A Decade of Service to the Poor

A Compendium of Speeches by
William D Dar
January-December 2009

ICRISAT
Science with a human face

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International Crops Research Institute for the Semi-Arid Tropics
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Biographical Sketch

William D. Dar, PhD, is Director General of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) near Hyderabad in Andhra Pradesh, India, since January 2000. ICRISAT is a non-profit, non-political and pro-poor institute and a member of the Alliance of Centers supported by the Consultative Group on International Agricultural Research (CGIAR).

Dr Dar holds the distinction of being the first Filipino and Asian to be Director General of ICRISAT and Chair of the Alliance Executive of the Alliance of Centers in 2005, a collegial body that facilitates collective action among the fifteen (15) CGIAR Centers. He was Chair of the Committee on Science and Technology (CST) of the United Nations Convention to Combat Desertification (UNCCD) from 2007 to 2009. Dr Dar was also Member of the UN Millennium Task Force on Hunger.

Prior to joining ICRISAT, he served as Presidential Adviser for Rural Development, and Secretary of Agriculture in the Philippines (equivalent to Minister of Agriculture), the first ever alumnus of the University of the Philippines Los Baños (UPLB) to become one. Before this, he was Executive Director of the Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development (PCARRD) and Director of the Bureau of Agricultural Research (BAR) of the Philippine Department of Agriculture (DA).

Dr Dar also served on the governing boards of the Australian Center for International Agricultural Research (ACIAR) and the CGIAR's International Maize and Wheat Improvement Center (CIMMYT) as well as of ICRISAT. Moreover, he was Chair of the Asia-Pacific Association of Agricultural Research Institutions (APAARI) and the Coarse Grains, Pulses Research and Training (CGPRT) Center based in Indonesia.

Dr Dar received a Doctor of Philosophy (PhD) in Horticulture from the University of the Philippines Los Baños and an MS (Agronomy) and BS in Agricultural Education from Benguet State University (BSU) in La Trinidad, Benguet, Philippines. He taught at BSU for 11 years and rose from the ranks to become full Professor and Vice President for Research and Extension.

He has received a number of awards and honors, including the Ten Outstanding Young Men (TOYM) of the Philippines , Outstanding Young Scientist of the Year, Crop Science Society of the Philippines ' Achievement Award for Research Management and Outstanding Science Administrator

given by the Philippines Department of Science and Technology. He was also awarded as Distinguished Alumnus of UPLB and the Most Outstanding Alumnus of BSU and the Ilocos Sur Polytechnic State College (ISPSC). In 2002, PCARRD honored him with its highest and most prestigious award, the Symbol of Excellence in R&D Management.

In 2008, Dr Dar was conferred an honorary degree of Doctor of Technology by the Isabela State University (ISU). In 2007, The Benguet State University conferred the honorary degree of Doctor of Resource Management on him. Earlier in 2003, he was conferred the honorary degree of Doctor of Science by the Mariano Marcos State University (MMSU) in Batac, Ilocos Norte, Philippines.

In 2003, the Vietnamese Government honored him with the, "For the Sake of Agriculture and Rural Development in Vietnam Award" while the Philippine Bureau of Agricultural Research awarded him with a Plaque of Recognition for his outstanding performance as its First Director. He is also the recipient of the "Anahaw Leaf Award" for being the Most Outstanding Alumnus of the Ilocos Sur Polytechnic State College (ISPSC) High School Class of '69.

In 2004, the Central Luzon State University in the Philippines awarded him the Golden Grain Award, commending him for his "deep concern and intense advocacy for the promotion of a global yet equitable program for food security and reduction of poverty through pioneering scientific and technological innovations".

In the same year (2004), he was given the Research Leadership Excellence Award, the most prestigious award of the Philippine Association of Research Managers (PhilARM). In 2005, he was given a plaque of recognition by the Philippine Department of Agriculture for his outstanding contributions when he was Secretary of Agriculture. In 2006, he was awarded the "KALSA: The Most Distinguished Alumnus Award" by the Benguet State University in recognition of his being the first Filipino and Asian to serve ICRISAT and for the heights he has reached in the management of research and agricultural resources, through Science with a Human face.

Recently, the Professional Regulation Commission (PRC) of the Philippine Government awarded him the 2007 Outstanding Professional of the Year Award in the field of Agriculture for displaying professional excellence in both private and public practice in the Philippines and abroad and for his noble advocacy of promoting a global yet equitable program of food security in Asia and sub-Saharan Africa.

In February 2009, he was conferred the Father Jose Burgos Award, Ilocos Sur's most prestigious award, for his outstanding achievement in the field of agriculture. In recognition of his excellent and outstanding contribution to pulses research and development, he was recently honored with the Indian Society of Pulses Research and Development (ISPRD) Lifetime Achievement

Award. In October 2009, the University of the Philippines Los Baños (UPLB) honored him with the Outstanding Alumnus Award.

With his outstanding leadership as Chair of the Alliance Executive (2005), the Alliance of Centers was made the third pillar of the CGIAR system.

Since leading ICRISAT, Dr Dar has intensively advocated a Grey to Green Revolution in the dry tropics of Asia and sub-Saharan Africa through Science with a Human Face. Towards this, he spurred the development of a new vision, mission and strategy for the Institute. In pursuing it, he has strengthened strategic partnerships with an array of stakeholders – NARS, ARIs, NGOs, development agencies and the private sector. These initiatives led to a stronger ICRISAT working for a food-secure SAT.

In 2008, ICRISAT led by Dr Dar, won for the fifth time the King Baudouin Award (the most prestigious in the CGIAR) along with eight other Centers. This was made possible through its involvement in the Collaborative Research Program for Sustainable Agricultural Production in Central Asia and Caucasus. Earlier in 2004, it had won the award together with CIMMYT, IRRI, IWMI and other national systems in the CIMMYT-led Rice-Wheat Consortium for the Indo-Gangetic Plains. In 2002, again under his leadership, the Institute together with ICARDA had bagged the award for developing new chickpea varieties with higher tolerance to drought and heat, greater resistance to pests and diseases that provide stable and profitable yields. ICRISAT is the only CGIAR Center to have bagged this award five times.

In 2003, ICRISAT underwent two external reviews from the CGIAR, acknowledging outstanding science quality and sound and excellent management under Dr Dar. These reviews gave the impetus for ICRISAT to carve out a new strategy for its transformation and renewal as a premier center of scientific excellence for the people of the dry tropics in the 21st century. In the same year, ICRISAT stood second among the 15 CGIAR Centers in terms of financial health indicators developed by the World Bank. Dr Dar's astute and decisive leadership was repeatedly manifest in the Institute's surplus budgets in the years 2000, 2003, 2004, 2005, 2006, 2007 and 2008. In 2009, a very positive Sixth External Program and Management Review (EPMR) pronounced that "ICRISAT today is a thriving research institute with a unique capacity to address poverty alleviation, food security, and natural resource protection in the semi-arid tropics".

There were more research outputs and impacts created by the Institute during the last nine years as well, both in Asia and sub-Saharan Africa. The turnaround for the Institute was possible because of Dr Dar's effective and human-oriented management, big-picture decisions and innovations and the positive attitude and high morale he infused in the staff. In 2006, he led the whole Institute in the formulation of the new ICRISAT Vision and Strategy to 2015, a road map to empowering the poor in the drylands.

As a demonstration of the strong faith in his outstanding leadership, the Governing Board awarded Dr Dar a third five-year term in office, starting January 2010.

Dr Dar's transformational leadership has turned ICRISAT into a forward looking institution, which has been ranked 'Outstanding' consecutively in 2006 and 2007 among the CGIAR centers. A man on a mission and a champion of the poor, Dr Dar has made a big difference and continues with conviction his mission of helping alleviate the conditions of the poor people living in the drylands of Asia and sub-Saharan Africa.

Foreword

It is an honour for me to write this foreword as ICRISAT completes a decade under the dynamic leadership of its Director General, Dr William Dar.

This compendium of his speeches, aptly titled *"A decade of service to the poor"*, chronicles the Institute's transformation into a center of excellence, helping farmers deal with the tremendous challenges they face everyday. Meticulously charting the Institute's course through its ups and downs, Dar's vision, ingenuity and forward-looking initiatives during this time have begun bearing fruit for the poor in the semi-arid tropics.

This year, a very positive "Sixth External Program and Management Review" pronounced that "ICRISAT today is a thriving research institute with a unique capacity to address poverty alleviation, food security, and natural resource protection in the semi-arid tropics."

Yet, the poor farmer has never seen more challenging times. He is buffeted by the adverse impacts of climate change on the one hand and on the other hand the unholy nexus of poverty, drought and land degradation, plus the energy and financial crises that converge to form a perfect storm threatening his livelihood and future. Productivity gains will have to be achieved through better management of natural resources, crop improvement and capacity building. ICRISAT is already, and will continue, to help the poor farmer.

ICRISAT's current and future initiatives in Asia and Sub-Saharan Africa are a recurring theme in the speeches. They serve as an inspiration for individuals and institutions to take bold steps, show willingness to adopt and welcome unprecedented change. They exhort us to let the light bulbs in the mind be lit and let them in turn light up the lives of people, especially the underprivileged.

Nigel Poole
Chair
ICRISAT Governing Board

Capacity Building Key to Effective Watershed Management

Inaugural Address, Workshop-cum-training Course of the Government of India-GTZ-MANAGE-ICRISAT Project on the Consortium Approach for Capacity Building in Decentralized Watershed Management, 20 January 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Good morning ladies and gentlemen,

Let me wish you a Happy New Year and extend a warm welcome to all the participants of the orientation program sponsored by the Ministry of Agriculture, Government of India and GTZ, India, on the Consortium approach to watershed management in the field of capacity building.

I take this opportunity to recognize our partners, Dr Kasturi Basu from GTZ and Dr Reddy from MANAGE.

Several developments have been taking place in the area of watershed management. As you are all aware, the 11th Five-Year Plan is just starting and new common watershed guidelines have been released by the newly established National Rainfed Area Authority (NRAA). ICRISAT too recently completed a Comprehensive Assessment of the impacts of watershed programs in India through a project jointly sponsored by the ministries of agriculture and rural development.

At the ministerial level, discussions are on to converge activities of the National Rural Employment Guarantee Act into watersheds. The MoRD

has merged all its watershed projects under the umbrella of a common program titled Integrated Watershed Development Program. Given these developments, this project comes at the most opportune moment to enhance the impact of watershed programs in India.

ICRISAT's watershed consortium approach has ensured tangible economic benefits to a large number of small and marginal farmers. The recently completed Comprehensive Assessment identified community watershed management as a growth engine for the sustainable development of drylands in India.

Huge investments to the tune of US$ 6 billion in watershed programs have silently transformed rainfed areas. Less than 1% of the programs were found economically unremunerative. However, as recommended by the Comprehensive Assessment, projects performing below par can be turned into growth engines by taking critical steps in terms of economic efficiency, equity, and sustainability parameters. The assessment recommended strong capacity building measures for all stakeholders, starting from farmers to policymakers and researchers to achieve the desired change in mindset to enhance the impact of watershed programs.

During your three-day orientation program, I am sure the team led by Dr Suhas Wani will enlighten you on ways of managing community watersheds and facing challenges that come in the way of their smooth and effective functioning. You will have the opportunity to visit the live model of our community watershed at Kothapally, where farmers speak the language of researchers and where livelihoods have been completely transformed in the last 10 years.

Kothapally is no longer the place it used to be in 1999, when women had to trudge 2-3 kms to fetch drinking water and where a single crop used to be grown in a year, yielding less than 1 ton per hectare. Today Kothapally

is prospering. Private entrepreneurs like Reliance have set up a milk procurement center due to a surplus of over 500 liters of milk per day.

Ladies and gentlemen, as leaders of watershed projects in different states, you can make a difference in the lives of millions of poor farmers in the country. Capacity building is what will make this difference.

I understand that many of you are visiting ICRISAT's campus for the first time. You will see that it is a live example of sustainable water management. I am sure the sessions over the next few days will equip you with skills to ensure the success of the project in the three pilot states of Rajasthan, Karnataka and Uttarakhand, where the consortium for capacity building will be established and operationalized through this project.

I wish you all the best.

Have a good day.

Exploiting Biotechnology's Potential for Greater Food Security

Guest of Honor, Valedictory Session, BioAsia 2009, 4 February 2009, HICC, Hyderabad, Andhra Pradesh, India.

Dr Manel Balcells, Professor Sayed Hasnain, Mr B P Acharya, distinguished guests, ladies and gentlemen, good afternoon!

Thank you for giving me this opportunity to speak at this year's BioAsia, an event with which we have been associated for the last six years. Our ties have grown stronger over the years; so have our beliefs in the potential of biotechnology.

In 2008, another 40 million people were pushed into hunger due to high food prices! A majority of the world's undernourished, over 900 million, live in developing countries alone! The world hunger crisis may further deteriorate as the financial crisis combined with the energy crisis, and emerging climate change issues threaten livelihoods. Hence combating the food crisis will require much greater investments in agriculture.

Cross-country estimates by Ligon and Sadoulet (2007) show that GDP growth originating in agriculture is at least twice as effective in reducing poverty as GDP growth originating outside agriculture. China and India have taken the lead among developing countries in investing in agriculture.

ICRISAT believes that biotechnology can contribute to global food, feed and fiber security; improve health and nutrition; use less external inputs for a more sustainable agriculture and environment; conserve biodiversity and help improve economic and social status and alleviate poverty in poor countries.

ICRISAT has pioneered transformation technologies for transgenic groundnut for resistance to the Indian Peanut Clump Virus and transgenic pigeonpea and chickpea with resistance to the devastating pod borer, *Helicoverpa armigera,* using genes from *Bacillus thuringiensis*.

Hybrids/varieties developed by ICRISAT have reached an increasingly greater number of farmers in the semi-arid tropics through private sector partnerships. ICRISAT's hybrid pigeonpea developed through cytoplasmic male sterility (CMS) system and the world's first, is paving the way for its viable commercial production in Asia and Sub-Saharan Africa.

Protocols and information/analysis systems for the molecular characterization and gene mining of crops, their pests and diseases and bio-control agents have been similarly developed.

Public-private sector partnerships play a crucial role in helping to deliver the benefits of agricultural biotechnology to developing countries. Through such partnerships, public research institutes can access modern tools and technologies to conduct effective research activities. With the active emergence of the private sector in agricultural R&D, these alliances facilitate technology development and transfer, and help build capacity. Agricultural innovations can be sustained and propagated to the poor only if they are made available to farmers in a reasonable time frame and cost.

The Agri-Science Park@ICRISAT was set up in 2003 to help achieve the institute's mandate to help poor farmers in the semi-arid tropics through public-private partnerships. Through the ASP, ICRISAT has delivered improved research products such as sweet sorghum, groundnut and hybrid pigeonpea technology to farmers and innovative ventures in biofuels, nutraceuticals,

agri-clinics and crop biotechnology. Its components include the Ag-biotech Innovation Center (AIC), Agri-Business Incubator (ABI), Hybrid Parents Research Consortium (HPRC), Bioproducts Research Consortium (BRC), NutriPlus Knowledge Center and SAT Eco-Venture.

The 40-member Hybrid Parents Seed Research Consortium was formed to increase the scope of accessibility to better hybrids of sorghum, pearl millet and pigeonpea. It deals with CMS systems, develops high-yielding disease-resistant hybrid parents and trains for transfer of hybrid seeds production technology.

The Agri-Business Incubator has emerged as a champion in incubating several technologies and enterprises, such as the use of sweet sorghum for ethanol production, and is a model for facilitating the creation of competitive agri-business enterprises through technology development and commercialization.

ICRISAT also addresses key issues such as food security, health and nutrition through NutriPlus Knowledge Center, a platform for R&D and innovation in food processing with a focus on cereals, legumes, fruits/vegetables, medicinal and aromatic plants.

Recently, the Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, approved a project worth US$ 6.2 M to set up a Platform for Translational Research on Transgenic Crops (PTTC) at ICRISAT. PTTC will translate transgenic technology and harness its products to meet the needs of agricultural growth and serve as a facility of reference to strengthen national, regional and international linkages in transgenic R&D, exchange of materials and information, as well as support training, consultation and technology commercialization.

These initiatives that have been built on complementarities, have been highly successful in moving technologies off the shelf to vulnerable groups, enabling access to cutting-edge S&T for research with positive impacts, facilitating innovation, and more importantly, leading to pro-poor benefits.

The challenge for biotechnology is to produce products that are valuable to small-scale farmers, for consumers and the environment. Let us remember that our role in ensuring global food security and development can be summed up in two words, technology and partnerships. The poor and hungry are counting on us to make these investments and to innovate. So let us work together to nourish lives, nourish rural communities and nourish the future.

Thank you and good day.

PTTC: Translating Research into Tangible Benefits for the Poor

Welcome Address, Foundation Stone Laying of the Platform for Translational Research on Transgenic Crops (PTTC), 9 February 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Dr M K Bhan, Secretary, Department of Biotechnology, Ministry of Science and Technology, Government of India, Dr S R Rao, Adviser-DBT, ladies and gentlemen, good morning!

Welcome to the foundation stone laying of the Platform for Translational Research on Transgenic Crops. I would like to first thank DBT for their generous help, without which PTTC would have remained just an idea. I would especially like to thank Dr Bhan for his support, trust and confidence in us.

Future food demand cannot be met merely from incremental gains from conventional plant breeding; a step change in yield improvement is needed, such as occurred during the Green Revolution. Finding solutions to major crop productivity constraints, developing new technologies that raise yields in low-potential areas and creating opportunities for diversification in agricultural value chains are some of the major agricultural challenges we face today.

Transgenics are a further step in an evolution that extends from the dawn of agriculture. Gene technologies offer a new set of tools to enhance crop

productivity and profitability. In 2006, farmers in 22 countries planted transgenic seeds on about 100 million hectares, about 8% of the global crop area.

Despite limited adoption, interest in transgenic crops remains high, and a wave of second generation products is making its way towards the market. Transgenic rice, eggplant, mustard, cassava, banana, sweet potato and lentil have been approved for field testing in one or more countries.

Transgenics offers a powerful tool for nutritional enhancement that may save lives or help farmers adapt to climate change through faster integration of genes for drought and flood tolerance, in the process generating social, economic and environmental benefits for resource-poor farmers.

Today's launch of PTTC is a major milestone for ICRISAT, for transgenic crops may well prove to be the superhighway which leads world agriculture to a profitable and sustainable future.

ICRISAT's experience in developing transformation technologies for its mandate crops, carrying out contained field-testing, studying the food and environmental safety of transgenic plants, communicating biotechnology to the media and transferring technology through training, places it in a strong position to undertake biotechnology activities in partnership with the NARS and private sector in India, and in other regions of Asia and Africa.

ICRISAT has developed expertise in assessing and developing systems for transgene expression in plants with a particular ability to transform difficult monocot systems (sorghum and minor millets) and legumes (groundnut, chickpea and pigeonpea).

PTTC will facilitate a collaborative and coordinated approach for the translation of existing genetic engineering technologies to the development of transgenic crop varieties, which can efficiently be taken through product development to commercialization. Particularly in the unfriendly drylands where climate change will have devastating impacts on the poor, resilient crops that can better withstand heat, drought, pests and diseases, can go a long way towards alleviating hunger and poverty.

Among the reasons for the slow progress in developing transgenic food staples include risks, weak regulatory capacity, limited access to proprietary technologies, and complexity of trade in transgenics. Limitations in commercialization pose serious barriers.

PTTC will closely examine issues linked to IPR associated with the transgenic events selected for product development; develop biosafety dossiers for the commercialization of products; coordinate and conduct with external agencies thorough evaluations of transgenic events for possible food, feed and environmental safety studies; obtain permission for growing cultivars derived from transgenic events in open fields following guidelines of the Department of Biotechnology and National Biosafety Regulatory Authority (NBRA), among others.

To maximize the benefits of research expertise and synergies, PTTC will operate and collaborate with a larger research community. This will be facilitated by its hub and spokes model, wherein PTTC serves as the locus for the basic infrastructure for research, training and outreach activities and the setting up of a series of specialized satellite centers (SSCs) in each region.

PTTC also plans to undertake contract research, consultancy services and set up a single window advisory service on IPRs.

I would like ICRISAT's scientists, especially Dr Kiran Sharma, to take this new initiative as a challenge to come up with the commercial release of at least two new transgenic crops by 2014.

