An roadmap to achieve pulses self-sufficiency for India by increasing production, yield and area under pulses, and by setting up seed hubs and demonstration of best technologies was recently drawn up by the Government of India (GoI) in consultation with national and international research institutes. The government announced the implementation of a Pulses Program, with an outlay of ₹ 4.05 billion (US$ 60.44 million), over the next four years to achieve self-sufficiency in pulses.

At a recent workshop, detailed plans were developed which include creating 150 seed hubs across the country to produce quality seeds. ICRISAT will be one of the seed hubs. These hubs will be set up by the Indian Council of Agricultural Research (ICAR). Funding to strengthen the facilities for seed production, processing and storage will be available along with the provision to establish a revolving fund for operational expenditure.

The target set for production is 23.5 million tons by 2020 and 27.5 million tons by 2025, while the target for average yield has been set at 900 kg per ha by 2020 and 1,000 kg per ha by 2025 against the current average yield of 750 kg per ha. The area under pulse crops is targeted to reach 26 million ha by 2020 and 27.5 million ha by 2025 against the current area of 24 million ha.

India is the largest producer (18.2 million tons), consumer (over 22 million tons) and importer (3-5 million tons per year) of pulses. The current initiative is an effort to bridge this gap.

Plans are in place to conduct 100 clusters of demonstrations on best-bet technologies across the country, with each cluster covering an area of 100 ha. Demonstrations will include crop varieties for all cropping seasons, cropping systems, mechanization, integrated crop management practices, grain processing and storage, value addition, marketing etc., so as to get an idea of the extent of enhancement in production and farmers’ income possible with available technologies.

Dr JS Sandhu, DDG, Crop Science, ICAR, spoke about scaling up seed production and distribution as a key intervention. Mr SK Pattanayak, Secretary, Agriculture, Cooperation and Farmers Welfare, GoI, emphasized three key areas: seeds of improved varieties, irrigation tailored to pulses (especially micro irrigation), and markets that allow farmers to increase their profitability aligned to improved farmer welfare. These priorities are aligned to the ICRISAT policy brief ‘Towards Self Sufficiency in Pulse Production in India’ submitted to the Prime Minister’s Office (PMO) earlier this year at the request of the PMO.
“ICRISAT can best support through accelerated seed production of improved varieties, facilitate and model upscaling through existing partnership with key state governments of Andhra Pradesh, Telangana, Karnataka, Odisha and possibly Uttar Pradesh. This will be through our work on the science of delivery and application of business intelligence platforms to coordinate on-the-ground activities and implement key performance indicators to track progress and make course corrections,” said Dr David Bergvinson, Director General, ICRISAT.

“ICRISAT has the additional strength to involve private sector partners to vertically integrate farmers into higher value chains as well as value addition and marketing through Farmer Producer Organizations (FPOs) and associations like Self Employed Women’s Association (SEWA). As the state governments will implement the programs, ICRISAT can integrate pulse self-sufficiency targets into the ongoing pulse related work in Andhra Pradesh, Karnataka, Maharashtra and Odisha,” he added.

Dr Bergvinson in his address, emphasized the need for detailed crop-wise implementation plans, based on the production and market demand at the district level.

“Realization and implementation will require granular work plans with key performance indicators and defined partnerships along the value chain. This will ensure profit for farmers and that targeted production based on market demand is achieved,” he said. He also mentioned that convergence of key partners is required for success at scale.

Dr Sandhu also reiterated the need for coordination and integration along the value chain. The absence of private sector was noticeable and this is an area where ICRISAT can play a role – bringing together public and private sector partners to scale up pulse production.

An important takeaway from the ‘Productivity Enhancement’ session was that many technologies exist but are not adopted due to poor knowledge exchange systems, poor economics and access to inputs. Dr PK Joshi, Director South Asia, International Food Policy Research Institute (IFPRI), said that long and fragmented value chains associated with pulses discourages farmers from cultivating pulses. He suggested that the milk marketing model, which has been successful in increasing availability of milk in India, may be studied and adopted for pulses.

