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 2, April-June, 2018

Program Leader's Message:
Greetings from AIP!

I am pleased to share with you the updates of the Agricultural Innovation Program for Pakistan for the quarter ended June 30, 2018.

During this period, AIP set up a stall at the Dawn Agri Expo in Lahore to present its successes in agricultural technology, improved seed, and innovative research projects, and disseminate information to farmers, government officials, donors, women, researchers and other stakeholders. During the event, farmers explored and acquired innovative technologies and approaches that will help improve major cereal crops in Pakistan and other related services.

Under the maize component, AIP provided instruments and hands-on training at academic and public research institutes to modernize maize research in Pakistan. It also provided seven partners with incubation chambers that have controlled heating, cooling, humidifying and illumination panels with spacious internal compartments. These incubation chambers also have user-friendly programmable digital microcomputer technology to regulate the temperature, humidity and illumination for specific periods. Fifty students including 20 women completed hands-on training and are now able to fully operate these instruments. Researchers from the public and private sectors, including private seed company representatives, participated in the "International Training Workshop on Seed Business Management" hosted by CIMMYT-Nepal. Participants were able to build their technical, financial and seed market management skills.

Through training sessions and field days, the AIP Wheat component enhanced Pakistani farmers' ability to get more yield from their wheat crop. During the field days, farmers were involved in identifying high yielding varieties based on their rust resistance and traits that increase yield. Training courses on quality seed production increased farmers' knowledge of field preparation practices and proper seed storage techniques. The National Annual Traveling Wheat Seminar (TWS) 2018 was organized and led by the International Maize and Wheat Improvement Center (CIMMYT) in collaboration with the Pakistan Agricultural Research Council (PARC). The TWS was attended by scientists from public and private institutions across the country, including breeders, agronomists, pathologists, agriculture extension workers, seed specialists and experts from food companies.

The AIP Agronomy component trained 486 farmers and agricultural extension staff on ridge planting, bed planting, water-saving agricultural practices and the use of small machinery in districts of Punjab and KP provinces. These practices will help farmers increase their crop production by 15-20% while also saving 50% of their labor costs. AIP Agronomy organized field days for 120 farmers on wheat planted using the zero-till Happy Seeder in Sheikhupura and Nankana Sahib districts in Punjab province in partnership with the Rice Research Institute Kala Shah Kaku and the Wheat Research Institute Faisalabad. Farmers in Sindh province were also trained to use wheat harvest and post-harvest techniques.

The AIP Socioeconomics component is switching from paper-based data collection to electronic data collection devices. The Socioeconomics component conducted studies on wheat and maize value chains in Pakistan. Staff members of the component participated in an international workshop on sustainable food systems under climate change in South Asia.

Under the AIP-PARC competitive grant, partnership continued across the country with 40 sub-grantees like Muhammad Nawaz Shareef University of Agriculture Multan (MNSUAM) to create awareness of off-season vegetable trials planted in the high tunnel on vertical technology in Punjab province.

The AIP Livestock component is helping smallholder livestock producers improve their livelihoods by providing knowledge on animal health and better livestock farming practices, and making them market oriented. It is also sensitizing them to recognize disease signs and symptoms in their animals. FATA veterinarians received artificial insemination training to enable them to sustainably conserve the genetic diversity of indigenous goats and sheep.

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 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.

Dr. Md. Imtiaz

Inside this Issue:

AIP achievements in the agricultural sector showcased at the Dawn Agri Expo 2018

AIP, led by CIMMYT and funded by USAID, set up a stall at the Dawn Agri Expo in Lahore on May 3 and 4, 2018. CIMMYT presented successes in agricultural technology and provided a platform for Pakistani farmers, government representatives and other stakeholders to explore and acquire innovative technologies aimed at improving Pakistan's major cereal crops and other linked products and services. The main attractions at the Dawn Agri Expo were wheat varieties Zincol, Pakistan, Borlaug and Pirsabak, and maize varieties (QPM – 200/300 and white) introduced by CIMMYT through its programs across Pakistan, the zero-tillage Happy Seeder (ZTHS), maize push row planter, hermetic bags for storing wheat and the multi-crop DSR planter. The AIP Livestock and Vegetable components exhibited products of its two competitive grant academic partners including products that add value to camel milk (dry and fresh cheese) and seasonal vegetable kitchen gardening (chilies, okra, squash, bell pepper).

