The people of rural India love their bajra chapatis. These flatbreads made of pearl millet flour are a highly nutritious staple in the diet of millions of Indians. And farmers love pearl millet because it will grow where other crops just do not have a chance.

But climate change is throwing all kinds of challenges at this cereal crop, which has been grown in Africa as well as the Indian subcontinent since prehistoric times. Today, heat waves, drought and newly emerging diseases are all contributing to lower yields.

However, a team of scientists from ICRISAT is making significant progress in developing pearl millet (Pennisetum glaucum) varieties which not only tolerate high temperatures and drier conditions but also resist the devastating blast disease.

ICRISAT scientists and their partners are working on a so-called pre-breeding project to identify and transfer beneficial genes from its wild relatives to cultivated pearl millet varieties. Ultimately, the scientists hope that farmers will be able to grow one of the world’s most important cereals in marginal environments despite a changing climate.

A smart food for millions

“More than 90 million people in about 30 countries depend on pearl millet for food and income,” said Dr Shivali Sharma, the Pre-breeding Theme Leader at ICRISAT. Pearl millet, the sixth most important cereal crop globally, is grown in the arid and semi-arid tropical and subtropical regions of Asia, Africa and Latin America. It is a dependable source of energy, but also other dietary needs too, especially micronutrients.

Pearl millet is mainly grown in harsh environments with marginal soils and in areas with low rainfall where other major staple cereal crops fail to grow. The crop can tolerate temperatures of up to 42°C, whereas other cereals, like maize (40°C), rice (32°C) and wheat (30°C) cannot handle the heat. But climate change means farmers need crops which are tolerant of even longer and hotter heat waves, and less rainfall, not to mention new diseases.

Stagnating yields

The changing climate is causing lower yields of pearl millet in Africa and in India. Breeders have been tasked with developing new varieties that can adapt to these changes.
The genetic diversity in domesticated pearl millet is limited, so breeders look to closely related species in the wild for their raw materials. Some of these distant cousins may have developed the characteristics which breeders need.

Dr Sharma and her team had a considerable amount of diversity to choose from. ICRISAT’s gene bank holds nearly 24,000 seed samples of pearl millet, including 794 samples of wild relatives. The challenge was to find which of those samples hold the traits the breeders are searching for.

**Crop wild relatives help build tolerance to heat**

“Crop wild relatives are an excellent reservoir of valuable genes for resistance to the stresses caused by climate change,” Dr Sharma said. “For example, the wild cousin of domesticated pearl millet, called subspecies violaceum, grows in the very hot and dry conditions of the Sahel region of Africa. We hope to be able to exploit this adaptation and introduce the relevant genes into domesticated pearl millet.”

“We evaluated for heat tolerance four pre-breeding populations derived from wild *Pennisetum violaceum* and cultivated pearl millet in different locations in western and northern India where the air temperature is more than 42°C at the time of flowering and much higher during heat waves. These populations were also evaluated for terminal drought tolerance in northern India.”

Dr Sharma and her colleagues measure tolerance to heat by determining how many seeds form in the panicle (known as seed set), or the cluster of flowers at the top of the plant. “We set a benchmark at 70% seed set at 42°C as this is what the best commercial hybrids achieve. We were able to identify over 40 pre-breeding lines across three trial sites which could equal or better this benchmark.”

**Blast: a newly emerging pearl millet disease**

The wild relatives also helped in the search for blast resistance. Blast, which is caused by a fungus known as *Magnaporthe grisea*, has emerged as a serious disease of pearl millet in India and Africa in the past decade. For example, in East Africa losses exceeding 80% have been reported in bad years. Commercial hybrids do not have resistance to this emerging disease.

Breeders from national agricultural research systems and seed companies have been quite vocal in their desire to see more blast resistance. “After consulting with scientists in both public and private sectors, we have identified blast as the number one research priority,” said Dr Rajan Sharma, a pearl millet pathologist at ICRISAT.

The ICRISAT team discovered that some populations of that wild pearl millet subspecies violaceum, found in Niger and Chad, had resistance to blast and also has some good agronomic characteristics. They crossed them with the domesticated pearl millet and developed four pre-breeding populations for further screening for blast as well as evaluation for flowering-stage heat and terminal drought tolerance.

Diseases like blast can be caused by different forms of the same species, called pathotypes. “We looked for lines which have resistance to multiple pathotypes,” Dr Rajan Sharma added. “We found some which have resistance to five pathotypes of blast, including a highly virulent one known as Pg 138.”

**Bridge to breeders**

“This means that we now have ample genetic material to introduce into programs so breeders can develop varieties which out-perform the currently used cultivars, not only for heat tolerance but also for other agronomic traits,” Dr Shivali Sharma said. “It’s a triple win!”

The screening success in various locations throughout India is music to the ears of pearl millet breeders. “We are eager to start using this material in our breeding programs,” said Dr S K Gupta, pearl millet breeder at ICRISAT. “The sooner we can use these lines in our breeding programs, the sooner it will lead to improved varieties for farmers.”

