



A Compendium of Speeches by
William D Dar
January-December 2012

ICRISAT @ 40: Forging Ahead in the Service of the Dryland Poor



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**International Crops Research Institute
for the Semi-Arid Tropics**

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Biographical Sketch

William D Dar, PhD, is the 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 member of the CGIAR Consortium.

Dr Dar has had a long and distinguished career as an educationist, agricultural scientist, administrator, and humanitarian in his native Philippines and abroad in the Asia Pacific region and sub-Saharan Africa.

He holds the distinction of being the first Filipino and Asian to be Director General of ICRISAT. 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 has also been a 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), Director of the Bureau of Agricultural Research (BAR) of the Philippine Department of Agriculture (DA) and Vice President for R&D and Professor of Benguet State University (BSU), Philippines.

Dr Dar 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 Most Outstanding Alumnus of BSU and the Ilocos Sur Polytechnic State College. In November 2002, PCARRD honored him with its highest and most prestigious award, the Symbol of Excellence in R&D Management. In 2003, he was awarded the "For the Sake of Agriculture and Rural Development in Vietnam Award". He was recipient of the 2007 Outstanding Professional of the Year Award in the field of agriculture awarded by the Professional Regulation Commission (PRC) of the Philippine Government.



In 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 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. In November 2010, he was conferred the Lifetime Achievement Award by the PCARRD Scholars Association, Inc., (PSAI). In August 2012, he received the BAR Legacy Plaque of Appreciation for his invaluable contributions as the first Director of Philippine's Bureau of Agricultural Research (BAR), setting its directions and bearing as the research and development (R&D) arm of the Department of Agriculture (DA).

Dr Dar has been the recipient of several honorary doctorates – Doctor of Technology from Tarlac College of Agriculture (TCA) and Doctor of Technology Management from Bohol Island State University (BISU) in 2012; Doctor of Humanities from Pampanga Agricultural College (PAC) and Doctor of Science (Rural Development) from University of Southern Mindanao (USM), Philippines (2011); Doctor in International Agricultural Development from Central Mindanao University (2010); Doctor of Technology from Isabela State University (ISU) (2008); Doctor of Resource Management from Benguet State University (2007); and Doctor of Science from Mariano Marcos State University (MMSU), Philippines (2003).

Dr Dar is a man on a mission and a champion of the poor. He led ICRISAT into renaissance, excellence and relevance with the motto *Science with a human face*. His transformational leadership has turned ICRISAT into a forward looking institute, which was ranked 'Outstanding' consecutively in 2006 and 2007 among the CGIAR Centers. His passion is to help alleviate the conditions of the poor living in the semi-arid tropics of Asia and sub-Saharan Africa.

Foreword

It is an honor to write this foreword to Willie Dar's compendium of speeches, *ICRISAT @ 40: Forging Ahead in the Service of the Dryland Poor*. This has indeed been a momentous year for ICRISAT. The Institute is celebrating its 40th Anniversary. In my mind, *ICRISAT @ 40* reflects a vision of an Institute that has produced quality science and is well primed to confidently confront the developmental challenges faced by smallholder farmers in the semi-arid tropics of Asia and sub-Saharan Africa.

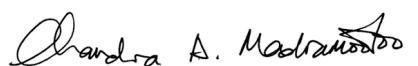


This compendium recounts ICRISAT's science, its progress in combating the vicissitudes of agricultural production and development in the harsh conditions of the dryland tropics, advancing the frontiers of knowledge, doing *Science with a human face*, and expanding food production to help the poor grow their way out of poverty.

The speeches illustrate how the Institute is anchored on a strong foundation of dedication and teamwork under Willie's leadership and stewardship. They demonstrate the dedication and commitment of a leader with a bold vision. Through Willie's determination and boundless energy, ICRISAT has become a powerful and influential agent of developmental change. Whether it is a new innovation or a novel way of promoting inclusive market-oriented development, expounded by Willie Dar, ICRISAT's focus and drive to serve the poor with a human face is reflected in each step taken.

The Institute is set to attain greater heights and tackle new challenges in agricultural research. Among its recent achievements have been the sequencing of the pigeonpea genome with partners, the launch of the Center of Excellence on climate change for plant protection, and the approval of two CGIAR Research Programs on Grain Legumes and Dryland Cereals, aimed at improving the food, nutrition and income security of millions of poor in the dryland tropics of the world. These and other aspects of its multi-faceted research are highlighted in this book.

I would recommend this book to anyone who wants a clear picture of ICRISAT's trials and tribulations, successes and accolades, and the ambitious future direction it has set for itself.


Prof. Chandra A Madramootoo

James McGill Professor and Dean
Faculty of Agricultural and Environmental Sciences
McGill University, Canada
and Member, ICRISAT Governing Board





Leading the Path to Sustainable and Inclusive Agricultural Growth



New BSU President, Dr Ben Ladilad; outgoing President, Dr Rogelio D Colting, Sr; officials, faculty and students of BSU, good morning! I take this opportunity to thank President Ladilad for inviting me to speak on the occasion of his investiture as the 5th President of BSU.

First of all, allow me to commend Benguet State University (BSU) for its unwavering dedication in the pursuit of academic excellence, and its commitment to strong, science-based agricultural research and development (R&D) in the country.

A nation's progress is highly dependent on its capability to harness its human resources. In this view, agricultural state universities and colleges (SUCs) like BSU are the ones that lay the foundation for the nation's continuing efforts to modernize agriculture and to promote industry-responsive R&D.

Message, Guest of Honor, Investiture Ceremony of Dr Ben Ladilad as President of Benguet State University (BSU), 12 January 2012, BSU, Philippines.

Nowadays, however, SUCs face tremendous challenges as well as opportunities amid the new global agricultural environment. In these extraordinary times, the role of SUCs is continuously evolving amid daunting global challenges such as climate change, land degradation, loss of biodiversity, food and energy crises, and population explosion. The rural poor and smallholder farmers are the most vulnerable to this confluence of factors.

History has shown that the youth are the hope of the future... the agents of socio-economic change and technological innovation. However, the youth of today has become less interested in agriculture, and few farmers would want their children to follow in their footsteps. We face the challenge of sustainability as farmers themselves are opting out of tilling the land.

And despite the country's competitive advantage and the efforts of various stakeholders to boost growth in agri-based industries, much still needs to be done in terms of bringing major improvements to the lives of small-scale producers and food-insecure farmers, and to help reduce hunger and vulnerability, especially in rural areas. This is both a challenge and an opportunity for SUCs in the country.

At this point, I challenge BSU to emerge as a dynamic academic institution, not only in teaching but in mainstreaming R&D interventions necessary to win the fight against food insecurity and poverty. This calls for a dynamic approach to the curriculum and teaching of agriculture, and in increasing the permeability between academe and the private and public sectors. In addition, there is a need to build teams, build partnerships, coordinate with governments, collaborate with outside agencies, and advocate entrepreneurship. Science and technology (S&T)-based solutions and innovations are imperative for the country to meet key challenges in food security and agricultural production.

At ICRISAT, we went through an elaborate visioning exercise to come to grips with our new strategic plan to 2020. We are now fully and better geared to find solutions to the turbulence faced by smallholder farmers in the semi-arid tropics of Asia and Africa. ICRISAT's new strategy to 2020 is about harnessing markets to achieve our four mission goals: to elevate the poor out of poverty, hunger, malnutrition and environmental degradation across the dry tropics of the developing world, aided by purposeful partnerships. The strategy, anchored on Inclusive Market-Oriented Development or IMOD for short, can be summarized in three simple words: *Innovate. Grow. Prosper.*

Here in the Philippines, we must invest in research for development, particularly in SUCs, to generate products and innovations that will help provide the poor with goods and services they need to participate in IMOD. We must design our research in ways that especially benefit women and children, as well as other disadvantaged groups such as the landless, marginalized communities, unemployed youth and the elderly.

We must generate scientific and technological innovations to reduce vulnerability to drought and climate change while increasing crop diversity and value; harness development pathways for inclusive prosperity; raise and secure productivity for health, income and sustainability; and increase productivity to help end hunger and food insecurity. Our agricultural policy must target such development outcomes as food sufficiency for all crops, intensification, diversification, resilience, health and nutrition, and women empowerment. If we can incorporate the above socio-economic process in shaping the future of Philippine agriculture, we are bound to have long-term growth and prosperity.

Higher education cannot ignore the economic realities of our country. With BSU celebrating its 26th year with the theme “New leadership: Accelerating the development of Benguet State University”, and with a dynamic and innovative new President in the person of Dr Ben Ladilad, I am confident that the three Ps – Perspective, Persistence and Personal commitment – will help you all pave the way to a successful future.

The mark of a successful university lies in its ability to emerge as an important venue for scholars and stakeholders to address some of the most complex and urgent problems facing society. Hence, a concerted and rapid effort by our higher education system is needed to shape the academic focus around the reality of issues that define the world’s system of food and agriculture.

I am sure that under the able and dynamic leadership of President Ladilad, BSU will find greater prominence leading the path to sustainable and inclusive agricultural growth in the country.

Thank you!





Ensuring Food and Nutritional Security through Inclusive Market-Oriented Development (IMOD)

Honorable Mag. Hans-Jörg Hörtnagl, Austria-India Trade Commissioner; Dr S Ayyappan, Director General, Indian Council of Agricultural Research (ICAR); Dr Roland Poms, Secretary General, International Association for Cereal Science and Technology (ICC); Prof John Taylor, ICC Governing Committee Chair; Dr Jan Willem van der Kamp and Dr Kiran K Sharma, Organizing Committee Members; respected guests, delegates, ladies and gentlemen, good morning!

On behalf of ICRISAT, allow me to extend my warmest greetings to the International Association for Cereal Science and Technology for organizing the 1st ICC India International Grains Conference. We are honored and privileged to be your partner in this very timely and important activity.

*Keynote Address,
1st ICC India
International
Grains Conference
Inauguration, 16
January 2012, Eros
Hotel, New Delhi,
India.*

Today, the world faces “a perfect storm” of big challenges that could lead to widespread food shortages and public unrest over the next few decades. These big challenges include climate change, energy crisis, food crisis, land degradation, loss of biodiversity and population explosion. Scientists predict that worldwide drylands will expand by 11%, and that we will experience increased frequency and severity of droughts across the globe. The past half decade has seen growing volatility in food prices and unexpected spikes in oil prices with severe impacts on the world’s poor. The international financial crisis is looming large, especially in developing countries.

Meanwhile, according to the World Bank, 44 million people have been forced into extreme poverty by food inflation since June 2010. Going by the latest FAO data, the world’s population is projected to reach more than 9 billion in 2050, which will require a 70-100% increase in food production to maintain current dietary standards.

Amid all these, agricultural productivity, especially in developing countries, continues to drop, while degraded natural resources and climate change are increasingly affecting food production and prices. The farming community, mostly composed of small and marginal farmers, is the most vulnerable and is getting poor returns for its produce at a time when the cost of cultivation has gone up drastically.

Ladies and gentlemen, this is the deeply worrying backdrop against which we in the agricultural research-for-development sector work.

International research centers, such as ICRISAT, through publicly available research, broad network of partnerships, and long experience in agricultural research-for-development (R4D), are well-positioned to contribute to the global fight against poverty and hunger.

Every US dollar spent on international agricultural research leads to a return on investment of US\$ 9 worth of economic value in developing countries. The key here is long-term R4D investments, which typically rank first or second in terms of returns to growth and poverty reduction, along with investments in infrastructure and education.

International agricultural research in the CGIAR has contributed much to agricultural development in general and to world food security concerns in particular. Over the course of nearly 40 years of investment, a growing pipeline of research products, innovations and impacts has been changing lives on a large scale.

At ICRISAT, we share the vision of a prosperous, food-secure and resilient dryland tropics with our partners all over the world. R4D investments have enabled us to generate scientific and technological innovations to:

- Reduce smallholder farmers' vulnerability to drought and climate change while increasing crop diversity and value;
- Harness development pathways for inclusive growth and prosperity;
- Raise and secure productivity for health, income and sustainability; and
- Increase productivity to help end hunger and food insecurity.

Our integrated genetic and natural resource management approach holds great promise in improving livelihood opportunities for smallholder farmers, particularly in the drylands. For instance, in the nutrient-starved soils of sub-Saharan Africa, 200,000 poor farm families have increased their productivity by up to 120% and their incomes by 50% with an innovation called microdosing. This technique ensures that even small, yet affordable, doses of fertilizer applied at the right place at the right time vastly benefit the crop.

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 these models, we have identified and minimized various yield gaps with the use of crop management practices and adapted crop varieties under current climate and climate change scenarios. Another successful case is the low-cost ELISA-based kit developed by ICRISAT which is now helping groundnut farmers in Asia and sub-Saharan Africa to export their produce to markets in the west.

ICRISAT has also strengthened its efforts in transgenic research for crop improvement by establishing the Platform for Translational Research on Transgenic Crops (PTTC) with support from the Department of Biotechnology (DBT), Government of India (GoI).



At ICRISAT, we believe that farming must be done as a business, and one of our critical focus areas involves fostering agro-enterprises. We do this by promoting and initiating key approaches, such as public-private partnerships, increased demand for agro inputs and outputs, a conducive business environment, and above all, by advocating proactive government policies. Our emphasis is on the smallholder farmers in the dryland tropics. In India these comprise 65% of the agricultural landscape, who must be made key partners in agri-business and food processing ventures.

Modernizing the agro-food system can be a strong engine for direct and indirect growth and poverty reduction in the drylands. It is all about shared challenges, technology exchange, capacity building, and creating opportunities through partnerships. This is the essence of our IMOD approach under our new strategic plan to 2020. IMOD is a dynamic progression from subsistence towards market-oriented agriculture.

This pathway is what will reduce poverty since markets create demand for a wider diversity of higher-value foodstuffs and agro-industrial products. This stimulates agro-enterprises that raise rural incomes and create opportunities beyond agriculture. Smallholder farm families have to be empowered and assisted along this development pathway to lead them from pessimism to prosperity.

At ICRISAT, this seed was sown as early as 2003, with the setting up of the Agri-Science Park@ICRISAT supported by the Government of Andhra Pradesh – now renamed as the AgriBusiness & Innovation Platform (AIP). In this program, an inclusive growth and development strategy through public-private partnerships is the key.

The NutriPlus Knowledge (NPK) Program of AIP works on value addition and post-harvest management in the agri-food sector. We do this by promoting innovative processing, product development and by enhancing the food safety of ICRISAT's mandate crops, namely chickpea, pigeonpea, groundnut, sorghum and pearl millet.

NPK has been involved in exploring technologies for developing innovative products based on sorghum and millets, in order to offer healthier and safe food options to consumers. NPK also seeks to link resource poor farmers to the dynamic Indian agro-food processing industry. Through the activities of the NPK program, we actively collaborate with partners such as ICC, and with our various stakeholders in the grain and food industry to promote grain science and technology with focus on quality, safety and health.

Meanwhile, the Agri-Business Incubation (ABI) Program of AIP has emerged as a champion and a model in creating competitive agri-business enterprises. ABI helps entrepreneurs and innovators by facilitating commercialization of technologies and services of our NARS partners through the Network of Indian Agri-Business Incubators (NIABI). In India and in most developing countries, much of the industrial activity is agro-based, with agro-food processing alone accounting for

a big percentage of the total manufacturing industry. We believe, therefore, that the fight against poverty, hunger and malnutrition involves stimulating agro-enterprises to raise rural incomes and to create opportunities beyond agriculture, through the IMOD approach. Again, we must remember that markets provide cash to enable the poor to break out of the poverty-hunger trap. Social and technical innovations increase farmers' rewards from market participation. And innovations must be specially tailored to the conditions of the poor.

Hundreds of millions of people, particularly those in the drylands, continue to live in poverty. At the heart of this global inequality lies food and nutrition insecurity. What every nation of the world needs is a sustainable, inclusive, resilient, profitable and healthy agricultural sector. We at ICRISAT believe that critical to achieving this is to pursue the following:

Crop diversification minimizes the risk of crop failure that might result from the vagaries of climate. At the same time, farmers could greatly benefit by adding high-value specialty crops such as fruits and vegetables to traditional grain/cereal crops of the drylands. Apart from bringing in more cash, diversified systems create a more nutritious household diet and provide remunerative labor opportunities as well as valuable by-products such as firewood, fiber and fodder.

Once IMOD has been triggered for staple food crops, the stage is set to expand it into additional high-value cash crops, because the basic experiences and channels for input supply and output marketing would have been established. We have been successful in introducing highly productive small market gardens which are now helping reduce poverty and improve nutrition in the Sahel region of Africa.

We have also explored opportunities for value addition or optimization in a sweet sorghum-food-ethanol-fodder production chain in a wide range of varieties and hybrids. We have also started forming public-private partnerships to make sweet sorghum a viable supplement feed stock for ethanol production.

Towards *climate change adaptation*, we have been developing and promoting resilient crops for the poor in the drylands, among which are short-duration chickpea cultivars that can withstand high temperatures; pearl millet flowering at 40+°C; and drought-resistant groundnuts.

We have also been conducting basic research on various dimensions of climate change, hazard analysis, and vulnerability assessment; and in reducing disaster risks and strengthen disaster resilience.

To *build a resilient food system*, we have to promote pro-poor agricultural growth by investing more in R&D, rural infrastructure, information monitoring and sharing, and by promoting institutional development and innovations. Most importantly, our approach must be deliberately inclusive of those who need us most. Since women and children particularly suffer the most from poverty, hunger and

malnutrition in the tropical drylands, in building a resilient food system, they must be empowered to participate and benefit in the development process.

The demand for grains is growing as a number of major global issues continue to impact the world's food security. Hence, grain science and technology, particularly in a country like India, has become a key factor in agro-enterprise development. Grains R&D addresses critical issues such as postharvest losses of grain produce, providing quality and safe food, fighting hunger and malnutrition, and improving livelihoods of smallholder farmers by providing them with entrepreneurial opportunities.

ICC has been instrumental in revolutionizing the field of grain science and technology through international cooperation, particularly in developing standard methods to improve food quality, food safety and food security for the health and well-being of all people. Our association with ICC in organizing this symposium is definitely one huge leap towards the realization of IMOD. This conference gives all of us enormous windows of opportunities to interact with the private and public sectors alike, and with the scientific community on how to augment our interventions to bring change to the lives of the forgotten poor.

In this regard I am delighted to see that the conference program has been designed to involve all the important partners and stakeholders of the grains value chain. I am sure that this conference will result in fruitful collaborations among stakeholders in the grains industry in ensuring food and nutritional security through the IMOD approach.

We appreciate ICC's initiative in leading the promotion of grain science and technology in this region of the world. ICRISAT, now having the privilege of being the first ICC Institutional Member in India, together with ICC, hopes that this conference will open up new challenges and opportunities toward improving the quality, safety and nutritional value of grain-based foods in this sub-continent.

Indeed, it is partnerships which hold out the greatest hope of finding solutions to the challenges we face – but there is much, much more to be done. An inclusive market-oriented development approach – in ways that alleviate hunger, end poverty, and promote sustainable development – requires us to work together more effectively.

The survival of one billion people – the weakest and most vulnerable on the planet – depends upon us finding answers to hunger now. The future of nine billion plus people depends on us putting in place the right technologies, policies, systems and approaches to deliver food security in an environmentally sustainable manner within a few decades.

This conference will definitely create partnership opportunities that will bring us one step closer to realizing a food and nutrition secure world. Let's do our part now! I wish all the participants of this conference great success!

Thank you and a pleasant day to all!



Promoting Agricultural Development through Innovation and Entrepreneurship

His Excellency Dr APJ Abdul Kalam, Former President of India; Dr S Ayyappan, Director General, Indian Council of Agricultural Research; Dr Bangali Baboo, Director, National Agricultural Innovation Project (NAIP), ICAR; Dr Hari S Gupta, Director, Indian Agricultural Research Institute (IARI); Dr Kiran Sharma, CEO, Agribusiness and Innovation Platform (AIP), ICRISAT; Organizing Committee members; distinguished guests, ladies and gentlemen, good morning and welcome to the 2nd Global Agri-Business Incubation Conference: NIABI 2012.

First, on behalf of ICRISAT, allow me to extend my warmest greetings to ICAR for organizing NIABI 2012. We are honored and privileged to be your partner in this very timely and important activity.

*Opening Address,
2nd Global
Agri-Business
Incubation
Conference:
NIABI 2012, IARI
Auditorium, Pusa
Campus, 6-8
February 2012,
New Delhi, India.*

Today, the world faces “a perfect storm” of big challenges that could lead to widespread food shortages and public unrest over the next few decades. These big challenges include climate change, energy crisis, food crisis, land degradation, loss of biodiversity and population explosion.

Scientists predict that worldwide drylands will increase by 11%, and that we will experience increased frequency and severity of droughts across the globe. The past half decade has seen a growing volatility in food prices and unexpected spikes in oil prices with severe impacts on the world's poor. The international financial crisis is looming large, especially over developing countries.

Let me present you with some more facts – 1.4 billion people (one in four) in the developing world live in poverty; more than a quarter of the world's children are still malnourished; nearly a quarter of the women population is illiterate; 1.6 billion are without modern energy; and one-sixth of the world's population is without clean water. Going by the latest FAO data, the world's population is projected to reach more than 9 billion in 2050, which will require a 70-100% increase in food production to maintain the same dietary standard we have today.

Amid all these, agricultural productivity, especially in developing countries, continues to drop, while degraded natural resources and climate change are increasingly affecting food production and prices.

The farming community, mostly composed of small and marginal farmers, is the most vulnerable to this situation. They are getting poor returns for their produce at a time when the cost of cultivation has gone up drastically.



Feeding the forgotten poor remains a major concern particularly in the drylands of Asia and sub-Saharan Africa with their marginalized, resource-poor and perennially shock-prone communities. People who are this poor live in a constant state of hunger and insecurity. They spend their days working hard in the fields, but get little for it because their lands are depleted and drought-prone.

Ladies and gentlemen, this is the deeply worrying backdrop against which we in the agricultural research-for-development sector work.

Feeding the forgotten poor is not only a need, but a moral imperative. Hence, we at ICRISAT along with our partners are working constantly to help empower these poor people to overcome poverty, hunger, malnutrition and a degraded environment through better and more resilient agriculture.

Amid the global challenges we face today, the growth strategy for most developing countries now must be focused on agricultural revitalization.

Accelerated agricultural growth is broadly transformative. Growing farm incomes raise the demand for industrial goods, lower food prices, and curb inflation; and encourage broad entrepreneurial activities such as diversification into new products, the growth of rural service sectors, emergence of agro-processing industries, and expansion into new markets.

To move toward this path, we must view agriculture and allied sectors as a business entity, and veer away from the traditional, subsistence mode. Globally, it has been proven that agricultural entrepreneurship plays a critical role in the development and well-being of society as it creates jobs, drives and shapes innovation and brings in competition which in turn improves productivity. Agricultural entrepreneurship thus acts as a catalyst for economic growth and national competitiveness. However, that is only possible if smallholder farm families, particularly in developing countries, are not sidelined in the process, but instead are empowered and assisted along this development pathway to lead them from hopelessness to prosperity.

Investments and innovations in knowledge and infrastructure support – especially in the form of science and technology and business incubators – have featured prominently and consistently in most strategies to promote sustainable and equitable agricultural development with focus on entrepreneurship development both at the national and international levels.

At ICRISAT, we embrace the principle that farming must be done as a business, and one of our critical focus areas involves fostering agro-enterprises. We do this by promoting and initiating key approaches such as public-private partnerships, increased demand for agro-input and outputs, creating a conducive business environment, and above all, by advocating proactive government policies.

Our emphasis is on the smallholder farmers in the dryland tropics. In India these comprise 65% of the agricultural landscape. These farmers must be key partners

in agri-business and food processing ventures. Modernizing the agro-food system can be a strong engine for direct and indirect growth and poverty reduction in the drylands. It is all about shared challenges, technology exchange, capacity building, and creating opportunities through partnerships.

This is the essence of our Inclusive Market-Oriented Development or IMOD approach under our strategic plan to 2020. IMOD is a dynamic progression from subsistence towards market-oriented agriculture. This pathway is what will reduce poverty since markets create demand for a wider diversity of higher-value foodstuffs and agro-industrial products. This stimulates agro-enterprises that raise rural incomes and create opportunities beyond agriculture.

ICRISAT's Agri-Business Incubation (ABI) Program, one of the components of our Agribusiness Innovation Platform, has now emerged as a champion in nurturing and incubating agricultural technologies and innovation, and is a model for facilitating the creation of competitive agri-business enterprises through technology development and commercialization.

ABI is our commitment to support emerging entrepreneurs on technology development and commercialization, envisioned to unite dedicated scientific research with market-oriented agricultural development.

At ABI, we do this by adopting a dual mode. The *service* strategy involves nurturing technologies and innovations on seed, biofuel, farming systems and agricultural biotechnology, while the *outreach* strategy involves partnering with institutes/ organizations globally. This dual mode promotes agri-business ventures and enhances technology commercialization through co-business incubation.

We envision ABI as a complete support structure for agripreneurs with ideas, by providing them with technology, business consultancy and opportunities for networking with management experts, government and development organizations; as well as venture capital funding and infrastructure facilities. By helping nurture agricultural innovations and entrepreneurship ABI has become one of our flagship programs contributing to the realization of our primary mission of eliminating poverty and improving livelihoods in the dryland tropics.

To date, ABI has commercialized 54 technologies, supported 223 business ventures, mobilized \$18 million worth of investment for ventures, generated direct employment for 832 individuals, introduced 82 products in the market, and benefitted 500,000 farmers.

We at ICRISAT feel honored and privileged that through ABI we have had the opportunity to help establish the Network of Indian Agri-Business Incubators (NIABI), a project of NAIP-ICAR with funding from the World Bank. A total of 10 Business Planning & Development (BPDs) units have been set up under NIABI. To make these business incubation centers successful and self-sustainable, ICRISAT-ABI has been entrusted with the responsibility of handholding and mentoring these



BPDs. Through NIABI, we have been building agri-business synergy in India, and have facilitated commercialization of innovative agro-technologies through agri-business development particularly benefitting smallholder farmers.

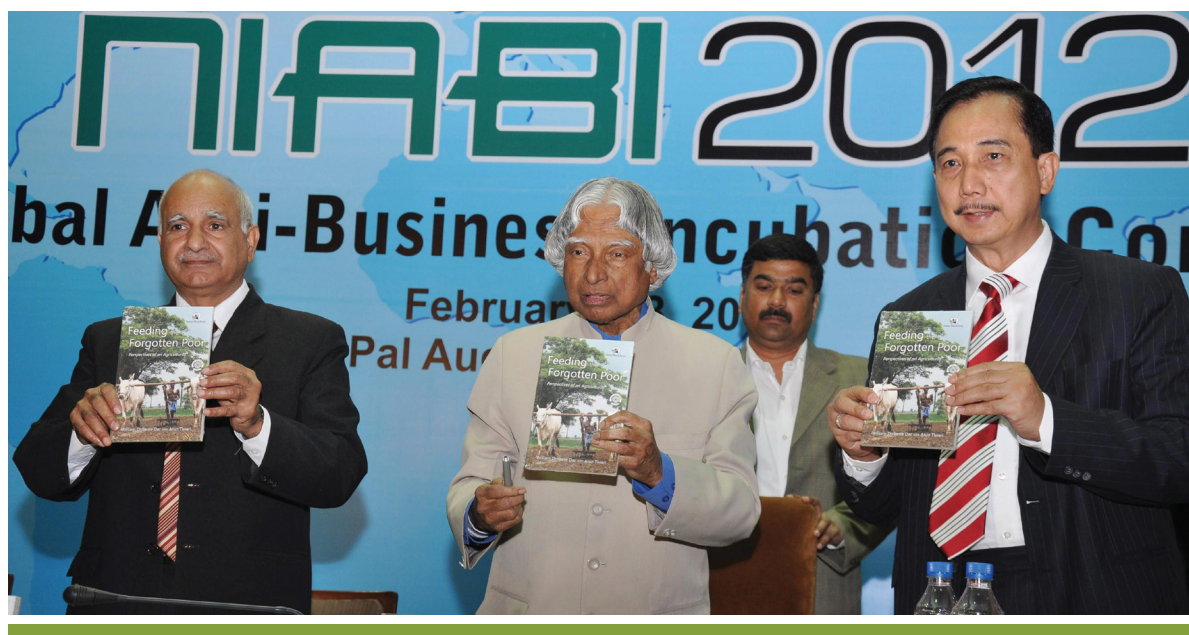
Worldwide, business incubators are now gaining recognition as vital to agricultural and industrial agri-business sectors, where technology serves as a precursor for improving the economic, social and environmental conditions especially of rural communities. We are happy to inform you therefore that ICRISAT-ABI – with NIABI as its model – is now making its presence felt in Africa with the UniBrain Initiative. Along with the Forum for Agricultural Research in Africa (FARA), several incubators across the continent will be set up under this initiative.

