Feature Stories

New sowing application increases yield by 30%

The test results of a new sowing app for groundnut farmers reveal that 175 smallholder farmers who followed the advice provided for sowing and managing their crop experienced a 30% yield increase.

These farmers, based in Andhra Pradesh, India, received ten sowing advisories through SMS in the local language (Telugu). Messages contained essential information such as: land preparation, soil test based fertilizer application, farm yard manure application, seed treatment, optimum sowing depth, preventive weed management, maintaining proper plant density, observing boron and zinc deficiency in field and applying nutrients if needed, harvesting, shade drying of harvested pods and correct storage practices.

Based on the advice received, farmers sowed groundnut in the last week of June and first week of July 2016. Mr G Chinnavenkateswarlu, a farmer with three acres (1.21 ha) says, “I sowed groundnut on 25 June based on the sowing recommendations provided. My crops were harvested on 28 October and the yield was about 1.35 tons per hectare. Advisories provided for land preparation, sowing, and need based plant protection proved to be very useful to me.”

The crop sowing period was calculated based on historic climate data spanning over 30 years (1986–2015) for Devanakonda area in Andhra Pradesh. Two step computations were done based on 1) present moisture adequacy index (MAI) calculated from the daily rainfall recorded and reported by the Andhra Pradesh State Development Planning Society and 2) future MAI calculated from daily rainfall forecasted for the area by aWhere Inc., for the next five days.

Based on these computations, the optimum sowing period was estimated to start from 24 June, which was followed by the registered farmers. Subsequently, sowing advisories were initiated and disseminated to those farmers. Dissemination of advisories continued till harvesting of crop.

Testing of the sowing recommendation and advisories was done in comparison with farmers who sowed during the first week of June 2016. However, during the 31 day period, starting from 10 August 2016, Devanakonda received meagre rainfall of about 8 mm and the groundnut crop sown in the first week of June was badly affected by lack of soil moisture.
In some farmers’ fields, the crop dried up and rains received later did not improve the situation. On the other hand, crop sown during last week of June and first week of July were able to recover from the moisture stress after receiving rains from 11 September onwards.

Crop cutting experiments conducted at selected farmers’ plots indicated that registered farmers who have sown as per the advisory have obtained 30% increase in yields compared to some of the non-registered farmers, who had sown in the first week of June 2016.

“We are excited about the results that have emerged from the use of the sowing application and personalized village advisory dashboard. We look forward to continuing our partnership with Microsoft to enhance incomes and improve the lives of smallholder farmers, and give a boost to our digital agriculture initiative in a big way,” said Dr David Bergvinson, Director General, ICRISAT.

In tandem with the application a personalized village advisory dashboard has also been developed to provide predictive analytics. This dashboard provides insights around soil health, fertilizer recommendations, and seven day weather forecasts derived from weather observations systems and global forecast models.

The sowing application is a joint partnership between the Government of Andhra Pradesh, Microsoft India (R&D) Pvt. Ltd. and ICRISAT. The pilot was implemented in Devanakonda administrative area in Kurnool district of Andhra Pradesh.

The results of the pilot were announced on 9 January in a panel discussion at the 20th National Conference on e-Governance in Visakhapatnam, Andhra Pradesh.

Project: Andhra Pradesh Primary Sector Mission (Rythu Kosam Project)
Partners: Government of Andhra Pradesh, Microsoft India (R&D) Pvt. Ltd, Chaitanya Youth Association, ICRISAT and partners.
Investors: Government of Andhra Pradesh

This work contributes to the UN Sustainable Development Goals
Smart Food selected as a global LAUNCH Food innovation

Smart Food, an initiative which will initially focus on popularizing millets and sorghum, has been selected by LAUNCH Food as one of the winning innovations for 2017. The global recognition and mentorship support of LAUNCH Food will help Smart Food to achieve major impacts globally by promoting the demand for millets and strengthen the value chains while ensuring that smallholder farmers benefit.

The Smart Food initiative is founded by ICRISAT and aims to build food systems where the food is good for you (highly nutritious), good for the planet and good for the smallholder farmer.

LAUNCH Food is a global competition where 10 innovations are selected each year for mentoring and linked with high level experts and organizations to accelerate the innovation. This year there were 280 submissions from 74 countries. The LAUNCH Food innovators will attend an event in San Francisco in March to present and discuss their innovation with key industries and investors.

LAUNCH was founded in 2009 by National Aeronautics and Space Administration, the United States Agency for International Development (USAID), the United States Department of State and NIKE Inc., who joined together to identify, showcase and support innovative approaches to sustainability challenges. LAUNCH Food is supported by the Australian Department of Foreign Affairs and Trade and USAID.

“Millets, including sorghum, are the first Smart Food we are focusing on. They are highly nutritious, have a low water and carbon footprint, and have so many multiple uses that are yet untapped,” said Smart Food initiator and leader, Joanna Kane-Potaka, Director Strategic Marketing and Communication, ICRISAT. “They have been traditional foods across India and many countries in Africa but with low investments their value chains are significantly underdeveloped which makes it more difficult for the farmers to invest. Over time they have become labeled as an old fashioned food. We plan to take a different approach and drive demand by first creating a new image and buzz around millets.”

