To increase the availability and accessibility of quality climate data in Mali an initiative titled ‘Enhancing National Climate Services’ (ENACTS) was launched recently. For the purpose, a workshop was held to introduce stakeholders to Mali weather station’s new data and web interface called the Mali Meteo Data Library and solicit their feedback.

The ENACTS initiative seeks to address the problem of declining quality of station climate data. A security crisis in the northern half of the country adversely affected climate data availability, particularly since 2012, which was further compounded by the low density of the weather station networks.

The initiative focuses on the creation of reliable climate information suitable for national and local decision making. Its main objective is to improve simultaneously the availability, access and use of climate information. The crux of the approach lies in collaborative work with the National Meteorological Hydrological Services (NMHS), blending national observations with satellite and other proxy data to improve the quality of their database and extend wall-to-wall coverage on a 5km grid.

Through ENACTS, products from climate data (rainfall and temperature) can freely be accessed via Mali Meteo’s Datatheque (French for Data Library) available at www.malimeteo.net. Users only need to specify the geographical coordinates of a target location to access diverse map room products pertaining to local climate (analysis, monitoring and forecast) and malaria historical analyses. This tool also provides a unique opportunity for stakeholders’ design of online custom analyses based on specific sectorial needs, using the available statistical tools. It is a flexible tool that still has room for more product development and improvement.

It is expected that the ENACTS initiative implementation in Mali will help achieve the following key objectives of the project Capacitating African Smallholder with Climate Services and Insurance Development (CASCAID):

- Building the capacity of NMHS to provide timely and reliable climate information
- Easing the implementation of the Participatory Integrated Climate Services for Agriculture (PICSA) approach in Mali – a sustainable approach, which provides smallholder famers with climatic information they don’t have access to, to manage climate related risks and improve resilience
- Generating merged data which may be used for improved food security sub-national outlooks – a novel
utilization the CASCAID project will test by calibrating the CCAFS Regional Agricultural Forecasting Tool (CRAFT) for a 100,000 km² area covered by the Compagnie malienne pour le développement des textil (CMDT) cotton parastatal in southern Mali.

Mr Djibril A Maiga, Director General, Mali Meteo, said that there is need for Mali Meteo to work hand in hand with stakeholders and research institutions to provide tailored products for better decision making. His views were endorsed by Dr Tufa Dinku, research scientist at International Research Institute for Climate and Society (IRI) and mastermind of ENACTS and Dr Ramadjita Tabo, Research Program Director, West and Central Africa and Country Representative Mali, ICRISAT.

However, relevant and salient new information products cannot be developed without the involvemente of a variety of actors alongside the NMHS: Sectorial government divisions, NGOs, Civil Society Organizations, research institutions, the private sector including telecom and agro-businesses all have a particular role to play in the development of a lively information value chain. “Mali Meteo needs to explore ways and develop investment strategies that could sustain such vision of new climate services product development, including the development of win-win private-public partnerships (PPP),” said Dr Robert Zougmore, Regional Program Leader - Africa region, Climate Agriculture and Food Security (CCAFS).

From all the challenging questions thrown in by a lively attendance, one Mr Yehia Abou from Direction Nationale de la Planification du Développement (DNPD) asked: “How will smallholders concretely benefit from these tools at the local level, and what are the mechanisms Mali Meteo intends to rely on to disseminate information to the last mile?” Clearly, while favorable climatic conditions is important for rainfed agriculture, a number of prerequisites need to be in place, most notably nutrient availability and accessibility, at the right time, and at the right price. “Until such conditions are met, smallholders fully realizing the value of quality climate information will remain a challenge. This shows the importance of mainstreaming the use of climate information, such as that provided by ENACTS, inside a larger ecosystem of farm services – rather than focusing on climate services as a standalone goal,” said Dr Pierre Sibiry Traore, Head-GIS, Bamako, ICRISAT and CASCAID project leader.

The workshop held on 3 November, was jointly organized by the CCAFS-funded CASCAID project led by ICRISAT and World Agroforestry Centre (ICRAF) and the United States Agency for International Development (USAID)-funded project Building Mali Meteo’s Capacity to Deliver Improved Climate Services, led by IRI.

As a next step, ICRISAT, IRI and Mali Meteo will organize in December a workshop for national members of the GTPA (Groupe de Travail Pluridisciplinaire d’Assistance agrometeorologique) and USAID project partners willing to discover and design customized sectorial information products out of Mali Meteo’s new ENACTS online tool.
Women farmers double incomes and enhance household nutrition by reclaiming degraded land

In eastern Niger, 241 hectares of degraded land was converted into productive farms for 10,770 women through the Bio-reclamation of Degraded Lands (BDL) system. This has resulted in a 50% increase in agri-income over non-BDL participants. These impacts are from a mid-term evaluation study conducted at the end of three years of a five-year project.

The results were shared with the local communities in 172 villages in the district of Mayahi (Maradi region) and Kantche (Zinder region) in a series of meetings over the past few months.

The initial results of the impact evaluation conducted by the ICRISAT socio-economics team show that the BDL system had a positive effect on women by giving them access to land and increasing their income. The 0.02 hectare piece of land allocated to each woman in the BDL plot of 1 ha resulted in an average increase in the household income of women participants by 14,345 FCFA (US$26) which is approximately a 50% increase over non-BDL participants. This does not include income from the forestry component, which if added raised the average household income to US$100.

The BDL system has an agroforestry component that incorporates high-value trees and vegetables in a holistic system, with the aim of reversing damage to soils caused by overgrazing and intensive farming. It is a climate-smart technology that helps regenerate the landscape by improving soil fertility through carbon sequestration via tree roots and reducing soil erosion.

The technology developed by ICRISAT had two main components – water harvesting techniques and high-value nutritious trees and annual crops. The water harvesting techniques included half-moons (demi-lunes) for trees, zai pits for annual crops and trenches for leafy vegetables. Through these techniques rain water was stored to sustain crops in the cropping season and trees in the dry period. The system also used micro-dosing of fertilizer in the zai holes to stimulate root growth of vegetable crops and promote better nutrient utilization. Examples of high-value trees and annual crops include drumstick tree (*Moringa oleifera*), pomme du sahel tree (*Ziziphus mauritania*), okra (*Abelmoschus esculentus*), hibiscus and sicklepod (*Senna obtusifolia*) among others.

