ICRISAT
Happenings
Newsletter
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Photo: A Diama, ICRISAT

Participants view the research posters on display during the regional planning meeting.

Integrating research across countries in West and Central Africa to benefit farmers

Exploring ways to enhance integration and cooperation among scientists and across research projects to benefit farmers was the theme of the West and Central Africa (WCA) Regional Planning meet held recently.

During the two-day regional planning meet, scientists:

- Reviewed key research for development (R4D) achievements and lessons learnt in the past 2-3 years;
- Reviewed and discussed detailed plans of experiments, methods and expected outputs of scientists in 2016;
- Discussed mechanisms for promoting collaborations and integrating R4D work among scientists and locations to harness synergies for efficient use of resources;
- Discussed nature and performance of existing partnerships and resource mobilization strategy for WCA region;
- Identified existing gaps across various issues;
- Explored opportunities for integrated resource management and systems design;
- Mapped existing projects and identified synergies across projects;
- Developed impact pathways;
- Developed ideas for policy advocacy, scaling out and impact; and
- Initiated operating protocols for the new Regional Program WCA.

Working groups reported on areas for better integration and efficiency gains (sharing sites, resources, and learning) and identified gaps that can lead to new research initiatives. Gaps identified for the WCA region will be converted into an operational document that will contribute to the country strategies being developed.

The meeting was organized around five technical sessions covering a wide range of issues and topics related to the WCA region.

The first technical session included five presentations on: climate change and adaptation, groundnut improvement and upscaling, progress in sorghum and pearl millet breeding, watershed management and diversifying cropping systems and livelihoods.

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Integrating research across... from page 1

Dr Prakash Gangashetty, Post Doctoral Fellow, Pearl Millet breeding, with Dr Samuel Partey, Scientist, CCAFS at the poster session.

Session II focused on issues related to delivery, impacts, markets, communication and public awareness. The third technical session focused on new regional programs and their operating protocols.

Session IV discussed work plans and experimental designs in small groups and Session V was a poster session with 31 posters across different topics.

The participants visited the ICRISAT groundnut and sorghum fields as well as the experimental fields of the World Agroforestry Centre (ICRAF) and the World Vegetable Center (AVRDC), CGIAR centers hosted by ICRISAT Samanko station. Participants also visited the plant pathology laboratory where work on aflatoxin was discussed. The Regional Planning meet was held at Bamako, Mali, on 23-24 March. ■

Inauguration of the new ICRISAT WCA building

The new ICRISAT WCA office building being inaugurated by Dr Ramadjita Tabo, Regional Director WCA, ICRISAT and Dr Peter Carberry, Deputy Director General Research, ICRISAT, in the presence of ICRISAT staff and partners at Samanko station, Mali on 23 March, before the opening session of the Regional Planning meeting.

Women's Forum launched at ICRISAT Mali

In continuation of the launch of the women's forum in Asia, ICRISAT-Mali also launched a Women's Forum to advocate women staff member's issues and work for their personal and professional development.

At the first meet of the forum participants identified three priority topics of interest for women staff development: exchange visits and partnership building with women in other locations; trainings; and recreational activities. A five member committee was formed and assigned the task of further advancing the forum. The forum agreed to meet on a quarterly basis and bring out forum related articles and publications on a periodic basis or when needed.

Launching the forum, Ms Agathe Diama, Regional Information Officer and the focal point of the forum said, "The forum will work to foster linkages between women employees and serve as a platform for the realization of their plans. It is a platform for expression, capacity building and socializing." She explained the objectives and missions of the forum towards a fulfilling work environment and developing pathways favorable to women.

Participants at the Women's Forum launch at Mali.

The forum was launched on 29 March, attended by 21 participants wearing a similar dress pattern to symbolize their unity. ■

Regional planning meet in pictures

Dr Sapna Jarial, Scientist, Crop Livestock and Dr Anthony Whitbread, in discussion.

Dr Konate Djeneba Keita, Scientific Officer, explains the aflatoxin work in the plant pathology laboratory.

Field visit organised during the regional meet.

Participants at the regional planning meeting.

New publications

The genome sequences of *Arachis duranensis* and *Arachis ipaensis*, the diploid ancestors of cultivated peanut.