Discussions were also held with Mr Avinash K Srivastava, Secretary, Ministry of Food Processing Industries, GoI and Mr Sanjay Lohia, Joint Secretary (Crops), Department of Agriculture, Cooperation and Farmer Welfare (DAC&FW), GoI, and Dr Bergvinson on market integration through the National Agricultural Marketing platform, warehouse receipts to reduce price volatility for farmers and grades and standards that can be automated to improve pricing for farmers and quality for consumers.

The two-day workshop “Towards Self-sufficiency of Pulses in India” was led by the Indian Institute of Pulses Research and organized by the National Academy of Agricultural Sciences (NAAS) on 7-8 April in New Delhi, India. Some of the sessions were: genetic enhancement; productivity enhancement; smart farming; harvest and post-harvest management; trade and policy; new dimensions, etc.

The meeting was attended by high-level government officials, NAAS fellows and representatives from the Borlaug Institute for South Asia (BISA), International Center for Agricultural Research in the Dry Areas (ICARDA), Bioversity, IFPRI and ICRISAT.
ICRISAT’s first interactive timeline is launched this week showing the story of fertilizer microdosing in Africa. ICRISAT scientists developed the microdosing technique and this story covers the wide variety of initiatives and organizations who further tested and implemented the technology across Africa.

Small doses of fertilizer applied in the right place at the right time, combined with an inventory credit system (warrantage) introduced by the FAO supported Intrants project, lead to large benefits in yields and incomes in several countries in sub-Saharan Africa.

**Impacts**

In West Africa, some 25,000 smallholder farmers in Mali, Burkina Faso and Niger have learned the technique and experienced increases in sorghum and millet yields of 44 to 120%, along with an increase in their family incomes of 50 to 130%.

In Zimbabwe, despite poorer than average rains, microdosing increased grain yields, enabling about 170,000 households to increase cereal production by an estimated 40,000 tons. The program significantly improved household food security and saved US$7 million in food imports, generated a net present value of US$26 million and an internal rate of return of 36% by 2013. Now 300,000 farmers are practicing this technique in Zimbabwe. Many of these farmers became interested in investing their own resources in fertilizer, but access has remained a constraint. The program has started working with fertilizer companies to test strategies for resolving this problem, through improved access to affordable smaller packs of fertilizer.

**What is microdosing?**

Microdosing is the strategic application of small quantities of fertilizers (three-finger pinch or full bottle cap) in the planting hole or to the base of the plants shortly after planting (10 to 14 days). With the efficient use of fertilizer, the roots grow out more quickly, helping the plant capture more native (non-added) nutrients before the rains leach them down below the root zone.

**Warrantage system**

The ‘warrantage’ or inventory credit approach is where farmers place part of their harvest in a local storehouse in return for inventory credit. This allows them to meet pressing post-harvest expenses and engage in dry season income generating activities, such as sheep fattening, vegetable cultivation using small-scale (drip) irrigation, groundnut oil extraction and small trading. The stored grain may be sold later in the year at a much higher price, ensuring farmers make a good profit. Moreover, this cooperative approach trains farmers to work together to protect stored grains from insects and also helps them to buy fertilizer in bulk and repackage it in smaller, more affordable units through local input stores. Hundreds of farmer organizations in the region now use the warrantage system, which links them directly not only to markets but also to financial institutions.
Restoring degraded land in the Sahel

A workshop was conducted recently to identify areas for scaling up, by looking at the experiences and analyzing the causes of success and failure of the Restoration of Degraded Lands (RTD) program.

As part of the project “Restoration of Degraded Lands for Food Security and Poverty Reduction in East Africa and the Sahel: Taking successes in land restoration to scale”, ICRISAT Niger hosted the workshop.

The workshop brought together 23 participants and experts from OXFAM, the Family Farming Development Programme/International Fund for Agricultural Development, Institut National de la Recherche Agronomique du Niger, the Food and Agriculture Organization of the United Nations, the project for Risk and Disasters Management in Niger and ICRISAT. A farmer, also an expert in natural regeneration management attended as a resource person.

Microdosing... from page 3

Need for microdosing

Land degradation affects more than half of Africa, leading to estimated losses of US$42 billion in income and 5 million hectares of productive land each year. Crop yields are low as a result of poor farming techniques, soils suffer from nutrient deficiency and lack of water, particularly in sub-Saharan Africa. Farmers are unable to invest in fertilizer, triggering a cycle of soil nutrient depletion, low productivity and hunger.