**Working with partners**

This work is part of the global Crop Wild Relatives Project managed by the Crop Trust. As the leader of this pre-breeding component of the project, ICRISAT has forged strong partnerships with both private sector companies and public sector research organizations. The private partners – Pioneer Hi-Bred, Bayer BioScience, Metahelix Life Sciences – and a public sector partner, the Chaudhary Charan Singh Haryana Agricultural University, have come together to further evaluate the pre-breeding material in various locations throughout India.

“The involvement of partners from private industry make this pre-breeding project quite unique,” said Dr Shivali Sharma. “Pioneer, Bayer and MetaHelix have major share in...”

Continued on page 3...
Climate-smart technologies to build resilience in agriculture of Niger, Mali

Two projects were recently launched to adopt climate-smart agricultural technologies in Niger and Mali for increasing food security and improving rural livelihoods.

The projects, ‘Climate Smart Agricultural Technologies for improved Rural Livelihoods and Food Security (CSAT)’ in Mali and Niger, will attempt to scale up technologies that help make agriculture resilient to climate challenges, and deploy them.

Maize, cowpea, sorghum, pearl millet and groundnut are target crops. Norway is funding the projects with specific objectives that include sustainable intensification of agricultural production, achieving improved resilience of production systems, increasing employment opportunities for youth, women and marginalized social groups.

Over 60 participants attended the launch event held on 20 March at ICRISAT’s Samanko station in Mali.

“Agricultural sector in Mali is promising but presents a lot of challenges. Our main goal is to improve food and nutrition security,” Mr Linderman Ole Andreas, Ambassador of Norway in Mali, said while explaining the reasons for supporting the projects.

The projects are being implemented by a collaboration of institutions which includes International Institute of Tropical Agriculture (IITA), ICRISAT, Institut National de Recherche Agronomique du Niger (INRAN), IER and others.

The CSAT proposal was drafted by IITA following a request from the Norwegian Embassy for initiatives to support resilience in agricultural sector. CSAT will be implemented in four major regions across Mali and Niger by leveraging existing partnerships and projects.

“CSAT consists of two major components. First component is focused on scaling up climate-smart technologies while the second component involves development and deployment of adaptive technologies,” said Dr Abdoulaye Tahirou, Project Manager, IITA.

“ICRISAT is ready to support this project in all its dimensions” said Dr Aboubacar Touré, who represented Dr Ramadjita Tabo, Research Program Director, ICRISAT-WCA. Dr Tabo is the principal investigator for the projects.

A bit of the wild in those chapatis

The ICRISAT team will now be able to continue working with these partners in the private sector. “The Crop Wild Relatives Project is delighted with the success that Dr Sharma and her team are having,” says Dr Benjamin Kilian, a scientist with the Crop Trust who coordinates the 19 pre-breeding projects of the Crop Wild Relatives Project. “As a result, we’ve extended the pearl millet project so these researchers can continue with their screening work.”

By introducing a bit of the wild into our domesticated pearl millet, Dr Sharma and her team are helping to ensure bajra chapatis will always be on the table.
Stakeholders meet discusses solutions to unshackle Myanmar’s groundnut value chain

Why does an ageing variety command 20% of land under groundnut cultivation? How can existing seed systems be strengthened? What type of varieties do industries need? These and other key issues facing Myanmar’s groundnut farming were discussed recently at a stakeholders meet organized to help develop market-desired varieties.

Improved varieties are restricted to 30% of groundnut cultivated area in Myanmar. The participants at the meeting called for development of new groundnut varieties with local adaptability, systematic seed multiplication systems, reduction in post-harvest losses through use of improved technology and efficient storage. The event was organized on 19 and 20 February in Nay Pi Daw, Myanmar.

Oil producers voiced preference for high oil varieties while food processors demanded uniform kernel size. Groundnut with high oleic acid content is seen as a future market segment of high value, as it can extend shelf-life of foods and promises significant health benefits. The untapped potential of groundnut oil as a cooking oil, owing to its higher cost compared to imported palm oil, was also discussed during the meeting.

Dr Naing Kyi Win, Director General, Myanmar’s Department of Agricultural Research (DAR) recalled the four-decade-long collaboration of DAR with ICRISAT. Currently, the organizations are working together to support groundnut seed systems through an OFID grant.

“Foliar disease resistance, adaptation to water deficit stress and early maturity are key production traits needed in groundnut varieties across the Central Dry Zone of Myanmar,” Dr Pooran Gaur, Director, RP-Asia, ICRISAT, said after summarizing the feedback from the extension staff of Department of Agriculture who closely work with farmers.

The participants at the meet included representatives of oil processing industry, seed sector representatives, extension and seed division of Department of Agriculture (DoA). NGO representatives, including Center for Social Economic Development, and specialists from Network Agriculture Group (NAG), besides those from Syngenta Foundation participated in the meeting. A training program on groundnut testing and seed production technology for 36 trainees was also conducted during the two-day meet.

To know more about ICRISAT’s groundnut research work, click here.

Project: Enhancing groundnut productivity and profitability for smallholder farmers in Asia through varietal technologies
Funder: OPEC Fund for International Development (OFID)
Partners: Department of Agricultural Research (DAR)
CGIAR Research Program: Grain Legumes and Dryland Cereals

DAR and ICRISAT scientists with groundnut value chain stakeholders in Nay Pi Daw, Myanmar.
Livestock value chain strengthening essential for improving production and food security in Niger, say scientists

Can Niger claim its rightful place on the food production charts? A group of scientists working with smallholder crop-livestock farmers believe strong market linkages may be the missing ingredient.