I am sure this DBT-ICRISAT initiative will go a long way in moving agriculture from a resource-based to a science-based industry and succeed in transferring the products of genetic engineering to farmers' fields through commercialization.

Thank you and good day.

Together We Sow, Together We Shall Reap

Address, Felicitation by the All India Coordinated Pearl Millet Improvement Project (AICPMIP), 12 February 2009, Mandor, Jodhpur, India.

Dr I S Khairwal, distinguished guests, ladies and gentlemen, good afternoon.

Let me first thank Dr Khairwal and AICPMIP for the honor they have bestowed on me today. It gives me great pleasure to be associated with your institution and I'm sure together we will be able to improve the lives of the poor in the drylands.

When two leading centers like AICPMIP and ICRISAT come together with a common objective, it is but inevitable that their complementary skills and resources will lead to great achievements in pearl millet improvement. This has been the hallmark of our ties, which have in recent years further evolved to cover diverse areas such as germplasm exchange, joint field days and workshops, training, strategic research, documentation and project development.

Let me give just a few examples of our collaboration. ICRISAT organizes field days every alternate year, with inputs from AICPMIP, to enable NARS and private sector scientists to select materials of their interest. In the field day held in 2008, NARS scientists selected 620 breeding lines and more than 1300 seed samples.

Also, last year, like every year, ICRISAT constituted 19 trials and nurseries (consisting of about 500 breeding lines and 300 testcross hybrids) which were distributed for evaluation and selection under the ICAR-ICRISAT

Research Partnership Project. AICPMIP too organizes field days in which ICRISAT scientists participate. In 2007, AICPMIP held its first annual workshop at ICRISAT, where for the first time as many as 10 hybrids/varieties were identified for possible release. All these cultivars were tested under AICPMIP network. Most of the hybrids were based on ICRISAT-bred male-sterile lines.

ICRISAT, AICPMIP and Chaudhary Charan Singh Haryana Agricultural University joined hands to develop HHB 67 Improved, developed by marker–assisted selection. It reached farmers' fields two years ago.

Our strong partnership with Rajasthan Agricultural University (RAU) is evident in the very promising pearl millet hybrids developed by RAU, in which ICRISAT-bred male-sterile lines are involved as one of the parents.

Our partnership has transcended germplasm exchange and cultivar development to include joint publication of books -- one on pearl millet breeding has been published and another on pearl millet research and development is in the pipeline.

I'm pleased to note that our partnership has been further strengthened in the area of project development and resource mobilization. AICPMIP is now a partner in a HarvestPlus Challenge Program research designed to develop pearl millet cultivars with high levels of grain iron and zinc.

It is indeed a matter of pride that the impacts of these collaborative efforts led to AICPMIP, its sub-centers, and ICRISAT being recognized with the Chaudhary Devi Lal Outstanding All India Coordinated Research Project Award in 2003.

I would like to mention that Dr Khairwal has been instrumental in building up these ties, for which ICRISAT recognized him with its Outstanding Research Partnership Award last year. I believe we have a lot more to do together to ensure a more secure livelihood for pearl millet farmers.

Thank you.

Global Research for Improving the Livelihood Security of SAT Farmers

Plenary Lecture, International Conference on Grain Legumes: Quality Improvement, Value Addition and Trade, 14 February 2009, Kanpur, India.

Dr Masood Ali, Director, Indian Institute of Pulses Research (IIPR), distinguished guests, ladies and gentlemen, good afternoon!

I would like to thank Dr Masood Ali for inviting me to speak here today, at a time when the food and financial crises are having grave implications for agriculture and the poor. The current global financial crisis has pushed food prices lower by decreasing demand for agricultural commodities for food, feed and fuel. At the same time, it has decreased capital availability at a time when agriculture needs it the most. This double blow is proving catastrophic for the poor.

Recent estimates of the Food and Agriculture Organization of the United Nations (FAO 2008b) show that the number of undernourished people increased from 848 million in 2003-05 to 923 million in 2007, largely owing to the food price crisis. Asia and the Pacific region account for 68% of the developing world's population and 64% of its undernourished population. Sub-Saharan Africa accounts for 13% of the population and 25% of the undernourished people in the developing world.

Between 2005 and 2007, developing countries in Asia grew at an annual average rate of 9%, while African economies grew at 6%. The good times

came to an end in 2008 as the food and financial crises set in. These intertwined threats combined with decreased investments in agriculture, could lead to 16 million more undernourished children in 2020! The financial crunch poses additional threats as it further lowers the real wages of the poor, and many are now losing their employment altogether.

As climate change further increases climate variability, temperature, and the risk of droughts and floods, diseases and pests, threats to agricultural productivity and production will escalate.

Increasing per capita food availability is possible by improving the productivity of crops that support the livelihoods of the poor living in the semi-arid tropics (SAT) through integrated genetic and natural resource management (IGNRM) approaches. The SAT covers parts of 55 developing countries and houses one-sixth of the world's population. This is where ICRISAT holds the global responsibility for improving livelihoods of the poor; where inherent low soil fertility, erratic rainfall and poor physico-social infrastructure pose serious threats to agriculture.

Food legumes are a relatively cheaper source of protein and energy compared to animal proteins. Their demand is likely to increase in countries like India, Bangladesh, Nepal, Myanmar and Sri Lanka, where the majority of the population has vegetarian-based food habits. They fetch higher prices compared to cereals and hence are increasingly being grown to supplement farmers' incomes, thus enhancing livelihoods. Cool season food legumes (faba bean, chickpea, lentil and pea) contribute almost 60% of the total pulse production and 40% of the area (Oram and Agcaoili 1994). Chickpea, faba bean and lentil are produced predominantly in developing countries and dry peas in both developing and developed countries.

Grain legumes occupy 71.8 million ha globally, mostly produced in tropical and subtropical countries where majority of the poor and malnourished live. Seventy-six percent of the area planted to legumes worldwide is in Asia

(49.6%) and Africa (26.2%). Despite its significance to human nutrition, legume consumption in many countries of South Asia and Sub-Saharan Africa is very low. For instance, the per capita net availability of pulses in India declined from 22 kg per annum in 1951 to 12 kg per annum in 2005. Also, the relative price of legumes has risen sharply as compared to that of cereals, making them less affordable to the poor.

Concerted research and development efforts supported by government policies have brought a paradigm shift in favor of rice and/or rice-wheat-based cropping systems in the last four decades in most Asian countries, relegating legumes to marginal lands.

Stagnation in productivity, water and nutrient imbalances and increased pest and disease incidence are becoming apparent in rice-wheat or rice-rice rotations. As an integral part of farming systems, food legumes in rotation with cereals and tuber crops help in maintaining soil fertility and sustainability of production systems (Rego et al. 1996). Cereal-legume crop rotations reduce weeds, diseases and insect pests in cereal monocrops. Legumes require minimum tillage and provide high quality protein in food and feed.

There is great scope for introducing legumes in irrigated rice and rice-wheat-based cropping systems and even in rice fallows. Increasing cereal yields may be one of the most practical justifications for having legumes in cereal rotations (Heenan et al. 1994; Saraf et al. 1997).

In South Asia, a substantial proportion of land is under a single crop, usually rainy-season rice, with the land left fallow in the postrainy season. This is mainly in areas growing rainfed rice, where irrigation facilities do not support

the second crop after rice. Legumes can find such niches as they can grow on residual soil moisture.

New improved legume varieties use fertilizer more efficiently, are more resilient to drought, pests and diseases and incorporate market-preferred grain quality traits.

Integrated pest management techniques which cut costs and reduce the hazards of pesticide sprays on legumes allow farmers to obtain higher incomes. Better-quality food connects farmers to processors and sellers, who in turn provide them with new technologies to stay competitive.

There is now greater emphasis on biofortification of cereals and legumes of rainfed agriculture with minerals (iron and zinc) and vitamins (Vitamin A), which will provide both nutritional security and increase incomes of farmers. These need to be promoted as health foods in urban areas in order to increase their consumption.

ICRISAT is committed to improving the productivity of chickpea, pigeonpea and groundnut. More than 50 short-duration and fusarium wilt-resistant cultivars have been released so far by national programs in several countries from ICRISAT breeding lines.

Improved short-duration and fusarium wilt-resistant varieties (ICCC 37 and JG 11 in desi type and ICCV 2, KAK 2, Vihar and LBeG 7 in kabuli type) have performed well, leading to a 3.7-fold increase in area, 1.9-fold increase in productivity, and 7-fold increase in production in Andhra Pradesh between 1995 and 2006.

Pigeonpea varieties Asha, Laxmi and Maruti with combined resistance to sterility mosaic and fusarium wilt are available to farmers. ICRISAT has developed the world's first pigeonpea hybrid based on cytoplasmic-genetic male sterility system and has perfected hybrid seed production technology. Among the medium-duration hybrids, ICPH 2671 matures in 165-175 days and has high levels of resistance to both wilt and sterility mosaic diseases. Over three years of testing, it produced 2937 kg ha^{-1} grain yield and exhibited 61% heterosis over the best pure line control cultivar (Saxena 2008).

In groundnut, several short-duration cultivars have been developed with tolerance/resistance to multiple diseases. ICGV 86015 with wider adaptation was released in Pakistan as BARD 92, in Vietnam as HL 25, in Nepal as Jayanthi and in Sri Lanka as Tikiri. Foliar disease-resistant varieties ICGV 86590 and ICGV 86699 are popular among farmers. Drought-tolerant ICGV 91114 has gained popularity in Anantapur district in Andhra Pradesh and Saurashtra in Gujarat, is doing well in Karnataka and has been released in Orissa.

ICRISAT has also pioneered transformation technologies for transgenic groundnut for resistance to Indian Peanut Clump Virus (IPCV) and in pigeonpea and chickpea with resistance to *Helicoverpa armigera* using *Cry1Ab* and *Cry1Ac* genes from *Bacillus thuringiensis*. These are currently under contained field testing.

According to an FAO/World Bank study, diversification is the single most important source of poverty reduction for small farmers in South Asia (Dixon et al. 2001). In Eastern and Southern Africa, ICRISAT's focus is on linking farmers to markets and diversification with legumes. In Asia, legumes are being promoted in cereal-dominated cropping systems.

ICRISAT has just completed its sixth External Program and Management Review. We have been commended for increases in areas cropped to some of our mandate crops, such as pigeonpea in Tanzania and chickpea in Myanmar.

The Panel was impressed with the quality and ambition of the breeding and adaptation programs conducted by our scientists, and commended that they showed clear signs of activity and innovation. It has found notable our efforts to understand and break the bottlenecks that constrain diffusion of improved varieties to poor farmers in the SAT.

ICRISAT has shown that public-private-people partnerships add value to research besides enhancing the impact of research outputs on smallholder farmers. Initiatives like the Agri-Science Park which was started in 2003 as part of the Genome Valley Initiative of the Government of Andhra Pradesh, and its components, the Ag-biotech Innovation Center, the Hybrids Parents Research Consortia, the Bio-products Research Consortium, among others, are a few examples of effective partnerships.

ICRISAT's US$ 6 million NutriPlus Knowledge Center is a platform for R&D and innovation in food processing with its focus on cereals, legumes, fruits/vegetables, and medicinal and aromatic plants.

The recently launched ICRISAT-DBT Platform for Translational Research on Transgenic Crops will facilitate a collaborative and coordinated approach for the translation of existing genetic engineering technologies to the development of transgenic crop varieties, which can efficiently be taken through product development to commercialization. Resilient crops that can better withstand heat, drought, pests and diseases, can go a long way towards alleviating hunger and poverty.

Hence building resistance to shocks caused by the food and financial crises is critical, and calls for a three-pronged approach. The most important step is to promote pro-poor agricultural growth. This means greater investments in R&D, rural infrastructure and institutions and information monitoring and sharing. It is commendable that India and China increased their investments in agriculture and social protection in 2008 by 24% and 27% respectively.

Secondly, market volatility must be reduced, in this case agricultural commodity markets in addition to financial markets.

Thirdly, expanding country-owned and country-driven social safety nets and child nutrition programs will mitigate short-term risks and prevent long-term consequences, as we are seeing now.

The poor desperately need a bailout. And as institutions of research, we can address the challenges the poor and food-insecure face through the use of science tools. Let us together make it happen!

Thank you.

Agropedia: Opening Up New Frontiers of Agri-knowledge

Inaugural Address, Launch of the Crop Knowledge Models and Agropedia Workshop, 19 February 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Dr Patil, Dr Prabhakar, representatives from State Agricultural Universities and ICAR, ladies and gentlemen, good morning!

Welcome to the launch of the Crop knowledge models and Agropedia workshop. I understand that we have participants from five State Agricultural Universities and seven ICAR institutions besides the KVK network attending this workshop. I am sure that all of you being scientists in the Indian NARS, are familiar with ICRISAT's work and impact in the semi-arid tropics of South Asia, especially India.

None of us is insulated from the challenges facing the world today. Energy, food and financial crises are threatening livelihoods, particularly of the poor. The critical challenges facing the SAT in India and in your own states and mandate eco-regions are further exacerbated by the unfriendly terrains you have to function in.

However, the overarching challenge is that related to water productivity, which is accentuated by climate change-related phenomena. In a recent and successful external review that ICRISAT had, this emerged as a key pointer for our ongoing and future research.

While ICRISAT develops new technologies, it also believes that dissemination of information is crucial for this knowledge to reach the needy. Knowledge is a key input and determinant in our responses to this emerging set of challenges.

Over five years ago, ICRISAT founded the Virtual Academy for the Semi-Arid Tropics (VASAT) as an experimental vehicle to study innovative ways to communicate drought-related information. A key gap we identified was that not enough agricultural information was available in the digital format. That acted as a constraint in building new services for information and learning to reach the masses. We explored several approaches and methods, and over a period of time, we formed a partnership that has led to the Agropedia.

There is considerable interest in finding new ways to reach agricultural information to practitioners, especially farmers. I believe the range of technologies and platform built on this effort will prove to be valuable across the globe. The emerging and cutting edge technology of semantic web is at the very heart of this Agropedia effort.

This will also serve as an opportunity for leading edge agri-scientists and computer science professionals to work together in the service of the poor. An end to the paucity of digital agricultural information will pave the way for new online and mobile phone-based services. The Department of Agriculture in the Philippines is keen to develop an Agropedia Filipino.

I am pleased that two of our consortium partners are represented here today. I learnt that the Indian Institute of Technology (IIT) in Kanpur, which leads the Agropedia design and development, is a national center of excellence in IT education and research. I am glad it has come forward to address a critical issue that has global relevance.

The University of Agricultural Sciences at Raichur in Karnataka is a brand new university. Its mandate region in northeast Karnataka consists mainly of the SAT region. Faculty of this University are active partners in this consortium. I appreciate the efforts made by these partners to hold the joint workshop here at ICRISAT.

I'm sure that during your two-day workshop, novel ideas will come up and new ways of sharing knowledge will be discussed. I wish your deliberations success.

Please do continue to stay in contact with the Agropedia community and make it your own. New advances in agriculture will need new strengths in knowledge sharing.

Thank you.

Ensuring Enhanced Livelihoods of Sorghum and Pearl Millet Farmers

Inaugural Address, Terminal Workshop of the CFC-supported Project on Enhanced Utilization of Sorghum and Pearl Millet Grains in the Poultry Feed Industry to Improve Livelihoods of Small-scale Farmers in Asia, 18 March 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Mr Nicolaus Cromme, Program Manager, Common Fund for Commodities, representatives from partner organizations in India, China and Thailand, delegates from Sri Lanka, Nepal, Philippines and India, distinguished farmers and members of farmers associations in India and colleagues from ICRISAT, good morning.

Welcome to the terminal workshop of the CFC-supported project on Enhanced utilization of sorghum and pearl millet grains in poultry feed industry to improve livelihoods of small-scale farmers in Asia.

Sorghum and pearl millet are two important mandate crops of ICRISAT, which apart from their food uses, have great potential as ingredients in poultry feed and in other industrial uses. Of late, sorghum's cultivated area has been declining; so is its food use which is having a bearing on farmers' incomes. This project was implemented to rectify the situation by enhancing the productivity and marketability of these two crops. This was facilitated by engaging farmers in production technologies and linking them with the poultry feed industry.

I have been closely associated with the project since its inception and am pleased with the way it has progressed towards successful completion.

ICRISAT and its partners have worked hard in the last four years to help farmers overcome difficulties associated with rainy-season sorghum.

This workshop is aimed at sharing the experiences of the project partners in India, China and Thailand, where the project was implemented and to facilitate the wider dissemination of learnings from it.

Facilities developed under this project helped farmers harvest the crop at physiological maturity and dry the harvested ear heads using ear head driers to overcome the deleterious effect of grain mold. Storage structures built have aided the safe and scientific storage of grains and helped farmers avoid distress sale of produce. This has enabled them to realize better prices and also improved their bargaining power.

The formation of farmers' associations in all the project clusters and linking these groups to markets was another important achievement of this project. Efforts at modifying the conventional supply chain to avoid intermediaries and linking producers directly to end users have been successful. Farmers have been trained in bulking, grading and bulk marketing of grains. The bulk marketing of sorghum and pearl millet thus helped farmers and industry.

Apart from the above, the project developed productive ties involving various partners from research, private, NGO and banking sectors. Farmers have been linked with formal credit institutions in all three countries and have released farmers from their dependence on private moneylenders.

This project's success can be attributed to its farmers'-centered, farmers'-owned, and farmers'-managed participatory approach, which has accelerated their true participation.

The project was successful in mobilizing small-scale sorghum and pearl millet farmers with the aim of enhancing farm-level productivity and improving harvesting, storage, handling and grain marketing practices. It also facilitated linkages between farmers on the one hand and seed and grain suppliers, credit agencies, poultry feed manufacturing companies and poultry producers on the other.

I would like to thank the Common Fund for Commodities for their generous support to this project and FAO for their guidance and backing in its implementation.

I take this opportunity to thank all the delegates, partners and farmers for the success of this project and wish the workshop great success.

Thank you.

Assessing Research Impact for a Sustainable Future

Inaugural Address, Impact Master Classes, 18 March 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Dr Eric T Craswell, Director, The Crawford Fund; Dr Debbie Templeton from the Australian Centre for International Agricultural Research; Dr P K Joshi, Director, National Centre for Agricultural Economics and Policy Research; participants from the NARES, and ICRISAT scientists, good morning and welcome to the Master Class on Impact Assessment.

One billion people are estimated to be undernourished – a figure that was aggravated by dramatically-high food prices in 2008. While food prices have fallen since last year's peak, the global food crisis is not over. The situation is compounded by the global financial crisis that limits governments' and individuals' room to manoeuvre. In some places, the quest for food security is breeding neo-colonialists.

Poor people spend 50 to 70% of their income on food and have little capacity to adapt as prices rise. The financial crunch lowers the real wages of poor workers, and leads to rising unemployment. And when economic growth declines, investment in agriculture is cut back.

In October 2008, Kenyan anthropologist Richard Leakey predicted that the financial crisis would be devastating to science and that not only would companies and governments have less money to spend on research and development, but philanthropists and aid agencies too would cut back support. But science must not be sacrificed as a result of the financial meltdown.

With funds becoming hard to come by, research organizations are going to increasingly be asked to provide concrete evidence that the benefits of research are reaching the poor and that these benefits are sustainable in the future.

Impact assessment is used to ensure that projects, programs and policies are economically viable, socially equitable and sustainable. It serves as an important means of improving technology choice.

Over the next few days, participants of the Master Class will be exposed to knowledge and skills necessary to undertake robust *ex ante* and *ex post* economic impact assessments of agricultural R&D. It will also make them aware of methodological advances in impact assessment and pathway analysis. The requirements for clarity, transparency and credible evidence in *ex ante* and *ex post* impact assessment will also be covered.

We basically see impacts-based evaluation as an integral part of learning and of improving program and institutional management. Following this route will ensure that the program and institution reach their ultimate goals.

Sound economic and agricultural policies, including significant investments in agriculture, can prevent gruesome outcomes. At the same time, policy and investment decisions in agriculture should be geared toward exploiting new opportunities and building resilience for future challenges.

ICRISAT recently went through an External Program and Management Review, in which the panel emphasized that greater attention to strategic planning and research prioritization is the key to our continued success.