The Expo was inaugurated by (then) Governor of Punjab province, Mr. Rafique Rajwana, accompanied by Mission Director of USAID Pakistan, Mr. Jerry Bisson, and diplomats from different countries. The AIP stall set up at the U.S. Government pavilion represented by USAID and USDA also attracted numerous visitors including farmers, policymakers, media, students, agricultural experts and scientists from both public and private organizations. This created new opportunities for AIP and CIMMYT to connect with target groups and explore agricultural prospects in Pakistan.

Maize

Providing instruments and hands-on training to academic and public research institutes to modernize maize research in Pakistan

CIMMYT, under the USAID-funded AIP project, aims to improve the country's maize value chain. AIP-Maize has successfully evaluated about 3,000 genetically improved maize genotypes for different agro-ecologies of Pakistan. Maize researchers from the National Agricultural Research System (NARS) highlighted that there is a lack of modern instruments for fast-track data recording and precise evaluation of genotypes. Modern instruments are required to enhance the capacity of public sector laboratories. CIMMYT- Pakistan, under AIP, took the initiative to provide public and academic partners with high precision instruments. A total of seven partners, *viz,* the University of Agriculture Faisalabad (UAF), the University of Agriculture Peshawar (UAP), MNS University of Agriculture Multan (MNSUAM), the National Agricultural Research Center (NARC)-Islamabad, the Cereal Crops Research Institute (CCRI)-Nowshera, the Agricultural Research Institute (ARI) Quetta and the Directorate of Agricultural Research Gilgit Baltistan (GB), were shortlisted to provide the incubation chambers through direct procurement by CIMMYT-Pakistan. These incubation chambers have the characteristic features of controlled heating, cooling, humidifying and illumination panels with spacious internal compartments. The incubation chambers also have user-friendly programmable digital microcomputer technology to regulate temperature, humidity and illumination for specific periods. These incubation chambers are useful for plant growth and tissue culture, seed germination and viability testing, seedling growth evaluation, culture testing of microorganisms, feeding of insects and Biochemical Oxygen Demand (BOD) testing of water quality. Maize researchers can perform all of the above-mentioned operations with high accuracy and precision.

Hands-on training was organized at UAF and MNSUAM to teach students to fully operate the instruments of plant breeding and genetics, and seed science and technology at their respective departments. Currently about 50 students including 20 women have completed hands-on training to enable them to fully operate the instruments. Students were delighted to express that they can operate the instruments to do their research activities. Regular training sessions will continue to further train the large number of students, build their capacities and improve their skills.These instruments will provide a great opportunity to accelerate data acquisition from maize breeding and evaluation trials. The public sector will be able to work more efficiently with enhanced capacity, whereas the private sector can obtain the benefits through strong public-private partnerships. Large numbers of interns, graduate and Ph..D. students could benefit further by being trained to operate these instruments, since they would facilitate precise data acquisition for their research work.

Practical demonstration to operate digital incubator in UAF.

Practical demonstration of how to operate a digital incubator in MNSUAM Multan.

Participation of private seed business representatives in the "International Training Workshop on Seed Business Management" hosted by CIMMYT-Nepal

Technical innovations in agricultural inputs, particularly with regard to maize hybrid seed, have resulted in enhanced maize productivity across the country. However, improved maize seed, along with better crop management technologies, is important to further increase the gains. Productivity gains and sustainability are more important for developing countries like Pakistan to accelerate the economy, alleviate poverty and improve the livelihoods of maize farmers. However, it can be challenging for farmers to find high quality seed in developing countries like Pakistan, where the lack of seed availability, affordability and accessibility is the major bottleneck, reflecting the prevalence of dysfunctional seed systems in the country. An indigenous maize seed system is still being established and thus largely untapped in Pakistan. Lack of availability of new technologies, technical expertise and business incentives is limiting the success of the current seed value chain.