Researchers from ICRISAT, International Livestock Research Institute (ILRI) and French Agricultural Research Centre for International Development (CIRAD) met with a stakeholder group on 12 March to discuss ways to enhance livestock productivity. The members of the group, an innovation platform comprising farmers, butchers, veterinarians and others in the value chain, pointed out the need for access to good quality animal feed, improved veterinary care and market access.

Niger exports livestock and meat, and has earned a reputation for quality livestock production in West Africa. Food insecurity, however, persists in the villages of the country. Integrated crop-livestock management approaches are being explored to increase production of food sourced from animals and to improve rural livelihoods.

The interventions discussed at the meeting were simulated in a whole-farm modelling system to demonstrate impact on farm incomes.

“We shared with the platform members a few whole farm modelling scenarios for three farm types to illustrate the potential impact of adoption of fodder and market interventions. Such demonstrations are convincing and can help motivate stakeholders to quickly adopt interventions,” said Dr Shalander Kumar, Principal Scientist, Innovation Systems for the Drylands (ISD), ICRISAT.

The meeting was organized as part of a project titled ‘Enabling Value Chains to Create Sustainable Income for Vulnerable People in Crop-Livestock Systems of Burkina Faso and Niger’. It is funded by USAID through Feed the Future Innovation Lab for Livestock Systems. The project was launched in 2018 to increase production of animal source foods through integrated management of crop-livestock systems, notably with the participation of small-ruminant livestock keepers.

To improve market linkage, researchers visited the animal and fodder market in Niamey to understand animal trade and local conditions that drive it.

“The visit helped understand the unique nature of animal trade corridors across countries in West Africa. We also saw the impacts of regional policies and events, and currency fluctuations on the trade in Niger,” Dr Kumar added.

The project aims to promote dual purpose crops as fodder, livestock services, connect producers with markets and identify niche markets for livestock producers.

The project is expected to improve the livelihoods of over 80% of rural population in the study region of Niger and Burkina Faso that depends on livestock and agriculture.

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Project: Enabling Value Chains to Create Sustainable Income for Vulnerable People in Crop Livestock Systems of Burkina Faso and Niger

Funder: USAID under the Feed the Future Innovation Lab for Livestock Systems under the coordination of University of Florida.

CRP: Grain Legumes and Dryland Cereals (GLDC)

Partners: International Livestock Research Institute (ILRI), New Mexico State University (NMSU), Conseil National de Recherche Agronomique (CNRA), Institute de l’Environnement et de Recherche Agricole (INERA) and Resilience and Economic Growth in Sahel - Enhanced Resilience project (REGIS-ER).
Iron For Adolescents’ (FeFA) to focus on evidence-based interventions to protect girls’ health

ICRISAT - ICMR-NIN collaboration will follow a systematic approach for understanding adolescent girls’ health needs in Telangana

‘FeFA Girls’, a new initiative to address malnutrition among adolescents was launched today. Iron deficiency anemia is a major cause of morbidity and mortality. Intensive approach to health and wellbeing is important for development of adolescent girls. Through this project, ICMR-National Institute of Nutrition (NIN) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) will work in partnership with the Government of Telangana to address these important issues.

FeFA Girls includes two components: i) to establish diet-based approaches for improvement in hemoglobin and iron status in adolescent girls, and ii) to generate scientific evidence on nutritional benefits of groundnut and pearl millet (ICRISAT mandate crops) on human health.

Together termed FeFA Girls “Iron For Adolescents” (Fe: symbol of Iron; FA: For Adolescent), the project reaches out to adolescent girls aged 16-19 from selected social welfare hostels in Telangana to address iron deficiency and poor dietary fiber intake. A key aspect of iron-deficiency anemia prevention and control is promotion of diets containing adequate amounts of bioavailable iron.

“Our approach is to use practical food-based solutions using crops rich in iron and dietary fibers that have been shown to improve the gut microbiome composition. We aim to achieve overall improvement of iron biomarkers naturally in adolescent girls with mild to moderate iron deficiency,” said Dr Peter Carberry, Director General, ICRISAT, speaking at the launch event.

Highlighting the importance of these efforts, Dr R Hemalatha, Director of NIN, stated, “This collaboration between ICRISAT and ICMR-NIN will bring together expertise and experience that complements each other”.

Adolescent girls suffering from mild to moderate anemia will receive high-dietary fiber-containing natural nutritional supplements in the form of a peanut-pearl millet bar every day for three months in government residential hostels, Telangana*. The daily consumption of 100 grams will be in two doses. To mark the launch, a project flyer was released highlighting key components and expected outcomes and peanut-pearl millet bars were displayed and distributed among the participants and media representatives.

Another project to understand the ‘Effect of National iron-folic acid (IFA) Supplementation Program on Gut Modulation and Iron Status among Adolescents’, will assess the effect of daily iron-folic acid supplementation (for a period of three months) on the gut microbiota composition and function of adolescent girls.