At the end of the Master Class, your skills at undertaking quantitative impact assessment will have been enhanced and a collaborative bond will have developed between all of you. It is hoped that this will continue into the future.

I take this opportunity to thank ACIAR and the Crawford Fund for sponsoring this event. I am sure that the participants from Bangladesh, Cambodia, China, India, Indonesia, Laos, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam will benefit immensely from this exercise. Ultimately, the research that we do has to transform the lives of the poor.

Thank you.

Efficient Clean Development Mechanisms for a Biofuel Revolution

Inaugural Address, Workshop on Awareness Building for Clean Development Mechanisms (CDM) in Biofuel Production, 2 April 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Mr Vineet Raswant, Senior Technical Advisor, IFAD; representatives from partner organizations in India, China, Philippines, Vietnam, Columbia and Mali; invited speakers and delegates from India and Japan; farmers, private sector partners and ICRISAT colleagues, good morning!

I would like to welcome all of you to this two-day awareness building workshop on Clean Development Mechanisms in biofuel production. CDM, established 11 years ago under the Kyoto protocol, has evolved based on the 1992 United Nations Framework Convention on Climate Change (UNFCCC), and provides the foundation for international efforts to reduce greenhouse gas emissions and to address climate change.

The fourth assessment report of the Inter-Governmental Panel on Climate Change (IPCC), released in 2007, has projected that temperature increase by the end of this century is likely to be in the range 2 to 4.5^{0}C.

Most of the observed increase in global average temperatures since the mid-20th century has been in the concentration of anthropogenic GHGs such as carbon dioxide, carbon monoxide, methane and nitrous oxide. Global

increases in CO_2 concentrations are primarily due to fossil fuel use, with land-use change (agriculture) too contributing significantly.

CDM was designed to create opportunities for synergies between cost-effective climate change mitigation and sustainable development. It allows industrialized countries with a greenhouse gas reduction commitment to invest in emission-cutting projects in developing countries. The certified emission reduction (CER) credits enable them to meet Kyoto targets that are tradable. The Netherlands, Japan, Spain and Italy are major buyers of CER while China, India and Brazil are major sellers.

Our energy future lies in a low carbon economy. CDM is expected to speed up the transfer and deployment of low and zero carbon technologies from developed countries to developing countries and to arouse business interest and engagement from the private sector into the issue of climate change mitigation.

Developing countries' efforts to eradicate poverty and enhance economic growth require vast amounts of energy and huge investments in energy infrastructure – more than half of the around $26 trillion forecast to be invested worldwide in the energy sector by 2030. Also, the greatest greenhouse gas mitigation potential – around 70% of what is possible worldwide – is in developing countries, for which environmentally sound technologies are central.

Since the beginning of 2006, the estimated potential of emission reductions to be delivered by the CDM pipeline has grown dramatically to 2.9 billion tons of CO_2 equivalent, about the combined emissions of Australia, Germany and the United Kingdom. Overall, more than 1230 CDM projects have been registered as of November 2008, with around 4200 more in the project pipeline.

We need to find and exploit opportunities that aid us in shifting towards becoming a low carbon economy where higher resource productivity – producing more with fewer natural resources and less pollution – will contribute to higher living standards and a better quality of life. This will

entail partnerships between government, research, business, educational institutions and others. In short, there are many opportunities provided we are willing to work together, to learn from best practices and to innovate.

Studies have shown that sweet sorghum is carbon dioxide neutral, emitting only as much carbon dioxide as it absorbs. The emission and absorption is at 45 tons of carbon dioxide per hectare of sweet sorghum.

The interest in using *Jatropha curcas* L. as a feedstock for the production of biodiesel is rapidly growing. The properties of the crop and its oil have persuaded investors, policymakers and CDM project developers to consider it as a substitute for fossil fuels to reduce greenhouse gas emissions.

However, jatropha is still a wild plant whose basic agronomic properties are not thoroughly understood and its environmental effects have not been investigated yet.

I would like to share ICRISAT's experience in the area of CDM. A most appropriately named village, Powerguda in Adilabad district of Andhra Pradesh, has pioneered the sale of CERs to the World Bank for $645 per annum. The village was selling 147 tons equivalent of saved carbon dioxide. This was possible because of Dr SP Wani, Dr Emmanuel D'Silva and their team in partnership with national partners. ICRISAT believes that any biofuel production program must be achieved without any detriment to the natural ecosystem, biodiversity and food reserves of the country.

I am sure that a platform such as this one will help not only in identifying best bet practices that can minimize GHG emission reductions in biofuel crops production and processing but also enlighten partners and stakeholders in understanding potential steps to operationalize CDM.

The participation of Tata Chemicals Ltd, Praj Industries Ltd and Syngenta India Ltd in the workshop will pave the way for exploring the potential of CDM projects based on biofuel feedstocks like sweet sorghum, jatropha and cassava.

Let me take this opportunity to thank the speakers from different parts of India and Dr Jane Romero from Japan who are here to share their wisdom and experiences. The awareness and knowledge gained here will help in enlightening partners on CDM issues, leading to projects and strengthening the biofuel revolution in the overall interest of dryland farmers in the semi-arid tropics.

I would like to reiterate that what we need is a science-based approach to biofuels development that can help ensure an alternative to fossil fuel, help reduce the adverse impacts of climate change, and improve the livelihood of dryland farmers without compromising food security.

Thank you!

Modern Molecular Pathways Open Doors to Crop Improvement

Message, ICRISAT-CEG Fifth Training Course on Molecular Marker Technologies for Crop Improvement, 18 May 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.*

Scientists from ICAR, State Agricultural Universities, Regional Agricultural Research Stations and other organizations and those from Kenya, Ghana, Eritrea and Nepal, good morning and welcome to the ICRISAT-CEG Fifth training course on Molecular marker technologies for crop improvement.

The Food and Agriculture Organization's most recent estimates put the number of hungry people at 923 million, an increase of more than 80 million since the 1990-92 base period. It is estimated that between 2003-05 and 2007, 75 million more people were added to the total number of undernourished.

Under-investment in agriculture over the past 30 years, high and volatile food prices and continuing economic turmoil are all combining to sharply increase the level of global food insecurity.

It is imperative that expanding food production through enhanced productivity must constitute the cornerstone of policies, strategies and programs seeking to attain a sustainable solution for food security. The financial crisis and climate change are threatening to destroy the delicate fabric of our lives.

** Delivered by Dr Mike Butterfield, Global Theme Leader for Biotechnology, on behalf of the Director General.*

These, combined with population explosion, low levels of food stock and slow production response in developing countries, may lead us to the next food crisis!

Future food demand cannot be met merely from incremental gains from conventional plant breeding. A quantum change in yield improvement is needed, such as that which occurred during the Green Revolution, which was made possible by a high level of both public and private investments, combined with a conducive public policy framework. Moreover, agriculture's share in total Official Development Assistance which fell from 17% in 1980 to a mere 3.8% in 2006, also needs to be reversed.

Finding solutions to major crop productivity constraints, developing new technologies that raise yields in low-potential areas and creating opportunities for diversification in agricultural value chains are some of the major present day agricultural challenges.

At ICRISAT, crop improvement research contributes to sustainable growth in crop production, farm income, food security and environmental protection. Improved varieties have been developed through the use of conventional tools.

We are now using current technologies such as structural and functional genomics to identify, isolate and manipulate genes for traits of interest as well as genetic engineering to introduce novel genetic variability for traits lacking sufficient inheritable diversity.

Among our notable successes in the area of modern technologies are the world's first cytoplasmic male sterility based-pigeonpea ICPH 2671 that resists wilt and sterility mosaic virus and yields 40% more than conventional varieties and pearl millet hybrid HHB 67 Improved developed through marker-assisted selection. HHB 67 Improved resists downy mildew and saves US$ 8 million in crop losses annually.

Since it was set up in 2007, ICRISAT's Center of Excellence in Genomics (CEG) has trained over 80 scientists from India and other developing countries in the application of marker technology in crop improvement. I am sure that the 25 scientist in the current course will find the course equally useful.

We have a new initiative, the ICRISAT-DBT Platform for Translational Research on Transgenic Crops, which will translate transgenic technology and harness its products to meet the needs of agricultural growth. It will serve as a facility of reference to strengthen national, regional and international linkages in transgenic R&D, exchange of materials and information, as well as support training, consultation and technology commercialization.

The current course will provide participants hands-on experience in the use of molecular markers (SSRs, SNPs and DArTs), gene/QTL mapping and

marker-assisted breeding. It will also focus on the experimental design and data analysis components of molecular markers, and the need to use high-throughput marker service facility.

I believe that searching for solutions to meet urgent food needs will require the sharing of insights by a diverse set of experts and actors, from scientists and engineers to regulators and policymakers. It is through collective efforts in capacity building that we can move ahead and ensure better and higher crop productivity.

Equipped with these tools, you will be able to disseminate these technologies for crop improvement for the greater good of the poor farmer.

Thank you.

Exploiting Low-cost Biological Options for Sustainable Agriculture

Message, Guest of Honor, First Asian Congress for Sustainable Agriculture, 21 June 2009, Acharya N G Ranga Agricultural University (ANGRAU), Hyderabad, India.

Honorable Minister for Agriculture, Government of Andhra Pradesh, Mr Raghuveera Reddy; Vice Chancellor of ANGRAU Dr P Raghava Reddy; Director of CRIDA Dr B Venkateswarulu; Dr MS Reddy from Auburn University; Dr Laxmi Kantha Reddy, Director of Research, ANGRAU; Dr S Desai, Organizing Secretary for the conference, delegates to this Congress, friends, ladies and gentlemen, good morning!

I would first like to thank the organizers for inviting me today to share my views on sustainable agriculture, with particular reference to plant growth promoting rhizobacteria (PGPR).

The Food and Agriculture Organization estimates that the number of undernourished people increased from 848 million in 2003-05 to 923 million in 2007, largely owing to the food price crisis. In addition, as climate change further increases climate variability, temperature, and the risk of droughts and floods, diseases and pests, threats to agricultural productivity and production will escalate. Hence the key to a sustainable future lies in improving crop productivity through ecologically friendly farming systems

that are more effective in harnessing nature, and that will go a long way in enhancing the livelihoods of the poor living in the semi-arid tropics.

Conservation agriculture systems generate benefits in terms of yield, sustainability of land use, incomes, timeliness of cropping practices, ease of farming and ecosystem services. It is estimated that worldwide there are now almost 100 million hectares of arable crops which are grown each year without tillage.

Critical to this is an increase in the quantities of organic matter in the soil, energy and nutrients required by soil-inhabiting flora and fauna that constitute the "life" of a soil, playing a vital role in maintaining its porosity, enhancing its moisture holding capacity and extending the availability of nutrients to crops. Enhancing soil health is a key strategy in the drylands.

Relying too much on chemical pesticides has resulted in safety risks, outbreaks of secondary pests normally held in check by natural enemies, environmental contamination, decrease in biodiversity of natural enemies and insecticide resistance.

A majority of the world's poor lives in countries of the semi-arid tropics, and usually comprises small holders owning less than 2 ha. Money spent on chemical pesticides can constitute 50% of the total input cost of crop production, especially for crops like cotton and pigeonpea, making it completely unviable for these poor farmers, obviously leading to low yields.

Increasing cost and negative effects of pesticides and fertilizers necessitate biological options of crop protection and production. Hence, we need to find low-cost biological options for resource poor SAT farmers.

Biological options such as entomopathogens, antagonistic microbes, endophytes, botanicals, crop residues and animal wastes serve as

alternatives to chemical pesticides and fertilizers. Incorporating crop residues and applying plant growth promoting rhizobacteria can have a direct impact not only on soil health and crop productivity but can also be an alternative to chemical pesticides. Majority of PGPR are isolated from rhizosphere and rhizoplane of leguminous and other field crops and various sources of herbal composts.

PGPR stimulate growth directly by (i) nitrogen fixation, (ii) solubilization of nutrients (phosphorous), (iii) production of growth hormones (1-amino-cyclopropane-1-carboxylate [ACC] deaminase), and indirectly by antagonizing pathogenic fungi (by production of siderophores, chitinase, β-1, 3-glucanase, antibiotics, fluorescent pigments and cyanide). The use of PGPR inoculants as bio-fertilizers and as antagonists of plant pathogens and insect pests provides a promising alternative to chemical fertilizers and pesticides.

Countries of the semi-arid tropics are rich in microbial diversity. This should be exploited for sustainable agriculture by focusing on identifying potential plant growth promoting microbes, screening and characterization for plant growth benefiting or promoting traits, and understanding the mechanism of action of these microbes.

Thus, we need to enhance the efficiency of external inputs by employing the best combinations of plant growth promoting microbes for improved and sustainable crop production.

Scientists at ICRISAT have isolated and identified a large collection of bacteria, fungi and actinomycetes with agriculturally beneficial traits from various herbal composts and rhizosphere soil samples of sorghum, pigeonpea and rice. These microbial accessions possess at least one of seven agriculturally beneficial traits studied, namely phosphate solubilization, siderophore production, cellulose degradation, nitrogen fixation, antagonism to disease-causing fungi, and entomopathogens.

We have just started working on bio-active secondary metabolites of the potential PGPR and botanicals. We have also identified a number of herbal plant composts capable of suppressing the growth of the above plant pathogenic fungi and insect pests and helpful in managing insect pests and disease causing fungi.

I am sure that during the course of this congress, new insights and ideas will emerge from interactions among participants to stir up a movement that will ensure food for the poor in the drylands, using low-cost inputs, including PGPR.

Thank you.

Village Level Dynamics: Carving Pathways Out of Rural Poverty

Keynote Address, Launch Meeting of the Project on Tracking Change in Rural Poverty in Household and Village Economies in South Asia, 30 June 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Dr Prabhu Pingali, Ms Ellen McCullough and Austin Walters of the Bill & Melinda Gates Foundation, partners from NCAP, IRRI, CPD/BRAC/ SocioConsult, the Indian NARS who bring special skills to the table, Hans Binswanger, TS Walker, Mruthyunjaya, Narpat Jodha and ICRISAT scientists, good morning! Welcome to the launch meeting of the project on Tracking change in rural poverty in household and village economies in South Asia.

I would like to thank the Foundation for their engagement with ICRISAT and their support to this project, which aims to dramatically increase the availability and use of reliable time-series panel data that addresses the dynamics of socio-economic development in the semi-arid and humid tropics in South Asia.

In many ways, South Asia is sitting on a tinderbox. By 2050, its population is likely to exceed 2.2 billion from the current level of 1.5 billion. About 70% of South Asians live in rural areas and account for about 75% of the poor. Most of the rural poor depend on agriculture for their livelihoods. The sector employs about 60% of the labor force, while it contributes only 22% of regional GDP.

With an estimated 600 million people subsisting on less than US$ 1.25 a day in South Asia, upheavals connected with food price, financial crises or climate

change can push a large number of people into destitution. High population densities, a concentration of poverty and climate variability all combine to make semi-arid South Asia highly sensitive and vulnerable.

Hence it is important to invest in high frequency village, household and field surveys such as those pioneered by ICRISAT in the mid 1970s, integrating biological, technical, social and economic approaches to obtain high quality data.

The village level studies, with their high frequency village, household and field surveys, generated a lot of useful information and helped policymakers, researchers, development functionaries and extension staff in identifying principles and practices relating to technology options. The farmers proved to be a valuable resource in this endeavor.

The data have been widely used in priority-setting exercises, in typology construction for identification of homogenous agro-climatic and socio-economic zones, and in the evaluation of trade liberalization issues and their implications for resource use efficiency.

Also, it is used in estimating farmer supply response, factor productivity, returns to investing in public sector infrastructure and agricultural research, and in the assessment of the extent and determinants of rural poverty and agricultural diversification.

More than 150 research papers and 36 doctoral dissertations were based on empirical analysis of VLS data in the SAT of India and West Africa.

Since then, numerous changes -- incidence of HIV/AIDS, globalization of agriculture markets, feminization of agriculture, deepening of resource crises, increased democratization, population growth, urbanization and integration of labor markets -- have profoundly shaped the livelihoods of people dependent on rainfed agriculture.

The objective of this project is to enhance the availability of reliable household-, individual-, and field-specific, high-frequency, time-series data in selected villages in the semi-arid and humid tropics of South Asia and increase the availability of updated and expanded meso-level agricultural data in India and Bangladesh.

Decentralizing the coverage of agricultural statistics will help us arrive at a clearer profile of the spatial attributes and correlates of poverty.

Let me highlight that the agricultural data from this project will be a launch pad for a more systematic organization, synthesis and use to track agricultural and rural development not only in South Asia but also in other semi-arid and humid tropics of Asia. Lessons can be learned for similar agroecosystems in Africa.

Finally, the project will nurture policy analysis and strengthen capacity building to fully exploit this data. The project covers South Asia: western Gujarat, Maharashtra, northern Karnataka, Rayalaseema region of Andhra Pradesh, Orissa, Chattisgarh, Jharkand and Bihar, spanning 6 of India's 20 agro-ecologies, in addition to Bangladesh.

Our societies expect a more comprehensive understanding and measurement of progress. We need to refine our indicators to express what is important to the rural poor in the semi-arid tropics and humid tropics and what makes up and improves their quality of life. As the late Nobel laureate physicist Niels Bohr said, "Nothing exists until it is measured.''

The project's title of tracking poverty should be interpreted broadly as the focus is on why and how changes in government programs, market prices, and institutions are mediated in village and district settings and affect the poor over time.

During the course of the project meeting, I am sure that Cynthia Bantilan and her group and our partners will have fruitful discussions on work plans and timelines, so that the data generated informs policy and leads to the improvement of the lives of the rural poor in the South Asian SAT and beyond.

The task of ensuring that the voices of the poor are heard is left to us. Let us make them be heard!

Thank you.

Providing HOPE and Food Security to Sorghum and Millet Farmers

Welcome Address, First Regional Work Plan Meeting of the Project on Harnessing Opportunities for Productivity Enhancement (HOPE) of Sorghum and Millets in Sub-Saharan Africa and South Asia, 11 August 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Good morning ladies and gentlemen!

I am pleased to welcome you all to the ICRISAT-Patancheru campus for this first regional work plan meeting of the project on Harnessing Opportunities for Productivity Enhancement (HOPE) of Sorghum and Millets in Sub-Saharan Africa and South Asia, which was recently approved for funding by the Bill & Melinda Gates Foundation.

We've been hoping for more than two years that the Foundation could be convinced to support research and development for the improvement of productivity and markets for nutritious cereals sorghum and millets to meet the needs of the rural and urban poor in Sub-Saharan Africa and South Asia. These 'hopes' have finally come to fruition.

Many of you attended the regional project proposal development meeting held here in November 2007. This was followed by a similar meeting of scientists from Western and Central Africa and Eastern and Southern Africa in Nairobi, Kenya.

Our first submission contained substantially more strategic 'crop improvement' research – and substantially less socio-economics research – than the approved proposal that has ultimately been agreed to by the donor.

However, the Foundation requested these changes so that we would be sure of establishing the baseline on which they might be able to extend longer-term support (10 years or more).

If this initial 4-year project is successful, the Foundation has indicated its interest to continue supporting improvement of these crops by ICRISAT and our partners. Future phases of this support could include substantially more strategic crop improvement research – along the lines of our initial proposal.

In order to obtain this longer-term research support, we must together demonstrate that our currently available technologies for these dryland cereals are acceptable to farmers and/or take farmers' assistance to identify priority areas where further refinement is required – and we must together demonstrate that our research efforts can improve the livelihoods of the rural families involved in production and marketing of these crops in the specific regions targeted in this project. The vision of this project is to raise yields of sorghum and millets by 35-45% more in the next four years.

Here in India, these target areas are the postrainy season-sorghum tract of Maharashtra – in the rain shadow of the Western Ghats – and the heart of the pearl millet tract in northwestern India, which extends from Gujarat through Rajasthan to Haryana. Here sorghum and pearl millet are the most reliable crops for production of staple sources of foodgrain for human consumption and dry fodder for ruminant livestock. These are challenging crop-livestock production environments in which the impact of both public-sector and private-sector plant breeding efforts have not been as great as in more favorable production environments for these crops in India. However, if it was going to be easy, it would already have been done.

I hope that you all have a very productive meeting here today and tomorrow, so that together we all come away with a clear idea of – and work plans for -- the specific activities required to meet the milestones indicated for the first year of this project as well as the progress that must be made this year to be able to deliver on project milestones for the second year.