NIABI 2012 has been designed to involve all our important partners and stakeholders in global agri-business incubation. I am confident that this conference will result in fruitful collaborations among our stakeholders in the agri-business industry, create new networking and partnership opportunities, take us one step ahead in revitalizing the agriculture sector not only in India but in other developing countries as well, and open up new livelihood opportunities for smallholder farmers.

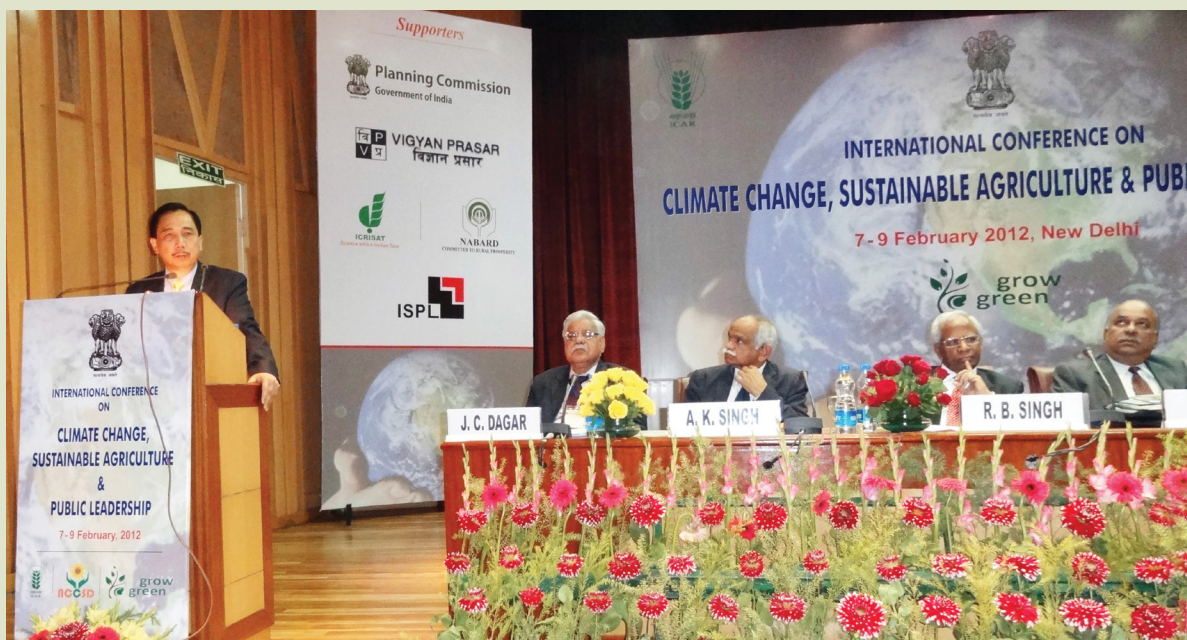
Finally, let me emphasize that now is the time to go the extra mile. Together with our partners, we in ICRISAT stand ready and driven with conviction to create excellent prospects for agricultural innovation and entrepreneurship to become the primary driver of sustainable agricultural development and poverty reduction, and in feeding the forgotten poor in the dryland tropics of the world.

I wish all the participants of this conference great success!

Thank you and a pleasant day to all!







Policymaking to Build Smallholder Resilience and Adaptive Capacity Amid Climate Change

Distinguished guests, ladies and gentlemen,

Thank you very much for inviting me to speak on this momentous occasion. I am especially honored to share with you some policy and technological responses to climate change, a fundamental challenge which confronts our planet and all of humanity.

Today I want to underscore the importance of science as essential for policymaking on sustainability issues in the face of climate change. I lay emphasize on how we can and must adapt to the effects of this looming threat, in the context of building smallholder resilience and adaptive capacity, particularly in the vulnerable regions of the world.

*Guest of Honor,
International
Conference on
Climate Change,
Sustainable
Agriculture & Public
Leadership, 7-9
February 2012,
National Agricultural
Science Centre
(NAS) Complex,
New Delhi, India.*

We all know and agree that climate change is happening! We must get serious about adaptation and mitigation and we must do so now. There is no time for delay.

The people who are bearing the brunt of the effects of climate change are those who can least afford to do so and who have done least to cause the problem. Hence, climate change adaptation and mitigation are both a practical need and a moral imperative. Development challenges are today compounded by the effects of increasingly extreme weather. Hence, we need to adopt a comprehensive approach involving all stakeholders, in identifying best adaptation and mitigation practices, and in prioritizing policy-relevant research needs across fields.

In the recent issue of *Science* magazine, authors of the article 'What next for agriculture after Durban?' said that "Agriculture worldwide is being impacted by climate change and in less than 15 years global population will rise by one billion people. Hence, policy makers and scientists need to work together, quickly, to chart a course toward a sustainable global food system."

As global temperatures continue to rise, the pace of environmental change will likely be unprecedented. More frequent and intense precipitation events, elevated temperatures, droughts, floods and other types of damaging weather, are all expected to take its tolls on crop yield and quality. This makes the challenge of feeding an estimated 9 billion people in the world by 2050 exceedingly difficult.

But much more than crop yield and quality, climate change will have far-reaching consequences for agriculture that will disproportionately affect poor and marginalized groups who depend on the sector for their livelihoods and have a lower capacity to adapt. The effects of climate change is more likely to be felt in the arid and semi-arid tropics (SAT) – home to the deepest pockets of poverty on earth – and where rainfed agriculture is the lifeline for most small and marginal farmers. A recent study assessing rainfed cereal potential under different climate change scenarios revealed loss of rainfed production potential by 10-20%. This is expected to affect 1-3 billion people by 2080 mostly in the tropical developing countries.

The relationships between climate change, agriculture and food security are complex and dynamic. But only by understanding this can we come up with solutions, open untapped opportunities to meet the challenge, and devise short-, medium- and long-term adaptation and mitigation strategies.

For the most vulnerable people in the dryland tropics dependent on rainfed agriculture, we need to look at not only technological but also social, institutional and policy mechanisms in building the resilience of resource-poor communities.

ICRISAT's climate change 'Hypothesis of Hope' states that "how farming systems cope with **current** rainfall variation is likely to yield important clues for adapting to **future** climate change". We believe that we can bridge the gap between the



farmers' yield and achievable potential yield to ensure improved food production and livelihoods for all farmers.

This, we can do by integrating the adoption of our climate-resilient crops and various soil, water and nutrient management strategies, along with supporting policies and institutions. Emerging science tools such as remote sensing, modeling and conventional natural resource management technologies will have to be integrated with social and policy interventions to achieve the desired results.

At ICRISAT, through our research-for-development initiatives, we hope to be able to provide science-based solutions and pro-poor approaches for adaptation, particularly of agricultural systems, to climate change. We believe that to reduce the vulnerability of smallholder farmers to extreme weather, we must create a sustainable, inclusive, resilient, profitable and healthy agricultural sector.

Along with our partners, we have developed varieties of dryland crops – such as sorghum and pearl millet, chickpea and groundnut – that can thrive and yield well in drought-prone and marginal areas. To make vulnerable communities more resilient in the face of climate change, they need to grow better adapted, more drought-tolerant crops. We have also been working with the NARS in Asia and sub-Saharan Africa in the development and adoption of viable seed supply systems in collaboration with the private sector; fertilizer and water-use efficiency techniques for improved productivity; and soil-water conservation and rehabilitation of degraded lands.

We are going beyond quick-fix solutions to pursue science-based sustainable alternatives amid the threat of climate change. And we hope to pursue this path through our Inclusive Market-Oriented Development approach which focuses on transforming subsistence to market-oriented agriculture by stimulating agro-enterprises to raise rural incomes and create opportunities beyond agriculture. Smallholder farm families have to be empowered and assisted along this development pathway to lead them from pessimism to prosperity.

Until recently, most scientific assessments on climate change were focused at a macro/regional level. Our ADB-funded project *Vulnerability to climate change: Adaptation strategies and layers of resilience* has generated valuable outputs that will have policy and livelihood impacts for the rural poor and vulnerable farmers in the semi-arid regions. This project will benefit the poor, marginalized, and vulnerable through improved strategies for managing risk and vulnerabilities that will diversify their sources of livelihood and provide alternative coping strategies through institutional innovations. The project will also generate new policy, institutional and technological options that will lead to improved management of scarce water resources and reduced resource degradation; and improved databases, information, and training that will enhance local communities' capacity for adaptation strategies.

We at ICRISAT believe that a progressive policy environment is equally important to see results on the ground. We should encourage more investment in infrastructure, education and research. This is towards improving understanding and prediction of climate-agriculture interactions, water policies, and land-use policies to encourage diversification and natural resource management, among others. Equally important are policies that encourage private sector engagement, and enable better access to credit and agricultural inputs. We also need policies that acknowledge the role of women in agricultural production, and contribute to value chains in the agricultural sector.

Our approach in building climate-change resilient rainfed agriculture needs a holistic paradigm. Our R4D work will have to be integrated deeply with those of development workers, policymakers and small and marginal farm communities. Through our concerted efforts, we must tackle the above issues seriously to free smallholder farmers in the dryland tropics from the pincer-hold of poverty and food insecurity.

I would like to outline opportunities for scientists to help improve the overall understanding of agricultural practices that will deliver multiple benefits in the areas of climate change adaptation and mitigation, global food security, and reducing dangerous emissions. These include:

- Integrating global and national policies on climate change;
- Increasing investment;
- Sustainable intensification;
- Helping the most vulnerable;
- Reshaping consumption around health;
- Reducing waste; and
- Sharing information.

The above blueprint was also echoed in the recent *Science* magazine article, which stated that “At the heart of it all is sustainability. Alternative agricultural practices, tailored to different regions, show promise for reducing greenhouse gas emissions and maintaining or improving yields despite extreme weather”.

Addressing the relationship between climate change and agriculture will require the sharing of insights by a diverse set of experts and actors, from scientists/ academicians and engineers to regulators and policymakers. Current policies are resonating a disconnect since they are aggregative, top down and highly macro level, coupled with uncertainties and information gaps, thereby obstructing the adaptation to mainstream in the policies/programs of marginal environments in the developing world.

Let me again emphasize that scientists and researchers like us have a responsibility to show policymakers that a climate-smart agriculture is possible, and that it is crucial to the success of any global climate change adaptation and mitigation effort. That, I am confident, is what's happening in this conference. This conference is an excellent platform for mainstreaming climate adaptation and mitigation into plans and strategies at the national, local and sectoral levels; and in scaling-up pilot community-based adaptation projects involving poor and vulnerable communities in both urban and rural areas.

Let us all work together to come up with a roadmap to operationalize suitable adaptation, mitigation and policy measures for overcoming the impacts of climate change on agricultural productivity and livelihood not only in India, but in the whole world as well.

The future of nine billion plus people by 2050 depends on us putting in place the right policies and systems to nurture a climate-smart agriculture that sustainably increases productivity and resilience, and reduces greenhouse gases while enhancing the attainment of a food-secure world.

At this point, I am pleased to inform you that the book *Feeding the Forgotten Poor* was launched yesterday by none other than the Former President Dr APJ Abdul Kalam during the NIABI 2012 conference held at IARI-ICAR. The book is a modest attempt to rally behind the world's poorest of the poor, particularly those in the drylands, who live in a constant state of hunger and insecurity. It extends a unifying message worldwide to make food security not just a need but a moral imperative.

Allow me to end this talk by saying that a climate-smart, food-secure world is possible only if we:

Act Now, as today's actions determine tomorrow's options

Act Together, since we all have a role to play and

Act Differently, to enable us to make robust rather than optimal decisions.

The need to integrate the economic, social and environmental dimensions of development so as to achieve sustainability was clearly defined a quarter of a century ago. Amid the threat of climate change, it is time to make it happen.

Thank you and have a good day!





Surmounting the Challenges of Climate Change, Food Security and Plant Protection



23

Distinguished guests, ladies and gentlemen,

Thank you very much for giving me the opportunity to speak on this important occasion – the launching of a partnership between India's Department of Science and Technology (DST) and ICRISAT to conduct focused research-for-development initiatives through the Center of Excellence (CoE) on Climate Change Research for Plant Protection (CCRPP).

This undertaking is another testament to what we refer to as "purposive partnership". At the highest level, the purpose is to implement R4D initiatives to progress towards the mission goals that we all share – to reduce poverty, hunger, malnutrition and environmental degradation across the dryland tropics.

We all know and agree that climate change is happening now, and has become one of the biggest challenges the world has

*Keynote Address,
Launch of the DST-
ICRISAT Center of
Excellence (CoE) on
Climate Change
Research for Plant
Protection (CCRPP),
9 February 2012,
ICRISAT-Patancheru,
Andhra Pradesh
502 324, India.*

to face! The people who are bearing the brunt of the effects of climate change are those who can least afford to do so and who have done least to cause the problem. Hence, climate change adaptation and mitigation are both a practical need and a moral imperative.

In the recent issue of *Science* magazine, authors of the article 'What next for agriculture after Durban?' said that "Agriculture worldwide is being impacted by climate change and in less than 15 years global population will rise by one billion people. Hence, policy makers and scientists need to work together, quickly, to chart a course toward a sustainable global food system".

As global temperatures continue to rise, the pace of environmental change will likely be unprecedented. More frequent and intense precipitation events, elevated temperatures, droughts, floods and other types of damaging weather, and new pests and diseases are all expected to take its tolls on crop yield and quality. This makes the challenge of feeding an estimated 9 billion people in the world by 2050 exceedingly difficult.

The effects of climate change is more likely to be felt in the arid and semi-arid tropics – home to the worst pockets of poverty on earth – and where rainfed agriculture is the lifeline for most small and marginal farmers. A recent study assessing rainfed cereal potential under different climate change scenarios revealed loss of rainfed production potential by 10-20%. This is expected to affect 1-3 billion people by 2080, mostly in the tropical developing countries.

It is estimated by FAO that almost 1 billion people went hungry in the past year, the highest ever level of world hunger, mainly due to declining agricultural production. It has been estimated that land degradation, urban expansion and conversion of crops and croplands for non-food production will reduce total global cropping area by 8-20% by 2050. This fact, combined with water scarcity, is already posing a formidable challenge to increasing food production by 75-100% to meet the projected demand of the world's estimated population of 9 billion by 2050.

But total food production alone does not define food security since food must be both safe and of appropriate nutritive value. Furthermore, food has social values inseparable from the production, distribution and value-chain activities. Food must be accessible, affordable and available in the required quantities and varieties of choice. This is dependent on production, distribution and trading infrastructure and mechanisms. All these factors may be affected by climate change, and some are affected both directly and indirectly through pest- and pathogen-mediated changes that occur because of climate change.

Diseases and insect pests cause crop losses of over US\$ 8.48 billion annually and these losses are likely to increase at least four folds under the climate change scenario. There are indications that global warming and climate change will lead to the emergence of more aggressive pest and pathogen populations, resulting

in heavy losses by epidemics, particularly in grain legumes such as chickpea and pigeonpea.

This brings us to why we are all gathered here today. Our partnership in this initiative will have a major bearing on environment-friendly, pest mitigation strategies for the sustainable production of grain legumes and in increasing food security in the dryland areas – particularly in regions most vulnerable to climate change.

ICRISAT's climate change 'Hypothesis of Hope' states that "how farming systems cope with **current** rainfall variation is likely to yield important clues for adapting to **future** climate change". We believe that we can bridge the gap between farmers' yield and achievable potential yield to ensure improved food production and livelihoods for the farmers.

Along with our partners, we at ICRISAT have been implementing research-for-development initiatives that provide science-based solutions and pro-poor approaches for adaptation, particularly of rainfed agricultural systems, to climate change. And we are confident that this partnership brings us one step closer towards the realization of our 'Hypothesis of Hope'.

Over the last 39 years, we have been developing climate-ready disease- and insect pest-resistant crops to help poor farmers adapt to climate change. We have been implementing climate change mitigation R4D, specifically in the areas of crop and weather modeling; and conducting extensive research on the effects of drought, water-logging, diseases and pests resistance on the production of our mandate crops, specifically chickpea and pigeonpea.

Our plant protection scientists have for years been engaged in determining the effects of differential ranges of temperature, precipitation, rainfall patterns, humidity, and light/sunshine on the outbreak of diseases and pests. We have also been utilizing molecular marker-aided technology and genetic engineering to reduce pest-associated losses and the adverse effects of global warming and climate change. Our Kanayo Nwanze Crop Protection Laboratory has more than 1,000 sq m of laboratory space, and is well equipped with the basic infrastructure needed for research in entomology and plant pathology.

We have identified medium-term priority strategies that will result in the development of crop varieties and cropping systems adapted to a changed environment. The key factors we have considered here are: (1) higher temperature tolerance; (2) moisture extremes – both increased moisture stress and risk of temporary flooding; (3) changed distribution and severity of insect pests and diseases; and (4) 'migration' of our mandate crops into marginal, harsh environments. We are going beyond quick fix solutions to pursue science-based sustainable alternatives amid the threat of climate change. Hence, we are integrating all these R4D efforts in our pursuit of the Inclusive Market-Oriented

Development approach, which focuses on transforming subsistence to market-oriented agriculture by stimulating agro-enterprises to raise rural incomes and create opportunities beyond agriculture.

Ladies and gentlemen, this CCRPP initiative will be an integral part of our overall climate change mitigation and adaptation strategies, particularly in enhancing our capability to focus and understand the complex phenomenon of crop-pest/pathogen-climate change interaction.

Any discussion about food security is incomplete without acknowledging the complex web of production, processing and policy issues, where climate change will primarily mediate the influence of plant and pest diseases to affect sufficiency, quality and safety of food. We pledge our commitment to CCRPP in devising and developing pest-resistant varieties, particularly of chickpea and pigeonpea, not only against existing pests and their forms, but also against new pests emerging with climate change.

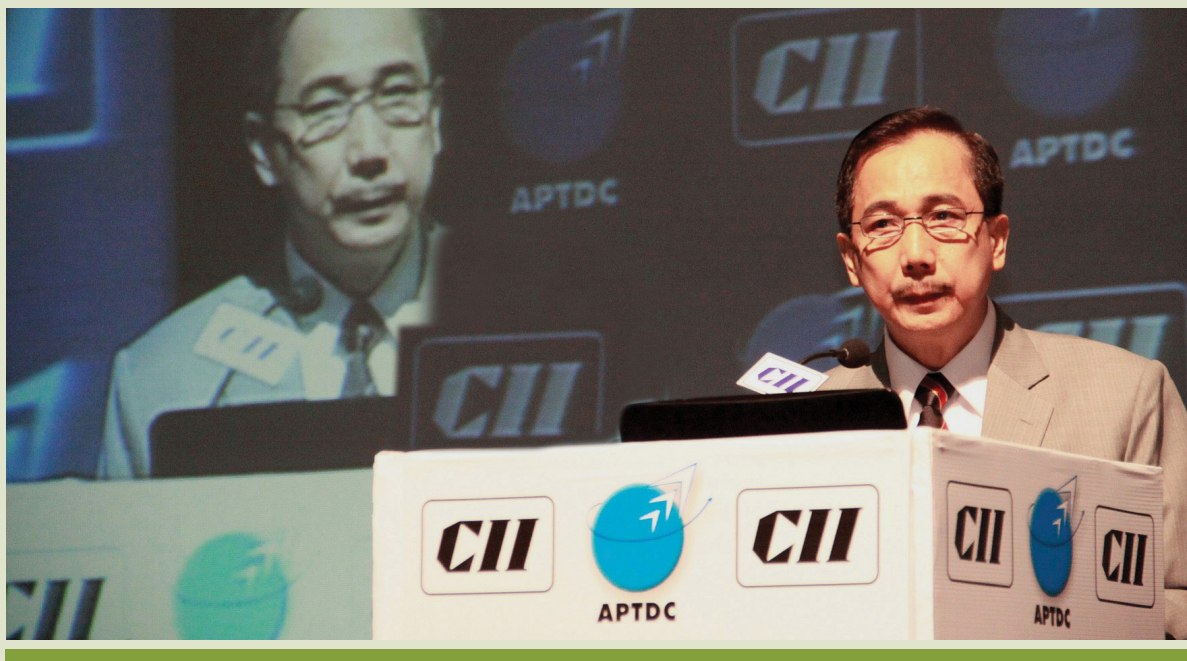
We are confident that combined with crop improvement and natural resource management, our plant protection R4D initiatives will help empower the poor, marginalized, and vulnerable farming communities of the dryland tropics. Improved strategies for managing risk and vulnerabilities will in effect diversify their sources of livelihood and provide them with alternative coping strategies.

Again, let me emphasize that global food production must increase by 75-100% to meet the projected demand of the world's population by 2050. Meeting this difficult challenge will be made even harder amid the threats of climate change. Integrated solutions and partnerships are considered essential. We hope that through the CCRPP, we can outline key links between climate change and key pest and disease management issues to be addressed in improving food security in a changing climate.

The future of nine billion plus people by 2050 depends on us providing science-based solutions and systems to nurture a climate-smart agriculture that sustainably increases productivity and resilience, and reduces greenhouse gases while enhancing the attainment of a food-secure world. At this point, I am pleased to inform you that the book *Feeding the Forgotten Poor* was launched last Monday by none other than the Former President Dr APJ Abdul Kalam during the NIABI 2012 conference held in New Delhi. This book is my modest attempt to rally behind the world's poorest of the poor, particularly those in the drylands, who live in a constant state of hunger and insecurity.

Again, we thank our NARS partners, particularly the DST for collaborating with us in this endeavor, towards the overall realization of our vision of a prosperous, food-secure, and resilient dryland tropics.

Thank you and have a good day!



Linking Farmers to Markets: Inclusive Agricultural Value Chains

Honorable N Kiran Kumar Reddy, Chief Minister of Andhra Pradesh; distinguished guests, ladies and gentlemen, good morning!

Developing countries worldwide are witnessing a fundamental shift in agriculture from subsistence farming to a more market-oriented production. Markets and institutions have become critical in leveraging the potential of agricultural growth for the benefit of small-scale producers.

In India, integrating agriculture and industry as a pathway to achieve a 9% growth target under the 12th Five-Year Plan remains an uphill task. Hence, it is now adopting a three-pronged strategy to improve the condition of its agriculture to include:

*Theme Address,
AP-TEC Conference
& Exhibition
on Enhancing
and Optimizing
Agricultural Value
Chains, 4 March
2012, Hyderabad
International
Convention Centre
(HICC), Hyderabad,
India.*

- Technological improvement to increase productivity;
- Improvement in input-delivery systems to reduce input prices; and
- Increasing the efficiency of value chain and effective value addition to enhance farm profitability.

The country must now take a giant leap in integrating agriculture and industry by improving the efficiency of agricultural value chains. I therefore congratulate the Andhra Pradesh Technology Development and Promotion Centre (APTDPC) and the Confederation of Indian Industry (CII), as well as other partners for organizing this very timely and fitting conference.

Now more than ever, we have to ask ourselves how market-based food supply systems that offer economically sustainable levels of financial reward to all participants in the food chain can be developed. This must be simultaneous with providing safe, nutritious, natural resource-stewarding and affordable food to consumers. The emergence from subsistence farming to market-oriented agriculture is a general trend in the foreseeable future. Special care must be taken to ensure that the poorest are able to participate in this changing environment, rather than being left behind. We at ICRISAT refer to this unifying conceptual framework as Inclusive Market-Oriented Development, the core of our new Strategic Plan to 2020.

The framework describes the escape out of poverty as a dynamic process of emergence from poverty-plagued subsistence farming to inclusive, market-oriented prosperity, enabling the poor to change their lives for the better. Smallholder farmers are constrained by a lack of capital, inputs, technology and services, and access to markets which may act as a barrier for their participation in the emerging markets. ICRISAT's numerous interventions for its mandate crops involve a holistic approach from production to marketing which covers improved crop technology and package of practices.

ICRISAT has likewise established an Agribusiness and Innovation Platform (AIP) as part of its efforts to give smallholder farmers technological and marketing opportunities. AIP primarily promotes public-private partnerships aimed at linking farmers to markets. In the presence of our esteemed Chief Guest, Honorable Chief Minister Kiran Kumar Reddy, I would like to thank the Government of Andhra Pradesh for partnering with us and investing in the establishment of the then Agri-Science Park, now AIP.

Since ICRISAT's establishment in 1972, the Institute and the State Government have been actively working together to empower dryland agricultural communities and build long-term resilience in the State. Mobilizing agricultural innovations, together we have generated high-yielding, drought-, pest- and disease-resistant varieties of sorghum, pearl millet, chickpea, pigeonpea and groundnut, which have been released and widely adapted and commercialized in India.



About 80% of the chickpea area in Andhra Pradesh is cultivated with improved varieties developed by ICRISAT and Indian NARS, ushering in a revolution in chickpea production in the State. Andhra Pradesh now has the highest yield levels in the country, recording a 9.3-fold increase in production (from 95,000 to 884,000 t) in 10 years. Our watershed management model has now become an icon of rainfed agriculture development for India, benefiting millions of farmers covering six districts in Andhra Pradesh, now to be expanded to 22 other districts in the State.

The Institute has always enjoyed the hospitality and steadfast support of the State Government. Most of ICRISAT-Patancheru's national staff, and all of its Regular Work Force, hail from Andhra Pradesh. Again, we express our gratitude to the Chief Minister for his Government's hospitality and continued support to ICRISAT for almost four decades now.

Relating back to the theme of the conference, the evolution and popularization of value chain innovations is essential in harnessing the power of markets to accelerate productivity growth and ensure food security. Scaling-up and scaling-out these institutions and developing them are possible through appropriate policies and regulations. Though central and state governments have taken a number of policy initiatives in this direction, some issues that are generic in nature merit more attention.

Public-private partnership is necessary to improve physical infrastructure. Competition must be promoted through private sector investments. Smallholder



farmers must be encouraged to organize into cooperatives, self-help groups or growers' associations. Effective grades and standards need to be developed and complied with given the rising demand for safe and quality foods in both domestic and international markets. Institutional insurance mechanisms for agriculture need to be developed and enhanced.

I would like to conclude by saying that agricultural value chains can succeed and be sustainable with proper coordination and forward and backward linkages from the production sector to the processing sector, and finally the end user. Creating strong public-private partnerships and involving a larger number of stakeholders create a self-sustaining value chain. But this requires critical inputs such as technical backstopping and market information, reaching the farmers in a timely manner, and safe and preferred commodities reaching end users.

Finally, let us not forget that the overall objective of an agricultural value chain should be to ensure inclusive growth. I believe that this conference is one step towards the sustainable and inclusive agricultural growth of Andhra Pradesh, in particular, and of India in general. I am confident that the next two days of deliberations will bring about key policy perspectives which will steer this nation towards achieving its 9% growth target under India's 12th Five-Year Plan goals. I wish the conference a grand success.

Thank you!





CGIAR on the Path to a Prosperous, Food Secure and Resilient Drylands



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Dr Ken Cassman, Chair of Independent Science Partnership Council (ISPC), members and staff of ISPC, staff from the Consortium Office, colleagues from the CGIAR centers, Indian NARS partners, ladies and gentlemen, good afternoon!

It is indeed a pleasure for me to welcome you all to this 5th ISPC Meeting. I would like to especially welcome you to India, host to ICRISAT in the last 40 years, and a staunch and committed partner in our quest for science-based innovations toward a prosperous, food-secure and resilient dryland tropics. I am pleased and honored to be a part of the CGIAR system at this time when the reform process is moving full speed ahead. The new CGIAR now emerging is hoped to be more efficient, more accountable and more open to effective collaboration with partner organizations.