“Next-generation high-throughput sequencing techniques will be utilized for assessment of differences in the microbiota state between baseline and end-point of the study. This will help us to understand the effect of high nutritional value peanut-pearl millet bars, developed at ICRISAT together with partners to benefit the society at large. Improved data collected through digital platforms too will help better engage adolescents,” said Dr Rajeev K Varshney, Research Program Director for Genetic Gains, ICRISAT and leader of the project from ICRISAT.
Establishment of an innovation and technology city in Niger
New partnership between Niger’s Agency for Information Society and ICRISAT

The establishment of an innovation and technology city at ICRISAT Sadore research station, as part of Niger government’s Niger 2.0 program, was formalized with the signing of an MOA between Niger’s Agency for Information Society (ANSI) and ICRISAT. The agreement was signed during the International Millet Festival (FESTIMIL) held in Niamey, Niger.

The center, developed around clusters (agribusiness, health, education and more), will host a startup and small-medium enterprises acceleration and incubation center, a training and certification center (university for technical/professional training), a coding academy, a business center, a national data center and assembly lines for digital and other equipment including computers, tablets and solar panels.

Dr Peter S Carberry, Director General, ICRISAT, and Mr Ibrahima Guimba Saidu, Director General, ANSI, signing the agreement in Niamey, Niger.

Sorghum improvement collaboration earns community appreciation in Nigeria

The Kambuwa community in Nigeria’s Kebbi state honored representatives of Nigeria Agricultural Transformation Agenda Support Program – Phase 1 (ATASP-1) and its outreach partner, ICRISAT, for improving sorghum technologies.

At the event held on 26 January in Kambuwa, which falls in Yauri emirate, an agricultural show demonstrated the impact of technologies developed by ATASP-1 and ICRISAT. Amidst a large gathering, Dr Hakeem Ajeigbe, ICRISAT’s Country Representative for Nigeria and a Sorghum Commodity Specialist, was presented a community shield, a calabash, a bow and an arrow, which together signifying loyalty, food security and power.

Dr Ajeigbe later gave a presentation titled ‘Importance of improved seed on crop productivity’.

Dr Aliyu Abubakar Dogondaji, ATASP-1’s Coordinator for Kebbi-Sokoto Staple Crop Processing Zone was recognized for the support given to ICRISAT and the Kambuwa community in dissemination and adoption of improved sorghum.
Diet diversification program aims to improve health of 13,000 tribal people in South India

Energy-dense foods made from millets, sorghum and pulses are being provided to tribal communities in parts of India’s Telangana state to combat malnutrition. ICRISAT launched the diet diversification project, *Giri Poshana*, in collaboration with governments of India and Telangana after last year’s successful pilot project, the *Nutri-Food Basket*.

Prevalence of malnutrition, including anemia, is reportedly high in tribal communities consuming undiversified diet. In Telangana’s Utnoor, Bhadrachalm and Etturnagaram blocks, where the food intervention was initiated, over 63% women and 56% children aged under 5 are anemic. About 22% - 35% of the children are also underweight while 26% to 38% are stunted. Wasting ranges between 13% and 22% in this age group.

ICRISAT’s Agribusiness Innovation Platform (AIP), through its Nutriplus Knowledge (NPK) Program, aims to raise nutrition levels of nearly 13,000 people in the three blocks. *Giri* (tribal) *Poshana* (nutrition) is targeted at children, adolescent girls, pregnant women and lactating mothers.

“Nutritionally balanced food products, formulated from local crops and validated at the NPK laboratory, are supplied to supplement existing diet of the beneficiaries. These foods are processed to enhance digestibility of carbohydrate/proteins and ensure enhanced bioavailability of micronutrients. The project is expected to improve key nutritional parameters among children and women,” said Dr Saikat Datta Mazumdar, Chief Operating Officer, NPK program.

Before *Giri Poshana* took off in January 2019, a baseline survey captured anthropometric data and anemia status of target beneficiaries. The food formulations - multi-grain meal, sorghum (jowar) meal, multi-grain sweet meal, nutri-cookies, energy bar and Jowar Bytes - were selected following acceptability studies. Formulations accepted by more than 95% of the intended beneficiaries were chosen for the project.

*Giri Poshana* is funded by Ministry of Tribal Affairs, Government of India, and Commissionerate of Tribal Welfare, Government of Telangana. Block-level Integrated Tribal Development Agencies (ITDAs) are working with ICRISAT in food distribution and monitoring.
Market oriented groundnut research in WCA gets a boost with near-infrared spectroscopy

An advanced spectrometer, calibrated to quantify fatty acids, oil, protein and moisture content, recently introduced at ICRISAT-Mali is set to take West and Central Africa’s (WCA) groundnut research closer to the markets. WCA staff was trained to use the Near Infrared Reflectance Spectroscopy (NIRS) for seed quality evaluation.

To meet market demands, quantification (phenotyping) of seed parameters in breeding populations is essential. Groundnut use depends on its composition; high oil content desired by oil producers and low oil content preferred in the food industry. Food producers also demand high oleic acid content to improve shelf-life and for consumer health benefits. NIRS can quantify oleic and linoleic acids, and oil content in groundnut kernels by utilizing near-infrared rays of wavelengths ranging from 400 nm to 2500 nm.