The CIMMYT-led and USAID-funded Agricultural Innovation Program for Pakistan provided an opportunity for indigenous seed companies to develop skills for precisely managing their seed business, have higher gains and fill the loopholes in business handling. AIP facilitated the participation of representatives of private seed companies (Jullundur Private Limited, Sohni Dharti International, ICI Pakistan, Tara Crop Sciences, Pak HiBred Pvt. Ltd and Petal Seeds Company) in the three-day "International Training Workshop on Seed Business Management" organized by CIMMYT-Nepal, on April 23-25, 2018. At the training workshop, participants learned to develop and manage market-oriented seed businesses with special emphasis on maize seed systems. Participants had the opportunity to build their technical skills, as well as their financial and seed market management capacities. They also learned the prerequisites of a competitive seed business using case studies from Africa and Asia. Training participants were also given the opportunity to interact with the experts who are running and managing the seed business very successfully.

The training workshop was facilitated by John MacRobert, Seed Business Consultant in Nepal and former Principal Seed System Specialist for CIMMYT. The training workshop included lectures, group discussions and customized exercises to develop business plans, marketing, production and financial strategies, control seed quality and develop research and development plans. Participants from Pakistan expressed that they found the training workshop useful because it improved their skills for managing indigenous seed businesses in the country.

Wheat

AIP-Wheat teaches Pakistani farmers how to get more yield from their wheat crop

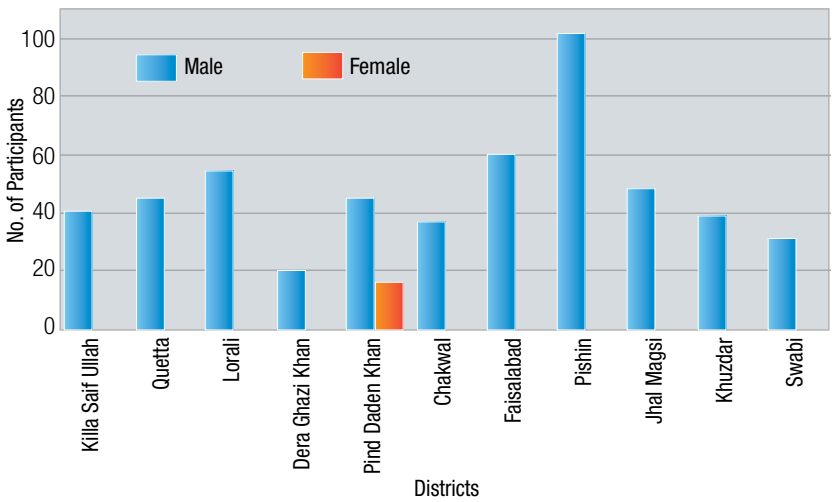
Demonstrating wheat seed storage techniques to workshop participants.

Low wheat productivity in Pakistan is caused by many factors like limited availability of quality seed, a weak agricultural extension system and repeated planting of old varieties. This scenario is a recipe for rust outbreaks, causing billion U.S. dollar losses. In Pakistan about 70% of wheat seed comes from the informal sector, which means that the seed is a mixture of different varieties that are obsolete and susceptible to rust. In combination with improper agronomic practices, all these factors cause a 50% yield gap in wheat production.

Widespread efforts are required to tackle farmers' lack of awareness of major wheat yield inputs. Most farmers in Pakistan don't know about newly released wheat varieties nor which varieties are suitable for rainfed or irrigated areas. Their knowledge of wheat rusts is also very limited. In view of all these scenarios, AIP-Wheat organized training sessions and field days to enhance farmers' awareness. Training sessions on quality seed production are quite comprehensive and build farmers' knowledge from field preparation to proper seed storage techniques. Field days involve farmers in identifying high yielding varieties based on rust resistance and yield-enhancing traits.