*Welcome Remarks,
5th Meeting of
the Independent
Science
Partnership
Council, CGIAR, 26
March 2012, NASC
Complex, ICAR,
New Delhi, India.*

We are now witnessing how the Consortium binds together the work of the 15 centers, and how the Consortium Board has refined the Strategy and Results Framework (SRF) as it evolves to meet changing needs. We see synergy and energy within the system, with the core pillars of the new partnership – CGIAR Fund and the Consortium of CGIAR Centers – showing clear lines of accountability and balancing the partnership between those who conduct research, on the one hand, and those who fund it, on the other.

We are definitely on the right track. With the Fund Council allocating and managing resources, along with the ISPC serving as an intellectual bridge between the Fund and the Consortium, there is only one way forward – CGIAR research that generates outcomes and impacts that benefit the poor. It is now better able to keep up with its mission to reduce poverty and hunger, improve human health and nutrition, and enhance ecosystem resilience through high quality international agricultural research, partnership and leadership.

The CGIAR Research Programs (CRPs) – most now running in full steam while others are still being fine-tuned – embrace an agricultural research-for-development approach, driven by partnerships and potential impacts, reflecting the global community's commitment to improving the living conditions of the poor and hungry. I am confident that we are getting it right this time. We are all in this together.

The “perfect storm” of big challenges that we face – climate change, energy crisis, food crisis, land degradation, loss of biodiversity and population explosion – has triggered a reconsideration of the importance of international agricultural research, and we are responding accordingly. Ultimately, poor and hungry people are the reason for the CGIAR's very existence. There is a moral imperative to do everything possible to ensure that agricultural research in the 21st century meets their needs. The CGIAR reform process gives its research the best possible chance of success.

At this point, let me take this opportunity to stress the importance of rainfed agriculture, and how unlocking its potential could spell the difference in the global fight against poverty, hunger and malnutrition.

The semi-arid or dryland tropics cover 750 million hectares in 55 developing countries. This 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. On the whole, rainfed agriculture is practiced on 80% of the world's farm area, and generates almost 40% of the world's staple foods despite the risks and poor policy support.

Unlocking the potential of rainfed agriculture will require much international and national policy and program support and significant investments, particularly in terms of broadened technology options for higher productivity and profitability



for dryland farmers; improved water management and technological innovations including rural infrastructure; and appropriate policy and institutional innovations.

The CGIAR's priority is to help the poorest of the poor – a focus that can be powerfully served by helping the forgotten one billion in the drylands whose lives depend on rainfed agriculture. Finally, let me emphasize that feeding the forgotten poor in the drylands is not only a need, but a moral imperative. Our overarching goal must be to constantly help empower these poor people to overcome poverty, hunger, malnutrition and a degraded environment through better and more resilient agriculture.

With that, welcome again and let us all look forward to a fruitful meeting/discussion ahead.







Leading the Path in Feeding the Forgotten Poor



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The Board of Regents, President Rafael Querubin, officials of the college, distinguished guests, graduating students and their parents, faculty and staff of ISPSC, friends, ladies and gentlemen, good afternoon!

First, let me thank President Querubin for inviting me to this important milestone in the history of ISPSC. This, to me, is a homecoming, coming back full circle to an academic institution that nurtured me in my early years. Decades back this college was called Ilocos Sur Agricultural College, where I graduated valedictorian in high school, and where I took up Agricultural Education for two years before moving to BSU. We now know this school, our school, as the Ilocos Sur Polytechnic State College or ISPSC.

As a son of the North, I am very happy to note that ISPSC has come a long, long way since its early days. With your continuous aspiration to meet global standards, you are now a recognized institution of higher learning for people

*Commencement
Speech,
Commencement
Exercises of
the Ilocos Sur
Polytechnic State
College (ISPSC),
8 April 2012,
Philippines.*

empowerment and sustainable development, propelled by the core values of excellence, effectiveness, accountability and integrity.

I was poor when I was growing up, and so I thank ISPSC for its dedicated service to the underprivileged sections of this region. Your academic excellence takes a deeper meaning as it provides education to students from the “depressed, deprived and disadvantaged sectors”.

Today I want to tell you stories from my life, how my quest to help end poverty started when I was a young farmer’s son, studying agriculture in college. I am an agriculturist. I know how people toil and sweat and yet remain hungry. That’s why mine is a life-long commitment to serving the poor, smallholder farmers of the world. This commitment has taken me decades of work as a science and research manager driven by a vision of a better life for the poor through excellence in agriculture.

Not so many years ago, I also sat and listened to a commencement speaker at BSU where I completed my college degree. I patiently listened throughout the speech, wondering what was in store for me. But deep inside, I was already aware that I had an ambition to succeed and a mission to pursue. What I wanted was to dedicate my life to serving the poor. Inspired by my goal to succeed, I worked harder and harder to reach the top. Hard work and patience paid off as I eventually became Professor VI and Vice President for Research and Development at BSU. I then moved to the

Department of Agriculture as the first Director of the Bureau of Agricultural Research (BAR). From BAR, I became the fifth Executive Director of the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD). Later on, I became the Secretary of Agriculture and then Presidential Adviser on Food Security and Rural Development.

I am humbled to be the first Filipino ever to be appointed as Director General of the International Crops Research Institute for the Semi-Arid Tropics. ICRISAT serves 55 countries of the dry tropics of the world – home to about 300 million people who are the poorest of the poor. Our core business is to improve agriculture in the dry



tropics through research-for-development, guided by the principle of *Science with a human face*.

You belong to the youth which comprises almost one-third of the population and nearly half of the country's labor force. As new graduates, you are about to begin this long journey and enter the real world of the 21st century.

However, the real world today faces a “perfect storm” of big challenges that could lead to widespread food shortages and public unrest over the next few decades. These big challenges include climate change, energy crisis, food crisis, land degradation, loss of biodiversity and population explosion.

Going by the latest FAO data, the world's population is projected to reach more than 9 billion in 2050, which will require a 70-100% increase in food production to maintain the same dietary standards we have today. We know that in a developing country like ours, almost a third of the population is poor and hungry. Added to this is the massive environmental degradation that is happening all over the archipelago. If today we are struggling to feed almost 100 million people, as we are still importing much of the food items that we need, what and how can we contribute to feed the almost 150 million Filipino people by 2050?

History has shown that the youth are the hope of the future – the agents of socio-economic change and technological innovation. However, the youth of today has become less interested in the field of agriculture, and few farmers would want their children to follow in their footsteps. We face the challenge of sustainability as farmers themselves are opting out of tilling the land. And despite the country's competitive advantage and the efforts of various stakeholders to boost growth in agri-based industries, much still needs to be done in terms of bringing major improvements to the lives of small-scale producers and food-insecure farmers, and to help reduce hunger and vulnerability especially in the rural areas. This is both a challenge and an opportunity for you, the graduates, and to ISPSC as well. At this point, I challenge ISPSC to emerge as a dynamic academic institution, not only in teaching but in mainstreaming R&D interventions necessary to win the fight against food insecurity and poverty in this country.

This calls for a dynamic approach to the curriculum and teaching of agriculture, and in increasing the permeability between academe and the private and public sectors. We must generate scientific and technological innovations to reduce vulnerability to drought and climate change while increasing crop diversity and value; harness development pathways for inclusive prosperity; raise and secure productivity for health, income and sustainability; and increase productivity to help end hunger and food insecurity.

Our agricultural policy must target such development outcomes as food sufficiency for all crops, intensification, diversification, resilience, health and nutrition, and women empowerment. If we can incorporate the above socio-economic process

in shaping the future of Philippine agriculture, we are bound for long-term growth and prosperity. You, the graduates, are at the center of today's activity, and I take privilege in sharing with you the culture that sent me to this rare and privileged position of being the global servant leader that I am now.

First and foremost is the culture of feeding the forgotten poor. Feeding the forgotten poor remains a major concern particularly in the marginalized, resource-poor and perennially shock-prone areas of the world. People who are this poor live in a constant state of hunger and insecurity. They spend their days working hard in the fields, but get little for it because their lands are depleted and drought-prone. Graduates, this is the deeply worrying backdrop against which you are entering the real world.

Second is the culture of using education as a powerful tool to extricate oneself from poverty. I was born to a poor family with a small farm as our main source of livelihood. I told myself: I don't want to stay poor and have this kind of life. I have to strive, to study hard, and succeed. And help my family out of poverty.

Third is the culture of advancing science-based solutions and innovations to meet key challenges in food security and agricultural production. Science and technology (S&T)-based solutions and innovations are imperative in the pursuit of food security and poverty alleviation, and in the sustainable agricultural growth of the country. We must be in the forefront of ensuring that S&T policies, plans and programs implemented through inclusive approaches, will enable the research and development sector to produce scientific discoveries that will benefit the people and the environment.

Fourth is the culture of capacity building and partnerships. Modernizing agriculture can be a strong engine for direct and indirect growth and poverty reduction. It is all about empowering stakeholders through knowledge sharing, technology exchange, capacity building, and creating opportunities through partnerships, and supportive policies. Capacity strengthening builds social capital through knowledge sharing and strategic partnerships.

Fifth is the culture of inclusiveness and entrepreneurship. At ICRISAT, we embrace the principle that farming must be done as a business. Linking farmers to markets is the essence of our Inclusive Market-Oriented Development approach under our new strategic plan to 2020. It is a dynamic progression from subsistence towards market-oriented agriculture.

Our approach must be deliberately inclusive of those who need us most, particularly women and children who suffer from poverty, hunger and malnutrition. You should share with them the gift of dreams, and your gift of excellence, dedication and service. When this happens, you, today's graduates, will have moved ISPSC to the next level of excellence, leadership and service beyond its first century.

Lastly, let me emphasize that agriculture is what feeds us.... If agriculture fails, nothing else will work.

Let us look at us, Filipinos of today, as 100 million potentials and opportunities. We can turn adversities and challenges into opportunities. With God's help, I am sure that you, the graduates, will all succeed.

Mabuhay po ang ISPSC! Mabuhay po kayong lahat!







Leading the Path to Knowledge-based, Sustainable and Inclusive Agricultural Growth

The Board of Regents, President Max P Guillermo, officials of the Tarlac College of Agriculture, distinguished guests, graduating students and their parents, faculty and staff, friends, ladies and gentlemen, good morning.

I am extremely grateful to President Guillermo for inviting me as guest speaker of TCA's 66th commencement exercises with the theme 'TCA in pursuit of global standards: exploring horizons to meet the demands of a knowledge-based economy'.

Let me begin by congratulating Dr Guillermo for his dynamic leadership in significantly strengthening the various programs of TCA, further advancing this college as a premier institution of higher learning in Central Luzon.

Commencement Speech, 66th Commencement Exercises of the Tarlac College of Agriculture (TCA), 9 April 2012, Philippines.

Agriculture occupies a fundamentally important position in the Philippine economy, and it is now crucial for the sector to take a big leap forward. This will be possible only with a clear roadmap to enhance the productivity, profitability, sustainability and competitiveness of the agriculture sector. A business-as-usual approach would not suffice to meet this challenge. A new “farmer-centered, industry-driven, knowledge-based” strategy is what will bring about the desired results.

As a premier academic institution, TCA’s contribution in addressing the agricultural development needs in Central Luzon through the years has been very significant. However, in today’s emerging knowledge-based economy, knowledge and knowledge management have to be leveraged effectively for the benefit of the farming community and the rural poor. Results from agricultural research must reach the users, particularly the smallholder farmers. The emphasis has to shift from physical inputs to knowledge inputs.

State Universities and Colleges (SUCs) like TCA must be in the forefront of S&T initiatives aimed at producing scientific discoveries that will benefit the people, the industry, and the environment, and at the same time enable the country to achieve improved agricultural productivity, sustainable use of natural resources, increased incomes, and better livelihood opportunities particularly of smallholder farmers. In particular, SUCs must prepare our youth to lead in shaping the country’s future towards sustainable agricultural development in a knowledge-based economy.

This requires dynamic academic institutions that will not only teach and do science, but will also mainstream R&D interventions that will provide us solutions to meet our food, fiber, and fuel needs through a knowledge-based and people-centric entry point.

Agriculture must now be driven by knowledge through high quality, reliable and efficient information systems built around science-based technologies. To our faculty and graduates alike, this is the crucial challenge we face.

At this point, I would like to direct my talk to the graduates, and to share with you some words of wisdom and gems of thought to guide and inspire you on your journey to success.

Not so many years ago, I also sat and listened to a commencement speaker at Benguet State University, my alma mater. What I wanted was to dedicate my life to serving the poor. I then set



my sights on a career in public service, starting as a government farm management technician. Inspired by my goal to succeed, I worked harder and harder to reach the top. I am humbled to be the first Filipino ever to be appointed as Director General of the International Crops Research Institute for the Semi-Arid Tropics. ICRISAT serves 55 countries of the dry tropics of the world – the home of about 300 million people who are the poorest of the poor. Our core business is to improve agriculture in the dry tropics through research-for-development, guided by the principle of *Science with a human face*. *Science with a human face* means that we harness science as a means to serve the rural poor, not as an end in itself.

When I came to ICRISAT 12 years ago, staff morale was low and uncertainty pervaded the organization. But we restored confidence and optimism at ICRISAT. We turned financial performance around from a deficit to a surplus situation. Through sound leadership and management, your humble countryman transformed ICRISAT into a strong, robust and stable organization. ICRISAT today is top among 15 CGIAR Centers all over the world. What I have humbly done at ICRISAT, being its servant leader, can also be done in our country. But we need your commitment, dedication and selflessness to help make this happen. You belong to the youth which comprises almost one-third of the population and nearly half of the country's labor force.

However, the real world today faces “a perfect storm” of big challenges that could lead to widespread food shortages and public unrest over the next few decades. These big challenges include climate change, energy crisis, food crisis, land degradation, loss of biodiversity and population explosion. The past half-decade has seen a growing volatility in food prices and unexpected spikes in oil prices with severe impacts on the world's poor. The international financial crisis is looming large especially in developing countries. Let me present you with some more facts – 1.4 billion people (one in four) in the developing world live in poverty; more than a quarter of the world's children are still malnourished; nearly a quarter of the women population is illiterate; 1.6 billion are without modern energy; and one-sixth of the world's population is without clean water.

Going by the latest FAO data, the world's population is projected to reach more than 9 billion in 2050, which will require a 70-100% increase in food production to maintain the same dietary standard we have today.

We know that in a developing country like ours, almost a third of the population is poor and hungry. Added to this is the massive environmental degradation that is happening all over the archipelago. If today we are struggling to feed almost a 100 million people, as we are still importing much of the food items that we need, what and how can we contribute to feed the almost 150 million Filipino people by 2050?

First and foremost is the culture of feeding the forgotten poor. Graduates, this is the deeply worrying backdrop against which you are entering the real world. Feeding

the forgotten poor is not only a need, but a moral imperative. Hence, I enjoin you to dedicate yourselves to serving poor people to overcome poverty, hunger, malnutrition and a degraded environment through better and more resilient agriculture. The older generation counts on you to help transform our country and become the beacon of hope for our long-suffering people.

Second is the culture of using education as a powerful tool to extricate oneself from poverty.

Third is the culture of advancing science-based solutions and innovations to meet key challenges in food security and agricultural production. We must be in the forefront of ensuring that S&T policies, plans and programs implemented through inclusive approaches, will enable the research and development sector to produce scientific discoveries that will benefit the people and the environment.

Fourth is the culture of capacity building and partnerships. It is all about empowering stakeholders through knowledge sharing, technology exchange, capacity building, and creating opportunities through partnerships, and supportive policies. Capacity strengthening builds social capital through knowledge sharing and strategic partnerships.

Fifth is the culture of inclusiveness and entrepreneurship. At ICRISAT, linking farmers to markets is the essence of our Inclusive Market-Oriented Development or IMOD approach under our new strategic plan to 2020. We believe that the fight against poverty, hunger and malnutrition involves stimulating agro-enterprises to raise rural incomes and to create opportunities beyond agriculture, through the IMOD approach. Our approach must be deliberately *inclusive* of those who need us most, particularly women and children who suffer from poverty, hunger and malnutrition.

To the graduates, as you go out of the portals of TCA, you must join the ranks of dedicated professionals who will serve our poor people and help turn the Philippines around. It is our privilege to stand ready and driven with conviction to create excellent prospects to help in feeding the forgotten poor of this country. You should share with them the gift of dreams: hopes that they can fulfill, homes where they can stay, jobs to earn a living, food to nourish their bodies, and other things to make a life that they can enjoy. When this happens, you, today's graduates, will have moved TCA to the next level of excellence, leadership and service beyond its first century.

Lastly, let me emphasize that agriculture is what feeds us.... If agriculture fails, nothing else will work.

Let us look at us, Filipinos of today, as 100 million people of potential and opportunities. With God's help, I am sure that you, the graduates, will all succeed.

Mabuhay po ang TCA! Mabuhay po kayong lahat!





Strengthening Rainfed Agriculture RD&E towards the Philippines' Food Security and Self-Sufficiency

Secretary Proceso Alcala, Dr Nick Eleazar, our partners at the Department of Agriculture, State Universities and Colleges, Commission on Higher Education, and PCAARD, colleagues from ICRISAT, friends, ladies and gentlemen, good morning!

We profoundly thank Director Nick Eleazar and the DA Bureau of Agricultural Research staff in initiating and organizing this symposium on Enhancing Philippine-ICRISAT Partnership in Agricultural Research for Development. I understand that this event kicks off DA-BAR's 25th anniversary celebrations this year. Congratulations DA-BAR!

*Message,
Symposium
on Enhancing
Philippine-ICRISAT
Partnership in
Agricultural
Research for
Development,
10 April 2012,
DA-BAR, Quezon
City, Philippines.*

As a bridge, broker and catalyst for rainfed/dryland agriculture, strategic partnership is the main engine in pursuing ICRISAT's global mandate. ICRISAT's work is directed at 55 developing countries with large semi-arid and rainfed areas. Related to this, we are collaborating closely with the Philippine National Agricultural Research and Extension System (NARES) to help improve rainfed agriculture in the country.

This collaboration focuses on important rainfed crops (sorghum, peanut, pigeonpea and chickpea) including community-based watershed management, policy advocacy, capacity building and science communication.

Our symposium is indeed timely as several crises confront global agriculture today. If unabated, their confluence will lead to a "perfect storm" triggering a disaster of unprecedented proportions. Warming temperatures, droughts, floods, land degradation, rising food prices, zooming energy demand and population explosion are creating extreme challenges to feed the world.

Climate change is real and the world is experiencing adverse impacts in terms of warmer temperatures, prolonged drought and widespread floods. From a global perspective, a warmer world will make the rainfed/dryland tropics even more vulnerable. With climate change, rainfed/dryland farming communities will be most affected since their food, nutrition and livelihoods depend on agriculture. Rainfed/dryland agriculture is practiced on 80% of the world's farm area. It also generates almost 40% of the world's staple foods despite the risks and weak policy support. Therefore, rainfed/dryland agriculture is crucial in attaining global food security under a climate change regime.

In the Philippines, the IPCC predicts that rainfall will increase by 20% with increased soil erosion and landslides. Likewise, temperatures will increase by 3% with more El Niño episodes and longer and more intense droughts.

ICRISAT's mission is to develop resilient farming systems, conserve crucial resources like soil and water, and adapt crops to warmer temperatures and new pest and disease patterns. To pursue this, ICRISAT and partners conduct research on a range of rainfed/dryland farming systems to develop options for farmers. We need to develop climate resilient or climate smart agriculture. It is in this context that I would like to view the partnership between ICRISAT and the Philippines.

Spanning more than three decades, our partnership has indeed flourished throughout the years. It all started when ICRISAT signed an agreement with PCARRD in 1975 and further strengthened with the DA-BAR in 2003. The Philippines has substantially benefitted from this strong partnership with the introduction of ICRISAT-bred materials, natural resource management and other cutting edge innovations in rainfed agriculture.

To date, ICRISAT has distributed 3,306 samples of 2,789 germplasm accessions. We also supplied 58 sets of trials, 911 advanced breeding lines, 36 mapping population parents, and 72 segregating populations to the Philippines. These have led to the development and release of improved, high-yielding varieties of peanut and sweet sorghum. Intensive testing and seed multiplication have also been done with pigeonpea and chickpea. The foregoing activities were complemented by other innovations, such as community watershed management and ICT-mediated knowledge sharing, capacity building and scientific and information exchange.

Indeed, the Philippine-ICRISAT partnership has come a long way. In August last year, it was further strengthened and institutionalized through a Philippine Rainfed Agriculture Research, Development and Extension Program (PHIRARDEP). Initially funded by the DA High Value Crops Development Program, PHIRARDEP primarily aims to develop, coordinate, monitor and evaluate a vigorous rainfed agriculture research, development and extension (RD&E) program in the country. This is primarily aimed to enhance food, nutrition and energy security, improve livelihoods and empower communities in Philippine rainfed areas.

PHIRARDEP is spearheaded by DA-BAR in partnership with DA-RFUs and attached agencies, SUCs, LGUs, civil society organizations and CGIAR Consortium Centers like ICRISAT and IRRI. This has been a good start but it could be better if significant funding is invested in this program.

Under a climate change regime, our models at ICRISAT show that yield gaps can be significantly narrowed down with improved management practices and adapted germplasm for warmer temperatures. This means that science-based innovations are the world's best bets in surmounting global warming. We therefore need institutional innovation to spearhead the country's R4D initiatives related to agriculture under climate change.

Hence, beyond PHIRARDEP, we are advocating for the establishment of a Philippine Rainfed Agriculture Research Institute. Or it can be called the Philippine Institute on Climate Resilient Rainfed Agriculture (PhICRRA). PhilRAI or PhICRRA will serve as ICRISAT's proactive partner in generating and adapting cutting edge innovations to improve the livelihoods of rainfed and upland communities, and is envisioned to unify, coordinate and strengthen all rainfed agriculture R4D initiatives in the country. Through cutting edge science and social empowerment, it will be the country's first line of defense against drought and climate change.

As we move our partnership forward through this symposium, let me share some practical, science-based approaches we could adopt in improving rainfed/dryland agriculture in the country:

First is promoting drought tolerant and climate resilient crops. ICRISAT and its partners have developed and released several varieties of sorghum, peanut, pigeonpea and chickpea which are more drought tolerant than currently grown crops.

Through our partnership, we could accelerate the release and commercialization of these varieties to benefit our rainfed farmers. Let me also mention that ICRISAT and partners have sequenced the genome of pigeonpea, a first among “orphan” but nutritious crops. This is a giant leap in crop improvement for rainfed/dryland farmers throughout the world.

Second is intensive action to replace vulnerable crops with those that are more drought tolerant. We must convince our rainfed/dryland farmers to grow other crops that mature earlier to escape drought. Likewise, an action plan for producing seeds of rainfed 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. Towards this, we recommend the adoption of community watershed management through integrated genetic and natural resource management. IGNRM aims at growing improved crops on soils conserved through natural means and pursued through community participation.

Fourth is empowering stakeholders through capacity building, knowledge sharing and formulating policies supportive of rainfed agriculture. Capacity strengthening 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 integrating livestock along with other income-generating activities that reduce risks of total crop failure and enhance farm income.

This foregoing science-based strategy has been showcased by ICRISAT and partners in Asia through a participatory development model with community watershed management as the entry point. This award-winning model is being scaled out in India and other Asian countries, benefiting more than three million farmers. Drought and other adverse environmental conditions are regular challenges in rainfed/dryland agriculture.

Hence, a large chunk of our public investments must be directed at implementing proven science-based successes embedded in a sustainable national food security and self-sufficiency program.

As I close, I am very happy to note that the government under the leadership of Secretary Proceso Alcala is determined to make the country self-sufficient in rice in the shortest time possible. Over the years, food security and food self-sufficiency especially in rice has been a cherished dream of every administration. Since the inception of Masagana 99, a succession of rice programs has been launched aimed at attaining self-sufficiency in the staple. We believe that the sustainable pathway to national food security is food self-sufficiency that will equitably benefit smallholder producers and consumers.

Climate change-related events have damaged farms of major food producing countries, reducing global food stocks to all-time lows. Thus, there is less food for export as countries move to secure domestic demand. In spite of available technology and manpower, a confluence of natural and human factors prevents the country from attaining sustained food security and self-sufficiency. We need to harness a strong political will to erase our global reputation as the world's largest rice importer. This is quite pronounced with the presence of reputed agricultural research institutions and a critical mass of highly trained scientific manpower in the country.

We subscribe to the dictum that poverty is the root cause of food insecurity. Increasing people's income is therefore indispensable in improving our people's access to food. National food self-sufficiency should be undertaken in the context of improving the income and livelihoods of our people within the framework of sustainable and Inclusive Market-Oriented Development. We therefore emphasize the imperative of taking immediate action now to fulfill the country's cherished dream of achieving sustainable food security for all. Towards this, we recognize the need to adopt supportive policies and sustained and significant investments supporting food production, post-production and marketing including research on behalf of smallholder farmers.

Moreover, we reiterate the basic mandate of the national government, LGUs and their private and civil society partners in pursuing sustainable food security and food self-sufficiency programs. We acknowledge the pivotal role of smallholder farmers and all other sectors involved in food production, marketing and distribution in attaining national food security and self-sufficiency. We need to once-and-for-all manifest a strong political will to attain sustained national food security and food self-sufficiency. Congress should enact a super-ordinate policy that will integrate food production, post-production, marketing and consumption.

Following the footsteps of India, we need to enact a National Food Security and Food Self-Sufficiency Act. Along with this, we need to wage a second Green Revolution that will include rainfed/dryland and upland areas which were bypassed by the first. Let me emphasize that rainfed/dryland agriculture is our untapped frontier for national food security and self-sufficiency. Towards this, increasing investments in rainfed/dryland agriculture RD&E and mobilizing scientific innovations, decision-makers and farming associations/communities will be the key.

Through our strong and enduring partnership, I am confident that we can do it.

Mabuhay po kayong lahat!





Showing the Way to Feeding the Forgotten Poor



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The Board of Regents, President Elpidio T Magante, officials of the Bohol Island State University (BISU), distinguished guests, graduating students and their parents, faculty and staff, friends, ladies and gentlemen, good afternoon!

First, let me thank President Magante for inviting me to this important event. As a premier and the first state university in the province of Bohol, BISU's contribution in addressing the agricultural development needs in this part of the country through the years has been very significant.

I was poor growing up, and so I thank SUCs like BISU for its dedicated service to the underprivileged sections of this region. Your academic excellence takes a deeper meaning as it provides education to students from the "depressed, deprived and disadvantaged sectors".

As I congratulate our graduates gathered here today, allow me to tell you stories from my life, how my quest to help end

*Commencement
Speech, Bohol
Island State
University (BISU)
Commencement,
12 April 2012,
Philippines.*

poverty started when I was a young farmer's son, studying agriculture in college. Not so many years ago, I also sat and listened to a commencement speaker at Benguet State University where I completed my college degree. Deep inside, I was already aware that I had an ambition to succeed and a mission to pursue. What I wanted was to dedicate my life to serving the poor. Inspired by my goal to succeed, I worked harder and harder to reach the top. Hard work and patience paid off as I eventually became Professor VI and Vice President for Research and Development at BSU. I then moved to the Department of Agriculture as the first Director of the Bureau of Agricultural Research (BAR).

From BAR, I became the fifth Executive Director of the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD). Later on, I became the Secretary of Agriculture and then Presidential Adviser on Food Security and Rural Development. During this time, I aimed higher and directed my energies to go global. I further strengthened my resolve to be leader in serving the poor not only in our country but in other developing countries of the world. I am now an international public servant championing the poor.

I am humbled to be the first Filipino ever to be appointed as Director General of the International Crops Research Institute for the Semi-Arid Tropics, which serves 55 countries of the dry tropics of the world – the home of about 300 million people who are the poorest of the poor. Our core business is to improve agriculture in the dry tropics through research-for-development, guided by the principle of *Science with a human face*. *Science with a human face* means that we harness science as a means to serve the rural poor, not as an end in itself.