“The use of NIRS will save our time and resources in groundnut breeding program at ICRISAT, Mali, alongside our national partners” says Ms Djénéba Konaté, Senior Scientific Officer, Groundnut Breeding Program, WCA, ICRISAT-Mali.

“It was a great opportunity for groundnut and sorghum scientific officers, research scholars and technicians at ICRISAT, Mali, to learn operation of the NIRS machine. They are confident of putting it to good use,” said Dr Haile Desmae, Senior Scientist, Groundnut Breeding, ICRISAT-Mali.

The training program, undertaken by ICRISAT’s research scholar Mr Dnyaneshwar Deshmukh, covered calibration of NIRS, development of prediction models, equations for nutritional quality parameters, validation of the NIRS predicted nutritional parameters and overall operations in groundnut quality analysis.

“NIRS takes less than 90 seconds to scan a sample. On average, 150-200 samples can be analyzed in a day. The selected lines can be planted immediately to advance to next generation, thus cutting down the breeding cycle time,” said Dr Janila, Principal Scientist, Groundnut Breeding, ICRISAT, Patancheru.

Presentations

How Smart Food can transform food, combat malnutrition and hunger

This topic was introduced to participants during the 4th International Congress Hidden Hunger at the University of Hohenheim, Stuttgart, Germany, on 28 February. The event was a platform for dialogue between scientists, policy-makers, representatives of non-governmental organizations and the private sector. Objectives of the meeting were to review available evidence on the double burden of malnutrition, discuss new research findings on underlying causes and consequences and develop innovative strategies to combat malnutrition.

This year the forum also emphasized the need to look at nutrition as a system issue, to adopt a broader multidisciplinary approach by understanding the connection between climate change and malnutrition. This meeting was attended by Professor Prabhu Pingali, Director, Tata-Cornell Institute for Agriculture and Nutrition (TCI) and ICRISAT’s incoming board member. Ms Agathe Diama, Head Regional Information, West and Central Africa, and Smart Food Coordinator for the region presented the Smart Food initiative at the congress.
Pearl millet ventures far from home to face climate challenges

Agriculture’s battles with climate are taking pearl millet to regions far from its original habitat. A team of researchers in Japan are trying to understand the crop’s hardiness while efforts are underway in the UAE to make it a fodder source in salinity affected lands.

Over the last few years, the University of Tokyo has been sourcing pearl millet material from ICRISAT. The university and its collaborators are trying to understand the genetic basis of the crop’s climate resilience. Meanwhile, the International Center for Biosaline Agriculture (ICBA) in Dubai and ICRISAT are collaborating to strengthen pearl millet’s presence in Central Asia and the MENA region. Its heat, drought tolerance, nutrition profile and salinity tolerance are the main motivators for the crop’s uptake.

“When we were first contacted by the university, we were surprised. Japan’s interest in pearl millet seemed unusual,” says Dr S K Gupta, Principal Scientist, Pearl Millet Breeding, ICRISAT. Pearl millet is cultivated in Africa, Saharan Africa and South Asia for human and animal consumption.

Following its genome sequencing by ICRISAT and partners, research interest in pearl millet increased. To help the university further its research, Dr Gupta recently showcased ICRISAT’s pearl millet-related work at the Asian Natural Environmental Science Center (ANESC).

“The efforts of public and private sector research institutions engaged in pearl millet improvement, including ICRISAT, helped to achieve higher genetic gains of about 3% per annum increase in grain yield productivity in India,” Dr Gupta said during his talk. He also mentioned that a highly climate resilient crop like pearl millet is set to become one of the most preferred food crops as the world fights climate change.

In Central Asia and South America, cultivars with high salinity tolerance were released for use as livestock fodder. The demand for such varieties continues to grow as countries attempt to find ways to use soils with high salinity.

During recent interactions with crop scientists at ICBA, Dr Gupta discussed the scope for expanding cultivation of pearl millet as a fodder crop in the country. The suitability of pearl millet in the region has already been established in 2014. Last year, a team of scientists including Dr Gupta, analyzed the genetic basis of pearl millet’s salinity stress tolerance. The potential use of sorghum and finger millet, as fodder, was also discussed during the meeting.

ICRISAT and ICBA scientists are now preparing a roadmap for using sorghum, pearl millet and finger millet in MENA and Central Asia.
Small in scale, big on impact: Intervention in groundnut value chain empowers women in south India

Nearly 700 women of Telangana, India, now earn yearly dividends from a processing facility run by a women’s collective. This modest investment could well be a model for increasing incomes of farmers and empowering women.

ICRISAT, through its Agribusiness and Innovation Platform (AIP), in collaboration with the Government of Telangana state, set up a groundnut processing facility in Dattaipally village following analysis of the region’s agriculture sector. The facility was installed to strengthen livelihoods of farmers and empower women who are part of a women’s collective called Mahila Mandal Samaikya (MMS). The processing facility produces groundnut oil, chikki (a mix of peanut and jaggery), groundnut paste and graded kernel for further processing. The groundnut is sourced from farmers of Wanaparthy District, where the village lies. AIP estimates that with good yielding varieties and scientific crop cultivation technology, value addition interventions, like the Dattaipally unit, can enhance income of groundnut farmers by as much as 30%.