Authors: Bertioli DJ, Cannon SB, Froenicke L, Huang G, Farmer AD, Cannon EKS, Liu X, Gao D, Clevenger J, Dash S, Ren L, Moretzsohn MC, Shirasawa K, Huang W, Vidigal B, Abernathy B, Chu Y, Niederhuth CE, Umale P, Araújo ACG, Kozik A, Kim KD, Burow MD, Varshney RK, Wang X, Zhang X, Barkley N, Guimarães PM, Isobe S, Guo B, Liao B, Stalker HT, Schmitz RJ, Scheffler BE, Leal-Bertioli SCM, Xun X, Jackson SA, Michelmore R and Ozias-Akins P

Published: 2016. Nature Genetics: 01-12. ISSN 1546-1718

Abstract: Cultivated peanut (*Arachis hypogaea*) is an allotetraploid with closely related subgenomes of a total size of ~2.7 Gb. This makes the assembly of chromosomal pseudomolecules very challenging. As a foundation to understanding the genome of cultivated peanut, we report the genome sequences of its diploid ancestors (*Arachis duranensis* and *Arachis ipaensis*). We show that these genomes are similar to cultivated peanut's A and B subgenomes and use them to identify candidate disease resistance genes, to guide tetraploid transcript assemblies and to detect genetic exchange between cultivated peanut's subgenomes. On the basis of remarkably high DNA identity of the *A. ipaensis* genome and the B subgenome of cultivated peanut and biogeographic evidence, we conclude that *A. ipaensis* may be a direct descendant of the same population that contributed the B subgenome to cultivated peanut.

http://oar.icrisat.org/9364/

Tryptophan fluorescence quenching as a binding assay to monitor protein conformation changes in the membrane of intact mitochondria.

Authors: Akbar SMD, Sreeramulu K and Sharma HC

Published: 2016. Journal of Bioenergetics and Biomembranes: 01-07. ISSN 1573-6881

Abstract: Intrinsic protein fluorescence is due to aromatic amino acids, mainly tryptophan, which can be selectively measured by exciting at 295 nm. Changes in emission spectra of tryptophan are due to the protein conformational transitions, subunit association, ligand binding or denaturation, which affect the local environment surrounding the indole ring. In this study, tryptophan fluorescence was monitored in intact mitochondria at 333 nm following excitation at 295 nm in presence of insecticides using spectrofluorometer. Methyl-parathion, carbofuran, and endosulfan induced Trp fluorescence quenching and release of cytochrome c when incubated with the mitochondria, except fenvalarate. Mechanism of insecticide-induced mitochondrial toxicity for the tested insecticides has been discussed. Reduction in the intensity of tryptophan emission spectra of mitochondrial membrane proteins in presence of an increasing concentration of a ligand can be used to study the interaction of insecticides/drugs with the intact mitochondria. Furthermore, this assay can be readily adapted for studying protein–ligand interactions in intact mitochondria and in other cell organelles extending its implications for pesticide and pharma industry and in drug discovery.

http://oar.icrisat.org/9365/

Environmental Influences on Pigeonpea-*Fusarium udum* Interactions and Stability of Genotypes to Fusarium Wilt.

Authors: Sharma M, Ghosh R, Telangre R, Rathore A, Saifulla M, Mahalinga DM, Saxena DR and Jain YK

Published: 2016. Frontiers in Plant Science, 07 (Art253): 01-10. ISSN 1664-462X

Abstract: Breeding for fusarium wilt resistance continues to be an integral part of genetic improvement of pigeonpea. Therefore, the study was aimed at identifying and validating resistant genotypes to fusarium wilt and determining the magnitude of genotype × environment (G × E) interactions through multi-environment and multi-year screening. A total of 976 genotypes including germplasm and breeding lines were screened against wilt using wilt sick plot at Patancheru, India. Ninety two genotypes resistant to wilt were tested for a further two years using wilt sick plot at Patancheru. A Pigeonpea Wilt Nursery (PWN) comprising of 29 genotypes was then established. PWN was evaluated at nine locations representing different agro-climatic zones of India for wilt resistance during two crop seasons 2007/08 and 2008/09. Genotypes (G), Environment (E), and G × E interactions were examined by biplot which partitioned the main effect into G, E, and G × E interactions with significant levels ($p \leq 0.001$) being obtained for wilt incidence. The genotype contributed 36.51% of resistance variation followed by the environment (29.32%). A GE biplot integrated with a boxplot and multiple comparison tests enabled us to identify seven stable genotypes (ICPL 20109, ICPL 20096, ICPL 20115, ICPL 20116, ICPL 20102, ICPL 20106, and ICPL 20094) based on their performance across diverse environments. These genotypes have broad based resistance and can be exploited in pigeonpea breeding programs.

http://oar.icrisat.org/9366/

Pest Management in Grain Legumes: Potential and Limitations.