Smart Food will be taken forward as a partnership and many organizations have already teamed up to popularize millets. In India, this includes the Indian Institute of Millet Research (IIMR), the National Institute of Nutrition (NIN), MS Swaminathan Research Foundation (MSSRF) and the Self Employed Women’s Association (SEWA). In Kenya, work has started under the USAID Feed the Future Program focusing on the Smart Food – millets, sorghum and selected pulses. Efforts have been initiated in rural areas to integrate Smart Food into messages by health workers and encourage new creative ways to cook with these crops. A social media campaign has been launched and a Smart Food reality TV show started as a competition to develop modern recipes using Smart Food. Processors are also being engaged to develop healthy convenience Smart Food products.

For ICRISAT’s role in popularizing millets click here
For ICRISAT’s work on dryland cereals click here

This work contributes to the UN Sustainable Development Goals

For ICRISAT Happenings January 2017 1737 | 3
Enhancing tribal farmers’ incomes through value addition

A dal mill (pigeonpea processing unit) and a sorghum processing unit has been set up to enable farmers in tribal areas of Telangana, India, enhance their incomes. The dal mill will fetch farmers a premium price of around INR 86 per kg instead of the farm gate price of INR 45 per kg as received by farmers during the previous season.

The aim is to eliminate intermediaries and step up farmers in the value chain by enabling them to process their own produce. By establishing direct linkages with retail and corporate actors, an incremental price benefit can be realized in comparison with the traditional market prices. This would also groom the entrepreneurial skills of the tribal farmers in the region.

The dal mill will process around 80 tons of pigeonpea estimated to be harvested in January. The market facilitation would be done by ICRISAT. With an investment of less than USD 10,000 per mill, it is a viable solution for rural areas.

During kharif (rainy) season of 2016, 2 tons of high yielding pigeonpea (ICPH 2740) seeds were distributed to 2000 farmers. These farmers were trained on best practices for pigeonpea cultivation. In addition exposure visits to ICRISAT were organized to address farmers’ queries on the challenges of cultivating pigeonpea. The crop production training at ICRISAT and in their respective mandals (smallest administrative area), ensured that farmers have a better understanding of the newly introduced pigeonpea hybrid in the region. Field visits were taken up by experts to provide timely support on fertilizer and pesticide usage as per field conditions.

Similarly, around 9 tons of high yielding sorghum seed varieties, namely Moti, Vasudha and Revati were distributed during the rabi (post rainy) season of 2016. To capture the incremental price realization through primary processing, the sorghum processing facility will be used to make sorghum flour. This would reduce the drudgery of around 3000 women who use chakkis (manually operated stone mills) to make flour. Since sorghum is a staple food in these areas and consumed in various forms as flour, broken grains and as porridge, farmers can use the sorghum flour also for their own consumption. The sorghum production is estimated to be around 60 tons and the flour will be marketed with support from ICRISAT.

The dal mill was inaugurated on 11 January, by Mr Harish Rao, Minister for Irrigation, Marketing and Legislative Affairs, Telangana at the Indira Kranti Patham Mandal Samakya Office, Wankidi.
Commending the project’s activities and the Integrated Tribal Development Agency (ITDA), Utnoor, for their commitment toward the welfare of tribal settlements, Mr Rao said, “This mini dal mill facility enables tribal farmers to engage in post-harvest value addition of pigeonpea, thereby receiving more equitable returns by commanding premium prices. The facility also aids in employment generation within the region, reviving the village economy.” Mr Rao was keen to implement similar projects in the remaining districts of Telangana.

A second dal mill and a sorghum processing unit would be established under this project, in Thiryani and Wankidi mandals respectively. The processing facilities are being implemented by ICRISAT-Agribusiness and Innovation Platform (AIP).

The overall aim of the project is to enhance income levels of farmers through adoption of better cultivation practices; enable improved access to new seed varieties, inputs and services that foster technology penetration; improve productivity; introduction of post-harvest technologies and providing market linkages to strengthen sustainable agriculture based livelihoods in the tribal mandals of Thiryani, Wankidi and Kerameri.
Study tracks significant increase in household income due to rainwater harvesting structures

A new study reveals that using farm level rainwater harvesting structures (RWHS) significantly increases farm productivity, cropping intensity, farm income and household income. Farmers using farm ponds in Akola district, Maharashtra, for example, have experienced an increase in farm productivity (12 - 72%), while in Chittoor district, Andhra Pradesh, RWHS resulted in farm diversification into fruits, vegetables and livestock production. This has doubled the household’s annual income from a low base of around USD 250 to more than USD 500.

This supplemental irrigation for Chittoor farmers, increased productivity of various rainfed crops such as pigeonpea, chickpea, groundnut, cotton, vegetables, mango and coconut which ranged from 5% to 72% (see table). On average the yield increase, compared to fields with no access to farm pond water, was 51% in pigeon pea, 55% in chickpea, 36% in cotton and 12.5% in soybean.