AIP-Wheat organized these events in partnership with several public research institutes, NGOs and private seed companies across Pakistan. It should be noted that 38 women also participated in these events. AIP Wheat component partners from Baluchistan were Kashmala Seed Corporation, the Agricultural Research Institute, Quetta, and the Baluchistan Agricultural Research and Development Centre. In Punjab province, these events were conducted by NRSP (also in KP) and the Wheat Research Institute-Faisalabad (WRI-Faisalabad). WRI-Faisalabad organized training on hermetic seed storage bags – scientifically designed bags for storing seed in an environmentally safe and cost-effective way.

Farmers expressed their appreciation for wheat varieties such as Benazir-13, Pakhtunkhwa-15, Pakistan-13, and Zincol-16, which were introduced by AIP in their respective areas. More than 80% of AIP-introduced varieties were liked by farmers, for they were expected to yield 10-15% more than the old, rust-susceptible varieties.



Capacity building events across Pakistan.

Highlights from the Traveling Wheat Seminar 2018

The TWS 2018 was organized led by CIMMYT in collaboration with PARC. This annual seminar is structured to identify the issues and challenges faced by stakeholders in the wheat production value chain. Stakeholders in TWS 2018 included wheat growers, private seed companies, and extension workers. They were provided with workable solutions through consultative discussions with experts. Scientists from public and private institutions across the country included breeders, agronomists, pathologists, agricultural extension workers, seed specialists and experts from food companies.

During the second phase of this country-wide traveling wheat seminar, the participants visited various wheat trials on the NARC premises. Dr. Md. Imtiaz noted that this important gathering of wheat scientists under the National Wheat Coordinated Program has been revived under the umbrella of WPEP which began in 2010 and is an outcome-driven science collaboration involving USAID, USDA, CIMMYT, PARC, ICARDA, and Pakistani scientific organizations working in all provinces of Pakistan including AJ&K and GB.

Highlights of the visit to NARC wheat trials.

Agronomy

AIP Agronomy focused on capacity building of farmers

Under USAID, AIP Agronomy organized farmer field days on bed planting and ridge planting of wheat in partnership with the Agronomy Research Station, Bahawalpur, Punjab province. More than 220 farmers visited the fields, where they learned that they can get 10-15% higher wheat grain yield and 30% water savings with ridge planting and bed planting in comparison with flat planting of wheat.

Another field day was organized for 91 farmers in collaboration with the Cereal Crops Research Institute (CCRI), Nowshera, KP province. Participants visited ridge planted wheat plots sown with a mechanized bed planter and a zero-till drill, which help farmers save 30% of irrigation water and obtain 15% more wheat grain yield.

A training session was organized for 175 farmers with the support and collaboration of the Model Farm Services Center (MFSC) in District Kohat, DI Khan and Nowshera. All the participants, including smallholder farmers and agriculture extension staff, were trained to use small machinery. This will help farmers increase their crop production by 15-20% while also saving 50% of the labor costs.

Demonstration of a generator-operated hand reaper for wheat harvesting.

Sowing maize with double push-row planters attached to a tractor.

Farmers visit wheat planted with a zero-till Happy Seeder in Punjab province

AIP Agronomy organized field days on wheat planted with a zero-till Happy Seeder (ZTHS) in Sheikhupura and Nankana Sahib districts in Punjab province. These field days were organized in partnership with the Rice Research Institute Kala Shah Kaku and the Wheat Research Institute Faisalabad. More than 120 farmers visited fields where wheat had been planted without burning rice residues. During the event, Mr. Zubair Sehol, a ZTHS farmer from Sheikhupura, told his fellow farmers that he planted wheat with the ZTHS on 50 acres in combine-harvested rice residues and saved PKR 7000/ per acre at planting, compared with using farmers' common practice.

Farmers' field visit to observe a ZTHS planted plot.

