USAID FROM THE AMERICAN PEOPLE
CIMMYT International Maize and Wheat Improvement Center
PARC

AIP NEWSLETTER

A Newsletter of the Agricultural Innovation Program (AIP) for Pakistan

Volume 5, Issue 1, January-March 2018

Program Leader's Message:
Greetings from AIP!

I am pleased to update you on the activities of the Agricultural Innovation Program (AIP) for Pakistan during the quarter that ended March 31, 2018.

During this quarter, the AIP-Maize component held its annual working group meeting in Islamabad. The event brought together 42 participants including public and private maize stakeholders and value chain actors. AIP introduced an innovation: the mandate to strengthen Pakistan's cereal crops sector. Under this initiative, for the first time in Pakistan the Maize and Millet Research Institute-Yousafwala and the University of Agriculture-Faisalabad received CIMMYT-developed seeds of tropically adapted second generation haploid inducer lines, which are useful for developing a large number of maize inbred lines in a very short breeding cycle. As far as post-harvest technologies are concerned, AIP is promoting hermetic storage techniques in collaboration with NARC's Insect Pest Management Program (IPMP) by training 15 farmers from Punjab on the proper use of metal silos for storing maize seed.

The AIP-Wheat component is leading the way by focusing on farmer capacity building and introducing new wheat varieties. AIP-Wheat works through a network of public and private partners to ensure fast and free availability of newly released wheat varieties to farmers. AIP-Wheat distributed 21.3 tons of quality seed of new disease resistant and high yielding wheat varieties among 1855 farmers, including 496 (26.7%) women from 42 districts in all provinces. These varieties will cover an estimated 2130 ha, and considering that Pakistan's average wheat yield is 2.7 t/ha, they will produce about 5751 tons of seed this season. Under the AIP-PARC competitive grant, a wheat breeding program for improving the crop's nutritional value through the identification of parental lines with high mineral concentration in whole grains was launched in Sindh in collaboration with the University of Agriculture, Tandojam.

During this tenure, thanks to the AIP-Agronomy component, farmers visited demonstration sites and observed the impact of conservation agriculture practices on wheat and other crops, which helped achieve higher wheat yields compared with farmers' traditional cropping practices. A total of 36 farmers' field days were organized for 2943 farmers in 21 districts of Punjab, Baluchistan and KP provinces. The field days gave farmers the opportunity to observe higher yields obtained with improved agronomic practices and other benefits such as water saving with laser land-leveling and ridge planting, cropping cost reduction using zero tillage, cost and time savings by direct seeding of rice and fertilizer cost savings on their farms or fellow farmers' fields. AIP-Agronomy collaborated with 23 national partners including 16 public sector agricultural research and extension organizations, and four private sector seed and fertilizer companies.

The AIP–Socioeconomics component conducted two studies on the maize sector. Their empirical findings indicated that the overall investment in maize germplasm made by AIP-Maize strengthened both public and private partners. Local maize seed production has had positive impacts that empowered public and private partners for local maize seed production. The studies showed that local production of maize hybrids can help save up to US$65 million in foreign exchange. The reduction in seed prices will lead to wider adoption of maize hybrids especially by small farmers, which will eventually lead to more production and lower overall production costs.

The AIP-Rice component organized workshops and on-field trainings on harvest and post-harvest operations and quality paddy production. Moreover, a rice breeding program aimed at improving Indica and Basmati rice varieties and screening bacterial leaf blight resistant material was tested in partnership with public and private sectors. Capacity building of young researchers remained the key factor in this component.

Under the AIP-PARC competitive grant, the vegetable component continues to work in partnership with Muhammad Nawaz Shareef University of Agriculture Multan (MNSUAM). They are implementing nursery vegetable production and a supply system for kitchen gardening, and building the capacity of the agriculture graduates for entrepreneurship. Another key project in partnership with NIGAB-NARC focuses on molecular-based genetic divergence in indigenous common bean of Pakistan's Himalaya region.

The AIP-Livestock component reached out to vulnerable female farmers in Kashmir, FATA and Southern Punjab. Capacity building of female farmers was carried out through collaborations and partnerships with provincial governments and local NGOs, and 660 women dairy farmers actively participated in training and awareness sessions. Trainings included animal health management and disease prevention in small and large ruminants.

AIP is the result of the combined efforts of the Pakistan Agriculture Research Council (PARC), the International Livestock Research Institute (ILRI), the International Center for Agricultural Research in the Dry Areas (ICARDA), the International Rice Research Institute (IRRI), the World Vegetable Center (AVRDC), the University of California at Davis, and the International Maize and Wheat Improvement Center (CIMMYT). It is funded by the United States Agency for International Development (USAID). With these national and international partners on board, AIP continues to improve Pakistan's agricultural productivity and economy.

Best regards and enjoy reading.

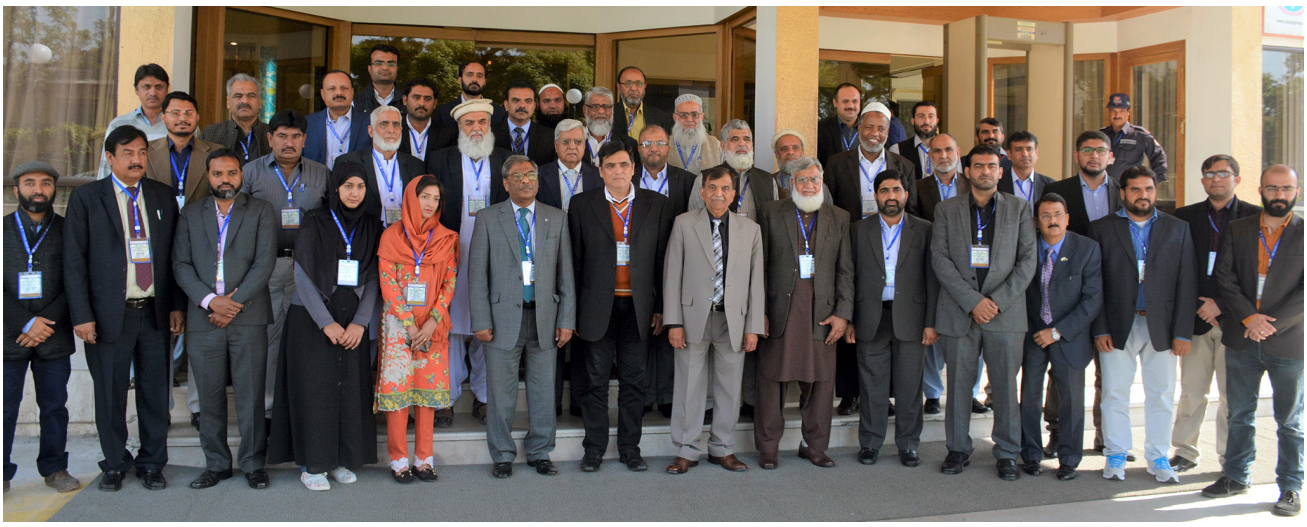
Md. Imtiaz

Inside this Issue:

Maize

Annual maize working group meeting held in Islamabad

The AIP-Maize component held its annual working group meeting in Islamabad. A total of 42 participants including public and private maize stakeholders and value chain actors attended the meeting. While opening the meeting, Dr. Yusuf Zafar, Chairman of Pakistan's Agricultural Research Council (PARC), expressed his appreciation for the maize innovations and interventions under AIP and urged the stakeholders to obtain maximum benefits from the program. He emphasized the importance of availability, affordability and accessibility of high yielding and improved seed for maize farmers to increase productivity, which is currently around six million tons. He thanked USAID for its financial support and CIMMYT for catalyzing maize product testing and deployment in Pakistan. During the meeting, AIP partners shared their progress and discussed constraints and opportunities across the maize seed value chain.



Participants in the AIP-Maize annual working group meeting.

Double haploid seed being handed over to UAF by Dr. Imtiaz Muhammad, CIMMYT Country Representative.

Doubled haploid technology of maize introduced in Pakistan

AIP has helped partners accelerate maize breeding through the introduction of double haploid (DH) technology, which is the first ever coordinated initiative in Pakistan. MMRI-Yousafwala and UAF received seeds of CIMMYT's tropically adapted second generation **haploid inducer lines**, which are useful for developing large numbers of maize inbred lines in a very short breeding cycle. Conventional methods require 6-8 generations (years), while the DH technique significantly shortens this period to 2-3 generations (years). DH technology also saves millions of rupees that national programs would have spent on developing maize products. In July 2017, AIP supported the participation of five Pakistani scientists (also from UAF and MMRI) in a two-week international training program aimed at effectively utilizing the DH innovation in Pakistan.

Hermetic storage technologies (metal silos) promoted to reduce post-harvest losses of maize

Traditional storage practices in developing countries cannot guarantee protection against major storage pests of staple food crops like maize, leading to 20-30 percent grain losses, particularly due to post-harvest insect pests and grain pathogens. Apart from causing quantitative losses, pests in stored grain are also linked to aflatoxin contamination and poisoning. Contamination by mycotoxins (especially aflatoxin and fumonisin) makes grain unsafe for human consumption and animal feed, thus adversely impacting food and feed safety. Consumption of high doses of aflatoxin leads to

Participants in a training program on metal silos at IPMP-NARC.

aflatoxicosis, which can result in acute illness and death. To address this problem, a metal silo was developed and proved effective in protecting stored grains from attack by insect pests. CIMMYT and its partners have been promoting this technology particularly in **Africa** and recently introduced it in Pakistan through AIP.

In Pakistan, aflatoxin contamination of maize is very common mainly due to poor drying and storage. Farmers and consumers have little or no information about hermetic storage techniques. Hence, AIP is promoting hermetic storage techniques in collaboration with the NARC-Insect Pest Management Program (IPMP) by training farmers on the proper use of metal silos. The National Rural Support Program (NRSP) showed interest in mass scaling metal silos and joined the project under public-private partnership. A one-day customized workshop was organized at NARC-Islamabad by AIP in collaboration with IPMP for 15 NRSP-nominated farmers from Punjab. Farmers were briefed in detail on the efficient use of metal bins and standard storage techniques. Similar trainings will be organized during May and June 2018 for local manufacturers to improve their skills and locally produce these metal silos.

Training on metal silos at NARC.

Wheat

AIP-Wheat validates performance of newly released wheat varieties through farmers' own perspectives

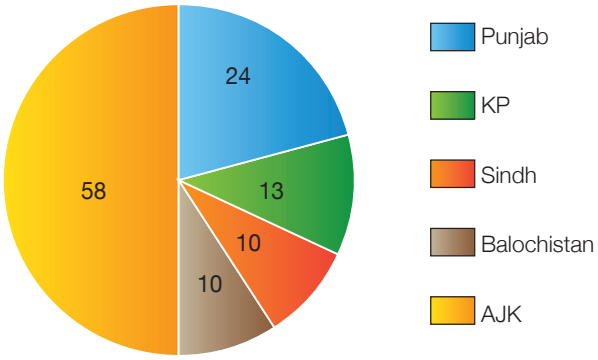
PVS trial in Baluchistan in collaboration with ARI, Quetta.

PVS trial in Chakwal in collaboration with NRSP.

Participatory varietal selection (PVS) provides an initial test to determine if a crop variety is worth investing resources in before popularizing it and engaging in large-scale seed production. AIP-Wheat works through a network of public and private partners to ensure fast and free availability of newly released varieties to farmers.

During 2017-18, a total of 115 PVS trials were conducted involving 18 new high yielding, disease resistant wheat varieties in KP, Punjab, Sindh, Baluchistan and AJ&K provinces to validate their performance and farmers' preferences locally. A total of 18 districts were covered with this intervention. Of the 115 beneficiaries, three were women, two in Sindh and one in AJ&K.

These varieties were also used in other AIP-Wheat interventions, such as demo plots and seed production plots. It is interesting to mention that varietal diversity in AJ&K is low, as is the average yield, which is 1.7 tons per ha. Through these PVS trials, farmers will have more options to select better varieties according to their preferences. These new wheat varieties could prove instrumental in increasing wheat productivity, thus providing financial benefits to farmers.



Number of PVS trials in each province.

Rapid deployment of new genetic gains in farmers' fields through demo plots

In Pakistan a wheat variety usually perishes soon after reaching most farmers, due to farmers' unawareness and the weak agricultural extension service. Instead, farmers stick to planting old varieties over the years. A continuous flow of improved and competitive crop varieties developed by breeding programs is a prerequisite for replacing old and obsolete varieties and ultimately improving crop productivity and addressing the overall challenges of food security and climate change. AIP-Wheat aimed to address both issues through demo plots and a network of public and private partners.