I request each of you to participate actively in the development of work plans for the specific portions of the project where you have expertise to be involved. By the end of this meeting you will have a reasonably clear understanding of what needs to be done, by what time, by which people, and with what resources, and how efforts of one group are related to those of others involved in implementing this project.

Once again, welcome and wishing you all very productive deliberations.

Thank you.

Serving the Poor through Agri-Business Ventures

Inaugural Address, Agri-business Camp, 13 August 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Dr Gopala Krishna, Vice President, Coromandel Fertilizer; Dr B N Sarkar, Scientist, DSIR, Government of India; and resource persons, good morning and welcome to the agri-business camp at ICRISAT and to a new way of doing business.

Agricultural research is increasingly being done through public-private-farmer alliances that ensure all stakeholders, especially the poor, gain. This, apart from ensuring access to proprietary technologies and processes, maximizes the public goods nature of innovations jointly owned with the private sector. For this goal of enhancing public-private partnership, we established and operationalized a platform called Agri-Science Park (ASP) where agri-business incubation is a major initiative.

ICRISAT's Agri-Business Incubator (ABI) is an institutional innovation system that facilitates the creation of competitive agri-business enterprises through technology development and commercialization to benefit farmers in the semi-arid tropics. This serves the purpose of leveraging emerging technologies of the developed world to benefit the developing world, and helps realize the potential of new opportunities in agri-innovations, biotechnology, biofuels, seed businesses and farm ventures.

Promoting innovations in agriculture requires coordinated support to agricultural research, extension and education, fostering innovation

partnerships and linkages along and beyond agricultural value chains, and creating an enabling environment for agricultural development. This is a very smart integrated approach to helping small holders and poor people in developing countries.

ABI-ICRISAT is well positioned to help you in this endeavor wherein we have globally established our leadership in the segment. ABI-ICRISAT has been awarded nationally and internationally as best incubator.

This camp will provide an opportunity for innovators to demonstrate their ideas and innovations. I believe it is an effort to build awareness, motivate innovators to set up small and micro enterprises (SMEs), to utilize local resources for value addition, to bring together entrepreneurs who are providers of goods and services and various government departments and their agencies who are catalyzing the government's development efforts.

However, facilitating the growth of SMEs and helping entrepreneurs undertake suitable economic activities first involves identifying and mapping existing resources, and identifying area-wise concentration of different primary produce for the development of clusters of activities with faster growth potential.

ABI's innovative ventures incubation program promotes ventures in agri-business which are proprietary products or novel services with good market potential. It facilitates funding through the Department of Scientific and Industrial Research, Government of India's Technopreneur Promotion Program (TePP), for which this camp will serve as a platform. ICRISAT is an outreach centre for this program.

While it is important for agri-entrepreneurs to find their feet and grow, it is equally important to ensure that the small farmer is brought into the picture. ICRISAT believes that the smallholder farmer holds the key to future food security. By helping nurture innovations and entrepreneurship in the field of agriculture, ABI is fulfilling ICRISAT's mission of eliminating poverty and improving livelihoods. I hope you too will pursue this noble ideal that will make the world a more equitable place.

Once again, welcome and wishing you fruitful deliberations.

Thank you.

Heralding a Unified Approach to Watershed Development Programs

Inaugural Address, Consultation Workshop on Common Guidelines for Integrated Watershed Development Program, 25 August 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Ms Rita Sinha, Secretary, Department of Land Resources, Ministry of Rural Development; Mr Madhukar Gupta, Commissioner, Watersheds, Rajasthan; Mrs A Santhi Kumari, Commissioner, Rural Development, Andhra Pradesh; Directors of state watershed programs; ISRO, partners from CRIDA, NIRD, MANAGE, NRSA, and the Government of Andhra Pradesh, good morning. Welcome to the Consultation workshop on Common guidelines for the Integrated Watershed Development Program.

Recent studies by the Asian Development Bank have shown that not only are investments in rainfed areas as productive as in the well endowed regions, but that such investments have greater impacts in these hotspots of poverty. Though 85 million hectares of rainfed areas out of the 142 million hectares of net cultivated area have suffered neglect in the past, today watershed programs in India are silently revolutionizing and improving the productivity of rainfed agriculture.

This quiet Indian success can be attributed to a combination of people-centered interventions and up-to-date science tools that enrich watershed programs.

Nonetheless, issues of water scarcity, rapid depletion of groundwater table, fragile ecosystems, land degradation, low rainwater use efficiency, high population pressure, underinvestment in water use efficiency and most importantly, climate change, remain of great concern to farmers and policymakers alike.

In the last three years, ICRISAT together with partner institutions from the Indian Government, Indian Council of Agricultural Research and other institutions undertook a meta-analysis of almost 600 watershed programs in India. The findings and recommendations of this Comprehensive Assessment, which was sponsored by the Ministry of Agriculture and Cooperation and the Ministry of Rural Development, were integrated into the new Common Guidelines for Watershed Projects in India, thus up-scaling ICRISAT's approach to the state and national levels.

Watershed projects aim at increasing water for enhancing agricultural productivity, water for people and their livestock as well as water for the environment. Growing water scarcity is one of the most significant factors that challenge the achievement of the Millennium Development Goals (MDGs) as also the reduction of poverty worldwide.

ICRISAT's experience in integrated watershed development and innovation programs dates back to 1999. In order to improve the living conditions of the rural poor and establish sustainable management styles to protect natural resources, ICRISAT established several community watershed models in India, Thailand, Vietnam, China and the Philippines.

Creating resilience among the rural poor through capacity building is key. Enabling communities to develop adequate adaptation strategies with a combination of local knowledge and latest scientific technologies and tools is one of the key features of ICRISAT's innovation in watershed development.

The nucleus watersheds constitute proof-of-concept sites and provide the experience and data needed to share successful approaches as well as failures with relevant policymakers and institutions. Ultimately, ICRISAT aims at scaling-up the lessons learned by feeding and sharing its experiences and recommendations into existing policy frameworks in the respective countries, and by sharing its experiences with donor agencies, NGOs and research institutes.

Recently, ICRISAT enriched its watershed programs with yet another component, biofuel production.

A sample of the impacts of our watershed programs:

- Soil sampling and micronutrient application led to yield gains in all project sites, thus increasing the benefit-cost ratio;
- Higher rainwater use efficiency (by 1.5 to 1.75 times) was observed in terms of net economic returns when micronutrients were applied leading to 25% yield increase in soybeans in Madhya Pradesh;
- Identified 2 million ha of rainy season fallow land in India with GIS and satellite imagery;
- Rehabilitation and cultivation of fallow lands added income and food security of communities;
- Analysis of fallow land guided policymakers and funding agencies in identifying further research areas and to remove bottlenecks associated with effective and sustainable utilization of rice-fallows in South Asia; and
- In northeastern Thailand, IPM techniques boosted farmers' net profit by 51% in cabbage compared to conventional chemical-based insect management.

To reiterate, a combination of people-centered interventions and up-to-date science tools that enrich watershed programs are needed to tackle the challenges ahead.

The new common guidelines for the Integrated Watershed Development Program are based on equity and gender sensitivity, decentralization, facilitating agencies, centrality of community participation, capacity building and technology inputs, and monitoring, evaluation and learning.

This workshop, with its combination of discussions and field visit to our model Adarsha watershed, will enhance awareness among senior policymakers about the new program. It will also identify issues to be addressed in operationalizing the guidelines.

I would like to take this opportunity to again thank Ms Rita Sinha and the Government of India for their continued support to ICRISAT in the service of the dryland poor and wish the workshop success.

Thank you.

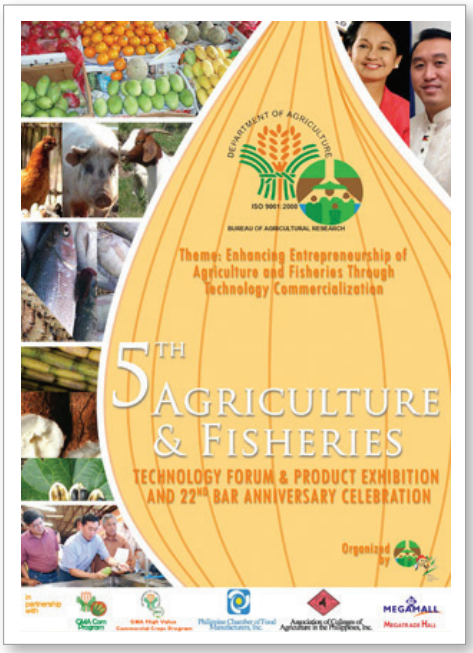
Enriching Lives through Technology Commercialization

Guest of Honor, 5th Agriculture and Fisheries Technology Commercialization Forum and Exhibit on Enhancing Entrepreneurship in Agriculture and Fisheries through Technology Commercialization, 27 August 2009, Mandaluyong City, the Philippines.*

Ladies and gentlemen, good morning!

The world is becoming more complex, and this calls for innovation. The food and financial crises have become more complicated with implications for financial and economic stability and food security. The food crisis has added to general inflation and macroeconomic imbalances while the financial crunch and the economic slowdown have decreased demand for agricultural commodities, for food, feed and fuel. This double blow is proving to be catastrophic for small farmers, particularly the poor.

Poverty continues to limit access to food, and yields of several crops have reached a plateau. Hence, there is a need to improve the efficiency of production and increase the utility of agricultural crops. Productivity gains will have to be achieved through better management of natural resources, crop improvement and capacity building.



With the advancement of the knowledge economy, the world is seeing how innovation empowers individuals, communities and countries with profound impact on business and society. Innovation is not just about generating new ideas. It is about accelerating economic growth and promoting development.

Innovation is about translating ideas into value-added products and services. This requires versatility of attitude and willingness to adopt and welcome unprecedented change on the part of all stakeholders involved: individuals, organizations and society.

* Delivered by Dr Santiago R Obien, Consultant, Philippines, on behalf of the Director General.

Ideally, technology commercialization enriches the human condition.

By enhancing technological state-of-the-art, it increases productivity, lowers costs, expands options for problem solving and creates new jobs.

Based on ICRISAT's experience in India, successful commercialization involves three core areas:

- Developing and managing an 'innovation team' of inventors, investors, technologists and entrepreneurs;
- Building a portfolio that spreads risk; and
- Leveraging input from technologists throughout the commercialization process.

Since even the best mousetrap in the world won't help you if the market isn't interested in catching mice, assessing what separates a successful and new technology from a flop is crucial.

Also, by integrating the actors within and across the input-supply, production, sale/storage, and marketing stages of the value chain, one can capture synergies and reduce transaction costs, resulting in large increases in production, yield, profitability and competitiveness.

For instance, in the past, there was free access to non-proprietary conventional technologies from the public sector. Now agri-biotechnologies are increasingly proprietary and owned mainly by the private sector. Public sector institutions in developed countries are protecting biotechnology with patents.

Different types of organizations and companies in various stages of innovations are at the forefront of investing in technology, research and development and innovation to create and maintain competitive advantage. The Philippines is in the midst of a transition where innovation as a catalyst will have a profound impact on the ways in which people live. Given the key role of innovation as a driver of growth and prosperity, relevant and appropriate policies, inputs and an enabling environment can help the Philippines fulfill its national potential and enable a better quality of life for everyone.

The only way in which sustainable and inclusive growth is possible is to adopt innovation as a business strategy. An approach that goes beyond R&D laboratories and universities, number of patents registered, or number of articles published in research journals is needed.

The Philippines being an agricultural country, it has to modernize smallholder agriculture to make it dynamic, for which we need innovations, institutions, and the best minds. It is sad but true that today the Second Global Innovation Index 2008 ranks the Philippines a lowly 63 in terms of innovations!

One perspective to the research in development process is that it involves two stages – invention and innovation. Invention implies the supply or creation of knowledge with the complete participation of users. The process of innovation entails the application of technical, organizational or other forms of knowledge and involves intermediary users to achieve changes in a particular situation. This involves an interplay of genetic, agro-ecological and social and institutional factors and encompasses knowledge, innovation and learning; actors, rules/norms, networks and processes and markets and assets.

An innovation can flourish only if the environment is right. Our institutions, laws, infrastructure, mindsets, incentives and culture have to be conducive to it. Human resources play a significant factor in the development of new ideas, which cannot flourish without adequate investment in the education system.

It is therefore imperative to have good-quality institutions of higher learning and R&D institutions in the country. The Department of Agriculture (DA) must do its share of re-inventing and strengthening or even creating R&D institutions that look into contemporary challenges like climate change that affect agriculture today.

The Bureau of Agricultural Research (BAR) must catalyze inventions, much more innovations to create impacts and prosperity in the sector. The DA must provide the policy support and environment, including investments, so that inventions and innovations will flourish and will create the desired ground for growth and development of the agriculture sector today and in the future.

The three-fold objectives of ICRISAT in harnessing partnerships through public-private synergy are to: (1) ensure that science at ICRISAT remains at

the cutting edge; (2) realize the public goods mandate of ICRISAT; and (3) improve the lives of smallholder farmers, and protect the environment in the SAT of Africa and Asia through rapid, direct, and broad-based application of technical knowledge and research products.

The primary vehicle for ICRISAT's technology commercialization is the Agri-Science Park which is made possible through its Agri-Business Incubator. The park was developed to incubate promising agri-business ideas into viable commercial propositions. Currently its main endeavor is to commercially generate ethanol from sweet sorghum.

Let me further elucidate on this example. One of the planks of commercialization of sweet sorghum involves linking private industries with farmers in the value chain of bioethanol along with other actors in the chain. The decentralized model deals with production of raw materials by linking farmer groups with micro-entrepreneurs (for decentralized juice extraction) and credit and input agencies.

Further, micro-entrepreneurs are linked with private distilleries (ethanol), and the association of distilleries is in turn linked with policymakers. Through such a continuum and seamless integration of various actors at different stages of the value chain (including by-products), benefits are maximized.

ABI has also successfully commercialized ICRISAT's groundnut ICGV 91114 and chickpea variety JG 11 in Andhra Pradesh, India, together with Aakruthi Agricultural Associates of India. It has also incubated 35 ventures and generated direct employment for over 550 and mobilized US$ 8 million for the companies that it has incubated.

ABI-ICRISAT has also assisted the Indian Council of Agricultural Research to facilitate the establishment of five Business Processing and Development Units across India. More recently, ABI-ICRISAT has been accredited as an outreach Center for Technopreneur Promotion Program by the Ministry of Science and Technology, Government of India.

With the rapid development of plant biotechnology, agriculture can be efficiently moved from a resource-based to a science-based industry. The Platform for Translational Research on Transgenic Crops (PTTC) facilitates a collaborative and coordinated approach for the translation of existing genetic engineering technologies to the development of transgenic crop varieties, which can efficiently be taken through product development to commercialization.

Besides acting as a clearing house for technology inputs, transgenic research leads and prototypes with proof of concept derived from research institutions, PPTC will help evaluate the concepts, ideas and technologies and promote advancement of the most promising concepts by prioritizing them through

a well-coordinated approach arising from networking among research institutions, industry and the government.

Innovation enables an organization to foster a supportive internal structure headed by product champions and bolstered by incentives. The extent to which we are able to change quickly, keeping an eye on the markets of the future, will determine how successful we are. Let us not forget that unless we innovate, we will never succeed in creating the level of prosperity desired by our country.

Let me reiterate that the challenge for our institutions lies in identifying and replicating the processes that facilitate swift movement of technology from the halls of academia to the frontline of Filipino agriculture and industry. Let the light bulbs in the mind be lit and let them in turn light up the lives of people, especially the underprivileged. We can do it!

Thank you.

Protecting Crop Diversity for an Evergreen Revolution

Inaugural Address, ICRISAT/GPG 2 Training Workshop on Genetic Diversity Analysis of Germplasm - Methods and Uses, 1 September 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Participants from CGIAR centers, the Indian and African NARS, ICRISAT colleagues, and ladies and gentlemen, good morning. Welcome to the ICRISAT-GPG 2 Training workshop on Genetic diversity analysis of germplasm - Methods and uses.

For centuries, genetic variation in wild and cultivated plants has provided opportunities to farmers and plant breeders to develop and select new crop varieties. In today's changing environment, genetic diversity infuses in plant species the ability to adapt to new climatic conditions, including resistance to emerging and new pests and diseases. This is crucial given the challenges faced by agriculture due to climate variability and/or climate change.

Crop genetic resources comprising local landraces, obsolete varieties and wild species are reservoirs of useful genes of economic importance, contributing towards achieving the global objectives of food security, poverty alleviation, environmental protection and sustainable development. The success of crop improvement programs solely depends on the availability of diversity in genetic resources.

The realization that crop genetic resources are finite and vulnerable to losses and extinction, led to the collection and conservation of genetic resources by Vavilov, and subsequently the Convention on Biological Diversity.

Though the Green Revolution of the 1970s transformed agriculture around the globe and world grain production increased by over 250%, the adoption of genetically uniform high-yielding and fertilizer-responsive varieties resulted in the irreversible loss of innumerable heterogenous traditional farmer's varieties, local landraces and crop species.

Increasing agriculture's role to meet the needs of almost a billion people in the world still below the poverty line, and an ever increasing world population are the greatest challenges to agricultural scientists worldwide and will depend on the identification, maintenance and use of genetic diversity.

In addition, genetic erosion caused by habitat loss and the use of uniform high-yielding cultivars (instead of landraces) has dangerously shrunk the pool of genetic diversity in many commercially important crops, which can lead to greater vulnerability of agricultural crops.

Lately, climate change has altered the situation further as a result of which existing environments may become unsuitable for the cultivation of several crop varieties.

To overcome these situations, an "Evergreen Revolution" needs to be ushered in through sustainable crop production, which in turn depends upon the efficient conservation and judicious use of diverse genetic resources for present and future generations.

At ICRISAT, the Rajendra S Paroda Genebank has the global mandate for germplasm collection, characterization, conservation and distribution of sorghum, pearl millet, chickpea, pigeonpea and groundnut and six small millets. It holds more than 119,000 accessions from 144 countries.

Systematic characterization of these germplasm accessions is essential for their efficient utilization in breeding programs. About 97% of the accessions in the ICRISAT Genebank have been characterized for morphological and agronomic traits and stresses over the years. Yet only a small proportion (<1%) has been used by plant breeders in crop improvement programs.

To overcome this, "core collections" (about 10% of the entire collection) and "mini core" collection (10% of the core collection or 1% of the entire collection) have been developed and evaluated at ICRISAT. The Institute's strategic research on these will enhance the use of germplasm in breeding programs globally to produce cultivars with a broad and diverse genetic base. Mini core is now an International Public Good and a gateway to access genetic diversity by the global community.

The evaluation of ICRISAT's mini core collections of five mandate crops -- chickpea, pigeonpea, sorghum, pearl millet and groundnut; as well as of finger millet -- resulted in the identification of trait-specific, genetically diverse and agronomically desirable new sources of resistance to abiotic and biotic

stresses which can be utilized by plant breeders. As part of its conservation efforts, ICRISAT also participated in the duplicate conservation of seeds in the Svaalbard Global Seed Vault as is the case of most of the Centers.

However, a critical and scientific analysis of diversity in germplasm collections calls for knowledge of diversity analysis methods and their uses, which is based on the types of traits scientists use in their studies. The use of the most appropriate distance measures for different types of traits or their combination to analyze diversity will be discussed during this training workshop.

The workshop will expose you to diverse datasets and analytical methods. Since scientists from the CGIAR and the Indian and African NARS are known for their concerted efforts towards greater utilization of germplasm in crop breeding programs, I am sure this workshop will be an enriching experience, ultimately strengthening various crop improvement programs.

Thank you.

Agriculture in a Changing Climate

Address, 2nd Agriculture Leadership Summit 2009 on Monsoon, Climate Change and Agriculture, 4 September 2009, New Delhi, India.*

Ladies and gentlemen, good evening!

Climate change is no longer an issue for the distant future. The impacts of higher temperatures, more variable precipitation, more extreme weather events, and sea level rise are being felt and will continue to intensify, meaning more intense floods, droughts and storms. These changes are already having major impacts on economic performance and on the lives and livelihoods of millions of poor people. Currently, over 2.8 billion people live in areas of the world prone to more than one type of the physical manifestation of climate change.