When I came to ICRISAT 12 years ago, staff morale was low and uncertainty pervaded the organization. But we restored confidence and optimism at ICRISAT. We turned financial performance around from a deficit to a surplus situation.

What I have humbly done at ICRISAT, being its servant leader, can also be done in our country. But we need your commitment, dedication and selflessness to help make this happen. As new graduates, you are about to begin this long journey and enter the real world of the 21st century. However, the real world today faces “a perfect storm” of big challenges – climate change, energy crisis, food crisis, land degradation, loss of biodiversity and population explosion. About 1.4 billion people (one in four) in the developing world live in poverty; more than a quarter of the world's children are still malnourished; nearly a quarter of the women population is illiterate; 1.6 billion are without modern energy; and one-sixth of the world's population is without clean water.

If today we are struggling to feed almost a 100 million people, as we are still importing much of the food items that we need, what and how can we contribute to feed the almost 150 million Filipino people by 2050?



You the youth are the hope of the future... the agents of socio-economic change and technological innovation. However, the youth of today has become less interested in the field of agriculture, and few farmers would want their children to follow in their footsteps. We face the challenge of sustainability as farmers themselves are opting out of tilling the land.

At this point, I challenge BISU to emerge as a dynamic academic institution, not only in teaching but in mainstreaming R&D interventions necessary to win the fight against food insecurity and poverty in this country. This calls for a dynamic approach to the curriculum and teaching of agriculture, and in increasing the permeability between academe and the private and public sectors.

You, the graduates, are at the center of today's activity, and I take privilege in sharing with you the culture that sent me to this rare and privileged position of being a global servant leader that I am now.

First and foremost is the culture of feeding the forgotten poor. Feeding the forgotten poor remains a major concern particularly in the marginalized, resource-poor and perennially shock-prone areas of the world. People who are this poor live in a constant state of hunger and insecurity. They spend their days working hard in the fields, but get little for it because their lands are depleted and drought-prone.

Graduates, this is the deeply worrying backdrop against which you are entering the real world.

Feeding the forgotten poor is not only a need, but a moral imperative. Hence, I enjoin you to dedicate yourselves to serving poor people to overcome poverty, hunger, malnutrition and a degraded environment through better and more resilient agriculture.

Second is the culture of using education as a powerful tool to extricate oneself from poverty. I told myself: I don't want to stay poor and have this kind of life. I have to strive, to study hard, and succeed. And help my family out of poverty. That's basically the story of my life – grabbing all opportunity to get the best education I could ever have, to make my big dreams come true.

Third is the culture of advancing science-based solutions and innovations to meet key challenges in food security and agricultural production. We must be in the forefront of ensuring that S&T policies, plans and programs implemented through inclusive approaches, will enable the research and development sector to produce scientific discoveries that will benefit the people and the environment.

Fourth is the culture of capacity building and partnerships. It is all about empowering stakeholders through knowledge sharing, technology exchange, capacity building, and creating opportunities through partnerships, and supportive policies. Capacity strengthening builds social capital through knowledge sharing and strategic partnerships.

Fifth is the culture of inclusiveness and entrepreneurship. At ICRISAT, we embrace the principle that farming must be done as a business. Linking farmers to markets is the essence of our Inclusive Market-Oriented Development or IMOD approach under our new strategic plan to 2020. IMOD is a dynamic progression from subsistence towards market-oriented agriculture. We believe that the fight against poverty, hunger and malnutrition involves stimulating agro-enterprises to raise rural incomes and to create opportunities beyond agriculture, through the IMOD approach.

Graduates and officials of BISU, we are all servants here, and it is our privilege to stand ready and driven with conviction to create excellent prospects to help in feeding the forgotten poor of this country.

You should share your gift of excellence, dedication and service. When this happens, you, today's graduates, will have moved BISU to the next level of excellence, leadership and service beyond its first century.

With God's help, I am sure that you, the graduates, will all succeed.

Mabuhay po ang BISU! Mabuhay po kayong lahat!





Linking Crop Science and Farmers to Sustainable Agricultural Productivity

Dr Leoncia Tandang, President of Crop Science Society of the Philippines (CSSP), Officials and members of CSSP, distinguished guests, ladies and gentlemen, good morning!

First, on behalf of ICRISAT, allow me to extend my warmest greetings to CSSP on the occasion of your 42nd Scientific Conference and Anniversary. I am honored and privileged to be your keynote speaker in this very timely and important activity.

Today, the world faces “a perfect storm” of big challenges that could lead to widespread food shortages and public unrest over the next few decades. These big challenges include climate change, energy crisis, food crisis, land degradation, loss of biodiversity and population explosion. Scientists predict that worldwide drylands will expand by 11%, and that we will experience increased frequency and severity of droughts across the globe.

*Keynote Speech,
42nd Scientific
Conference and
Anniversary of
the Crop Science
Society of the
Philippines (CSSP),
16-21 April 2012,
Puerto Princesa
City, Palawan,
Philippines.*

The past half-decade has seen a growing volatility in food prices and unexpected spikes in oil prices with severe impacts on the world's poor. The international financial crisis is looming large especially on developing countries.

Let me present you with some more facts – 1.4 billion people (one in four) in the developing world live in poverty; more than a quarter of the world's children are still malnourished; nearly a quarter of the women population is illiterate; 1.6 billion are without modern energy; and one-sixth of the world's population is without clean water. Going by the latest FAO data, the world's population is projected to reach more than 9 billion in 2050, which will require a 70-100% increase in food production to maintain the same dietary standard we have today.

Amid all these, agricultural productivity, especially in developing countries, continues to drop, while degraded natural resources and climate change are increasingly affecting food production and prices. The farming community, mostly composed of small and marginal farmers, is the most vulnerable to this situation. They are getting poor returns for their produce at a time when the cost of cultivation has gone up drastically. Feeding the forgotten poor remains a major concern particularly in the marginalized, resource-poor and perennially shock-prone areas of the world. People who are this poor live in a constant state of hunger and insecurity. They spend their days working hard in the fields, but get little for it because their lands are depleted and drought-prone.

Ladies and gentlemen, this is the deeply worrying backdrop against which we in the agricultural research-for-development sector work on. *Feeding the forgotten poor* is not only a need, but a moral imperative. Here in the Philippines, the search for solutions to meet food, fiber and fuel needs is crucial. We know that in our country, almost a third of the population is poor and hungry. Added to this is the massive environmental degradation all over the archipelago. If today we are struggling to feed almost 100 million people in the country, as we are still importing much of the food items that we need, how will we ever feed the almost 150 million Filipino people by 2050?

Science and technology (S&T)-based solutions and innovations are imperative in the pursuit of food security and improved agricultural production. The Philippines has substantially benefitted from its strong partnership with ICRISAT, particularly with the introduction of ICRISAT-bred materials, as well as natural resource management and other cutting edge innovations in rainfed agriculture.

To date, ICRISAT has distributed 3,306 samples of 2,789 germplasm accessions to the country. We also supplied 58 sets of trials, 911 advanced breeding lines, 36 mapping population parents, and 72 segregating populations to the Philippines. These have led to the development and release of improved, high-yielding varieties of peanut and sweet sorghum. Intensive testing and seed multiplication have also been done with pigeonpea and chickpea. These have all been complemented by other innovations like community watershed management and ICT-mediated knowledge sharing, capacity building and scientific and information exchange.



Colleagues, I therefore pose the challenge to you, the best crop scientists in the Philippines, to be proactive in generating and effectively delivering appropriate crop science technologies, particularly to smallholder farmers, to improve the productivity, income and well-being of the country's farming communities. Let us all focus our attention and energy to help in *feeding the forgotten poor* of this country primarily by aiming to enhance food, nutrition and energy security, improve livelihoods and empower communities in our farming communities. With science, let us also stand ready and able to combat the threats of climate change. Under a climate change regime, our models at ICRISAT show that yield gaps can be significantly narrowed down with improved management practices and adapted germplasm for warmer temperatures and increasing droughts.

This means that science-based innovations are the world's best bets in surmounting global warming. Cutting-edge science and social empowerment will be the country's first line of defense against drought and climate change. At this point, let me share some practical, science-based approaches you as crop scientists, could pursue and adopt to help attain sustainable agricultural growth, and toward winning the fight against poverty and hunger in the country.

First is developing and promoting drought-tolerant and climate-resilient crops. ICRISAT and our partners have developed and released several varieties of sorghum, peanut, pigeonpea and chickpea which are more drought tolerant than currently grown crops. Let me also mention that ICRISAT and partners have sequenced the genome of pigeonpea, a first among 'orphan' but nutritious crops. Also, we are the only CGIAR center that have led a genome sequencing activity. This is a giant leap in crop improvement for rainfed/dryland farmers throughout the world. We are also leading and almost finishing the genome sequencing of chickpea.

Second is intensive action to replace vulnerable crops with those that are more drought tolerant. We must convince, particularly our rainfed farmers to grow other crops that are more drought tolerant and crops that mature earlier to escape drought. Water use efficiency is key in a changing climate. Likewise, an action plan for producing seeds of rainfed 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. Towards this, we recommend the adoption of community watershed management through integrated genetic and natural resource management (IGNRM). IGNRM aims at growing improved crops on soils conserved through natural means and pursued through community participation. We have upscaled this technology in a big way in India leading to 30-60% yield increases.

Fourth is empowering stakeholders through capacity building, knowledge sharing and formulating policies supportive of rainfed agriculture. Capacity strengthening 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.

My main message here today is that, we must go beyond quick fix approaches to pursue science-based sustainable solutions, propelled by dynamic partnerships.

Hence, public and private investments must be directed in implementing proven science-based successes embedded in a sustainable national food security and self-sufficiency program. We believe that the sustainable pathway to national food security is food self-sufficiency that will equitably benefit smallholder producers and consumers.

At ICRISAT we are now fully and better geared to find solutions to the turbulence faced by smallholder farmers, specifically in dryland areas of the world. Our new strategic plan to 2020 is about harnessing science-based innovations and markets to achieve our mission to elevate the poor out of poverty, hunger, malnutrition and environmental degradation across the dry tropics of Asia and Africa. Anchored on Inclusive Market-Oriented Development (IMOD), our strategy is to promote the application of scientific innovations backed up with adequate policy, marketing and other support services, to enable smallholder farmers to increase their crop productivity and incomes by several-fold, while improving the resilience of their lands and livelihoods.

We subscribe to the dictum that poverty is the root cause of food insecurity. Increasing people's income is therefore indispensable in improving our people's access to food. National food self-sufficiency should be undertaken in the context of improving the income and livelihoods of our people within the framework of sustainable and inclusive market-oriented development (IMOD).

Towards this, we recognize the need to adopt supportive policies and sustained and significant investments supporting food production, post-production and marketing including research on behalf of smallholder farmers. We acknowledge the pivotal role of smallholder farmers and all other sectors involved in food production, marketing and distribution in attaining national food security and self-sufficiency. We enjoin you to work with us along the path to IMOD.

I believe that if we all commit to the same cause, this country is bound for long-term agricultural growth and prosperity, free from hunger and poverty. To our top crop scientists here today, now is the time to go the extra mile. Our country counts on us to deliver on our promise.

We must all stand ready and driven with conviction to create excellent prospects toward feeding the forgotten poor of our beloved country, the Philippines. With this, let me once again congratulate CSSP on your 42nd Scientific Conference and Anniversary.

Thank you and I wish all of us the very best of success!





Improving Farmers' Livelihoods and Food Security through Enhanced Legume Productivity



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Distinguished partners, colleagues, ladies and gentlemen, good morning and welcome to this Review and Workplan Meeting of the Tropical Legumes Improvement-II (Phase 2) Project - South Asia.

The year 2011 highlighted ongoing challenges to global food security, from food price volatility, extreme weather shocks and famine, to unrest and conflicts. On the policy front, major developments at the global and national levels both offered grounds for encouragement and pointed to areas where further action is needed.

For all of us gathered here today, this points us to one direction – to empowering farmers and researchers in sub-Saharan Africa (SSA) and South Asia (SA) to achieve better livelihoods and food

Inaugural Address, The Tropical Legumes Improvement-II (Phase 2) Project, South Asia Regional Workplan Meeting, 14-17 May 2012, Bhubaneswar, Odisha (Orissa), India.

security through enhanced productivity of six legume crops – chickpea, common bean, cowpea, groundnut, pigeonpea, and soybean.

We know that agriculture is the single largest employer in the world, providing livelihoods for 40% of today's global population. As a human enterprise, it reflects the single largest use of land of any sector. In developing countries, smallholder farms provide up to 80% of the food supply. Let me present you with some more facts – 1.4 billion people (one in four) in the developing world live in poverty; more than a quarter of the world's children are still malnourished; nearly a quarter of the women population is illiterate; 1.6 billion are without adequate energy; and one-sixth of the world's population is without clean water.

The SSA and SA regions combined account for nearly 63% (24% in SSA and 39% in SA) of the world's 700 million undernourished people, including children. The numbers in these regions have been increasing over the last three decades. Going by the latest FAO data, the world's population is projected to reach more than 9 billion in 2050, which will require a 70-100% increase in food production to maintain the same dietary standard we have today.

Ladies and gentlemen, *feeding the forgotten poor* remains a major concern particularly in the marginalized, resource-poor and perennially risk-prone areas of the world. People who are this poor live in a constant state of hunger and insecurity. They spend their days working hard in the fields, but get little for it because their lands are depleted and drought-prone, as most are rainfed. This is the deeply worrying backdrop against which we in the agricultural research-for-development sector work. *Feeding the forgotten poor* is not only a need, but a moral imperative. Hence, we at ICRISAT along with our partners are working constantly to help empower these poor people to overcome poverty, hunger, malnutrition and a degraded environment through better and more resilient agriculture. We believe that science and technology (S&T)-based solutions and innovations are imperative in the pursuit of food security and improved agricultural production.

We are thus, pleased and honored for the support and commitment of the Bill & Melinda Gates foundation to this TLII – Phase 2 project as it refreshed its agriculture strategy with a strong focus on agricultural development in SSA and SA. Agriculture is now increasingly seen as part of a larger context. It is becoming clear that agriculture contributes not just to food production, but also to human nutrition and health – conditions that in turn can affect agricultural productivity and overall economic growth. TLII is a case in point, with its focus on grain legumes which contribute to the livelihoods, health and nutrition of more than 700 million poor people in the dryland tropics of SSA and SA.

SSA and SA account for approximately 16% and 22%, respectively, of the world's total area for tropical legumes, but their contribution to production is only about



6% and 11%, respectively, indicating the low level of productivity in the two regions. Average yields in SSA and SA are less by 30% and nearly 10%, respectively, than the world average. High moisture stress, plant diseases, insect pests, parasitic weeds, poor soils, lack of access to seeds of improved varieties, poor input and output market access, and lack of awareness by farmers about improved technologies are some of the major factors that contribute to low yields of these crops in the two regions.

Legumes have not been given the due research and development (R&D) attention they deserve in the past. This TLII project, hence, is considered a monumental leap in improving the livelihoods of smallholder farmers in the drought-prone areas of SSA and SA through enhanced productivity and production of grain legumes. Productivity is expected to increase by 20% and 30% in all tropical legume areas in the two regions covered by improved varieties and appropriate crop management technologies. The expected increase in added value of these productivity gains in the rural areas of these regions will amount to more than US\$ 4.83 billion over a period of 10 years.

With the consistent support of the Gates foundation, we at ICRISAT together with our partners, several state/national programs, private sector, and NGOs will work closely with smallholder farmers to ensure that seed of improved varieties from the project reach the farmers' fields.



As Bill Gates has stated, “If you care about the poorest, you care about agriculture. Investments in agriculture are the best weapons against hunger and poverty, and they have made life better for billions of people”. The international agricultural community, hence, needs to be more innovative, coordinated and focused to really be effective in helping poor farmers grow more. If we can do that, we can dramatically reduce suffering, and build and ensure food and nutritional security.

We are proud that the first phase of the project has already made valuable impact. More than 60 new varieties of tropical legumes have been released in several countries and 93,000 metric tons of seeds of improved legume varieties produced have reached 240,000 smallholder farmers, who together with extension workers, have been trained on improved farming practices that can enhance yields. In particular, the role of women in producing food and making decisions about family nutrition needs has now been recognized. Likewise, the project has strengthened the capacities of national agricultural research systems in partner countries.

We look forward to this second phase of the project as it gives more focus on gender specific aspects of tropical legume production, marketing and consumption. Moreover, particular emphasis will be given to location-specific monitoring and evaluation, impact assessment, data management and increased seed production and delivery. The project will also emphasize sustained capacity strengthening of national agricultural research systems in the two regions.

I believe that the TLII second phase is a very important step to share economic and nutritional benefits to poor farmers in sub-Saharan Africa and South Asia. By the end of 2014, we will have reached an additional 10 million smallholder farmer households, a very significant achievement in the fight against poverty and hunger in the drylands. Partners and colleagues, now is the time to go the extra mile. Under this project, poor and hungry people in SSA and SA count on us to deliver on our promise. We are all servants here, and it is our privilege to serve this great mission of tackling poverty and food insecurity in the dryland tropics, through improved productivity and production of major tropical legumes.

Particularly to our state/national partners in India and Bangladesh, I hope that this project further contributes to the institutionalization of collaborative approaches by linking state/national research program efforts with farmers and farmer organizations towards winning the fight against poverty, hunger and malnutrition.

Let us all stand ready and driven with conviction to create excellent prospects toward feeding the forgotten poor of this world. With this, I wish you all a fruitful, productive and rewarding deliberation ahead.

Thank you!





Let Us be the Revolutionaries the World Needs Today

Ladies and gentlemen, good evening!

My dear friend and mentor Dr MS Swaminathan has been called by many names. He is recognized as the “Father of the Green Revolution in India”. UNEP hails him as “the Father of Economic Ecology”. He was one of three from India included in TIME Magazine’s 1999 list of the ‘20 most influential Asian people of the 20th century’, the other two being Mahatma Gandhi and Rabindranath Tagore. Well before his time on this threatened earth is over, Dr Swaminathan has already reaped a bumper harvest of awards and distinctions from organizations both in India and in many parts of the world. He has figuratively arrived. He can very well go into a more relaxed mode, take it easy and enjoy the comforts of life.

But knowing my good friend and mentor, he is not about to do that any time soon. He knows that the reward of excellent

*Address,
4th MS Swaminathan
Award Function,
19 May 2012,
Peacock Hotel
Marigold, Green
Park, Begumpet,
Hyderabad, India.*

work is more excellent work which he is still doing up until this period. Ladies and gentlemen, there is something that truly excellent people are good at and it is this: they are contagious. They inspire excellence in others. They raise the bar of performance and demand nothing less each time. Those who are fortunate to work with them or around them know this and thrive in a super-charged atmosphere of relentless achievement of excellent results. And then when this culture of excellence permeates a bigger portion of the population, things begin to happen. The tipping point is reached and revolutions are launched.

Let me congratulate this year's awardees, Dr R Saikumar for his outstanding achievement in the field of corn breeding, and Dr N Shobha Rani for her outstanding work in plant breeding for rice quality improvement. With this award, you join the ranks of the infected. You become revolutionaries. May you never stop the cycle of excellence and may your work push the limits of what science can do to move back the frontiers of hunger, poverty, malnutrition and poor health in the world. Excellence extends beyond great outputs and marvellous impacts. Excellence needs to be relevant, to provide solutions to the crying needs of our times. Let's sustain the gains of the Green Revolution which is happening in irrigated areas but also now work harder to have a Green Revolution in the dryland tropics of India.

ICRISAT is your partner in this war against hunger and poverty and in the search for solutions. The semi-arid or dryland tropics cover 6.5 million square kilometers of land in 55 countries. It is home to over 2 billion people, and 644 million of these are the poorest of the poor. ICRISAT and its partners help empower these poor people to overcome poverty, hunger and a degraded environment through better and climate resilient agriculture. We envision a prosperous, food-secure and resilient dryland tropics. To achieve this, our mission is to reduce poverty, hunger, malnutrition, and environmental degradation in the dryland tropics. Our approach is through partnership-based international agricultural research-for-development that embodies *Science with a human face*.

Before I close, let me give yet another challenge to the association. You have institutionalized this MS Swaminathan Award and have been recognizing achievers from India only. Dr Swaminathan is a global personality but very Asian. Is it not time to have a category for Asian achievers on top of what is now given to an Indian achiever? I leave this idea to you to appreciate and take a call. I thank the leaders of this association – RICAREA – for inviting me here today. I congratulate our awardees for their excellence. And I enjoin all of you to do your share in making this a world less poor and hungry, a world more at peace. Let us be the revolutionaries the world needs today.

Thank you and good evening to all of you!



Building Climate Resilient Agriculture in India: A Policy Dialogue

Dr S Ayyappan, distinguished guests, dear participants, ladies and gentlemen, good morning!

"We're going to hold ourselves accountable. We'll measure results. And we'll stay focused on clear goals: boosting farmers' incomes and over the next decade helping 50 million men, women and children lift themselves out of poverty."

Thus spoke US President Barack Obama last Friday at a symposium on "*New Alliance for Food Security and Nutrition*" on the eve of the G8 meeting at Camp David. In the same speech, President Obama unveiled a US\$ 3bn (£1.9bn) plan to boost food security and farm productivity in Africa funded by private US companies. "It's a moral imperative, it's an economic imperative and it's a security imperative," President Obama said. The \$3bn announcement by Obama is a bold US initiative

*Keynote Address,
Building Climate
Resilient Agriculture
in India: A Policy
Dialogue, 22 May
2012, National
Agricultural Science
Centre (NASC)
Complex, New Delhi,
India.*

which, however, goes only a small way to fulfilling the \$22bn pledge of the G8 nations in 2009.

At the end of the Camp David summit, the leaders of eight of the world's wealthiest nations said they would continue to work to end poverty and hunger. The G8 statement said, "as part of that effort we commit to fulfil outstanding L'Aquila financial pledges, seek to maintain strong support to address current and future global food security challenges, including through bilateral and multilateral assistance, and agree to take new steps to accelerate progress towards food security and nutrition in Africa and globally, on a complementary basis".

Despite the warm words and unfulfilled pledges, there is not a doubt that today, climate change and its impact on agriculture, hunger and nutrition are back on the development agenda around the world. I am honored by this opportunity to speak before you and share ICRISAT's vision and my personal insights on this topic: 'Climate change and developing a resilient agriculture that will be able to meet the needs of all including the small farmers in Asia and sub-Saharan Africa'.

Today I want to underscore the importance of two points.

Firstly, science must guide and enlighten policymaking on issues ranging from health, industry, pollution control, global warming, agriculture and sustainability issues in the face of climate change; and

Secondly, institutions such as ICRISAT and ICAR must continue to strengthen institutional mechanisms to engage public leadership and policy makers. There is a much greater awareness of the changes taking place across the globe due to climate change especially in critical regions. The people who ultimately bear the brunt of the effects of climate change, however, are those who can least afford to do so and who have done least to cause the problem. Hence, climate change adaptation and mitigation are both a practical need and a moral imperative. The smallholder farmers who live in the semi-arid tropics and coastal areas are severely affected by climate change trends that are the result of mostly industrial and urban lifestyles.

If I may indulge, the crisis management plan for drought prepared by the Government of India (2012) presents a disturbing picture. The report says that annually 50 million people are exposed to chronic drought. Sixteen percent of India's land area is drought prone, 68% of land area sown is exposed to drought. Most drought prone areas in India lie in the arid (19.5%), semi-arid (37%), and sub-humid (21%) areas of the country occupying 77.6% of total land out of 329 million ha. Thirty-three percent of land receives less than 750 mm of rainfall and is classified as chronically drought prone.

Rainfall is found to be erratic in four out of ten years. Per capita water availability is rapidly declining due to population and urban growth, industrialization, cropping intensity and depleting ground water. Millions of women, men and children live in these areas and are at high climate risk. The challenges for us as scientists and



agricultural leaders are very serious. As I mentioned earlier, our obligation and imagination must be focussed on those who will be most seriously affected by these changes and are least powerful to change the course of history or what is happening elsewhere, far away from their small villages or neighborhoods.

There must be greater, more serious and if I may add a more genuine effort on our part to examine what is happening but also to listen and learn from the women and men, young people, families and communities in the periphery. Here I emphasize the need we have to adopt a different perspective and approach by listening, observing and learning from the people we are supposed to help with our findings, technology and knowhow.

A grassroots approach is vital where we make them active partners in learning, i.e. research so that we jointly search, jointly find, jointly adapt and adopt. This is a departure from a benevolent view of doing good for them, who may not know what is good enough for them. Such an approach is doomed to fail. People will do what they finally decide is good for them.

The technology, tools, and methods we develop for the farmers have to be finally accepted by them, and evaluated, however informal and crude it may be, from their point of view. While we must continue to improve our data collection and analytical tools and methods, and develop new technologies, we must also strive to explore ways of making our efforts create beneficial impacts on our communities. Therefore, a grassroots perspective, understanding the context in which farmers live and manage their livelihoods, is of great relevance.



By being in the villages, examining issues and variance of farmer realities will enhance our objectivity as well as the effort of seeking the truth of the situation. Further, as scientists engaged in institutions that have clear missions and obligations, where we wish to improve the quality of life of the smallholder farmers, we must be more grassroots- and participatory-oriented.

The Village Level Studies launched in the 1970s by ICRISAT, in partnership with ICAR, is a unique scientific model of social transformation taking place at the village level in India, Bangladesh and Africa. The longitudinal studies undertaken painstakingly by an interdisciplinary team of scientists working in these locations have now begun to yield results and outputs. This wealth of knowhow needs to be understood not only by the social scientists but also by the other agriculture scientists, as well as those working in agrarian settings, to make their research more socially relevant.

Identifying the root causes and what needs to be done to mitigate and adapt is a relatively easy challenge for the confident professional scientists that we are. But the bigger challenge is to make sure that the changes that we recommend based on research findings are actually accepted, adopted, funded and implemented. Here we face a much more formidable challenge of the “commons”. Much of the “locus of control” of environmental issues has shifted to global, national and local governance structures.

Much of what needs to be done in facing the challenges of climate change must be implemented by the governments and other organizations operating at different levels. Here is the challenge to organizations such as ICRISAT and ICAR. Our recommendations must translate into policies that are actually financed, supported, and implemented with the political will it requires. It is with the collective efforts of our institutions, especially the national lead organizations such as ICAR, the ministries, departments, commissions, that we can make a change to influence our own program directions. Changes are also required of the elected policy makers to make the necessary legislative enactments to have sustained effects.

The lessons we have learned from the ongoing project as well as others are that we must be more grounded in the realities at the grassroots level and in the farming communities in order to be relevant to our clients, and that we must also be effective at the policy level so that our efforts are implemented, funded and sustained. It's not just a moral imperative. It's an economic imperative. And ultimately, it's a security imperative for us who share this threatened planet. To this end we'll have to hold ourselves accountable. We'll have to measure results. And we'll have to stay very, very focused.

Thank you and have a good day!





Sustainable Intensification of Rainfed Agriculture through Natural Resource Management



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Ladies and gentlemen, good morning!

Let me especially recognize the presence of our valuable consortium partners represented by the Indian Institute of Soil Science (IISS); Central Arid Zone Research Institute (CAZRI); Rajmata Vijaya Raj Scindia Krishi Viswa Vidyalaya (RVRSKVV), Madhya Pradesh; National Research Centre for Agroforestry (NRCAF), Uttar Pradesh; and our NGO partners. I also especially welcome Dr Bhaskar Mitra from Tata Trust who has supported ICRISAT for this particular project aimed at increasing agricultural productivity and reducing poverty while minimizing land degradation.

To all of you, let me extend a very warm welcome to ICRISAT, home of *Science with a human face*.

*Inaugural Address,
Tata-ICRISAT-
ICAR and Model
Watershed Projects
Review and
Planning Meeting,
23 May 2012,
ICRISAT-Patancheru
502 324, Andhra
Pradesh, India.*

When I came to ICRISAT almost 13 years ago we were focused on high science. We were doing a good job but our research remained in our experimental plots and labs. We have come a long way since and now we measure ourselves not just in terms of excellence but also in creating impact and relevance to the grassroots.

