Mar-15	Molecular and biochemical studies to identify the most effective nitrogen fixing rhizobial strain from mungbean	Dr. Nisar Ahmed	N.A	N.A	CABB		4.97 Million
32		25-Mar-15	Establishing phonological models and genetic responses to seasonal shifts in guava for crop regulation	Dr. Muhammad Usman	N.A	N.A	Institute of Horticultural Sciences		5.0 Million
33		25-Mar-15	Next generation sequencing of legume plant infected with geminivirus to identify differentially expressed genes responsible for maintenance of viral	Muhammad Mubin	N.A	N.A	CABB		5.0 Million
34		25-Mar-15	Molecular screening of host plants maintaining economically important viruses and training of Pakistani farmers to identify and eradicate the	Dr. Muhammad Shah Nawaz-ul-Rehman	N.A	N.A	CABB		5.0 Million

			alternate reservoirs of plant viruses						
35		25-Mar-15	Attraction and repellency of medicinal plant volatile against *Aedes aegypti* in laboratory and semi-field experimental hurts	Dr. Shahid Majeed	N.A	N.A	Department of Entomology		2.82 Million
36		25-Mar-15	Measuring baseline susceptibility of *Spodoptera litura* field populations to Bt cry toxins for resistance monitoring	Dr. Muhammad Arshad	N.A	N.A	Department of Entomology		4.45 Million
37		25-Mar-15	Management of lepidopterous rice pests using sex pheromones to reduce pesticide residues	Dr. Muhamamd Sufian	N.A	N.A	Department of Entomology		1.7 Million
38		25-Mar-15	Development of native *baculovirus* based biopesticides for sustainable management of lepidopteran	Dr. Ahmad Nawaz	N.A	N.A	Department of Entomology		2.7 Million

			insect of vegetables						
39		25-Mar-15	Oestrids and calliphorids as major causes of myiasis in livestock: identification, characterization and cure	Dr. Fatima Mustafa	N.A	N.A	Department of Entomology		5.0 Million
40		25-Mar-15	Control of some bird and rodent pests using eco-sustainable technologies for crops and indoor environments in the selected agro-ecological zones of Punjab, Pakistan	Dr. Hammad Ahmad Khan	N.A	N.A	Department of Zoology, Wildlife and Fisheries		3.7 Million
41		25-Mar-15	Developing the tillage and nutrient management practices to enhance soil sustainability and crop productivity in rice-wheat cropping system field setting and modeling approach	Dr. Tasneem Khaliq	N.A	N.A	Department of Agronomy		5.0 Million

42		25-Mar-15	Prevalence of root-knot nematode (Meloidogyne graminicola) in rice-wheat cropping system in central Punjab and its management	Prof. Dr. Nazir Javed	N.A	N.A	Department of Plant Pathology		4.8 Million
43		25-Mar-15	Combating potato cyst nematodes: an emerging threat to potato production and export in Pakistan	Dr. Amjad Ali	N.A	N.A	Department of Plant Pathology		4.9 Million
44		25-Mar-15	Impact Assessment of climate change on vulnerable agro ecological zones of Punjab	Prof. Dr. Ashfaq Ahmad	N.A	N.A	Department of Agronomy		5.0 Million
45		25-Mar-15	Optimization of in vivo micropropagation system in local genotypes of Ziziphu spp of Pakistan for seeding production	Dr. Siddra Ijaz	N.A	N.A	CABB		5.0 Million
46		25-Mar-15	Enhancing photosynthetic by species-specific RuBisCO activase overexpression in plastome	Dr. Faiz Ahmad Joyia	N.A	N.A	CABB		2.89 Million

47		25-Mar-15	Best cotton picking practices for female workers using mechanical hand picker	Dr. Assad Farooq	N.A	N.A	Department of Fibre & Textile Technology		5.0 Million
48		25-Mar-15	Assessment of Bt cotton varieties and segregating population for water deficit areas in polymer treated soils	Dr. Muhammad Tehseen Azhar	N.A	N.A	Department of Plant Breeding and Genetics		4.89 Million
49		25-Mar-15	Identification, evaluation and documentation of tomato germplasm suitable for waste water irrigated areas	Dr. Asif Saeed	N.A	N.A	Department of Plant Breeding and Genetics		4.9 Million
50		25-Mar-15	Employing resource conservation technologies in rice-wheat cropping enhance soil and crop productivity	Prof. Dr. Ehsanullah	N.A	N.A	Department of Agronomy		4.0 Million
51		25-Mar-15	Germplasm enhancement of kalonji (*Nigella sativa* L.)	Dr. Amir Shakeel	N.A	N.A	Department of Plant Breeding and Genetics		3.90 Million
52		25-Mar-15	Genetic assessment of multi-ovary spike and rust resistance in	Dr. Muhammad Kashif	N.A	N.A	Department of Plant Breeding and Genetics		4.80 Million

53		25-Mar-15	Enhancing total factor productivity and sustainability of rice-wheat cropping system	Dr. Muhammad Farooq	N.A	N.A	Department of Agronomy		5.0 Million
54		25-Mar-15	Employing biological nitrification inhibition ion mitigation greenhouse gas emission and improving nitrogen use efficiency of wheat	Dr. Muhammad Farooq	N.A	N.A	Department of Agronomy		5.0 Million
55		25-Mar-15	Potential use of superabsorbent polymers in improving wheat productivity under water deficit conditions	Dr. Muhammad Farooq	N.A	N.A	Department of Agronomy		3.5 Million
56		25-Mar-15	Spatio-temporal trend and integrated management of red pumpkin beetle (*Aulacophora foveicollis*) on vegetables	Dr. Muhammad Ahsan Khan	N.A	N.A	Department of Entomology		3.29 Million
57		25-Mar-15	Economic and institutional drivers of net foreign direct investment inflows (FDI) in agricultural input and output sectors of	Dr. Burhan Ahmad	N.A	N.A	Institute of Business Management Sciences		2.0 Million

			Pakistan: AN analysis of FDI policy in Pakistan						
58		25-Mar-15	Establishing flowering in sugarcane to under local condition in Pakistan by using viral vector	Dr. Iqrar Ahmad Rana	N.A	N.A	CABB		5.0 Million
59		25-Mar-15	The impact of women economic empowerment on economic growth of Punjab	Prof. Dr. Sultan Ali Adil	N.A	N.A	Institute of Agri. And Resource Economics		4.0 Million
60		25-Mar-15	Women's role in the adoption and impact of technology in agrioculture	Dr. Rakhshanda Kousar	N.A	N.A	Institute of Agri. And Resource Economics		3.0 Million
61		25-Mar-15		Dr. Hafeez ur Rehman	N.A	N.A	Department of Agronomy		5.0 Million
62		25-Mar-15	Development of improved female date palm plants with novel marker-assisted sex differentiation technology	Dr. Faisal Saeed Awan	N.A	N.A	CABB		5.0 Million

63		25-Mar-15	Revision and date base of predatory mites of family phytoseiidae from Pakistan	Dr. Muhammad Hamid Bashir	N.A	N.A	Department of Entomology		3.51 Million
64		25-Mar-15	Marker assisted dissection for hydrogen cyanide (HCN) genetics in fodder sorghum under drought stress	Dr. Amir Bibi	N.A	N.A	Department of Plant Breeding and Genetics		5.0 Million
65		25-Mar-15	Investigating the potential of heat shock proteins coupled with biochemical and molecular markers for heat-tolerance breeding in mungbeen	Dr. Rana Muhammad Atif	N.A	N.A	Department of Plant Breeding and Genetics		5.0 Million
66		25-Mar-15	Identification of phosphorous use efficient genotypes of *Gossypium hirsutum* L.	Dr. Muhammad Tehseen Azhar	N.A	N.A	Department of Plant Breeding and Genetics		4.93 Million
67		25-Mar-15	Identification and development of *Gossypium hirsutum* L. genotypes for heat stress conditions	Dr. Muhammad Tehseen Azhar	N.A	N.A	Department of Plant Breeding and Genetics		4.8 Million