“The main objective is to get local women to run the facility. The second objective is to ensure a market for the crop. The products we make are sold under the brand name ‘Wana’. We currently get an order for 1,000 liters of groundnut oil a month through a farmers’ collective. The unit is starting to impact the lives of the women,” said Ms Renuka Devi, Assistant District Rural Development Officer, Wanaparthy.

After testing and initial runs since the unit’s installation in October 2018, AIP handed over the facility to MMS. However, AIP continues to mentor the women in production, quality standardization, food safety and operational management of the unit.

“We were earlier working ad-hoc jobs and worried about earning a daily wage. The plant has been good for us as we get paid monthly wages, which are higher than what we earned earlier,” a woman working at the facility told visiting journalists.

The Dattaipally plant can process 500 tons of groundnut a year. Women working in the plant earn a monthly wage while those not working at the facility earn annual dividends for being a member of MMS.

“For the people of Wanaparthy, often forced to seek employment in other areas, groundnut processing could provide entrepreneurial opportunities. Farmers in the region benefit from processing as their produce does not fetch high rates in the market,” said S Aravazhi, Chief Operating Officer at AIP.
Study shows consumer acceptance to diversify staples with Smart Foods

A study in Tanzania and Myanmar analyzed consumer acceptance of pigeonpea, millets and sorghum in a variety of forms in both rural and urban markets. The crops were trialed to diversify staples to improve nutrition and through modern convenience products to assess agribusiness potential. The study showed that when prepared in culturally sensitive ways, Smart Foods excited consumers and were significantly more nutritious.

High acceptability was shown through sensory evaluations by consumers in markets, at home and in schools as well as through retailer feedback during sessions with food service providers and through sales of products created. Economic viability testing in Tanzania also showed significant cost savings.

The market research was funded by the Innovation Exchange of the Australian Department of Foreign Affairs and Trade (DFAT) and undertaken by ICRISAT. DFAT and USAID had selected the Smart Food initiative as one of the top 10 global food innovations, aimed at diversifying staples across Asia and Africa. The initiative recognizes that by focusing on what may often be 70% of the plate, a larger impact can be made on health, environment and farmer welfare. The initiative does this with Smart Foods which are foods defined as good for you, the planet and the farmer.

DFAT suggested selecting an Asian and African country to test consumer acceptance of diversifying staples with Smart Foods. Subsequently, nutritional, economic and agricultural needs of Tanzania and Myanmar were assessed to select appropriate Smart Foods for testing. Rather than an academic survey approach, testing was undertaken through school feeding, sale of products in the markets and providing food to homes for determining family acceptance. A participatory approach was taken in designing the methodology and selecting products.

In Myanmar, millets and pigeonpea were tested. Sensory evaluation in Myingyan District’s Oe Bo village showed high acceptance of recipes like pigeonpea soup and cooked little millet alongside pigeonpea curry. A feeding program of children under the age 2 showed that diversification with millets and pigeonpea can improve nutritional status of children in three weeks. Market research with 13 Smart Foods in Yangon revealed high urban acceptance of processed millets and pigeonpea foods.

Following stakeholder consultations in Tanzania, pigeonpea, finger millet and sorghum testing in schools of Babati and Kondoa districts demonstrated high acceptance among the students. Composite flours for cakes, cookies, donuts, mandazi and porridge were promoted in restaurants and bakeries of Arusha, while the final products were promoted in retail stores. Results demonstrated a potential for urban market development with significant impact on the farmers’ livelihoods and nutritional status of consumers.

The study also identified value chain players, helped forge partnerships and engage with governments. The detailed results will be released soon and funding for scaling out will be sought.
PM-KISAN (Pradhan Mantri Kisan Samman Nidhi) is one of the largest income support schemes for small-holder farmers in the world. A targeted support to the agriculture sector is always a welcome move. However, the initiative does not cover landless agricultural laborers and the sharecroppers/tenants, thanks to unavailability of credible records.

As per the Agriculture Census 2010-11, there are 138.35 million farm-holdings in India, of which 92.8 million are marginal (<1 ha) and 24.8 million are small (1-2 ha). Even though small and marginal farmers account for more than 85% of total farm holdings, their share in operational area is only 41.2%. About 1.5-2 million new marginal and small farmers are added every year due to law of inheritance. Predominance of smallholders demonstrates their importance in the agriculture policy landscape. Besides, agricultural landless laborers, pastoralists, fisherfolk and sharecroppers/tenants/lessees equally contribute to agricultural growth and deserve attention.

Land reforms in India have not been successful across several states, with the exception of ‘Operation Barga’ in West Bengal. The land reform legislations in post-Independence India consisted of redistribution of surplus land from the rich to the poor, abolition of intermediaries, security of tenure to tenants (and tenancy regulations) and consolidation of landholdings. Agricultural productivity and farm-size are inversely related. Therefore, policies must raise land productivity through appropriate technologies. It is equally important to legalize land leasing to enhance farm efficiency.