Within 20 years, the number of hungry people as a result of climate change is projected to almost double to 75 million. Within the same 20 years, climate change is projected to reduce global food production by approximately 50 million tons, in turn forcing hikes in food prices. Where does that leave the 900 million already afflicted with hunger, the 1.5 billion poor in developing countries and the many more who will meanwhile join their ranks?

The recent L'Aquila Food Security Initiative linked the need for effective actions on global food security to those related to climate change, sustainable

* Delivered by Prabhat Kumar, Director, Business and Country Relations, on behalf of the Director General.

management of water, land, soil and other natural resources, including the protection of biodiversity.

Climate change predictions point to a warmer world within the next 50 years. Though according to the IPCC, the impact of rising temperatures on rainfall distribution patterns in Africa and Asia remains far less certain, in some parts of the world, the increasing frequency of extreme rainfall events and droughts appears significant.

And this is only the beginning. The impact of climate change on rainfall patterns is not going to be a temporary phenomenon. The impact of erratic rainfall patterns on agriculture is an issue of great significance to the lives and livelihoods of poor farmers who depend on this sector for survival. The threat of marginalization of agriculture and livelihoods of the poor looms large.

The fate of the Indian subcontinent is closely tied to the course of the monsoon, as we have witnessed in recent times. Since agriculture represents a fourth of India's national income, when the monsoon deviates from its normal pattern, agricultural operations are disrupted, proving disastrous in terms of food security. We are also experiencing warmer temperatures for longer periods and long dry spells during the cropping season.

Satellite data shows that the dry tropics, where rainfed agriculture provides 60% of the world's food and some of the world's poorest live, will be the most vulnerable to climate change. Data from ICRISAT shows that increases in temperature will have a significant reduction (8-30%) in grain yields of dryland crops. The World Bank has hinted that India will see a fall in major dryland

crop yields from Andhra Pradesh and that rice production in Orissa's flood-prone coastal regions could drop by 12% due to climate change.

Recent studies suggest that projected trends in world population growth and dynamics will place substantially greater multi-sectoral demands on water, leading to exacerbated competition between sectors for an increasingly limited supply. This, in turn, will curtail the ability of agriculture to respond to the expanding food requirements of a global population and raises the specter of a worsening food security crisis.

Current rainfall variability and future climate change are important considerations for ICRISAT given its mandate for rainfed agriculture. Studies conducted by ICRISAT in dryland villages of India since 1975 provide empirical evidence on the vulnerability of the poor to various risks and shocks and their inability to access physical, financial and social resources.

ICRISAT's strategy looks at climate change in two time frames: a short-to-medium-term strategy to help farmers cope better with rainfall variability, and a medium-to-long-term strategy to adapt crops such as pearl millet, sorghum, chickpea, groundnut and pigeonpea to grow in a warmer world.

Unless the livelihood resilience and adaptive capacity of vulnerable communities can be greatly increased in the context of current rainfall variability, adapting to future climate change will be daunting for most and impossible for many. Secondly, for vulnerable communities and agricultural stakeholders to adapt to future climate change, their ability to cope with the rainfall variability associated with current climates must first be enhanced. This entails addressing issues such as higher temperature tolerance, moisture extremes, changed distribution and severity of pests and diseases, and the 'migration' of our mandate crops to new geographical areas.

The unholy nexus of poverty, drought and land degradation in the drylands can be broken by adopting a four-pronged science-based strategy developed by ICRISAT and its partners for mitigating the effects of climate change.

The first involves growing drought-tolerant and climate change-ready crops to match the available length of the growing season and low soil moisture.

Second is contingent action to replace affected crops with those that are more drought tolerant. Farmers should grow other crops that mature earlier to escape drought. Short-duration crops thrive and yield well even with scarce water as they mature before soil moisture gets depleted. For instance, in sorghum growing areas, farmers can instead plant pearl millet. Likewise, an action plan for producing seeds of dryland and other alternate crops should be put in place.

Third is the efficient management of natural resources, arresting land degradation, conserving soil moisture and harvesting water in the rainy

season for supplemental irrigation. Towards this, ICRISAT recommends the adoption of integrated genetic and natural resource management, which aims at growing improved crops on soils conserved through natural resource management pursued through community participation.

Fourth is empowering stakeholders through capacity building, enabling rural institutions and formulating policies supportive of dryland agriculture. Capacity building builds social capital through knowledge sharing and strategic partnerships. Likewise, suitable institutional mechanisms for credit, market linkages, rural infrastructure and other support services need to be ensured.

ICRISAT also recommends growing an array of crops together with livestock along with other income-generating activities that can lessen the risks of total crop failure and enhance farm income.

ICRISAT is ahead of the game with its climate-ready crops. With its partners, it has developed and released several varieties of sorghum, pearl millet, chickpea, pigeonpea and groundnut, all of which are more drought tolerant than currently grown varieties. We have developed short-duration chickpea cultivars ICCV 2 (Shweta), ICCC 37 (Kranti) and KAK 2 and short-duration groundnut cultivar ICGV 91114 that escapes terminal drought. We recently developed a super-early pigeonpea that flowers in 32 days and matures in about 65-70 days. We have integrated trees into traditional annual cropping systems to help reduce the impacts of winds and to protect soils from erosion.

ICRISAT has also developed plants that resist pests and pathogens such as downy mildew-resistant improved pearl millet hybrid HHB 67 in India; wilt-resistant high-yielding pigeonpea ICEAP 00040 in Tanzania, Malawi and Mozambique; and rosette-resistant groundnuts in Uganda, to name a few. Guiding our crop adaptation work are crop growth simulation models such as APSIM that examine the disaggregated impact of a range of climate change scenarios on our mandate crops across the semi-arid tropics of the world.

Along with the following, policies and programmes supportive of dryland agriculture need to be formulated and implemented:

- Increasing public investments in dryland agriculture, including higher funding for agricultural research and rural infrastructure;
- Developing sophisticated techniques of predicting and forecasting monsoons;
- Enabling collective action and rural institutions for agriculture and natural resource management;
- Upscaling and outscaling the community watershed management model;
- Rehabilitating degraded lands and diversifying livelihood systems;

- Recharging depleted groundwater aquifers and enforcing strong regulations on groundwater extraction;
- Initiating government support for water saving options; and
- Including dryland crops in the minimum support price scheme.

When Robert Malthus observed that population increases at a geometric rate, doubling about every 25 years if unchecked, and agricultural production increases arithmetically—much more slowly, he was talking of a biological trap that humanity can never escape. What is alarming is that climate change makes this situation infinitely worse.

Global warming tolerance thresholds are not too far. Therefore a combination of adaptation and mitigation approaches are crucial to deal with the crisis. So is a show of political will by countries to combat current damage and cope with future risks. We need to act now!

Thank you.

Chickpea for Rainfed Rice Fallow Lands: Challenges and Opportunities

Inaugural Address, Chickpea in Rainfed Rice Fallow Lands (RRFL), Review & Planning Meeting for Chickpea in RRFL Chhattisgarh and Madhya Pradesh, 8 September 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Distinguished participants, guests, partners, colleagues at ICRISAT, ladies and gentlemen, good morning.

On behalf of ICRISAT, let me welcome you all to this challenging project of introducing pulses, in this case chickpea, as a second crop in Rainfed Rice Fallow Lands (RRFL) of India.

India is the largest pulse producer (70%) and consumer in the world with a 25% share in global production and 32% in area. However, its current production of 15.19 million tons falls way short of the current consumption of 17.65 million tons, forcing the country to annually import 2.5-3.0 million tons, draining away precious foreign exchange.

Given India's increasing population and its preference for pulses as the cheapest source of dietary proteins, the demand for pulses is only set to escalate.

Pulses are mainly grown under rainfed conditions (>87%) in arid and semi-arid regions where water is scarce. However, there is scope to introduce and enhance pulse production as a second crop by expanding their production in selected niches. There is a big potential of about 30-40% of the approximately 15 m ha of rainfed rice fallow lands in the states of Eastern Uttar Pradesh, Bihar, Chhattisgarh, Jharkhand, Orissa, West Bengal, Eastern Madhya Pradesh, Assam and others for this purpose.

In these areas, farmers either leave the area cultivated to rice without growing a second crop or end up growing local pulse varieties which often fail or yield low, thus discouraging pulse production.

In these parts, rainfall during the rainy season is usually adequate to grow rice, and the residual moisture can support a second crop of a deep-rooted pulse such as chickpea. The success of chickpea cultivation entails that the crop be sown and established soon after harvesting rice.

Recent feasibility studies on postrainy season cropping of chickpea in RRFL at select locations in Chhattisgarh, Madhya Pradesh, Jharkhand and Orissa by ICRISAT and its partners in ICAR and State Departments of Agriculture clearly show that the area under improved (short duration, wilt resistant) varieties of chickpea (ICCV 2, ICCV 10 and KAK 2) can be expanded following Improved Pulse Production and Protection Technology (IPPPT).

Unfortunately, farmers in the RRFL regions have inadequate access to newly developed high-yielding varieties of chickpea and other pulses and the economical and user-friendly IPPPT.

These farmers have shown great interest in cultivating improved high-yielding varieties of chickpea in rice fallows as a second crop due to their adaptability and profitability in comparison to other crops which seldom fail due to erratic rains.

In this context, the National Food Security Mission (NFSM), Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India-funded project on Enhancing chickpea production in rainfed rice fallow lands of Chhattisgarh and Madhya Pradesh states of India through improved pulse production and protection technologies for four years (2008-2012) came at the right time.

ICRISAT in partnership with Indira Gandhi Krishi Viswavidyalaya (IGKV), Raipur and Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, state departments of agriculture, and NGOs of these states initiated project activities during the 2008-09 postrainy season. The farmer-centric and science-based pilot project is operational in four districts each in Chhattisgarh and Madhya Pradesh, with the following four major components:

- Farmers' participatory varietal selection;
- Improved Pulse Production and Protection Technology (IPPPT) demonstrations;
- Village-level seed system; and
- Backstopping R&D on constraints identified by scientists and farmers.

In a rainfed ecology, realizing the genetic yield potential of high-yielding varieties depends upon the successful management of edaphic, biotic and

abiotic stresses. Therefore the IPPPT component of the project includes minimal/zero tillage for crop establishment, and integrated disease, pest and nutrient management.

Moreover, short-medium-duration chickpea varieties (Vaibhav, JG11, JG 74 JAKI 130, etc.) were found suitable in rotation with recently introduced short-duration high-yielding rice varieties such as MTU 1010 and Purnima.

The project is promoting high-yielding chickpea varieties identified in the last 5 years in the All India Coordinated Research Project-Chickpea (AICRP-CP) and by ICRISAT. Following the successful first year's work plan, we need to develop a detailed one for 2009-10 addressing the mutually agreed objective of increasing chickpea production in India.

I would like to take this opportunity to congratulate Dr S K Rao from JNKVV Jabalpur and our collaborator in this project, who has been awarded the prestigious Dr Rafi Ahmad Kidwai Award 2008 for Lifetime Achievement in Agriculture. We are also grateful to Mr Ayush Poddar and Drs Swapan Dass Gupta from CERES Seed Company for their involvement in chickpea seed production at the village level, and Mr Rajdeep Singh from National Agro Industries, Ludhiana, for exploring the feasibility of introducing zero/minimum till seed-cum-fertilizer drills in the project sites.

I am pleased to learn that the project partners -- IGKV and JNKVV and their associates -- are working together to capitalize on synergies towards RRFL double cropping in order to double the income of resource poor farmers in Chhattisgarh and Madhya Pradesh. I wish the scientists involved in this project great success and look forward to the project's impacts.

Thank you and good day.

Desertification and Land Degradation Trends

Chairman's Remarks at the Opening Session of the First UNCCD Scientific Conference, 22 September 2009, Buenos Aires, Argentina; Chair, UNCCD Committee on Science and Technology (CST) 8; and Chair, Scientific Conference.

Dear friends,

It is an honor with a deep sense of humility to discharge this responsibility of chairing the UNCCD 1st Scientific Conference under the Ninth Session of CST.

Our journey from CST8 in Madrid to CST9 here in this beautiful city of Buenos Aires, has been a busy and fruitful one. We have handled many fundamental issues of reform called for by the 10-Year Strategy of UNCCD. We were asked to reshape our processes and our programme of work, and we have done so. We have launched a Scientific Conference format, and we have adopted a very inclusive, consultative and evidence-based approach. We must continue to carry these reforms forward.

This is a pathbreaking scientific conference of UNCCD, one that pledges to make room for substantive scientific discussions on combating desertification, land degradation and drought. We should recall the reasons why this new path is so important. The world is facing a 'perfect storm', with a number of huge problems converging around land issues. At the center of this storm are the poor, who depend on the land for survival – yet, they are unable to fight off the massive storm clouds that are building.

Already beset by poverty and hunger, the World Bank estimates that developing countries will bear 80% of the environmental costs to mitigate climate change. Yet, climate change threatens ever harsher temperatures, droughts and storms, all of which can send the poor right back to the bottom

of the development ladder. Increasing population pressure and poverty will just increase the intensity of this perfect storm, and the suffering that it causes.

Our whole UNCCD community recognizes that we need science to better understand this storm, and to devise solutions that work for the poor. We need options for people that reduce their vulnerability and increase their resiliency. We need options for the land that prevent irreversible losses of precious natural resources like soil, biodiversity and water. We need both policy and technical options – the two go hand-in-hand. Again, the key message is that: "People and Land Matter".

Let us have your positive engagement for a rich scientific discussion in our First Scientific Conference. Many eyes are watching us to see if we are brave enough to walk down this new path. If we hesitate or turn back, they may walk away from us. But if we are bold and continue forward, we will find many new friends along the way. And together we will find ways to weather the perfect storm.

Thank you.

Let Us Combat the DLDD Threat Together

Chairman's Closing Comments, UNCCD First Scientific Conference, 24 September 2009, Buenos Aires, Argentina.

Dear friends,

First, I want to congratulate you all. Together, we've achieved something extremely important over the past three days. We've opened the door to a new and vigorous scientific dialogue within the Committee on Science and Technology. This reflects the sincerity of our commitment to the UNCCD 10-Year Strategy of reform.

In the Opening Session, I talked about the perfect storm that is forming around issues of DLDD. Climate change, population growth, food security, energy security are pressures that are converging on a shrinking and degrading land base.

While the pressures are ominous, we are not helpless against them. For three days, we've heard and discussed a wide range of ways that science can help society to weather this storm, and even to thrive. It will be up to all of us in society as a whole to decide whether we take advantage of these opportunities.

We brought leading scientists from around the world to explain these methods and opportunities. They built on a base of over 100 scientists in three global working groups, and worked hard to develop white papers leading to key messages and recommendations. They shared their draft white papers for comment worldwide and took that feedback into account. I want

to sincerely thank them for their time and commitment. It is a clear show of solidarity with the decision-makers and with society as a whole. We are all in this together, and need to combat the DLDD threat together.

I would also like to express our deep gratitude to the donors and institutions that supported this process. There are many and I cannot name them all. But I would like to especially note the financial and material support provided by the EC, GTZ/BMZ, the Global Mechanism, IFAD and the UNCCD Secretariat.

And a special thanks to the DSD consortium, whose five institutions contributed a large amount of the time and resources of their staff out of sheer commitment to the UNCCD. We could not have carried out this intensive process without this support.

Finally, I want to sincerely thank all of you who attended this Conference and participated so actively. We have all been inspired by the large and attentive audience here. It sends us all a signal – that land matters, and that science matters to the UNCCD.

We have sown the seeds of success here. But like any dryland crop, it has to be nurtured or else it will wither.

We must consider this final Session not as an end, but as a beginning. Like any first step, it has been a learning experience. We will be open to learn and improve on all aspects, as well as to note what worked well and build on it.

Friends, colleagues and dignitaries: I hereby declare the UNCCD First Scientific Conference to be closed.

Thank you.

Harnessing the Potential of Biofuels for Pro-poor Rural Development

Guest Speaker, First National Review of BAR-funded Projects on Sweet Sorghum, 6-7 October 2009, BAR Conference Room, BAR, Philippines.

Thank you for inviting me to speak at the First national review of BAR-funded projects on sweet sorghum.

Economic, environmental and energy security concerns resulting from excessive reliance on fossil fuels are forcing countries throughout the world to shift to environmentally sustainable alternatives like biofuels. Such shifts also aim to generate employment for the rural poor, regenerate wastelands and reduce greenhouse gas emissions.

Central to ICRISAT's BioPower strategy is its commitment to make bio-energy opportunities work for the poor through biomass sources such as sweet sorghum. Moreover, smart crop sweet sorghum with its multiple uses as food, fuel and feed, and its wider adaptability, is the ideal climate change crop.

Research collaboration on sweet sorghum cultivars' testing and improvement between ICRISAT and the Bureau of Agricultural Research and Mariano Marcos State University that dates back to 2006, has focused on:

- Identifying sweet sorghum cultivars for different agroclimatic conditions;
- Strengthening hybrid parents and hybrids development research; and
- Commercializing sweet sorghum stalks use as feedstock for ethanol production and its grain use for food and feed.

The Bureau of Agricultural Research is funding two projects, a two-year project on Sweet Sorghum Hybrid Parents Improvement for Bioethanol Production for Sustainable Energy Security in the Philippines with UPLB implementing it and a mega project on Integrated R&D program on biofuels.

There is also an ICRISAT-IFAD-funded three-year project on Program for Linking the Poor to Global Markets: Pro-poor Development of Biofuel Supply Chain with MMSU as partner. PCARRD too is funding sweet sorghum breeding by supporting work on developing pure lines.

To date 998 seed samples, including 20 germplasm accessions, 344 hybrids, 47 hybrid female parents, 269 restorer lines or varieties and others have been supplied to MMSU and the University of the Philippines at Los Banõs.

Among the other activities that have been initiated was the commissioning of a small-scale sweet sorghum mill at Barangay Bungon Village, Ilocos Norte in January 2007 to manufacture syrup, vinegar, biscuits, etc, from the juice of sweet sorghum stalks. The seed of a promising sweet sorghum variety, SPV 422 was distributed to farmers for cultivation. In all, 140 hectares were sown under different sweet sorghum projects during 2007-08.

In addition, the private sector was sensitized to initiate work on sweet sorghum-based ethanol production technology (SSBET). As a result, five private enterprises signed MOAs with ICRISAT on joining the Sweet Sorghum for Ethanol Consortium.

Coming to capacity building, ICRISAT has facilitated visits of important officials and scientists from the Philippines. A total of 97 farmers in Cabiao, Nueva Ecija, Batac, Ilocos Norte, and Isabella and Cagayan provinces were trained in sweet sorghum production technology.

I would like to illustrate how sweet sorghum is indeed a viable and profitable crop for farmers. The multi-season evaluation of NTJ 2, ICSV 700, ICSR 93034, ICSV 93046, and SPV 422 during 2007-08 in different agro-ecological zones in Luzon, Visayas and Mindanao have shown that SPV 422 and ICSV 93046 were best performing for high sugar yield (2.35 t ha^{-1}, 2.11 t ha^{-1}) and grain yield (4.04 t ha^{-1}, 2.82 t ha^{-1}) respectively.

Among the hybrids found to be promising in limited field trials conducted at MMSU during 2008 were ICSA 516 x SPV 422 with sugar yield of 4.05 t ha^{-1} and grain yield of 5.9 t ha^{-1} and ICSA 675 x ICSV 93046 with sugar yield of 3.84 t ha^{-1} and grain yield of 6.72 t ha^{-1}.

Let me also set aside doubts on cost of production and expected returns. In 2008, in Ibrahimbad cluster of villages in Medak district in Andhra Pradesh state, India, where soils are less fertile and sandy, the total cost of sweet sorghum production (excluding family labor) was Rs. 11,765 ha^{-1} and net returns (excluding family labor costs) was Rs. 6490 ha^{-1}. Labor cost accounted for 55% of the total cost followed by bullock and fertilizer costs. The profitability of sweet sorghum with competing crops is being assessed but farmers are willing to replace maize with sweet sorghum since they are assured of buy back and also obtain credit for initial inputs.

A comparison of grain sorghum and sweet sorghum in the state of Karnataka in India where soils are fertile and vertisols revealed that sweet sorghum was economically advantageous to farmers because of an additional 133% increase in net returns (Rs. 5700 for grain sorghum compared to Rs. 11,170 for sweet sorghum). This data serves as a pointer to the cultivation of sweet sorghum in the Philippines.