68		25-Mar-15	Identification and development of heat tolerant tomato (*Solenum lycopersicum*) accessions for extending growing seasons in Punjab	Dr. Hafiza Masooma Naseer Cheema	N.A	N.A	Department of Plant Breeding and Genetics		3.8 Million
69		25-Mar-15	Impact of climate changes on the yield of major food-crops in Punjab	Dr. Muhammad Yaseen	N.A	N.A	Department of Statistics		4.35 Million
70		25-Mar-15	Whole genome sequencing for *Ceratocystis manginecans*, fungal pathogen of mango wilt disease	Dr. Iqrar A. Khan	N.A	N.A	CABB/PBG		4.6 million
71		25-Mar-15	Exploring the natural dye yielding potential of wheat husk for textile industry	Dr. Naeem Iqbal Associate Professor, Telephone: 0419201167, Email: drnaeem@gcuf.edu.pk	Mr. Shahid Adeel, telephone: 041921167, shahidadeelchemist@gmail.com	Dr. Makhdoom Hussain, Director Wheat AARI, Faisalabad. Dr. Muhammad Azeem, Assistant Professor, Department of Botany, GC University Faisalabad.	Department of Botany, GC university Faisalabad.	Two years	4.6 million
72		25-Mar-15	Induction of blight and virus resistance in tomato	Dr. Muhammad Yussouf Saleem, Principle scientist, Telephone: 041-9201751, Email: mysaleem1966@gmail.com	Mrs. Sajida Bibi, Senior Scientist, Telephone: 041-9201751, Email: Sajida10@gmail.com	Dr. Abdul Rehman Khan, Senior Scientist, NIAB. Mr. Khalid Pervaize Akhtar, Principle Scientist, NIAB. Dr. Muhammad Asghar, Principle Scientist, NIAB.	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	Two years	4.587 million

73		25-Mar-15	Intervention of modified nitrogen fertilizers for high efficiency to enhance crop tield	Mahmood-Ul-Hassan, Principle Secientist.	Dr. Robiah BT Yunus, Director, Institute of advanced technology, Putra University, Malaysia. Dr. M.Saeed Ashraf, Assistant Research Officer, Agronomic Research Institute AARI Faisalabad.	N.A	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	Two years	5.0 Million
74		25-Mar-15	Development of sustainable grass production technologies for higher livestock productivity in saline environments	Abdul Rasul Awan, Principle Scientist, Telephone: 041-9201751, Email: arawan77@yahoo.com	Dr. Khalid Mahmood, Deputy Chief Scientist, NIAB	Mr. Muhammad Rizwan, Senior Scientist. Dr. Hafiz Naubhar Hussain, Senior Scientist	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	Two Years	4.98 million
75		25-Mar-15	Development of Nutraceutical Byproducts from Rice Bran	Dr. Rubina Arshad, Principle Scientist, Telephone: 9201751, Email: arshadrubina@hotmail.com	Dr. Muhammad Rashid, Principle Scientist, NIAB	Dr. Amjad Hameed, Principle Scientist, NIAB. Dr. Noreen Bibi, Senior Scientist, NIAB. Mr. Saeed Iqbal, Principle Scientific Assistant, NIAB	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	Two Years	4.60 million
76		25-Mar-15	Control of multi-species aphids outbreak in wheat through a structered IPM program.	Dr. Rashid Ahmed Khan, Principle Scientist, Telephone: 041--9201776, Email: rashidpp2004@yahoo.com	Noor Abid Saeed, Senior Scientist, NIAB. Telephone: 0419201751, Email: noor_alspk@yahoo.com	Mr. Kamran Saleem, Mr. Kamran Mirza, Mr. Imran Sohail.	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	Two Years	3.2 million
77		25-Mar-15	Production of coccinellid predators and development of their prolonged storage technology	Dr. Nazia Suleman, Principle Scientist, Telephone: 041-9201776. Email: nazianasir2002@yahoo.com	Dr. Muhammad Hamed, Director / Deputy Chief Scientist, NIAB. Telephone: 041-9201776. Email: hamrazapak@yahoo.com	Dr. Sajid Nadeem, Principle Scientist. Mrs. Asia Riaz, Senior Scientist. Mr. Muhammad Yousaf, Principle Scientific Assistant.	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	Two Years	5.0 Million

78		25-Mar-15	Post-harvest treatment of tomato with simple, low cost and environment safe chemicals for the improvement of shelf life and quality.	Dr. Sumaira Yousaf, Senior Scientist, Telephone: 041-9201751, Email: sa_niab@yahoo.com	Khalid Pervaiz Akhter, Principle Scientist, NIAB. Telephone: 041-9201751, Email: kpervaiz_mbd@yahoo.com	Dr. Nighat Sarwar, Plant Pathologist / Biochemist. Mr. M Tanvir Elahi, Plant Breeser. Mr. Zubair Ahmad Scientific Assistant.	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	Two Years	5.0 million
79		25-Mar-15	Management of economically important tomato diseases, using environment friendly chemicals and plant extracts.	Dr. Sumaira Yousaf, Senior Scientist, Telephone: 041-9201751, Email: sa_niab@yahoo.com	Khalid Pervaiz Akhter, Principle Scientist, NIAB. Telephone: 041-9201751, Email: kpervaiz_mbd@yahoo.com	Dr. Nighat Sarwar, Plant Pathologist / Biochemist. Mr. M Tanvir Elahi, Plant Breeser. Mr. Zubair Ahmad Scientific Assistant.	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	Two Years	5.0 million
80		25-Mar-15	Integrated use of inorganic phosphorus fertilizer and animal manure for heigher phosphorus use efficiency and better yield of wheat and maize.	Dr. Muhammad Akhtar, Principle Scientist, Telephone: 041-9201784. Email: akhtarniab@gmail.com	Dr. Arif Naeem, Senior Scientist, NIAB. Telephone: 041-9201784. Email: scountuaf@gmail.com	Mr.Muhammad Yaqub, Principle Scientist. Imran Ahmed, Scientific Assistant-I, Mr. M. Arshad, Scientific Assistant-II, Mr. Waqas Javed, Scientific Assistantt-III	Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.	Two Years	4.915 million
81		25-Mar-15	To identify the areas where waste water is the only available source for irrigation and to propose the alternate crops other than vegetable crops for growing under waste water.	Dr. Abid Niaz, Assistant Agriculture Chemist, Telephone: 041-9200745, Email: drniazch@gmail.com	Mr. Tahir Saeed, ARO, Floriculture Deptt, AARI, Faisalabad. Telephone: 03006640907,	Ms. Ifra Saleem, ARO, Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad. Mr. Atif Muhmood, ARO, Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad.	Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad.	Two Years	5.0 Million

82		25-Mar-15	Impact assessment of macronutrients (P&K) foliar application using isotopic labeling technique.	Dr. Syed Shahid Hussain Shah, Assistant Research Officer, Telephone: 041-9200745, Email: shahid_1321@yahoo.com	Dr. Muhammad Akhtar, Principal Scientist, NIAB, Telephone: 0314-3022077, Email: akhtarniab@gmail.com	Mr. Abdul Wakeel, ARO, Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad. Mr. Allah Nawaz, ARO, Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad.	Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad.	Two Years	5.0 Million
83		25-Mar-15	Quantification of heavy metals loads in main sewage water drains (Survey Study)	Dr. Syed Shahid Hussain Shah, Assistant Research Officer, Telephone: 041-9200745, Email: shahid_1321@yahoo.com	Dr. Fakhar Mujeeb, Assistant Agriculture Chemist, Soil Bacteriology section, AARI, Faisalabad. Telephone: 0333-6704180, Email: mfakharmujeeb@yahoo.com	Ms. Ifra Saleem, ARO, Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad. Mr. Atif Muhmood, ARO, Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad.	Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad.	Two Years	5.0 Million
84		25-Mar-15	Survey of Soils and Crops regarding heavy metals pollution caused by pesticides spraying and phosphatic fertilizers.	Dr. Abid Niaz, Assistant Agriculture Chemist, Telephone: 041-9200745, Email: drniazch@gmail.com	Imran Nadeem, ARO, Entomological Res. Institute, Faisalabad. Telephone: 0303-6238770, Email: imrannadeem.eri@gmail.com	Mr. Shakeel Ahmed Anwar, Assistant Agricultural Chemist, oil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad. Mr. Atif Muhmood, ARO, Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad.	Soil Chemistry Section, Institute of Soil Chemistry & Environmental Sciences, AARI, Faisalabad.	Two Years	5.0 Million