Unable to feed their families, farmers abandon unproductive land to clear forests and plow new areas. Clearing new lands for farming accounts for an estimated 70% of the deforestation in sub-Saharan Africa.

Microdosing technique uses only about one-tenth of the amount of fertilizer typically used on wheat, and one-twentieth of that used on maize in the USA. Yet in sub-Saharan Africa, crops are so starved of nutrients such as phosphorous, potassium and nitrogen that even this micro amount often doubles crop yields.

The future

Although results have shown consistent yield increases, farmers have reported that microdosing is time consuming and laborious and that it is difficult to ensure each plant gets the right dose of fertilizer. In an attempt to address these issues, researchers are looking at packaging the correct dose of fertilizer as a tablet that aids application, and this is proving to be popular. In collaboration with partners in national agricultural research systems, ICRISAT is also exploring the use of seed coating and an animal-drawn mechanized planter as other options to further reduce the quantity of fertilizer used, as well as to address the labor constraint.

Lack of access to fertilizer and credit, insufficient flows of information, inadequate training for farmers and inappropriate policies have been identified as major constraints to the widespread adoption of the technology in sub-Saharan Africa. Greater adoption of microdosing requires supportive and complementary institutional innovations, as well as input and output market linkages.

View the interactive timeline at: http://www.icrisat.org/Timelines/microdosing/
The need for effective branding and marketing of drought tolerant crops is critical in order to change consumer perceptions and attitudes was highlighted at a roundtable discussion on issues affecting marketing and value addition of drought tolerant crops.

Dr Moses Siambi, Director - Eastern & Southern Africa, ICRISAT-Kenya, during his presentation on the ICRISAT Smart Food campaign said, “Drought tolerant crops including sorghum, millets, pigeonpea and groundnut are smart crops because of the high nutritional value, high resilience under extreme weather and the potential to improve incomes of smallholder farmers living in very dry areas.” The Smart Food campaign aims to improve nutrition, reduce poverty and improve incomes along the value chain.

Ms Bilha Maina, Managing Director, Kenya Promotions and Marketing Company (H) Ltd, sharing her experiences in sorghum contract farming said, “Certainty pricing is important but there is more that is needed to make farmer contracting actually work.” According to Ms Maina, supporting farmers to bear market risks can win their trust and promote development of contract farming. Some challenges that need to be addressed include, underdeveloped markets and shortage of capital, making it difficult for enterprises to fulfil their contracts with farmers. “Market development is key and it will help trigger production,” she said. This was seconded by Ms Paloma Fernandez, Executive Officer, Kenya Cereal Millers Association, who said, “It’s difficult for us to use these crops because it increases the cost of products. Without consumer education, this becomes difficult for us.” Ms Fernandez pointed out that the biggest challenge is usually the standards of farmer organizations, the quality, cost and quantities. “If the cost of sorghum is going to be higher than maize, we might not succeed to get millers interested,” she said.

“Ninety percent of our grain goes to milling. We therefore need to support millers work with these high value crops,” asserted Dr Romano Kiome, Program Manager (Chief of Party), Feed the Future Kenya Accelerated Value Chain Development (AVCD) Program, International Livestock Research Institute, adding that increasing productivity and market development is the key to bringing the price down.

The AVCD Program seeks to not only improve productivity of drought tolerant crops but also promote utilization of nutritious foods in Kenya. Under this program, ICRISAT is working to overcome the challenges that affect the sorghum and millets value chains. These include low productivity, poor systems for disseminating improved varieties and lack of a functioning marketing system to link smallholder producers with domestic and international markets.

The team agreed that monthly forums will be held on the first Friday of every month and the drought tolerant crops value chain team was requested to put together a team to develop and move forward the action plan for the nutrition behavior change communications campaign.

The meeting which took place in Nairobi on 11 March was attended by 10 partners and stakeholders. Companies and organizations represented included USAID, FIRM (Financial Inclusion for Rural Microenterprises), World Food Program (WFP), Kenya Promotion and Marketing Company (KPMC), Cereals Millers Association (CMA), Green Forest Foods, Farm Africa, International Livestock Research Institute and ICRISAT.

