First scientific study on millet-based meals in schools shows millets boost child growth by 50%

Findings from a recently published three-month feeding study with 1,500 children in Karnataka suggest that millet-based mid-day meals can increase relative growth by 50%. Children rated the meals, which were designed by scientists and chefs and included little millet as a rice substitute, over 4.5 on 5 for taste.

The findings of the study were released jointly by Prof Ramesh Chand, Member, NITI Aayog, and Dr Ashok Dalwai, Chair, Empowered Body, Doubling Farmers’ Income, Government of India, in New Delhi on 18 December. The results were presented at the Tasting India Symposium later in the day.

“This is an example of not only a science-backed nutrition solution, but also a link between agriculture and nutrition. It is important now that we achieve mainstream consumption of millets and that they are not just for the elite,” said Prof Ramesh Chand.

Dr Ashok Dalwai emphasized, “Making it profitable for farmers to grow nutritious foods like millet has to be a key part of the Doubling Farmers’ Income vision and millets are important in the rainfed areas for farmers to cope with climate change and water scarcity.”

This Smart Food study, ‘Acceptance and impact of millet-based mid-day meal on nutritional status of adolescent school going children in a peri-urban region of Karnataka state in India,’ published in the journal *Nutrients*, was undertaken by The Akshaya Patra Foundation and ICRISAT. Early adolescent school children in four villages – Thathaguni, Kagallipura, Allahali and Chensandra, which are located around Bengaluru – participated in the study. Growth was assessed using anthropometry measurements – height and weight, along with age, while sensory evaluations were made to determine acceptability.

The researchers found that children fed millets had a 1.5% increase in height on average in three months while children in the control group registered a 1% increase in height during the same period. In effect, the study group children grew 50% taller than the height
increase of control group children. Similarly, the study group children registered a 5% increase in weight on average, while 3% average weight increase was registered in the control group during the study period. Thus, the weight increase of the study group children was over 50% higher than that of the control group.

“It is not good enough just to say we are going to add millets into the meal,” said Dr S Anitha, Nutrition Scientist, ICRISAT, and the study’s corresponding author. “The type of millet, its variety, how it is cooked and the foods it is combined with are some of the key elements that can make a difference in nutrition. For instance, the amount of iron available in a meal can be doubled by selecting the right variety of millet. This is the first known scientific study of millet-based meals in a school feeding program.”

The researchers gave the study group children meals including idli, khichdi, upma and bisibella bath in which rice was replaced by pearl millet (bajra), ragi (finger millet) or little millet (kutki). The anthropometric measurements at the end of the feeding program were compared with that of control group children who consumed fortified rice with sambar.

“Akshaya Patra is always looking for ways to improve nutrition in mid-day meals. The millet meals were exceptionally successful and were really liked by the children. We appreciate the Karnataka state government’s support, and with this positive result, we now hope this will garner the support needed to make nutritious millet-based meals available to our future generations,” added Mr Ajay Kavishwar, Head of Research, The Akshaya Patra Foundation.

“This initiative also included developing guidelines on how to introduce millets into menus to maximize the nutrition benefits and likability. This is pertinent now given the renewed interest in millets,” said Mr Ashok Jalagam, Smart Food Coordinator for Asia Pacific and one of the study’s authors.

Call to policy makers

The study’s authors have called for policies that (1) Follow the lessons learnt on how to include millets into meals; (2) Create a level playing field for the pricing and availability of millets through Minimum Support Price, Public Distribution Scheme and feeding programs (Mid-day Meals (MDMs), Integrated Child Development Services (ICDS)) that will benefit from not only including millets, but also from the approach taken to introduce them; (3) Go one step further and select millets by varieties in programs, ensuring maximum nutritional value and impact and (4) Promote millets in positive fun ways.

This is highly relevant now as millets have gained attention for their nutritional value and resilience in the face of water scarcity and climate change, making them a viable option for struggling farmers if markets can be further developed. The Government of India and various states like Karnataka and Odisha have led the cause to make millets a popular food choice. The Government of India designated 2018 as ‘National Year of Millets’ and initiated a millet mission. NITI Aayog recently announced a pilot to include millets in the ICDS and MDM schemes.

“These results and guidelines developed from the study are equally important for any scheme addressing malnutrition or general health diets—whether that of governments, NGOs or private sector processors or caterers,” noted Ms Joanna Kane-Potaka, Executive Director of Smart Food and Assistant Director General of ICRISAT. Ms Kane-Potaka outlined plans for clinical testing to determine bioavailability of millets and the role of gut-microbiome, besides research to see how different forms of processing and cooking can affect nutritional composition of millet meals.

“ICRISAT holds the world’s largest collections of millet genetic material and works closely with Indian Institute of Millets Research and other partners to improve millets by developing varieties having higher nutrient levels as well as the more conventional traits like yield and resilience,” commented Dr Peter Carberry, Director General, ICRISAT.

To see the scientific journal article, click https://www.mdpi.com/2072-6643/11/9/2077/htm.
Focus on breeding

Groundnut breeding program in Burkina Faso gets a boost with seven new improved groundnut varieties

More than 20 years after the last groundnut seed variety was registered in the seed catalog, the groundnut breeding program in West and Central Africa is set to be enhanced through the registration of seven improved groundnut varieties in Burkina Faso. The registration in the West Africa Variety Catalog 2018 was achieved by the Institute of Environment and Agricultural Research (INERA) through its groundnut improvement program in collaboration with ICRISAT.

Of these varieties, ICGV 93305 (Miou Paale) and ICGV 91328 are aflatoxin-tolerant varieties. KIEMA, ICGV-IS 13830, ICGV-IS 13912 and ICGV-IS 13806 are drought-resistant. According to Mr Sy Appolinaire Traore, a researcher at INERA, these last four varieties are quite appreciated for their ‘slightly large seeds’. The last registered variety (ICGV 01276) is resistant to foliar diseases. It is a medium-duration and ‘stay-green’ variety.

“All these varieties are high-yielding. A variety is only proposed for registration when the yield is higher than 1.5 t/ha. Six of them are of short-duration cycle (90 days) and one is of medium duration (105 days),” explained Sy Appolinaire.

This major breakthrough is the result of more than 200 demonstrations and field days conducted with farmers and seed companies in four major groundnut production zones in Burkina. “When farmers were asked to choose their preferred varieties, they paid particular attention to morphological development of plants. This random selection also contributed in evaluating the productivity of the varieties based on criteria such as the number of pods by plants, the pods and seeds size (marketability), the percentage of maturity, the color of the seeds and haulm production by variety,” said Mr Sy.