Today we ensure that our research projects have downstream components and up-scaling activities. This completes the research and development continuum and, working with partners like you, we are able to create credible impacts on the ground, helping farming communities, ensuring food security, helping to end poverty and protecting the environment in various production systems, particularly in the semi-arid tropics.

Significant challenges, however, still remain. Feeding 7 billion people in the world today continues to be a challenge. One in every 7 is poor and hungry. In India, with 1.2 billion people, one third of the population is poor, unable to buy 3 meals a day. Yet you produce rice and wheat in excess. There is enough food but not enough money so that the poor and smallholder farmers can buy it. This nexus of poverty and hunger continues to haunt India and the rest of the developing world, particularly in the semi-arid areas which is the focus and locus of ICRISAT's work.

If feeding 7 billion people today is a tremendous challenge, how much more in the next 30-40 years? In 2050 there will be 9.4 billion in the world and India will be the most populous country with 1.5 billion, overtaking China. In this light, this project seeks to unlock the potential of rainfed and dryland areas in India and the rest of the world. It is good that there are foundations like Tata who support this endeavor. The power of collaboration and partnership is the key to unlocking this potential. We thank our partners here for sharing our vision and working shoulder to shoulder with us out there in the fields.

I believe that using the power of science and technology we can increase agricultural productivity, enhance remunerative agriculture and sustain our gains while at the same time conserving our environment. By working together, we can balance productivity, profitability and sustainability to feed our hungry world.

I rest my case with you.



Soar like Eagles

Distinguished guests, dear graduates and parents, colleagues and friends, good evening!

Many years ago I also sat where you are right now, glowing with a sense of achievement and yet deep inside wondering what the future may hold for me. We celebrate graduation as a milestone. It marks the end of our basic education and the commencement of bigger challenges ahead of us.

I congratulate you for the good performance you have done to finish your studies. I also want to congratulate your teachers and administrators because your success is theirs as well. I want to extend a special word of thanks to your parents and family members for the support they provided you. You see, graduation is not the product only of individual effort. It is the result of collective endeavor. We can't spell "success" without "u" and therefore we have to extend our thanks to recognize the contribution of others. Please say thank you to those who helped you succeed by waving your hand to them.

*Address,
International
School of
Hyderabad
Graduation
Ceremony, 25 May
2012, Park Hyatt
Hotel, Banjara
Hills, Hyderabad,
Andhra Pradesh.*

It was 30 years ago in 1982 that ICRISAT received permission to operate a school and thus the International School of Hyderabad (ISH) was born. ISH's mission is to develop responsible global citizens through proactive and adaptable professionals, an evolving and progressive curriculum, and world-class facilities. Today, ISH enrolls over 250 students from 26 countries and is the best school in its class in the city without a doubt. You are very fortunate to graduate from such a prestigious school.

It was not like that for me. My parents sent me to public school, not the same quality as ISH. In our village only a few went to high school. In my case, I was determined to rise above the aimlessness and the hopelessness therein. I was convinced that a good education was my ticket out of poverty. I wanted to be at the top of the pile. I worked my way up. I had to try harder than the rest because I had a bigger dream than most. I wanted to soar like an eagle and not wallow with the ducks. The rest, as you know, is history. On the other hand, having graduated from this school and having received the best education, you are in a much better position to succeed in life.

As the Director General of ICRISAT in the last almost 13 years, I have come to a conclusion that leadership and success are based on one's ability to see the future and act decisively upon it. There are no shortcuts to success but, yes, there are certain competencies you can develop along the way. Let me share some with you, as my graduation gift.

Well cultivated self-awareness

The first secret of success lies inside each one of us. We need to cultivate a sense of our personal strengths and be aware of our weaknesses. It is this understanding and self-mastery which is the springboard for much of the good we can do. From within comes personal conviction and the emotional intelligence that allows us to overcome all sorts of difficulties and obstacles in our path to success. The values we hold dear and our convictions define our character and character will let us do what is right even when no one else is looking.

How many of our leaders today pass the trial of achievement but fail the test of character?

Compelling vision

The second secret is being visionary, to have a dream, to be driven to be better each time. People with vision go farther and are willing to go the extra mile. And when you hear them speak, you feel their passion over and above their superior communication skills. You believe them. They easily earn your loyalty and trust.

How far do you think your dream will take you?

Masterful execution

The third secret is execution. Leaders drive results. They possess good planning, organizing, and delivery skills. They make sound decisions that others follow. For them good enough is never good enough. For them the name of the game is “be fast or be last”.

Real way with people

A leader must have the ability to get others to act in the desired way. They win respect from those who must be influenced, and build mutual respect. They will give directions and expectations in an appropriate way to influence others to act, and they are also open to ideas and listen actively to others.

They walk the talk, influencing others by following rules themselves, modelling good behavior, and they reinforce the appropriate attitude and performance in others. They are mentors, not tormentors; coaches, not drill masters. They communicate to the group in a way that sways the group towards behaving in the desired way. They energize others and are a source of inspiration to those who follow them.

Relevance and social contribution

Successful leaders are true change agents. They leave indelible imprints on their organizations and in society at large. They are memorable because they change people’s lives for the better. They are the salt of the earth and a light to the world.



ICRISAT has been an excellent example of an organization with a social conscience. Not only are we mandated by our charter to help people in the semi-arid areas rise from the trap of poverty and hunger but do science well – *Science with a human face*. This is where eagles actually help the ducks.

Renewal and continuous learning and adaptation

Lastly, successful leaders have an uncanny ability to reinvent themselves in the face of incessant change. They have to deal with increasingly complex challenges, the need to innovate to be competitive, to understand and master technological advances and operate in a global environment. They have to learn to focus with so many interruptions in a day. Being an authentic leader, ensuring that one's values are aligned with leadership behaviour, is a challenge many leaders will face in the future. Emulating a healthy lifestyle will be important to leaders. And they will have to be savvy in nurturing collaborative, participative and transformational leadership styles.

In closing, let me underscore that the future belongs to the young who comprise more than half the world's population. They are speaking out and taking active leadership roles throughout society to build a world truly fit for a younger generation.

As graduates of ISH, you have more than what it takes to lead and succeed. Go and capture your moment in the sun.

Soar like eagles and work hard for your dreams!





Women Leaders Level Up



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Ladies and gentlemen, good evening!

I am delighted to be surrounded by so much talent and beauty from all over the world. It is like watching the planet Venus transiting the face of the sun: a rare occasion, filled with much admiration and amazement.

I am amazed at what could still be done together to highlight the role of women in society today, particularly in the agricultural sector. This workshop is a product of such collaboration but we need to work so much more to face up to the challenge of moving from mere “lipstick service” to full integration of women in development and in the work place.

In fact, we have just brought to the attention of CGIAR that its call to action and its 7-point action plan to be presented at the RIO+20 United Nations Conference on Sustainable Development has a basic flaw and a serious omission: it has no specific mention of the role of women at all. RIO+20 which will be held in Brazil next week is a historic opportunity to define

*Inspirational
Talk, Women's
Leadership and
Management
Development
Course, 6 June 2012,
ICRISAT-Patancheru
502 324, Andhra
Pradesh, India.*

pathways to a safer, more equitable, cleaner, greener and more prosperous world for all. Can we afford not to highlight the role of women in our call to action? I say we cannot. It will never be a safer, more equitable, cleaner, greener and more prosperous world for all without the essential empowerment and contribution of women and women leaders.

Gender and diversity are old hats, as old as the proverbial Garden of Eden. They have been on the development agenda for over three decades. Yet there remain gaping holes in policy and practice today. I encourage you to be the advocates for the greater participation of women in all aspects of development, and start within your own organizations, families and communities.

At ICRISAT, we are happy to note that we are very close to achieving our gender and diversity targets. We continue to do our best to have more women scientists and more women managers particularly from developing countries. Allow me to share with you an inspiring insight from a management guru Peter Drucker. "Leadership," Drucker says, "is not magnetic personality – that can just as well be a glib tongue. It is not 'making friends and influencing people' – that is flattery. Leadership is lifting a person's vision to higher sights, the raising of a person's performance to a higher standard, the building of personality beyond its normal limitations."

As women leaders you have a challenge of Olympian proportions before you. I say that because in the Olympic tradition, the medals go only to those who get things done better. The Olympic motto *Citius, Altius, Fortius* is Latin for "Swifter, Higher, Stronger". These Latin words are comparative adverbs, not adjectives. They describe actions not things. You will be the women leaders you want to be only if you get things done better. And to do this better you must bend without breaking, aim, and shoot for the next higher level of performance.

With that I wish you will enjoy tonight's performance to cap a fruitful and memorable time at ICRISAT.

Thank you and good evening to all of you!



The War for Independence Never Ends

Ladies and gentlemen, Mabuhay!

Thank you all for joining us in this simple celebration of the 114th Anniversary of Philippine independence.

Our search for freedom is unique and in the annals of our history, the date June 12, 1898 is forever etched as the date of the proclamation of our independence from Spanish rule by the young General Emilio Aguinaldo in Kawit, Cavite. The revolution gave us a sense of nationhood, a thirst for freedom, and ideals of equality and fraternity for which to fight and lay down our lives. The first Philippine Republic was the very first in all of Asia, yet it was short-lived. Unknown to the Filipino freedom fighters, the Treaty of Paris was signed on December 10 of the same year whereby Spain ceded, I say sold, the Philippines to the United States of America for US\$ 20 million. Thus when the Malolos Constitution was proclaimed on 22 January 1899, transforming the government into what is known today as the First Philippine Republic, with Aguinaldo

*Speech, 114th
Anniversary
Celebration
of Philippine
Independence,
12 June 2012,
Kaliva, Banjara
Hills, Hyderabad,
Andhra Pradesh.*

as its president, we in effect had already acquired new masters. Unfortunately, Twitter and Facebook were not yet invented at that time.

It was on July 4, 1946 that the Philippines attained its independence. This was immediately after World War II. The country was in utter disarray and faced a number of challenges to rebuild itself from the ravages of war.

Today, even as we stand proud as an independent state in the community of nations, that task of building and rebuilding the nation does not cease. As part of the Filipino diaspora, let us continue to do our share in nation building. There are 12.5 million Filipinos working abroad today. We are the serious minority the country needs to put together the building blocks of our country. We simply need to be the best in whatever we are doing wherever we are because the war for independence never ends.

Tonight I would just like to highlight a number of freedoms we need to work harder for: freedom from economic stagnation, freedom from corruption, and freedom from poverty and hunger.

With this, let us enjoy this evening as only Filipinos can. We may not be a rich country but we certainly know how to have fun. As they say back home, "it's more fun in the Philippines".

Happy Independence Day! Mabuhay tayong lahat!





Technology as a Driver for Agricultural Growth: Ensuring Farm Prosperity

Distinguished guests, good afternoon!

It is my privilege to be here today and lead this Panel Discussion on 'Technology as a driver for agricultural growth: ensuring farm prosperity' involving key stakeholders of the agricultural industry. I would like to take this opportunity to reemphasize the fact that we have a great challenge and indeed a great responsibility ahead of us in terms of feeding the growing global population.

Despite the successes of the Green Revolution, the battle to ensure food and nutrition security for hundreds of millions

*Speech, Panel
Discussion,
Technology
as a Driver for
Agricultural
Growth: Ensuring
Farm Prosperity,
6 July 2012,
Hotel Golconda,
Hyderabad, India.*

of miserably poor people is far from won. Population explosion, deteriorating production environments, the growing menace of global warming and supply chain constraints have led to a steep decline in global food stocks and skyrocketing prices of food commodities. This is not to say that the Green Revolution is over.

Improvements in crop management productivity can be made all along the line, in tillage, water use, fertilization, weed and pest control, and harvesting. In addition, for the genetic improvement of food crops to continue at a pace sufficient to meet the needs of the 9.2 billion people projected for 2050, both conventional breeding and biotechnology interventions will be required. Farmers across the world must have access to high yielding crop-production methods as well as new biotechnological breakthroughs that can increase their yields.

Modern biotechnology, particularly transgenic technology has gained significance in recent years. This is bolstered by the increasing demand for efficient agricultural production to provide sufficient food for the growing population, estimated to increase by almost 3 billion over the next 50 years.

While conventional breeding involves exchange of genes between two plants to produce offspring that have desired traits, it is limited to exchanges between the same or very closely related species. Transgenic technology, on the other hand, enables combining in one plant useful genes from a wide range of living sources and at a relatively shorter time.

Agricultural biotechnology has the potential to reduce crop losses from pests and diseases; to enhance the nutritional value of food and animal feeds; to extend the post-harvest life of fruits and vegetables; and to increase the stress tolerance of crop plants allowing them to tolerate various environmental extremes. In developing countries in particular, biotechnology has the potential to revitalize the agricultural sector and increase the profitability of farming. As a scientific solution to improve crop productivity, biotechnology today plays an indispensable role in empowering the rural sector by boosting food production, enhancing income for the small farmer, and improving nutrition.

The latest report of ISAAA, *Global Status of Commercialized Biotech/GM Crops: 2011*, highlights the fact that biotechnology crops now cover 160 million ha worldwide. Interestingly, of the 16.7 million people who grew transgenic crops in 2011, 15 million or 90% were small resource-poor farmers in developing countries. This clearly dismisses the myth that modern biotechnology is not suitable for smallholder farmers.

An estimated 160 million ha of land is under GM crops and we are witnessing a sustained annual increase of 8% or 12 million ha since 1996. Now, there is a need to move beyond Bt cotton and embrace genetically modified food crops that can make an enormous contribution to the 2015 Millennium Development Goal of



cutting poverty in half by optimizing crop productivity in the proposed global initiative. At this juncture, it is critical to mainstream biotech crops in developing world farming systems to provide a faster response to evolving pests and diseases, severe and rapid climate changes as well as addressing issues such as malnutrition and food and feed safety.

As with every new emerging technology, the potential hazards and concerns must be considered. However, they should not be a limiting factor for the deployment of technological advances in the agricultural sector, particularly when the risks outweigh benefits. Having said this, let me point out the increasing need for a stringent, scientifically driven and globally harmonized regulatory systems approach to evaluate and ensure the safe use of transgenic technology.

Let me have a few minutes to share the approach ICRISAT uses in the deployment of transgenic technology. We employ transgenic technology as a last resort for crop improvement where conventional plant breeding options do not exist. Governed by the CGIAR policies, the transgenic research at ICRISAT adheres to the highest international standards, follows stringent regulations and conducts research in a socially responsible way.

Our research is primarily focused on finding solutions to problems that constrain production of important crops for the semi-arid region, particularly chickpea, pigeonpea, groundnut and sorghum.

Today, in general, the private sector is leading in new sciences, such as biotechnology and information technology, but the public sector continues to play a critical role, especially in developing science innovations for the poor. More recently, the private sector has shown greater openness in helping to reach and lift the poor farmers out of poverty. There is a strong basis for pursuing public-



private partnerships to help poor farmers through joint development of science innovations and marketing them to poor farmers.

ICRISAT strongly believes that institutional strength and robust public and private partnerships are the key enablers for future large-scale adoption of biotechnology. To elevate the game further, ICRISAT has partnered with the Department of Biotechnology, Government of India in setting up a Platform for Translational Research in Transgenic Crops (PTTC). This would serve in translating the proof-of-concept technologies from public and private sectors to agri-biotech products of importance to national and global agricultural needs.

I would like to stress here that biotechnology tools are not the only solutions to the current agricultural challenges, but form an important and inevitable component of a package of approaches that has to be employed.

With these thoughts, I open up the panel discussion and request the expert speakers/panelists to share their views and experiences.





With Every Drop of Rain



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Ladies and gentlemen, I want to greet each of you a green and good morning!

As I look around the verdant campus, on gentle rain softly landing on an emerald carpet of grass, I realize that we are absolutely powerless to determine how much rain actually touches the ground. We ask for a downpour. We get only dampness. We ask for 5 cm of rain, we are thankful if we get 0.5 cm. In the era of climate change we can expect that it can be very, very disappointing at times. But, as I look around the room, and the success you all represent, I know it is not time for despair.

It is in fact time to harness the power of human science, to do *Science with a human face* and apply the extent of what we know about water and soil and plants to benefit other humans, particularly those who have less in life.

I am very pleased to welcome you to this workshop to discuss very innovative, dynamic and farmer-centric initiatives of the Government of Karnataka. Let me first recognize

*Inaugural Address,
GoK-CGIAR and
Bhoochetana II
Initiatives Workshop,
21 July 2012,
ICRISAT- Patancheru
502 324, Andhra
Pradesh, India.*

the champion of these initiatives, Dr KV Raju, Economic Advisor to the Hon Chief Minister of Karnataka who not only visualized the benefits of science-led development for farmers in Karnataka but also facilitated the implementation of the innovative programs which we will be discussing during this workshop.

I also welcome Drs SA Patil, Chairman of the Krishi Mission of GoK; SB Dandin, Vice-Chancellor of University of Horticulture; Dr Ananda Krishna, MD of Karnataka State Seed Corporation; and Dr VS Prakash, Director, Karnataka State Drought Monitoring Cell. My special welcome in advance to Drs Bharat Lal Meena, Principal Secretary, Agriculture and Dr KV Sarvesh, Director, Department of Agriculture (DoA) who are in Delhi today to discuss the prevailing drought situation in Karnataka, who will be joining us this evening.

Welcome to all the participants and our colleagues from CIMMYT, ICARDA, IFRI, ILRI, IWMI, IRRI and our colleagues from ICRISAT. As the country in general, and Karnataka in particular, is currently facing drought conditions, we must bring science to the rescue of small farmers who are most vulnerable to the impacts of drought. The initiatives that are going on in the State as well as this upcoming GoK-CGIAR initiative would definitely help to minimize the damage due to drought in the short term, as well as due to climate change in the long run. But I would suggest that during this workshop we leverage the best brain power available and present here to devise interventions which can be implemented by the Department to minimize the sufferings of the farmers during this season. I am sure Suhas Wani won't stop until we get the inventory of possible interventions to cope with the current drought situation prevailing in the state.

Karnataka State has taken a number of innovative steps to take the science of dryland agriculture to the doorsteps of farmers through Bhoochetana. Already the impacts are observed and appreciated by all the stakeholders. The state has become a shining example for other states to emulate in order to achieve agricultural growth and productivity. As highlighted by the Honorable Chief Minister in his budget speech, Bhoochetana has contributed significantly to achieve increased agricultural production. This has provided the 'proof-of-concept' that science-led participatory research-for-development (R4D) is a win-win approach for policy makers, researchers and farmers alike.

DoA in Karnataka has shown the path for convergence and the capacity to reach millions of small and marginal farmers through trained farm facilitators as implemented through Bhoochetana. The DoA-ICRISAT team supported by the policy makers of Karnataka covered 3 million ha area during the last rainy season. If, with the mercy of God, rains arrive in time this year, then during this season 5 million ha are targeted to be covered through Bhoochetana.

The CGIAR consortium of seven centers is formed to undertake R4D, a first-of-its-kind initiative not only in India but also around the world. The GoK must be



congratulated for this bold step. We, from the CGIAR Centers must work as one with our partners in Karnataka to deliver and produce the targets that we have set for the benefit of the small farmers of the State. In particular, let me congratulate the DoA of Karnataka for preparing the soil health atlas for the State and providing appropriate technology recommendations to farmers which has become a model for other states in India as well as other developing countries in Asia and Africa. During my recent visit to Africa, I had discussions with officials of the Alliance for a Green Revolution in Africa (AGRA). I shared with them the Bhoochetana initiative of GoK and they showed keen interest and preparedness to learn and adopt it in Africa. The rain falling in Bhoochetana can also fall in Africa.

Enjoy a memorable and productive stay at ICRISAT. Thank you and good day!







To Feed the Country's Poor



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Ladies and gentlemen, good morning!

As the DA-BAR turns a silver leaf in its history and celebrates 25 years of R4D excellence in agriculture and fisheries in the Philippines, I am pleased to join the celebration today and inaugurate the 8th Agriculture and Fisheries National Technology Commercialization Forum and Product Exhibition.

Thank you for inviting me, but I am not here to sing praises today. Instead I will echo the clarion call of the FAO that to feed the world by 2050 business-as-usual will not be the usual business. Basic and pervasive changes have to take place. The time to start changing was yesterday.

By 2050 the world's population will hit 9.2 billion, 34% higher than today. Nearly all of this population increase will occur in developing countries. About 70% of this population will be urban compared to 49% today. They will enjoy much better incomes and their food preferences will alter the food production chain around the world. How do you feed this larger, more urban population of the future? The consumers of

*Guest Speaker,
25th Anniversary
Celebration of
DA-BAR and the
8th Agriculture and
Fisheries National
Technology
Commercialization
Forum and Product
Exhibition, 9 August
2012, Mandaluyong
City, Philippines.*

the future will be fatter and richer. These city dwellers will want second servings of their favourite food. That means invariably more meat and less grain. At an FAO meeting in Rome early this year one idea was discussed: why not give them grasshoppers for lunch? Insects are high in protein and other nutrients. A 100-gram portion of grasshopper meat contains 20.6 grams of protein, just 7 grams less than an equivalent portion of beef. In addition, insect farming requires less water, less feed, and less land per calorie than traditional livestock farming, and it produces much lower greenhouse gas emissions. Entomophagy or the practice of people eating insects is a real option for the future. Fortunately for Filipinos, some of us are already engaging in this practice!

In developing countries like the Philippines, 80% of the necessary production increases would come from increases in yields and cropping intensity and only 20% from expansion of arable land. With global decline in the rate of growth in yields of the major cereal crops, the challenge for R4D, therefore, is to reverse this decline. We know of course that the challenge is two-pronged. On one hand, we need increased investment in research and development for sustained productivity growth, infrastructure and institutional reforms, environmental services and sustainable resource management. On the other hand, policies should not simply focus on supply growth, but also on access of the world's poor and hungry to the food they need to lead active and healthy lives. This is a challenge of productivity and equity.

ICRISAT strongly advocates and practices *Science with a human face* – research not for its own sake, but dedicated to the poorest of the poor. Our strategy is to mobilize the power of science and technology for development, food security, poverty alleviation and environmental protection in partnership with similarly oriented agencies and organizations to improve the livelihood of smallholder farmers in the dryland tropics and rainfed areas of the world.

We found an able and willing ally in DA-BAR. Since 2002 when we formalized an MOA with DA-BAR we worked together to achieve national food security, targeting food self-sufficiency, and improving the lives of the marginalized farmers and fisher folk. This is really the heart and soul of the partnership existing between DA-BAR and ICRISAT. We collaborated for the development of the country's rainfed agriculture systems and conducted suitability trials, production, utilization, and/or commercialization on four of ICRISAT's mandate crops: pigeonpea, groundnut, sweet sorghum, and chickpea.

We shared resources and expertise in natural resource management, capacity building and innovative knowledge sharing to enhance excellence in the conduct of research by capacitating research and technical staff and providing a more favorable environment for their work. DA-BAR and ICRISAT worked together in exploring new research methods, advancing agricultural technologies, creating useful scientific literature, and conducting trainings, seminars, conferences, and workshops to develop human capital.

We helped BAR set up the national R4D agenda for rainfed areas and crafted the Philippine Rainfed Agriculture Research and Development and Extension Program (PHIRARDEP). We continue to lobby in congress for the creation of the Philippine Dryland Research Institute (PhilDRI) or the Philippine Rainfed Agriculture Institute (PhilRAI) to lead the coordination, strengthening, and unification of all dryland agriculture and biofuel researches and technologies. It will be a proactive research organization to encourage the growing of agricultural commodities that are drought resistant and will thrive even under changing climatic conditions.

In tandem, ICRISAT and DA-BAR are making rainfed agriculture a business proposition which is a viable reality in the country, particularly for the sake of the poor who live in the drylands. The rainfed areas represent the most vulnerable side of agriculture. They cover more than 3 million hectares in Northern Luzon, Central Visayas and Southern Mindanao, characterized by high climate variability, low precipitation, erratic rainfall, and poor soils which subsequently result in low and unpredictable crop and livestock production. Twenty million families live in these areas and are dependent on agriculture in conditions most at risk under the vagaries of climate change, drought, pest infestation, poor and degraded soils, and lack of physical infrastructure and social services.

Despite the fact that rainfed agriculture contributes 40% of the total food production of the country, it remains underinvested today. Over the past three decades, bulk of the agricultural RD&E investments as well as policy support and infrastructure development had mostly favored irrigated and lowland farming, to the detriment of poor people who live in the drylands/rainfed and upland areas. They are our country's forgotten poor. In his third and latest SONA, President Aquino drew an optimistic trajectory for Philippine agricultural productivity. From a net importer of 2 million metric tons of rice in 2010, the country is set to achieve rice self-sufficiency by the end of 2013. This is laudable and highly achievable,



barring bad weather. What I want to emphasize here is that we should go for it, but not to the exclusion of the poor communities of the rainfed and upland areas.

The Agriculture and Fisheries National Technology Commercialization Forum and Product Exhibition, now in its eighth edition, should showcase this bias for equity and the sense of urgency to bring the results of research down to the point of commercialization. For what good is research if it remains in the laboratories? Who will profit from publications that remain on the shelves?

At ICRISAT we launched in 2003, in partnership with India's Department of Science and Technology (DST), the Agri-Business Incubation (ABI) Program to promote agricultural technologies developed by ICRISAT, other R&D centers of excellence, universities, and other institutions, separately and jointly. ABI is the only incubator with an inclusive, market-oriented development plan that seeks to improve farmers' livelihoods through business incubation. Its approach features a dual service and outreach strategy. The service strategy focuses business development services on five strategic areas, building on the expertise of ICRISAT and its partners: seed, biofuels, ventures to develop particular innovations (products or services), farming (high-value crops), and agricultural biotechnology. The outreach strategy involves collaborative business incubation to bring a wider range of expertise and resources to bear on business development to foster agricultural development in other regions.

Since its establishment, ABI has supported more than 158 ventures in agri-business. Among ABI's clients, 62% are seed entrepreneurs, 13% are incubatees located on site, 30% are co-business incubatees, and 4% are biofuel entrepreneurs. To date, agri-business products and technologies incubated through ABI have included sweet sorghum for ethanol production; insect-resistant transgenic cotton; a biofermentor for biopesticide production; a drought-tolerant groundnut variety; better-yielding chickpea varieties; biopesticide formulations; and organic farming methods. Businesses supported by ABI are estimated to have benefited 40,000 farmers.

In Andhra Pradesh and Maharashtra, 4,000 acres have been brought under sweet sorghum cultivation for ethanol production. The drought-tolerant groundnut variety is used by 1,500 farmers on more than 5,000 acres; a new chickpea variety is planted in 100,000 acres in Anantapur district by 20,000 farmers. There is much more that needs to be done to bring research results to impact our communities, especially in rainfed areas. I have two specific proposals to offer today. One is for DA-BAR to institutionalize a program on micro-enterprise development in agriculture using science-based products and solutions. The second one is to go for a massive soil and water rehabilitation program and to take a province as the upscaling area using lessons we learned in ICRISAT.

In the joyous din of celebrating DA-BAR's 25th Anniversary, let us not drown out the clamor of the poor dryland/rainfed communities. Even as we boost food security for all, we must ensure the small farmer's access to technology and eventually the marketplace. For the forgotten poor also deserve a fair deal.





The Seeds of Hope



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Dr OP Yadav, Project Coordinator – Pearl Millet, AICPMIP;
Dr RP Jangir, Director of Research, Bikaner Agriculture
University, Rajasthan; Dr RP Narwal, Director of Research,
Haryana Agricultural University, Hisar, Haryana;
Dr CJ Dangaria, Director of Research, Junagarh Agricultural
University, Gujarat; Dr RL Patel, Director of Research, Sardar
Dantiwada Agricultural University, SK Nagar, Gujarat; our
partners from the private and public sectors; the HOPE Project
team members; colleagues; ladies and gentlemen, good
morning and welcome to ICRISAT!

As is most appropriate in this setting today, I want to begin
to address you on a note of hope. I hope that this meeting
will be a productive platform to give our project partners an
opportunity to interact and recommit to the project goals and
aspirations.