In Akola district, pond water could provide supplemental irrigation to >2 ha area for a household. With a more regular water availability, farmers planted additional fruit trees and it also resulted in productivity increase of existing fruit trees: mango (39%) in Chittoor district and coconut (51%) in Vellore district, Tamil Nadu.

As crop productivity increased, there was also an increase in access to crop residues as fodder and drinking water for cattle. This in turn increased milk production.

The study notes additional residual impacts on farmers and farming households due to RWHS: For example in Chittoor, additional income gained from higher production of mango and vegetable crops was used to educate children and acquire diesel operated pump sets for their own use or for hire.

This study was conducted in five districts of India: Chittoor, Akola, Bangalore rural, Vellore and Bhilwara. These districts have diverse soil types with a varied annual rainfall from 327 to 949 mm. The study uses data from surveys and focus group discussions to assess the performance of farm level rainwater harvesting under different agro-climatic conditions covering semi-arid and arid regions in India.

Results from this study have been published in the journal of Agricultural Water Management:
http://oar.icrisat.org/9814/

### Impact of farm level rainwater harvesting on farm productivity.

<table>
<thead>
<tr>
<th>District</th>
<th>Increase in gross cropped area (%)</th>
<th>Extent of increase in the yield of major crops (for 0.3–2.0 ha area) (%)</th>
<th>Additional fruit plant (Nos.)</th>
<th>Increase in yield of existing fruit plants (%)</th>
<th>Increase in livestock production*</th>
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<td></td>
<td>Pigeonpea</td>
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<td>Chickpea</td>
<td>Groundnut</td>
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* Increase was due to improved access to fodder and water.
India releases the world’s most advanced and comprehensive analytical data base of national food nutritional composition

The Indian Food Composition Tables (IFCT) - 2017 was recently released by the Government of India. The publication contains data on 586 varieties of Indian food and their nutritive values. This is the first expansive and comprehensive food composition data to be released since 1971 with its own complete food composition database.

The IFCT serves as a handbook that will be just as relevant to the general public in making dietary choices as it will be for dieticians, medical and health professionals and students of nutrition. It forms a basis for developing dietary guidelines, framing of food regulations and food safety mechanisms and consumer education. The food industry can capitalize on this data for labeling and product development. The IFCT also has the potential to guide planning of institutional diets, sports nutrition and the food service industry.

“This will also be translated to something usable and helpful to the common person, as a mobile app, which will be ready in a couple of months,” said Mr JP Nadda, Union Minister for Health and Family Welfare, Government of India.

The Indian Council of Medical Research (ICMR) in 2011, initiated the Indian national food sampling and analysis program to develop a new and authoritative source of food composition data in India. Key foods were prioritized and analyzed for a comprehensive set of nutrients at the National Institute of Nutrition (NIN), Hyderabad.

Dr Longvah, Director, National Institute of Nutrition (NIN), Hyderabad said, “The new database covers more than 150 nutrients, many more than covered before including anti-nutrients and contaminants. The methodology took nearly two years to develop and the sampling was also extensive covering six well dispersed agro-ecological regions.” This database will be very useful for taking decisions to overcome health concerns in India. As explained by Dr T Longvah, in India, malnutrition in children had been decreasing until 1997. However, since then it has stagnated at 43%. Diabetes is increasing currently reaching 6% and 23% of the population suffers from hypertension.

“We have more than 1,100 crops being cultivated in India and we need to have the nutritional value of each variety. Soil type, weather and many other factors affect their nutritional value. Agricultural systems contribute to nutritional security and science backed solutions are critical to address the needs,” said Dr Trilochan Mohapatra, Secretary, Department of Agricultural Research and Education (DARE) and Director General, Indian Council of Agricultural Research and Board Member, ICRISAT.

Dr Soumya Swaminathan, Director General, ICMR, indicated that the database gives a better idea of what the average Indian is eating and will help in tackling the issue of hidden hunger.

According to Dr Ruth Charrondiere, Nutrition Officer, International Network of Food Data Systems (INFOODS), Food and Agriculture Organization: to overcome issues of malnutrition, over-nutrition and micronutrient deficiencies, it is necessary to step aside from the ‘business as usual’ approach. She says, “In FAO for example, we have calculated that vitamin A deficiency can be eliminated worldwide by using the higher Vitamin A varieties of crops. We have the means already available and just need the will to do this. It can be achieved without fortification of foods. We have to work in a food system approach. This is reflected in the change of the name of my division in FAO, from the Division of Nutrition to Division of Nutrition and Food Systems.”

The urgency and importance of meeting the sustainable development goals (SDG) was highlighted by Dr Hameed Nuru, Representative and Country Director, World Food Programme (WFP) India. “SDG targets cannot be met globally if not met in India. Interest in non-nutritive components is also a growing area and less collected. These data include this. WFP is working with the Government of India to set up pilots and scale up successful approaches to fight hunger and malnutrition. We are at a crossroads in India now. The tools are here, the opportunities are here and the time is now,” said Dr Nuru.