85		25-Mar-15	Up-gradation of Main Library, Ayub Agriculture Research Institute, Faisalabad. Through IT Lab and Digitization.	Muhammad Nadeem Akhtar, Librarian, Telephone: 041-9200564, Email: Aarilibrary@gmail.com	N.A	N.A	Ayub Agriculture Research Institute, Faisalabad.	One year	5.0 Million
86		25-Mar-15	Strengthening of Mash Germplasm for Indentification of High Yielding and Disease Resistant Genotypes.	Mr. Muhammad Shafiq, Pulses Botanist, Telephone: 0300-6663519, Email: mainshafiq60@yahoo.com	Mr. Irfan Rasool / Mr. Muhammad Naveed, Assistant Research Officer, Telephone: 0321-4769940, Email: naveed1735@yahoo.com	N.A	Pulses Research Institute, Faisalabad.	Two Years	5.0 million
87		25-Mar-15	Identification of Climate Resilient Chickpea Genotypes for Mitigation Impacts on Yield Potential.	Mr. Muhammad Shafiq, Pulses Botanist, Telephone: 0300-6663519, Email: mainshafiq60@yahoo.com	Mr. Muhammad Naveed, Assistant Research Officer, Telephone: 0321-4769940, Email: naveed1735@yahoo.com	N.A	Pulses Research Institute, Faisalabad.	Two Years	5.0 million
88		25-Mar-15	Development of short duration mash germplasm with erect and determinate growth habit.	Dr. Aziz ur Rehman, Botanist, Telephone: 0333-6883255, Email: aziz_kml@yahoo.com	Mr. Irfan Rasool, Assistant Research Officer, Telephone: 0321-4769940, Email: irfanrasooldeo@yahoo.com	N.A	Pulses Research Institute, Faisalabad.	Three year	5.0 Million
89		25-Mar-15	Commercialization of BLB resistant rice line(s) developed through Marker Assisted Backcross Breeding approach	Dr. Muhammad Arif, Principal Scientist, Telephone: 041-2651475 Email: marif_nibge@yahoo.com	N.A	Mr. Tariq Mahmood PSA, Mr. Qaisar Zaman SA-III, Mr. Zahid Mahmood SA-IV	National Institute for Biotechnology and Genetic Engineering (NIBGE)	Two Years	2.0 million

90		25-Mar-15	High throughput citrus dianostics and screening of pathogens from Pakistani germplasm	Prof.Dr. Shagufta Naz, Director Research, Professor and Head of Department, Telephone: 042-99203801, Email: drsnaz31@hotmail.com	Dr. Faiza Saleem	Ambreen Zafurallah, Research Officer	Lahore College for women, University, Lahore	Three year	5.0 Million
91		25-Mar-15	Improving the efficacy of Bt-based Biopesticides by genetic manipulation	Dr. Faiza Saleem, Assistant Professor, Telephone: 042-99203801, Email: zoologist1pk@yahoo.com	Dr. Farheen Aslam	Aisha Younas, Research Officer	Lahore College for women, University, Lahore	Three year	5.0 Million
92		25-Mar-15	Comparison of composting efficiency of different bacteria isolated from composting sites and development of a suitable microbial inoculum for agriculture waste.	Dr. Neelma Munir Assistant Professor, Telephone: 042-99203801, Email: neelma.munir@yahoo.com	Dr. Rasheeda Bashir	N.A	Lahore College for women, University, Lahore	Two Years	3.0 million
93		25-Mar-15	Identification of genes responsible for leaf rust resistance in wheat	Dr. Nasir Ahmad Saeed, Principle Scientist, Telephone: 041-2550830, Email: nasaeedpk@yahoo.com	N.A	Dr. Imran Habib, Mr. Moddassir Ahmad, Dr. Zahid Mukhtar.	National Institute for Biotechnology and Genetic Engineering (NIBGE)	Three year	5.0 Million
94		25-Mar-15	Development of technique for the routine screening of Puccinia striiformis f.sp. Tritici (yellow rust) of wheat in Pakistan.	Dr. Fatiha Mubeen, Principle Scientist, Telephone: 041-2651475, Email: mufathia@yahoo.com	Dr. Mhammad Javed, Wheat Botanist, Ayub Agriculture Research Institute, Faisalabad.	Dr. Muhammad Sajjad Mirza, Dr. Ghulam Rasul, Dr. Sumera Yasmin	National Institute for Biotechnology and Genetic Engineering (NIBGE)	Two Years	5.0 Million

95		25-Mar-15	Assessment of baseline susceptibility and field-evolved resistance in Helocoverpa armigera populations against CryLAc expressed in Bt cotton	Dr. Muhammad Arif, Principal Scientist, Telephone: 041-2651475 Email: marif_nibge@yahoo.com	Mr. Imran Rauf, Senior Scientist, NIA. Telephone: 041-2651475, Email: juniper_786@hotmail.com	Mr. Muhammad Tayyad Naseem, Ms. Rubab Zahra Naqvi.	National Institute for Biotechnology and Genetic Engineering (NIBGE)	Two Years	4.8 Million
96		25-Mar-15	Enhancement of soybean gene pool and establishment of transgenic soybean technology in Pakistan	Dr. Ghulam Raza, Senior Scientist, Telephone: 041-2652475, Email: graza4@gmail.com	Dr. Zahid Mukhtar, Principle Scientist/Head ABD, NIBGE, Telephone: 041-2652475, Email: zahidmukhtar@yahoo.com	Dr. Niaz Ahmad	National Institute for Biotechnology and Genetic Engineering (NIBGE)	Two Years	5.0 Million
97		25-Mar-15	Establishment of Event Characterization Technologies for Transgenic Crops.	Dr. Muhammad Saeed, Telephone: 041-2651475, Email: saeed_hafeez@yahoo.com	Dr. Imran Amin, Principle Scientist, NIBGE	Dr. Zahid Mukhtar, Dr. Shaeen Asad, Dr. Naseer A. Saeed	National Institute for Biotechnology and Genetic Engineering (NIBGE)	One year and six months	5.0 Million
98		25-Mar-15	Development of strip based test for on-site diagnosis of peste des petits ruminants disease.	Dr. Qaiser Mahmood Khan, Deputy Chief Scientist, Telephone: 041-2651475, Email: qk_5@yahoo.com	Muhammad Asif, Junior Scientist, NIBGE. Dr. Fazli Rabbi Awan, Principle Scientist, NIBGE	Dr. Sadia Zafar Bajwa, Mrs. Ameena Mobeen.	National Institute for Biotechnology and Genetic Engineering (NIBGE)	Two Years	5.0 Million
Livestock									

99		25-Mar-15	Withdrawal time of three commonly used antiprotozoal drugs in indigenous animals	Dr. Sualeha Riffat Telephone: 042-99210575 Email: sualeha@uvas.edu.pk	Dr. Mateen Abbass Assistant Professor, UVAS, Lahore. Telephone: 0333-6546752 Email: mateen.abbas@uvas.edu.pk	Dr. Muhammad Ijaz Assistant Professor, Deptt. Of Clinical Medicine and Surgery, UVAS, Lahore	Bioequivalence Study Center, Quality Operation Lab, University of Veterinary and Animal Sciences, Lahore.	Two years	4.9 million
100		25-Mar-15	Trichomoniasis in Naturally Infected Cholistan Bulls-An Approch towards Enhnced Livestock Productivity for Cholistani Nomads, Pakistan.	Dr. Umer Farooq, Asssiatant Professor, University College of Veterinary & Animal Sciences, The Islamia University of Bahwalpur. Phone 062-9255567 Mobile No. 0333-3683888 Email: umer.farooq@iub..edu.pk	Dr. Umair Riaz,Lecturer University College of Veterinary & Animal Sciences, The Islamia University of Bahwalpur. Phone 062-9255567 Mobile No.	Dr. Muhammad Ijaz Assistant Professor, Deptt. Of Clinical Medicine and Surgery, UVAS, Lahore	Bioequivalence Study Center, Quality Operation Lab, University of Veterinary and Animal Sciences, Lahore.	One year	4.875 million
101		25-Mar-15	Pathobiology and Molecular characterization of Clostridium perfringens type A: the causative agent of Jeujenal hemorrhage syndrome, a highly fatal disease of cattle and buffalo:	Aamir Ghafoor, Associate Professor, University of Veterinay and Animal Sciences, Lahore. Phone: 0333-4299619 Email: aamir.ghafoor@uvas.edu.pk	Dr. Hamid Irhsad, SSO, Animal Health Program NARC, Islamabad. Phone 0333-5609890 Email: hamidirshad@hotmail.com	Dr. Zubair Shabir Assistant Professor, UVAS, Lahore.	University of Veterinay and Animal Sciences, Lahore.	Two years	4.5 million