Let's not forget why we are doing research continuously. We
do research for development and that is what we call *Science
with a human face*. We should be able to appreciate our shared

*Inaugural Address,
Conference on
Promoting Seed
Production of
HOPE-tested
Farmer-identified
Pearl Millet Hybrids
(Pearl Millet-South
Asia), 17 August
2012, ICRISAT-
Patancheru
502 324, Andhra
Pradesh, India.*

overarching goals of ensuring food security, reducing poverty, and protection of the environment of the drylands of Asia and Africa.

With that I hope we can use this platform to iron out kinks, overcome hurdles, smoothen out the rough roads of our project implementation, and collectively ensure that certified hybrid seeds of pearl millet are made available to farmers in India.

Finally, I hope that because we are able to make available to them certified seeds, our cooperator farmers will experience increased productivity, enjoy profitability and sustain their gains by taking care of the environment and their natural resources. At the end of the day, using the inclusive market-oriented approach, Project HOPE is about giving hope to the farmers who eke out a living under inhospitable conditions of the drylands.



The 'Harnessing Opportunities for Productivity Enhancement of Sorghum and Millets in sub-Saharan Africa and South Asia' (HOPE) project is led by ICRISAT in close partnership with several Indian state and national institutions and private seed companies. The over-arching project hypothesis of HOPE project is to test the combination of improved technologies (crop varieties and management) with institutional innovations to increase market access and demand which can drive adoption and increase productivity of pearl millet in South Asia.

For pearl millet in India, the target is to identify/develop hybrids suitable for marginal environments and to up-scale promising management practices. Under the HOPE project, public and private-bred pearl millet hybrids were already tested in 2010 and 2011. This was done on a large scale on farmers' fields in the drier parts of Rajasthan, Gujarat, and Haryana.

The results have been encouraging and some farmer-preferred hybrids were identified through scientist-farmer participatory testing. Now, the challenge is to make available to the farmers the seeds of these identified hybrids. We faced no problem with the private-bred hybrids. The challenge in seed production was from public-bred hybrids, as the seed corporations of these three states have not been able to produce certified seeds of these hybrids. Thus the HOPE team thought of addressing this issue through the Public-Private Partnership platform of the Pearl Millet Hybrid Parents Research Consortium platform.

We need to find some workable mechanisms for allowing non-exclusive marketing rights to seed companies for public-bred hybrids. This kind of mechanism already exists in the public domain in India. It is our challenge to surpass the many hiccups and hurdles in the smooth implementation of this concept.

By bringing together the administrators of our HOPE partner states (Directors of Research) and management of private seed company members (both Consortium and non-Consortium companies) on a common platform, we are creating an opportunity for them to interact and find suitable pathways for seed production and delivery of these identified public-bred hybrids. A lot of funding and scientific efforts are involved in the development of these hybrids in the public domain, but due to poor seed production systems the farmers are still waiting to reap the benefits of this technology.

Let us together find some solution to increase the utilization of resources (both monetary and scientific efforts), and ensure seed availability. Let us finally bring the seeds of hope to our dryland farmers.

Thank you!





Next Generation Approaches to Sequencing Data Analysis and Molecular Breeding

We have come a long way, no doubt, since man first domesticated agricultural plants more than 10,000 years ago. Today we are the beneficiaries of much more evolved science and technology around plant breeding. Crop science draws from and is vastly enriched by molecular biology, cytology, systematics, physiology, pathology, entomology, chemistry, statistics (biometrics), even information technology.

And at no other time have we been beset with a more staggering amount of data to analyse and assist us in our selection and hybridization challenges than now. Our scientists and plant breeders today need better ways to handle the massive amounts of data being generated by plant molecular

*Inaugural Address,
3rd International
Workshop on
Next Generation
Sequencing
Data Analysis &
Molecular Breeding
Approaches, 29
August 2012,
ICRISAT-Patancheru
502 324, Andhra
Pradesh, India.*

studies, using approaches that should help speed up the development of improved crop varieties.

I therefore welcome this 3rd International Workshop on 'Next generation sequencing data analysis & molecular breeding approaches' as both timely and crucial.

I am also pleased to extend a personal note of welcome to all of you who have come from 8 countries to attend this workshop at ICRISAT at a time when we are buzzing with excitement about our forthcoming 40th anniversary.

As a part of one project funded by the CGIAR Generation Challenge Program (GCP), this workshop will revolve around the development of analytical tools for analyzing high-throughput sequencing data for use in breeding programs. Scientists and plant breeders increasingly use molecular tools to develop improved crop varieties. By identifying genes associated with desirable traits, they don't have to wait to observe crops grown from seeds.

But molecular tools require analyzing massive amounts of data, and important traits like drought tolerance and yield are the result of the combined actions of multiple genes, each with a small effect. These genes are called quantitative trait loci (QTLs), and the conventional Marker-Assisted Selection (MAS) approach to handling molecular data has limited power to detect small-effect QTLs and estimate their effects. This is where the next generation approaches come in to help more accurately predict trait values.

I am pleased to note that while working with GCP and in collaboration with several partners, the ICRISAT team has already developed ISMU (Integrated SNP Mining and Utilization) Pipeline version 1.0 and I want to thank and congratulate Rajeev and his project team including Abhishek, Sarwar and Trushar for leading and implementing this project. Now the team would like to integrate these breeding applications tools in the pipeline so that this pipeline can be used by breeders not only from ICRISAT but also by other CGIAR centres and NARS partners.

It is good to see experts in the area of next generation sequencing data analysis and molecular breeding like Prof PK Gupta and Prof Andreas Graner, our old friends and colleagues from CIMMYT, IRRI, James Hutton Institute, University of Nebraska, University of Minnesota, etc. I am sure that their expertise will help the dedicated ICRISAT project team develop more improved tools for enhancing breeding efficiency. I am also happy to see several breeders and scientists not only from ICRISAT but also from the private sector who are keen to use modern tools in their breeding programs. We all, together, need to embrace new tools of modern breeding for crop improvement to tackle international agricultural issues and meet the Millennium Development Goals.

In a special way I want to thank and recognize the Generation Challenge Program represented by Mark Sawkins here. ICRISAT has a long term collaboration with GCP in several areas. The pipeline developed from this project will be part of an Integrated Breeding Platform that GCP is developing. We look forward to having continuous support from GCP and all of you, in order to meet the goal of improving the livelihood of poor people by enhancing crop productivity, particularly in the marginal drylands of the world.

As you learn from the experiences of the experts and discuss the approaches for deploying NGS and HTPG approaches in molecular breeding including MAS, MARS, GS and GWAS, it is my hope that you will take away with you a deeper commitment to leverage your science to benefit the smallholder farmers and the poor who live in the drylands and practice what we in ICRISAT call *Science with a human face*.

Have a fruitful workshop and a pleasant stay at ICRISAT!







Sorghum Biofortification is Key to Improving Nutritional Security

Dear partners, colleagues, ladies and gentlemen, good afternoon!

I welcome you all to this beautiful campus of ICRISAT. A special welcome to our partners from the Directorate of Sorghum Research (DSR) and Marathwada Agricultural University (MAU) who are one with us in helping smallholder farmers to enhance their livelihoods.

First, let me congratulate the team for winning this proposal on sorghum biofortification being funded by the Department of Biotechnology (DBT), Government of India. I thank the DBT for its support to this important work. As you know, nutritional security is as important as food security and it is sad to note that more than 40% of women and children in developing countries are malnourished, in spite of rapid

*Opening Address,
Project Launch-
cum-Workplans
Development Meeting,
ICRISAT-DBT Project on
Biofortifying Sorghum
with High Grain Iron
and Zinc Concentration
for Combating
Micronutrient
Malnutrition, 18
September 2012,
ICRISAT-Patancheru
502 324, Andhra
Pradesh, India.*

progress in agricultural production. Malnutrition is a blot on human society and the irony is that it is further spreading in spite of rapid economic development in some of the developing countries including India. Considering this, research on nutrition is promoted at ICRISAT and other CGIAR centers, and reducing malnutrition is now one of our mission goals.

Biofortification is an innovative process of enhancing grain mineral concentration by genetic means. The biofortified products complement food diversification, food fortification and supplementation that are currently being employed to combat micronutrient malnutrition. ICRISAT's mission is to work in partnership with you all to enhance food and nutritional security, reduce poverty and sustain the environment. This project on biofortification contributes directly to our mission.

ICRISAT and partners are working on sorghum biofortification under HarvestPlus for the last 7-8 years. I am happy to note that they have now developed improved hybrid parents and varieties that have 50% higher grain iron (Fe) and zinc (Zn) concentration compared to the base level (30 ppm Fe and 20 ppm Zn). While pushing these improved products for commercialization, it is important to continue and elevate the ongoing work to further enhance grain Fe and Zn concentrations.

The proposed project is a step in that direction which focuses on identification of molecular markers linked to QTL conditioning the grain Fe and Zn concentrations in sorghum. This will enhance the efficiency of product development through marker assisted selection. This project is very interesting in the sense that it has combined both classical breeding and use of modern tools for product development. We have to enhance working in partnership with national programs since the beginning so that we will be more productive and successful in not only producing outputs but also in its adoption by farmers.

ICRISAT is celebrating its 40th Anniversary next week. We have come a long way in addressing the challenges of smallholder farmers in the semi-arid tropics of Asia and sub-Saharan Africa. We salute all our partners and stakeholders who have helped us in marching towards achieving our mission goals. On this occasion, we need to rededicate ourselves to the cause of smallholder farmers in sub-Saharan Africa and Asia to make a difference in their lives. To this end, I wish you a fruitful workplan development meeting.

Thank you!



Pearl Millet Scientists Field Day



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Ladies and gentlemen, good morning!

Welcome to the Pearl Millet Scientists Field Day, which is a biennial event at ICRISAT. We will be holding a similar Field Day for sorghum in the first week of October which some of you will be attending. It is our 40th Anniversary and we are all excited that you could celebrate this milestone with us.

Development and dissemination of improved breeding lines, tools and techniques is a core research activity of all crop improvement programs at ICRISAT. We regularly disseminate these outputs through various trials and nurseries, and through individual visits and contacts. But Scientists Field Days provide opportunities for you all, from the public and private sector, to come together on a common platform and get extensive exposure to a much larger diversity of materials. It also allows you personal interaction with each other and with

*Inaugural Address,
Pearl Millet
Scientists Field
Day, 20 September
2012, ICRISAT-
Patancheru 502
324, Andhra
Pradesh, India.*

ICRISAT scientists, which goes a long way in further strengthening our partnerships.

Our crops being climate resilient, they are now expanding across the globe under the present set of harsh climatic variables. Pearl millet crop is now occupying large areas in new ecologies like Central Asia and Brazil, and today we have a Consortium member company from Brazil (Adriana Seed Company) who have used ICRISAT materials and developed some very good products. They will be sharing their knowledge and results tomorrow during the plenary session. I congratulate them on their successes and wish them good luck in their efforts.

We at ICRISAT firmly believe in, and pursue, partnership-based impact-oriented research and you all, both from public and private sectors, are our valued partners in pearl millet improvement and product delivery. The depth of partnership, of course, varies depending on your interest in the research programs that we pursue at ICRISAT, and the strategic thrust and location of your research center. Thus, some of you partner with us in joint evaluation of ICRISAT-bred materials under the ICAR-ICRISAT umbrella project on partnership research, and select materials useful for your programs.

In addition, while some of you are our partners in the HOPE project, there are many others who also partner with us in the HarvestPlus biofortification research. Overall, this partnership has grown over time and become stronger, which has proved beneficial to all of us in achieving our common objectives, namely serving the pearl millet farming communities.

The outcome of this partnership has led to immense on-farm hybrid cultivar diversity, and significant grain yield improvement and production stability of this crop in India. In the new program structure being developed at ICRISAT, our thrust in pearl millet research will be on hybrid development even for the African regions. And the knowledge generated with your partnership in the Indian context is going to be valuable for developing hybrid programs for the African regions.

In recent evaluations, it has been found that ICRISAT bred hybrids have performed very well and gave high grain yields in Eastern African countries (Tanzania and Kenya). These results open up new windows for future expansion of the crop in newer areas. We can promote such activities under the platform of South-South collaboration, and this group can play a big role in improving productivity of pearl millet in these regions. There is severe shortage of fodder for our livestock, and the value of pearl millet fodder has steadily increased over time. Thus, crop-livestock productivity forms another thrust area in our new research program structure. Modest efforts at ICRISAT are under way to identify germplasm sources and breed for high biomass. This requires your attention to develop hybrids with high forage yield potential and enhanced nutritional quality. You will see some breeding materials being developed for use in forage hybrid breeding. In addition, you will



see a lot more of the germplasm materials that can be useful for forage cultivar development.

I would like you all to understand that micronutrient malnutrition is now increasingly being recognized as a very serious health problem. It is heartening to find that pearl millet has very high levels of grain iron and zinc content (the two critical mineral micronutrients). Also, there are great opportunities to further enhance the level of these micronutrients through genetic improvement. Thus, biofortification forms another research thrust in the new project structure. Recently, our scientists at ICRISAT developed a high Fe version of an open pollinated variety, ICTP 8203, which has been recommended for release in Maharashtra State.

It is good to know that many of you have joined ICRISAT's efforts in this research area to develop high-yielding hybrids with high iron and zinc content. I am confident that working together you all will learn many useful lessons in this relatively new research area, and be able to achieve our common objectives the same way as with other traits in the past.

In dryland agriculture, the problems related to agricultural productivity are already complex and far more challenging than those in more favorable and irrigated agriculture. With climate change, these problems are likely to become even more challenging. The occurrence of drought will be more frequent and more severe in the future, but in some years it may be just the opposite. For instance, there was drought during planting time of pearl millet this year; and then there was excess of rain which creates an unfavorable environment for plant growth and development. Thus, a new challenge you will be facing is to develop genotypes which can tolerate not only drought but also excess water.



In the HOPE project, we targeted increase of pearl millet productivity by at least 30-40% in drought-prone ecologies, and we were able to identify some very good hybrids bred by public and private sector institutions. There is need to up-scale the seed production of such identified hybrids where public-private sector partnership can play a big role. It is encouraging that some of our public and private sector partner organizations are working in this direction and will achieve success in meeting the seed demand of farmers.

Increase in air temperature is another consequence of climate change. You all have experienced excessively high temperature during the summer this year. The world is going to be warmer than this in the future. Thus, there is a need to breed for adaptation to such environments, especially for summer-season cultivation.

You all know that pearl millet has excellent adaptation to such environments. In fact, a few of the pearl millet hybrids are already widely cultivated under such environments as irrigated crops, which combined with high input management give grain yield as high as 4-5 t ha⁻¹, thus making pearl millet look more like a commercial cash crop.

There is a need to increase our research efforts in this area to diversify the hybrid cultivar base for summer cultivation, not only to increase grain and fodder yield, but also to manage downy mildew disease. Our ICRISAT scientists have made modest efforts in this direction, and identified some very good sources of high temperature tolerance, but a lot more remains to be done in terms of breeding heat-tolerant breeding lines and hybrids, and also in terms of understanding the biology and genetics of heat tolerance, to enhance the breeding efficiency for this trait.

Climatic changes will also change the disease and insect pest scenario for which we need to remain ever vigilant. You all know that pearl millet blast was hardly noticeable a few years ago. And now it has emerged as a very serious problem, at some places even more serious than downy mildew. ICRISAT scientists have developed a large number of breeding lines for blast tolerance which you can select during the field visit. Also, ICRISAT has standardized the screening protocols for blast, and you can use this facility to screen your materials for blast resistance. It is good to see that with joint research efforts from all of you, downy mildew is no more as serious a problem as it used to be in the 1980s and before. But we should not relax on this.

As I mentioned before, the problems we face to increase pearl millet productivity and its sustainability are complex and becoming more challenging. But it is the same story for all crops, especially so for dryland crops. With our partnership power also on the rise, I am confident that you will exert your best efforts and meet these challenges as you have admirably shown in the past.



The new advances in biotechnology and information technology will greatly address varied research and development issues of a complex nature. Innovations in these areas and their application forms another thrust area of our new project structure. Thus, looking into their importance we organized a 'Special session on forage research and double-haploid breeding in pearl millet', yesterday with interested public and private sector partners to devise a future strategy on these important aspects.

In the field visits today and tomorrow, you will find a diverse range of productive breeding materials with specific traits. You are welcome to select whatever you find useful for your research program. Development and dissemination of diversity, in elite genetic background, is the core business of crop improvement research programs at ICRISAT. You will also be exposed to screening approaches that are followed for disease resistance and salinity tolerance.

There is another core business, which is an integral part of crop improvement research: it is the assessment of on-farm impact, and impact of our research outputs on strengthening your research programs. This requires your cooperation and feedback about the utility of materials that you select during the Field Days and also from the trait-specific nurseries that are supplied to you on your request under the ICAR-ICRISAT Partnership Project.

I sincerely hope that you will respond to requests from our crop scientists and socio-economists in providing such information. It helps us in assessing the usefulness of ICRISAT's research to your programs. It also helps our scientists to re-orient their research, if and where needed, to serve you better. The Indian national pearl millet program is working closely with the ICRISAT program, and scientists of All India Coordinated Pearl Millet Improvement Program (AICPMIP) and ICRISAT



have worked together as a team to increase the productivity of this crop for the benefit of smallholder farmers.

As we know, the present AICPMIP coordinator, Dr OP Yadav, has been given the responsibility of leading the Indian Maize program by ICAR, but we are sure that he will be helping the pearl millet group in different capacities whenever needed.

Let's all work together with more energy and enthusiasm, and generate better products to uplift the smallholder farmers in marginal environments.

I wish you all productive engagements and a comfortable and memorable stay on this beautiful campus.





ICRISAT @ 40: Guided by our Successful Past, we Reinvent our Future

Ladies and gentlemen and friends of ICRISAT, good morning and a happy 40th Anniversary to all!

Forty years provide us a strategic vantage point to view how far we have come and where to move forward. It is indeed a significant milestone. Our collective experience and impacts of four decades give us enough reason to celebrate. Let us then clap our hands together and let the sound of celebration ring far and wide. But the occasion of our 40th Anniversary is not only for celebrating past glory. More importantly, it is a time to reflect on and surmount the global challenges that we face today.

As we do this, let us harness our collective strength in pursuing our vision of lasting prosperity in the dryland tropics. We look back to the time when the Institute was founded, 40 years ago. Our original champion, the eminent Professor MS Swaminathan,

*Address, 40th
Anniversary
Celebration
of ICRISAT, 26
September 2012,
ICRISAT- Patancheru
502 324, Andhra
Pradesh, India.*

Father of India's Green Revolution, was one of the architects of ICRISAT's creation. Then a member of the CGIAR Technical Advisory Committee and Director General of ICAR, Professor Swaminathan was largely influential in the creation of ICRISAT. In the Philippines, he was instrumental in the establishment of the Philippine Rice Research Institute (PhilRice), whose founding Director, Dr Santiago Obien, is with us today.

ICRISAT is the first Center to be set up a year after the CGIAR was established in 1971. With Dr Ralph Cummings, the first DG of ICRISAT, Professor Swaminathan worked hard for the Government of India to grant us the immunities and privileges associated with UN organizations. Hence, we owe the good Professor a profound debt of gratitude. Let us then give him a thunderous applause. We also have some people who are still with us today since the foundation of ICRISAT. They too can share many stories about the institutional growth and transformation of the Institute.

Let us acknowledge the presence of employees who have faithfully served the Institute for 35 years or more. As we celebrate today, let us look at the past so we can clearly see how we will reinvent our future. The first decade (1970s) marked the birth of the Institute and its formative years. This period saw the selection of the first DG, land acquisition, construction of research facilities and the conduct of initial experiments. Likewise, it marked the beginning of the vast collection of germplasm of our mandate crops and initial capacity strengthening of partners.

The second decade (1980s) saw the rise of ICRISAT's excellence and efforts to reach out to the world. This period marked the beginning of our African programs and the formation of regional networks. Moreover, Asian cooperation and South American initiative were also initiated in this section.

The third decade (1990s) was quite challenging as ICRISAT adjusted to reduced funding. This period also saw rapid changes in ICRISAT's management.

The fourth decade (2000s) saw ICRISAT's turnaround and the birth of new optimism across the Institute. With our renewed vision and commitment, ICRISAT embraced *Science with a human face* under our humble leadership. It was also marked by the exploration of opportunities for inclusive and sustainable development to finally surmount the twin challenges of global hunger and poverty in the dryland tropics.

As we take stock of our scientific triumphs, we are happy to note that we have made substantive impact on the lives and livelihoods of millions of poor smallholder farmers. These are enshrined in the *Jewels of ICRISAT*, a publication which we have just launched.

From a handful of employees 40 years ago, we are now more than a thousand strong, better equipped and ever dedicated to serve the world's poorest.

I am also happy to report that our financial health is strong. Our current revenue is about US\$ 67.3 million. With prudent management, we have consistently enjoyed revenue surpluses amounting to US\$ 14 million during the last 5 years. This year,



our estimated operating surplus is US\$ 1.9 million. In terms of earned income, ICRISAT is on top of all the 15 Centers with US\$ 21.1 million. We are also quite solvent, as our reserves are now US\$ 22.4 million.

From these figures, we are committed to ensure the continued financial viability of ICRISAT as a global leader in improving agriculture in the dryland tropics. We take pride in our people whose passion for excellence has transformed ICRISAT over the years. I refer to our scientists, managers and rank and file employees, who ensure that our work is done efficiently and effectively, on time and with the highest quality. You pursue excellence through long hours of work and dedication to service. You are the people who bring our products from our laboratories and research farms to the fields, and into the hearts of policy makers, donors, the private sector and other stakeholders. It is a joy for us to work with people who have a passion for excellence. To all the excellent women and men of ICRISAT, a round of applause. The joy of looking back, however, does not afford us the luxury of resting on our laurels.

As we move forward into our fifth decade, we will rise to the daunting challenges brought about by the perfect storm. By 2050, the world's population will reach 9.1 billion, 34% higher than today. Nearly all of this population increase will occur in developing countries. About 70% of the world's population will be urban compared to 49% today. In order to feed this much bigger, more urban population, food production must increase by 70%. Hence, the world needs our science-based innovations to drive increases in productivity and build a more food-secure, resilient and prosperous future. The way to enhance our relevance is through excellence in our science and in our ability to influence policies and markets through our research.

Ladies and gentlemen of ICRISAT, this is the key to our sustainable success in the future. Poverty, hunger, malnutrition and environmental degradation in the tropical



drylands won't go away overnight. We know what would be needed to accomplish our mission. Towards this, we have mapped out a Strategic Plan to help the poor escape poverty for good through Inclusive Market-Oriented Development (IMOD).

Will our triumphs in the last 40 years assure us of success in the future?

To this, I boldly say yes, but only if we do not rest on our past success and instead strive to reinvent our future in the midst of change. As Charles Darwin said, "It is not the strongest of the species that survives nor the most intelligent, but those most adaptive to change."

During the last 40 years, ICRISAT thrived with flying colors. Who made it happen? You made it happen. Scientists, managers, administrative assistants, writers, artists, farm hands, mechanics, drivers, security personnel, cooks, janitors, finance specialists, development partners, top level management and the Governing Board: you all made it happen. As we enter into our fifth decade, I am convinced that ICRISAT will be critically relevant to the hungry, malnourished populations 40 years from now, living in a world vulnerable to the vagaries of climate change. They will rely on our science-based solutions and in our ability to influence policies and markets by our research.

Two weeks ago, we received feedback from the Bill & Melinda Gates foundation, our single biggest donor, on ICRISAT's Village Level Studies and I quote, "People tend to think that data cannot feed the hungry. This project is proving the contrary. The poor will be able to speak directly to policy makers through your data, your research, your briefs and your advocacy".

I may not live long enough to see the metamorphosis of ICRISAT 40 years hence. But I envision a world where, despite a burgeoning population, there are proportionately less people who are poor, hungry and malnourished. As urban populations become richer, their village counterparts will enjoy relative prosperity. Information technology will enhance access of even smallholder farmers to scientific approaches and solutions to maximize their production. Information will allow them to understand market dynamics better and seize opportunities, even create them. Enlightened governments and donors will dismantle roadblocks to agricultural value chains. Research institutions like ICRISAT will evolve to be trusted advisors and become the brokers, bridges and catalysts of socio-economic change.

Can we do it? The truth is if we can see it, we can achieve it. There is nothing in this world that can stop us, except ourselves. We can and we must make it happen again for the poor smallholder farmers of the semi-arid tropics.

So to all of you, members and partners of Team ICRISAT, let us savor the past and take a bold step to reinvent our future. From the bottom of my heart, I thank all of you for this opportunity to serve. Have a memorable 40th Anniversary celebration today and throughout the rest of the week.

Thank you and good day!







Leading with Legume Genetics and Genomics

Ladies and gentlemen, good evening!

Welcome to Asia where the ICLGG is being held for the first time. Welcome to India, home to a rich legume biodiversity. And welcome to Hyderabad, the City of Pearls, my adopted home for the last 13 years.

I am privileged to welcome to you all to the VI International Conference on Legume Genetics and Genomics. I'm impressed by the large turnout! We have more than 500 participants from 44 countries. Your enthusiasm bodes well for the future of legume genetics and genomics research. And that bodes well for our hopes to better feed a hungry world. Just to set the stage, I would like to highlight why the world should care about legumes, and say a few words about what my institution, ICRI SAT is doing.

*Inaugural Address,
VI International
Conference on
Legume Genetics
and Genomics,
2 October 2012,
Marriott Hotel &
Convention Center,
Hyderabad.*

Malnutrition is a massive problem

One out of every 7 people in the world today is hungry or malnourished. Malnutrition, as measured by stunting, affects one of every three children in developing countries. One out of every six infants is underweight at birth. Their plight often begins with a malnourished mother. Malnutrition makes these children more susceptible to diseases, causes learning disabilities, mental retardation, poor health, blindness and even premature death. Malnutrition is closely connected to poverty. As a general rule, regions where the people consume less than 2,000 calories per day tend to have high rates of malnutrition. Consuming this low amount of calories is an indicator that the people cannot afford to eat as much as they would like to eat. And when this occurs, we also know that these poor consumers are making choices – they buy the cheapest foods available, which are starchy grains, roots and tubers. They cannot afford to eat enough meat and dairy products to avoid deficiencies of protein, fat and other nutrients in their diets. Often, governments subsidize the starchy crops to help the poor afford them. But this further imbalances the diet.

Legumes to nourish the poor

This is where legumes have a crucial role to play for the poor. They provide much cheaper protein and oil than meat, dairy and fish. The cost of protein from milk powder is five to ten times higher per unit weight of protein than the cost of protein from legumes. No wonder legumes are called the “poor person’s meat”. Milk is still the best food for children but when the poor can’t afford it, they need additional solutions. Legumes contain two to four times more protein than cereals. When legumes and cereal foods are eaten together on the dinner plate, they complement each other in terms of protein quality. The resulting protein is adequate for healthy growth.

Dietary fat intake by the poor is also insufficient. Cereals contain very little fat, but oilseed legumes – soybean and groundnut – are rich in fat. Fat is essential both for supplying energy to people who don’t eat enough calories, and also for the absorption of vitamins such as Vitamin A in the human gut. We also need to consider palatability for severely malnourished children. Children love the taste of groundnuts and chickpeas. This is why the World Food Program and others use them as the base ingredient in famine relief foods, such as Plumpy’Nut from groundnut in Africa, and Wawa Mum from chickpea in Asia. Children who have lost their appetites due to malnutrition will almost miraculously regain them when offered these very nutritious pastes.



Increasing incomes

Grain legumes usually play a dual role for smallholder farmers. They eat some, and they sell some. Something remarkable we've seen over the last decade or so has been the development of higher-value urban and export markets for tropical grain legumes.

Smallholder farmers have been connected to export markets for groundnut by the National Association of Smallholder Farmers of Malawi, for example, and by the Government of Ethiopia for chickpea, among many other examples – faba bean, lentils, soybean and others. We think it is critically important that smallholders continue to be intentionally included in such value chains. Smallholders are included in these examples, so let's study them closely and use them as models. Since women's health directly affects children's health, let's make especially sure that poor women benefit from these value chains.