Farmers learn about wheat harvest and post-harvest techniques in Sindh province

The Agronomy Department of Sindh Agriculture University Tandojam, conducted a demonstration of proper wheat harvest and post-harvest techniques on May 3-4, 2018. A total of 11 participants, including six students and five farmers, attended the event. The activity was conducted at the Department's Experimental Farm at Tandojam. Through this activity farmers and students learned about yield-increasing parameters, such as a higher number of tillers per plant, a higher number of grains on each spike and, especially, higher grain weight. Different wheat varieties produced bold and healthy seed, while some produced small, weak and shriveled seed. Bold and long healthy seed will increase crop yield by 15%. By following these harvest and post-harvest practices, farmers can increase their income by 20%.

Weighing wheat seed and counting the number of grains per spike after wheat demo plot harvesting.

Socioeconomics

AIP-Socioeconomics conducted studies on wheat and maize value chains in Pakistan

The AIP-Socioeconomics component conducted studies on the following subjects during 2018:

- **Maize value chain**
- **Wheat value chain**
- **Farmers' willingness to pay for climate resilient maize and wheat varieties**
- **Upscaling QPM hybrids**
- **Sustainability of conservation agriculture**

Comprehensive questionnaires were prepared for the wheat and maize value chains. Separate questionnaires were prepared for consumers, dealers, seed companies, flour millers, the processing industry and consumers. AIP-SEP pre-tested the questionnaires in order to determine the adequacy of the research instruments, assess the feasibility of (full-scale) studies and identify the missing linkages among different value chain actors, in two tehsils of Rawalpindi district, i.e., Taxila and Gujjar Khan. The main objective of these value chain studies was to identify the incentives, bottlenecks, constraints and key roles of various stakeholders (farmers, seed companies, dealers, processors, consumers, etc.) involved in value chain processes. AIP Socioeconomics also plans to conduct full-scale value chain studies after incorporating the observations gathered while pre-testing the research instruments.

AIP-SEP pre-test the questionnaires on wheat and maize value chains.

AIP Socioeconomics participate in an international workshop on sustainable food systems under climate change in South Asia

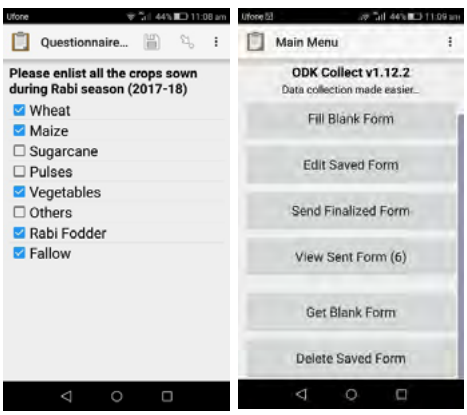
AIP-SEP research staff give a presentation on climate and socioeconomic changes during an international workshop held at the Serena Hotel, Islamabad.

AIP Socioeconomics participated in an international workshop on "Sustainable food systems under climate change in South Asia" on June 26-28, 2018, organized by the Federal Ministry of Education and Research (BMBF), Germany, Potsdam Institute for Climate Impact Research (PIK), Germany, and the Centre for Climate Research and Development (CCRD), Pakistan. The main objective of this workshop was to identify the gaps in existing food systems and make recommendations for sustainable transformation options in South Asian countries under climate change, demographic growth, and life-style changes included in sustainable development goals.

AIP-SEP also made a presentation on "What would be a vision of sustainable agriculture in South Asia considering climate and socioeconomic changes."

AIP-SEP switches from paper-based surveys to electronic data collection devices

The socioeconomics component of AIP recently switched from paper-based data collection to electronic data collection devices. The wheat and maize value chain questionnaires are being designed using the Open Data Kit (ODK) for data collection. This will help collect accurate data and reduce the data entry time.