Women’s groups and individuals who produced indigenous vegetables using BDL improved their incomes as well as their household nutrition. For example, the level of Vitamin A in 100g of *Moringa* is four times that of carrots, its protein content is twice the protein of yogurt and it has four times the calcium of milk. Households were also able to take advantage of the benefits in the same cropping year and did not have to wait for several years for trees and crops to start producing.

For more information about our work on agroforestry systems see Project: Programme d’Appui à la Sécurité Alimentaire des Ménages-Tanadin Abincin Iyali (PASAM-TAI) through water, sanitation and hygiene (WASH) program.

Investor: USAID through Catholic Relief Services (CRS)

Partners: GRET (Groupe de Recherche et d’Echange Technologique), Government of Niger (GoN) and CADEV Niger (Caritas Developpement), ICRISAT

CGIAR Research Program: Dryland Systems

This work contributes to the UN Sustainable Development Goals

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**Women participants with their harvest from crops grown on reclaimed land.**

*Photo: S Abdoussalam, ICRISAT*
Newly developed high biomass sorghum and pearl millet a boon to 2G biofuel production in India

The advantages of newly developed high biomass sorghum and pearl millet developed by ICRISAT and Indian Institute of Millets Research (IIMR) for use as feedstock in second generation or lignocellulosic (2G) biofuel production in India was highlighted at a recent workshop.

The advantageous traits of these dryland crops are wider adaptability, fast growth, high biomass production potential, resilience to drought, and non-compromise on food security as the grain is used for human consumption. The use of these crops in biofuel production has the potential of improving incomes of Indian farmers in the semi-arid regions.

India is a signatory to the UN Climate Change Paris Agreement (COP21) and biofuel production is one of the thrust areas identified to reduce greenhouse gas emissions. The country’s ethanol production is mainly from sugarcane molasses. However, considering severe water shortages there is limited scope to increase the production of this water-intensive crop. Hence there is a need to develop newer feedstocks along with supply chain mechanisms and optimized biomass processing technologies for establishing commercial 2G biofuel plants. These plants need to have the capacity to produce sufficient ethanol to augment the blending demands of the country. The government’s current goal is to blend 5% of ethanol in gasoline across the country and increase the blending percentage to 10% in the short run and up to 20% in the next five years.

To develop an action plan to address the above issues, 70 participants representing the Government of India, industry and academia cutting across various specializations met at ICRISAT headquarters.

The main objectives of the workshop were –

- To develop a road map for meeting the Government of India’s blending targets (10% by 2017) using lignocellulosic ethanol production (the current status is 3.5 -5.0% blending).
- Creating a sustainable biomass supply chain to ensure unhindered supply of feedstock for all the proposed lignocellulosic ethanol plants to be set up by Indian public sector oil marketing companies (Hindustan Petroleum Corporation Limited, Bharat Petroleum Corporation Limited and Indian Oil Corporation Ltd).

Participating organizations such as ICRISAT, IIMR, Central Salt and Marine Chemical Research Institute (CSMCRI), and Reliance Industries have carried out significant research in biofuel feedstock production and provided critical inputs to the discussion.
ICRISAT’s work in partnership with IIMR and distilleries over the years on developing sweet sorghum value chain for first generation (1G) ethanol production was highly appreciated. The group suggested that the 2G commercial plants proposed to be set up can take the learnings from sweet sorghum improvement, crop production, supply chain management and commercialization in exclusive distilleries and in sugar mills for ethanol production. Currently, the estimated production of ethanol in India is in the range of 2.5-3.0 billion liters which is primarily used for potable alcohol, chemical industries and for ethanol blending. It is the first time that key stakeholders met on a single platform and chalked out an action plan on 2G biofuels. The wrap-up session held at IIMR called for unified action through this platform to make 2G biofuel a successful model in the country.

The two-day workshop “Creating sustainable biomass supply chain for the proposed Lignocellulosic (2G) Ethanol projects undertaken by Oil PSUs” was held on November 15 and 16. It was organized jointly by the Working Group on Biofuels, Ministry of Petroleum and Natural Gas, Department of Biotechnology, Government of India and ICRISAT.

For more on sweet sorghum

This work contributes to the UN Sustainable Development Goals

Exploring the potential of data driven agriculture in increasing farm productivity and profitability

Scientists, researchers, members from the industry and administrators from the public sector came together at ICRISAT in an international conference to ask the big question: How to ensure modern innovation and digital agriculture increases farm productivity and profitability of resource poor farmers? The international conference kick-started with a unanimous agreement that breakthroughs in science and technology must be realized keeping farmers in mind and such breakthroughs along with their applicability must be communicated adequately to reach their full impact.

The deliberations of the conference focused on how science can improve and develop agriculture, not only in terms of high yielding varieties and pest resistant crops but also in terms of providing accurate and crucial information that farmers require. Information on when to sow and how much fertilizer to use, factoring in impacts of region specific ecological developments and climate change is important. Accessibility of such vital information at the right time by farmers can define the threshold between yield and increased profits. The first step to ensure access of agriculture related scientific information requires accumulating necessary data and subsequent analysis. Therefore, the conference focused primarily on opportunities that exist for smart information systems and big data application in agriculture improvement. The next step would be management of big data to help solve developmental issues pertaining to agriculture and in achieving the sustainable development goals.
The application of information technology to analyze biological data and to extract biological meaning from that data was one of the key themes of the conference. Dr Kelly Robbins, Director, Genomic and Open-source Breeding Informatics Initiative (GOBII), Cornell University, emphasized on high throughput genotyping to not only understand crop genetic diversity, but also the opportunity to sequence staple food crops.

Dr David Bergvinson, Director General of ICRISAT touched upon the topic of large-scale phenotyping. “Our ability to track moisture accurately, to capture photosynthesis in a precise manner so we can unpack the optimization of water resources for biomass accumulation, green production and steadying the root system, making sure that we can optimally design a plant that enables us to manage our water responsibly and for the planet to withstand periods of drought, will be an increasingly important issue,” he said.

Dr Robbins pointed to the opportunity and complexity in statistical approaches to relate phenotype to genotype with substantial accuracy. In this background, he introduced the Genomic Open-source Breeding Informatics Initiative (GOBII) which specifically focuses on enhancing the capacity of public-sector breeding programs (see box).