Project: Feed the Future Kenya Accelerated Value Chain Development Program  
Investor: Feed the Future (USAID)  
Partners: International Livestock Research Institute (ILRI), International Potato Center (CIP), Kenya Agricultural and Livestock Research Organization (KALRO), Egerton University, Ministry of Agriculture, Livestock and Fisheries, and ICRISAT  
CGIAR Research Program: Dryland Cereals
New publications

High transpiration efficiency increases pod yield under intermittent drought in dry and hot atmospheric conditions but less so under wetter and cooler conditions in groundnut (Arachis hypogaea (L.)).

Authors: Vadez V and Ratnakumar P

Published: 2016. Field Crops Research. 01-08. ISSN 1872-6852 (In Press)

Abstract: The paper re-explores the contribution of transpiration efficiency (TE) to grain yield in groundnut by using a novel experimental approach in which TE is measured gravimetrically throughout the crop life cycle, in addition to measurement of TE surrogates. Experimentation was carried out with the groundnut reference collection (n = 288), across seasons varying for the evaporative demand (vapor pressure deficit, VPD) and across both fully irrigated and intermittent water stress conditions. There was large genotypic variation for TE under water stress in both low and high VPD season but the range was larger (5-fold) in the high VPD than in the low VPD season (2-fold). Under water stress in both seasons, yield was closely related to the harvest index (HI) while TE related directly to yield only in the high VPD season. After discounting the direct HI effect on yield, TE explained a large portion of the remaining yield variations in both seasons, although marginally in the low VPD season. By contrast, the total water extracted from the soil profile, which varied between genotypes, did not relate directly to pod yield and neither to the yield residuals unexplained by HI. Surrogates for TE (specific leaf area, SLA, and SPAD chlorophyll meter readings, SCMR) never showed any significant correlation to TE measurements. Therefore, TE is an important factor explaining yield differences in groundnut under high VPD environments, suggesting that stomatal regulation under high VPD, rather than high photosynthetic rate as proposed earlier, may have a key role to play in the large TE differences found, which open new opportunities to breed improved groundnut for high VPD.

http://oar.icrisat.org/9381/

Rainfall risk and the potential of reduced tillage systems to conserve soil water in semi-arid cropping systems of southern Africa.

Authors: Mupangwa W, Walker S, Masvaya E, Magombeyi M and Munguambe P


Abstract: Improvement of household food security in the Limpopo Basin has been elusive due to a combination of factors related to information and market constraints, but also farmers’ risk aversion induced by the high variability of rainfall during the growing season. The purpose of this study was to (1) characterize the rainfall and growing season patterns experienced by smallholder farmers, and (2) measure soil water dynamics in ripper and basin tillage systems being promoted in the semi-arid Limpopo Basin of southern Africa. The results show that the second half of the growing season receives more rainfall than the first half in the Limpopo Basin. However, rainfall is more variable during the January-March than the October-December period. Growing seasons start earlier and end later in the Mozambique part of the basin which is closer to the Indian Ocean. The Limpopo Basin is prone to two and three week dry spells with chances of 14 day spells higher (34-42%) than the 21 day spells (8-12%). The chances of 14 and 21 day dry spells increase substantially during the second half of the growing season. The 1980–1990 was one of the driest decades in the Limpopo Basin. Planting basin system conserved more soil water on sandy loam (18-24%) and clay loam (4-12%) soils than the conventional practice during flowering and grain filling maize growth stages. Ripper had 17–29% more soil water than conventional practice during flowering and grain filling maize growth stages. There is a high risk of dry spells and soil water deficits in smallholder cropping systems of the Limpopo basin. There is therefore scope in promoting rain and soil water management technologies, and good land husbandry in order to reduce risk of crop failure in the smallholder cropping systems.

http://oar.icrisat.org/9382/

Comparative genomics and prediction of conditionally dispensable sequences in legume-infecting Fusarium oxysporum formae speciales facilitates identification of candidate effectors


Published: 2016. BMC Genomics, 17 (191). 01-24. ISSN 1471-2164

Abstract: Soil-borne fungi of the Fusarium oxysporum species complex cause devastating wilt disease on many crops including legumes. We present and compare draft genome assemblies for three legume-infecting formae speciales (ff. spp.): F. oxysporum f. sp. ciceris (Foc-38-1) and f. sp. pisi (Fop-37622), significant pathogens of chickpea and pea respectively, the world’s second and third most important grain legumes, and lastly f. sp. medicaginis (Fom-5190a) for which we developed a model legume pathosystem utilizing Medicago truncatula.