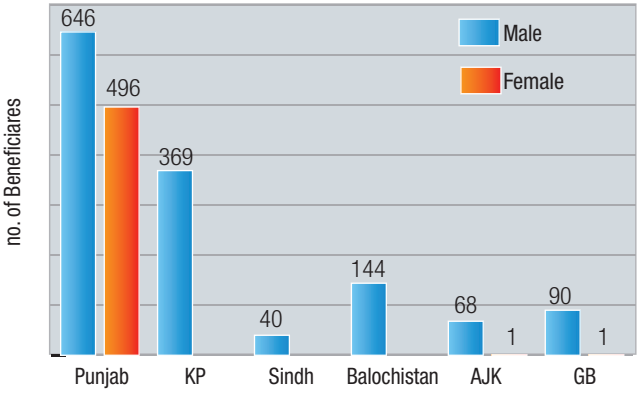
AIP-Wheat distributed 21.3 tons of quality seed of new disease resistant and high yielding wheat varieties among 1855 farmers including 496 (26.7%) women from 42 districts in all provinces. This area covers 2130 ha, and considering that the average wheat yield in Pakistan is 2.7 t/ha, it could produce about 5751 tons of seed for the coming season.

At harvest during the coming months of May and June, yield data will be collected from these plots to further demonstrate the percent yield advantage of the new varieties over local ones.

Provision and production of seeds of recently released wheat varieties

In many areas of Pakistan, farmers, especially smallholders, don't have easy and/or maximum access to quality wheat seeds, which is one of the reasons for the yield gap. Increasing access to seeds of new wheat varieties through village-based growers and private seed companies is AIP's major strategy for enhancing smallholders' average yields. From November 2017 to January 2018, 450 seed growers, including 11 women, planted seed of new high yielding, rust resistant wheat varieties covering about 49 districts all over Pakistan. A total of 20.5 tons of quality wheat seed was distributed through these village-based seed production interventions, which covered about 205.5 ha. The expectation is that this could produce about 550 tons of seed, which would be enough to plant 5000 ha in the neighboring areas during the upcoming wheat season. A total of 321 seed growers were established under AIP for village-based seed production and marketing. Most of these activities focused on far-flung areas such as P.D. Khan, Bannu, Chitral and Shangla, and remote areas of Balochistan, that is, Pashin, Lorali and Umerkot in Sindh province. The concept of decentralized seed production means farmers have easy, local access to seeds because seeds are produced in every village and marketed in the samevillage.

AIP has also strengthened wheat seed supply, production and marketing, as it has helped private seed companies have access to tons of seed produced at public institutes, which was not the case before AIP's intervention. This has enabled private companies to produce and market 50 percent more seed.



Male and female beneficiares of demo plots.

Miankhail Seed Company from KP province and Kashmala Seed Company from Baluchistan province were major beneficiaries of this public-private partnership (PPP) intervention. This year from November to January, 11.3 tons of seed were planted under PPP, which will produce quality seed for the coming season.

Heat resilient wheat lines/varieties developed by AIP-Wheat

As part of AIP's efforts to combine heat stress with rust resistance and identify desirable entries for heat stress, the South Asian Bread Wheat Genomic Prediction Yield Trials (SABWGPYT, 10 trials with 60 entries per trial) were planted at the Wheat Research Institute Faisalabad during 2017-18 under normal and late planting conditions. Data on germination, rust (leaf and yellow), Normalized Difference Vegetative Index (NDVI), canopy temperature (CT) and lodging were collected and yield data were also gathered; final selection of desirable entries will be performed in the next quarter after completing yield data analyses. Along this, 63 previously selected lines (from SABWGPYT 2016-17) such as HYT-65, and 27 lines (from HYT-55 selected from SABWGPYT 2015-16) such as HYT-30 were also planted on normal and late sowing dates. HYT-65 was planted at Faisalabad and seven other partner institutes (CCRI-KP, Uni. of Swabi-KP, BARI-CWL, BARDC-Q, ARI-Tarnab, ARI-Swabi, RRI-KSK) for further evaluation and selection under heat stress (late planting). HYT-30 (including 27 lines and 3 checks) was planted at the following partner institutes: Uni. of Swabi KP, BARDC-Q, ARI-Tarnab KP, ARS-Swabi, NIA-TJ and WRI-FSD. Other partners also performed selection based on their specific objectives and environments in previously shared heat trials. For instance, selections from HYT-55 for the 2017-18 season by partners include CCRI-KP (n=34), AZRI-Bhakkar (n=15), BARI-CWL (n=6) and RRI-KSK (n=8). Recently we advanced 5 lines to NUWYT and 10 lines to provincial yield trials for evaluation across the country and release as new varieties.

Natural variation for grain nutrient concentration, proteins and dietary fiber of different wheat varieties under different agro-ecological regions of Sindh implemented

Sindh Agriculture University, Tandojam, implemented the project under an AIP-PARC Competitive Grant. Appropriate mineral availability is essential for all biological systems (plant, animal and human) to complete their biochemical and physiological development. Among developing countries, Pakistan has one of the highest levels of malnutrition. Malnutrition makes children more vulnerable to disease, and stunts their mental and physical development.

Through this project, wide genetic diversity for all grain nutrients will be identified in wheat varieties. Multi-location and multi-year evaluations of wheat varieties will help to identify superior and stable varieties. The results open the possibility of designing a specific breeding program for improving the nutritional value of wheat through the identification of parental lines with high mineral concentration in whole grains.

Under the project, different areas of Sindh province were visited to select a suitable location for conducting the experiments. Selection was based on geographical, climate, soil and infrastructure conditions. The experimental farm of the Agronomy Department of Sindh Agriculture University, Tandojam, Thatta and Sakrand, was selected for conducting the experiment.

Project Field Visit by students.

To conduct the experiment, seeds of 57 wheat varieties were collected from different research institutes of Pakistan including the National Agriculture Research Center (NARC), Islamabad, the Nuclear Institute of Agriculture (NIA), Tandojam, the Wheat Research Institute (WRI), Sakrand, and progressive local growers. The seeds collected from different research institutes will provide wide variation for nutrient availability and will be multiplied for sowing in a coming season. Fifteen participants in addition to the students took part in the activities.

Fields planted to wheat varieties.