Since poverty in the Philippines is largely a rural phenomenon, biofuels production creates an additional window to create livelihoods, raise incomes and improve overall productivity in the countryside. There is a clear link between access to energy services and poverty alleviation and development. The first set of critical energy needs satisfy needs such as cooking, heating and lighting, energy for pumping water, and electricity for health and education services. The second set provides energy for income-generating activities that help break the cycle of poverty.

Though economic competitiveness is a very frequent argument against renewable energy, Brazil's experience with ethanol has shown that economies of scale and technological advances lead to increased competitiveness of this renewable alternative, reducing the gap with conventional fossil fuels.

This is so because for many products and services, unit costs decrease with increasing experience. This effect is often referred to as progress curve, experience curve or learning curve.

Technology advances will not only help make bioenergy more competitive with fossil fuels, but will also expand the range of feedstock that can be used, some of which can thrive in less fertile and more drought-prone regions.

You will be astonished to know how ethanol production has been critical to Brazil's fuel security. Since 1975, ethanol has displaced more than 280 billion liters (1.7 billion barrels) of gasoline and saved more than US$ 100 billion in the cost of oil imports. The sugar/ethanol sector has become a major employer: roughly 1 million jobs. Half of Brazil's transportation fuel is now ethanol. So together with energy security, environmental benefits have accrued. Also, the price of ethanol dropped 3/4 since 1980 due to technological progress.

In my meetings with Secretary of Agriculture Arthur Yap, I have emphasized the role of sweet sorghum in ethanol production and the benefits that can accrue. Sweet sorghum is quite new in the Philippines and therefore genetic improvement will be more challenging in this crop compared to rice and corn. Initial results have proven that we could indeed come up with better materials than initially introduced.

In addition, the following policy lessons could prove beneficial to the Philippines:

- Subsidizing biofuels during market development until economy of scale allows fair competition with oil products;
- Allowing renewable energy-based independent power producers to compete with traditional utilities;
- Supporting private ownership of sweet sorghum distilleries; and
- Stimulating rural activities and thus rural employment based on biomass energy.

Only when both the public and private sectors, working as partners, make long-term commitments and investments in innovation, will energy security no longer be a major concern. Together let us make it possible!

Thank you.

Wisdom to Reach for my Dreams

Acceptance Speech for the 2009 Outstanding UPLBAA Alumnus Award, 9 October 2009, Baker Hall, UPLB, Los Banõs, Laguna, Philippines.

I would like to thank the Governing Board of the University of the Philippines Los Banõs Alumni Association for choosing me as its 2009 Outstanding Alumnus.

It is with great pride that I accept this outstanding award today. The skills that UPLB endowed me with, combined with a background from a farming family, gave me a deep interest in agriculture and agricultural science and technology. With it came the potential to improve the conditions of the poor and develop a sensitivity to and compassion for the less fortunate farmers.

To my family, this honor is yours as well. You have consistently persevered with me and helped me reach my dreams, and the success I am enjoying in my work. Without you, these achievements amount to nothing. Once again, thank you.

I am also aware that my education from UPLB has given me the confidence to be at par with my global counterparts. It has given me the strength and determination to face any adversity, no matter how insurmountable the challenges are.

The skills I learned from UPLB came in handy when I was chosen to head a floundering ICRISAT in 2000. With proactive planning and a clear mission and vision, I was able to transform the institute into a high performing global organization. A strong coalition was created, guided by the mantra of doing science with a human face.

It has been a long, yet fulfilling journey of change, where adaptation, innovation and evolution were the guiding forces. Success came to us because Team ICRISAT believed in the institute's vision of improving the lives of the poor in the semi-arid tropics of the world, including the Philippines.

All these years, transformational leadership was and still is the order of the day at ICRISAT. It is the type of leadership where change and innovation are a constant and where everyone in the institute is a partner for growth and excellence.

The complete transformation of the institute is reflected not only in its quality science but also in its institutional health. ICRISAT's budget tripled during my watch. We were ranked Outstanding by the Consultative Group for International Agricultural Research in 2006 and 2007. The institute has been the proud recipient of the most prestigious CGIAR King Baudouin Award five times.

We are in the forefront in generating knowledge and technologies, and are constantly re-inventing ourselves to tackle serious challenges like climate change and desertification that are plaguing agriculture.

I'll be completing 10 years in ICRISAT soon, with another 5-year term, and so I pledge to remain the servant leader of the poor of the semi-arid tropics. As Greek politician Pericles once said, "What you leave behind is not what is engraved in stone monuments, but what is woven into the lives of others."

I would like to make a call for UPLB to revitalize itself and focus its efforts in dealing with the global challenges that our country is facing as well. This is an age of renaissance where UPLB can emerge as a driving force in creating opportunities not only for our scientists and students but more so for our people.

This award I have received is a fitting tribute not to me but to UPLB and its rich tradition of producing professionals with a great vision for the less fortunate. Thank you again for this great honor.

UPLB, you have given me education. You have challenged me to reach for the stars. You have given me the wisdom to stand on and reach for my dreams, dreams I could never have reached without you.

Thank you.

Applying Genomic Technologies for a Food Secure Tomorrow

Opening Remarks, ICRISAT-CEG Sixth Training Course on Application of Genomics Technologies in Plant Breeding, 16 November 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.*

Good morning and welcome to the sixth training course on application of genomics technologies in plant breeding.

The semi-arid tropics is facing a 'perfect storm', with a number of enormous problems converging around land issues and the poor who depend on it for their survival. Apart from a growing population, high food prices, disruptions of financial markets and economic stagnation, energy demands, and effects of climate change are making it increasingly difficult for agriculture to be conducted.

ICRISAT firmly believes in the potential of biotechnology to enhance the speed, precision, efficiency and value addition of its crop improvement efforts, especially in addressing complex traits that have remained intransigent to conventional breeding. The Institute uses promising genomic tools and approaches for the genetic improvement of its mandate crops, with the larger goal of reducing poverty, hunger, malnutrition and environmental degradation in the SAT.

I am glad to note that there are more than 30 participants here today, including some from Botswana, Ethiopia, Kenya, Nigeria, and Tanzania and one participant from the International Potato Centre, Peru. Let me emphasize that capacity building is an ongoing process through which individuals, groups, organizations and societies enhance their ability to identify and meet development challenges, involving the development and sharing of good practices.

* Delivered by Dr Rex Navarro, Director of Communication, on behalf of the Director General.

Plant breeding relies on the breeder's ability to identify individual crop plants with superior characteristics for traits of interest. This often involves taking extensive and complex measurements of crop plants under specific field conditions. This slows down the selection process. Molecular marker-assisted selection reduces this selection time, since selection can be based on DNA analysis of the plants in the lab, without waiting for each generation to grow in the field.

This is why ICRISAT's Center of Excellence in Genomics was set up with financial support from the Department of Biotechnology, Government of India. The Centre has the capacity to generate about one million data points per year. NARS has started using our genotyping services.

Large-scale genomic resources eg, 2000-5000 SSR markers, 400,000-500,000 ESTs and 50,000- 80,000 BAC-end sequences have been generated in chickpea, pigeonpea and groundnut.

We also launched a platform for Translational Research on Transgenic Crops with support from DBT, Govt. of India, which serves to evaluate potential new genetic engineering options and then advance these, in a focused way, to meet specific objectives in agriculture.

So far, CEG has successfully organized four training courses during 2008, and trained 84 scientists, including 7 from abroad. It offers courses and conducts workshops for scientists/researchers on application of novel genomics technology in crop research and breeding, which encompasses experimental design, sample submission and data analysis.

The genomics applications covered range from molecular markers and marker-based diversity assessment to gene/QTL/trait mapping and marker-assisted breeding.

Construction of genetic linkage maps, QTL mapping based on purpose-created populations, and association (LD) mapping using breeding lines or germplasm accessions have also been covered, as is the use of decision support systems for plant breeding.

I am proud to say that ICRISAT is part of the global team that has unravelled the sorghum genome, the first such breakthrough for a dryland agricultural crop that is adapted to drought.

I am sure that all of you who have come here today will return to your institutes with greater knowledge and tools that will help your countries tackle the multifarious challenges agriculture is facing today.

Thank you.

Giving Tropical Legumes their Due Place Under the Sun

Closing Remarks, Tropical Legumes II, Second Annual Review and Planning Meeting, 20 November 2009, Azalai Salam Hotel, Bamako, Mali.*

His Excellency Agathane Ag Alassane, Minister of Agriculture, Mali; Dr Paula Bramel, DDG-R, International Institute of Tropical Agriculture; Dr Joe Tohme, representing the DDG-R, International Centre for Tropical Agriculture; and Dr David Bergvinson, Senior Program Officer, the Bill & Melinda Gates Foundation; Objective Coordinators, Principal Investigators, scientists and ladies and gentlemen, good morning and welcome to the Tropical Legumes II (TL II) Second annual review and planning meeting.

First of all, please accept my apologies for not being able to participate from the very beginning of this important meeting because of other urgent commitments that needed my attention over the last three days.

During the last few years, we have seen unparalleled changes in the global community and financial markets. Unprecedented global economic expansion led to growth in the world's most populous developing countries.

Rising incomes guided skyrocketing demand for energy, livestock products, and feed grains. Food needs too rose to record levels. The negative impact of these events fell more severely on the urban and rural poor living in the low-income countries of the semi-arid tropics. Today, smallholder and subsistence farmers are facing a much more risky world.

* Delivered by Dr Dave Hoisington, Deputy Director General-Research, on behalf of the Director General.

Together with anticipated population increases, the recent food price spikes, disruptions of financial markets and economic stagnation, energy demands, and effects of climate change are creating the perfect storm, and are challenging the food security scenario.

Considering the role of agriculture in social and economic progress and the vulnerability of agricultural systems to the impacts of climate change, a renewed agenda for agricultural research, more aggressive investments in and better management of agricultural research and knowledge will go a long way towards improving the productivity and production of food crops.

In this context, the TL II project's goal to bring about significant improvements in the productivity and production of crops and hence improve the food security, nutrition quality and income of small farmers in the drought-prone areas of Sub-Saharan Africa and South Asia is unique.

The project involves three international agricultural research centers, nine countries, and eight objectives. It envisages that the productivity and production of tropical legumes would increase by 15%; some 30% of the area planted to these crops would be covered with improved varieties; and approximately 57 million poor farmers would benefit from it within 10 years.

During its two-year period, nearly 100 institutions and 300 scientists, technicians, extension personnel, seed producers, agro-dealers and policy makers, among others, have worked in synergy. I am truly encouraged that the team has achieved all the milestones it set for itself and beyond.

The targeting team has given us situation and outlook analyses, highlighting production, trade, consumption, utilization trends and future projections.

It is rather encouraging to see that some 130 varieties/advanced lines with farmer- and market-preferred traits have been identified across the nine project countries and advanced for further testing under state and national trials or recommended for release. Nine groundnut varieties have been recommended for release in Tanzania (5), Mozambique (3) and Malawi (1). The launching of the world's first CMS-based commercial pigeonpea hybrid ICPH 2671 was a major milestone in India.

Coming to the seed systems objective, diverse seed production models identified during the first year have been refined. Variations in seed delivery and awareness raising models are also being tested across target countries. The production of over 3500 metric tons of various categories of seed and use of small seed packets have been catalyzed.

Coming to capacity building, training sessions lasting up to 30 days for all partners in the tropical legumes value chain have been carried out.

The project has led to the building of a strong partnership base and trust between farmers and researchers/development agents. A good number

of technologies are in the pipeline. There has been an extensive use of participatory variety selection, training and demonstration. More importantly, it has generated a strong will among many governments to improve the performance of tropical legumes and other agricultural commodities.

We have learnt a few lessons along the way. We realize that member NARS' variable capacity necessitates different approaches of support to different countries. Our development approach has internalized that African farming systems are system-based rather than commodity-based. The need to strengthen crop management and post-harvest technologies is also being addressed.

With the continued vigor and enthusiasm shown by the TL II team, these results have great potential to bring about significant improvements in the productivity and production of TL II crops. This is just the beginning. The knowledge gained so far has to be put to good use on a wider scale.

The goal of developing a sustainable system for tropical legumes can be achieved, for which I seek your support. A speedy variety release procedure is essential to get the promising varieties out to the farmers. Donor support would be crucial to expand the use of improved technologies on a wider scale.

Finally, allow me to extend our gratitude to those who helped TL II become a reality. This project would not have been a success without the generous funding support of the Bill & Melinda Gates Foundation and that of Dr David Bergvinson, our senior program officer. I am very grateful to the Advisory Board members for overseeing the project's progress; the Government of Mali for hosting us; the scientists who worked hard to ensure the project's success; and to the organizing committee of this meeting, Dr Bonny Ntare and his team.

Thank you.

Tackling Bio-safety Issues in Pest Management Technologies

Inaugural Address, Symposium on Bio-safety and Environmental Impact of Genetically Modified Organisms and Conventional Technologies for Pest Management, 20 November 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Good morning ladies and gentlemen!

Welcome to ICRISAT, the only global R&D institute for dryland tropics. We are happy to host this Symposium on Bio-safety and environmental impact of genetically modified organisms and conventional technologies for pest management.

The world needs to develop new and inventive responses to what is likely to be the most complex challenge that the world's food production systems have ever faced. My reference here is to climate change and the many pests and diseases which are expected to change in unpredictable ways in future.

Crop production is constantly threatened by difficulties in controlling insect pests, which are a major impediment to improved livelihoods of poor farmers. Of the several methods available to control them, conventional insecticides are still popular among most farmers.

As a result of overdependence on insecticides for pest management, an 'insecticide treadmill' situation is developing due to the poor choice of insecticides, use of poor application equipment, and the development of resistance to insecticides. Apart from huge direct economic costs, indirect

costs such as the deleterious effects of pesticides on the environment and human health are becoming increasingly severe all over the world, calling for appropriate technologies and guidelines for their judicious application.

Natural plant products, biopesticides, parasites and predators have been proposed as safer alternatives to synthetic pesticides. However, given the lack of information on their bio-safety, this issue needs to be probed in the context of environmental safety and sustainable crop production.

Significant progress has been made over the past three decades in the introduction of exotic genes into GMOs for pest management.

Recombinant DNA technology has helped extend the range of conventional genetic manipulation to meet the increasing need for food and fiber. GMOs have been deregulated for use in pest management to increase crop production in several countries. Genetic engineering as a means to improve the effectiveness of crop protection technologies is an environmental friendly method that has resulted in a drastic reduction in pesticide sprays and increased crop production.

Products of genetic engineering are not conceptually different than those derived through conventional technologies. Crop cultivars derived through conventional breeding have not been subjected to bio-safety assessment as the transgenic plants with resistance to insects.

The potential of recombinant technologies to allow a greater modification than is possible with conventional technologies has raised some concerns, and therefore, GMOs have been subjected to more rigorous bio-safety assessment.

Procedures employed to assess the bio-safety of transgenic crops to non-target organisms, coupled with the interpretation and utilization of such information are important components for the sustainable deployment of transgenic crops for food and environmental safety in the future.

The potential of transgenic crops can be best realized when deployed in conjunction with other components of pest management such as biopesticides, natural plant products, natural enemies and synthetic pesticides. It is important to assess their relative efficacy for pest management, bio-safety and environmental effects to make informed decisions.

Given the different protocols and guidelines used in the past for testing and commercialization of pest management technologies, it is important to have a comparative assessment of the:

- Protocols used to assess the bio-efficacy and bio-safety of conventional technologies and GMOs to non-target organisms in the environment;

- Impact of conventional technologies and GMOs on non-target organisms in the environment;
- Impact of conventional technologies and GMOs on biodiversity; and
- Policies and guidelines for deploying conventional technologies and GMOs for pest management and environmental safety.

This symposium, organized under the auspices of The Academy of Environmental Biology, is quite timely since it critically examines procedures employed to assess the bio-safety of synthetic pesticides, biopesticides and transgenic crops, and their impact on the environment.

I am sure that during the deliberations, appropriate procedures and guidelines will be framed for their testing and deployment in future for sustainable crop production and food and environmental safety.

I wish you all the best!

Good day.

HOPE: The Lifeline of Small Farmers in Sub-Saharan Africa and South Asia

Message, Launch Meeting of the Project on Harnessing Opportunities for Productivity Enhancement (HOPE) of Sorghum and Millets in Sub-Saharan Africa and South Asia, 22 November 2009, Bamako, Mali.*

Yilma Kedebe from the Bill & Melinda Gates Foundation, partners and ICRISAT scientists, good morning and welcome to the launch of the project on Harnessing Opportunities for Productivity Enhancement of Sorghum and Millets in Sub-Saharan Africa and South Asia.

Dryland areas in West and Central Africa and East and Southern Africa are among the poorest and most food-insecure areas on earth, as measured by the UN's Human Development Indices. Africa's children and future are missing out on large potential productivity gains that are possible given their soils, crops and climates. Grain yields could potentially be doubled or tripled from their current low levels of about 0.5 to 1 metric ton per hectare, particularly through strong positive yield synergies between improved crop varieties, fertilizer and other management techniques. Deep poverty is also rampant in rural dryland areas of South Asia.

A perfect storm, a confluence of crises brought about by climate change, desertification, loss of biodiversity, high energy demand and an exploding population, also threatens these regions that are particularly vulnerable.

* Delivered by Dr Dave Hoisington, Deputy Director General-Research, on behalf of the Director General.

Amidst this bleak scenario, ICRISAT found HOPE that the battle against hunger could be won. The opportunity to better the livelihoods of the poor in these regions was provided by the Bill & Melinda Gates Foundation.

As Winston Churchill once said, and I quote, “The pessimist sees difficulty in every opportunity. The optimist sees the opportunity in every difficulty”.

HOPE is a 10-year project and builds on over 30 years of research for development by ICRISAT and a number of partners at national, regional and international levels.

Though the project has six objectives, emphasis during the first four years is on ensuring that technologies developed during the last 30 years and that have either not been disseminated widely or are still “on the shelf” are delivered and increase farmer yields by 30% or more, benefiting 110,000 households in Sub-Saharan Africa and 90,000 households in South Asia through increased food security and incomes.

Major dryland cereals like sorghum, pearl millet and finger millet are the means by which HOPE will provide an opportunity to alleviate food insecurity and poverty in ten countries of SSA and four states in India.

Given the lack of adaptive approaches to raise productivity and shrinking markets, dryland farmers are only cultivating crops at a subsistence level, leading to reduced security of food supplies; widespread hunger and malnutrition; loss of economic opportunity; and increased dependence of growing urban areas on imported food grains, among others.

With less production and less market demand, there is less justification for investment in dryland crops and for the research, development, support services and infrastructure needed to commercialize them. Add to this the prospect of climate change wreaking havoc on an already enfeebled system, and it isn’t difficult to visualize its impacts on the poor.

With the emergence of major new trends towards increasing demand for dryland cereals, poor dryland households need technologies, linkages and development impetus to harness the “pull” of these growing markets.

The project’s integrated value-chain approach is meant to harness this market “pull”. This is linked to increased production potential from technologies to stimulate the production of sorghum and millets in selected target areas.

By integrating the actors across and within the input-supply, production, sale/storage and marketing stages of the value chain, the project will capture synergies and reduce transaction costs, resulting in large increases in yield, production, profitability and competitiveness for dryland cereal crops.

The direct beneficiaries of the project will be poor smallholder farmers and their households as well as others involved in the crop commodity value

chain. Consumers too will benefit through more stable and lower prices and better quality grain and products for these essential foodstuffs.

In the spirit of true partnership for the poor, the four-year HOPE project supported by an $18 million four-year grant, will be undertaken by 50 partners led by ICRISAT.

The reason for all of us participating in this launching meeting is therefore threefold:

- To learn from each other the ongoing activities in Sub-Saharan Africa and South Asia;
- To ensure there are complementarities between projects; and
- To determine gaps that our development partners may consider supporting.

I take this opportunity to thank the Foundation for its trust in us and urge all the partners' active cooperation in this endeavor to improve the lives of the poor in SSA and South Asia.

Thank you and good day.