Vegetables (Under the AIP-PARC Competitive Grant)

Tomato trial is planted in the high tunnel on vertical technology

AIP's sub-grantee Agricultural Research Station, Swabi in Khyber Pakhtunkhwa, organized a field visit to compare yield trials of tomato and squash crops which were planted in Qazi Abad, Mufti Abad (Gohati) and Baja villages, District Swabi. The tomato trial was planted in the high tunnel on vertical technology; the first picking started in March and the farmers got a high price (PKR 35 per kg) during the off-season (compared to PKR 20-25 per kg during the normal season) in the (Mandi) market. The winter season squash trials were planted in the last week of December, 2017, in low plastic tunnels. Through this low plastic tunnel technology, the squash crop started yielding fruit in the off-season when the market price was high and farmers got high net returns. Farmers got PKR 25 per kg, while its price in the normal season was PKR 10. As pickings from tomato and squash trials are still continuing, farmers are expected to increase their squash production by 40-50% and their tomato production by 25-30%.

Under USAID, the sub-grantee AIP project organized different field days and observations of integrated approaches for managing broomrape (*Orobanche* sp.) in tomato in KP and Baluchistan provinces. Tomato nurseries were transplanted and weed control treatments were applied in the months of April and May. The research staff and local farmers attended these events, as they were involved in the experimentation process. From the experiments farmers learned how to manage *Orobanche* sp., which is a major parasitic weed that infests tomato.

Farmer picking the tomato crop from a demonstration nursery.

Walk-in tunnel established by MNSUM for raising vegetable nurseries

A project on Vegetable Nursery Production and Supply System for Kitchen Gardening is being implemented by MNSUAM. The project was started in November 2017 in collaboration with private nursery farms. Its objective is to promote kitchen gardening by establishing a healthy nursery system for economical and clean (pesticide free) vegetable production by overcoming germination- and season-related problems, and to build the entrepreneurial capacity of agriculture graduates. A walk-in tunnel (130 x 15 ft^2) was constructed for raising nurseries of tomato, chili, pepper, brinjal and cucurbits (gourds and cucumbers, etc.). Different potting media (peat moss, Perlite, silt and compost) are being evaluated for raising nurseries. Both male and female students were involved in various activities of the project to promote their capacity building in nursery media preparation, multi-pot tray filling, sowing and further nursery management. A portal for online sale of vegetable nurseries has been launched on the website at mnsuam.edu.pk/Nursery/. Programs for raising society's awareness of healthy foods and promoting kitchen gardening for self-sufficiency in vegetables were conducted at three schools/colleges. Market linkages have been developed with different department stores, food festivals, CSD shops, etc., to provide space for displaying nurseries for sale at their stores.

A farmer makes farrows in a vegetable high tunnel.

Livestock

Promoting livestock health management by training volunteer women farmers in southern Punjab

The outstanding livestock breeds of Cholistan are world renowned and most (over 90%) livestock rearing is conducted in villages especially by women, in smallholdings ranging from 1-2 buffaloes/cattle and 4-5 goats. This initiative was taken up by the USAID-funded Agricultural Innovation Program-ILRI to help smallholder livestock producers by providing them with knowledge on animal health and better livestock farming practices, and making them market-oriented. They were also informed of mastitis and other disease signs and symptoms to improve their livelihoods. In view of the need to assess women livestock farmers, a training course on animal health was organized in Lateef Abad, tehsil Mandi Yazman, Bahawalpur, on March/April 2018, in collaboration with Khawateen Welfare Council (KWC), Bahawalpur. Volunteer women farmers having a primary education and small or large ruminants were selected. A total of 45 women participated, interacted in discussions and chipped in actively during practical demonstrations. The program was intended to sensitize livestock owners about management criteria and measures for preventing seasonally occurring diseases.

Temperature taken by female farmer.

Use of surf excel for mastitis detection.

Hands-on training on artificial insemination and ultrasonography.