For Mr Tarpaga François, a farmer in the village of Daltenga, it was easy to choose a variety. “I chose the drought-tolerant varieties because the rainy season is short in our area with frequent drought. Earlier, my yields were around 700-800 kg/ha. With INERA’s improved varieties introduced by the TL III project, the yield reached between 1300 to 1500 kg/ha,” he said. With this increase in yield, Taparga was able to sell part of his produce. In 2018, he invested in livestock and is now using his groundnut haulms to feed them. “With these haulms, I saved more than FCFA 700,000 (US$ 1,195) during the dry season which otherwise would have gone for livestock feed expenses,” he says. In order to modernize his farming activities, using the earnings from the sale of his seeds and oxen, Taparga bought a new tractor, for FCFA 10 million (US$ 18,000).

In addition, Tarpaga was able to help a group of women in his community to start their own seed production. The women’s group was produced quality seeds and used the proceeds of their sale to buy goats and sheep, and to support some household expenses, including school fees. There is now a growing interest among other women to engage in groundnut production.

Another impact of the production of improved groundnut varieties is witnessed in the village of Sangha in the Eastern Centre Region of Burkina Faso. "I earned about FCFA 500,000 (US$ 855) from a year’s groundnut produce. Each bag of 100 kg was sold at FCFA 30,000 (US$ 50). Then, I bought a motorcycle at FCFA 400,000 (US$ 684) and with the remaining money I helped my husband pay our children’s school fees,” says Mrs Marguérite Koara.

Building on the experience of past projects to strengthen the national seed system, the registration of these varieties in the West Africa variety catalog is not only a success for scientists but also a breakthrough and big relief for groundnut seed system in Burkina Faso. The TL III project ended in June 2019. The Accelerated Varietal Improvement and Seed Delivery of Legumes and Cereals in Africa (AVISA) is now consolidating his impacts among the target communities.

For more on ICRISAT’s work on groundnut, click here.

Project: Tropical Legumes III
Partners: ICRISAT (lead), International Center for Tropical Agriculture (CIAT), International Institute of Tropical Agriculture (IITA) and national agricultural research systems partners (NARS) from 7 African countries and the Indian Institute of Pulses Research (ICAR), Kanpur, (UP) in India
Funder: Bill & Melinda Gates Foundation
CRP: Grain Legumes and Dryland Cereals (GLDC)
Setting the stage for hybrid pearl millet research consortium in West Africa

Exciting times ahead as public and private institutions come together to promote millets

Seed research stakeholders and representatives of private seed companies from Burkina Faso, Mali, Niger and Nigeria, met with scientists, millet breeders and seed systems coordinators recently at Niamey, Niger, to discuss creation of a consortium to promote hybrid pearl millet varieties in their regions on the lines of Hybrid Parents Research Consortium (HPRC) in India.

They attended hands-on training sessions on hybrid seed production, listened to experts’ presentations about new varietal releases and technologies, including millet hybrids and open pollinated varieties (OPV) bred by the ICRISAT pearl millet improvement program.

Participants viewed more than 40 diverse millet hybrids and OPVs at demonstration plots, and learned about productivity, maturity time, plant height, disease resistance, etc. all of which allowed them to choose germplasm for testing in their operating environments in 2020. Dr Prakash Gangashetty, Lead Scientist, Pearl Millet Breeding, ICRISAT-WCA, assured them of availability of adequate quantities of seeds.

The group also visited hybrid seed multiplication plots of several parent lines. The visit to these experimental plots led to many discussions on the best layouts and practices to ensure an optimal harvest of hybrid seeds on the heads of female parents.

Dr Gangashetty updated them on the latest advances in the millet improvement program in West and Central Africa, and Dr Issoufou Kapran, Senior Scientist, Seed Systems, ICRISAT, explained the constraints and opportunities of millets in the region. Mr Issoufou Maizama, President, Seed Trade Association of Niger, said, “This gathering is a golden opportunity for the private sector to access varietal technologies from researchers and help transfer them to farmers, while protecting their reputation because fraudulent suppliers cannot produce hybrids.”

The meeting concluded on the usefulness of a partnership on millet seeds systems, on the lines of the HPRC that facilitated the spread of ICRISAT’s millet hybrids in India.

The idea of a platform or consortium was positively welcomed by all participants and their wish to participate in the consortium was highly appreciated. Drs Gangashetty and Kapran will further engage with them to finalize the consortium agreements and start work on it from the year 2020.

This training event was held during 22–23 October 2019 at L’Institut National de la Recherche Agronomique du Niger (INRAN), Niamey, Niger.

For more on ICRISAT’s work in pearl millet, click here.

Participants from private seed companies of Niger, Nigeria, Mali and Burkina Faso in hybrid seed parent ICMA 177002 multiplication plot at ICRISAT research station, Sadore, Niger.
Pre-breeding efforts for better traits in pigeonpea

Annual Review Meeting of GCDT-ICRISAT collaborative research project and participation in Pigeonpea Field Day

With a view to using new and diverse sources of genetic variations in pigeonpea, the Pre-breeding Theme at ICRISAT is leading the drive to use wild Cajanus species to create new variability for ready use in its pigeonpea breeding program.

The narrow genetic base of cultivated pigeonpea is one of the major factors hindering its genetic improvement. Despite large breeding efforts, pigeonpea productivity is still not more than 0.8-0.9 t/ha across varied agro-ecologies in the country. There is a growing need to meet the demand for nutritious food, for instance, legumes such as pigeonpea.

To mitigate this challenge, under Phase I of the project, ‘Identification of superior alleles and lines from wild Cajanus species for pigeonpea (Cajanus cajan) improvement’, promising introgression lines (ILs) were identified. Under the ongoing Phase II ‘Utilization of introgression lines derived from wild Cajanus species for pigeonpea (Cajanus cajan) improvement’, these high-yielding, salinity-tolerant and disease-resistant ILs are being evaluated in multiple agro-ecologies and socio-economic settings.

In India, a few ILs such as ICPL 15010, ICPL 15072, ICPL 15062 and ICPL 17116 have been nominated by NARS for multi-location evaluation in the Initial Varietal Trials (IVT) of All India Coordinated Research Project (AICRP) on Pigeonpea during 2019-20 crop season. As per the feedback from NARS, it is interesting to know that a few promising ILs such as ICPL 15028, ICPL 15072 and ICPL 17124 are also being used as donors in national crossing programs in India and Myanmar. As pigeonpea is a highly photo- and thermo-sensitive crop, efforts are also being made to develop photo-and thermo-insensitive pigeonpea pre-breeding lines using wild Cajanus species.

“We’d like to bring back the traits that have been lost to us as part of domestication of pigeonpea,” said Dr Shivali Sharma, Principal Investigator and Theme Leader, Pre-breeding, ICRISAT.