AIP-Wheat component harvests successes in Pind Dadan Khan, Punjab; farmers share their successes with the AIP delegation

CIMMYT's delegation included Dr. Hans Braun, Director of the Global Wheat Program, the Country Representative and the Chief of Party of the Agricultural Innovation Program (AIP) visited Pind Dadan Khan to attend Farmers' Day. The event was attended by more than 100 women and men farmers, who described AIP's progress and successes in the area. The delegation also visited fields sown to wheat varieties introduced by AIP.

Salinity and drought are common problems in Tehsil Pind Dadan Khan, Jhelum District, Punjab. USAID-funded AIP has been led by CIMMYT since its inception in 2014; it focuses on improving farmers' livelihoods through innovative and improved cereal crop systems and aims to increase agricultural productivity and incomes by promoting and disseminating modern practices to be applied in wheat.

USAID'S Agricultural Innovation Program (AIP) through Pakistan-CIMMYT sub-granted the National Rural Support Program (NRSP) for a participatory varietal selection (PVS) research project that involves on-farm demonstrations, multiplication and popularization of new high yielding rust resistant wheat varieties. Before these interventions, smallholders and poor farmers had no access to quality wheat seed and modern farming techniques. The average yield of the old wheat varieties was about 15-20 Munds per acre, which was very low due to old varieties and low quality seed.

With the support of NRSP, AIP distributed 29 tons of seed of new wheat varieties to 1141 vulnerable families (241 female, 900 male) in Pind Dadan Khan. These varieties included Pakistan 13, Dharabi 11, Ihsan 16, Zincol 16 and Ujalla-16, which need less water and produce higher yield. Farmers in the area produced tremendous yield and also multiplied seed for the next seasons. Farmers are now getting yield of more than 40 Munds per acre. These varieties were introduced as the result of research by CIMMYT-Mexico and in collaboration with public partners NARC Islamabad, BARI Chakwal and WRI Faisalabad. With the introduction of a seed grader locally manufactured by AIP, farmers are not only getting quality and graded seed but also saving on seed purchases. Certified seed costs PKR 2600-3000 per 50 kg on the open market. However, farmers in Pind Daden Khan are buying seed at PKR 2300 per 50 kg thanks to AIP seed graders and an informal seed bank system initiated by AIP. In addition, farmers benefited from capacity building and training on topics including sowing, post-harvest actions and storage for future sowing.

Farmers formed seed groups at the village level to multiply the success of this program and help include farming communities so they can benefit from this innovative agricultural program. Mr. Tajamul Hussain, president of a Farmers' Seed Group, thanked AIP for its efforts and asked for more coordinated efforts to help farmers in the area. He stressed that if laser leveling machines and techniques are introduced and more training given to farmers, "we will have better wheat crops in coming seasons."

Agronomy

Dissemination of conservation agriculture technologies through partnership

AIP-Agronomy facilitated demonstrations of zero till (ZT) wheat planting, ridge planting of wheat and laser land-leveling on 489 farms and trained 263 stakeholders including farmers and technical staff. A total of 36 farmers' field days were organized for 2943 farmers in 21 districts of Punjab, Balochistan and KP provinces. The field days gave farmers the opportunity to observe better yield with improved agronomic practices and other benefits such as water saving with laser land-leveling and ridge planting; cost reduction by using zero tillage; saving planting costs and time with direct seeding of rice; and saving fertilizer by using the Leaf Color Chart (LCC) in rice on their own farms or fellow farmers' fields.

AIP-Agronomy collaborated with **23 national partners** including 16 public sector agricultural research and extension organizations, four private sector seed and fertilizer companies; Engro Fertilizers, Miankhel Seed Corporation, Petal Seeds and Rice Partners Limited (RPL), two machinery manufacturers; Greenland Engineers, Sharif Engineering and one NGO; and the National Rural Support Program (NRSP). National partners were instrumental in disseminating ridge planting of wheat, ZT planting of wheat and laser land-leveling, and providing locally produced zero till Happy Seeders (ZTHS) on a cost-sharing basis and efficient fertilizer management techniques for wheat.

Demonstration of CA technologies

National partners, namely, AZRI Bhakkar, ARS Bahawalpur, NRSP, BARI Chakwal, Adaptive Research Punjab, Wheat Program NARC, WRI Faisalabad in Punjab Province; ARI DI Khan, CCRI Nowshera, Miankhel Seeds and MFSC in KP Province; Department of Balochistan Agriculture Research, ARI-PARC Jaffarabad in Balochistan Province; and WRIS-Sakrand, AZRI Umerkot and NSTHRI Thatta in Sindh Province assisted 489 farmers in the application of ZT wheat planting, ridge planting of wheat, laser land-leveling and rainfed wheat planting after mung bean in the project area.

Zero till wheat planting in Jaffarabad District.

National partners provided technical support to farmers adopting wheat planting with zero tillage after the rice crop on 254 farms in the districts of Jhal Magsi and Jaffarbad in Balochistan Province, Thatta, Sujawal and Jacobabad in Sindh Province, DI Khan in KP Province and Faisalabad, Nankana Sahib, Sheikhupura and Kasur Districts in Punjab Province. Furthermore, 36 farmers planted wheat with ZT drill after mung bean or Guar in Bhakkar and Chakwal Districts in Punjab Province and DI Khan District in KP Province. Discussion with national partners indicated that ZT drill adoption for wheat planting after rice is gaining momentum in Balochistan Province, where 12,000-13,000 acres were planted with ZT after rice in 2017-18. During the 2017 wheat season, the number of service providers increased, and as a result, the rate for ZT wheat planting went from PKR 1100 to PKR 900 per acre in the Jaffarabad region. ZT wheat planting technology after rice / legumes helped farmers save PKR 7500/ha in land preparation costs and obtain 0.2 t/ha additional wheat grain in comparison with farmers' land preparation practices followed by broadcasting of wheat seed and fertilizer.

Zero tillage wheat planting after mung bean in Bhakkar.

AIP provided technical assistance and seed to 164 farmers who were instrumental in demonstrating ridge planting of wheat on 34 farms in 10 districts of Sindh Province, 33 farms in eight districts of KP Province, 95 farms in 14 districts of Punjab Province and two farms in one district of Balochistan Province. Data collected from farmer field trials and demonstrations showed that they produced 10-15 percent more tillers and 12 percent higher wheat grain yield with ridge planting, compared with the farmers' practice of broadcasting seed followed by

shallow cultivation. Ridge and furrow planting of wheat also showed water savings of 30-40 percent in comparison with the farmers' practice. Furrow irrigated ridge planting also helped to reduce lodging during grain filling. Farmers who adopted ridge planting had PKR 10,767 more profit per hectare than farmers who did not adopt the technique.