Many studies have established direct linkages between tenure security and income security. Ensuring land leasing through a legal framework incentivizes tenant cultivators to invest and conserve agricultural land resources, which, in turn, leads to increased land productivity and profitability. Recently, the NITI Aayog recognized that land lease should be viewed as economic necessity and not as an instrument of a feudal agrarian structure.

Enacting appropriate land leasing laws should be the highest priority of state governments. Such pro-farmer moves (though often viewed with suspicion by political executives and influential groups within the farming communities) are expected to benefit Indian agriculture and ultimately, raise farmers’ incomes. The committee on Doubling Farmers’ Income (DFI) of the Government of India has also recommended legislating the model Agricultural Land Leasing Act (brought out by NITI Aayog) to ensure private sector investments in agriculture.

The bottleneck of credit flow to lessee farmers/sharecroppers/tenants could be addressed by legalizing land leasing, as land is often used by lending financial institutions as collateral for farm loans. The existing legislations on land revenue matters are diverse and complex across the states. The model Land Leasing Act does not specify the rent on leased land and the period of lease, but has rightly left it to the concerned parties in the land lease market (landowner lessor and lessee cultivators) without interference from the government. A few states like Madhya Pradesh, Maharashtra and Uttarakhand have implemented the suggested land leasing legislation with some modifications suitting local contexts. States like Odisha and Uttar Pradesh are considering amendments to their existing revenue laws to legalize land leasing. There is no legal ban on leasing in a few states viz. Andhra Pradesh, Tamil Nadu, West Bengal and Rajasthan. In Odisha, Karnataka and Uttar Pradesh, specific persons/institutions (armed forces personnel; privileged raiyats) are permitted to lease out agricultural lands.

Ensuring food and nutrition security and tackling the looming threat of climate change makes land reforms necessary. A land reforms agenda, with land leasing legislations and updated land records, should receive the highest priority to increase incomes of smallholders, tenant farmers and sharecroppers.

Restrictive land leasing legislations in many parts of the country have led to informal and concealed tenancies without security of tenure. This has ultimately resulted in impeding investments in the agriculture sector and negatively impacted agri-productivity. The fear of
agricultural lands falling into the hands of sharecroppers after a specific period (due to restrictive clauses) has also led to large chunks of lands (as high as 25 million hectares, as per some estimates) remaining fallow in the country.

With an enabling framework, legalizing land leasing could correct such anomalies. With rising levels of income, the prices of agricultural lands are increasing; landless agri-laborers and small/marginal farmers cannot afford to purchase new parcels of lands. Land tenure security and collective farming are also in the interest of smallholder agriculture. From the evidence in India and the rest of the world, ensuring access to the land lease market could prove a game-changer for enhancing farmers’ income. However, such a big-ticket reform needs strong political will and demands corruption-free implementation.

Another important aspect is ensuring effective modernization and digitization of land records. The computerization of land records, land-property transactions and the registration processes has not matched the challenges of land revenue administration so far. The process of mutation and updating of land records has been slow in many states. The poor maintenance of land records and slow pace of digitization of land revenue administration is negatively impacting agriculture. High resolution satellite imagery coupled with ground assessment has also been suggested for the survey operations. Aadhaar is uniquely positioned to assist the ongoing process of modernizing land records to validate land assets. As land ownership in India is presumptive, moving the existing system include state-guaranteed conclusive titles is often advocated.

However, the proposed titling would require a massive upgradation of land records and existing processes through computerization, capacity building of stakeholders and amending the appropriate land laws. This can be carried out in the PPP mode, as already demonstrated in few states of India. Police records in many Indian states show that land disputes are the reason behind a sizeable chunk of cognizable offences (as high as 40% in Bihar) and, therefore, an updated record of ownership would help farmers avoid land-related litigations.

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Myanmar’s chickpea farmers reap the fruits of decades-long research collaboration

Myanmar has witnessed a chickpea revolution during the past two decades as production increased nearly eightfold (from 67,000 tons in 1998 to 527,000 tons in 2017) due to 300% increase in area (101,000 to 376,000 ha) and doubling of productivity (660 to 1,400 kg/ha). The country is now the third largest producer after India and Australia, with most of the chickpea cultivated area under improved varieties produced through DAR-ICRISAT collaboration. Consequently, it has emerged as a major exporter.

I recently visited Myanmar’s chickpea fields to participate in the Farmers’ Field Day at Zaloke Research Farm of the Department of Agricultural Research (DAR). About 120 farmers participated in the event. The research farm demonstrated varieties awaiting release alongside released cultivars. The seed samples of these varieties were also displayed. Farmers examined the crop and voted for three preferred varieties.

Farmer feedback on the varieties is valuable as it helps in the final selection of a variety for release. The farmers listed early maturity, enhanced tolerance to terminal drought and heat stresses, and suitability to machine harvesting among the desired traits. The DAR chickpea breeding program has remained highly focused and effective thanks to regular interactions with farmers.

ICRISAT and DAR have had strong collaborations in chickpea breeding in the last 40 years. All but one variety released in Myanmar are from breeding materials supplied by ICRISAT. The Department of Agriculture (DOA) maintains variety-wise statistics on area, production and yield of chickpea. DOA’s data suggests that 96% of the chickpea area in 2017-18 was under the five improved varieties developed through ICRISAT-DAR partnership research. These varieties and their share in coverage are - Yezin 3 (ICCV 2) 36%, Yezin 4 (ICCV 82028) 14%, Yezin 6 (ICCV 92944) 28%, Yezin 8 (ICCV 97314) 17% and Yezin 11 (ICCV 01309) 1%.