In the realm of big data analytics, Mr Prashant Gupta, Principal Director, Microsoft Cloud and Enterprise Division, India, elaborated on the opportunity to instrumentalize intelligent cloud to transform agriculture steered to positively impact farmers with small land holdings. Mr Gupta explained that intelligent cloud offers an open and flexible platform with a global reach, to which scientists from any part of the world can contribute or access. He presented two examples of data driven agriculture: Farmbeats focuses on four aspects- farming-yield estimation, precision irrigation, pest-infection and fertilizer application. Data required to advice on those four aspects are acquired from the farm and collected on cloud using TV White Space technology. At the farm level a white space device such as a router is installed by the farmer that would facilitate data collection on soil moisture, nutrient content, etc.

The second example Mr Gupta cited was the new sowing app developed by Microsoft in partnership with ICRISAT and the Government of Andhra Pradesh. This app is intended to advise farmers on soil health, fertilizer recommendation and seven-day weather forecast. The app runs on forecasting models equipped with historical region specific weather and ecological data. The sowing app is currently in a controlled experimental phase being implemented in selected villages of Andhra Pradesh.

For more information on the sowing app, click [link]

Dr UC Sud, Director Indian Council of Agricultural Research (ICAR)-Indian Agricultural Statistics Research Institute and honorary secretary of Indian Society of Agricultural Statistics (ISAS) announced that a special issue of the peer reviewed international journal of ISAS will be released for the conference proceedings.

The international conference titled – Statistics & Big Data Bioinformatics in Agricultural Research was held at ICRISAT headquarters from 21-23 November chaired by Dr Abhishek Rathore – Theme Leader, Biometrics. This conference was organized in association with the Indian Society of Agricultural Statistics (ISAS) on the occasion of its 70th year of operation.

Other dignitaries who attended the event were: Dr Padam Singh, former member of National Statistical Commission and Executive President - ISAS; Dr S Ayyappan, former Secretary Department of Agricultural Research and Education - Ministry of Agriculture and Farmers Welfare and Director General ICAR and President ISAS; Dr K Alagusundaram, Deputy Director General, Agricultural Engineering, ICAR; Dr Jeffrey Ehlers, Senior Program Officer Bill and Melinda Gates Foundation; and Ms Joanna Kane-Potaka, Director - Strategic Marketing and Communication, ICRISAT.
Popularizing millets among urban consumers in India

About 50 media representatives and bloggers engaged with industry experts and state government officials concluding that while the value of millets is high, awareness is low and modern ways to use them are yet to be fully discovered. This was the first curtain raiser event to develop a campaign to popularize millets with new products ranging from millet ice cream to millet pasta and muffins on the menu and the agenda.

The campaign is an initiative of the Karnataka Government of Agriculture and was the result of a roundtable discussion with food processors in August this year to identify the opportunities and hurdles to develop the millet industry. ICRISAT and the Indian Institute of Millet Research (IIMR) will coordinate the campaign.

Mr Krishna Byre Gowda, Minister for Agriculture, Government of Karnataka, noted that, “We are working closely with farmers but this is not enough as we also need to look at the whole value chain. But nothing will work if we do not satisfy the different needs of consumers and the media are key in both communicating what people want as well as building awareness about millets.”

“The public have an increasing level of consciousness about the environment and the challenges that will come with climate change like higher temperatures and more droughts. What few consumers know is how environmentally friendly millets are with a low carbon footprint and a low water footprint and being so hardy they are some of the last crops standing in times of drought,” stressed Dr Vilas Tonapi, Director, IIMR.

Dr Bhaskarachary, Senior Scientist, National Institute of Nutrition, noted, “The dangerous rise in diabetes in India making it the diabetic capital of the world means we need to seriously look at our diet. Along with the need for weight control, millets are a great solution for both, being slowly digestible with a low Glycemic Load (GL). However millets also have many benefits to keep us healthy with high levels of many vitamins, minerals and antioxidants.”

Steps needed to popularize millets were debated with a robust discussion at the end. Some of the key focus areas included:

- Building awareness with consumers and especially building a positive and modern image of millets was seen as critical. Urban areas were seen as key in this process as they are the aspirational markets and set the trends in the rural areas as well.
- The need for a credible common information source about millets, especially the nutritional benefits.
- National level minimum price support that covers at least the costs of production but should also cover the social benefits of millet.
- Product development of convenient modern products that keep the nutritional value of millets and are healthy; also of nutrient dense products and sports energy foods.
- Developing better equipment for mechanization; however it was also noted that the existing mechanization is not fully utilized and awareness needs to be raised.
- Support for rural processing facilities to be set up.
- As women are often the millet farmers, mechanization and processing developments that target and are designed for women were recognized as important to include.

The Minister reiterated his commitment behind this movement to popularize millets, with a collective approach needed to make a major impact.

Hear what urban consumers say: Click on the below video links

Mary Rose Abraham - Independent journalist; Maya - Editor Earth Magazine; Ayan Acharya - Trainee journalist NSJ; Dwiji Guru - Technology developer SSA; Manav - IT professional

This work contributes to the UN Sustainable Development Goals
The impact of 256 new legume and 119 dryland cereal varieties developed and released in partnership with National Agricultural Research Systems under two CGIAR Research Programs – Grain Legumes, and Dryland Cereals, were reviewed at a meeting held recently. The review covered research efforts that helped improve farmers’ productivity and consumption of 12 crops in 40 countries in sub-Saharan Africa, South and South Asia, and Latin America and the Caribbean (see graphic on page 8).

The two global CGIAR research programs led by ICRISAT were launched in mid-2012 in response to the global challenges of hunger, malnutrition, poverty and climate change. With a strong global partnership with organizations such as the International Center for Tropical Agriculture (CIAT), International Center for Agricultural Research in the Dry Area (ICARDA), International Institute of Tropical Agriculture (IITA) and National Agricultural Research System partners, the knowledge, expertise, and experience from stakeholders in the public and private sectors, governments and farmers worldwide was brought together.

The legume crops include chickpea, common bean, cowpea, faba bean, groundnut, lentil, pigeonpea and soybean. The new legume varieties and hybrids were developed for traits such as drought, heat, herbicide, low phosphorus tolerance, early maturity, insect resistance, machine harvestability and high nitrogen fixation. Other key areas of intervention included developing productive management systems, facilitating legume seed and technology delivery systems, enhancing post-harvest processing and market opportunities; gender mainstreaming, fostering innovation and managing knowledge.