Dr NP Singh, Director, Indian Institute of Pulses Research, Kanpur; Dr IP Singh, Project Coordinator- AICRP on pigeonpea, along with about 40 pigeonpea researchers from public and private sectors in India, NARS partners from Myanmar and Kenya, and 19 farmers from major pigeonpea-growing regions visited pigeonpea pre-breeding field trials at ICRISAT, Hyderabad during this field day. Participants showed keen interest in the pre-breeding materials and selected promising ILs for use in breeding programs. Farmers provided their feedback about this material and identified the best ILs having farmer-preferred traits.

The annual project review meeting of Phase II of the project was held on 18 December 2019 at ICRISAT, Hyderabad.

For more on ICRISAT’s work on pigeonpea, click here.

Dr Shivali Sharma, Theme Leader, Pre-breeding, ICRISAT, explains how pre-breeding forms a critical link between genebanks and crop improvement programs in pigeonpea pre-breeding field during the Pigeonpea Field Day.

Dr NVPR Ganga Rao, Principal Scientist, ESA, ICRISAT, gives his feedback during the workshop.

This work contributes to UN Sustainable Development Goals

Project: Utilization of introgression lines derived from wild Cajanus species for pigeonpea (Cajanus cajan) improvement
Funder: Global Crop Diversity Trust
Partners: Professor Jayashankar Telangana State Agricultural University – Regional Agricultural Research Stations, Palem and Warangal; Acharya NG Ranga Agricultural University – Regional Agricultural Research Station, Tirupati; Department of Agricultural Research (DAR), Yezin, Myanmar; and ICRISAT
CGIAR Research Program: Grain Legumes and Dryland Cereals
Short and mid-early pigeonpea varieties steal the show
Pigeonpea Network Group (Asia) Workshop-cum-Field Day 2019

Pigeonpea researchers from across Asia hailed a short and mid-early variety of pigeonpea that is also high-yielding and disease-resistant, at a recent brainstorming session to benchmark region-specific prioritized breeding for pigeonpea in the region. They added market-demand traits such as dhal (split cotyledons) recovery, cooking time, protein, Zn and Fe contents, along with yield, disease resistance and pest tolerance, as long-term achievable goals. They designed breeding niches driven towards scaleable crop improvement in pigeonpea. The current upscaling of pigeonpea, a naturally climate-resilient crop, is the outcome of the efforts of pigeonpea researchers combining multidisciplinary research with effective seed system programs. With the discovery of cytoplasmic male-sterile lines, pigeonpea breeding reaped a major breakthrough. After the release of first-ever grain legume hybrid ICPH 2671 in 2010, the follow-up release and wider acceptance of ICPH 2740

Dr Anupama Hingane, Scientist, Pigeonpea Breeding, ICRISAT, highlighted the need-based diversification into varietal breeding. She explained that there was an urgent need for short and mid-early varieties to help farmers tackle terminal drought with a shifting climate. She also discussed the ongoing research on developing high-yielding, disease-resistant and pest-tolerant mid-early groups, long-podded short and mid-early types, diversification of cytoplasmic base with a partnership-based evaluation of CMS and restorers line from A2 Source.

Dr NP Singh, Director, Indian Institute of Pulses Research, Kanpur, emphasized ICRISAT’s leadership in pigeonpea R&D by giving the best of hybrid technology to the world with a parallel emphasis on pureline breeding as the ‘Bread and Butter’ of breeding. “A near step of success lies in the modernization of breeding technologies, a multi-disciplinary approach-based product profile designing and team-based approach of structuring the breeding program,” said Dr Jan Debaene, Global Head, Breeding, ICRISAT. Dr Harish Gandhi, Regional Breeding Lead, Asia, ICRISAT, advocated exploration of germplasm stocks and the plant-based protein market as the best fit for pigeonpea. Dr NPVR Ganga Rao, Principal Scientist, Eastern and Southern Africa Program, ICRISAT; Dr Mar Mar Vin, Representative, Department of Agricultural Research, Myanmar; and Dr IP Singh discussed opportunities for location-specific breeding stocks in alignment with their Indian counterparts.

Field day
The high-yielding, disease-resistant varieties of short and mid-early material stole the limelight at the pigeonpea field day. The enthusiastic response for these selections by the stakeholders depicted their great potential. A parallel emphasis was laid on developing photoinsensitive, mechanization pro-hybrids and varieties and seed production systems.
The Genebank team, led by Dr Vania Azevedo, Head, Genebank, ICRISAT, displayed the 13,783-strong pigeonpea germplasm collection, while Dr Mamta Sharma, Theme Leader – Integrated Crop Management, ICRISAT, and her team exhibited on-site and Open Top Chamber (OTC) facilities for climate change influenced disease and pest outbreak dynamics. Dr Pooja Bhatnagar-Mathur, Theme leader – Cell, Molecular Biology & Genetic Engineering, showcased speed breeding as one of the modern technologies standardized for efficient crop improvement in pigeonpea.

In conclusion, it was decided that ICRISAT would play the role of baseline product concept designer and NARS partners would work on the location-specific traits according to ICAR norms. The Pigeonpea Network Group (Asia) Workshop-cum-Field Day, a two-day program for over 40 participants, including pigeonpea researchers from ICAR, State Agricultural Universities, private seed companies and NARS partners in Asia, was successfully organized by Pigeonpea Breeding Team ICRISAT during 17–18 December 2019. ■

Dr Anupama Hingane, Scientist, Pigeonpea Breeding, ICRISAT, with participants during the field day.

**Pigeonpea Network Group (Asia) Workshop-cum-Field Day**

**CGIAR Research Program:** Grain Legumes and Dryland Cereals
New dual-purpose pearl millet shows promise as excellent fodder in Niger

Two varieties of dual-purpose (food and fodder) pearl millet were shown to increase weight and overall growth in sheep, according to a study conducted in Niger. These two varieties could be considered as good quality fodder for crop-livestock systems in the country.

Earlier this year, Dr Clarisse Umutoni et al. conducted a study to assess the quality of crop residues of five new pearl millet varieties used as fodder for local young sheep. The study revealed that the different varieties of pearl millet differ in digestibility and nutrient composition which significantly affects the growth performance of the sheep.

Out of the five dual-purpose varieties (Chakti, ICMV 167005, ICMV 167006, ICMH 177111 and ICMV 167002) developed in Niger, two varieties (ICMV 167005 and ICMV 167006) provided higher final live weight and average daily live weight gain in the sheep at the end of the study period. Moreover, the sheep fed ICMV 167005 excreted lower levels of nitrogen in their feces. This means a lower impact on environment, which is also a favorable factor towards selection of this variety.

ICMV 167005’s other traits include medium maturity (85–90 days), downy mildew resistance, striga tolerance, long panicle (75–80 cm), high grain yield (1.5–1.8 t/ha) and high fodder yield (4.8–5.1 t/ha) with high in vitro biodigestibility (53%).