In KP Province, MFSC, a local partner, provided service to 30 farmers in the districts of DI Khan, Kohat and Tank, laser land-leveling more than 87 hectares. Laser land-leveling adopters obtained 15 percent higher grain yield and 29 percent greater water savings in comparison with non-adopters. In addition, Wheat Program NARC and CCRI Nowshera facilitated planting of mung bean with zero till and conventional practices on five one-acre farmers' fields in Nowshera, KP Province, and in Rawalpindi, Punjab Province.

Ridge planting of wheat in Jaffarabad, Balochistan.

Training stakeholders on CA techniques and disseminating technologies through field days

National partners AZRI Bhakkar, NRSP, MFSC-KP, Miankhel Seeds and WRIS Sakrand collaborated with AIP on organizing eight trainings in the districts of Bhakkar, Hafizabad, Mianwali, Islamabad, DI Khan, Swabi, Nowshera, Hyderabad and Shaheed Benazir Abad. More than 263 farmers and NRSP and MFSC staff members attended these trainings. The trainings focused on zero till wheat planting, ridge planting of wheat, wheat production technology and nutrient management in wheat. The trainings improved the understanding of staff and farmers regarding adoption of improved techniques.

Field day on ridge planting of wheat in KP province.

Demonstration of GreenSeeker™ use in Nowshera.

National partners organized a total of 36 field days including eight in Balochistan, four in Sindh, five in the KP and 19 in Punjab. The objective of the these field days was to disseminate information to farmers on improved practices such as laser land-leveling, ZT Happy Seeder planted wheat, ZT wheat planting after rice / mung bean, ridge planting of wheat, bed planting of wheat and maize, maize planted with push row planter, mung bean cultivation in rainfed areas, precision nitrogen management in wheat and direct seeding of rice using a DSR planter. A total of 2943 farmers and agriculture professionals attended these field days in the districts of Jaffarabad in Balochistan Province, Bannu, DI Khan, Kohat, Nowshera and Swabi in KP Province, Bhakkar, Bahawalpur, Chiniot, Gujrat, Mandi Bahauddin, Rawalpindi, Sheikhupura, Vehari, Sahiwal, Nankana Sahib and Gujranwala in Punjab Province and Sanghar, Shaheed Benazir Abad and Umerkot in Sindh Province. Farmers visited fields under improved practices, and adopters shared experiences with their fellow farmers and agriculture professionals.

Pilot testing and refinement of new CA-based implements and technologies

Sharif Engineering, a local partner, manufactured and sold 11 zero till Happy Seeders (ZTHS) to farmers on a cost-sharing basis in Punjab Province. In addition, 133 farmers used ZTHS and bed planters to sow wheat in Punjab, KP and Sindh Provinces. Around 88 operators, farmers and agriculture staff were trained on use of ZTHS for wheat planting, troubleshooting and maintenance in Punjab Province. A total of 11 ZTHS manufactured by Sharif Engineering were sold to farmers at PKR 160,000 per seeder on a cost-sharing basis in Hafizabad, Gujranwala, Nankana Sahib, Lahore, Sialkot, Narowal, Sheikhupura, Sargodha, Khanewal and Kasur districts in the rice-wheat area of Punjab Province. AIP covered 48 percent of the cost of new ZTHS during the 2017 wheat planting season, while farmers paid 52 percent of the cost. These modified ZTHS have depth wheels that are used for transporting the ZTHS from one field to another and for maintaining planting depth during sowing. Since project initiation, AIP has provided a total of **32 ZTHS** in the rice-wheat area of Punjab Province, including 23 ZTHS provided to farmers / service providers on a cost-sharing basis during 2016-17 and 9 ZTHS to national partners free of cost as part of strengthening their capacity.

AIP imported multicrop planters and supported Greenland Engineers (Greenland PVT), a local partner, in the development of inclined-plate seeding planters. Engineers manufactured **187 "Green Multicrop DSR planters"** during the 2016 and 2017 rice season. These DSR (Direct Seeder for Rice) planters have an inclined plate seeding system and can drill both seed and fertilizer simultaneously while maintaining appropriate plant-to-plant distance without breaking the seeds. A representative of Greenland Engineers said that the company will be manufacturing more than **200** DSR planters in 2018 for rice farmers in Pakistan. Adoption of DSR would help farmers save water and labor, and improve rice plant population and productivity by 10 percent in comparison with transplanted rice.

ZTHS planted wheat at Farooq Abad, Sheikhupura.

ZTHS with wheels manufactured by Sharif Engineering, Faisalabad.

Training on sensor-based nitrogen management in wheat

AIP-CIMMYT, in collaboration with national partners RRI-Kala Shah Kaku and WRIS Sakrand, organized trainings on precision nutrient management in wheat at RRI-KSK and WRIS Sakrand. A total of 26 agriculture professionals from national partners were trained to use the GreenSeeker for recording NDVI and an android urea application calculator for calculating the nitrogen fertilizer dose. These trainings and new partnerships helped national partners demonstrate and disseminate precision N management techniques to wheat farmers across Pakistan, which will enable them to apply nitrogen according to the crop's need and reduce input costs.

Training on GreenSeeker use in WRIS, Sakrand, Sindh.

Socioeconomics

Economic impact of maize germplasm investment in Pakistan

The AIP-Maize component has distributed maize germplasm to 16 public and private partners in Pakistan since the start of the AIP project. The main objective of the current study was to estimate the potential economic impact of the maize germplasm investment in Pakistan. A questionnaire was developed that included a number of questions regarding the partner's overall profile, seed production, sales information, maize seed prices, number of entries tested (provided by CIMMYT under AIP), as well as the partner's business outreach. Data were collected from a total of 16 public and private partners.

The empirical findings indicate that the overall maize germplasm investment made by AIP-Maize to strengthen public and private partners for local maize seed production will have positive impact. In the near future, the germplasm investment will have significant impact on Pakistan's maize seed industry. The germplasm introduced to public and private partners has generated time savings of approximately 5 years (see table below). The maize companies are also expecting to increase their business volume, and in a couple of years, the varieties will be ready to be released by the partners, and will be available in the local market.