Mr Ashish Bahuguna, Chair, Food Safety and Standards Authority of India (FSSAI), discussed FSSAI’s contribution and the role of government schemes to bridge the wide nutritional gaps in India. Mr Bahuguna said, “We have fallen behind the race to reduce malnutrition. We hope not only the Government will come forward with solutions and initiatives but also that the private sector will come forward with initiatives. We want consumer awareness to be higher in regards to nutritional levels. This new data should be used to improve in this area and give a new dimension to our work to mitigate malnutrition.”

The book was released by Mr Nadda at the ‘International Symposium on Food Composition in Nutrition and Health’, organized in New Delhi on 18 January.

ICRISAT is working with NIN to apply the nutritional information on millets, sorghum and legumes to the future of scientific research for development and incorporating into the Smart Food initiative.

For more information on the Smart Food initiative click here

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A technical report on energy and agriculture for smart villages in India was recently released. The smart village concept as developed by the Smart Villages Initiative, explores how renewable energy (solar, wind, hydro, biomass, and hybrid combinations) offers attractive and sustainable opportunities to rural communities in India.

The report is an outcome of a workshop attended by experts from the domains of research, entrepreneurship, information and communications technology, business, finance, policymaking, and non-profit to discuss and focus more attention on the relationship between energy and agriculture relevant to smallholder farmers in India.

Women entrepreneurs in smart villages was a topic of discussion by Dr Shailaja Fennell, Lecturer, Centre of Development Studies, University of Cambridge. Dr Fennell argued that reliance on biomass for cooking, creates risks and hardships for women. At the same time large number of rural households are without electricity, for example, 87% in Bihar and 71% in Uttar Pradesh. Therefore, enabling energy access could provide opportunities for women’s entrepreneurship. Women play a critical role in energy provision and consumption within households and communities, and therefore possess valuable knowledge relevant to sustainable energy solutions.

Mr Debajit Palit, Associate Director, Social Transformation, The Energy and Resources Institute, discussed renewable energy and mini-grids for agriculture. Mr Palit outlined an overall framework for mini-grids comprising three levels of access: 1) small-scale renewable energy technologies for isolated and vulnerable communities providing for basic needs such as lighting and cooking, which can create a market for mini-grids; 2) village-scale mini-grids for larger or more developed villages which can cater for productive uses in agriculture, education, sewing, and cottage industries as well as street lighting; 3) mini-grids coupled with the main grid for a cluster of villages providing modern societal needs such as modern domestic gadgets and appliances for space heating, cooling and productive applications.

Successful implementation of a Smart Nanogrid™ solution at Chhotkei village in rural Odisha was described by Mr Ameet Deshpande, Head projects, SunMoksha. The 30 kW solution is now meeting the energy needs of 140 households, 20 streetlights, a temple and three community centres which is about 20 kW. The remaining has been set aside for day-time use by irrigation pumps and microenterprises such as poultry, stitching, rice-puff machines, provision stores, etc., to improve agricultural output, generate employment, and enable value addition.

Prof Dr Ashok Jhunjhunwala, Department of Electrical Engineering, Indian Institute of Technology Madras, spoke about ‘green homes’ for smart Indian villages and concluded that roof top solar direct current (DC) can change rural homes, as power can be available 24/7 at affordable rates even during periods of power outage. Properly designed roof top solar and solar micro-grid could power agricultural pumps and supplement power for rural industries. India’s rural scenario can change as India aims to meet 50% of its energy needs from solar by 2030.

As part of the workshop intensive breakout groups were formed to facilitate further detailed discussions on more concrete questions. Finance availability was a point of discussion since participants felt that loans for renewable energy technologies could be improved. Some participants also noted that there are guidelines in place encouraging banks to lend, but the implementation is very poor due to perceived risks.

Key points from the breakout group exercise were:

▪ The main problem is not finance, but market distortions which makes renewable energy unattractive to the private sector.
▪ Understanding the disconnect between villagers and markets: villagers are not aware of activities in urban areas which makes it difficult for them to enter the market.
▪ Agriculture start-ups must consider how to attract the end user keeping in mind that there has to be a ‘pull factor’ even for the best product.

Participants also discussed appropriate innovations that may influence climate change in agriculture, for example...
the use of e-markets and farmer producer organizations (FPO). India is rapidly moving towards e-markets where the product is graded with fixed pricing which reduces the role of intermediaries. FPOs enable negotiations to take place at the bulk level. By aggregating at the local level, combining products, activities, and having a fixed price from e-markets, greater security for farmers could be attained.

Sir Brian Heap, Special Advisor to the Smart Villages Initiative, noted that, “In India where two-thirds of the population lives in around 600,000 villages, empowering villagers to create income-generating enterprises can lead to improved food security, education and health, and to participatory democracy.”

Example of a small-scale, low-input, family-managed, farming enterprise showing energy flows through the system. Outputs are primarily fresh food for local consumption, although they may also be delivered to local processing companies. Along with human and animal power, some direct energy inputs can be obtained from other sources, such as solar thermal and solar PV systems and biogas produced using a simple anaerobic digester.