Farming system productivity and sustainability

There is tremendous potential, I believe, to increase the fixation of nitrogen by legume crops. In smallholder farms, legume yields are very low, largely because nitrogen fixation is operating well below its potential. Usually it is constrained by environmental stresses and deficiencies of other nutrients. If we can find ways to improve legume stress resistance and to correct phosphorus and micronutrient deficiencies on smallholder farms, we can unleash the potential of nitrogen fixation. This will trigger large yield increases, both for the legume and for the following crops.

Grain legumes also improve the sustainability and resilience of smallholder farming. Not only do they add nitrogen to the soil; they also diversify a farmer's crops. This reduces the risk of food insecurity in case one crop is damaged by drought or some other stress. Planting more crops also keeps the soil better covered, reducing erosion. Thirdly, more crops increase the recycling of nutrients.

Grain legumes' role in the CGIAR

Because of their benefits for the poor, our mother organization, the CGIAR, has asked us to catalyze a major new research-for-development program, called a CGIAR Research Program or CRP for short. CRP Grain Legumes aims to help smallholder farmers increase yields of eight major grain legume crops of the developing world by 20% over ten years, and also increase the sown area by 20%. This will benefit 300 million poor people across the world. The crops are groundnut, common bean, chickpea, cowpea, pigeonpea, soybean, faba bean, lentil.



The expected benefits of US\$ 3.0 billion over the decade will result from increasing food supplies by 7.1 million tons and fixing an additional 402,000 tons of atmospheric nitrogen. The improvements in quality of life from increased sense of smallholder household security and improved health of women and children cannot be easily quantified but are enormously important.

This CRP on Grain Legumes unites the R4D efforts of eleven principal partner institutions, both within the CGIAR and beyond. All are leaders in grain legume research. I am happy to note that three of these principal partners have been closely involved with the organization of this Conference and are well represented in this meeting: ICRISAT, ICAR and GCP.

We received today the information that the Independent Science Council (ISPC) of CGIAR has endorsed the approval of Grain Legumes CRP and it is now sent to the Fund Council for final approval on a 'no-objection' basis. Congratulations to Dave Hoisington who coordinated the development of the program which also includes all legume scientists from all partner institutions!

Progress in molecular genetics at ICRISAT

I will not discuss molecular genomics in detail since all of you will have much more to say about it this week. I would just like to note with pride that ICRISAT coordinated a consortium of partners that sequenced the pigeonpea and chickpea genomes. Moreover, ICRISAT scientists under the leadership of Rajeev Varshney have developed markers and identified QTL regions for drought tolerance related traits in chickpea and disease resistance in groundnut. We will continue our commitment to molecular genetics through partnerships with many like-minded institutions such as yours. We see the potential payoffs as enormous.

Using science for impact

In the course of this conference, I hope you will not lose sight of the end-all and be-all of your science: the challenge of feeding a hungry world, improving nutrition and health, diminishing poverty, while sustaining the environment. At ICRISAT we call this *Science with a human face*. Leading with your legume genetics and genomics, I count on you to reach out and make a difference in our fragile world.

With that, I welcome you once again to this beautiful city and I look forward to seeing you again during your visit to the ICRISAT campus in Patancheru on October 5. I wish everyone an inspiring, productive and enjoyable conference and a memorable stay in Hyderabad!





Let us Elevate the Game!



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Ladies and gentlemen, good morning to you all!

I am very pleased to welcome you all to ICRISAT and thank you for participating in the Sorghum Scientists Field Day Program.

Sorghum is a climate-smart nutritious cereal and is an important food, feed, and fuel crop in India as well as in many countries in sub-Saharan Africa which are the focus areas of ICRISAT research in the world. In spite of some good progress in enhancing rainy season sorghum productivity, the sorghum area in this season decreased in India in the last few years with more viable alternative crops coming in. It is time that we elevate the game; develop improved products and create awareness among stakeholders including farmers and policy makers alike on the climate-smartness and nutritional benefits of sorghum to regain the lost ground and work in new areas. To achieve this, we aim to create science-based products and technologies and deliver them to farmers with the help of partners. ICRISAT alone cannot do this and we need your strengthened partnership to move forward.

*Welcome Address,
Sorghum Field
Day, 3 October
2012, ICRISAT-
Patancheru
502 324, Andhra
Pradesh, India.*

We, at ICRISAT, are indeed fortunate to be working in partnership with scientists from ICAR, the universities and the private sector in several areas of sorghum research. The Indian sorghum research program has been very strong since 1972 when the All India Coordinated Sorghum Project work commenced and we acknowledge that ICRISAT's sorghum program benefited from it initially. Further on, India recognized the role of the private sector and allowed the private sector to operate in seed enterprises using ICRISAT materials to the fullest extent and transferring research outputs to farmers. I take this opportunity to express my appreciation to the private sector for their support to ICRISAT's core sorghum improvement research through the Hybrid Parents Research Consortium. I hope that this support will continue and flourish in the years to come.

At this point, let me mention briefly the recent changes in CGIAR, ICRISAT and in sorghum research in particular. The change process in CGIAR has created a Consortium of Centers with legal status with a mission to achieve sustainable food and nutrition security and reduce poverty through increased livelihood opportunities in developing countries through international partnership in research for development. ICRISAT embraced the new strategic plan for 2020 that focuses on 'inclusive market-oriented development (IMOD)', inclusive here meaning the smallholder farmers.

Last week, we celebrated the 40th Anniversary of ICRISAT. We are proud of our achievements over the last 40 years in partnership with organizations like yours in helping smallholder farmers. The milestone celebration gave us a moment to relish our accomplishments but it is not time to sit on the laurels of the past.

There is a perfect storm brewing in the form of climate change, land degradation, population explosion, increasing food prices, malnutrition, and energy crisis and so on. We need to overcome it and therefore, we all need to work more in tandem to make a difference in the lives of smallholder farmers in the semi-arid tropics. In this context, I am sure you all agree with me that the partnership work is more important than ever before.

You may have observed a paradigm shift in utilization of sorghum in Asia, particularly in India in the recent years. While food use of sorghum is stagnant or declining, the non-food uses are increasing. The grains produced in the rainy season are used to some extent as food but they are mostly being used in animal feed rations and in potable alcohol manufacturing. Owing to its quick growth, higher biomass producing ability and greater resilience to abiotic stresses, the use of sorghum as a feed source by the dairy industry is increasing at a rapid rate driven by increased demand for milk and milk products in Asia. Therefore, we are working to improve the grain and stover yields in sorghum along with resistance to insects like shoot fly, stem borer, midge and diseases like grain mold using classical breeding methods and modern tools.

Of late there is growing concern about the environmental pollution caused by the use of fossil fuels as energy source. In this regard, we consider sweet sorghum a SMART crop for it produces grain for human consumption, and sweet juice from stem for bioethanol, and bagasse/leaves for animal feed without significant tradeoffs among them. On top of that it is an ideal feed stock for ethanol production. While sweet sorghum ethanol production is technically feasible its economic viability needs policy support.

Sweet sorghum is complementing the ethanol production in China and vinegar production in the Philippines. For second generation cellulose biofuel technology, sorghum is an ideal feedstock and we are working together with partners in India on high biomass sorghums. Biofortification of sorghum is another major research area. As you know, in spite of rapid economic progress in recent years, more than 40% of children in India are malnourished. Biofortification helps complement the on-going efforts to combat micronutrient malnutrition. One of the ICRISAT-MKV partnership varieties, Parbhani Swetha (PVK 801) possesses high grain Fe concentration (35% higher than the base level of 30 ppm). Efforts are underway to develop high-yielding sorghum hybrids with high grain Fe and Zn concentrations. Parallel to the changes in agricultural product utilization pattern, on the technology front there is tremendous progress in biotechnology, participatory breeding, data management and communication technologies.

Therefore, there is a big challenge in front of you – to blend effectively the new tools with the conventional methods to rapidly bring in the desired impact at the farm level. Further, the commodity markets are very dynamic both in space and time. Depending on the product needs, you need to change the crop improvement contours to be relevant to meet not only the present challenges but also challenges of the future. Hence, in addition to participatory plant breeding, anticipatory plant breeding is important so as to be relevant to the changes of the future.

You have been helping the ICRISAT sorghum program to make its research objectives, strategy and methodologies more focused and relevant to the needs of India and the rest of the world. Considering this, we at Patancheru remodeled our program with emphasis on post-rainy season adaptation although globally it is the rainy season that gets the highest score.

The ICAR-ICRISAT collaborative projects, HPRC, IFAD, HOPE, NAIP and DBT projects are some of the examples of our partnership sorghum research and tech transfer efforts in recent years. I wish to quote here the work done under the HOPE project in enhancing post-rainy sorghum yields in 25,000 farmers' fields in Maharashtra State, which is now a well-known success story in our partnership impacts. While we push on-shelf technologies, we need to develop game changing products and technologies. I am sure that this two-day field day program will provide you an opportunity to exchange information on the new tools, examine the potential, and relevance of the various products and technologies in sorghum at ICRISAT, and to



bring out the needed focus in sorghum research to achieve the set impact readily at farm level. This also helps you to select the breeding products for use in your programs.

I wish all of you a comfortable and productive stay at ICRISAT and look forward to your inputs and partnership in shaping, sharpening and carrying out the current and future sorghum research agenda. Remember, the science we do should have meaning for the poor in the SAT, and science and development should go hand-in-hand to win the war against hunger and poverty, and we must win this war.

Ladies and gentlemen, once again I welcome you all to ICRISAT, wish you much success, and hope that you will have a memorable stay on our campus.

Thank you and good morning to all!





Biotechnology: An Ethical and Moral Imperative



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Distinguished participants, friends, ladies and gentlemen, good afternoon!

It is a pleasure to be associated with the Research and Information System (RIS) for Developing Countries and other partners including DBT and DST, for this 'Sixth Asian Biotechnology & Development Conference'.

This is a very timely conference for three reasons: 1. there is tremendous progress that has been made in the field of biotechnology in recent years; 2. the current environment of uncertainties on the deployment of this technology; and 3. the pressing need to produce more but nutritious food. Moreover, due to the far-sightedness of the organizers of this conference, the timing is just right when the whole world is sitting in Hyderabad, trying to address the issues of biodiversity and harmonize the global use of this futuristic technology.

*Valedictory
Address, 6th Asian
Biotechnology
and Development
Conference,
7 October
2012, HICC-
HITEX Complex,
Hyderabad, India.*

Several crises confront agriculture today. These include warming temperatures, drought, floods, increasing land degradation and desertification, loss of biodiversity, rising food prices, zooming energy demand and population explosion, that are creating extreme challenges. Their confluence, if unabated, will lead to a “perfect storm”! ICRISAT is a global research-for-development institution dedicated to help and serve smallholder farmers and the poor in the dryland tropics of Asia and Africa. We work on, and improve, the productivity of five crops namely, pigeonpea, chickpea, groundnut, sorghum and pearl millet. We also have a socio-economics program, and a program on resilient dryland systems. We use the power of science using modern tools to improve our crops for the poor.

Plant genetic resources are essential components to meet future global food and nutritional security needs. These hold potential to increase world food production on existing agricultural lands. We need to increase food production at the level of 70-100% to support the dietary requirements of 9 billion people by 2050. The most promising technological strategy at this time is to integrate the best of conventional crop improvement technologies and the best of biotechnology applications. Biotechnology in general, and transgenic technology in particular, offers a powerful tool for crop productivity enhancement, not only in terms of quantity, but also in nutritional quality. This can, not only save lives, but also help farmers adapt to climate change, and in the process generate social, economic and environmental benefits for resource-poor farmers.

Plant biotechnology has the potential to move agriculture from a resource-based to a science-based industry. ISAAA in its report for 2011 highlighted that 16.4 million farmers from 29 developing countries are already planting genetically modified crops on 160 million hectares. More than 90% of these farmers are smallholder farmers.

ICRISAT is using biotechnology/transgenic technology on a needs basis, especially for constraints that cannot be easily addressed due to the lack of available germplasm resources for specific traits. We believe that the sustained growth of agricultural biotechnology needs, among other things, science-based regulatory decisions. Since scientific advances are opening new avenues for biotechnology applications, risk assessment and biosafety research should be essential inputs in our decision making process.

We will proceed with this revolutionary science with caution, giving utmost importance to introducing biosafety measures from the initial stages of research and by following a precautionary approach during the entire product development. In this regard, RIS along with its partners has built a strong global capability and position over the years covering several key issues confronting agricultural development including food security, economic contributions of biotechnology, trade and IPR-related issues, the implementation of biosafety protocols, and most importantly, the role of public-private partnerships. At the heart of all this is how



to bring the benefits of biotechnology to small farmers and economies, that is very close to ICRISAT's strategic framework of Inclusive Market-Oriented Development.

There are new and exciting developments in biotechnology that are helping the developing world meet the demands for a safe, sustainable food supply. What we should focus on is to harness ways in which we can do a better job of using this science, and have a better understanding of the benefits that it brings. While biotechnology is a valuable tool in eliminating global hunger, poverty and malnutrition, and it is a strategic weapon in winning the next Green Revolution, let us harness biotechnology with due regard to consumer and environmental safety.

I would highly suggest that on top of the recent advances of biotechnology which have been remarkable, RIS should consider a systematic and sustained effort in communicating and marketing the biotechnology work of public institutions including that of the work that we do with the private sector. We will not succeed in developing and deploying GMOs if the public at large is not part of the process and will not support us in all our endeavors.

I am sure that the deliberations of this conference will be pointing us in that direction. I congratulate RIS and its partners in the successful conduct of yet another important chapter in their series of conferences.

Thank you and good day!







The Urgency of Crop Improvement Using Biotechnology



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A very good morning and a warm welcome to ICRISAT!

I am glad to see old friends Dr RR Sinha, Senior Adviser, DBT; Professor PK Gupta, Chairman of the ACIP Task Force; and several other eminent scientists.

These days, Hyderabad is the cynosure of the global discourse on biodiversity. Despite a lot of critics and nonbelievers, modern biotechnology including marker-assisted breeding, tissue culture, transgenic crops and genomics, are all quite useful for conserving biodiversity in many ways.

Plant biotechnology in fact is crucial in the farming of crops with multiple durable resistance to pests and diseases, particularly in the absence of pesticides. We are using marker-assisted selection and transgenic technologies to assist in the development of high yielding crops, which will be needed to feed the world and save land for the conservation of plant

*Address, 8th Meeting
of the Expert
Committee on
Accelerated Crop
Improvement
Program,
Department of
Biotechnology,
Government of India,
11 October 2012,
ICRISAT-Patancheru
502 324, Andhra
Pradesh, India.*

biodiversity in natural habitats. High quality crops with improved nutritional and health characteristics could also be developed using biotechnology to help avert a looming “perfect storm” brought about by climate change, land degradation, loss of biodiversity, food and energy crises, and a population explosion.

Thus we find it most opportune that the Department of Biotechnology of the Government of India has chosen ICRISAT to organize the 11th Task Force Meeting of the Accelerated Crop Improvement Program (ACIP). ICRISAT’s collaborative experience with the Department of Biotechnology, Government of India, has been very productive. We can cite the Center of Excellence in Genomics (CEG) headed by our energetic champion, Dr Rajeev Varshney; and the molecular breeding on chickpea, amongst several others. I should also recognize the role and contribution of DBT to establish PTTC at ICRISAT. These projects and initiatives have been very useful for accelerating biotechnology research with potential applications.

Let me emphasize the importance of our biotechnology work at ICRISAT. On the one hand, PTTC has been engaged in transgenic research in our mandate crops and is ready for translating transgenic research in crop improvement. Similarly in the area of molecular breeding, ICRISAT has been engaged in mapping of QTLs and genes for traits of interest. In some cases, molecular breeding products have also been generated. ICRISAT is proud to have developed the first MAS-bred project in any crop species in India in the form of HHB 67- Improved pearl millet hybrid. I understand that under ACIP, our ICRISAT scientists are also making good progress in the molecular breeding of chickpea. ICRISAT has been engaged in similar activities in chickpea for drought tolerance through the Bill & Melinda Gates foundation and DBT.

However, while some centers in the NARS today are able and equipped to undertake molecular breeding, there are many NARS partners who are still not ready to deploy molecular markers in their breeding programs. We need to work on two major issues here. One is related to bringing down the high genotyping costs and the other issue is expert development and availability. The CEG provides genotyping services on a cost-to-cost basis and also conducts training courses for staff development. We fully appreciate DBT’s support in this initiative and the cooperation of senior scientists from India. We have to do more to encourage molecular breeding applications in a range of crops in India.

Biotechnology certainly holds a lot of promise but only when we put urgency and importance in the work we do in crop improvement can we hope to avert the perfect storm and produce enough to feed the world.

In the end, I would like to wish all the Task Force members and scientists engaged in 7 different network projects a successful review.

We hope that you will have a pleasant and memorable stay at ICRISAT!





Sharing CGIAR Research Data and Information with Stakeholders: Opportunities and Challenges



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Distinguished speakers, colleagues from CGIAR Centers, CGIAR partner organizations and institutes all over the world, ladies and gentlemen, good afternoon!

I have been asked to address a question, "What are the most important opportunities and challenges the CGIAR faces in sharing research data and information with its stakeholders?"

Let me provide you some insights, discussing the challenges first and then the opportunities. In the end, I will show a solution or framework for CGIAR to better handle research data and information sharing with its stakeholders, based on Open Access principles, the recommendations of Enabling Open Access Scholarship, and the experiences of ICRISAT and other CG partner institutes.

*Discussion Paper,
GCARD-2012 Second
Global Conference
on Agricultural
Research for
Development,
31 October 2012,
Punta del Este,
Uruguay.*

CGIAR and its research data, information and knowledge

The CGIAR Centers and partner organizations have been engaged in research for a food-secure future for around 40 years now and continue to generate research data and knowledge in the form of knowledge outputs and datasets. The most important knowledge output of CGIAR institutes is our research findings that end up as articles in peer-reviewed journals or in conference proceedings.

Data is an important object which is an integral part of the scientific record. Agricultural research today is extremely data intensive. Except for the representative datasets, a great deal of data has become detached from the published conclusions (reported as journal articles) that depend upon it. Most of the data and datasets generated from CGIAR research programs are either buried in scientists' systems (files, personal computers, etc.) or in other storage devices.

The knowledge outputs and research data are very valuable as International Public Goods (IPGs) and can be seen as long-term assets of CGIAR. If CGIAR centers do not make these knowledge outputs and research data available to their intended end users, they will fall short of their immediate responsibility to share research outputs with their ultimate stakeholders: the smallholder farmers, National Agricultural Research Systems, NGOs, CBOs, private agricultural companies, food processors, and all those who are interested in utilizing these knowledge outputs.

What is happening?

Today, much information in peer-reviewed journals remains inaccessible behind toll-based access or subscription fees. Furthermore, these journals do not have space for publishing full datasets and this did not emerge as a norm. As a consequence, data generated in agricultural research laboratories became private preserve and inaccessible.

On the other hand, voluminous data and knowledge outputs are being produced by today's agricultural research programs and the new digital opportunities for collecting, storing, manipulating and transmitting data and knowledge outputs have opened up new avenues for sharing and dissemination.

One such digital opportunity is the Open Access (OA) platform. OA is the practice of providing unrestricted access via the Internet to peer-reviewed scholarly journal articles. Theses, scholarly monographs and book chapters are also increasingly openly accessible. Open Access benefits the whole world of science. It enables the free flow of research information between north and south, east and west, helping research to progress much more effectively. In 2009 ICRISAT adopted formal open access mandate and ran its OA institutional repository. Today, it houses more than 5,700 research documents which include peer-reviewed journal articles, conference

papers, theses, monographs and a few other types of documents produced by ICRISAT scientists.

This repository complies with international open access standards and easily forms part of global indexing services viz. Google, Google Scholar, Bielefeld Academic Search Engine, OAlster, AGRIS etc. This repository has considerably enhanced the visibility of research done at ICRISAT. From May 2011 to October 2012, the repository has witnessed more than 144,000 downloads from more than 70 countries. The repository counts at least 6,000 unique visitors every month and on an average 300 downloads every day. It acts as a digital showcase of knowledge products of ICRISAT and provides an easy interface for all curious minds to use them and build on.

ICRISAT has recently set up an open data test-bed through *dataverse* platform, an application developed by Harvard University. The test-bed holds data generated from more than 40 studies as of now. We have started the process of discussions to reach institution-wide consensus on sharing data and designing policies. A special data management taskforce has been set up under the umbrella of our Knowledge Sharing and Innovation (KSI) program.

We have also launched a virtual knowledge series platform – KSI Connect – to enable learning exchanges and knowledge transfers across the globe. Through KSI Connect, ICRISAT highlights the most interesting projects, the most cutting-edge research, and the most fascinating stories at ICRISAT to both in-house and global audiences. This platform also allows experts across the globe to share their project experiences and cutting-edge research activities contributing to global food security.

Several challenges were experienced along the open access highway and foremost of these challenges are:

1. Effecting **cultural change** to encourage and motivate scientists to share datasets and knowledge outputs;
2. Crafting **institutional policies and strategies** that foster availability of quality-controlled research results (in the form of research papers and other outputs) for the broadest possible range of users, and maximising their visibility, accessibility and scientific impact; and
3. Developing clear **incentive mechanisms and exposure** to new approaches, methods and tools.

I have shared some experiences from ICRISAT and strongly believe it is high time all the CGIAR centers should have an institutional repository or actively participate in a shared OA repository. The repositories should comply with globally accepted OA protocols and established and managed according to the best OA practices and strategies to allow interoperability and future networking for wider usage.

ICRISAT and also some sister CGIAR centers have already initiated their efforts to have institutional repositories. However in the light of the new CRP framework we have to think of how we can unify the isolated efforts of the consortium institutions in tackling the critical issues related to global agriculture. The CRPs lay emphasis on collaboration among researchers specializing in different fields to work together in combating broader issues such as climate change, food security and nutritional security. One of the motivating factors for collaboration is to realize the benefits of scaling up research-based innovations on a massive scale.

For CGIAR, it is time to consolidate all our efforts and give a single interface for the data and knowledge products of all CGIAR institutions. Having a CGIAR shared repository with clearly defined strategies, policies and incentive mechanisms indeed allows CGIAR to share research data and knowledge outputs with its stakeholders.

I am happy to share the news that the CGIAR Consortium Office has already developed an Open Access Policy and initiated their efforts in this direction.

Thanks again!





Innovation and Technology towards Climate Resilient Agriculture



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“Food is the biggest consumption category in India with a market size of US\$ 181 billion. With a population of more than one billion individuals and food constituting a major part of the consumer’s budget, this sector has a prominence next to no other business in the country.”

When I read this on your website I could not agree with you more, but addressing you today as a Knowledge Partner of Food 360°, I want to take this discourse beyond India, beyond agriculture being a prominent business sector, to a level where it is a moral imperative to make food accessible and affordable to the poor.

Food is up on the global development agenda these days, and the questions are how do we feed the world in 2050 with 9.2 billion people? How do we cater to the needs of the

*Special Address,
FOOD 360°:
International
Seminar on
Agribusiness and
Food Processing,
5 November 2012,
Hotel Taj Krishna,
Hyderabad, India.*

growing urbanized population who enjoy improved incomes and changing food preferences? More importantly, how do we ensure that the larger, impoverished slice of the population also have access to food that is affordable and nutritious?

Tremendous pressure is upon agriculture to produce more food by as much as 70% by 2050. The pressure is compounded by several crises confronting agriculture today. These include warming temperatures, drought, floods, increasing land degradation and desertification, loss of biodiversity, rising food prices, zooming energy demand and population explosion. Their confluence, if unabated, will lead to a “perfect storm”!

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is part of the CGIAR system of 15 international agricultural research institutes, and we are committed to make agriculture climate resilient, particularly in the semi-arid tropics, and responsive to global requirements. Together with our partners, we are leading this battle on various fronts of innovation and technology utilization:

- (1) We scour the world for genetically-diverse types of our five focus crops that we then use in plant breeding to improve crop productivity and tolerance/resistance to diseases, insects and environmental stresses;
- (2) We develop and roll out science-led interventions, like the ICRISAT Bhoochetana project in Karnataka, to provide workable solutions to stagnant agricultural growth through sustainable use of natural resources, improved crop management practices, and a strengthened delivery system;
- (3) We design and adopt crop value chain approaches through agri-business incubation and innovation platforms, public-private partnerships and collective farming methods. We believe these are key to link farmers with markets,



financial institutes and end users thereby gaining maximum socio-economic benefits;

- (4) We maximize the use of information and communication technologies which are increasingly more crucial to enable farmers and other stakeholders to take appropriate decisions; and
- (5) We conduct village level studies to inform and influence market dynamics, policies and institutions to support smallholder agriculture.

We do all this in consonance with our institutional strategy of Inclusive Market-Oriented Development (IMOD) to enable smallholder farmers and the poor, particularly women and youth, to participate, rather than be sidelined by the development process. In this manner we will promote “resilient development” in order to make smallholder agriculture increasingly productive, linked to commercial markets, sustainably implemented, and resilient to shocks, especially climate change. This also leads us to understand that the agricultural research-for-development community must become more effective in scaling-up innovations for wider impact, and must learn faster in a world in which knowledge is advancing at an ever-accelerating pace.

ICRISAT is glad to have partnered with FCCI on many initiatives particularly in this edition of Food 360° with the theme ‘Seeding success through innovation and technology’. Jointly and severally, we are bringing forth ways and means to promote agri-business and food processing especially benefitting and empowering the smallholder farmers and entrepreneurs, thus enabling inclusive market-oriented development.

We thank FICCI for involving our Institute as a Knowledge Partner in this undertaking. I am sure that the conference shall provide all the stakeholders with an understanding of the important prerequisites, mechanisms and technologies required to establish an adaptive agricultural innovation system, one that will seed success through innovation and technology, and ultimately benefit the smallholder farmers and the millions who depend on the sector.

With that, I wish you all a meaningful day and more power to FICCI!





The Soul of Agriculture is in the Village



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Good morning, ladies and gentlemen, and welcome to ICRISAT where science works with a human face!

It was Mahatma Gandhi, the Father of India who said at the beginning of the 20th century that “the soul of India lives in its villages”. The demographics bear him out even today when 69% of Indians or around 833 million people live in 640,000 different villages. On the other hand, neighboring Pakistan has and continues to urbanize at a faster pace than India. From 1995-2025, the UN forecast says Pakistan is urbanizing from 35% to 60%, while India’s forecast is 26% to 45%. For this year, a little over 40% of Pakistan’s population lives in the cities compared to India’s 31%.

In China, 691 million people – 51% of China’s total population of 1.3 billion – today live in urban areas. You wonder who will take care of feeding the Chinese urbanites. The answer? Some 600 million who still live in the villages! An expected

*Welcome Address,
Third Annual Review
Meeting, Village
Dynamics Studies in
South Asia (VDSA),
Tracking Change
in Rural Poverty in
Household and Village
Economies in South
Asia, 7 November
2012, ICRISAT-
Patancheru 502 324,
Andhra Pradesh, India.*

positive consequence of the increasing urbanization of society in Pakistan will be the creation of an over 100 million strong middle class by 2030. This large urban population will not only create a domestic market for goods and services, but it can create a skilled work force that can be the engine of economic growth and a source of innovation for the country.

In India, could the increase in urban migration be driven by the collapse of millions of livelihoods in agriculture and its related occupations? Massive migrations have gone hand-in-hand with a deepening agrarian crisis: more than 240,000 farmers, mostly broken by debt, committed suicide in India between 1995 and 2009. These are appalling and disturbing statistics. But I hope they bring home the point that what you are doing today, piecing together an understanding of the dynamics of poverty and well-being over the long term, is so relevant and meaningful. This is, as a matter of fact, the very essence, the core of research for development.

One of the *Jewels of ICRISAT* is precisely our Village Level Studies. These are revitalized by your 'Village Dynamics Studies in South Asia (VDSA): Tracking change in rural poverty in household and village economies in South Asia'. You provide quantitative evidence on long-term poverty dynamics and its determinants. You make it easier for policy makers and international development funding institutions to determine where to invest their resources and how.

As you enhance the availability of reliable data you actually give a voice to the poor and forgotten. You will speak their language and preach that the soul of agriculture remains in the villages.

