New pearl millet varieties and hybrids capture farmers and seed producers’ interest in Niger

The newly developed open pollinated varieties and hybrids of pearl millet were showcased during a field day in farmers’ fields near Yuri in Niger and also at the ICRISAT research center at Sadore.

As part of the program, a farmer participatory varietal selection was conducted during the field day. Farmers, seed companies and NGOs were asked to select the new varieties and hybrids based on their interest. This exercise helped to better understand the requirements of the farmers in different regions of Niger. The selected varieties and hybrids will be produced in the next season to showcase these varieties and hybrids in the farmers’ fields in coming days.

The newly developed ICRISAT-bred pearl millet varieties with high grain Fe content were planted in farmers’ field and also in Sadore for demonstrations. The new varieties are ICTP 8203, GB 8735, ICMV 221 Wbr, ICRI- Tabi and Jira Ni along with hybrids ICMH IS 14002, ICMH IS 14003, ICMH IS 14009, ICMH IS 14011, ICMH IS 15012, ICMH IS 16265 and ICMH IS 16266.

Varieties selected by participants based on their regions’ need included ICTP 8203 and ICMV 221 Wbr and hybrids such as ICMH IS 14002, ICMH IS 14003, ICMH IS 14009, ICMH IS 14011, ICMH IS 16012 and ICMH IS 16265.

During the field visit, the seed kits of 250 g of ICTP 8203 seeds were distributed to each farmer for sowing in their fields next year. After the visit the AINOMA seed company expressed interest for training in hybrid seeds production. An AINOMA technician will come to ICRISAT as an intern for field training during the off-season trials. This work was carried out in partnership with HarvestPlus.

The Indian Ambassador, His Excellency Mr RS Malhotra inaugurated the field day and visited the pearl millet demonstrations in Sadore research station and in farmers’ field at Yuri. He also visited ICRISAT research facilities such as abiotic stress studies platform, genebank and micronutrient soil analytical laboratory. He appreciated the research being conducted at Sadore and the ICRISAT facilities at Niger.
Breeding tool plays a key role in program planning

Region-wise Program Improvement Plans for target crops – groundnut, chickpea, cowpea and common bean – were presented at a recent Tropical Legumes (TL) III Genetic Gains workshop. The workshop used the results of the Breeding Program Assessment Tool (BPAT) as a resource to help guide breeding programs in improving their targeting, speed, scale, efficiency, quality (control, precision, and accuracy) according to each partner’s unique characteristics and resources.

The workshop was attended by key breeding programs of CGIAR centers and select National Agricultural Research System (NARS) partners from eight participating countries. The discussions resulted in partners agreeing on the following:

- Extensive use of Breeding Management System (BMS)
- Adoption of more mechanized practices
- Leveraging capacities of partners
- Exploring capacities to harness forward breeding
- Building modern foundation seed stores.

Key traits identified for development included early maturity, foliar fungal disease resistance, drought tolerance, groundnut rosette disease resistance, P-efficiency, tolerance to aflatoxin contamination and nutrient-use efficiency to meet the needs of poor soil fertility in Ghana, Burkina Faso, Tanzania and Uganda.

Partners realized the most immediate improvement they can make in their breeding program is increasing the cropping cycle by at least one cycle per year to translate the enhanced breeding efficiency. Materials received from ICRISAT for foliar fungal disease resistance were useful and a few adapted lines were selected and promoted to advanced trials. It was also noted that an internal mechanism in CGIAR centers is required to incentivize breeders for sharing of breeding lines with NARS partners. NARS partners were encouraged to engage and invite objective leaders of TL III to their annual work-planning meetings which may provide guidance on collaborative activities to be carried out.

The common objective presented across the countries was to develop market preferred varieties with drought tolerance, pest and disease resistance and improved nutrition. To achieve this it was recommended to increase number of nurseries, number of crosses, breeding trials and sites. Partners were of the view that to improve quality, higher precision phenotyping is required. There is a need for measurement of genetic...
gain, better data capture and seed storage facilities. NARS partners presented the program improvement plan for each legume in a crop by country combination – chickpea in Ethiopia and India; common bean in Ethiopia, Tanzania and Uganda; groundnut and common beans in Tanzania and Uganda; groundnut and cowpea in Burkina Faso, Ghana, Mali and Nigeria.