Characteristics of ICMV 167006 include, high tillering (3–4 per plant), early maturing (75–80 days), downy mildew resistance, high grain yield (1.5–1.6 t/ha), compact medium-length panicles (45–50 cm), high fodder yield (4.2–4.5 t/ha) along with high in vitro digestibility (51%).

These two varieties were released for commercial cultivation in Niger for the Sahelo-Sudanian zone and are ready for commercialization in Economic Community of West African States (ECOWAS) countries.

Digestibility of fodder is one of the key factors that have significant impact of livestock productivity and, in turn, on household economy. When animals feed on low-energy-value feeds (low digestible energy), their digestive systems slow down, resulting in reduced appetites. The combined effect of reduced appetite, lower feed intake and slower release of digestive energy leads to low weight gain and decreased milk production (see figure overleaf).

Poor quality fodder leads to decreased output from small ruminants.

Head length of ICMV 167005 and ICMV 167006.

Photos: Clarisse Umutoni, ICRISAT, Niger

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**Funder:** Feed the Future Innovation Lab for Livestock Systems

**CGIAR Research Program:** Grain Legumes and Dryland Cereals

**This work contributes to UN Sustainable Development Goals**

1. **Food security**
2. **Health and wellbeing**

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ICMV 167005’s other traits include medium maturity (85–90 days), downy mildew resistance, striga tolerance, long panicle (75–80 cm), high grain yield (1.5–1.8 t/ha) and high fodder yield (4.8–5.1 t/ha) with high in vitro biodigestibility (53%).

Characteristics of ICMV 167006 include, high tillering (3–4 per plant), early maturing (75–80 days), downy mildew resistance, high grain yield (1.5–1.6 t/ha), compact medium-length panicles (45–50 cm), high fodder yield (4.2–4.5 t/ha) along with high in vitro digestibility (51%).

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Poor quality fodder leads to decreased output from small ruminants.

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Photos: Prakash Gangashetty, ICRISAT, Niger.

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Head length of ICMV 167005 and ICMV 167006.

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**Funder:** Feed the Future Innovation Lab for Livestock Systems

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Poor quality fodder leads to decreased output from small ruminants.
The African Plant Breeders Association (APBA) was launched recently to bring together plant breeders from several African nations to work towards achieving food security in Africa through breeding.

Dr Sagri Bambangi, Deputy Minister of Food and Agriculture in Ghana, urged the breeders to begin conversations on securing the food future of Africa through plant breeding. He also advised APBA to use the platform to kickstart a political debate on the importance of genetic crop improvement for environmental and socio-economic objectives through unbiased quantitative and qualitative data.

Prof Ebenezer Oduro Owusu, Vice-Chancellor, University of Ghana, said that APBA would help Africa reach its goal referred to as the ‘Agenda 2063: The Africa We Want’.

Prof Eric Y Danquah, Interim President of APBA and Director of the West Africa Center for Crop Improvement (WACCI), asked the members to reflect on the current state and future prospects of plant breeding research in Africa and said that the formation of APBA would open doors for collaborations needed to generate innovative solutions for agricultural development in sub-Saharan Africa. “We can unlock the African dream and free the next generation to take the continent to the next level. This is all that the APBA is about,” he said.

The Association was launched during the conference ‘Advances in classical breeding and application of modern breeding tools for food and nutrition security in Africa’, co-sponsored by the AVISA Project, led by ICRISAT.

Participants shared their research findings, discussed recent developments in their fields, and deliberated on potential collaborative actions to be put in place.

As part of the APBA conference, ICRISAT through the AVISA project, also held a four days’ workshop on 'Digitalization of Breeding Programs and Data Management', to help develop problem-solving skills to address agricultural challenges. Two days of the workshop focused on increasing usage of the Breeding Management System (BMS) platform. “We got an official account on BMS during the training. We now have access and can enter our data safely,” said Dr Nofou Ouedraogo, a sorghum breeder at INERA in Burkina Faso. For Ms Viola Furaha, a research technician in ICRISAT-Kenya, the training was an excellent opportunity to learn, train and manage data directly in the system. She added that the idea of involving everybody in the training shows that the AVISA project was not only interested in senior breeders but also other stakeholders, including young scientists. More than 70 researchers, breeders, technicians and students participated in the workshops.

The conference saw over 400 scientists, researchers, national agriculture policymakers, students, professionals, private and public sector actors from 30 countries converge at the University of Ghana, Accra. Representatives from international institutions including the Alliance for Green Revolution Africa (AGRA), MARS Inc., International Institute for Tropical Agriculture (IITA), ICRISAT, AfricaRice, International Maize and Wheat Improvement Center (CIMMYT), and International Potato Center (CIP) pledged their support for APBA activities.

Project: Accelerated Varietal Improvement and Seed Delivery of Legumes and Cereals in Africa (AVISA)
Donor: Bill & Melinda Gates Foundation
Partners: ICRISAT, IITA, CIAT, Institut de l’Environnement et Recherches Agricoles (INERA), Burkina Faso; Institut d’Economie Rurale (IER), Mali; Council for Scientific and Industrial Research-Savanna Agricultural Research Institute (CSIR-SARI), Ghana; Institute for Agricultural Research (IAR) of Ahmadu Bello University (ABU) and Usmanu Danfodiyo University of Sokoto (UDUS), Nigeria; Ethiopian Institute of Agricultural Research (EIAR), Ethiopia; Department of Research and Development (DRD), Tanzania; National Semi-Arid Resources Research Institute (NaSARRI) of the National Agricultural Research Organization (NARO), Uganda. CGIAR Research
Key technology for biofortification goes online

*Online platform opens up easy access to x-ray fluorescence testing at ICRISAT*

To support development of nutritious crop cultivars across the globe through biofortification, ICRISAT and CGIAR’s HarvestPlus opened up their x-ray fluorescence (XRF) testing facilities through a recently launched online platform.

The platform will make available existing and new XRF analyzers at ICRISAT for determining iron (Fe), zinc (Zn), calcium (Ca) and other minerals in whole grain samples. XRF, which is widely used in mining, was first introduced for agriculture in India by ICRISAT in 2011. The online platform aims to automate access to testing facilities and obtaining results.

“What is the relationship between soil availability of iron and zinc, and the ability of germplasm to biofortify micronutrients and make them bio-available? The full connection has to be made between what is happening in the field and what is being consumed,” said Dr Peter Carberry, Director General, ICRISAT, during the launch of the platform. He underscored the importance of biofortification for India at a time when the Indian government plans to launch a country-wide program to strongly link agriculture and nutrition with a focus on native crops.

Biofortification increases concentration of nutrients to help consumers meet nutritional requirements. To develop a biofortified crop variety, breeders have to screen germplasm to identify parent lines that have necessary levels of the target nutrient. XRF can quickly assess with precision the concentration of mineral nutrients.