The dryland cereals include barley, finger millet, pearl millet and sorghum. Biofortified cultivars and those suitable for malting and use as fish feed and green gram were developed. The interventions included integrated Striga management, microdosing, motorized seeder, parasitoid wasps for tackling pearl millet head miner, double cropping, conservation agriculture, usage of sprinklers, and formation of seed consortia among others.

The two programs completed their first phase in December 2014 and are currently in a two-year extension phase. Delivery of outcomes and impact from the two programs has been significant since their inception.

More than 125 key stakeholders that included global partners, scientists, Steering and Advisory Committee members of CGIAR Research Programs on Grain Legumes, and on Dryland Cereals attended the three-day meeting held in early October 2016 at ICRISAT, India. A poster session with about 81 posters highlighted the scientific achievements of the programs. All presentations and posters can be accessed at: http://grainlegumes.cgiar.org/grain-legumes-review-meeting/

At the three-day review meeting, the coordinators of the 15 game-changing product lines of Dryland Cereals and Grain Legumes presented the progress in their areas of research (see links below). Dr Shoba Sivasankar, Director, CRPs Grain Legumes and Dryland Cereals presented the highlights of the two programs. Dr Jill Findeis, Director, Division of Applied Social Sciences at University of Missouri, USA and Chair, Steering and Advisory Committee for Grain Legumes; Prof. Peter Langridge, University of Adelaide, Australia and Chair, Steering and Advisory Committee for Dryland Cereals; Dr Ylva Hillbur, Deputy Director General, International Institute of Tropical Agriculture (IITA); Dr Steve Beebe, Program Leader, Agrobiodiversity Research Area, Bean Program, International Center for Tropical Agriculture (CIAT); Dr Michael Baum, Director, Biodiversity and Integrated Gene Management Program, International Center for Agricultural Research in the Dry Areas (ICARDA); and Dr David Bergvinson, Director General, ICRISAT, participated actively in the proceedings.
The poster presentation sparks a lively debate.

### Achievements of Dryland Cereals: 2012 to mid-2016

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
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<tbody>
<tr>
<td>Number of New Cereals Released</td>
<td>85 varieties, 34 hybrids</td>
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<tr>
<td>Seed Produced / Distributed (CPM facilitated)</td>
<td>14,386 metric tons</td>
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<tr>
<td>Management Practices Demonstrated</td>
<td>34</td>
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<tr>
<td>Area Covered by Improved Varieties</td>
<td>8,701,562 ha</td>
</tr>
<tr>
<td>Total Number of Publications</td>
<td>217</td>
</tr>
<tr>
<td>Farmers at Farmer Field Days</td>
<td>67,394, 18,372 women</td>
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<tr>
<td>Trainees in Short-Duration Training Programs</td>
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<tr>
<td>Students Completed Master’s Training</td>
<td>28</td>
</tr>
<tr>
<td>Students Completed PhD Training</td>
<td>24</td>
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### Achievements of Grain Legumes: 2012 to mid-2016

<table>
<thead>
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<th>Category</th>
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</thead>
<tbody>
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<td>Number of New Cereals Released</td>
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<td>Seed Produced / Distributed (CPM facilitated)</td>
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<td>Management Practices Demonstrated</td>
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<td>Demonstration Trials for Management Practices</td>
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<td>Total Number of Publications</td>
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<td>Farmers at Farmer Field Days</td>
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<td>Trainees in Short-Duration Training Programs</td>
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<td>Students Completed Master’s Training</td>
<td>129, 83</td>
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<tr>
<td>Students Completed PhD Training</td>
<td>150, 45</td>
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New improved pigeonpea variety released in Zambia to withstand climate change

A new medium duration pigeonpea variety MPPV 2 (ICEAP 00554) was released for general cultivation in sole and intercropping systems of Zambia. The new variety has many profitable traits. It has wider climate adaptability and pest tolerance, high yield potential, attractive grains and is suitable to ratooning and can be used as green peas. Pigeonpea is gaining popularity in Zambia, due to its climate adaptability, suitability to prevailing cropping systems, farmers and consumers preference and market opportunities.

MPPV 2 is a distinct, stable and uniform variety with non-determinate and semi-spreading growth habit. It flowers in about 85-90 days and matures in 150-160 days. Each pod contains 6-7 seeds. Shellability of green pods is excellent and the variety is suitable for ratooning. Seeds are large white/cream with 100-seed mass of 17-19 g. It has excellent dehulling quality of up to 85% and therefore suitable for processing. The potential yield of immature grain is 7-10 tons per hectare and dry grain is 1.8-3.4 tons per hectare.

For over 15 years, Zambia had only one officially released improved pigeonpea variety which was of long duration. Over the years the yields from this variety started dwindling due to climate change characterized by shorter seasons. Therefore the new variety was released by fast tracking efforts after several on-station trials, farmer participatory varietal selection trials, large-scale demonstrations and seed bulking.

ICRISAT through the I-FINITE project funded by Feed the Future (FtF) Zambia, provided two sets of medium-duration pigeonpea nurseries from where five entries including ICEAP 00554 were advanced to National Performance Trials by Zambia Agriculture Research Institute (ZARI) through APPSA project. After good performance across different agro-ecological zones of Zambia, the variety ICEAP 00554 was submitted for release and it was officially released on 14 October by the Variety Release Committee under the aegis of Seed Control and Certification Institute.

The release is the result of team work by researchers at Msekera Research Station of Zambian Agricultural Research Institute, ICRISAT-Malawi and ICRISAT-Nairobi.

For more information on our work in Zambia
For more information on pigeonpea

This work contributes to the UN Sustainable Development Goals
Farmer preferred improved varieties demonstrated in Niger

Open pollinated improved varieties of pearl millet, sorghum and cowpea were demonstrated to farmers in the Tillabéri region of Niger during the rainy season of 2016. These new varieties had improved grain yield and early maturity.

All improved varieties were compared to farmers’ local check with at least two objectives: (i) to introduce new varieties to young men and women farmers and expose them to the benefits of improved varieties over local landrace varieties, and (ii) to identify preferences of female and male farmers on each crop variety.

A total of 63 demonstration sites across 21 villages and five communities were covered by five ICRISAT pearl millet varieties (ICMV IS 89305, ICMV IS 94222, ICMV IS 89001, ICRI-Tabi and ICMV IS 94206), three improved varieties of sorghum (IRAT-204, SSD35 and Mota Maradi) and three improved varieties of cowpea (TN-5-78, IT-90K-372-1-2 and IT97K-499-38).