According to Dr John Holmes, Co-leader of the Smart Villages Initiative said, “The national grid may never reach parts of India for economic and geographical reasons. Of the 240 million people who are not connected to the national grid, or are often without reliable energy supply, it has a negative impact on agriculture and associated activities that are extremely important within the rural economy. Energy shortages also create problems for lighting homes, charging mobile phones, and in some cases cooking.”

Dr Kiran Sharma, Chief Executive Officer, Agribusiness and Innovation Platform (AIP), ICRISAT, explained three main elements in ICRISAT’s initiatives on Inclusive Market-Oriented Development (IMOD), which are: harnessing markets in ways that include the poor; reinvesting gains in innovations that move smallholders along the development pathway; managing risks that are barriers for the poor, and building resilience.

In India AIP has established 22 business agriculture incubators in agricultural institutes and universities. These incubators have trained 3,700 entrepreneurs and created over 200,000 jobs. Similarly in Africa, AIP has established six incubators, which have supported 186 agribusiness start-ups and commercialized 58 agro-technologies.

This workshop on ‘Energy and Agriculture for Smart Villages in India’ focused on energy for agriculture in villages and its potential to catalyze productive enterprises that add value to agri-business, the food chain and open new opportunities for food security, employment, education, and the engagement of women and girls in new enterprises.

To read the full technical report on the workshop click here
A training was conducted to enable groundnut seed value chain actors to establish functional innovation platforms (IPs) in Uganda. The training provided participants with an in-depth knowledge on the innovation systems approach, innovation platform, seed value chain mapping, steps to establish functional IPs, learning within IPs, roles and responsibilities of IP facilitators with emphasis on documentation of IP processes.

Through IPs, groundnut value chain actors have the opportunity to identify constraints and come up with solutions on how best to address context specific challenges, opportunities and help to scale up innovations.

In Uganda, groundnut is an important legume and ranks second after beans. The value chain for groundnuts consists of many different actors including input suppliers, seed dealers, producers, traders, processors, exporters and consumers. The value chain is dominated by smallholder farmers who sell their surplus produce to rural traders (sometimes through agents) in either unshelled or shelled form. Due to poor quality of seeds, only about 33% of the produce can be considered as marketable.

Intermediaries link producers and buyers. Most of the times these intermediaries are farmers or members of the farming community. They normally guide buyers who are not familiar with the location of different farmers. Transport of produce and delivering market information are the major services they provide in the value chain. At times they buy farmers’ produce and store it in urban trading centers which are easily accessed by buyers (typically urban wholesalers). As no large-scale groundnut processing units are present in Uganda, processing is done by traders and wholesalers based in urban areas as a means of adding value before selling.

In this context, IPs can be considered as a space for interaction and coordination between different stakeholders in the value chain to capitalize on opportunities, solve problems and take actions to innovate practices of all actors involved in the innovation process.

The objectives of the training were to support stakeholders to better understand the rationale behind the IP and to: (i) strengthen their capacity on key steps to establish functional IP (ii) share tools to facilitate IP (iii) develop their plan to have functional IP.

Emphasis was on implementing the groundnut seed roadmap in producing and delivering 267 tons of basic seed and 4000 tons of certified/quality declared groundnut seed in Uganda by 2019.

The training brought together 23 participants such as researchers, extension workers, seed companies, local seed business representatives, members of farmer seed producer organizations and individual seed producers, dealers, retailers, government seed program managers, and representatives from partner programs involved in groundnut seed sector development. The training was conducted on 12-14 January in Uganda.
Strengthening seed business management

A workshop was organized to share experiences on groundnut and common bean seed business. It included discussions on principles of seed production, processing, sampling, testing, marketing, resources required to run the seed business, and partnership development within the seed value chain. Participants were further introduced to: the use of Information and Communications Technology to expand seed business, different components of inclusive seed business, developing seed business plans, and tools to keep business records. Practical group work was organized to map local seed demand in their area. The group work also included developing an internal and external quality assurance system, mobilizing finance, equipment and human resources. This workshop took place on 16 – 19 January in Uganda and was attended by 34 participants.

Both workshops were facilitated by Dr Essegbemon Akpo, Scientist - Seed Systems Specialist, ICRISAT, Nairobi; Enock Maerekia, Seed Business Development Specialist International Center for Tropical Agriculture (CIAT), Lilongwe; Dr Jean-Claude Rubyogo, Seed Expert, CIAT-Arusha and Dr Monyo S Emmanuuel, Consultant and groundnut breeder, ICRISAT, Nairobi.
During the chickpea scientists’ meeting at ICRISAT, participants selected a large number of breeding lines from various fields for further research. These lines will be supplied to them after harvest.

Dr GP Dixit, Project Coordinator, All India Coordinated Research Project (AICRP) on Chickpea presented salient achievements of AICRP on chickpea for the past two years. He expressed his concern on finding a replacement for the mega varieties such as JG 11 and JAKI 9218. He indicated that the current priority areas of AICRP on chickpea include utilization of wild species and the land races and restructuring of plant type with improved nutrient and water use efficiency. He emphasized on the use of molybdenum in chickpea grown after soybean, which showed promising results in several demonstrations across India.