When x-rays are passed through a crop sample, the mineral nutrients in it emit x-rays, characteristically different from the incoming rays. The outgoing rays are characteristic of that mineral, thus facilitating determination. Dr Parminder Virk, Head, Crop Development, HarvestPlus, said that XRF could be used by breeders without damaging the sample to extract mineral information to be compared with that of check varieties.

For now, chickpea, pearl millet, finger millet, rice and wheat can be analyzed by three machines that ICRISAT and HarvestPlus have set up at ICRISAT’s headquarters in Hyderabad, India. According to Dr Govindaraj Mahalingam, Sr Scientist, Pearl Millet Breeding, ICRISAT, the online platform can take the benefits of a well-established technology like XRF at a low price point to biofortification programs across the world. He said that two more analyzers were being procured to increase the testing potential to about 125,000 samples per year.

Researchers expect the new platform to play an important role in supporting breeding efforts in countries like India, which seeks to set minimum nutrient levels for its crops. At the moment, minimum iron and zinc levels have only been prescribed for pearl...
millet by the Indian government. The All India Coordinated Research Project on Pearl Millet has been using ICRISAT’s XRF facilities, informed Dr Tara Satyavathi, Project Coordinator, ICAR-AICRP on pearl millet, while adding that XRF could contribute to achieving quality standards and biofortified varietal development in India.

The XRF manual and Standard Operating Procedures booklet, prepared by Dr VG Shobhana, Visiting Scientist, ICRISAT, was released at the event.

X-Ray fluorescence machine.
Migration is making a U-turn out of Bundelkhand region in India where a project is underway to double farmers’ incomes. Water harvesting efforts initiated earlier this year have helped families in a remote village return to their homes and farms after decades of migration.

As a part of the Doubling Farmers Income Project in Poora Birdha village, an 800-meter long channel and havelis (tanks) were built to tap rains. Subsequently, farmers, who earlier had abandoned agriculture for want of water, returned to till their lands this kharif season (monsoon June–September). Encouraged by increased water availability, farmers like Yajuthi cultivated groundnut, sesame, lemon and rice on small land patches for the first time.

“I returned to farming after migrating for work many years ago. I have been able to live with my family since my return and resume farming my land with the water made available,” the farmer told a team of ICRISAT scientists and officials visiting the region. The visit was organized by ICRISAT Development Center (IDC), which is partnering with the government of Uttar Pradesh State, ICAR-Central Agroforestry Research Institute (CAFRI) and non-governmental organizations to execute the project.

Inadequate rainfall in drought years, compounded by water runoff and flooding of fields during other years, deterred farmers from agriculture during kharif in Bundelkhand. After the harvesting structures were made, water is being drained away from the uplands and made available for irrigation and groundwater recharge in the valleys. Agroforestry initiatives, alongside promoting improved crop varieties and agronomy, are helping the region’s farmers vest faith in rainfed farming.

“I used to work for other farmers far away from home but decided to return to my farm when I saw water available. My family is happy that we are farming our land, which was left fallow until monsoon this year,” another Birdha farmer Nannu said.

Farmer Bahadur narrates a similar story. After nearly a decade of leaving his land fallow and settling for work with inadequate pay, he returned to farming on the heels of the project. He has harvested 1,200 kilos of groundnut, and over 100 kilos of a mix of crops including black gram, mung bean and sesame from this year’s kharif cultivation. Assured of water availability, Bahadur’s land is being readied for the second crop season.
A female calf birthed recently in a north Indian village, following sexed sorted insemination, could herald the end of rampant abandoning of livestock in the region, thereby increasing farmers’ returns.

The calf, born in Nathupura village of Mahoba district in the Bundelkhand region of Uttar Pradesh state, is a result of insemination with sexed sorted semen which has a probability of yielding 90% female births. Extended droughts, fodder and water shortage force farmers in Bundelkhand to abstain from rainfed agriculture and let livestock loose to freely graze in summer. The practice is called ‘annapratha’. The grazing continues well into kharif (monsoon) season and is blamed for extensive crop damage. According to various estimates, the area under kharif cultivation is just half of that during rabi. Nearly a quarter of the crop produced during kharif is damaged by the straying cattle.

The state government and its research partners have realized the need for creating more value in livestock to tackle annapratha and reduce the liability of animals to farmers. Consequently, increasing the number of high quality female cattle is being seen as a good solution to provide farmers with livelihood options by way of sale of milk produced by the cows.

In January, BAIF Institute for Sustainable Livelihoods and Development (BISLD) and ICRISAT introduced sexed sorted insemination in Bundelkhand. Sexed semen is produced by sorting male and female chromosomes in the semen. Further, farmers are also being provided with rapid pregnancy diagnosis facilities, which makes pregnancy detection possible in 18-20 days as compared to three or four months it normally takes.

The Nathupura calf is a buffalo of Murrah breed which was birthed by a 9-year-old female. Ms Malti Pateria, the farmer who owns the animals, said that the calf has caught the attention of the village. Ms Pateria’s family earns its livelihood by selling the nine liters of milk that its two buffalos produce every day. Since the birth of the Nathupura calf, seven more female calves were born across the region.

“Farmers have more reasons to rear livestock if sexed sorted insemination services are provided. This technology can produce breeds of choice for the farming community. Around 310 inseminations were carried out by September in Mahoba and Chitrakoot districts of Bundelkhand. Similar interventions have been initiated in all the seven districts of the region under the Doubling Farmers’ Income project from October,” said Dr Prakash Rathod, Visiting Scientist, ICRISAT.

To further increase the value of cattle and buffaloes for farmers, around 20 easy-to-install, portable and compact biogas units are being set up across the region after five such plants installed earlier in Mahoba and Chitrakoot districts provided multiple benefits. These include free cooking fuel, freeing women from drudgery of collecting firewood, and preventing exposure of a family, primarily that of women, to hazards of firewood pollution. The slurry left behind after digestion of dung in the unit can be used as manure, Dr Rathod added.

**Project:** Doubling farmers’ income in Bundelkhand Region, Uttar Pradesh  
**Funder:** Government of Uttar Pradesh  
**Partners:** BISLD, ICAR-IGFRI, ICAR-CAFRI, BUAT, Bharat Agriculture, Lakshya Seva Samiti, Gram Unnati, Samarpan Jan Kalyan Samiti, Samarth Foundation, Gram Unmesh Sansthan, Gramin Vikas Kendra, Upman Mahila Samsthan.
The voices of rural people most affected by the climate crisis are not being heard

Today, millions of school children are expected to congregate across major cities in the latest round of school climate strikes, fighting for their future. The climate crisis will disproportionately affect the lives of young people as the negative effects of climate change are expected to worsen from 2050 onwards. Their strikes are a visible and poignant reminder that climate change should rightfully be considered an inter-generational equity issue.