I also visited DOA’s Pauk Inn Seed Production Farm in Chaung U Township of Sagaing Division. The department was producing seed of improved chickpea varieties on 1,200 acres with residual soil moisture but it looked like an irrigated crop!

During our discussions, Dr Naing Kyi Win, Director General, DAR, requested ICRISAT’s help in modernizing Myanmar’s breeding programs with a focus on speed breeding and data management. He also recognized the collaboration of DAR with ICRISAT during the former’s Crystal Jubilee celebrations on 27 January 2019. Dr Win presented a certificate acknowledging our long standing collaboration with DAR.

ICRISAT’s chickpea breeding program is well aligned with the priorities of Myanmar’s farmers. In response to farmer demands and local conditions, development of machine harvestable early maturing varieties with enhanced tolerance to terminal drought and heat stress are underway.

About the author:
Dr Pooran Gaur, Research Program Director-Asia, ICRISAT
End of an era in agricultural science, a trail to follow: Dr Jaswant Singh Kanwar

"Soil is the living heart of agriculture." This profound statement that overhangs a description of soil types, often gives visitors their first lesson at ICRISAT. Testimonies to its soundness lie in the life and work of the man who made it.

Dr Jaswant Singh Kanwar, ICRISAT’s first Deputy Director General, who passed away on 1 March, firmly believed hungry soils only make for a hungry nation. And he made sure soils never went hungry.

In the 1960s, institutions needed vision and handholding. Dr Kanwar provided both in countless measure, first at one of India’s oldest agricultural universities, then at the Indian Council of Agricultural Research (ICAR) and subsequently at ICRISAT. His achievements as a researcher stand taller.

In 1962, Dr Kanwar was made Punjab Agricultural University’s first Director of Research. Just a decade before, his master’s research work on earthworms influencing soils had been path breaking.

In its tribute to Dr Kanwar, the Indian Society of Soil Science pointed out the pioneering research he did to combat sulphur deficiency in soils of Punjab, which later proved helpful throughout the developing world. Dr Kanwar had worked extensively in the areas of resource management, mainly soil and water, and in environment, spanning authorship of over 300 publications. He later joined ICAR as its first Deputy Director General (Soils, Agronomy, Engineering and Water) after turning down a much coveted offer from FAO in 1966. He did it again in 1973 to help establish ICRISAT.

“Dr Kanwar was DDG when I was a student at ICRISAT. He advocated for quality science. He was a great scientist and leader,” Dr Peter Carberry, Director General, ICRISAT, fondly recalls. ICRISAT’s library has been named after Dr Kanwar.

Dr Kanwar helped create the All India Coordinated Research Project on Dryland Agriculture which later become the Central Research Institute for Dryland Agriculture (CRIDA) in Hyderabad.

“The completion of 15 years of distinguished service directing the research program of ICRISAT marks another milestone in the career of Dr Kanwar,” ICRISAT’s Founding Director Dr Ralph W Cummings had said on 30 March 1988 after Dr Kanwar’s retirement.

“He is to be congratulated on the quality of his leadership in this responsibility and the people of the semi-arid regions of the world can be forever grateful for all that he has done to contribute to their welfare and well-being.”

Awards

Dr Rajeev Varshney receives the coveted GD Birla Award for Scientific Research

The KK Birla Foundation honored Dr Rajeev K. Varshney, Research Program Director - Genetic gains, with the 28th GD Birla Award for Scientific Research for the year 2018. The award was in recognition of Dr Varshney’s high caliber scientific research and pioneering contributions in integrating advanced discoveries in genomics with crop improvement in developing countries. This coveted award in the scientific community is given to eminent Indian scientists below the age of 50.

New projects

A strategy to exploit genomic selection for achieving higher genetic gains in groundnut

Donor: Newton Babha Fund-BBSRC through University of Edinburgh/DBT, India
Period: 5 October 2018 - 4 October 2021
PI: Dr Manish Pandey
RP: Genetic Gains Program

Innovative and contextual agromet advisory services for climate smart agriculture

Donor: Earth System Sciences Organization (ESSO), Ministry of Earth Sciences (MoES), Government of India
Period: 29 November 2018 - 28 November 2021
PI: Dr Anthony Whitbread
RP: Innovation Systems for the Drylands Program

Climate services for better risk management and build resilience of smallholder farmers in the highly vulnerable rainfed areas of India

Donor: Earth System Sciences Organization (ESSO), Ministry of Earth Sciences (MoES), Government of India
Period: 29 November 2018 - 28 November 2021
PI: Dr Anthony Whitbread
RP: Innovation Systems for the Drylands Program

Striga control in pearl millet phase II

Donor: Bill & Melinda Gates Foundation thru King Abdullah University of Science and Technology, Saudi Arabia
Period: 1 January 2019 - 31 December 2023
PI: Dr Prakash Gangashetty
RP: West and Central Africa Program

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