102		25-Mar-15	Optimizing growth potential of ring-necked and green pheasants and their application as cottange industry	Dr. Arshad Javid, Assistant Professor, Univesity of Veterinay and Animal Sceinces, Lahore. Telephone: 0300-5768085 Email: arshadjavid@uvas.edu.pk	Dr. Hamda Azmat, Assistant Professor, Department of Fisheries and Aquaculture UVAS, Lahore. Telephone: 0333-6629386 Email: hamda.azmat@uvas.edu.pk	N.A	University of Veterinay and Animal Sciences, Lahore.	Two years	2.472 million
103		25-Mar-15	Molecular classification and Geno-diversity Analyses of Food borne and Livestock Pathogens under "One Health Concept"	Ali Raza Awan, Assistant Professr, Institute of Biochemistry and Biotechnology, UVAS, Lahore. Telephone: 0321-8442090 Email: arawan77@uvas.edu.pk	Aftab Ahmad Anjum, Professor, Department of Microbiology, UVAS, Lahore. Telephone: 042-99213709 Email: aftab.anjum@uvas.edu.pk	Dr. sehrish Faryal, Assistant Professor, Institute of Biochemisty and Biotechnology, UVAS, Lahore.	Institute of Biochemistry and Biotechnolog y, UVAS, Lahore.	Two years	5 million
104		25-Mar-15	Molecular epidemiology of tick-borne hemoparasitic diseases using multiplex PCR along with their phylogenetic analysis in bovine and ticks	Dr. Muhammad Ijaz, Assistant Professor, Department of Clinical Medicine and Surgery, UVAS, Lahore. Telephone: 042-99213021 Email: mijaz@uvas.edu.pk	Dr. Muhammad Imran Rashid, Assistant Professor, Department of Parasitalogy, UVAS, Lahore.	Dr. Shahid Hussain Farooqi, PhD Scholar, Department of Clinical Medicine and Surgery, UVAS, Lahore.	Department of Clinical Medicine and Surgery, UVAS, Lahore.	Two years	4.8 million
105		25-Mar-15	Determination of chemical composition of "Designer Crop" and assessment of their feeding value for lactating buffaloes"	Dr. Saima, Assistant Professor, Department of Anmal Nutrition, UVAS, Lahore. Telephone: 0333-8363561 Email: saimanaveed@uvas.edu.pk	Dr. Sualeha Riffat, Assistant Professor, Best Center, UVAS, Lahore. Telephone: 042-99211461 Email: sualeha@uvas.edu.pk	Mr. Yasir Allah Ditta Mr. Burhan e Azam	University of Veterinay and Animal Sciences, Lahore.	Two years	4.3 million

106		25-Mar-15	Development of livestock infromation management system to integate sustainable and genetic improvement of tarm animals	Dr. Atia Basheer, Assistant Professor, Department of Livestock Production, UVAS, Lahore. Telephone042-90211449 Email: atia.basheer@uvas.edu.pk	Dr. Imran Zahoor, Assistant Professor, Department of Livestock Production, UVAS, Lahore. Telephone042-90211449 Email" imran.zahoor@uvas.edu.pk	Prof. Dr. Khalid Javed, Department of Livestock Production, UVAS, Lahore	University of Veterinay and Animal Sciences, Lahore.	Two years	5 million
107		25-Mar-15	Evaluation of Genetic potential and identification of genetic markers for milk and related traits in different breeds of camel-A valuable genetic resource of Pakistan	Dr. Imran Zahoor, Assistant Professor, Department of Livestock Production, UVAS, Lahore. Telephone: 042-90211449 Email: imran.zahoor@uvas.edu.pk	Dr. Atia Basheer, Assistant Professor, Department of Livestock Production, UVAS, Lahore. Telephone042-90211449 Email: atia.basheer@uvas.edu.pk	Prof. Dr. Khalid Javed, Department of Livestock Production, UVAS, Lahore	University of Veterinay and Animal Sciences, Lahore.	Two years	5 million
108		25-Mar-15	Evaluation of different antibiotics and steroidal residues in meat of chicken and their effects on humans in Punjab Pakistan	Dr. Sualeha Riffat, Assistant Professor, Bioequivalence study Center Quality operation lab, UVAS, Lahore. Telephone: 042-99211461 Email: sualeha@uvas.edu.pk	Khezar Hayat, Lecturer, Institute of Pharmaceutical Sciences, UVAS, Lahore. Telephone: 0345-7552249 Email: khezar.hayat@uvas.edu.pk	Talib Hussain, Lecturer, Institute of Pharmaceutical Sciences, UVAS, Lahore. Telephone: 0300-6907704 Email: talib.hussain@uvas.edu.pk	Bioequivalence study Center Quality operation lab, UVAS, Lahore.	Two years	4.800 million
109		25-Mar-15	Utilization of Solar Energy as Heating Source in Poultry Houses	Dr. Shahid Mehmood, Assistant Professor, UVAS, Lahore. Telephone: 0332-4522310 Email: shahid.mehmood@uvas.edu.pk	Dr. Muhammad Hayat Jespal, Assistant Professor, UVAS, Lahore.	Engr. Saqib Manzoor, Lecturer, UVAS, Lahore. Telephone: 0345-4222104 Email: engr.saqib@uvas.edu.pk	University of Veterinay and Animal Sciences, Lahore.	Two years	2.74 million

110		25-Mar-15	Enhancing nutrative value of Camel milk by introducing Camel milk cheese sweets and dried cheese powders	Dr. Saima Inayat, Assistant Professor, UVAS, Lahore. Telephone: 0333-5145747 Email" saima.inayat@uvas.edu.pk	Mr. Ishtiaque Ahmad, Lecturer, UVAS, Lahore.	Dr. Muahmmad Nadeem, Dr. Muhammad Junaid	University of Veterinay and Animal Sciences, Lahore.	Two years	0.31 million
111		25-Mar-15	Enhancement of Omega-3 fatty acids in Butter and Margarine through Chia(Salvia hispanica L.) Oil	Dr. Muahmmad Nadeem, Assistant Professor, UVAS, Lahore. Telephone: 0334-4190542 Email: muhammad.nadeem@uvas.edu.pk	Dr. Saima Inayat, Assistant Professor, UVAS, Lahore. Telephone: 0345-4773623 Email: mjunaid@uvas.edu.pk	Dr. Muhammad Ayaz D.r Muhammad Junaid	University of Veterinay and Animal Sciences, Lahore.	One Year	0.291 million
112		25-Mar-15	Direction of withdrawal time and drug residues of currently used anthelmintics in bovine	Dr. Mateen Abbas, Assistant Professor, Quality operation lab, UVAS, Lahore. Telephone: 0333-6546752 Email: mateen.abbas@uvas.edu.pk	Dr. Sualeha Riffat, Assistant Professor, Bioequivalence study Center Quality operation lab, UVAS, Lahore. Telephone: 0345-4294856 Email: sualeha@uvas.edu.pk	Dr.Muhammad Ijaz, Assistant Professor, UVAS, Lahore.	Quality operation lab,University of Veterinay and Animal Sciences, Lahore.	Two years	4.5 million
113		25-Mar-15	Biological and Chemical Detoxification of Aflatoxin in Feed	Dr. Mateen Abbas, Assistant Professor, Quality operation lab, UVAS, Lahore. Telephone: 0333-6546752 Email: mateen.abbas@uvas.edu.pk	Dr. Khusi Muhammad, Professor, Quality Operation Lab, UVAS, Lahore. Telephone: 0333-4250708 Email: drkhushi.muhammad@uvas.edu.pk	Dr. Muhammad Ijaz Assistant Professor, Deptt. Of Clinical Medicine and Surgery, UVAS, Lahore	Quality operation lab,University of Veterinay and Animal Sciences, Lahore.	Two years	4.9 million