Climate change, however, should not be seen only through the lens of age; it is also about time and space. It is an important geographical issue, with rural people – often in remote areas across low and middle-income countries – most vulnerable and bearing the worst impacts. Because of their geography and remoteness, they are often missing from the story. Nonetheless, their numbers are astounding. Roughly two billion people are living and working as farmers, food traders, herders, livestock keepers, fisherpeople and farm workers in rural areas, dependent almost completely on the environment for their food and income. Because of this, it’s already hitting them the hardest.

This fact alone means that rural people need to be better included in the climate change agenda, and if we cannot easily hear their voices through strikes, we must ensure we can raise them up in other ways.

Otherwise, the price of doing nothing will be costly, affecting political stability, security, migration, human well-being and child poverty, amongst other things. But we know how to help these farmers. Many of these solutions already exist and more innovations are needed – they just need help accessing them.

By building resilience to climate shocks, the global agricultural research network CGIAR is mobilising to help 300 million small-scale farmers rapidly adapt their farming systems to the new challenges of the climate crisis.

For instance, the Sahel region of west Africa is one of the world’s hotspots for climate change and is struggling to feed a rapidly growing population as rainfall becomes more erratic and the land has degraded to unprecedented levels. Yet, by improving access to innovative technologies and practices that already exist, we can help 15 million food producers in the Sahel build resilience to climate stresses, maintaining food production in increasingly tough conditions.

These include climate services to help farmers adapt to changing weather patterns, introducing sustainable practices such as accurately applying fertilizer or water, and finally empowering young farmers to develop more resilient value chains.

Likewise, Asian mega-deltas are experiencing flooding more frequently, exacerbated by urbanisation as well as extreme weather events like typhoons and sea-level rises. Preparing those who live along the deltas against the threat of flooding has the potential to help some 30 million farmers and fisherpeople prepare for - and better cope with - the high risk of flooding and the impacts that come with it, including damaged crops, soil and other economic assets.

But it is not simply enough to help those in rural areas adapt to climate change. They must also be involved in the fight against it. Read more...

About the author:
Dr Elwyn Grainger-Jones
Executive Director, CGIAR
Team members and partners of the CGIAR Research Program on Grain Legumes and Dryland Cereals (CRP-GLDC) gathered fascinating facts about *Striga hermonthica*, one of the major parasitic weeds, also called ‘witch weed’, during a recent visit to the Plant Transformation Laboratory at Kenyatta University in Nairobi, Kenya.

The team visited the highly successful research center, housed in the Department of Biochemistry and Biotechnology of the University, and interacted with Professor Steven Runo and his team. Prof Runo himself referred to *Striga hermonthica*, a deadly parasite to GLDC cereals (sorghum, finger millet and pearl millet) as a ‘cereal killer’ in a recently published review in *PloS Pathogens*. (https://journals.plos.org/plospathogens/article?id=10.1371/journal.ppat.1006731).

Professor Runo, who also doubles as the Department Chairman, leads the research on the biology of parasitic weeds. Accompanied by one of the postgraduate students, he impressively summarized the research activities of the lab. Supervising over 20 postgraduate male and female students, Prof Runo executes his research through training and mentorship. His determination to eradicate the ‘cereal killer’ is evidenced by the number of publications on *Striga hermonthica* biology in different crops, ranging from maize, rice and sorghum, with more publications on finger millet and pearl millet in preparation. The visitors were taken around the facility, which included a histology lab, a growth room and greenhouses. A tour through the glasshouses clearly demonstrated Prof Runo’s passion for research on GLDC crops, with most of the experimental crops growing in the greenhouses being finger millet, pearl millet and sorghum.

For quick observation of plants showing resistance to the witch weed, the postgraduate students in Prof Runo’s lab grow the crops through portable rhizotrons, small growth cassettes enabling clear observation of the plant roots. “These rhizotrons make it possible for us to detect resistant plants within a few weeks, as they allow the introduction of *Striga* into the roots of the cereals, and subsequent observation of the *Striga* establishment or lack thereof, in the case of resistance,” says Prof Runo. At the back end of the greenhouse, the participants also saw two students opening up rhizotrons containing finger millet seedlings, and introducing a known number of pre-germinated *Striga* into the roots.

“The finger millet varieties they are working on were provided by ICRISAT-Nairobi,” says Dr Damaris Odeny, a genomics scientist. “We make use of this facility for millets and sorghum screening against *Striga* since Prof Runo has a well-established system, and there would be no reason for us to duplicate this effort,” Dr Odeny explains further.

At the end of the visit, Prof Runo highlighted the benefits of collaborations with ICRISAT, supported by CRP-GLDC, which included access to ICRISAT’s genomics lab for his students, access to germplasm, evaluation fields. The visit to the Plant Transformation Laboratory was part of the annual ‘Science Meeting’ of the CRP-GLDC in Nairobi, Kenya, during 25-29 November, 2019.
Workshop on gene editing held at ICRISAT

Twenty crop scientists from Asia and Africa were trained for two weeks at ICRISAT on gene-editing tools, including the increasingly popular CRISPR/Cas technology.

From trait selection to validation of edited plants, specific sessions were conducted on designing strategies for gene editing, basic gene-editing workflows, cloning of the guideRNA (gRNA) and their delivery in plant cells. The trainees also had an exposure visit to National Institute of Animal Biotechnology (NIAB), Hyderabad, to acquaint themselves with applications of gene editing in livestock improvement. During the two-week training program, a number of national and international experts served as resource persons discussing various tools, methodologies and applications of emerging gene-editing technologies in agriculture.

This international training program was organized by ICRISAT during October 14-25 in collaboration with APCoAB program of Asia Pacific Association of Agricultural Research Institutions (APAARI), BIRAC-BioNEST Ag-biotech incubator of ICRISAT and the CRP Grain Legumes and Dryland Cereals. The NARS participants hailed from India, the Philippines, Vietnam, Taiwan, Thailand, Malaysia, Egypt, Senegal, Kenya and Rwanda.

Keynote speaker Prof Arjula R Reddy and lead speaker Prof RP Sharma from Hyderabad Central University gave the opening presentations on evolution of the technology and the status of regulatory policies across the globe.

Dr Peter Carberry, Director General, ICRISAT, underscored the importance of gene editing in crop improvement during the inaugural session. Dr Rishi Kumar Tyagi, Coordinator of APCoAB, shared the expectations from the training program. Dr Pooja Bhatnagar-Mathur, the course coordinator, briefed the participants on the tools and technologies for genome editing in agriculture.

Several ICRISAT scientists including Dr Rajeev Varshney, Director, Genetic Gains Research Program; Dr Rajeev Gupta, FP-5 leader of CRP Grain Legumes and Dryland Cereals; and Dr Jan Debaene, Global Head, Breeding, ICRISAT, addressed the workshop participants.