Selected Interviewed Partners

Public Sector Partners	Private Sector Partners
Department of Agricultural Research Gilgit	Sohni Dharti International
Agricultural Research Station Dadu	Hi Sell Seed Industry
Maize and Millet Research Institute Yusafwala, Sahiwal	Tara Crop Sciences (Pvt) Ltd
CCRI Pirsabak Nowshera KPK	Kanzo Quality Seeds
Department of Agriculture AJK, Muzaffarabad	ICI Pakistan
Directorate of Cereal Crop ARI, Quetta	Petal Seed Company
Muhammad Nawaz Shareef University of Agriculture Multan	Ali Akbar Group
National Agricultural Research Centre, Islamabad	Jullundur Private Limited

Impacts of Germplasm Investment

AIP Germplasm Impact	Public	Private
Time saved due to AIP germplasm (years)	5.33	4.29
Business volume (seed) increased (tons/year)	5.73	96.67
AIP germplasm varieties ready for release (months)	24.80	39.00

Key outcomes of maize germplasm investment

- Maize seed prices are expected to decrease by US$2-3 per kg due to local seed production
- Local production of maize hybrids will help save US$65 million in foreign exchange
- The reduction in seed prices will lead to greater adoption of maize hybrids, especially by small farmers
- Greater adoption will eventually lead to more production
- Due to the availability of seed at a reduced price, overall production costs will also decrease

Agronomic performance of quality protein maize in Pakistan

In order to document the agronomic performance of quality protein maize (QPM) varieties in Pakistan, data were collected from 50 farmers who cultivated them. Details of the sample are presented in the table below. The QPM maize varieties were compared to traditional varieties. Information on the number of households and farm-level characteristics was collected. The sampling area of of the study included Punjab, KP and AJ&K Provinces.

The key findings of the study are as follows:

- Most farmers lack awareness about QPM maize; hence they need information and guidance about QPM production technology. The information can be disseminated through effective extension, as well as through field days, flyers and brochures, etc.
- As this is only the second year since QPM was introduced in Pakistan, farmers have allocated very little area to QPM maize, i.e., 0.25 to 1 acre. Effective extension can help increase the area under QPM varieties provided seed is available.
- The agronomic performance of QPM maize indicates that it is very competitive with conventional maize and, in some aspects, even better.

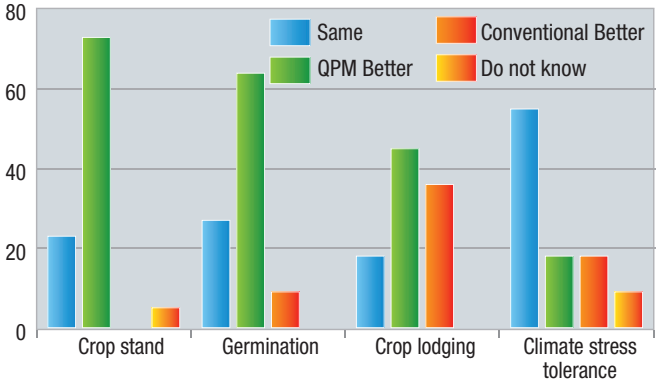
Collecting QPM data in Gojra (T.T. Singh).

- Germination of QPM maize is higher as compared to conventional maize, indicating that QPM can help obtain good yield, as it will maintain greater plant population.
- QPM maize has good color and taste, and is also good livestock fodder.

District Wise Distribution of Sample

Districts	Frequency	Percent
Mansehra	6	12.0
Okara	4	8.0
Pakpatan	9	18.0
Sahiwal	7	14.0
T.T. Singh	7	14.0
Vehari	5	10.0
Qasoor	1	2.0
Rawalpindi	1	2.0
Poonch (AJK)	8	16.0
Bagh (AJK)	2	4.0
Total	50	100.0

- The cob size of QPM is better as compared to conventional maize but the yield of conventional maize is higher than QPM maize yield (9 percent); hence more efforts are needed in this direction.



Agronomic characteristics.

- The cost:benefit ratio of QPM maize is 1.043, while that of conventional maize is 0.702; this indicates that QPM maize is quite competitive with conventional maize.

The chart below compares the characteristics of QPM maize and conventional maize, indicating that QPM is quite competitive with conventional maize and even better in certain aspects.

Rice

AIP rice breeding program for improved *Indica* and basmati rice at the Rice Research Institute (RRI), Kala Shah Kaku

A total of 187 lines were selected out of 824 IRRI lines evaluated at the Rice Research Institute (RRI), Kala Shah Kaku (KSK), for biotic bacterial leaf blight (BLB) and abiotic (flood/submergence, drought, salinity and heat) stress tolerance, yield potential and grain quality. Of the selected lines, 101 were high yielding elite, **53** were resistant to super basmati bacterial leaf blight (**BLB**), **23** were tolerant to **drought** and **salinity**, and 10 lines were of the IR-6 Sub1 variety for **submergence tolerance**. These lines were used to develop 42 new fresh crosses during 2016 for BLB resistance, submergence and salinity tolerance, and high yield at RRI-KSK.

IRRI rice germplasm planted at RRI, Kala Shah Kaku, Lahore, Punjab.

Improving *Indica* and basmati rice and screening for BLB resistant material at Engro farm

The Seed Research and Development Farm of Engro Fertilizer, Sheikhupura, evaluated 164 lines provided by AIP, including BLB resistant lines, zinc-fortified lines, and other varieties/lines like Indian varieties (**Sharbatti, Pussa Sogandha, Duplicate Basmati, Pussa 1509 and Pussa 1401**), NIBGE (BR 1, BR 18 & BR 23; GSR 1 & GSR 2), NIAB (like Noor Basmati and an old one: IR – 9), Rice Research Institute, Kala Shah Kaku (PS – 2, Basmati.515, Punjab Basmati, Chenab Basmati and Kissan Basmati, PK – 386, IR-6, KS – 282, KSK – 133, KSK – 434 with Basmati Super as a local check) varieties under natural conditions at a BLB hot spot at the Engro farm.

Screening AIP IRRI lines at the Research and Development Farm of Engro Fertilizer Pvt.