114		25-Mar-15	Novel Approach for Treatment and Control of Brucellosis in Dairy Animals	Dr. Muhammad Avais, Assistant Professor, Deparmtent of Clinical Medicine & Surgery, UVAS, Lahore. Telephone: 042-99211449 Email: mavais@uvas.edu.pk	Dr. Arfan Ahmad, Assistant Professor, University Diagnostic Laboratory, UVAS, Lahore. Telephone: 042-99211449 Email: iffivet@uvas.edu.pk	Prof. Dr. Masood Rabbani	Deparmtent of Clinical Medicine & Surgery, UVAS, Lahore.	Two years	7.84 million
115		25-Mar-15	Determining antibiotic residues in Fish	Dr. Ghafoor Ali Khan, Assistant Professor, Institute of Phrmaceutical Sciences, UVAS, Lahore. Telephone: 042-99210575 Email: ghazanfar.khan@uvas.edu.pk	Dr. Sualeha Riffat, Assistant Professor, Bioequivalence study Center Quality operation lab, UVAS, Lahore. Telephone: 0345-4294856 Email: sualeha@uvas.edu.pk	Mr. Abdul Muqeet Khan, Lecturer, QOL, UVAS, Lahore.	Institute of Phrmaceutical Sciences, UVAS, Lahore.	Two years	3 million
116		25-Mar-15	Introduction of Biofloc Culture: A Chaper Solution to Water Quality Management with Safe and Productive Recycling of Execessive Dictary and fecal nutrient load in Fish ponds	Muhammad Ashraf, Professor/Dean UVAS, Ravi Campus Pattoki. Telephone: 0300-7627688n Email: muhammad.ashraf@uvas,edu.pk	Dr. Hamda Azmat, Assistant Professor, Department of Fisheries and Aquaculture UVAS, Lahore. Telephone: 0333-6629386 Email: hamda.azmat@uvas.edu.pk	Dr. M. Hafiz ur Rehman,	UVAS, Ravi Campus Pattoki.	Two years	4.5 million
117		25-Mar-15	Wave Emergence: A Novel Strategy for Improving Super-ovulatory Response in Cattle	Dr. Amjad Riaz, Assistant Professor, Department of Theriogenology, UVAS, Lahore. Telephone: 0333-6252325 Email: dramjadriaz@gmai.com	Col. Mehboob Ahmad Butt, A/Comdt. CEBG, Embryo Transfer wing of Remount Veterinaty and Farm Corps, Okara. Telephone: 042-3636001 Email: cebg.renala@gmail.com	Capt. Khalid Mahmood, Assistant Research Officer, CEBG, Embryo Transfer wing of Remount Veterinaty and Farm Corps, Okara., Telephone: 042-3636001 Emali: km_rana2004@yahoo.com	Department of Theriogenology, UVAS, Lahore.	Two years	4.926 million

118		25-Mar-15	Current sctbacks in non-availability of Catla catla can be Reprimanded with Profer Brood stock Management and Intelligent Fry Rearing Technology	Muhammad Ashraf, Professor/Dean UVAS, Ravi Campus Pattoki. Telephone: 0300-7627688n Email: muhammad.ashraf@uvas,edu.pk	Dr. M. Hafeez ur Rehman	Dr. Hamda Azmat	UVAS, Ravi Campus Pattoki.	Two years	4.4 million
119		25-Mar-15	Enhancement of sperm Quality through Genomic Selection of Genetically Suerior Bulls	Dr. Asif Nadeem, Assistant Professor, Institute of Biochemistry and Biotechnology, UVAS, Lahore. Telephone: 0347-4446413 Email: asifnadeem@uvas.edu.pk	Muhammad Younas, Deputy Director, SPU Semen Production Unit, Qadirabad.	N.A	Institute of Biochemistry and Biotechnology, UVAS, Lahore.	Two years	8.99
120		25-Mar-15	Enhancement genetic merit of dairy buffalo through genome analysis and early age marker assisted selection	Dr. Maryam Javed, Assistant Professor, Institute of Biochemistry and Biotechnology, UVAS, Lahore. Telephone: 0347-4446413 Email: maryam.javed@uvas.edu.pk	Dr. Muhammad Abdullah, Professor, UVAS, Lahore	N.A	Institute of Biochemistry and Biotechnology, UVAS, Lahore.	Three year	4.8 million
121		25-Mar-15	A Study of correlation of serum electrolytes and teace elements along with associated risk factors in diarrheic ruminants in Punjab	Dr. Jawaria Ali Khan, Associate Professor, Department of Clinical Medicine & Surgery, UVAS, Lahore Telephone: 0300-4104696 Email: jawaria.khan@uvas.edu.pk	Dr. Muhammad Avais, Assistant Professor, Department of Clinical Medicine & Surgery, UVAS, Lahore. Telephone: 042-99211461 Email: mavais@uvas.edu.pk	Mr. Waseem Yaqub	Department of Clinical Medicine & Surgery, UVAS, Lahore	Two years	

122		25-Mar-15	Innovation in production and processing systems that enhance nutritional value, eating quality and shelf life of fresh mutton and lamb meat	Dr. Muhammad Hayat Jaspal, Assistant Professor, Dept. of Meat Science ande Technology, UVAS, Lahore. Telephone: 0333-1402020 Email: hayat.jaspal@uvas.edu.pk	Prof. Dr. Talat Naseer Pasha, Professor, UVAS, Lahore. Telephone: 042-99211476 Email:tnpasha@uvas.edu.pk	Mr. Jamal Nasir, Lecturer, UVAS, Lahore.	Dept. of Meat Science ande Technology, UVAS, Lahore.	Two years	4.8 million
123		25-Mar-15	Replacing cottonseed cake with altenate protein soureces to decrease aflatoxin levels in buffalo diets	Dr. Anjum Khalique, Professor, Department of Animal Nutrition UVAS, Lahore. Telephone: 0300-9412987 Email: akhalique@uvas.edu.pk	Murtaza Ali Tipu Assistant Research Officer, Animal Nutrition Section Buffalo Reaearch Institute, L&DD, Pattoki.	N.A	Department of Animal Nutrition UVAS, Lahore.	Two years	3.728 million
124		25-Mar-15	Documenting immunomodulatory effects of local herbs (Nigella sativa and Curcuma Longa) against expeimental viral infectious diseases of Poultry	Muhammad Yasin Tipu, Associate Professor, Department of Pathology, UVAS, Lahore. 042-99211449 Email: yasintipu@uvas.edu.pk	Imran Altaf, Assistant Professor, UVAS, Lahore. Telephone: 042-99211449 Email: imran.altaf@uvas.edu.pk	Two Reaearch Associate(to be Hired)	Department of Pathology, UVAS, Lahore.	One year	3.5 million
125		25-Mar-15	Microbial up-gradation of industrial waste/by-products	Dr. Shahid Nadeem, Principal Scientist, NIAB, Faisalabad. Telephone: 041-9201751 Email:snadeem63@yahoo.com	Ms. Shumaila Yousaf, Senior Scientist, NIAB, Faisalabad. Telephone: 041-9201751 Email: shumailayousaf_alvi@yahoo.com	N.A	NIAB, Faisalabad.	Two years	5 million