Dr Sudhakar Reddy, Scientist, ICRISAT, with the help of staff and students of Cell, Molecular Biology and Genetic Engineering, provided participants with the requisite support in all aspects of gene editing.

By the end of the training course, the participants had understood workflows with bioinformatics, cloning and genetic transformation, and screening skill sets which would help them prepare to run successful gene-editing applications in their respective programs.
‘Science of Discovery to Science of Delivery’ discussed at University of Cambridge

Dr Rajeev Gupta talking about CINTRIN.

Partnerships are key to deliver on ICRISAT’s mission of ‘Science of Discovery to Science of Delivery’. To discuss several of ICRISAT’s ongoing collaborative programs including CINTRIN, TIGR2ESS, MillNET_i, Dr Rajeev Gupta, Principal Scientist and Theme Leader, Genomics and Trait Discovery, ICRISAT, visited the University of Cambridge (UCAM), UK. He delivered a lecture at the Department of Plant Sciences about ‘Engineering N-storage capacity of plants to improve drought tolerance’, a theme relevant to climate change and food security. Dr Gupta, who is also the FP5 leader of CRP-Grain Legumes and Dryland Cereals, made this visit on 6 December 2019.

As the Principal Investigator of CINTRIN, Dr Gupta also attended a ‘Dissemination Event’ – a three-day workshop – on agricultural Nitrogen (Ag N) at BBSRC-UKRI. The event was conducted to deliberate on recent advances in Ag N, including biological N use efficiency, biological N fixation and agronomical N use efficiencies in various cropping systems in India, China, Brazil and UK.

CINTRIN is one of the four Virtual Joint Centres (VJCs) set up for studies on Ag N. At the event, funding agencies from UK, India, China and Brazil expressed satisfaction at the outcomes of VJCs and considered possible continued support for such programs in future. The workshop was held during 3–5 December 2019.

CINTRIN – the Cambridge-India Network for Translational Research in Nitrogen – is led by ICRISAT and NIAB, is one of four Virtual Joint Centres in Ag N in India, delivered in partnership by the Biotechnology and Biological Sciences Research Council (BBSRC), the Natural Environment Research Council (NERC) and the Department of Biotechnology (DBT), India. The major partner institutes of CINTRIN include ICRISAT, PAU & NIPGR from India and NIAB, Department of Plant Sciences and SLU, Cambridge University, UK.
Collaboration with Ethiopian institutes on systems-based research programs – including joint projects in soil fertility management, watershed management, dryland irrigation systems, rangeland management, nutrition and policy influence – were discussed during a recent visit to Ethiopia by Dr Peter Carberry, Director General, ICRISAT.

His visit coincided with the global meeting of the Water, Land and Ecosystems (WLE) CRP in Addis Ababa, hosted by ICRISAT Ethiopia.

During a field visit to Debre Birhan, a cool highland region about 200 km north of Addis Ababa, Dr Carberry and the WLE team deliberated on the necessity of watershed management, particularly in areas with variable rainfall, extreme erosion and low production and productivity despite the good soils and high rainfall availability.

Watershed management in uplands must consider erosion control, soil fertility improvement, sedimentation, vegetative cover, increased crop and forage productivity, improved water flows and overall upstream-downstream relationships. The major contribution of ICRISAT’s watershed work was to develop community-managed, resource-conserving, integrated watershed management learning sites, where a balance between production, conservation and environmental services and their implications for local communities is considered. For downstream communities, the highlands are major sources of water in the form of rivers, seasonal springs and floods that could be diverted towards irrigating crop fields and rangelands.

Although ICRISAT’s Ethiopia office opened only in 2014, it ICRISAT has been working together with the Ethiopian Institute of Agricultural Research (EIAR) for the last three decades. A conversation between Dr Mandefro Nigussie, Director General, EIAR, highlighted the increasing momentum of collaboration between the two institutions, which have jointly provided important information for policy making by serving on an advisory committee to the Ministry of Agriculture and other Ministries.

Going forward, a strong alliance is expected in the areas of crop improvement modernization, germplasm enhancement, strengthening the EIAR Biotech Lab and capacity building in data analytics, geospatial information systems and remote sensing.

Dr Carberry also met His Excellency, Mr Kebede Yimam, Deputy Commissioner of Ethiopia, Environment, Forest and Climate Change, and discussed continual support to the government in developing resilient and productive landscapes using best-bet technologies and social arrangements at a scale, capitalizing on successful watershed experiences of ICRISAT in India.

Dr Peter Carberry visited the Ethiopia office during 28–30 November 2019. The WLE Global Meeting was during 26–28 November 2019.
Homegrown technologies help farmers boost yields and incomes

Farmers’ Field Day in Bidar, Karnataka

The means to help farmers improve their livelihoods are not developed in offices and laboratories alone, but rather on the fields with indigenous innovative ideas and implements, as was demonstrated during a recent Farmers’ Field Day in Manhalli village, Bidar district, Karnataka.

Project Bhoosamruddhi conducted a field visit to update stakeholders on the innovations and recent developments in the agricultural fields of a few farmers in the above village. Local development officers, scientists and other farmers viewed agricultural implements that made a significant difference in the efforts put in and the outputs derived by the farmers using them.

The ICRISAT Development Center (IDC) has been working on the multi-stakeholder project Bhoosamruddhi in Karnataka since 2015, forming a consortium with other CGIAR centers in India. The goal was to operationalize research for development (R4D) to benefit small and marginal farmers in the region. As part of the project, among other activities specialized implements for farming were made available to the farmers and capacity-building training provided to them for optimum use of the technology.

During the visit, Dr Peter Carberry, Director General, ICRISAT; Dr Sreenath Dixit, Head, IDC; Dr ML Jat, Principal Scientist, CIMMYT; Dr AN Rao, IRRI; Dr Gajanan Sawargaonkar, District Coordinator for Bidar, ICRISAT; Mr Ansari, Assistant Director of Agriculture, Bidar; Dr Vidyanand, Joint Director of Agriculture, Bidar; Mr Malikarjun Bavage, Deputy Director of Horticulture, Bidar; other officials from Bidar district administration and scientists from ICRISAT Development Center, several other officials, farmers and even students of agriculture observed demonstrations of the various technologies used by the local farmers.
Dr Gajanan Sawargaonkar, District Coordinator for Bidar, ICRISAT, explains the aerobic composting intervention to Dr Peter Carberry, Director General, ICRISAT.

A farmer checks out an ICRISAT-modified Broadbed Furrow (BBF) machine. It can cover 1½ beds at a time, as opposed to one bed in regular ones. BBF machines help in on-site moisture conservation, especially for black soils like in Bidar.

Some of the other items on display were:

**Laser leveler:** The fields had been leveled using accurate laser levelers, resulting in reduced runoff of rainwater and more even irrigation throughout the field.