Performance of the demonstrated high yielding varieties was welcomed by all farmers and participants from non-governmental organizations (NGOs) and National Agricultural Research System (NARS). Not only did the participants note the selected varieties of their choice but also requested improved seeds for the next rainy season. Discussions were held around the requirement of improved seed varieties by each village and on how to produce adequate quantity of varieties.

Farmers were trained on biological control of the millet head miner moth, a common pest found in West Africa that infests millet crops during flowering phase resulting in yield losses. Farmers were supplied with parasitoid wasp bags to protect their crops.

Farmer fairs were organized in each demonstration village from 28 September to 7 October. The fairs focused on the potential of each improved variety and provided an opportunity for farmers to tour through demonstration sites and rate the varieties of their preference. These ratings were shared with NARS partners, village heads, project partners and NGOs. The next step would be to establish seeds sale points in the villages for farmer preferred varieties for the 2017 cropping season.

A total of 1,500 participants (500 women and 1,000 men) attended the field visit. The demonstrations and farmer fairs were part of the McKnight Foundation supported ‘Niger Seed Systems Project for Pearl Millet and Legumes’. These activities were conducted in collaboration with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)-Niger ASAP (Appui à la Sécurité Alimentaire des Populations) project which is an initiative of the Niger-German cooperation to provide assistance to households affected by food insecurity.

For more information on our work in Niger see
For more information about our work on Sorghum see
For more information about our work on Pearl Millet see

CGIAR Research Program - Dryland Cereals and Grain Legumes
Project – Niger Seed Systems Project for Pearl Millet and Legumes
Donors – McKnight Foundation and GIZ-Niger
Partners – GIZ- ASAP Niger, NARS and ICRISAT

This work contributes to the UN Sustainable Development Goals
Leading Zimbabwe farmers out of poverty and equipping them to face future shocks

Policy makers, researchers and agricultural extension workers came together to learn how to develop future farm scenarios and co-design pathways that will lead Zimbabwe farmers out of poverty and equip them to face future climate and economic shocks. As part of the workshop activity, the group reviewed contrasting pathways that might shape the future of farming in Zimbabwe and came up with Representative Agricultural Pathways and Scenarios (RAPS) (see box).

Need for gender-inclusive policies

The workshop specially focused on gender and nutrition. The impact of national level policies to shape the future of women in farming was among the issues discussed. “Women carry the major burden of farming in Zimbabwe and there is no sign that this is going to change in the future; it might rather increase as male labor leaves rural areas for wage labor opportunities. Hence, what would it mean if policy evolved to ensure women equal control over resources, production factors and information? What would be the implications for food security and nutrition?” These questions were raised by Dr Amy Sullivan, Bridgewater Consulting, AgMIP stakeholder liaison.

Leveraging uptake of climate-adaptation technologies

The importance of sharing information on technologies was also stressed in one of the sessions. “Informing crop improvement programs is critical, especially for supporting the highly vulnerable smallholder farmers in marginal areas to adapt to climate variability and change,” said Dr Dumisani Kutywayo, Director Crops Research Division, Department of Research and Specialists Services.

Mr Ben Mache, Head of Crops Agricultural Technical and Extension Services said that such dialogues help to create conditions and mechanisms that can leverage uptake of technologies and cater to shock situations, in preparation for agriculture under future climate scenarios.

In this context, the importance of web-based tools was stressed. Special mention was made of the Agricultural Model Intercomparison and Improvement Project (AgMIP) tool ‘Impacts Explorer’ to make information available to a broad range of users, and for revision and adjustment processes (www.agmip.org).

The science behind RAPS

Presenting the science behind RAPS, Dr Roberto Valdivia, Economist, Co-leader of the AgMIP regional economics team, Oregon State University, said it is a structured research-led approach to inform solutions across national and local scales. “It is an important source of information that can guide future decisions about crop and livestock production, illustrating supply and demand at national and international markets in order to meet future requirements. It can guide policy processes and facilitate dialogue with research towards integrated farming systems,” said Dr Reneth Mano, Agricultural Economist, Livestock and Meat Advisory Council, Zimbabwe.

Sharing the scope of the AgMIP project Dr Sabine Homann-Kee Tui, Scientist, Markets, Institutions, Nutrition & Diversity, ICRISAT, and Principal Investigator, Crop Livestock Intensification Project (CLIP), highlighted the CLIP project in Nkayi district as a regional case study that looks at options for redesigning mixed crop-livestock farming systems facing climate change.

The workshop titled “Future scenarios to inform decision making processes: National RAPs for Zimbabwe” was held as part of the AgMIP project, which aims at understanding climate change impacts and prioritizing effective adaptation strategies. The sessions covered relevance for future farming beyond the AgMIP focus on climate change which included the future state of the environment, distribution of wealth and gender inclusiveness.

The workshop was held at the ICRISAT-Zimbabwe office on 25-26 October. Participants represented Department of Research and Specialist Services, Department of Climate Change, Meteorological Service Department, Agricultural Technical and Extension Services, Department of Livestock Production and Development, Ministry of Women Affairs, Department of Economics and Markets, Livestock and Meat Advisory Council, UNDP and Nkayi Rural District Council.

The AgMIP Crop Livestock Intensification Project (CLIP) team facilitating this workshop included researchers from
Contrasting scenarios for developing RAPS

Two contrasting pathways “Greener Pastures” and “Thistles and Thorns” were defined by the participants

“Greener pastures” was defined as a future towards sustainable development, slow and inclusive agricultural growth, strong engagement of farmers’ unions and the private sector. Women would play a strong role in agriculture, which would directly translate into greater diversity in production, food and nutrition security, supported by policy directives that promote inclusive agricultural development. Given assumptions of rapid economic growth dominating social and environmental considerations the future in Zimbabwe would look very different.

“Thistles and Thorns” was illustrated as a future with islands of highly productive areas, while most people would be driven into marginal lands, impoverishment of the bottom poor. Under this more aggressive approach to development, women would be largely excluded from decisions, vulnerable groups securing their livelihoods off-farm, stronger rural urban migration. There would be trade-offs between export oriented cash crops and nutrition.

Both, the “Greener Pastures” and “Thistles and Thorns” worlds were assumed to have a queen in one case and a king in the other. Participants were divided to be part of those kingdoms, adopting the role of advisors, to make sure that policies, institutions and technologies would follow the socio-economic and biophysical trends to arrive at these future worlds. The participatory and interdisciplinary approach enlightened the scenario development process across national and district scales.