Promoting Innovations for Efficient and Equitable Agricultural Growth

Presidential Address, Launch Program of Handholding and Mentoring of BPD Units of NARS, 25 November 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Padmashree Anil K Gupta, Professor, Indian Institute of Management, Ahmedabad & Executive Vice-Chair, National Innovation Foundation; Mr HK Mittal, Advisor & Head, National Science & Technology Entrepreneurship Development Board, Department of Science and Technology, Government of India; Dr Yaduraju, National Coordinator, Component-1, NAIP-ICAR; Vice chancellors of universities, Directors of ICAR institutes, ICRISAT scientists, ladies and gentlemen, good morning.

I would like to welcome all of you to the launch of the Network of Indian Agri-business Incubators, a new initiative of ICRISAT's Agri-Business Incubator being supported by the National Agriculture Innovation Program of the Indian Council of Agricultural Research.

ABI-ICRISAT is well positioned to mentor this endeavor wherein we have established our leadership globally. ABI-ICRISAT has been awarded nationally and internationally as the best incubator in recent years. Thanks to the Department of Science and Technology for their trust and continuing support.

How will this initiative be useful, you may ask?

The whole world is seriously concerned with the challenges posed by demands of a burgeoning population, declining global food stocks, skyrocketing food prices, deteriorating production environments and the growing menace of global climate change. These elements converge into a rising storm that threatens the livelihoods of the poor.

Agriculture in India accounts for about 18% of the gross domestic product and supports nearly 58% of the total working population in terms of

employment. Foodgrain production increased significantly from 50 million tons during 1950-51 to a record of 230.7 million tons in 2007-08.

But since the country's population is projected to grow to 1.3 billion by 2025, we will need to produce about 320 million tons of foodgrains by then. This implies more pressure on our existing and already scarce and degraded land, soil and water resources.

The slowdown in the agriculture sector can be addressed by enhancing agricultural production and productivity, increasing farm income, accelerating agricultural growth and conserving natural resources. In this context, innovations to improve efficiency, equity and the environment are very crucial.

Innovation is about translating ideas into value-added products and services. This requires versatility of attitude and willingness to adopt and welcome unprecedented change on the part of all stakeholders involved: individuals, organizations and society.

It is the process of creating and putting into use combinations of knowledge from many different sources. It may be brand new but it usually involves new combinations of existing knowledge, i.e., small, gradual changes in technology, processing, organizational management, etc and/or creative innovation.

Promoting innovations in agriculture requires coordinated support to agricultural research, extension and education, fostering innovation partnerships and linkages along and beyond agricultural value chains, and creating an enabling environment for agricultural development.

Agricultural research is increasingly being done through public-private-farmer alliances that ensure all stakeholders, especially the poor, gain. This, apart

from ensuring access to proprietary technologies and processes, maximizes the public goods nature of innovations jointly owned with the private sector.

In this context, incubators play a crucial role in bringing together different stakeholders. Business incubators are programs designed to accelerate the successful development of entrepreneurial companies through an array of business support resources and services, developed and orchestrated by incubator management and offered both in the incubator and through its network of contacts. Successful completion of a business incubation program increases the likelihood of a start-up company staying in business in the long run.

ICRISAT's Agri-Business Incubator is an institutional innovation system that facilitates the "creation of competitive agri-business enterprises through technology development and commercialization to benefit farmers in the semi-arid tropics".

This serves the purpose of leveraging emerging technologies of the developed world to benefit the developing world, and helps realize the potential of new opportunities in agri-innovations, biotechnology, biofuels, seed business & farm ventures.

ABI is making efforts to build awareness and motivate innovators to set up Small & Micro Enterprises (SMEs), to utilize local resources and bring together entrepreneurs who are providers of goods and services on the one hand and various government departments and their agencies who are catalyzing the government's development efforts on the other hand.

However, facilitating the growth of SMEs and helping entrepreneurs undertake suitable economic activities requires identifying and mapping existing resources and identifying area-wise concentration of different primary produce to develop clusters of activities with swifter growth potential.

It is a challenge for all stakeholders, the scientific community, farmers, extension agencies and the industry to understand the opportunities, and evolve strategies different from those that were adopted in the past in conventional agriculture. While it is important for agri-entrepreneurs to find their feet and grow, it is equally important to ensure that the small farmer is brought into the picture. ICRISAT believes that the smallholder farmer holds the key to future food security.

I understand that this programme will involve networking of Agri-Business Incubators across the country to maximize agricultural impacts by encouraging innovators, mobilizing a pool of commercial technologies, and thereby maximizing the benefits to farmers. Agri-Business Incubators' network will also provide an excellent platform to exchange ideas, share successful experiences, identify R&D areas and develop future partnerships.

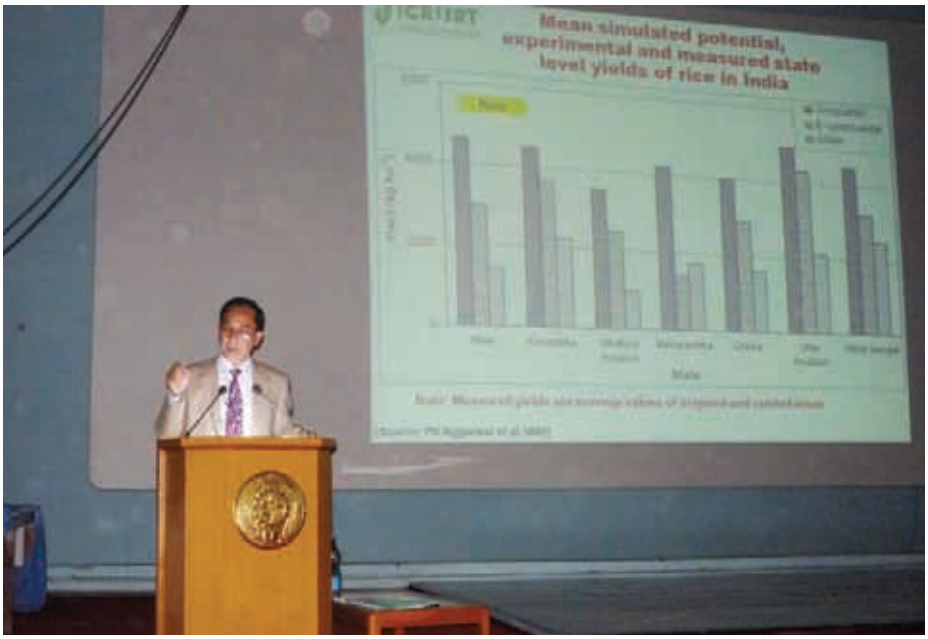
By helping nurture innovations and entrepreneurship in the field of agriculture, ABI and partners are helping fulfill ICRISAT's mission of eliminating poverty and improving livelihoods. I hope you too will multiply and pursue this noble ideal that will make the world a more equitable place.

I take this opportunity to thank Prof Anil Gupta, Mr Mittal and Dr Yadaraju for having taken the time out to come today. I also congratulate the principal investigators of the newly set up Business Planning Units/Business Incubators.

Finally, I would like to commend the efforts of team Agri-Business Incubator at ICRISAT headed by Dr Kiran Sharma, with Karuppanchetty and the National Agricultural Innovation Program for this wonderful and timely initiative.

Thank you.

The Semi-arid Tropics and Climate Change: Research & Policy Solutions



Raghotham Reddy Memorial Lecture, 26 November 2009, Acharya N G Ranga Agricultural University, Hyderabad, Andhra Pradesh, India.*

A 'perfect storm' is brewing

The semi-arid tropics (SAT) spans 750 million hectares in 55 developing countries across the globe. The region is home to more than 2 billion people. Of these, 1.5 billion depend on agriculture for a living, with 670 million comprising the poorest of the poor. It also houses nearly 50% of the world's undernourished and more than 70% of its malnourished children.

The SAT is facing a 'perfect storm', with a number of huge problems converging around land issues. Beyond the anticipated population increases, the recent food price spikes, disruptions of financial markets and economic stagnation, energy demands, dwindling biodiversity and effects of climate change create a more difficult environment in which agriculture must operate. At the center of this storm are the poor who depend on the land for survival.

* This article is based on a PowerPoint presentation (in the attached CD).

Since every 1% increase in agricultural productivity translates into an average decrease of absolute poor by 6 to 8 million, agriculture is the engine for overall economic growth and empowerment of the poor in the SAT. Yet farmers here face substantive risks -- very short growing seasons, separated by very hot and dry periods during which crop growth without irrigation is difficult; poor natural soil fertility; incidence of pests and diseases that are often difficult to control; a dearth of local infrastructure and national policies that do not adequately and effectively promote agricultural growth and development. Since such risk-entailed dryland rainfed agriculture is practiced on approximately 80% of the world's agricultural area and yet, generates 60-70% of the world's staple food, addressing the needs of rainfed farming is critical in improving the livelihoods of the resource poor in the SAT.

Rockström (2009) has proposed a framework based on nine planetary boundaries which define the safe operating spaces for humanity with respect to the Earth system and are associated with the planet's biophysical systems or processes. Of the boundaries, three -- climate change, rate of biodiversity loss and interference with the nitrogen cycle -- have transgressed their threshold limits. This, according to him, could have irreversible consequences such as abrupt environmental changes and be detrimental to human development.

The SAT poor are highly vulnerable to both current and future climate change impacts, given their high dependence on agriculture, strong reliance on ecosystem services, rapid growth and concentration of human and livestock populations and relatively poor health services. The factors limiting increased agricultural production and sustainability are only expected to worsen with the frequency and intensity of extreme events (tropical cyclones, floods, droughts and heavy precipitation).

Nearly 80 million hectares of India's net sown area is rainfed, with 40% of the foodgrains coming from it. Over 80% of coarse cereals, 55% of upland rice, 77% of oilseeds and 65% of cotton are cultivated under rainfed farming. However, productivity levels of crops like millets, pulses and oilseeds at farmers' level continue to remain low. Though potential yields of up to 2 tons per hectare are possible, the yield gaps are exacerbated by vagaries of climate and the southwest monsoon playing truant. Hence the need to restore the eroding confidence of the Indian farmer in agriculture.

There is a strong urgency to acknowledge and include agriculture prominently in climate response since both are inextricably tied together. Today agriculture contributes about 14% of annual greenhouse gas emissions, and forestry another 17%. A recent study on climate change by the International Food Policy Research Institute (IFPRI) warns of an addition of 25 million malnourished children in 2050 without serious mitigation or adaptation; a fall in irrigated wheat yields (by 30%) and irrigated rice yields (by 15%) in

developing countries in 2050; and increased prices of wheat by 90%, rice by 12% and maize by 35% in 2050.

Climate change is already inevitable, but in the absence of robust adaptation strategies, will almost certainly exacerbate food insecurity. Millions of people in countries that already have food security problems will have to give up traditional crops and agricultural methods as they experience changes in the nature of the seasons, for which, over time, they have developed coping strategies that have enabled them to survive.

Climate change also threatens poverty reduction efforts because poor people depend directly on already fragile ecosystems for their well-being. They also lack the resources to adequately defend themselves or to adapt rapidly to changing circumstances, and more importantly, their voices are not sufficiently heard in international discussions, particularly in climate change negotiations. Environmental effects such as desertification and rising sea levels triggered by climate change can lead to increased conflict for resources, which in turn can displace people.

Technical solutions

Climate change being a threat multiplier, adaptation and mitigation strategies need to be urgently integrated into national and regional development programs. Developing countries need to participate in a globally integrated approach to this problem. Policies on adaptation include changes in land use and timing of farming operations, adaptive plant breeding and crop husbandry technologies, irrigation infrastructure, water storage and water management. Mitigation measures may include better forecasting tools and early warning systems, improved crop and livestock management practices including improved input use efficiencies (such as ICRISAT's microdosing), crop systems diversification and improved water management.

Policy solutions

More investments in agricultural research and infrastructure

Considering the role of agriculture in the social and economic progress of developing countries, and the vulnerability of agricultural systems to the impacts of climate change, a renewed agenda for agricultural research, more aggressive investments in and better management of agricultural research and knowledge can make significant improvements in food security goals. A progressive policy environment should also include more investment in infrastructure and education and research that improves understanding and predictions of the interactions between climate change and agriculture.

Water management

Almost 95% of the developing countries' water withdrawals are used to irrigate farmlands. Therefore water policy to make more efficient use of water for agriculture is crucial. This involves understanding water flows and water quality, improved rainwater harvesting and water storage and diversification of irrigation techniques. Such considerations will need to be framed in the context of rapidly expanding populations that are predicted to exacerbate inter-sectoral competition for abstracted water supplies. Robust irrigation infrastructure may be necessary to cope with climate change risks in the short to medium term. Maintenance of existing infrastructure too deserves early attention.

Land-use practices

Land-use policies to encourage diversification and natural resource management, including protection of biodiversity, are critical. Erosion control and soil conservation measures, agroforestry and forestry techniques, forest fire management and better town planning are some steps that can be initiated to blunt the impacts of climate change. Reducing and sequestering terrestrial greenhouse gas (GHG) emissions are possible by enriching soil carbon, farming with perennials, climate-friendly livestock production, protecting natural habitat and restoring degraded watersheds and rangelands.

Weather and climate services

The role of weather and climate services and products in developing adaptation solutions is crucial. Stock-taking of available climate information in developing countries to ascertain where systematic observation needs are most pressing, collaboration between national and international providers of climate information and users in all sectors and generating awareness

among different user communities of the usefulness of such information are essential. Climate change assessment tools are needed that are more geographically precise, that are more useful for agricultural policy and program review and scenario assessment, and that more explicitly incorporate the biophysical constraints that affect agricultural productivity. Packaging this data for its effective use and rescuing historical meteorological data are equally important. The National Meteorological Services in the developing world must be encouraged and enabled to become fully integrated into research and development initiatives.

Engagement of the private sector

Policies that encourage holistic approaches including the engagement of the private sector should feature in any national and international approach to address climate change and facilitate the transition to a low-carbon economy. The private sector can invest in clean new technologies and develop innovative market mechanisms to combat climate change, particularly the dangers from GHG emissions.

Capacity-building and collective action

Policies that enhance the effectiveness of rural institutions at the local, national and international levels will be a central concern as they seek to speed up the pace of agricultural adaptation. Unless steps are taken to initiate and strengthen cooperation among academic and research institutions, regional and international organizations, and NGOs to provide opportunities for strengthening institutions, dealing with climate change impacts may be cumbersome. Involving local communities, education on

climate change and raising public awareness are key to combating climate change.

Economic diversification

Economic diversification to increase the economic resilience of and to reduce reliance on vulnerable sectors is crucial. Reducing dependence on climate-sensitive resources is an important adaptation strategy that must be promoted. Improved food security through crop diversification, developing local food banks for people and livestock, and improving local food preservation need to be encouraged.

Database of adaptation options

Given the diversity of agro-ecological zones and their inherent problems, it is also essential to assemble, document and disseminate a comprehensive and action-oriented database of adaptation options of different farming and livelihood systems and agro-ecological zones.

Access to credit and crop insurance

Since farmers are often constrained by access to credit, policies that enable better access to credit (micro-finance) and agricultural inputs in order to intensify integrated production systems need attention. Catastrophic or weather-risk insurance and index insurance (insurance linked to a particular index such as rainfall, humidity, or crop yields rather than actual loss) can be used as new climate risk management tools in developing countries.

Gender diversity

Policies that recognize the important role of women in agricultural production should be acknowledged. By virtue of the valuable knowledge in water, forest and biodiversity management that women have acquired over the years, and their important role in supporting households and communities to mitigate and adapt to climate change, their contribution to the identification of appropriate adaptation and disaster mitigation processes could be very useful. Women's environmental resources, knowledge and practices can be key elements in climate change processes.

Contributing to value chains

Policies that contribute to value chains in the agricultural sector and smallholder farmer participation in these value chains is fundamental to efforts to deal with climate change.

The CET opportunity

The emerging market for carbon emissions trading (CET) offers new opportunities for farmers to benefit from land uses that sequester carbon. Policies that encourage and enhance participation in carbon emission trading schemes must be put in place.

ICRISAT's role

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) serves the poor of the semi-arid tropics in Asia and Sub-Saharan Africa (SSA).

It recognizes that vulnerable rural communities need to adapt to climate change, beginning with enhancing their ability to cope better with the rainfall variability associated with current climates.

To help farmers in Sub-Saharan Africa cope better with climate variability, ICRISAT currently facilitates a NEPAD-endorsed consortium for 15 national, regional and international partners titled *Investing in rainfed farming systems of sub-Saharan Africa: Evaluating the agricultural implications of current climatic variability and planning for future climate change*. ICRISAT is currently partnering with meteorological services, CGIAR centers and climate science specialists in several projects pertaining to climate risk management in Asia and Africa. There are currently 10 such projects taking place in SSA. Equally important is the identification and promotion of crop, soil and water management innovations that not only optimize the efficiency of use of water stored in the crop root zone, but which also minimize the impacts of both current and future climate-induced risk.

ICRISAT has developed and continues to develop tools and technologies enabling the resource poor to improve livelihoods. It uses sophisticated techniques of predicting and forecasting the monsoons in the context of climate change; enables collective action and rural institutions for agriculture and natural resource management; upscales and outscales its community watershed management model; rehabilitates degraded lands and diversifies livelihood systems for landless and vulnerable groups; and initiates government support for water saving options.

Climate-ready crops

ICRISAT already has on hand crops that are adapted to high soil and air temperatures; knowledge and understanding of flowering maturities;

information on genetic variation for water use efficiency; short duration varieties that escape terminal drought and high-yielding and disease-resistant varieties. For instance, we have developed short-duration chickpea cultivars ICCV 2 (Shweta), ICCC 37 (Kranti) and KAK 2 and short-duration groundnut cultivar ICGV 91114 that escapes terminal drought. We recently developed a super-early pigeonpea line that flowers in 32 days and matures in about 65-70 days. We have integrated shrubs and trees into traditional annual cropping systems to help reduce the impacts of winds and to protect soils from erosion.

ICRISAT has developed crop varieties that resist pests and pathogens such as downy mildew-resistant pearl millet hybrid HHB 67 Improved in India; wilt-resistant high-yielding pigeonpea ICEAP 00040 in Tanzania, Malawi and Mozambique and rosette-resistant groundnuts in Uganda, to name a few.

Guiding our crop adaptation work are tools such as INSTAT and GENSTAT, MARKSIM and APSIM/DSAT that analyze climate data and produce high-quality information and products tailored for agricultural applications and to quantify the relationships between climate, crop, soil and water resources.

Since ICRISAT's mandate crops are already more adapted to heat and high soil temperatures, our breeding strategy factors these harsh and dry conditions while developing improved varieties. What we need to better understand is the physiological mechanism underlying heat tolerance; identify wider gene pools to develop crops with wider adaptability; and develop more effective screening techniques of germplasm for desired traits. ICRISAT's genebank holds more than 119,000 accessions from 144 countries that will help safeguard and exploit genetic diversity in order to enhance adaptation.

Biofuel production

ICRISAT is also responding to the challenges by exploiting the potential of 'pro-poor' opportunities for biofuel production. Its BioPower initiative encourages more investments in bio-energy crops and systems to provide a major impetus for sustainable development; empowering the dryland poor to benefit rather than be marginalized, so that farmers can better cope with stresses, climate change or otherwise. The current activities include developing higher-yielding sweet sorghum varieties for food, fuel, feed and fodder; pilot-scaling pro-poor commercial startup company partnerships in sweet sorghum bioethanol production and research-to-development alliances for pro-poor Jatropha plantation development for biodiesel.