We demonstrate that distinction of core and potential dispensable genomic regions of novel F. oxysporum genomes is an effective tool to facilitate effector discovery and the identification of gene content possibly linked to host specificity. While the legume-infecting isolates didn’t share large genomic regions of pathogenicity-related content, smaller regions and candidate effector proteins were highly conserved, suggesting that they may play specific roles in inducing disease on legume hosts.

http://oar.icrisat.org/9383/
‘Leave no one behind’ commits global agricultural research and innovation community

International representatives from key sectors in agri-food research and innovation have pledged to ‘leave no one behind’ by committing to create more opportunities for rural women and youth, to equip tomorrow’s farmers and researchers with the skills they need, and to push for more investment so that rural communities can grow and flourish.

These were some of the commitments made at the Third Global Conference on Agricultural Development (GCARD3) held recently.

Extensive national and regional consultation on country priorities and needs over 2015 and 2016 had identified five key challenges in realizing the full development value from agricultural and food innovation systems. They were: to ensure better rural futures; keep science relevant and future-focused; scale up research results for impact; showcase results and demonstrate impact; and sustain the business of farming. To address these challenges, participants agreed to 17 actions that they would take collectively to help deliver on the United Nations Sustainable Development Goals (SDGs).

To ensure better rural futures, participants called for the establishment of foresight platforms that bring together research and innovation actors to develop a shared vision for their futures. Together they can then plan, design and implement initiatives to achieve that future vision.

To keep science relevant and future-focused, agricultural education programs will be overhauled in 100 universities on five continents, to combine multi-disciplinary training in agriculture-related sciences with skills in leadership, entrepreneurship, interpersonal relations and team building. Continuing professional development will focus on innovation and entrepreneurship in agricultural practices, products and services.

In scaling up research to achieve more impact the GCARD3 committed to developing a ‘culture of impact’ across the agri-food research sector, to lobby for investment and capacity building, and to embed research and innovation into country’s own national agricultural systems.

To better demonstrate the impact of investment in research and innovation, stakeholders will contribute to national measures of progress toward the SDGs, and build the capacity of countries to undertake integrated measures, as well as engage with farmers, women and youth. Agriculture indicators will be harmonized and linked to the SDGs.

To support farming as a sustainable business, actions will include “clustering” of smallholder farmers so they can better participate in research and development and develop links to finance and markets. Evidence-based and demand-driven data will be developed to enrich policy and attract finance. At the same time, research and science will recognize the value of traditional farming methods and knowledge.

Dr Shadrack Moephuli, President and CEO, Agricultural Research Council, South Africa, said the GCARD3 Global Event had been very successful in galvanizing participants in understanding and exploring ways of implementing some of the SDGs. “Now it’s up to everyone who has a stake in agricultural research and innovation to find ways to implement these actions,” he said. “An important next step will be to take the GCARD3 Outcomes Statement to policymakers to ensure that the specific resolutions are properly resourced and implemented. We then need to follow up with monitoring and learning from the impact of implementing these decisions.”

Dr Mark Holderness, Executive Secretary of the Global Forum on Agricultural Research and Co-Chair of GCARD3, said the meeting was a milestone in a continuing dialogue on how to transform agricultural research and innovation systems in developing countries around the world. “If we are to get research out of the labs and into the hands of resource-poor farmers, it’s going to require a more concerted approach across the different sectors, and more targeted investment in national agricultural systems. As a result of this week’s meeting, and the extensive national and regional consultations that have gone on in the lead-up to it, we can align our efforts and ensure we are meeting countries’ own development needs. We are ready to take action.”