Participants experienced how scenarios can provide useful information for future oriented priority setting for both research and policy making. “Generating RAPS illustrated the need for better streamlined two-way dialogue among researchers and policy makers. Co-designing RAPS is necessarily iterative, and requires feedback from stakeholders. It is important that RAPS represent trade-offs between economic growth, social and environmental consequences,” said Dr Valdivia. They must be explicit on drivers that define the levels of wealth distribution, equity vs manifestation of ‘have’ and ‘have nots’. Specific organizations can then use the RAPS for shaping their own investments and strategic plans.

ICRISAT, Matopos Research Institute, ICRAF, National University of Science and Technology, Institute for Development Research and Lilongwe University of Agriculture and Natural Resources.

The workshop was supported by DFID, CLIP research team, AgMIP, Columbia University, Oregon State University and ICRISAT.

For more information on our work in Zimbabwe see here
For more information on development pathways see here

Project: Re-designing smallholder crop-livestock systems in semi-arid Southern Africa to address poverty and enhance resilience to climate change: Stakeholder driven integrated multi-modeling research
Investor: DFID, in partnership with the US Department of Agriculture, Agricultural Research Service.
Partners: ICRAF Lusaka, Plant Production Systems group-Wageningen University, University of Cape Town, Matopos Research Institute, National University of Science and Technology, Institute for Development Studies, Lilongwe University of Agriculture and Natural Resources, Instituto de Investigação Agrária de Moçambique.

CGIAR Research Program: Dryland Systems; and Policies, Institutions and Markets
Strengthening the ‘End Hunger’ campaign in Kongwa, Tanzania

Lending support for the *Ondoa Njaa Kongwa* (End hunger Kongwa) campaign regional and international agricultural research institutes shared research results from key initiatives in the region at a meeting held recently.

The research results presented were on: aflatoxin mitigation, food safety and market competitiveness, gliricidia-pigeonpea legume technologies, maize-pigeonpea intercropping using phosphorus fertilizer microdosing, improving poultry genetics and feeding for enhanced productivity, integrated crop and livestock management technologies, and improved seeds for quality protein maize among others. The results were presented by representatives from Hombolo Agricultural Research Institute, Selian Agricultural Research Institute and ICRISAT.

The researchers also emphasized on the importance of scaling up techniques such as mother-baby techniques, farmer field schools, demos, field days and Going Beyond Demos (GBDs).

The Kongwa District Council initiated the movement and named the ICRISAT-led Africa RISING project as the backbone of the campaign to end hunger in the central Tanzanian district of Kongwa. The participatory research approach adopted for solving crop and livestock production challenges in the region were appreciated by Mr Deogratias Ndejembi, District Commissioner, Kongwa. He said the project came at the right time to catalyze the campaign by leading a collaborative scaling up of proven crops and livestock technologies.

The Africa RISING program is being implemented in the semi-arid areas of Kongwa and Kiteto districts in Tanzania by ICRISAT in partnership with ARI-Hombolo, Sokoine University of Agriculture (SUA), and University of Dodoma (UDOM), the International Centre for Maize and Wheat Improvement (CIMMYT) and the World Agroforestry Centre (ICRAF). The campaign meeting was held on 20-21 October.

For more information on our work in Tanzania
For more information on nutrition see [here](#)

This work contributes to the UN Sustainable Development Goals

![UN SDG icons]

2 Zero Hunger
3 Good Health and Well Being
17 Partnerships for the Goals
Malian farmers keen on adopting agroforestry and contour bunding techniques

Agroforestry systems for growing nutritious local trees and crops for feed and fodder, and contour bunding technologies for preventing soil erosion caught the attention of farmers attending field days in two districts in Mali. The events were organized by two technology parks to showcase and review innovations and technologies developed and tried over a period of two years.

Women farmers like Ms Mariam Sarah from Sirakele village were interested in technologies related to nutrition. Mr Kalifa Coulibaly, the Mayor of M’Pessoba, stressed on encouraging women to be more involved in the nutrition program. “The nutrition research of the Africa RISING project is very important to help our district address the problem of malnutrition. The technology park is a learning school that will help promote local crops and the nutrition field schools offer an opportunity to enrich and diversify the household diet,” he said.

Two farmers from M’Pessoba village in Koutiala district, Mr Daouda Diallo and Mr Dramane Dembélé, were impressed by the contour bunding technology and said they were ready to adopt it on their fields. Mr Diallo wanted to use the technology on his one-hectare barren plot and transform it into a silvipasture (combining forestry and grazing pastures). Mr Dembélé wanted to try contour bunding to control soil erosion in his field as heavy rains often wash away the top soil taking away with it nutrients and the seeds that are sown. He also plans to implement crop-livestock integration on his farm.

Apart from featuring the above technologies, presentations on trials of sorghum, groundnut, cowpea, maize and vegetables; land and water management technologies; food banks and adapted trees species were made. Over 300 participants, mainly farmers, development and extension agents, students and local authorities, actively took part in the discussion sessions on the technologies, the challenges and opportunities for their implementation and possibilities of scaling out.

“We have gained knowledge that will help us in our studies. Visiting this park is a great learning opportunity on various technologies that we have learnt in the classroom,” said Mr Abdoulaye Keita, a student of the Centre d’Apprentissage Agricole (CAA) that specializes in training extension agents.
Dr Ramadjita Tabo, Research Program Director, West and Central Africa and Country Representative, ICRISAT-Mali, emphasized on the role of youth in agricultural development. Mr Oumar Samake, interim director, AMEDD (Association Malienne d’Eveil au Développement Durable) reiterated the need for encouraging youth. “I am glad to see the involvement of participants in the park’s work and the interest it creates among visitors. This demonstrates that we are prepared for tomorrow’s agriculture. The future belongs to the youth and this park is an opportunity they can take to prepare themselves better. In this park which proved to be a platform for mutual sharing, we are currently laying the groundwork for tomorrow’s agriculture,” he said. Other important participants at the event included Mr Elisé Goita, representative of Bougouni agriculture office and Mr Siriki Sidibé, Vice-president, District Council, Bougouni.

The field days were organized on 28 September in Flola, Bougouni district and on 12 October in M’Pessoba, Koutiala District.