Conclusion

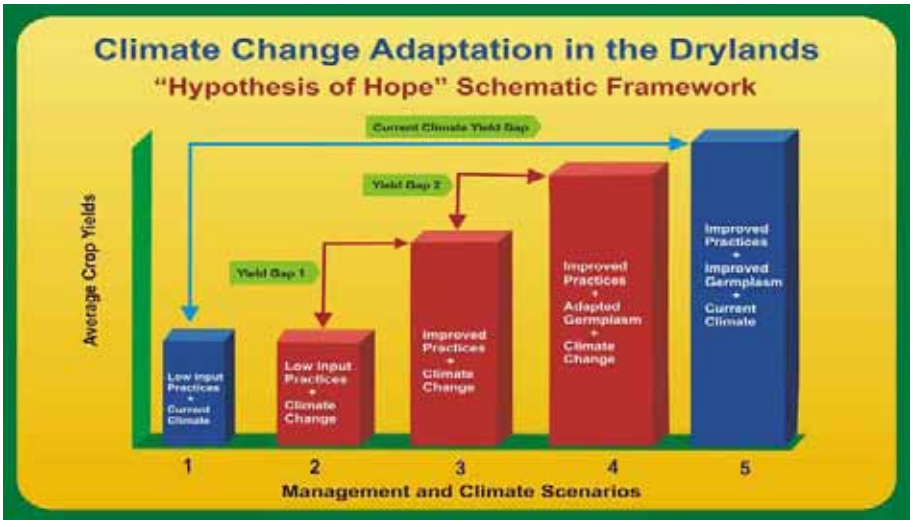
If developing countries in the SAT are to contribute meaningfully to efforts toward adaptation and mitigation of climate change impacts, they will need the strengthened capacity that comes with development. A conducive

and comprehensive policy environment that enhances opportunities for smallholders given the climate change scenario, needs to encompass all levels – farm, basin, regional, national and global. It must include adaptation and mitigation strategies, more investment in agricultural research and extension, rural infrastructure, and access to markets for small farmers, among other things. The bottom line is to ensure that they develop resilient ecosystems, resilient crops, resilient livestock and resilient communities.

ICRISAT's scientists have used a range of proven models to provide insights on the potential impact of climate change on crop productivity. Out of this, ICRISAT has identified yield gaps that ICRISAT must address in seeking solutions to both current and future climate-induced production risks as crop management practices and adapted crop varieties are used under current climate and climate change scenarios.

The first and last columns show the yield gaps between low input and improved practices and germplasm under the current climate. The three columns in between show yield gaps with various crop management practices and adapted germplasm under climate change. Column 2 indicates lower yields due to climate change if farmers continue using low inputs. Columns 3 and 4 show that better yields are possible even with climate change if farmers utilize improved crop management practices and climate-adapted crops. On the whole, high yields are still possible under climate change if farmers combine improved practices with climate-adapted crop varieties.

Hence policymakers should take notice that better formulated and targeted policies that facilitate and support the adoption of agricultural innovation today assume even greater urgency. Not only will they improve the welfare of rural population today but will do a great deal to mitigate the impacts of future climate change.



Be a Hero to Someone

Loyalty Day Speech, 30 November 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

Dr Ragnhild Sohlberg, Former Chair, ICRISAT Governing Board and our chief guest today, honored awardees, MG and RC members and Team ICRISAT, good morning and welcome to our 37th anniversary celebrations!

Today, I would like to dedicate a poem in free verse to TEAM ICRISAT and all our champions like Ragnhild Sohlberg and express my thanks to all those who have made ICRISAT what it is today.

When the poor farmer in the SAT sits down to eat his roti and dhal,
he says thanks in his prayer

And as the wheel of life turns, he knows he has a hero
who has changed his life!

He thinks of seeds, better varieties, new methods,
and the marketplace

He thinks of science and sees a human face,
that of the one who put more food on his plate,
more fruits on his plants, more money in his pocket.

Little does he know that his hero had been
through depressing times himself.

His hero had despaired of ever rising above
his discouraging status in life, not seeing how
his few successes could be more meaningful to himself and others.

Then someone came along who knew how to follow
and knew how to lead, and they called him Servant Leader.

This someone saw people as themselves and as a Team,
and he called them TEAM ICRISAT.

And he showed the Team how to believe in themselves,
how to cherish each other, how to think together.

He taught the Team how to make a path where
there was none, and leave a trail.

The poor farmer of the SAT sits, eats his roti and dhal,
and thinks of the times the Team talked in strange words,
and smiles. He feels good.

The Captain showed the Team how to produce more variety in their crops,
and taught them what they already knew in their head, biodiversity.

The Captain made them see how they could grow more crops,
harvest more, earn more, and taught them what they
had already seen with their eyes, crop diversification.

And the Team explored the complexities of modern science inside and
outside the laboratory, of sustainable natural resource management,
even while strengthening policies, and innovating along the way.

The Team exulted when novel things began to show – hybrid pigeonpea,
HHB 67 Improved, ICGV 91114, sweet sorghum for ethanol,
guinea race sorghum hybrids and climate ready cultivars.

The Team ventured more and reached out more,
went out consolidating and regionalizing,
creating impacts in Asia and Africa.

And the Team realized that the wheel had turned and the shackles of traditional thinking had been broken.

The Team saw that they had created a new ICRISAT, financially sound and rejuvenated.

Ready to face the rising storm that rages in the SAT
The poor farmer in the SAT sits, eats his roti and dhal, and says thanks in silence.

He knows in his heart that the Team is watching over him, even if they are hidden.

TEAM ICRISAT! This is your Captain speaking.
Don't forget the hidden hero inside you.
Don't forget to look out for more of the hidden potential.

Be the hero for more of the ones in need.
Be the hero for more people in the SAT!

A Decade of Service to the Poor

Speech, 37th ICRISAT Annual Day, 1 December 2009, ICRISAT-Patancheru, Andhra Pradesh 502 324, India.

To my most esteemed colleagues and guests, good morning.

Today, ICRISAT celebrates thirty seven years since its inception. As always, I am very delighted to speak before you on this momentous event.

Today, we are honored to have with us our former colleague, Dr. Kanayo Nwanze who is now President of IFAD and Dr Ragnhild Sohlberg, our former Governing Board Chair. Even as Dr Nwanze has gone to higher places, I am sure that ICRISAT and South Asia have always remained close to his heart.

ICRISAT and IFAD share the same mission of serving the poor. ICRISAT does research to improve the well-being of the poor of the semi-arid tropics. IFAD enhances poor peoples' access to financial services, markets, technology, land and other resources.

Ten years ago, I came to ICRISAT as your servant leader, a time when the Institute was facing serious challenges. ICRISAT was then reeling from the past, marked by low staff morale, financial challenges and unusual turnover in its governance and senior management.

Today, ICRISAT is fully transformed and a high performing institution, ready to face the emerging challenges of semi-arid agriculture. But this transformation did not happen overnight. I look at it as a challenging journey by all of us – a journey in pursuit of a better life for the poor people of the semi-arid tropics.

Let me now look back at those ten years of our journey, and visualize what lies ahead. In the years of my life as your servant leader, I have embraced a personal mission to serve the poor. Thus, when I came to ICRISAT, we launched "Science with a Human Face" as our battlecry. As you know, science with a human face means that we do research not for its own sake but to serve the poor.

Today, ICRISAT is synonymous with science with a human face and has become our institutional brand worldwide. As we embraced our battlecry, we needed an engine to move this forward. And so "Team ICRISAT" was born. Since then, we have surged forward, and there has been no turning back.

From a very challenging situation in 2000, I am happy to report that ICRISAT is now on top and in the best of health. From $22 million in 2000, our budget has grown to $56 million this year. Among 15 CGIAR Centers, ICRISAT is now number three in terms of budget size.

We have also achieved consistent budget surpluses since 2003. Today, we are number one in the CGIAR System in terms of cumulative budget surpluses and earned income. Our reserves have consistently grown since 2000. Today, we are number three in the CGIAR System in terms of reserves. On the whole, ICRISAT is at the top together with 4 out of 15 Centers with the best financial performance. This is based on the two major CGIAR indicators of liquidity and reserves.

Let me mention that this performance will be sustained only with strict adherence to sound financial practices. Hence, we must further strengthen full cost recovery and judicious spending in the coming years.

On top of our financial health, we have had two external reviews recognizing the good quality science and sound governance and management of ICRISAT. In 2003, the external program review cited ICRISAT for its remarkable scientific accomplishments, specifically its high quality research on genetic resources and plant breeding.

In the same year, the external management review highlighted "that the management upheaval and accompanying loss of morale and confidence that characterized much of the second half of the 1990s is now generally water under the bridge."

Overall, the panel acknowledged that "a period of stability has begun, with improved organizational structures, and with strengthened financial, human resource, information and support systems in place."

This year, our Sixth External Program and Management Review concluded that "ICRISAT today is a thriving research institute with a unique capacity to address poverty alleviation, food security, and natural resource protection in the semi-arid tropics." Likewise, the panel observed "a remarkable turnaround in the five years since the Center's 2003 review, thanks to strong leadership and improved staff morale. The budget grew by 70% and is projected to continue growing over the next five years."

Our hard work has not gone unrewarded. In 2002, ICRISAT got its third King Baudouin Award. Again for the fourth time and fifth time, we got this same prestigious award with other Centers in 2004 and 2008, respectively. This record remains unsurpassed by any other CGIAR Center. Likewise, in 2006 and 2007, ICRISAT was rated as 'Outstanding' by the CGIAR. Before this, ICRISAT was also rated 'Superior' in 2004 and 2005, and the same for 2008.

As Chair of the UNCCD's Committee on Science and Technology, we sowed the seeds of science to energize policy in combating land degradation.

As we take stock of our outstanding achievement, let me share how we made this happen. At the core of this achievement is transformational management. This is also a major instrument in pursuing our vision and mission. Propelled by a culture of innovation and scientific and management excellence, we pursued transformational management with ten components:

(1) Proactive governance; (2) Decentralization; (3) Inclusive and team-based work culture; (4) Innovative resource mobilization and strategic communication; (5) Sound financial management; (6) Public-private-farmer partnerships; (7) Visibility and accessibility; (8) Seamless knowledge sharing and management; (9) Leveraging human and physical resources; and (10) Cost optimization and costaving.

Our journey was not easy, but we have made giant strides along the way.

At this juncture, let me express my most profound thanks and congratulations to all of you — the dedicated men and women of Team ICRISAT, for making this happen. Let me also acknowledge our Governing Board for their guidance, and our partners and donors for helping us.

I am indeed very proud as your servant leader, and together, our journey goes on. However, as I look far into the horizon, dark clouds loom over us. In fact, a 'perfect storm' is brewing and may hit the whole world unless something is significantly done to prevent it.

You may be wondering what we mean by 'perfect storm.' This takes place when a rare combination of circumstances happens, creating a gigantic problem. Several crises confront global agriculture today, and their confluence, if unabated, will lead to a 'perfect storm.'

Warming temperatures, droughts, floods, increasing land degradation, loss of biodiversity, rising food and energy prices, and population explosion are creating extreme challenges to feed the world. As this happens, the hardest hit will be the poor people of the semi-arid tropics. This is because they do not only produce food but also make a living out of farming under very marginal conditions.

Preventing this perfect storm is the biggest challenge we will face in the next leg of our journey. These challenges require globally coordinated, multifaceted and science-based approaches. Hence, we will not be able to do it alone. We must therefore team up and enhance our alliances with others in our journey to help the world weather this perfect storm.

In this context, the CGIAR System has a key role to play. But we in the CGIAR System must abandon our usual way of doing things for us to help prevent


ICRISAT

this perfect storm. Against this backdrop, let me now share the ongoing change process in the CGIAR. At the heart of this process is a new results-oriented strategy and an improved organizational structure designed to attract additional funding.

Along with this, a new set up is being developed which will distinguish the "doers" from the "funders." This will establish clear and distinct roles for research management and research funding.

The results-oriented strategy will harmonize Centers' research agenda and strengthen collaboration for greater efficiency and impact. Moreover, the new set up aims to foster a supportive research environment that will attract the best scientists around the world. It will cultivate new, stronger and more dynamic partnerships to generate high-quality research outputs and strengthen research institutions in developing countries.

Most importantly, the new CGIAR will better meet the needs of poor farmers, fishers, herders and consumers throughout the world. Let me emphasize that the CGIAR change process is not about closing down or merging Centers. Its main purpose is to eliminate duplication and improve the effectiveness, efficiency and funding of the CGIAR System.

On at the home front too, we are blazing the trail for change as we undertake a strategic planning process. We are doing this exercise out of the EPMR Panel's recommendation that "ICRISAT take ownership of and celebrate the strategic planning and research prioritization process."

To move this forward, I appointed a Strategic Planning Task Team chaired by the Deputy Director General-Research and composed of the members of the Management Group.

Beyond the EPMR Panel's recommendation, we are undertaking a strategic planning process since a range of issues have emerged in our task environment. Among these are climate change, water scarcity, land degradation, loss of biodiversity, increasing food and energy prices and other threats to dryland agriculture. Let us note that these are the main ingredients of the brewing perfect storm.

More specifically, we need to further re-focus our mission and elevate our research for development agenda. While eradication of hunger and poverty remains our main goal, we need to tackle such problems by increasing productivity, ensuring profitability and enhancing sustainability of semi-arid systems. We also need a clearer investment focus and elevate the performance of research, management to support services.

More importantly, we need to reposition ICRISAT in the new CGIAR. We must create a remarkable niche for ICRISAT so that we maintain our global leadership in research and innovation for the semi-arid tropics.

Let me note that we are doing this exercise from a position of strength as our funding has increased significantly. This gives us an excellent opportunity to address the real challenges of the drylands without financial pressure.

We have lined up several events next year in relation to our strategic planning initiative. The primary purpose of these exercises is to heighten our inclusiveness in the planning process and get extensive buy-in from staff, partners and stakeholders. The draft strategic plan will then be subject to stakeholder feedback and submitted to the Governing Board in September for approval. Finally, a business plan will be drafted to implement the strategic plan.

We have planned these sequence of events to allow ICRISAT to first map out its strategic direction next year. We will align our plan to the broader changes in the new CGIAR as it will take shape towards the middle of next year. Our new strategic plan will then position ICRISAT in the new CGIAR. Furthermore, it will enable us to better generate and share international public goods to help bring about pro-poor growth and sustainable development in the semi-arid tropics.

I therefore urge every member of Team ICRISAT, here in Asia and in Sub-Saharan Africa, to actively engage in our strategic planning exercise. This is a crucial initiative since it will serve as the roadmap for our journey in the next five years and beyond.

Our journey together has gone far, but we have a long, long way to go to reach our destination. That destination is a world free of hunger and poverty. But our journey will not be easy. There will be new and more difficult challenges along the way.

However, I am confident that Team ICRISAT and its partners will elevate their scientific excellence to surmount these challenges. We have done it in the last ten years. We will do it even better in the next ten years and beyond.

Can Team ICRISAT do it again? Yes we can!

As we have done this, we will dedicate our triumph to the poor people of the semi-arid tropics.

Thank you and good day!

Seeking the Highest Interest of the Lowest

Guest of Honor and Speaker, 30th Anniversary Celebration of the Ilocos Agriculture and Resources Research and Development Consortium (ILARRDEC), 17 December 2009, Philippines.

Good morning.

It is an honor for me to be here today addressing you on the momentous occasion of the 30th anniversary celebrations of the Ilocos Agriculture and Resources Research and Development Consortium. I am happy to tell you that the International Crops Research Institute for the Semi-Arid Tropics in India celebrated its 37th anniversary a fortnight ago. We too have come a long, long way. We all have good reasons to celebrate.

Under the leadership of President Miriam E Pascua, MMSU is pursuing an array of R&D activities on existing and new crops to provide local farmers a host of opportunities to choose from in their quest for livelihood and better income.

MMSU's R&D system is integrated and promising. It is now the lead agency in pigeonpea and sweet sorghum R&D in the country and is also undertaking multi-locational testing for its champion crops around the country. No wonder, when it comes to the institution's champion crops, your scientists can really talk about the crop's seed-to-shelf science-based handling.

It must surely be a very proud moment for your organization. If I may cite examples of your other successes, the E-kawayan bamboo technologies

generated and MMSU's kawayan tile machine which won the LIKHA award in 2003 and 2005, respectively, have led to economic and social benefits, increased utilization of bamboo and farmers' incomes, provided employment opportunities, opened up local and international market opportunities and developed new linkages for higher levels of achievements. You are showing to every one of us what is a most noble purpose of science – to better the lives of the underprivileged. With science, we must seek the highest interest of the lowest.

I note that your PoPeYe (Poles Per Year) technology has made it possible to predict the productivity of Bambusa blumeana (Kawayan) clumps in terms of both culms and shoots by retaining a specific number of culms and shoots. Your Kawayan Charcoal Briquettes (KCB) Technology is now adopted in various parts of the country as an alternative source of income and at the same time a way to mitigate environmental pollution.

I am sure that under the current able leadership, your organization will scale even greater scientific heights.

After congratulating you, I must say that the challenge for science to do even better is great. Today, more than 30% of Filipinos live in poverty. What was once the second richest country in Asia, after Japan, has plummeted to become one of the region's poorest.

The country is faced with a sluggish economy, rapid population growth, uncontrolled urbanization, inadequate infrastructure, depleted natural resources, and overall environmental degradation.

Roughly three-quarters of the rural poor depend on agriculture for employment and income. But their contribution is decreasing. The share of

agriculture in the country's GDP declined from 21.6% in 1991-94 to 14.2% in 2005-07. This is something to think about seriously. Consider that in 2002, the Philippines invested $0.46 for every $100 of agricultural output, which was more than 70% higher than the equivalent ratio recorded a decade earlier.

Thinking of all that, I submit that there are three I's that are the overarching needs of Philippine agriculture: Investments, Incentives and Information.

The government must invest more in infrastructure. Arable farmland comprises roughly a quarter of our country's total land area. Although the country is rich in agricultural potential, inadequate infrastructure has limited growth in the countryside.

The government must provide more incentives to higher productivity and efficiency. This calls for more support to agriculture in terms of government policies backstopped by adequate financing schemes.

The government must manage knowledge better. The Philippine National Science and Technology Plan (NSTP) 2002-20 with its 12 priority areas, stipulates that the country should be a world-class knowledge provider and user in selected S&T areas by 2020 and that it should develop a wide range of globally competitive products with high technology content. It was not long ago that the Philippines had one of the largest agricultural research systems in Asia.

Today, it has never been more compelling to prepare the country for a rising perfect storm which is the biggest threat to agriculture. This perfect storm is the confluence of the adverse effects of climate change, desertification, food crisis, energy crisis, and population crisis.

To succeed in this, we in science must dramatically enhance our capability and coverage in adaptive agricultural R&D, as this will be our first line of defense against climate change. To do all that efficiently, we need new ways of working, new non-traditional partnerships and truly integrated approaches.

The technical problems are getting more complex. For instance, the impacts of climate change do not necessarily occur in isolation. Temperature increases and droughts can occur in the same year. More rains do not always translate into an ideal situation for agriculture.

Take the case of India. This year was a drought season at first, with a 50% deficit in rains. Then came the floods, severely affecting crops.

In the Philippines, the areas most vulnerable to the impacts of climate change are eastern Mindanao, parts of Samar, Quezon, western Luzon, including Metro Manila and other highly urbanized areas. We must prepare for any eventuality.

Drought, Land Degradation and Desertification (DLDD) conditions have already set in. For instance, drought in south Mindanao in 1998, the hottest year on record, caused losses of 828 million pesos. Alarmingly, our forest cover is shrinking and we are experiencing extreme weather events.

Losses due to ENSO- (El Niño-Southern Oscillation) related events have been severe. El Niño caused a 6.6% decline in our GDP in 1997-98 and during 1990-2003, ENSO-related drought caused losses worth US$ 370 million.

We have been witnessing an increase in the frequency of typhoons -- four during 1976-1980, five during 1971-76, eight during 1986-90, and thirteen during 1991-95. Our agricultural growth rate is lagging and affecting sustainable and inclusive growth. We cannot achieve food security given this situation.

More frequent droughts, depletion of nutrients from the soil, loss of top soil due to increased erosion, depletion of groundwater and reduced water quality as evident with the eutrophication of our lakes, loss of forest cover and biodiversity, and increased losses in agricultural production due to unusual events, all show that our system has reached the point where degradation is greater than development, as we have been abusing the environment.

We must adopt a framework for action that will involve understanding the problem, followed by vulnerability assessments and mapping supported by policy changes. Knowledge can inform action only with engagement and communication.

Strong partnerships combined with knowledge exchange networks that link stakeholders; innovation systems and above all, if I may repeat, greater investments in research and development are critical if our country is to achieve its food security and poverty reduction goals.

According to UNESCO, 380 people per one million should be scientists and engineers. There are only 105 per million in the Philippines! That tells us how far we need to go before we can prove the cynics wrong when they say the country is hopeless. Let us show them that every Filipino is a miracle worker. We must make the Ilocano spirit triumph. Ammoyo ken ammok, nga no kayatna, awan ti di kabaelan ti Ilocano!!!

Thank you.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ICRISAT

About ICRISAT

ICRISAT
Science with a human face

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 644 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT is supported by the Consultative Group on International Agricultural Research (CGIAR).

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