Frank Rijsberman, CEO, CGIAR Consortium, said agriculture is the backbone of sustainable development, but agri-food...
Welcome

Dr Edward M Bikketi, a Kenyan national, joined on 11 April, as Post-Doctoral Fellow (PDF) – Gender Research, at ICRISAT Kenya. Dr Bikketi holds a Doctorate in Social Anthropology and Sustainable Development from University of Berne. Being a social anthropologist with a rural sociology background, he brings over 10 years of experience having worked with Kenya Agricultural and Livestock Organization (KALRO) as a social scientist in the socioeconomics and applied statistics programme.

We welcome Dr Bikketi to Team ICRISAT and wish him all success.

New publications... from page 6

Insecticidal activity of a novel fatty acid amide derivative from Streptomyces species against Helicoverpa armigera

Authors: Gopalakrishnan S, Rajendra V, Arumugam S, Sharma HC, Vadlamudi S, Bhimineni RK, Gonzalez SV, Mehta TM and Simic N

Published: 2016. Natural Product Research. pp. 1-10. ISSN 1478-6419

Abstract: Helicoverpa armigera, an important pest causes serious damage to grain legumes. The main objective of this study was to isolate and identify the metabolite against H. armigera from a previously characterized Streptomyces sp. CAI-155. The culture filtrate of CAI-155 was extracted using Diaion HP-20 and the active fractions were fractionated on Silica and C18 column chromatography. The C18 active fraction was further fractionated on Silica gel 60 F_254 thin layer chromatography (TLC). The most active fraction (Rf 0.64) purified from TLC led to the identification of a novel metabolite N-(1-(2,2-dimethyl-5-undecyl-1,3-dioxolan-4-yl)-2-hydroxyethyl)stearamide by spectral studies. The purified metabolite showed 70–78% mortality in 2nd instar H. armigera by diet impregnation assay, detached leaf assay and greenhouse assay. The LD_{50} and LD_{90} values of the purified metabolite were 627 and 2276 ppm, respectively. Hence, this novel metabolite can be exploited for pest management in future.

http://oar.icrisat.org/9391/

GCARD3... from page 7

systems today are not sustainable, nor are they providing healthy food for all. “We are also facing increasingly complex and alarming global challenges, particularly climate change. Action and forethought are required from us all – there is no longer time to wait. To ensure that CGIAR is best equipped to deliver solutions to these pressing challenges, we need to ensure our current and future research agenda is, on the one hand, well aligned with the global development agenda and, on the other, with national priorities and needs.”

ICRISAT at GCARD3

ICRISAT was represented at the event by Dr Peter Carberry, Deputy Director General for Research, Dr Shoba Sivasankar, Director, CGIAR Research Programs on Dryland Cereals and on Grain Legumes, and Mr Showkat Nabi Rather, Senior Officer, Communications.

In his Live Periscope interview Dr Carberry said, “Agricultural research has been trying to deliver benefits to Africa from many decades. There is some success, but when we look at the overall performance, there are some constraints like connecting farmers to markets.”

“Agriculture is a market-based enterprise; there has to be development of markets, we have to have the value chains in place and Africa doesn’t have it to the degree that can connect farmers to markets in an efficient and cost effective manner,” added Dr Carberry.

Quoting examples from recent initiative of ICRISAT, where six underprivileged youth from South Africa were trained at ICRISAT, Dr Carberry highlighted the need to engage more youth in agriculture.

Dr Sivasankar co-chaired a Theme on “Keeping science relevant and future-focused” and the theme discussions highlighted challenges, perspectives, strategies, solutions and collective actions needed to scale-out individual and institutional capacity development.

Mr Rather participated as a youth delegate and social reporter for the GCARD3, where he was involved in live social media reporting including live tweeting and blogging.

The GCARD3 was held in Johannesburg during 5-8 April. Over 500 representatives from farmers’ groups, research organizations, education and extension services, development agencies, civil society, and the private sector participated in the event.

Erratum: In the previous issue - Happenings 1722, the correct title of the first project is ‘An insight of actinobacteria and nodulating rhizobium possessing 1-aminocyclopropene-1-carboxylate (ACC) deaminase on salinity tolerance of chickpea’ with the project period as 2016-2018 and not as mentioned in the issue. The error is regretted.