126		25-Mar-15	To combat reproductive problems of buffalo by the use of locally prepared MAP Sponges.	Dr. Rehana Kauser, Principal Scientist, NIAB, Faisalabad. Telephone: 041-9201751 Email: rehana_niab@yahoo.com	Dr. Qaisar Shahzad, Veterinary Officer, BRI, Pattoki. Telephone: 0332-4414849 Email: raoqaisarshahzad@gmail.com	Mr. Mujahid Hussain, Principal Scientist	NIAB, Faisalabad.	Two years	5 million
127		25-Mar-15	Epdemiological survey of newly emerging high ptahogenic Newcastle Disease virus (NDV) for future control stragegies.	Dr. Muhammad Salah-ud-Din Shah, Senior Scientist, Animal Sciences Division, NIAB, Faisalabad. Telephone: 041-9201751 Email: msalahuddin786@hotmail.com	N.A	Dr. Muddassar Habib, Senior Scientist, Animal Sciences Division, NIAB, Faisalabad. Dr. Irfan Ahmad, Asssistant Prof. UVAS, Lahore	NIAB, Faisalabad.	Two years	5 million
128		25-Mar-15	To exploit various rumen manipulation strategies for better animal productivity	Dr. Hafiz Noubahar Hussain, Senior Scientist, NIAB, Faisalabad. Telephone: 041-9201751 Email: hnoubahar@yahoo.com	N.A	Mr. Mujahid Hussain, PS/Head, ASD Mr. Abdul Shakir, Principal Scientific Assistant,	NIAB, Faisalabad.	Two years	4.6 million
129		25-Mar-15	Scrutinizing the changes in immune profile and meat quality in response to selection for higher four week body weight in Japanese quails till three generations	Dr. Jibran Hussain, Assistant Professor, Department of Poultry Production, UVAS, Lahore. Telephone: 0301-7008767 Email: jibran.hussain@uvas.edu.pk	Dr. Muhammad Hayat Jespal, Assistant Professor, UVAS, Lahore. Telephone: 0333-1402020 Email: hayat.jaspal@uvas.edu.pk	N.A	Department of Poultry Production, UVAS, Lahore.	Two years	4.8283 million

130		25-Mar-15	Characterization, development and evaluation of biologically active phytogens of Moringa oleifera for commercial organic quail meat production under heat stress	Dr. Hafsa Zenab, Assistant Professor, Department of Anatomy & Histology, UVAS. Lahore. Telephone: 042-99211449 Email: hafsa.zenab@uvas.edu.pk	Dr. Muhammad Shahbaz Yousaf, Assistant Professor, Deparment of Physiology, UVAS, Lahore. Telephone: 042-99211449 Email: drmshahbaz@uvas.edu.pk	Prof. Dr. Habib ur Rehman, Department of Physiology, UVAS, Lahore. Dr. Sahar Ijaz, Lecturer, Department of Anatomy & Histology, UVAS, Lahore.	Department of Anatomy & Histology, UVAS. Lahore.	Two years	3.59 million
131		25-Mar-15	Development of breed conservation model for small ruminants under arid region of Punjab Province	Dr. Muhammad Moaeen-ud-Din, Assistant Professor, Faculty of Veterinary and Animal Sciences, PMAS, Arid Agriculture University Rawalpindi. Telephone: 051-9292159 Email: drmoinawan@gmail.com	Dr. Ghulam Bilal, Assistant Professor, Faculty of Veterinary and Animal Sciences, PMAS, Arid Agriculture University, Rawalpindi. Telephone: 051-9292159 Email: ghulam.bilal@gmail.mcgill.ca	Prof. Dr. Muhammad Yaqoob, Prof. Dr. Muhammad Sajjad Kahn	Faculty of Veterinary and Animal Sciences, PMAS, Arid Agriculture University Rawalpindi.	Three year	6 million
132		25-Mar-15	Production and Influence of Exogenous Fibrolytic Enzyme on Calf Growth and Buffalo Lactation Performance of Buffaloes Fed Forage Based Diets	Dr. Tanveer Ahmad, Associate Professor, Department of Livestock Production and Management, PMAS, Arid-Agriculture University, Rawalpindi. Telephone: 051-9292144 Email: tanveer.ahmad@uaar.edu.pk	Dr. Muhammad Fiaz, Assistant Professor, Faculty of Veterinary and Animal Sciences, PMAS, Arid Agriculture University Rawalpindi. Telephone: 051-9292144 Email: drfiazlm@gail.com	N.A	Faculty of Veterinary and Animal Sciences, PMAS, Arid Agriculture University Rawalpindi.	Two years	4.328 million

133		25-Mar-15	Peanut hay (Arachis Hypogaea L.) : as novel fed resources for sheep in rain-fed area of Punjab.	Dr. Muhammad Fiaz, Assistant Professor, Faculty of Veterinary and Animal Sciences, PMAS, Arid Agriculture University Rawalpindi. Telephone: 0300-5252384 Email: drfiazlm@gail.com	Dr. Tanveer Ahmad, Associate Professor, Department of Livestock Production and Management, PMAS, Arid-Agriculture University, Rawalpindi. Telephone: 051-9292144 Email: tanveer.ahmad@uaar.edu.pk	Mr. Muhammad Mushtaq, Assistant Research Officer, Barani Livestock Production Research Institute, Kherimurat, Distt. Attock.	Faculty of Veterinary and Animal Sciences, PMAS, Arid Agriculture University Rawalpindi.	Two years	3.8 milion
134		25-Mar-15	Whole genome sequencing of Nili Ravi Buffalo and identification of mutations that have negative impact on animal health and production	Imran Amin, Principal Scientist, NIBGE, Faisalabad. Telephone: 041-2651475 Email:imranamin@yahoo.com	Muhammad Asif, Junior Scientist, NIBGE, Faisalabad. Telephone: 041-2651475 Email: asif_nibge@hotmail.com	Dr. Qaisar M. Khan Dr. Muhammad Asif, Mr. Muhammad Faooq	NIBGE, Faisalabad.	Two years	5 million
135		25-Mar-15	How much buck nutrition is sufficient for optimum sperm output? Development of candidate gene markers for improvement in semen quality of Beetal bucks	Dr. Hassan Riaz, Assistant Professor, Department of Bio Sciences, COMSATS Institute of Information Technology, Shaiwal. Telephone: 0321-6935097 Email: hasan@ciitsahiwal.edu.pk	Prof. Liguo Yang Professor, Deptt. Of Animal Genetics, breeding and Reproduction, Huazhong Agricultural University, Wuhan, PR. China. Telephone: Email: yangliguo2006 @qq.com	Dr. Muahmmad Farooq, CEO, Al-Haiwan Sires, Sahiwal, Pakistan.	Department of Bio Sciences, COMSATS Institute of Information Technology, Shaiwal.	Two years	3.936 million
136		25-Mar-15	Progeny Testing Program in Nili Ravi Buffalo: Enhancing progress and its value through modern next generation genome sequencing	Dr. Ahmad Ali, Associate Professor, COMSATS Institute of Information Technology, Shaiwal. Telephone: 040-4305001 Email: ahmadali@ciitsahiwal.edu.pk	Dr. Marcos Vinicius Barbosa da Silva, at EMBRAPA Brazil. Dr. Maqsood Akhtar, S.R.O. Genetics Division, Buffalo Research Institute, Pattoki.	Prof. Dr. Khalid Javed, Department of Livestock Production, UVAS, Lahore.	COMSATS Institute of Information Technology, Shaiwal.	Two years	5 million

			through International Collaboration						
137		25-Mar-15	Protein profiling of Cervico-vaginal fluid around estrus in Nili Ravi Buffalo	Dr. Farukh Jamil, COMSATS Institute of Information Technology, Shaiwal. Telephone: 0333-4064014 Email: farrukhccb@gmail.com	Dr. Hassan Riaz, Assistant Professor, Department of Bio Sciences, COMSATS Institute of Information Technology, Shaiwal.	N.A	COMSATS Institute of Information Technology, Shaiwal.	Two years	4.3 million
138		25-Mar-15	Oestrids and Calliphorids as Major Causes of Myiasis in Livestock: Identification Characterization and Cure	Fatima Mustafa, Assistant Professor, University of Agriculture, Faisalabad. Telephone: 0335-4553352 Email: fatima_swl@yahoo.com	Dr. Muahmmad Sohail Sajjad, Assistant Professor, UAF, Telephone: 0333-6508667 Email: drsohailuaf@uaf.edu.pk	Dr. Jalal Arif, Professor, Deptt. Of Entomology, UAF.	University of Agriculture, Faisalabad.	Three year	5 million
139		25-Mar-15	Epidemiology of Q fever (*Coxiella burnetii*) among dairy animals and human on institutional dairy farms in Punjab, Pakistan	Dr. Muhammad Saqib, Assistant Professor, Deptt. Of CMS UAF. Telephone: 041-9200161 Email: drsaqibm@uaf.edu.pk	Dr. Muhammad Mashkoor Mohsin Gilani, Assistant Professor, Institute of Microbiology, UAF. Email:mashkoormohsin@uaf.edu.pk	Dr. Tanveer Ahmad Lecturer, Deptt. Of CMS, UAF.	Deptt. Of CMS UAF.	Two years	5 million