Authors: Sharma HC, Manuele T, Bouhssini ME and Ranga Rao GV

Published: 2016. Pages 275-292 in: Integrated Pest Management in the Tropics. New India Publishing Agency, New Delhi.

Abstract: Grain legumes, the principal source of dietary protein among vegetarians, are an integral part of daily diet worldwide and are an important component of cropping systems to maintain soil fertility because of their ability to fix atmospheric nitrogen, extract water and nutrients from the deeper layers of the soil as compared to cereals, and add organic matter into the soil through leaf

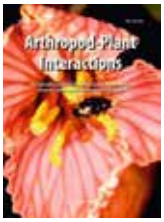
drop. However, grain legumes are mainly grown under rainfed conditions and the productivity levels are quite low because of severe losses due to insect pests and diseases. Average grain yield of pulses (0.86 t/ha) is about one fourth the average yields of cereals (3.54 t/ha). Production and productivity of grain legumes is constrained by several biotic and abiotic factors, and suffer an average of 31.9 to 69.6% loss in crop productivity due to insects, diseases, drought, weeds, and soil fertility.

http://oar.icrisat.org/9376/

Elevated CO_2 influences host plant defense response in chickpea against *Helicoverpa armigera*.

Authors: Sharma HC, War AR, Pathania M, Sharma SP, Akbar SMD and Munghate RS

Published: 2016. Arthropod-Plant Interactions. 01-11. ISSN 1872-8847



Abstract: Global atmospheric concentration of CO_2 is likely to increase from 350 to 750 ppm over the next 100 years. The present studies were undertaken to understand the effects of elevated CO_2 on enzymatic activity and secondary metabolites in chickpea in relation to expression of resistance to pod borer, *Helicoverpa armigera.* Fifteen day-old chickpea plants [ICCL 86111—resistant and JG 11—commercial cultivar] grown in the greenhouse were transferred to open-top chambers (OTC) and kept under 350, 550 and 750 ppm of CO_2. Twenty neonates of *H. armigera* were released on each plant at 7 days after shifting the pots to the OTCs. Un-infested plants were maintained as controls. After 7 days of infestation, the activities of defensive enzymes [peroxidase (POD), polyphenol oxidase (PPO), phenylalanine ammonia lyase (PAL) and tyrosine ammonia lyase (TAL)] and amounts of total phenols and condensed tannins increased with an increase in CO_2 concentration in chickpea. The nitrogen balance index was greater in plants kept at 350 ppm CO_2 than in plants kept under ambient conditions. The *H. armigera*-infested plants had higher H_2O_2 content; amounts of oxalic and malic acids were greater at 750 ppm CO_2 than at 350 ppm CO_2. Plant damage was greater at 350 ppm than at 550 and 750 ppm CO_2. This information will be useful for understanding effects of increased levels of CO_2 on expression of resistance to insect pests to develop strategies to mitigate the effects of climate change.

http://oar.icrisat.org/9377/

An Update on Genetic Resistance of Chickpea to Ascochyta Blight

Authors: Sharma M and Ghosh R

Published: 2016. Agronomy, 06 (01). 01-15. ISSN 2073-4395

Abstract: Ascochyta blight (AB) caused by *Ascochyta rabiei* (Pass.) Labr. is an important and widespread disease of chickpea (*Cicer arietinum* L.) and is particularly severe under cool and humid weather conditions. Breeding for host resistance is an efficient means to combat this disease. In this paper, attempts have been made to summarize the progress made in identifying resistance sources, genetics and breeding for resistance, and genetic variation among the pathogen population. The search for resistance to AB in chickpea germplasm, breeding lines and land races using various screening methods has been updated. Importance of the genotype × environment (GE) interaction in elucidating the aggressiveness among isolates from different locations and the identification of pathotypes and stable sources of resistance have also been discussed. Current and modern breeding programs for AB resistance based on crossing resistant/multiple resistant and high-yielding cultivars, stability of the breeding lines through multi-location testing and molecular marker-assisted selection method have been discussed. Gene pyramiding and the use of resistant genes present in wild relatives can be useful methods in the future. Identification of additional sources of resistance genes, good characterization of the host–pathogen system, and identification of molecular markers linked to resistance genes are suggested as the key areas for future study.

http://oar.icrisat.org/9378/

Crops that feed the world 11. Pearl Millet (*Pennisetum glaucum* L.): an important source of food security, nutrition and health in the arid and semi-arid tropics.