Program Improvement Plans at African Hubs

**Groundnut**

Traits of focus are drought resistance, leaf diseases, aflatoxin and rosette. The objective of the Program Improvement Plan is to improve genetic gains, increase genetic effects and minimize environmental error. Prior to BPAT the West and Central Africa (WCA) program relied mostly on Malawi and India programs for crossing and segregating populations. The actual crossing program started in 2009 with only nine crosses per year. The proposed area of improvement following BPAT for both Eastern and Southern Africa (ESA) and WCA hubs are as follows:

- Increase the crossing capability of the program (up to 250 crosses per year per site) and widening the genetic pool through introductions from the genebank in India
- Optimization of the selection strategies through Single Seed Descent (SSD), pedigree modification and early generation selection from F2 and F3 generations
- Testing strategies to optimize target and testing environments including number of test sites in each environment
- Number of replications and number of years for on-station and on-farm testing
- Make use of advanced statistical tools (mixed models, spatial analysis) to optimize selection precision
- Use of marker technologies (currently focus on traits for late leaf spot and rust)
- Strategic partnerships for winter nurseries at government stations in Malawi (early leaf spot and groundnut rosette disease), Naliendele Agricultural Research Institute (NARI) Tanzania for rust or shuttle breeding between WCA and ESA to speed up generation advance.

**Cowpea**

The program has been in existence for more than 50 years and Program Improvement Plans for immediate follow-up include:

- Recruitment of an additional breeder and postdoctoral researchers for molecular breeding and host plant resistance entomologist, etc.
- Upgradation of facilities for aphid infestation and drought. Improve irrigation systems and screen houses

**Common Bean**

The common bean program intends to address three pipelines:

- Drought, low phosphorus (P) and low nitrogen (N) tolerance
- High mineral iron (Fe) and zinc (Zn) lines
- Insect pests bean stem maggot and bruchids, and disease resistance (angular leaf spot, common bacterial blight and bean common mosaic virus)

The other key traits include cooking time and yield.

Program Improvement Plans for immediate follow-up includes

- Speed – aiming at four generations per year in Uganda – SSD for fast generation advance, plot mechanization including planters and harvesters
- Increase number of crosses to 100 per year; handle up to 5,000 – 10,000 lines per year; use BMS and molecular tools
- Quality phenotyping
  - Uniformity of fields
- DNA marker technology
  - Use the CGIAR common genotyping facility at ICRISAT or Intertek genotyping platform
  - Better use of data in decision making
- Improve irrigation facility (solar powered)
- Already using electronic data capture tools; increase use of automated data collection.
**Chickpea**

For chickpea, key challenges include Fusarium wilt, ascochyta and pod borers. The program in Ethiopia has a target to increase production by 50% by 2020. Researchers will focus on working with partners to identify quantitative trait loci (QTL) for the meeting the challenges mentioned above. Program Improvement Plans to address these constraints include the following:

- Increase the crossing capability of the program (up to 50 crosses per year) and widening the genetic pool by requesting new germplasm from the genebank in India
- Use SSD for fast generation advance, aim at 2-3 generations per year
- Use BMS and molecular tools
- Quality phenotyping
  - Uniformity of fields
- Use electronic data capture tools; increase use of automated data collection.

**Way forward**

All partners expressed satisfaction that the BPAT exercise added value to their programs. Dr Jeff Ehlers, Senior Program Officer, Bill & Melinda Gates Foundation, commented that BPAT can be used in an advocacy role: pushing national programs and CGIAR centers to deliver more efficiently.

Dr David Bergvinson, Director General, ICRISAT, said that BPAT assessment should be extended to other locations as well. Dr Moses Siambi, Regional Director- ESA, emphasized on the need to increase production and productivity of the four key legumes under TL III in order to meet the high demand in project focus geographies. “With our integrated efforts we not only need to enable smallholders to move from subsistence farming to marketable surplus production but also ensure better nutrition and health,” he said.

Dr Ehlers commended the partners’ effort for bringing in a real change in mindset and thinking of NARS and other partners and he also appreciated the visible efforts of incorporating the outcomes of the BPAT for improving the breeding programs. He also suggested the need to have the benchmark studies and document the reports on the genetic gains in key breeding programs.

Dr Rajeev Varshney, Research Program Director - Genetic Gains, ICRISAT, encouraged the partners to utilize the ICRISAT genotyping platform/high throughput phenotyping and genotyping facility. He urged the Crop Improvement Breeding and Genetic Gains units of ICRISAT to work closely for better integration of the breeding activities and genomics.

The workshop on ‘Increasing the Genetic Gains of Project Partner Breeding Programs’ was held from 1-2 September at Nairobi, Kenya.

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**Project:** Tropical Legumes III  
**Investor:** Bill & Melinda Gates Foundation  
**Partners:** CIAT, IITA, and NARS partners from sub-Saharan Africa and South Asia.  
**CGIAR Research Program:** Grain Legumes

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**This work contributes to UN Sustainable Development Goal**
Monitoring, Learning and Evaluation (MLE) work plan to document the roadmap to achieving the Tropical Legumes (TL) III project aim was prepared by participants attending a workshop in Kenya. The TL III project aims at releasing 50 high-yielding, stress resistant, market preferred varieties with superior cooking and nutritional qualities of groundnut, cowpea, common bean and chickpea by 2019.