140		25-Mar-15	Pathobiology and molecular epidemiology of avian lymphoid leukosis commercial poultry	Prof. Dr. Ahrar Khan, Professor, Deptt. Of Patholoty, UAF. Telephone: 0333-6517844 Email: drkashif313@gamil.com	N.A	Dr. Muhammad Zargham Khan, Professor, Deptt. Of Pathology, UAF.	Deptt. Of Patholoty, UAF.	Two years	5 million
141		25-Mar-15	Strengthening poultry industry in Punjab, Pakistan: insights from value chain analysis	Dr. Hammad Badar, Lecturer, Institute of Business Management Sciences, UAF. Telephone: 0322-6622662 Email: hammad.badar@uaf.edu.pk	Dr. Abdul Ghafoor, Assistant Professor, Institute of Business Management Sciences, UAF. Telephone: 0333-6533193 Email: ghafooruaf@hotmail.com	Dr. Burhan Ahmad, Assistant Professor, Institute of Business Management Sciences, UAF.	Institute of Business Management Sciences UAF.	Two years	3.73 Million
142		25-Mar-15	GIS-based metagenomic analysis of ticks and tick-borne pathogens of livestock population in different ecological zones of Punjab, Pakistan	Dr. Sohail Sajid, Assistant Professor, Deptt. Of Parasitology, Univesity of Agriculture, Faisalabad. Telephone: 041-2428667 Email: drsohailuaf@hotmail.com	Dr. Muhammad Imran Arshad, Assistant Professor, Institute of Microbiology, University of Agri. UAF. Telephone041-9200161 Email: drimranarshad@yahoo.com	Prof. Dr. Zafar Iqbal, Dean, Faculty of Veterinary Sciences, UAF.	Department of Parasitology, UAF.	Two years	4.868 Million
143		25-Mar-15	Development of Densified Straw-based Pelleted Feed for Dairy Buffalo Heifers	Muhammad Qamar Shahid, Assistant Professor, Deptt. Of Livestock Production, Faculty of Animal Production and Technology, UVAS, Lahore. Telehpone: 0321-4797539 Email: qamar.shahid@uvas.edu.pk	Muahmmad Naveed ul haque, Assistant Professor, Deptt. Of Animal Nutrition, Faculty of Animal Production and Technology, UVAS, Lahore Telephone: 0333-4783691 Email: muhammad.naveed@uvas.edu.pk	Mr.Saadullah, Lecturer, Dept. of Livestock Production, UVAS, Lahore.	Deptt. Of Livestock Production, Faculty of Animal Production and Technology, UVAS, Lahore.	16 Months	2.53 million

144		25-Mar-15	Radio-frequency identification: A cost effective tool to improve livestock sector by implementation on the Government livesctock farm.	Mr. Faisal Shahzad, Lecturer, University College of Veterinary and Animal Sciences, The Islamia University Bahawalpur. Telephone: 0333-4892523 Email:faisalshehzad76@yahoo.com	Dr. Muhammad Naeem Tahir, Assistant Professor, University College of Veterinary and Animal Sciences, The Islamia University Bahawalpur. Telephone: 0334-4592144 Email: m_naeem.tahir@yahoo.se	Dr. Riaz Hussain, Govt. Livestock Farm Jugait Peer Bahawalpur	University College of Veterinary and Animal Sciences, The Islamia University Bahawalpur.	One year	4.96 million
145		25-Mar-15	Screening Livestock and ticks of southern Punjab for Crimean-Congo hemorrhagic fever virus	Dr. Tauseef-ur-Rehman, Assistant Professor, University College of Veterinary and Animal Sciences, The Islamia University Bahawalpur. Telephone: 0334-7514376 Email: drtauseef@iub.edu.pk	Dr. Rao Zahid Abbas, Associate Professor, University College of Veterinary and Animal Sciences, The Islamia University Bahawalpur. Telephone: 0334-7514376 Email: drtauseef@iub.edu.pk	Dr. Waseem Babr, Assistant Professor, University College of Veterinary and Animal Sciences, The Islamia University Bahawalpur. Telephone: 0334-7514376 Email: waseem_babar@hotmail.com	University College of Veterinary and Animal Sciences, The Islamia University Bahawalpur	Two years	4.7 million
146		25-Mar-15	Effect of Magenetic-Activated Cell Sorting on Cryopreservation of Cholistani Bull Spermatozoa: An Approach to Improve Sperm Fertilizing Potential	Dr. Umer Farooq, Asssiatant Professor, University College of Veterinary & Animal Sciences, The Islamia University of Bahwalpur. Phone 062-9255567 Mobile No. 0333-3683888 Email: umer.farooq@iub.edu.pk	N.A	Dr. Farrah Ali, Assistant Professor, Theriogenology, UCV&AS, IUB.	University College of Veterinary and Animal Sciences, The Islamia University Bahawalpur	18 months	4.65 million

147		25-Mar-15	Conservation of Nachi Gaot thorugh improved breeding and Cryo-Preservation	Dr. Muhammad Saif-ur-Rehman, Assistant Professor, Institute of Animal Sceinces, UAF. Telephone: 041-9200161 Email: shsaifurrehman@yahoo.com	Dr. Muhammad Sajjad Khan, Professor, Institute of Animal Sceinces, UAF. Telephone: 041-9200161 Email: drsajjad2@yahoo.com	Mr. Fida Hussain Assistant Director, L&DD, GOP. Lahore	Institute of Animal Sceinces, UAF.	Two years	5 million
148		25-Mar-15	Documentation and conservation of Mundri Sheep a new breed of Sheep	Dr. Faiz-ul-Hassan, Lecturer, Institute of Animal Sceinces, UAF. Telephone: 041-9200161 Email: faizabg@gmail.com	Dr. Muhammad Sajjad Khan, Professor, Institute of Animal Sceinces, UAF. Telephone: 041-9200161 Email: drsajjad2@yahoo.com	Dr. Muhammad Saif-ur-Rehman, Assistant Professor, Institute of Animal Sceinces, UAF.	Institute of Animal Sceinces, UAF.	Two years	5 million
149		25-Mar-15	Production of bacteriocins from locally isolated becteriocinogenic Lactic acid bacteria and their evaluation as biopreservatives in Fish	Dr. Muhammad Ashraf, Assistant Professor, Institute of Microbiology, UAF. Telephone: 0333-6625110 Email: mashraf@uaf.edu.pk	Dr. Raja Adil Sarfraz, Assistant Professor, Dept. of Chemistry, UAF. Telephone: 0345-2932949 Email: rajaadilsarfraz@gmail.com	One Research Associate	Institute of Microbiology, UAF.	Two years	4.4 million
150		25-Mar-15	Application of probiotics, prebiotics and synbiotics in the feed of major carps fry and fingerling under intensive culture system	Dr. Sajid Abdullah, Lecturer, Dept. of Zoology, UAF. Telephone: Email: uaf_safidabdullah@yahoo.com	N.A	Research Associate	Dept. of Zoology, UAF.	Two years	5 million