Alternate wetting and drying (AWD) demonstrated in rice fields

Water is a vital input of agriculture. Therefore, farmers were trained to install AWD pipes, measure water through the use of Flume and measure the water level in an AWD tube. They were also taught water application methodology, and received AWD water tubes and basmati seeds. As the application of AWD technology reduces water use, water measuring pipes were manufactured locally and used in farmers' fields to irrigate the rice fields by monitoring water levels inside the pipes. Irrigation was applied when the water level inside the pipes reached a depth of six inches below the soil surface.

AWD, a resource conservation technology in rice, was established on 100 demonstration plots covering an area of 900 acres (700 acres in Nankana Sahib and 200 acres in Sheikhupura) in farmers' fields in Punjab during 2017. Data indicated that a maximum of 36 percent water saving was recorded on AWD plots, with an average 20 to 25 percent water reduction. As AWD crops do not lodge, AWD fields produce 5 to 10 percent higher yield as compared to conventional irrigated fields and practices.

Demonstrating AWD in farmers' fields.

Extension of drum seeder demonstrations on farmers' fields

Mechanization through drum seeder demonstrations were conducted in Punjab and KP Provinces. Results showed that the drum seeder provided 15-20% higher yield than the conventional method of rice transplanting with 20% labor saving.



Demonstrations of DSR and drum seeder at public institutes and on farmers' fields.

The AIP-Rice component organized specialized training for scientists and extension officers

With the collaboration of partners, the AIP-Rice component organized specialized training courses for researchers, extension officers and progressive growers on resource-saving (DSR, AWD, drum seeder) rice production technologies in Punjab and KP Provinces. Two hundred researchers, scientists and extension officers have been trained on resource-saving rice production technologies along with disease and insect management, and harvest and post-harvest management issues (100 at the Soil Salinity Research Institute, Pindi Bhattian, and 100 at the Agriculture Research Institute, Mingora Swat).

Workshop on harvest and post-harvest operations and quality paddy production

AIP-Rice organized a farmers' training and field day program titled "Role of Quality Paddy Combine Harvester and Postharvest Processes in Minimizing Grain Losses, Aflatoxin Contamination, and Enhancing Quality Basmati Export" at Daharanwala Farm, Tehsil Muridkey, Sheikhupura District. The participants were farmers, combine harvester owners, rice millers, exporters, middlemen and extension workers. The training /field day program was organized in collaboration with the seed research and development unit of Engro Fertilizer Pvt Ltd. A total of 120 rice stakeholders participated in this training /field day program. After a brief introduction about AIP, the participants learned about the proper stage to harvest a rice crop and how to select an appropriate combine harvester for harvesting the crop at the right paddy moisture percentage. They also discussed what the speed of the combine should be, especially the threshing drum, as well as how to reduce grain losses, and which drying and storage techniques reduce the chances of stored insect-pest attack and aflatoxin contamination. Marketing strategies to get higher paddy prices were also discussed with farmers. Practical demonstrations of combine harvesters were shown to the participants so they could see the results of the proper use of a rice combine harvester (no grains fall on the ground, no broken rice and no green straw debris in the paddy) compared to using a wheat combine harvester adapted for rice harvesting and threshing. At the end, participants thanked USAID for introducing these new technologies to farmers in remote areas.




Vegetables
(Under the AIP PARC Competitive Grant)

Project vegetable nursery production and supply system for kitchen gardening

Irrigation of a vegetable plant nursery.

Tomato sowing and further nursery management.

In collaboration with private nursery farms, this project started in November 2017. Its objectives are to promote kitchen gardening by establishing a system for providing healthy nurseries for economical and clean (pesticide-free) vegetable production by overcoming germination- and season-related problems, and to build the capacity of agriculture graduates for entrepreneurship.

Filling multipot trays with peat moss.

A walk-in tunnel (130x15 ft^2) was constructed for raising tomato, chili, pepper, brinjal and cucurbit (gourds and cucumbers, etc.) nurseries. Different potting media (peat moss, Perlite, silt and compost) are being evaluated for nursery raising. Both male and female students are involved in various project activities that build their capacity to prepare nursery media, fill multipot trays, and sow and manage nurseries. A portal for online sale of vegetable nurseries has been launched at mnsuam.edu.pk/Nursery/. Programs to raise people's awareness of healthy foods and promote kitchen gardening for self-sufficiency in vegetables were conducted at three schools/ colleges. Market linkages were developed with different department stores, food festivals, shops, etc., to provide space for displaying nurseries for sale at their stores. So far, 6,480 tomato, 6,420 chili, 5,700 sweet pepper, 660 bringle, 3,300 cucumber, 600 bitter gourd, 1,020 pumpkin, 780 vegetable marrow, 120 luffa and 300 melon plants are being raised in multipot trays. Marketing of vegetable nurseries started on February 25, 2018, and up to now, 2,097 chili, 2131 tomato, 1,774 sweet pepper, 630 bringle, 692 pumpkin, 1,127 cucumber, 629 vegetable marrow, 105 luffa and 150 melon plants have been sold.

Molecular-based genetic divergence in indigenous common bean of Himalaya Pakistan implemented by NIGAB

The Himalaya region of Pakistan is rich in legume production. Common bean has a diverse genetic base. Indigenous bean germplasm contains high variation for morphological traits and is usually sown in mixtures at high elevations, so the exact performance of individual genotypes is not known. In order to separate the various genotypes, they need to be separated into different groups according to their seed morphological traits.

Molecular markers can be used to effectively characterize genetic diversity and aid in the management of plant resources. Molecular-based characterization of indigenous germplasm is helpful in identifying promising material to be used in breeding programs for developing varieties with superior attributes.

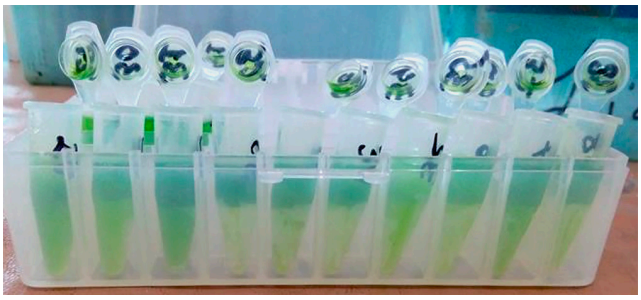
Under the project, more than 200 accessions of common bean were collected from different locations in Swat District, Gilgit, Shangla, Neelum Valley AJ&K, Nagar, Diamer, Kel, Kumrat, Dir, Ghizer, Ishkoman, Batagram, Mansehra, Astore, Parachinar and Kurram Agency. The collected germplasm was grouped based on seed coat color, pattern and seed shape. A tentative sowing plan for the proposed locations has been prepared. Morphological characterization of the collected germplasm is in progress at two locations, i.e., at NIGAB, NARC Islamabad and at IBGE, University of Agriculture Peshawar. About 96 accessions were planted in glasshouses at IBGE and the University of Agriculture Peshawar. The crop performed better under greenhouse conditions.