The developments in chickpea research at ICRISAT with partners was explained by Dr Pooran Gaur, Theme Leader-Crop Improvement, ICRISAT, India. He highlighted the significant progress made in the development of breeding lines with improved drought and heat tolerance and suitability to machine harvesting.

A brief account of the strategies to attain chickpea self-sufficiency in India was delivered by Dr NP Singh, Director, Indian Institute of Pulses Research (IIPR). He emphasized on: enhancing area under rice-fallows; productivity gains (through adoption of improved varieties and production technologies); and policy support required to make farming profitable to farmers. He also emphasized that pulses should be brought into the public distribution system and mid-day meal schemes for providing nutritional benefits to children and economically weaker households.

A special session was organized on ‘Breeding Management System (BMS)’ in which Dr Abhisekh Rathore, Theme Leader-Statistics, Bioinformatics & Data Management, ICRISAT, India, and his team presented various features of BMS to the participants. The BMS is a suite of interconnected software specifically designed to help plant breeders manage their daily activities through all phases of the breeding programs.

During the closing session, progress on the advancement of transgenic chickpea and pigeonpea was discussed. It was also emphasized that dry root rot is emerging as a major disease of chickpea in central and southern India. There is a need to strengthen efforts for identification of sources of resistance from the germplasm of cultivated and wild species, and understanding variability in the pathogen.

The annual chickpea scientists’ meet took place at ICRISAT India on 5 - 6 January and was jointly organized by Indian Council of Agricultural Research (ICAR) and ICRISAT. Thirty seven scientists from 17 states of India, working in various ICAR institutes and state agricultural universities and 20 scientists from ICRISAT attended the meeting. The next chickpea scientists’ meet will be organized at IIPR, Kanpur in March 2018.

ICAR-ICRISAT partnership in chickpea improvement research has been effective in the development of improved varieties. The breeding materials supplied by ICRISAT to ICAR institutes and state agricultural universities have led to the release of 42 varieties (29 desi and 13 kabuli) in India. Nineteen of these varieties (JAKI 9218, JG 11, JG 14, JG 130, Virat, JG 16, Vishal, JG 6, KAK 2, RVG 201, JGK 3, RVG 203, JGK 2, Vaibhav, GG 4, Pratap Chana 1, Ujjawal, Himachal Chana 2, NBeG 3) are in the

![Scientists inspecting and selecting chickpea breeding lines.](image-url)
This work contributes to the UN Sustainable Development Goals

For more information on ICRISAT’s work on chickpea click here

Seed chain and have a share of 53% in the total indent of chickpea breeder seed in India for 2017-18. The scientists also visited various field experiments, laboratories and controlled environment research facilities. The meeting had aimed to bring together chickpea scientists from all over India for sharing knowledge on recent developments in chickpea research, and to provide an opportunity to Indian scientists for selecting breeding materials and germplasm of their interest from ICRISAT.

A study by ICRISAT reveals that there is reason for optimism on the pulse production side in India. While trends in the area under pulses did not increase significantly from 2000 to 2014, apart from some fluctuations in area, production has shown an upward trend.
Five bean varieties rich in iron and zinc were recently released for the first time in Uganda. These varieties included three bush and two climber growth types.

Prior to the release, 16 different bean varieties were evaluated for their yield potential, ability to accumulate micronutrients such as iron and zinc and farmer’s preferences. Five varieties that fulfilled all the test requirements were identified for release. These were MOORE 88002, RWR 2154, RWR 2245 (bush type), MAC 44 and Nyiramuhondo (climber type) varieties.

“The varieties, also known as NAROBEAN 1, 2, 3 4C and 5C, are an excellent source of iron. Instead of buying expensive supplements, communities can now buy and grow these beans as a way of boosting nutrition and reducing anemia (a major health concern in Uganda) knowing that they will get yield despite drought,” said Dr Stanley Nkalubo, Scientist and Head of bean research at the National Crops Resources Research Institute (NaCRRI), Uganda.

Evaluation of these varieties was conducted across six agro-ecologies in Uganda encompassing the central, southern, southwestern, eastern, northern and western regions. The Tropical Legumes III (TL III) project, led by ICRISAT, in particular played a great role in supporting the participatory variety selection process and variety demonstration trials.

Common bean breeders in the region identified short cooking time as a major trait demanded by consumers to save on time and energy required for cooking. Hence bean breeders prioritized the assessment of cooking time in all their breeding pipelines. To facilitate further development, two automated Mattson cookers were used to phenotype cooking time of developed breeding lines.

These varieties were developed and released by the Pan-Africa Bean Research Alliance (PABRA); the National Agricultural Research Organization (NARO) together with partners including HarvestPlus, International Center for Tropical Agriculture (CIAT), United States Agency for International Development (USAID)-Feed the Future and Tropical Legumes III (TL III).