Artificial insemination training for FATA veterinarians to sustainably conserve the genetic diversity of indigenous goats and sheep

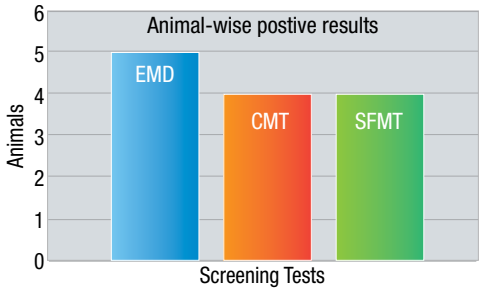
The Federally Administered Tribal Areas (FATA), which are now merged with Khyber Pakhtunkhwa (KP) province, consist of seven tribal agencies (districts) and six frontier regions. This region is blessed with a variety of sheep and goat breeds, but rearing and breeding are lagging due to lack of awareness. To fill this gap, the USAID-funded Agricultural Innovation Program-ILRI conducted a three-day training program for FATA veterinarians from April 10-12, 2018, at the University of Agriculture, Peshawar. This program was aimed at sustainably conserving the genetic diversity of indigenous sheep and goats, as well as improving their fertility by promoting disease-free, cost-effective and timely breeding at the farmers' doorstep through artificial insemination. Participating in this training were 28 veterinary officers from different agencies – Orakzai (2), Kurram (3), Mohamand (3), Khyber (2), Bajawar (6), FR Kohat (5), Bannu (2), South Waziristan (3), Dera Ismail Khan (1) – and one woman from Kashmir. Since the concept of artificial insemination in goats was new to many of the trainees, they showed great interest during discussions and focused on practical demonstrations. Given that quality genetics is vital to small ruminant breeding success, the director of Livestock FATA encouraged all the participants to disseminate artificial insemination techniques at the grassroots level with a target number of animals.

An innovation that instantly detects sub-clinical mastitis in dairy animals

Field surveys of major livestock diseases in Pakistan have indicated that sub-clinical mastitis (SCM) is one of the most problematic diseases of dairy animals, causing enormous economic losses to the country's dairy industry. Detection of SCM is difficult; high skills and ample practice are required to perform the test and correctly interpret the results. To revitalize SCM detection and provide an easy and less cumbersome diagnosis, AIP-ILRI tested the Electronic Mastitis Detector (EMD) for the first time in Pakistan. A farmer-participatory research trial was conducted from 17-25 April, 2018, to determine the validity and evaluate the relationship of three commonly used tests – namely, the California Mastitis Test (CMT), the Surf Field Mastitis Test (SFMT) and the traditional Somatic Cell Count (SCC) test – for diagnosing SCM. A total of 136 milk samples from each quarter of 34 animals (24 cows and 10 female buffaloes) were screened directly at the herd by using EMD, CMT, and SFMT; samples were also collected for SCC. Results showed that the new EMD technique is easy, accurate, user-friendly, and more sensitive for detecting sub-clinical mastitis. Timely use of EMD makes it possible to acquire useful information on udder health, make management decisions and eventually help to reduce financial losses by up to 30%.

Screening by EMD.

Screening by CMT.



Total number of mastitic animals as detected by EMD, CMT, and SFMT.

Collecting blood for serum-mineral profile.

Bioavailability of minerals and their benefits leads to better herd health

AIP-Livestock has been working to find different profitable solutions under various alternative feeding regimes. Minerals are essential for optimum health. Mineral deficiencies and excesses can lead to disease. AIP-ILRI proposed a multidisciplinary approach to provide essential minerals to lactating stock over a period of three months (April to July, 2018). A total of 15 animals (six cattle and nine buffaloes) were observed, including 10 animals that received supplements of Anmol Mineral Mixture @ 100 g/animal/day, and five animals as controls for the said period. The targeted minerals were sodium, potassium, calcium, phosphorus and magnesium because they substantially enhance reproductive performance and, ultimately, lactation length. To test for their bioavailability, blood was collected to measure the serum-mineral profile on a monthly basis. The final objective of all these efforts is proper mineral supplementation that provides numerous benefits to the lactating herd by improving reproductive performance, minimizing the effect of metabolic disorders on fertility, decreased somatic cell count, fewer days open, fewer services per conception, and increased percentage of cows pregnant at 150 days in milk.

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: 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)