151		25-Mar-15	Production of genetically vigorous seed through genetic analyses based brood stock management of major carps	Dr. Khalid Abbas, Assistant Professor, Dept. of Zoology, UAF. Telephone: 0333-6734766 Email: dr.abbas@uaf.edu.pk	N.A	Research Associate	Dept. of Zoology, UAF.	Two years	5 million
152		25-Mar-15	Socio-economic impact and health perspectives of using hormonal feed additives and antimicrobial growth promoters in domestic animal species	Dr. Bilal Aslam, Assistant Professor, Institute of Pharmacy, UAF. Telephone: 0300-5013800 Email: cba933@gamil.com	Dr. Junaid Ali Khan	Dr. shamshad ul Hassan, UAF	Institute of Pharmacy, Physiology and Pharmacology	Two years	5.0 Million
153		25-Mar-15	Development and evaluation of strip test for the diagnosis of fasciolosis in livestock population in some districts of Punjab, Pakistan	Dr. Muhammad Kasib Khan, Assistant Prfessor, Dept. of parasitology, UAF. Telephone: 0334-656066 Email:mkkhan@uaf.edu.pk	Dr. Muhammad Nisar Khan, Professor, Dept. of parasitology, UAF. Telephone: 041-9201100 Email: khanuaf@yahoo.com	Dr. Zafar Iqbal, UAF	Department of Parasitology	Two years	2.1 Million
154		25-Mar-15	Investigating potential risks of zoonotic transmission of antibiotic resistant bacteria at human-animal interface	Dr. Mashkoor Mohsin Gilani, Assistant Professor, Institute of Microbiology, UAF. Telephone: 041-9200161 Email: mashkoormohsin@uaf.edu.pk	Dr. Muhammad Saqib, Assistant Professor, Dept. of CMS, UAF. Telephone: 041-9200161 Email: drsaqib_vet@hotmail.com	Dr. Kashif Saleemi, UAF.	Institute of Microbiology, UAF	Two years	4.0 Million

155		25-Mar-15	Health perspectives and biomarker profiling of recombinant bovine somatotropin abuse in cattle	Dr. Junaid Ali Khan, Assistant Professor, Institute of Pharmacy, UAF. Telephone: 0331-3544476 Email:junaidali.khan@uaf.edu.pk	Dr. Bilal Aslam	Dr. Muhammad Saqib, AP, UAF	Institute of Pharmacy, Physiology and Pharmacology	Two years	5.0 Million
156		25-Mar-15	Surveivability, pre and post-weaning growth performance of orphan buffalo calves offered milk replacer at two levels of intake	Dr. Shaukat Ali Bhatti, Associate Professor, Institute of Animal Sciences, UAF. Telephone: 041-9201232 Email: sabhatti60@gmail.com	N.A	Dr. Mumtaz Ahmad Khan, SS, UAF	Institute of Animal Sciences	One year	3.0 Million
157		25-Mar-15	Gene Expression Profiling and Genetic Variability of Heat Shock Protein (Hsps) and immunity related cylokine genes in different camel based under extreme climate conditions	Dr. Tanveer Hussain, Assistant Professor, Dept. of Molecular Biology, 54-Lawrence road Lahore. Telephone: 0333-4955348 Email: tanveer.hussain@vu.edu.pk	Dr. Rashid Saif, Assistant Professor, Virtual University of Pakistan, Lahore. Telephone: 0321-7107501 Email: rashid.saif@vu.edu.pk	Dr. Msroor, Ellahi Babar,	Dept. of Molecular Biology,	Two years	3.8 million

Appendix 61 *Call for invitation of applications for competitive grants*

Web link

http://parc.gov.pk/files/parc_pk/Agricultural-Innovation-Program-2015/Ad_CG_AIP_Newspapers.pdf

Details of leading newspapers nationwide:

- Daily Jang Karachi: https://e.jang.com.pk/03-30-2015/karachi/page9.asp

- Daily The Nation Karachi: http://nation.com.pk/E-Paper/Karachi/2015-03-30/page-5/detail-7
- Daily Mashriq Peshawar http://www.dailymashriq.com.pk/index.php?edition=&date=2015-03-30&page=3&type=
- Daily The Nation Lahore: http://nation.com.pk/E-Paper/Lahore/2015-03-30/page-3/detail-5
- Daily The Nation Islamabad: http://nation.com.pk/E-Paper/Islamabad/2015-03-30/page-5/detail-6
- Daily Jang Rawalpindi-Islamabad: https://e.jang.com.pk/03-30-2015/karachi/pic.asp?picname=09_24.gif

6. Monitoring and Evaluation

Appendix 62 *Summary of beneficiaries by commodities/themes and partner organization.*

Activity name	Livestock	Vegetables	Maize	Wheat	Agronomy	Rice	Perineal Horticulture	e-Pak Ag	HRD
Trainings	80	279		2,988	269	7	143		41
Farmers' fields planted with new varieties/technologies	30			8,704	417				
Awareness on IPM practices		276							
Workshop participants				32			281	295	
Exposure visit to varietal trials					1,200				
Distribution of seed (Hybrid/Basic/Pre-basic)			7,388	268		34	600		
Farmer field days				275			175		
Demonstration of new technologies				507		129	2		
Total	110	555	7,388	12,774	1,826	170	1,026	295	41

7. Communications

Appendix 63 *COMMUNICATION PRODUCTS DEVELOPED.*

Title	Component	Type[2]	Purpose	Release Date	Language
AIP infographic One pager	AIP	Publications	External promotion	February 2015	English
AIP infographic One pager	AIP	Publications	External promotion	February 2015	Urdu
AIP infographic video profile	AIP	Visibility	External promotion	February 2015	Urdu with English subtitles
AIP landing page	AIP	Visibility	External Promotion	March 2015	English
AIP livestock fact sheet On DVC (12)	Livestock	Publications	External Promotion	February 2015	English
e-PakAG fact sheet On ICT (02)	e-PakAG	Publications	External Promotion	February 2015	English
Brochure (01)	Vegetables	Publications	External Promotion	February2015	English
Brochure (02)	Rice	Publications	External Promotion	February 2015	English
Flyer (02)	Rice	Publications	External Promotion	February 2015	English
Post card story (01)	Rice	Publications	External Promotion	February 2015	English
Post card story (01)	Agronomy	Publications	External Promotion	February 2015	English
AIP Quarterly Newsletter Volume 1 issue 3 (July-Sep 2014)	AIP	Publications	External Promotion	October 2014	English
AIP Quarterly Newsletter Volume 1 issue 4 (Oct-Dec 2014)	AIP	Publications	External Promotion	March 2015	English

[2] Types includes Press Clippings, Press Releases, Radio/TV Interviews, Advertisement and Publications, etc.

Call for invitation of applications for competitive grants	CGS	Advertisement	External promotion	March 30, 2015	English/ Urdu
AIP to strengthen agri research http://nation.com.pk/business/17-Jan-2015/newsbrief	AIP	News story	External promotion	January 17, 2015	English
Visibility material for Pakistan Agri. expo; Standees, elements for display, framed photographs etc.	AIP	Visibility	External promotion	February 19-20, 2015	English/ Urdu
Visibility material for Dawn Sarsabz expo; standees, elements for display, publication etc.	AIP	Visibility	External promotion	March 19-20, 2015	English/ Urdu

Appendix 64 *Contribution to CIMMYT's Weekly E-Newsletter Informa.*

Component	**Medium**	**Title**		**Date**	**Language**
Wheat	CIMMYT Informa	Pakistan Wheat Farmers Call for Quality Seed of the Right Varieties	INFORMA No. 1921	February 2-6, 2015	English/ Spanish
Wheat	CGIAR Research Program on Wheat	Pakistan Wheat Farmers Call for Quality Seed of the Right Varieties	www.wheat.org	February 2015	
Maize	CIMMYT Informa	Pakistan: Maize Needed for Marginal Areas	CIMMYT's Informa; 1917	December 2014	English/ Spanish
Agronomy	CIMMYT Informa	Zero tillage for smallholder wheat farmers in Balochistan	Informa No. 1921	February 02-06, 2015	English/ Spanish
Agronomy	CIMMYT Informa	Happy seeder happy farmers: tillage in a single pass in Punjab province Pakistan.	Informa No. 1927	March 16-20, 2015	English/ Spanish
AIP	CIMMYT Informa	CIMMYT Showcases Advances in Agricultural	Informa No. 1927	March 16-20, 2015	English/ Spanish

		Technology and Development in Pakistan			
Agronoy	CIMMYT Informa	Happy Seeder, Happy Farmers: Tillage in a Single Pass in Punjab Province, Pakistan	Informa No. 1927	March 16-20, 2015	English/ Spanish
Agronomy	CIMMYT Informa	Agriculture Innovation Program for Pakistan - Building national capacity on conservation agriculture.	Informa No. 1916	November24, 2014	English/ Spanish