Enhancing common bean productivity and production in Ethiopia, Tanzania and Uganda has been a primary focus of the TLIII initiative. This is achieved through strengthening research, providing training on common bean breeding principles, creating awareness on new variety release process...
and instituting capacity building programs for bean breeders. In addition, several field demonstrations of common bean varieties are being conducted in all three countries.

**Capacity building**

To create awareness of the policies and administrative processes that guide new releases, young researchers in Tanzania were trained on government policies on variety release, specific to legumes.

The training covered topics such as: (i) Distinctness, Uniformity and Stability (DUS) testing and characteristics, (ii) development of variety descriptors for DUS, (iii) highlights on use of farmer preferred variety selection (iv) seed quality control, (v) variety release and registration process, (vi) application of marker assisted selection (MAS) in breeding, (vii) seed legislation (seeds act and seed regulations), and (viii) regional seed trade harmonization acts.

This training on ‘variety release process’ was attended by 33 researchers (24 male and 9 female) from six Tanzanian research institutions: Agricultural Research Institute (ARI), Naliendele; ARI, Maruku; ARI, Selian; ARI, Uyole; CIAT; and Sokoine University of Agriculture (SUA).

A Mattson cooker is a standalone machine monitored by a computer and the test results are automatically recorded on the computer.

Cooking time is calculated when 80% of the beans are soft enough to be pierced through by pins i.e, when 20 of the 25 pins in the cooker have penetrated the seeds. The cookers have been utilized to assess cooking time of a set of 150 released bean varieties in the PABRA. Cooking time ranges from 28 to 100 minutes have been obtained.

Similar systems have been purchased for installation at three participating national programs (Melkassa Agricultural Research Center (MARC), Ethiopia; NaCRRI and ARI, Uyole).

As a further development of the semi-automated cooker, a thermometer has been integrated to capture temperature data during cooking process. This will help to standardize different types of cookers and electric supply variations.

For more details on the TLIII initiative [click here](#).

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**Project:** Tropical Legumes III  
**Investor:** Bill & Melinda Gates Foundation  
**Partners:** USAID-Feed the Future, CIAT, International Institute of Tropical Agriculture (IITA), national agricultural research system (NARS), partners from sub-Saharan Africa and India and ICRISAT.

This work contributes to the UN Sustainable Development Goals

1. **No Poverty**
2. **Zero Hunger**
3. **Good Health and Well-being**
4. **Partnerships for the Goals**

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*Photo: CIAT*  
Mattson cooker at CIAT-Kawanda.
New Projects

Improving Groundnut Seed Production Systems to Improve Livelihood and Nutrition Outcomes of Smallholder Farmers in Zimbabwe

Principal Investigator: Dr Kizito Mazvimavi
Duration: 19 Oct 2016 - 31 May 2017
Donor: Department for International Development (DFID) through Food and Agriculture Organization (FAO)
Description: The starting point needs to strengthen with the technology supply side of the value chain. Adoption of improved groundnut varieties, and allied management technologies leads to productivity gains, thereby increasing supply of grain to the market. Diverse groundnut varieties are needed for different agro-ecological and market needs. In Malawi, ICRISAT has released 7 improved groundnut varieties that have addressed different needs of the actors in the value chain. In order for Zimbabwean farmers to tap into the growing regional and local markets for groundnut, there is need to use modern varieties and improve production technologies.

Zimbabwe Resilient Building Fund - Enhancing Community Resilience and Sustainability (ECRAS)

Principal Investigator: Dr Kizito Mazvimavi
Duration: 1 July 2016 - 30 July 2019
Donor: United Nations Development Programme in Zimbabwe (UNDP Zimbabwe) through Cooperative for Assistance and Relief Everywhere (CARE) International
Description: CARE, Plan and ICRISAT propose to implement the Enhancing Community Resilience and Sustainability (ECRAS) project in Chiredzi and Mwenezi Districts, aimed at increasing the capacities of communities to sustain development gains and achieve improved well-being outcomes in the face of shocks and stresses. Through this project, ECRAS envisions the objective of enhancing Chiredzi and Mwenezi household and community resilience by improving their absorptive, adaptive and transformative capacities. By the end of the project, households and communities in the two districts will have increased capacity to access assets, opportunities and wider choices to improve their wellbeing outcomes and withstand shocks and stresses in a favourable enabling environment.

Sorghum Genomics Toolbox: TERRA Partnership

Principal Investigator: Dr Vincent Vadez
Duration: 16 September 2016 - 30 September 2019
Donor: Bill & Melinda Gates Foundation through Donald Danforth Plant Science Center (DDPSC), USA
Description: The Sorghum Genomics Toolbox is a new initiative funded by the BMGF which broadens the scope of earlier TERRA-REF project, funded by the Department of Energy (USA) and focused on bio-energy sorghum. The Sorghum Genomics Toolbox is focused on grain sorghum for SSA and aims at sequencing about 1000 genomes of diverse sorghum germplasm and at developing phenotyping hubs in Ethiopia in collaboration with EIAR, in Senegal in collaboration with CERAAS and CIRAD, and at ICRISAT-HQ in India. Phenotyping effort will combine both field phenotyping using multi-spectral imaging techniques (India, Ethiopia, Senegal), with platform-based phenotyping targeting key traits for crop adaptation (LeasyScan/LysiField at ICRISAT, PhenoArch at INRA Montpellier, LemnaTec platform at D Danforth Center in Missouri). This project is a rich partnership between leading national or regional research institute in SSA, together with CIRAD and ICRISAT, aiming at generating a rich source of genomic and phenomic information at different level of plant organization on a large and representative set of germplasm, opening opportunities to gear up the breeding of improved varieties for different regions of Sub-Saharan Africa.
New publications