Dr Irmgard Hoeschle-Zeledon, Manager, Africa RISING West Africa and East/Southern Africa Projects and many members of the project-managing group attended the visits.

For more information on our work in Mali

**Project:** Africa Research in Sustainable Intensification for the Next Generation (Africa RISING)

**Investor:** USAID

**Partners:** International Institute of Tropical Agriculture (IITA), World Agroforestry Centre (ICRAF), World Vegetable Center, International Livestock Research Institute (ILRI), Center, Institut d’Economie Rurale (IER) NGOs – Association Malienne D’Éveil au Développement Durable (AMEDD), Améliorer la sécurité alimentaire et la souveraineté alimentaire au Mali (AMASSA Afrique Verte), Groupe de Recherches d’Actions et d’Assistance pour le Développement Communautaire (GRADECOM), Centre d’Appui d’Autopromotion et de Développement (CAAD), FENABI farmers’ organization and ICRISAT.

This work contributes to the UN Sustainable Development Goals

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The cooking of enriched porridge, which was part of the nutrition field school activity, attracted lot of attention at the field day organized in Sirakele village, Koutiala district, Mali.
Large-scale testing of rust-resistant groundnut lines suggested by Karnataka agriculture minister

With the groundnut lines improved for rust resistance developed by ICRISAT and partners (see box) performing very well in the state of Karnataka, Mr Krishna Byre Gowda, the agricultural minister, suggested that the next step was large-scale testing in the farmers’ fields. Mr Byre Gowda visited the trial plots of molecular breeding lines in groundnut at the University of Agricultural Sciences (UAS)-Dharwad.

The three popular groundnut varieties namely ICGV 91114, TAG 24 and JL 24 were successfully improved for rust resistance by using molecular breeding approach. Promising lines were nominated for the first time in the All India Coordinated Research Project on Groundnut (AICRP-G) of Indian Council of Agricultural Research (ICAR) and these lines are under evaluation at different locations of India, including UAS-Dharwad.

The selected groundnut introgression lines recorded higher pod yield over the state check varieties, GPBD 4 and G 2-52, under both irrigated and rainfed conditions. The introgression lines recorded pod yield of 6.8 tons per ha which is 26% higher than GPBD 4 (5.4 tons per ha) and 46% over G 2-52 (4.8 tons per ha) under irrigated conditions. Under rainfed conditions, introgression lines recorded a pod yield of 5.8 tons per ha, which is 29% higher than GPBD 4 (4.1 tons per ha) and 40% over G 2-52 (3.6 tons per ha) under rainfed conditions.

The delegation that accompanied the minister on 24 October included Dr DP Biradar, Vice Chancellor, UAS-Dharwad; Dr PM Salimath, Vice Chancellor, UAS-Raichur; Mr Ashok Dalwai, Additional Secretary, Ministry of Agriculture and Farmers Welfare, Government of India and many other senior officials from UAS-Dharwad. The ICRISAT delegation included Dr David Bergvinson, Director General; Dr Rajeev K Varshney, Research Program Director-Genetic Gains; Dr SP Wani, Research Program Director, Asia Program and Theme Leader, IDC; Dr K Krishnappa, Resident Scientist and Dr Manish Pandey, Scientist-Groundnut Genomics. The team from UAS-Dharwad included Dr HL Nadaf, Dr Ramesh Bhat and other senior scientists.

For more information on groundnut click here
For previous work on groundnut breeding click here
**Exploring collaborations**

The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) and ICRISAT agreed to explore collaborations in the following focus areas – mapping out the agricultural human capacity needs in their respective member countries; deployment of ICT in agricultural training, research and extension; intensifying research on climate change especially climate smart agriculture, “orphaned” crops and nutritional security; establishing business incubation and entrepreneurship mentorship programs and attachment of graduate students to ICRISAT research programs. The operationalization of the above will be guided by the existing Memorandum of Understanding signed by ICRISAT and RUFORUM in September 2014. This event took place on 17 November at the RUFORUM Secretariat.

**Web updates**

**Agri-buzz**

**New blog**
The “so what” question: Integrating and communicating gender research

Dr R Padmaja, Senior Scientist - Gender Research, Markets, Institutions, Nutrition & Diversity Innovation Systems for the Drylands Program, ICRISAT

I believe it is imperative to think about what we report or communicate to our stakeholders and development practitioners. The documentation should be credible and powerful as well so that it can bring about change such as gender equitable control over resources, knowledge and opportunities and ultimately lead to the empowerment of the poor and vulnerable.

**New publication**

Genome wide transcriptome profiling of *Fusarium oxysporum* f. sp. *ciceris* conidial germination reveals new insights into infection related genes

Authors: Mamta Sharma, Anindita Sengupta, Raju Ghosh, Gaurav Agarwal, Avijit Tarafdar, A Nagavardhini, Suresh Pande and Rajeev K Varshney

Published: 2016. Sci. Rep. 6, 37353; doi: 10.1038/srep37353

Abstract: Vascular wilt caused by *Fusarium oxysporum* f. sp. *ciceris* (*Foc*) is a serious disease of chickpea (*Cicerarietinum* L.) accounting for approximately 10–15% annual crop loss. The fungus invades the plant via roots, colonizes the xylem vessels and prevents the upward translocation of water and nutrients.

Infection is initiated by conidia that invade the host tissue often by penetration of intact epidermal cells. Here, we report the characterization of the transcriptome of *Foc* sequenced using Illumina Hiseq technology during its conidial germination at different time points. Genome-wide expression profiling revealed that genes linked to fungal development are transcribed in successive ways. Analysis showed that *Foc* have large sets of germination-related genes and families of genes encoding secreted effectors, cell wall/pectin-degrading enzymes, metabolism related enzymes, transporters and peptidases. We found that metabolism related enzymes are up-regulated at early time point whereas most transporters and secondary metabolites important for tissue colonization and pathogenicity are up-regulated later as evident from the qRT-PCR. The study demonstrated that early conidial germination in *Foc* is accompanied by rapid shifts in gene expression that prepare the fungus for germ tube outgrowth, host cell invasion and pathogenesis. This work lays the foundation for facilitating further research towards understanding this host-pathogen interaction.