Germination stage in screen- or greenhouses.

At NIGAB, 98 accessions were planted under screenhouse conditions. Accessions were planted in a randomized complete block design with two replications. Out of the 98 accessions, 77 showed better germination overall, whereas 23 showed vigorous growth in the second week of germination and had larger stems and broader leaves than the other accessions. Leaf color variation was observed, i.e., dark green, green and light green.

Variation in leaf shape was also observed, i.e., broadly ovate leaflets with cordate or deltoid primary leaves. Flower color also varied, i.e., lavender, white, cream, lilac, purple, white with lilac shade, and lilac with dark purple stripes on the outer edge of standard petals. Plant growth habit varied from indeterminate bushy or prostate vine to indeterminate erect vine. Aphid attack was observed in the early vegetative stage in 48 accessions, 5 of which were severely affected, while 49 accessions showed resistance. However, attacks by pest were reduced by washing with detergent and spraying insecticide at the proper time.



DNA extraction.

Livestock

Setting new standards for productivity through innovation for widows and poor female livestock farmers in disaster prone areas of Bagh District, Azad Kashmir

AIP-Livestock organized a capacity building program for widows and poor female livestock farmers in Bagh District in collaboration with L&DD, AJ&K and IRP. More than 400 participants (95 percent female) including several civil society members from NRSP, Save the Future and other reputed organizations attended this event. As a contribution from IRP, in early 2017 they distributed 70 cows costing PKR 150,000 in this district. AIP-Livestock provided a specially designed feeding chart and distributed food graded water troughs (300) and milk cans (200) to 200 livestock farmers belonging to various villages in Bagh District. Feed was distributed to five dairy farmers as an initiative to encourage other farmers in the community to adopt semi-commercial dairy farming.

Informative session on animal health benefits and disease prevention practices for farmers' improvement

In collaboration with L&DDD, ICT, and Islamabad, AIP-ILRI organized a one-day farmer training and awareness program at Golra Sharif, Islamabad. The program aimed to increase the effectiveness of general hygienic practices, proper farm management and disease prevention measures. A total of 50 farmers joined the training and were guided through a prepared checklist with non-leading, open-ended questions to ensure completeness of purpose.


Volunteer female farmers in Southern Punjab trained on livestock health management

Cholistan is endowed with a significant amount of livestock. Cholistan's outstanding livestock breeds are world renowned and most (over 90 percent) of them are reared in villages, specially by women, in smallholdings ranging from 1-2 buffaloes/cattle, 4-5 goats and a dozen or so poultry. AIP-ILRI organized different initiatives to help smallholder livestock producers by providing information to safeguard the health of their livestock. This will sensitize them to the signs and symptoms of mastitis and other diseases. In view of the need to assess women livestock farmers, a training program on livestock was organized in Lateef Abad, tehsil Mandi Yazman, Bahawalpur, in collaboration with KWC, Bahawalpur. The first beneficiaries selected for the discussion were female farmers owning a small or large number of ruminants. A total of 45 females actively participated in the discussions and practical demonstrations. The program was intended to inform livestock owners about management criteria (clean animal housing, hygienic milk production), disease prevention measures and diagnosis by observing the symptoms that animals show.

Simple domestic tests to confirm disease.

A female farmer takes the temperature of a goat.

Small female dairy owners' sustainability enhanced via a training/awareness program on animal health and disease prevention practices

AIP-Livestock conducted training/awareness programs on animal health and disease prevention practices in collaboration with the Bahawalpur, in Haheji and Moza dita Baloch tehsils. About 140 female farmers from Hatheji and 70 from Moza dita Baloch participated. These events were aimed at encouraging women farmers to make changes in their daily routines and animal management practices to obtain better results. The training improved small dairy owners' understanding of the need to successfully control targeted disease complexes and immediately report any disease occurrence to nearby veterinarians. Seasonal calendars for vaccination and deworming for identified diseases and parasites were also extensively discussed at the community level.

Evaluation of Rhodes grass cultivation in Federally Administered Tribal Areas (FATA)

AIP-Livestock established 19 demonstration plots covering nine acres of cultivated area in three FATA agencies, namely Bajaur, Khyber and Mohmand in collaboration with FATA Secretariat's Livestock Department. In these demonstration trials, Rhodes grass produced remarkable results and up to 18 tons per acre of biomass. Farmers produced 3.5 times more biomass with 3-6 cuts annually, as compared to other grasses including shaftal, oats and natural grasses. AIP-Livestock joined hands with Farm Dynamics Pakistan (FDP) to promote high yielding perennial grasses in various areas of FATA in collaboration with the Livestock Department of FATA Secretariat. The main aim of this trial was to grow quality grass with high nutritional value and obtain maximum green grasses in the summer season when other fodders are unavailable. A total of nine livestock farmers from three different villages were involved in this evaluation and performance trial (a 9-acre area sown to Rhode grass).

- The maximum plant height (62 inches) was recorded at the fourth cut, while the average plant height was 30 inches.
- The result revealed that Rhode grass production in FATA is 16 tons/acre on a fresh basis, while on a dry matter basis, the yield is 4.5 tons/acre. Compared to other grasses in FATA, the annual biomass production of Rhode grass is 10 time higher.

This newsletter is made possible by the support of the American people through the United States Agency for International Development. The contents are the sole responsibility of the International Maize and Wheat Improvement Center and its partners, and do not necessarily reflect the views of USAID or the United States Government.

Executive Editor: Genevieve Renard
Edited by: Bianca Beks and Kashif Syed
Reviewed by: Dr. Md. Imtiaz
Layout/Design: Eliot Sánchez Pineda

Contact Us:
CIMMYT - Pakistan Office
CSI Building, NARC, Park Road Islamabad, Pakistan
Phone: +92 51 925 55 22-24
Fax: +92 51 925 54 34
Website: www.cimmyt.org
For AIP newsletter: Shamim Akhtar
(s.akhtar@cgiar.org)