Interpreting the Shared Socio-economic Pathways under Climate Change for the ECOWAS region through a stakeholder and multi-model process
http://oar.icrisat.org/9766/

Plant resting site preferences and parity rates among the vectors of Rift Valley Fever in northeastern Kenya
http://oar.icrisat.org/9843/

Are there “women’s crops”? A new tool for gender and agriculture
http://oar.icrisat.org/9792/

Integrated runoff and soil loss monitoring unit for small agricultural watersheds
http://oar.icrisat.org/9767/

What Do We Mean by ‘Women’s Crops’? Commercialisation, Gender and the Power to Name
http://oar.icrisat.org/9796/

Soil Nutrient Mapping for On-farm Fertility Management
http://oar.icrisat.org/9781/

Role of Heat Shock Proteins in Improving Heat Stress Tolerance in Crop Plants
http://oar.icrisat.org/9795/

Understanding the Linkages between Crop Diversity and Household Dietary Diversity in the Semi-Arid Regions of India.
http://oar.icrisat.org/9822/

Role of Pulses in Enhancing Nutritional Status of Rural Poor: Micro-Level Evidence from Semi-Arid Tropics of India
http://oar.icrisat.org/9821/

Mainstreaming Gender and Empowering Women in Agriculture in the Thar Region of India
http://oar.icrisat.org/9823/

Genotypic variation in soil water use and root distribution and their implications for drought tolerance in chickpea
http://oar.icrisat.org/9805/

Genome-Enabled Prediction Models for Yield Related Traits in Chickpea
http://oar.icrisat.org/9797/

Spectral matching techniques (SMTs) and automated cropland classification algorithms (ACCAs) for mapping croplands of Australia using MODIS 250-m time-series (2000–2015) data.
http://oar.icrisat.org/9859/

Modelling cereal crops to assess future climate risk for family food self-sufficiency in southern Mali.
http://oar.icrisat.org/9804/

The “efficient boundaries” of international agricultural research: A conceptual framework with empirical illustrations.
http://oar.icrisat.org/9787/

Incorporation of satellite remote sensing pan-sharpened imagery into digital soil prediction and mapping models to characterize soil property variability in small agricultural fields.
http://oar.icrisat.org/9813/

Assessing crop model improvements through comparison of sorghum (sorghum bicolor L. moench) simulation models: A case study of West African varieties.
http://oar.icrisat.org/9818/

Population Dynamics of Lobster Moth, Neostauropus alternus Walker on Pigeonpea in Relation to Abiotic Factors of Pantnagar Region.
http://oar.icrisat.org/9617/

Root traits confer grain yield advantages under terminal drought in chickpea (Cicer arietinum L.)
http://oar.icrisat.org/9803/
Reader’s comments

Surely sub-Saharan Africa cannot feed itself with conventional crop production practices. The new technologies will certainly assist in improving crop production. Africa is certainly grateful for the combined therapy, while we congratulate ICRISAT on the 45th anniversary. I am also involved in the Groundnut Upscaling project in Nigeria, and wish to further inform you that our groundnut farmers had really benefitted from the intervention not only with respect to increased oil content but also improvement in grain production in the country.

I look forward to receiving the next issue of Happenings while I also continue to expect to hear the development on our smart village proposal for north-western Nigeria.

Dr Lawali Abubakar

Thank you for this newsletter, with emphasis on community ownership and empowerment of market chain participation. The comment in one posting that the way the message is delivered is equally important as the technology itself, rings very true. The role of ICRISAT as a catalyst is critical for dissemination and adoption of innovations - with implications for engaging counterpart organizations and individual researchers as equals in project design, operation, and management. I commend ICRISAT for taking these approaches.

Mr DS Bisht

On irrigation I refer to the Report on Wheat Production and Marketing in Nigeria (1979) in which self-sufficiency for wheat seemed out of reach, and even more so now with population more than doubled, drastic contraction of lake Chad, and northern rivers in Nigeria under threat from climate change.

Dr Bob Redden

The DG’s video message concluding 2016 and looking forward to 2017 is very meaningful and focused. The write-up on making SSA self-sufficient in food grains is thought provoking. I think ICRISAT’s Watershed research and development in India highlights a sustainable integrated production system, which merits adoption and up-scaling with local adaptations in SSA.

It has all the essential components of natural and community management system. It matches available natural resources to an efficient production system integrating animal components, community participation and market orientation. It is an all-inclusive sustainable system merits consideration and further debate.

Thanks for sharing ICRISAT news, with best wishes and warm regards,