Urging participants to embrace and adopt the approved MLE work plan, Dr Emmanuel Monyo, Project coordinator TL III, said, “Quoting release of varieties per se is not enough but emphasis needs to be put on the genetic gains of those varieties and the available seed systems for their dissemination.” He said there needs to be a better way of documenting project achievements. A properly designed MLE plan will help the team to achieve this.

Dr Jeff Ehlers, Senior Program Officer, Bill & Melinda Gates Foundation applauded the efforts of all the TL III partners and stressed that at the donor level, the Foundation sees the National Agricultural Research System (NARS) as key implementers for the third phase of the project. He also reminded the need for return on investments (ROI) for funds, but above all, synchronizing the work being done with national strategies in order to have bigger impact. He was happy to point out the investments in national institutions like the Ethiopian Institute of Agriculture (EIAR) were bearing fruit. “We need to continue documenting adoption of improved varieties and technologies developed as part of this project. We need to avail indicators of successful return on investments: what has been achieved and how confident we are on what has been reported. The Foundation is interested in knowing what NARS is doing, their capabilities and how we can measure these successes better while adopting the MLE plan,” he said.

Addressing the participants Dr David Bergvinson, Director General, ICRISAT, highlighted the need to develop market-driven varieties and define the research agenda to answer the concerns along the production chains like: what are the market requirements? Who are the partners needed for its delivery? Who are the actors involved throughout the chain? He emphasized on role of engaging with policy makers and urged the CGIAR leaders to be ambassadors to strive for policy reforms. He urged the project partners to synchronize the plans to the country strategies; look for avenues to unlock markets, and document the constraints, enabling policies and partnership environments needed to unlock markets.

During the two-day deliberations MLE consultant Dr Yvonne Pinto, Director of Agricultural Learning and Impacts Network (ALINe), Firetail, sensitized project partners on TL III MLE principles, highlighted the detailed functioning of MLE, reiterated the objectives, theory of change, elaborated MLE framework and the significance of MLE to TL III project. Mr Amos Kioko, Project Officer – MLE, facilitated and educated the participants on filling of MLE data collection tools and forms. Objective-wise groups were formed to have better integration and synergy while filling the MLE forms and reporting on the project development.

Project indicator reference sheet was discussed to provide guidance on definition of terms, calculations, type of indicator, level of aggregation, data disaggregation, method of data collection, data sources, frequency of data collection, persons responsible, etc. Percentage of women using improved technologies, percentage change in gender yield gap along with number of improved legumes varieties developed and released, number of improved legumes varieties available for national testing, number of farmer-preferred varieties released in the national system, number of participants reached/ awareness created were some of the important indicators discussed as part of the MLE indicators.

The Breeding Management System was also discussed as a tool for data management and reporting. It was suggested to track the average age of variety in a particular country to understand the genetic gains in farmers’ fields.

Dr Stanley Nkalubo, Scientist from National Crop Resources Research Institute (NaCRRI), Uganda, urged NARS to look at...
the country strategies and what works are being done to improve the nutrition and food security in the country. He cited the example of how iron-rich beans released under this project are helping in the fight against anemia in Uganda.

MLE is a way of learning for all and we need to learn and define the impact using the available facilities and resources, said Dr Clare Mukankusi, who represented International Center for Tropical Agriculture (CIAT). Dr Christian Fatokun, International Institute of Tropical Agriculture (IITA), emphasized on the need to work with industries in the private sector and mentioned about their work with Monsanto for developing improved cowpea technologies. He reminded the team that Tropical Legumes project is a ten-year vision currently in its eighth year and there is need for ex-post assessment of the success achieved and project the future of legumes when the project ends in 2019. There is a need to plan on how to attract youth to replace the ageing generation of farmers. The way farming should be practiced must reflect the changing environment to encourage more youth to join agriculture, he said.

Underlining the importance of efficient data management and use of Breeding Management System (BMS) discussions were facilitated by Dr Rajeev Varshney, Research Program Director - Genetic Gains, ICRISAT and Principal Investigator, TL III, with NARS partners to finalize the target locations per country and identify the country focal points. It was decided that assessment of existing capacities on data management and BMS of NARS partners will be done and accordingly plans for trainings and implementation of BMS and data management strategy will be developed as follow-up activity.

The workshop was held on 30-31 August and was attended by more than 60 participants from CIAT, IITA, the Bill & Melinda Gates Foundation, ICRISAT and NARS partners from sub-Saharan Africa and South Asia.

This work contributes to UN Sustainable Development Goal.