**Plastic mulching machine:** A multitasking machine that can 1) make broad beds 2) lay drip laterals 3) lay mulching paper and 4) punch holes in the mulching paper.

**Rice transplanter:** A manually operated transplanter to replant seedlings.

The relay planter is a multi-tasking implement that is a ridgemaker, cultivator, planter/sowing machine, rotavator for intercultivation, and a water pump; all this at a nominal price affordable to small and marginal farmers.

Local farmers observe a multi-crop digger for its features.

Farmer Bhimrao Mulgi and Mr Raghavendra, Scientific Officer, ICRISAT, demonstrate the seed dibbler, a lightweight handheld tool to quickly and easily sow seeds. It can be adjusted to release one or more seeds at a time.
Understanding food systems transitions is key to achieve nutritional outcomes

Food systems can be effectively transformed by identifying drivers of food choice and factors influencing personal food environments, thereby enabling effective strategies to link agriculture and nutrition.

This was one of the key messages at the recent conference of the Agricultural Economics Research Association (AERA), India, which focused on “Changing Landscape of Rural India” as well as understanding the major trends, impacts and its contributions to the Indian economy. Also, a potential opportunity was announced for students and researchers for accessing ICRISAT’s VLS-VDSA farm household panel dataset, with appropriate financial support through Jim and Wendy Ryan Endowment Fund (https://www.icrisat.org/jim-andwendy-ryan-endowment-fund/).

At a plenary session, panelists illustrated different aspects of food systems through case studies.

Dr Shalander Kumar, Principal Scientist, ICRISAT, used a case study in Telangana, India, to recommend mapping of rural food environments, and identifying and evaluating nutrition-oriented value chain interventions. Understanding the food environment which provides key interface between food systems/value chains and consumer behavior is critical to design effective strategies for strengthening agriculture and nutrition linkages, he said.

Dr R Padmaja, Senior Scientist, ICRISAT, highlighting the dynamics of nutrition in urban sprawls, said, “In developing countries like India, environmental, community, macro-economic, household and individual factors serve as obstacles to healthy eating and improvements to better nutritional outcomes.”

Dr Ravi Nandi, Associate Scientist, ICRISAT, presented an inclusive value chain model framework specifically developed for dryland smallholders to ensure farmer participation along the value chain through primary and secondary processing of their crops. “In tribal regions, traditional agriculture and food systems were negatively affected by policy and loss of diversity due to ecological changes, markets, and the modernization process,” said Dr E Revathi, Director, Centre for Economic and Social Studies (CESS), under the Indian Council of Social Science Research (ICSSR). She reiterated that a deeper understanding of rural-urban transformations and their relationship with food insecurity.

Ms Kavitha Kasala, Senior Scientific officer, ICRISAT, presented a paper on the prevalence of malnutrition in adolescent girls in the tribal regions of Telangana. The study highlights the need for policies and programs specifically aimed at adolescents in the tribal regions to challenge the existing cultural norms related to food consumption.

The 27th AERA Annual Conference was held at Punjab Agricultural University, Ludhiana, Punjab, India during 17-19 December 2019. The event was supported by the CGIAR Research Program Grain Legumes and Dryland Cereals.
ICRISAT student researcher employs advanced technology for pearl millet trait development in US collaboration

PhD student Rashika Aher made the most of an opportunity to carry out research at Corteva Agriscience, Johnston, Iowa, USA. She recently returned to ICRISAT after completing a 10-week collaborative research assignment, which involved shuttling between two labs, improving knowledge of pearl millet transformation and gene editing with one group, while gaining a better understanding of how rancidity develops in pearl millet flour in another lab.

“We’ve enjoyed having Rasika in our labs,” states Dr Laura Wayne, Senior Research Scientist at Corteva. “We’ve learned from each other and appreciate Rasika’s dedication and passion for her work. Combining biochemistry and advanced plant breeding tools are important to finding solutions and delivering greater value to farmers and consumers.”

Pearl millet is a critical food security crop throughout the semi-arid tropics of the world. The crop produces grain in harsh conditions and is highly nutritious, yet quickly develops rancidity after milling. Any flour not used quickly must be discarded, creating potential for waste while also creating significant inconvenience for the women of the household who are most often responsible for freshly milled product each day.

“Rancidity is a major barrier to convenience with the greatest impact on women, and an otherwise valuable grain is not used to full potential,” says Dr Pooja Bhatnagar-Mathur, the Principal Investigator and Ms Aher’s supervisor at ICRISAT. “Waste is also a problem, as any unused flour must be thrown away. An improved flour would also be a value-add for marketing pearl millet flour.”

Ms Aher is the second student in two years from Dr Bhatnagar-Mathur’s team to spend time with Corteva scientists. In 2018, Ms Sirisha Kaniganti focused on sorghum transformation and gene editing, and since returning to India has developed her own capabilities for high-efficiency transformation and CRISPR-Cas editing in Hyderabad. Read about her visit here.

Dr Neal Gutterson, Chief Technology Officer, Corteva Agriscience, impressed with the progress made in the cross-institution alliance, says, “ICRISAT has been a great partner and we’re pleased to see how our collaborative research agreement signed in 2018 is already demonstrating value.”

Photos: J Gaffney, Corteva Agriscience

Rasika Aher with Bill Gordon-Kamm and Ning Wang, reviewing progress on pearl millet transformation.

Rasika Aher with Kayla Flyckt, Senior Research Associate, Output Traits team, Corteva Agriscience

Read about her visit here.
**In the media**

**BusinessLine**

*Meals with millets boost child growth by 50 per cent: Study*

Replicating rice in the midday meal (MDM) with small millets can boost the growth of children by nearly 50 per cent over three months, a study carried out among 1,500 children in Karnataka has found.

**Telangana Today**

**ICRISAT study links millets to child growth**

Findings in Karnataka suggest millet-based mid-day meals can boost growth of adolescent schoolchildren by 50% in three months.

**The Times of India**

**Study shows millets based mid-day meals boost child growth, can be a better substitute to rice**

Vithala Mishra | TNN | Dec 18, 2019, 21:04 IST

How is this normal girl making lakhs per month?

Cancer Journal

NEW DELHI: In a first ever scientific study of its kind in schools, millet based mid-day meals were found to significantly boost child growth in terms of body mass index (BMI), nutrition and also can be a better rice substitute in India.

Findings of the study published in journal "Nutrients" were released on Wednesday by NITI Aayog member Sneh Kaur.

**AB InBev inks MoU with ICRISAT to develop watershed replenishment structures in villages**

Hyderabad, Dec 7 (UNI) Strengthening its commitment to ensure communities access quality water, AB InBev on Saturday announced that they have signed an MOU with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) to develop watershed replenishment structures in villages around Charminar and Crown Breweries in Sangareddy District in Telangana.