Authors: Jukanti AK, Gowda CLL, Rai KN, Manga VK and Bhatt RK

Published: 2016. Food Security. 01-23. ISSN 1876-4525

Abstract: Pearl millet is a major cereal in the arid and semi-arid regions of Asia and Africa. It is primarily cultivated for grain production, but its stover is also valued as dry fodder. Pearl millet is resilient to climate change due to its inherent adaptability to drought and high temperatures. It is also tolerant of saline and acid soils, and is well adapted to marginal lands with low productivity. Pearl millet germplasm exhibits large genetic variability for yield components; and various agronomic, adaptation and nutritional traits. Open pollinated varieties and hybrids are two important cultivar options, but higher productivity is realized through hybrids. Pearl millet has fewer pest and disease problems compared to other cereals and is suited to different cropping systems. It is highly responsive to improved crop management practices, as witnessed in parts of India where it is grown as an irrigated summer crop that produces higher yields and better quality grain. Pearl millet has high nutritional value in terms of high levels of energy, dietary fiber, proteins with a balanced amino acid profile, many essential minerals, some vitamins, and antioxidants. These play a significant role in prevention of important human ailments such as diabetes, cancer, cardiovascular and neurodegenerative diseases. There is great potential for harnessing these positive attributes through genetic improvement, improved crop management, and grain processing and food products technologies. These should help to develop greater global awareness of the importance of this crop for food and nutritional security.

http://oar.icrisat.org/9379/

New projects

An insight of actinobacteria and nodulating rhizobium possessing 1-aminocyclopropane-1-carboxylate (ACC) deaminase on salinity tolerance of chickpea

Principal investigator: A Satya

Period: 2016 – 2018

Investor: Science & Engineering Research Board (SERB), Government of India

Synopsis: Biofortification is a strategy that can tackle this hidden hunger merely through staple foods that people eat every day. This strategy can be achieved through agronomic practices, conventional breeding and genetic engineering and each have their own pros and cons. The sustainability of such grain fortification with higher seed mineral concentration is soil health-dependent, especially on the availability of Fe and Zn in the rhizosphere. Microorganisms, the invisible engineers in improving the soil health by solubilizing trace elements and by driving various biogeochemical cycles of soil, have the ability to serve as a key solution for this complex issue. Increasing the seed mineral density with the use of such PGP microbes is in its infancy. Hence the present project is aimed at exploring a consortium of microbes with metal mobilizing and PGP traits for enhanced Fe and Zn fortification in chickpea. This proposed strategy acts as a complementary sustainable tool for the existing biofortification strategies. It is also expected to substantially reduce the chemical fertilizer inputs and reduce protein and mineral malnutrition incidences in developing countries.

Improving Agricultural Productivity and Rural Livelihoods at Benchmark Location through Integrated Watershed Management in Western Maharashtra, India

Principal investigator: SP Wani

Period: 2016 – 2021

Investor: Asian Paints

Synopsis: The overall goal of this initiative is to increase agricultural productivity and improve the livelihoods on a sustainable basis by enhancing the impact of integrated watershed management programs through capacity-building initiatives using site of learning. The specific goal of this initiative is to increase agricultural productivity and improve rural livelihoods sustainably in selected villages around APL Khandala Works, in western Maharashtra.

Expression of resistance to diapausing and non-diapausing spotted stem borer, *Chilo partellus* in sorghum and maize: Implications for crop improvement and IPM

Principal investigator: HC Sharma

Period: 2016 – 2019

Investor: National Agricultural Science Fund (NASF), Indian Council of Agricultural Research (ICAR), Government of India

Synopsis: Genetic and molecular characterization of locally adapted life-history traits of insects such as diapause and polyphenism is important to understand the response of insect populations to climate change (Soderlind and Nylin 2011), and the host plants on which it feeds. This is particularly relevant for the polyphagous pests such as spotted stem borer, *Chilo partellus*, since this species feeds on several species of the family *Gramineae*, including the two major cereal crops, sorghum and maize in India. It undergoes winter diapause (hibernation) in northern India, and aestivation in summer in southern India. However, the information on the existence of genetically diverse populations of *C. partellus* in different agro-ecological conditions, induction and termination of diapause, and the interaction of different ecotypes of *C. partellus* with their host plants in relation to environment is unknown. This information is important to develop stem borer resistant cultivars in sorghum and maize, and develop IPM strategies to minimize the extent of losses due to this pest. The research under this project will help to fill in the above research gaps for better understanding of insect-plant interactions, and devising target-specific management strategies for *C. partellus* in different crops, with particular emphasis on maize and sorghum, without which the research efforts on host plant resistance in these crops will continue to be unproductive.