[www.nature.com](http://www.nature.com)  
New Projects

Soil Conservation and Rehabilitation of Degraded Land for Food Security in India
Principal Investigator: Thomas Falk
Period: 2016 –17
Investor: Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH, Germany
Synopsis: The objective of this project is to study the impact of cropping system and soil fertility management practices on selected ecosystem services in the context of semi-arid areas in Maharashtra state of India. It is a direct contribution to the GIZ facilitated project on Soil protection and rehabilitation for food security in India (SPRFS). Using the well tested 6+1 approach of the Economics of Land Degradation Initiative (ELD 2015), this effort will add to a growing data set providing globally relevant data on the economic benefits of land and land based ecosystems.

Identification of Markers and Genomic Regions Associated with Aflotoxin Resistance in Peanut
Principal Investigator: Rajeev Varshney
Period: 2016 – 2019
Investor: Mars Chocolate North America, LLC, USA
Synopsis: At present, there is not much information available on molecular markers and genes associated with aflatoxin contamination that can be used in molecular breeding. Therefore, identification of markers and genes conferring resistance to aflatoxin resistance is a must for deploying molecular breeding approaches to develop superior lines with enhanced resistance to aflatoxin.

Genomics-assisted breeding for high yielding and climate resilient finger millet (ragi) varieties/hybrids and promotion of best suitable cultivars for food and nutritional security in Karnataka State of India
Principal Investigator: Santosh Deshpande
Period: 2016 –2019
Investor: Department of Agriculture, Government of Karnataka
Synopsis: The aim is to contribute to the development of improved finger millet varieties in the state of Karnataka by developing and deploying genomics tools in finger millet breeding. The project envisages that the genomics information for developing superior cultivars with enhanced crop productivity in the target regions is developed. This project will also help in enhancing livelihoods of farming women since majority of the field operations involved in the crop production are traditionally carried by them. Stabilized grain and fodder yields provide opportunities of improved livelihoods and nutrition to finger millet farmers.

Strengthening Sorghum and Millet Value Chains for Food, Nutritional and Income Security in Arid and Semi-Arid Lands of Kenya and the United Republic of Tanzania (SOMNI)
Principal Investigator: Henry Ojulong
Period: 2016 – 2020
Investor: IFAD
Synopsis: The goal of the project is “improved food, nutritional and income security for enhanced livelihoods and gender equity among smallholder farming households in semi-arid lands of Kenya and Tanzania”. The objective is to identify, develop and test improved cultivars of sorghum and millets to increase dryland cereal production and drylands productivity for improved food and nutrition security, increase household incomes while protecting the local environments.

Conducting of a study to ascertain local and national availability of seed and other agricultural inputs and ascertain the capacity of drought affected vulnerable communities and households in seven SADC countries (Lesotho, Madagascar, Mozambique, Malawi, Swaziland, Zambia and Zimbabwe) to timely access inputs given the eroding impact of the El Nino drought on farmers
Principal Investigator: Kizito Mazvimavi
Period: September –December 2016
Investor: FAO
Synopsis: The purpose of this study is to ascertain national availability of seed and other agricultural inputs and also the capacity of drought affected vulnerable communities and households to timely access appropriate seeds and other agricultural inputs.

For the provision of building the necessary evidence base to support the scaling up of Climate-Smart Agriculture (CSA) approach in West Africa
Principal Investigator: Robert Zougmore
Period: 2016 – 2017
Investor: FAO
Synopsis: The activities to be undertaken are to support the project support transition towards climate smart agriculture food systems with the following objectives:

1. To enhance the awareness and knowledge of national approaches to coordinate and implement inter-sectoral programs needed for the required climate smart transformation of the agricultural agenda.
2. To enhance the evidence base of appropriate CSA technologies and practices and decision-makers to ensure adequate policies and strategies towards scaling up of these CSA practices.
3. To establish a multi-stakeholder platform to promote the CSA approach both at national and local level.
Managing Organic Amendments to Reduce Greenhouse Gas Emissions and Supplement Fertiliser Nitrogen Inputs in Tropical Indian and Sri Lankan Agricultural Soils

Principal Investigator: Anthony Whitbread
Period: 2016 – 2018
Investor: Asia-Pacific Network thru Queensland University of Technology, Australia

Synopsis: The project directly addresses the climate change and climate variability and resources utilization and pathways for sustainable development research agendas. This includes filling a key data gap in global inventories by providing emission and emission factor baseline data of key crop rotations in India and Sri Lanka, and identifying the potential of matching OA derived N with synthetic nitrogen inputs. This also allows farmers to better make utilization of their existing nitrogen resources, both organic and synthetic, to improve nitrogen use efficiency and sustainability of Indian and Sri Lankan farmers.

A key focus is to enhance the capacity for environmental and agricultural research in India and Sri Lanka by the transfer of the knowledge and skillsets required to conduct global change research to local researchers and enhance NUE and sustainability of tropical farming systems. This will be achieved by extending the existing research network between Australia, Sri Lanka and India, enabling the transfer of the scientific expertise required for successful operation of the latest GHG monitoring technology and production of high quality research outputs. Local extension specialists, farmers, scientists and decision makers will be directly exposed to research outcomes via local and CGIAR communications departments and extension networks across the Asian Pacific region and through research networks such as the Australian Nitrous Oxide Program database (www.n2o.net.au) and peer reviewed publications.

Scientific trials contributing to chickpea improvement
Principal Investigator: PM Gaur
Period: 2016-17
Investor: Tata Trusts

Synopsis: The project aims at tapping genetic variability present in the wild species for improvement of chickpea and broadening its genetic base. A large number of progenies generated from interspecific crosses would be evaluated to identify lines with early maturity, heat tolerance and desired agronomic traits.

Soil protection and rehabilitation for food security in Ethiopia
Principal Investigator: Tilahun Amede
Period: 2016 – 2017
Investor: BMZ-GIZ

Synopsis: The aim is to ensure that the existing information on the response of crops to organic and inorganic fertilizer applications in Ethiopia is compiled, categorized and used for developing a farmer-friendly guide for fertilizer applications. The overall goal is to develop and validate an interim fertilizer decision support guide.

Inviting applications for AgriTech Accelerator Program

T-Hub in partnership with ICRISAT and RViP (Riverbridge Ventures Innovations Platform) launched the ‘AgriTech Accelerator Program’.

This initiative is designed to enable the participating startups to scale their projects through real-time management, full-time engagement and knowledge sharing. The selection process involves up to three levels of application screening to curate the most relevant applications to finally identify the top 10 participants of the program.

Interested startups can register at: http://signup.t-hub.co/agritech