I have just returned from the Second Global Conference on Agricultural Research for Development (GCARD2) at Punta del Este, Uruguay, held from 29 October to 1 November 2012. GCARD2 focused on the ways to implement the tasks identified in the GCARD RoadMap with special attention to 'Foresight and partnership for innovation and impact on smallholder livelihoods'.

What you do in this project relates very closely to the GCARD2 tasks of foresight by:

- Improving stakeholder engagement and diversity (including women and youth);
- Developing metrics for foresight impact;
- Outlining a plan of action for sustainable production and consumption patterns; and
- Solidifying and coordinating global action with action at the national and subnational levels.

We must learn to "shout from the rooftops" the results of our Village Level Studies. As part of ICRISAT's *Jewels*, these international public goods have value only if they are shared as broadly as possible, consistent with CGIAR's Intellectual Assets

Principles and directive to open and free access to all CGIAR research results.

We must also pursue the impact assessment study on VLS to look at the benefits that have been derived all these years.

I thank each and every one of you for coming to participate in this program and contributing to its success. I thank our partners in this endeavor.

My wish is that you find satisfaction in your work and that you strengthen your network and your commitment to serve the poor in the semi-arid tropics.

Thank you!







LIVES: Reaching and Enriching Lives



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Good morning, ladies and gentlemen, and a warm welcome to ICRISAT!

Now I would like a show of hands here. How many of you learned about the results of the US presidential elections through television? The newspaper? The Internet? Your mobile phone?

It is amazing how news travels so fast these days across the world, thanks to the information and communication technologies (ICTs) which have revolutionized the way we live. They have totally transformed the way we communicate with the outside world.

Of the ICTs, however, it is mobile telephony which has undergone a sea change in the last 5-10 years. In India it has already touched over a billion connections. The popularity of mobiles even in the hinterlands has provided solutions to the age old challenges of "last mile connectivity" and "reaching the unreachable". As my friend and mentor Professor MS Swaminathan said, "mobile telephony is truly a transformational technology impacting everyone".

*Chief Guest, LIVES
(Learning through
Interactive Voice
Educational
System) Project
Inauguration,
9 November 2012,
ICRISAT-Patancheru
502 324, Andhra
Pradesh, India.*

Poor and marginal farmers not only lack resources but also have little or no access to information. They are poor and so cannot afford access to information, and because they have no access to information they remain poor and marginalized, trapped in a vicious cycle of underdevelopment.

Thanks to the new ICTs and the enabling policy environment, mobiles have become very affordable even to the marginal farmers in many poor countries in Asia and Africa. This will help in removing the digital divide and empowering the poor in the truest sense. It will act like a great leveler, bridging the gap between the rich and the poor, the literate and the illiterate. This empowerment will also help in achieving the inclusive growth everyone is talking about. I strongly believe that mobiles will play a major role in ushering a revolution in all fields including agriculture and rural development.

Mobile for Development (M4D) is a major interest among international development organizations today. ICRISAT was among the first to actually deploy novel M4D approaches on a reasonable scale in 2009 to 2010. Today ICRISAT is associated with another ongoing National Agricultural Innovation Project (NAIP) of the ICAR, wherein mobile technology is at the center of agricultural extension. The project has been implemented as a pilot in selected states involving over 30 Krishi Vigyan Kendras (KVKs). Through the platform, dubbed as the Virtual Krishi Vigyan Kendra (VKVK), the project has served over 25,000 farmers who now regularly receive crop advisories – on best practices, market, weather, insurance, etc – as voice messages over their mobile phones. This is a major and a successful trial in the field of agriculture and is unprecedented in scale and innovation.

The challenge now lies in the application of mobiles for educating farmers who cannot read and write. In the context of climate change and globalization of trade, there is a need for launching a genetic (relating to genetically modified farm products), legal (IPR and farmers' and breeders' rights), quality (sanitary and phytosanitary measures and Codex Alimentarius standards), trade (prices in home and external markets), and the climate (climate smart agriculture) literacy movement. We need to give special thought to this aspect.

ICRISAT and the Commonwealth of Learning (COL), Canada, have enjoyed working together as partners for many years and it is such a pleasure that we are inaugurating today this project on LIVES (Learning through Interactive Voice Educational System). The LIVES project enables us to send voice educational messages to illiterate and semi-literate farmers and educate them on several agricultural matters to enhance their production and productivity thereby bringing change in their socio-economic status. We are happy to work with very credible NGOs such as Mann Deshi Foundation and Vidiyal and UAS-Raichur. We also thank our partners KVK-Mahbubnagar; DOR, Hyderabad; and ILRI.



I am truly encouraged by your collaboration as you integrate the use of learning platforms for the co-generation of knowledge. This is right along the path of the task of partnership as espoused by the Second Global Conference on Agricultural Research for Development (GCARD2) which I recently attended in Punta del Este, Uruguay.

I thank you all for coming to this event and I wish the workshop and the project much success!







Creating Opportunities for Agri-business Ventures in Emerging Markets

Sa-wat-dee!

Respected dignitaries, our distinguished guests, the Organizing Committee members, ladies and gentlemen, good morning!

On behalf of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), I would like to thank the organisers – the Thai Business Incubators and Science Parks Association (Thai-BISPA), the Asia-Pacific Business Incubation Network (APIN) and *infoDev* of the World Bank – for organizing this conference for promoting agri-business ventures in the ASEAN region. I am honored to be here to deliver the inaugural address on ‘Creating opportunities for agri-business ventures in emerging markets of the world’.

*Inaugural Address,
Regional Conference
and Workshop on
Co-incubation and
the Opportunities
for Food and
Agriculture Start-
up Businesses
after ASEAN
Integration in
2015, 29 November
2012, Swissotel Le
Concorde Hotel,
Bangkok, Thailand.*

Entrepreneurship plays a critical role in the development and well-being of societies around the world. It creates jobs, drives and shapes innovation, and brings in competition which in turn improves productivity. An entrepreneurial venture generates employment and income for the local economy, allows for application of new technology, and brings in changes to lifestyle leading to more value creation across other sectors. Entrepreneurship thus acts as a catalyst supporting the growth of the economy and national competitiveness. Formal SMEs contribute up to 45% of employment and up to 33% of the GDP in developing economies.

Today, the agricultural sector is facing serious threats in the form of climate change, energy crisis, food crisis, land degradation, loss of biodiversity and population explosion. It is a recipe for a “perfect storm”, one that could lead to widespread food shortages and public unrest over the next few decades. Agricultural productivity, especially in developing countries, continues to decline, affecting food production quantity, price and returns to the farmer-producer. Scientists predict that we will experience increased frequency and severity of droughts across the globe. The past years have seen increasing volatility in food prices with severe impacts on the world’s poor; according to the World Bank, 44 million people have been forced into extreme poverty by food inflation since June 2010. The persisting international financial crisis will affect government investments in the agricultural sector.

Therefore the farming community, which is mostly composed of small and marginal farmers, remain the most vulnerable in this scenario, getting poor returns for their produce at a time when the cost of cultivation has gone up.

We therefore need to develop sustainable strategies to address these challenges and find solutions for feeding the world population in 2050 which, as per FAO projections, will reach 9.2 billion. Given the precarious situation, how will we develop solutions to get that 70-100% increase in food production to maintain the same, if not improved, dietary standards? In the short term, how do we cater to the needs of the growing urbanized population who enjoy improved incomes and changing food preferences? More importantly, how do we ensure that the larger, impoverished slice of the population have access to food that is affordable and nutritious?

We need to accelerate agricultural growth and the way forward is to foment an entrepreneurship climate in the sector. Agriculture and allied sectors should be seen as a business entity, and should veer away from the traditional, subsistence mode of operations. Modernizing the agro-food system can be a strong engine for direct and indirect growth and poverty reduction, while nurturing an ecosystem for innovations in the sector. This will enhance agricultural productivity, raise demand for industrial goods, lower food prices, and curb inflation. It will also encourage broad entrepreneurial activities, such as diversification into new products, the growth of rural service sectors, emergence of agro-processing industries, and expansion into new markets.

At ICRISAT, we share the vision of a prosperous, food-secure and resilient dryland tropics with our partners all over the world and are committed to make agriculture climate-resilient and responsive to global requirements. As a member of the CGIAR Consortium, we are committed to help empower the poor people of the semi-arid tropics to overcome poverty, hunger and a degraded environment through our agricultural research-for-development (AR4D) activities.

We believe that through our Inclusive Market-Oriented Development or IMOD approach, we will be able to stimulate agro-enterprises to raise rural incomes and to create opportunities beyond agriculture. We must remember that effective access to markets provides surplus cash to enable the poor to break out of the poverty-hunger trap. IMOD is the cornerstone of our Strategic Plan to 2020 and the way we do research at ICRISAT. While the broad goals remain, we now strive to develop technologies that are more oriented towards the needs of the market, which can be taken up by farmer entrepreneurs.

However, entrepreneurship always has risks associated with it. The risks are even higher in agriculture-based ventures, given the variables at play in the sector. This is where business incubators play a crucial role, in providing a nurturing ecosystem for the growth of the venture. Worldwide, business incubators are now gaining recognition as vital to agricultural and industrial business sectors, where technology serves as a precursor for improving the economic, social and environmental conditions especially of rural communities.

Our Agri-Business Incubation (ABI) program was started in 2003, with the support of the Department of Science & Technology, Government of India, and was the first agri-incubator in the country. ABI, which is one of the components of our Agribusiness Innovation Platform (AIP) has now emerged as a champion in nurturing and incubating agricultural technologies and innovation, and is a model for facilitating the creation of competitive agri-business enterprises through technology development and commercialization. At ABI, we do this by adopting a dual mode. The Service strategy involves nurturing technologies and innovations on seed, biofuel, farming systems and agricultural biotechnology, while the Outreach strategy involves partnering with institutes/organizations globally. This dual mode promotes agri-business ventures and enhances technology commercialization through co-business incubation.

To date, ABI has commercialized 72 agro-technologies, supported 256 business ventures, mobilized \$18 million investment for ventures, generated direct employment for 832 individuals, introduced 82 products in the market, and benefitted over 500,000 farmers.

ABI has also been instrumental in scaling up the agri-business incubation program in the Indian National Agricultural Research Systems (NARS). The Network of Indian Agri-Business Incubators (NIABI) is a World Bank-aided project from the Indian



Council of Agricultural Research (ICAR), which consists of 10 Business Planning & Development (BPDs) units or agri-business incubators set up across the country. ABI has been entrusted with the responsibility of handholding and mentoring these BPDs to make them successful and self-sustainable. Through NIABI, we have been able to scale up our incubation support services to budding entrepreneurs, through co-business incubation for technology transfer, building agri-business synergy in India, and have facilitated commercialization of innovative agro-technologies in different agricultural sectors, thereby benefitting smallholder farmers.

ABI has been able to promote agri-business incubation into Africa also with its recent partnership with the Forum for Agricultural Research in Africa (FARA). FARA has setup a unique business incubator model known as the Universities, Business and Research in Agricultural Innovation (UniBRAIN) project, which involves six value chain agri-business incubators in five countries in Africa. Here also, ABI is providing handholding and mentoring support, and through co-business incubation is engaged in technology transfer from Indian NARS to Africa. Meanwhile, the Ministry of Food Processing Industries (MFPI) of the Government of India is also planning to set up five food processing business incubators in Africa with ABI as the implementing agency. This shows the capability of ABI and the recognition that agri-business incubators and agri-business ventures are the way forward in addressing the challenges faced by the sector and in achieving the targeted outputs from the sector.

Co-business incubation activities play a vital role in promoting agri-business ventures in the global village. It will be a vital aspect of the incubator as it allows a two-way channel: firstly, in terms of commercializing agro-technologies from the R&D units to another regional/national/international market; secondly, it allows start-up ventures to access new markets, resources and networks through partner incubators in other regions/countries, thereby helping it to scale up and sustain.

With ASEAN Integration by 2015, the ASEAN bloc will become one, allowing for free flow of trade, services and labor. For start-ups, the ASEAN Integration will mean more regional cooperation and improving scale efficiencies, dynamism and competitiveness. It will offer new ways of coordinating supply chains, or access to new markets for established products. The potential for more foreign investments into the ASEAN Bloc will be high which will benefit SMEs to a large extent. All this will invariably spur the growth of more agri-business ventures as opportunities open up when markets and resources get integrated.

For agri-business incubators, this integration offers the chance to promote innovation and entrepreneurship amongst youth and aim to achieve more sustainable agriculture development in the region. With regional integration, incubators through co-business incubation mode will be able to leverage each

other's network in sharing of technologies and promoting agri-business ventures into new markets. However, systems and processes need to be in place to maximize the co-incubation potential of the incubator.

Indeed, partnerships hold out the greatest hope of finding solutions to the challenges we face. To that end, our ABI program has already initiated a Global Agri-Business Incubation (GABI) network at the 2nd Global Agri-business Incubation Conference which took place in February 2012. GABI with its current partners of MARDI of Malaysia, SEEDS initiative of Philippines, REN of Sri Lanka, FARA-UniBRAIN of Africa, and ICAR and ICRISAT from India was formed with the objective of promoting globally competitive, rural based agri-enterprises.

By leveraging the strengths of the partners, GABI aims to create an enabling environment for agri-business incubation supporting smallholder farmers and rural youth; encourage bilateral and multilateral development partners to support efforts to bring in private sector involvement in the agricultural value chain; and also to encourage local and regional agri-business networks to improve the ease of doing agri-business. GABI needs to be nurtured and can be further strengthened by bringing in more partners especially from the ASEAN bloc, given that agriculture plays a vital role in the development of the economy in the region.

An inclusive market-oriented development approach that promotes sustainable development in the sector and improves the livelihoods of the millions that depend on it requires us to work together more effectively.

The survival of one billion people – the weakest and most vulnerable on the planet – depends upon us finding answers to hunger now. The future of 9 billion plus people depends on us putting in place the right technologies, policies, systems and approaches to deliver food security in an environmentally sustainable manner within a few decades.

I hope that this conference will create partnership opportunities that will take us one step closer to the realization of a food and nutrition secure world, where we will be able to reduce poverty, and enhance the quality of the environment, at the same time, empowering the farming community to adopt technologies that enhance their returns from the sector and eventually become self-sufficient.

Thank you!





Innovative ICT and Knowledge Sharing Platforms: Opportunities and Challenges



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Distinguished speakers on the dais, colleagues from NARS Centers and other partner organizations, ladies and gentlemen, good morning!

Information and Communication Technology (ICT) innovations in linking research-extension-education-markets for agriculture and rural development are a major interest among various development organizations today. But this is the first time an Agriculture or ICT for agriculture workshop/consultation is happening in a technology institute, an esteemed partner organization at that. We launched a new initiative – the Center of Excellence for ICT Innovations in agriculture – during the 40th Anniversary of ICRISAT in September this year in which Infosys and ICAR are initial partners. So soon after that, I am happy to see this consultation and it certainly is a good way to start collaborative activities.

*Welcome Address,
Global Consultation
on Innovative ICT
and Knowledge
Sharing Platforms
for Revitalizing
Agricultural Extension
and Education:
Opportunities and
Challenges, 3-4
December 2012,
Concept Hall, Infosys
Campus, Hyderabad,
India.*

I am also welcoming colleagues from other organizations participating in this event - IFAD, GFAR, MANAGE, NAARM, CRIDA, CSC, CABI, Digital Green, CDAC, Thomson Reuters Market Light, ITC, DAI ICT, ACRC, TNAU, Agricultural Today and others – to join hands with us in transforming our big ideas into reality.

I am also very pleased to see the “International Education Center”, which we initiated together with the University of Florida and consortium, graduating to a “Global Education Platform”. I sincerely believe this will allow more universities from India, Africa and USA to participate in enabling tri-lateral educational programs for enhancing capacities of faculty members, students, extension agents, private sector individuals and farmers both in developing and developed nations.

Let me take this opportunity to share ICRISAT’s experiences in applying ICTs for Agricultural Extension and Education.

ICRISAT began its work on ICT innovations and knowledge sharing platforms in the late 1990s. Over time, ICRISAT together with partners has developed and sustained many ICT innovations to provide access to ICRISAT research data and knowledge outputs to its stakeholders – smallholder farmers, National Agricultural Research System (NARS) partners, NGOs, CBOs, private agricultural companies, food processors, and all those who are interested in utilizing these knowledge outputs in the quest for a food-secure future.

The first project of ICRISAT started with computers and the Internet through village knowledge centers with up-to-date knowledge on best farming practices, eg climate adaptation methods, crop rotation, diversification and pest management for smallholder crops, such as millet or sorghum. We carried out these experiments in the poorest, drought-prone regions of South Central Asia and sub-Saharan Africa. Although the work introduced a new mechanism to transfer technology packages more effectively and efficiently from laboratory to farm to the broadest number of farmers, computer mediated models still have limitations in reaching out to the less privileged and less endowed regions – and in some cases failed to establish the last mile connectivity.

The advent of mobile technology has addressed a greater array of earlier ICT platforms’ last mile connectivity issues – infrastructure, connectivity, training needs, literacy issues etc., and revolutionized the way we live. ICRISAT’s work on mobile for development is a major and a successful trial in the field of ICT for agriculture and rural development. It is unprecedented in scale and in innovation. The platform enables expert-farmer-expert communication through mobile-mediated voice interactions in three ways: Expert to Farmer, Farmer to Expert, and Expert to Expert. The project is currently serving nearly 20,000 farmers in the South India region through Krishi Vigyan Kendras (Farmer Knowledge Centers) that are regularly receiving useful and timely crop advisories as voice messages over their mobile



phones and plans are underway to replicate and expand this model in other parts of the world.

As a next move, ICRISAT initiated projects with tablets/ phablets/handheld ICT devices to go beyond providing agro advisory to provide quality inputs and market access along with agro advisory through virtual transactions facilitated by info-entrepreneurs. Our ongoing pilot project aims at creating efficient ways for more input technology companies to compete in this sector, thus broadening the availability of quality inputs along with agro advisory and market access at the doorsteps of smallholder agriculture.

We envisage the pilot project outcome to provide more insights to create a framework that will lead to a self-sustaining, locally led set of economic activities to lift smallholder farmers to a higher plane of knowledge and productivity. The framework is expected to create a “backbone communication network” that will improve the quality and convenience of information (crop, market, weather and user’s choice, etc.) dissemination to smallholder farmers and transparency within value chains. I sincerely hope the outcome of this consultation on sub-theme 1 – ICT for Agricultural Extension – will bring more useful inputs to fine-tune this framework further.

How we apply ICTs in Agricultural Education is equally important. In yesteryears, these capacity building and knowledge transfer activities were conducted through residential, face-to-face mass training and education. This approach, although effective, was costly and had limited reach and follow-up opportunities. Moreover, changing lifestyles and learner needs demand a more innovative and efficient access to appropriate information, knowledge, and skills. The new approach to capacity building envisions a world in which all stakeholders can easily access and share the information, knowledge and skills they need – anywhere and anytime – in a cost effective manner.

This is where we see ICTs play a predominant role. The International Education Center initiative together with the University of Florida and consortium partners is a big success in organizing short courses and offering degree programs. I am glad this is growing further and enrolling more institutions through the Global Education Platform.

Let me also highlight other important ICT for Agricultural Education initiatives of ICRISAT.

Open Access Repository (OAR) - <http://oar.icrisat.org/>, KSI Connect - a Virtual Knowledge Series platforms - <http://23.21.178.168/>, and now AgED Open Courseware of ICRISAT enable learning exchanges and knowledge transfers across the globe.

1. ICRISAT's OAR platform houses more than 5,700 research documents, which include peer-reviewed journal articles, conference papers, theses, monographs and a few other types of documents produced by ICRISAT scientists. OAR complies with international open access standards and easily forms part of global indexing services viz. Google, Google Scholar, Bielefeld Academic Search Engine, OAlster, AGRIS etc. The Open Access Repository has considerably enhanced the visibility of research done at ICRISAT. From May 2011 to October 2012, the repository has witnessed more than 144,000 downloads from more than 70 countries. The repository counts at least 6,000 unique visitors every month and on an average 300 downloads every day. This repository acts as a digital showcase of knowledge products of ICRISAT and provides an easy interface for all curious minds.
2. Through KSI Connect, ICRISAT highlights the most interesting projects, the most cutting-edge research, and the most fascinating stories at ICRISAT to both in-house and global audiences. This platform also allows experts across the globe to share their project experiences and cutting-edge research activities contributing to global food security.
3. The AgED Open Courseware brings research-infused curriculum for enhancing the capacities of students, faculty members, extension agents, etc.

Although there are several good initiatives we will only be able to see the real impact once we have wider outreach with greater convergence. This two-day consultation is timely so as to get insights and inputs from domain experts, policy makers, tech developers, and value chain experts to allow us to scale-up and create a larger impact. Further it will help to define direction and scope for both potential programming and consortia.

With this, I wish the organizers and all the participants a fruitful consultation. With our dedicated efforts, we can make a difference towards a food secure future.

Thank you!





Developing India's Sorghum Research Strategy for the HOPE Project

Good morning ladies and gentlemen!

I welcome you all to this beautiful campus of ICRISAT-Patancheru. A special welcome to the partners from the public sector, scientists from the Directorate of Sorghum Research (DSR), Mahatma Phule Krishi Vidyapeeth (MPKV), Marathwada Krishi Vidyapeeth (MKV) and University of Agricultural Sciences (UAS)-Dharwad who share the commitment and interest of ICRISAT in enhancing the livelihoods of smallholder farmers in the drylands.

The private sector scientists have been helping ICRISAT in moving the products to the farmers and I welcome them as well to this meeting.

*Inaugural
Address, Meeting
on Developing
Sorghum Research
Country Strategy-
India for HOPE
Project,
12 December 2012,
ICRISAT-Patancheru
502 324, Andhra
Pradesh, India.*

You all know that this meeting is very important in that it helps to give shape to sorghum research particularly in improving post-rainy season sorghums in the context of the HOPE project.

The scientists from DSR, MPKV and MKV helped develop the HOPE project proposal, now in its third year of implementation. With the active partnership of MPKV and MKV scientists in improving the productivity of post-rainy season sorghum in Maharashtra, the project helped to move the improved package of practices and sorghum varieties to over 25,000 farmers in the State.

I am glad to note that the farmers themselves report that the productivity of sorghum with improved interventions increased by 40% and fodder by 30% on average over three years when compared to local practices.

I congratulate the sorghum team and the farmers for this splendid achievement and I hope that this will be sustained and scaled out to other areas. ICRISAT and partners in India and other countries are working on sorghum improvement and over the years have helped realize higher productivity in Africa and Asia particularly of the rainy season sorghums.

Post-rainy season sorghum is unique to India. There are post-rainy sorghum areas around Lake Chad in Africa, but these sorghums are transplanted. By and large, the rainy season adaptation in India corresponds to the main season in several countries in Africa, the Americas and Asia.

Hence ICRISAT has been working mainly on the rainy season sorghums both in India and countries in Africa. Realizing the decreased area in the rainy season in India and increased importance of post-rainy season sorghum for food and fodder, ICRISAT in Patancheru shifted the emphasis in research from rainy season sorghum to post-rainy season sorghum in the last four years.

We know that the Indian program has developed several varieties and improved packages for post-rainy season productivity enhancement but, unfortunately, these have not reached the farmers yet and this has become the main focus of the HOPE project on sorghum in India in the last three years. In addition, ICRISAT enhanced its efforts to develop improved hybrid parents and hybrids for post-rainy season adaptation.

The CGIAR system has undergone major changes in the last few years. It has become a legal entity resting on two pillars, namely, the Fund Council, and the Consortium Board where the 15 Centers are members. There are today 16 CGIAR Research Projects (CRPs) to address the Strategy and Results Framework of CGIAR. ICRISAT is the lead center for two of the 16 CRPs, namely the CRP on Dryland Cereals and the CRP on Grain Legumes.



Overall the objectives and activities of the CRP on Dryland Cereals are to:

1. Utilize the comparative advantage of the centers, and international partners, for access to and implementation of modern breeding methods for crop improvement, including heterosis;
2. Partner with in-country agencies and link with other CRPs to integrate genetic gain within farm-level implementation of optimum farming systems; and
3. Collaborate with other CRPs and other agencies to address wider issues of in-country infrastructure relating to communications, extension, and seed distribution – leading to improved farmer adoption and market access.

The vision of success of Dryland Cereals is to achieve an increase in farm-level crop productivity and total crop production of at least 16% over ten years. In the target geographies of harsh dryland conditions, total grain production will rise by a total of 11 million metric tons to reach a total value of US\$ 20 billion, along with increases in animal feed and fodder with a value of about US\$ 10 billion. These food, feed and financial benefits will flow to about 5.8 million smallholder farms and around 34 million total beneficiaries by way of improved food quantity, quality and security, and through cash income generated by off-farm sales into emerging markets for feed, fodder and specialty processed foods driven by the increased urbanized population.



The success of Dryland Cereals will contribute primarily to three CGIAR System Level Outcomes of reduced rural poverty, improved food security, and improved nutrition and health. In addition, since dryland cereals are already efficient users of soil water and nutrients, the expansion of cereals alone, more particularly in cereal/legume systems, is expected to optimize crop production without undue reliance on artificial nitrogen fertilizer inputs. It will also lead to a balance of increased production while minimizing the risks of environmental degradation to achieve sustainable management of natural resources, especially in view of the projected effects of climate change.

The Dryland Cereals CRP targets sorghum, millets and barley. This project has been approved and all of you are major partners in implementing it. Research on post-rainy season sorghum productivity enhancement is the main focus as far as sorghum in Asia is concerned in the CRP Dryland Cereals. With three years of experience in working with farmers and scientists on post-rainy season productivity enhancement in Maharashtra under the HOPE Project, we now have to clearly focus the research on post-rainy season sorghum and how to expand the sorghum area in India further.

ICRISAT has come a long way since its creation 40 years ago. Working with esteemed partners like you, we have covered some distance in addressing the challenges of smallholder farmers in the semi-arid tropics. We salute all our partners and all of you and other stakeholders who helped us in achieving our mission goals.

Let us make use of this meeting to rededicate ourselves to the cause of smallholder farmers in sub-Saharan Africa and South Asia so as to make a difference in their lives!





From Digital Divide in Agriculture to Digital Opportunities for Farmers



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Information and communication technologies have revolutionized many aspects of the way we live. However, like any new technology, the benefits from using them have been enjoyed mainly by a chosen few – the rich, the literate, and the influential. The poor and the marginalized are left behind. They have no or little access to tools and technologies of information and communication to improve their livelihoods.

Things, however, have started to change in the past decade. And they are changing for the better. With the massive penetration of mobile phones in the recent past, majority of the rural households are now “connected”. With this, many developmental agencies are in a better position to serve the poor and the underprivileged more effectively than ever before.

*Chief Guest,
Inauguration,
Sensitization
Seminar on
Agropedia,
13 December 2012,
ICRISAT- Patancheru
502 324, Andhra
Pradesh, India.*

Many developing and less developed countries have recognized the importance of ICT for development and have started making increased investments in IT infrastructure. In India for instance, the government is implementing the National Knowledge Network (NKN) project to provide gigabyte level connectivity to over 1500 institutes of higher learning. Already over 800 academic institutions have been given high speed connectivity. This is expected to enhance sharing of data and information between organizations and foster collaborative research. According to Sam Pitroda, the Advisor to the Prime Minister on Public Information and the man behind the communication revolution in the country in the 1990s, the NKN will be a game changer, revolutionizing the way we connect, collaborate and deliver. Similarly, through another scheme, broadband fiber optic connectivity will be provided to over 250,000 local governing bodies (Panchayats). Over ₹ 300 billion has been allocated for this ambitious project, which is likely to be completed in 18 months' time. Setting up of over 100,000 common service centers (CSCs) under Public-Private Partnership is already underway. This will serve as a single window delivery point for many services to the public.

The importance given to "Information" by the Government of India can be gauged better, when Sam Pitroda, in his famous press meet over Twitter three months back, called "Information" the fourth pillar of democracy along with the Legislature, the Judiciary and the Executive. In his now famous 'Democratization of Information' talk, he talked about how information brings about openness, accessibility, transparency, accountability, networking and decentralization.

Information is critical for development, hence it should be made readily available to people. There are those, however, who regard information as a source of power and a tool for control and domination and therefore restrict its dissemination.

With about six billion connected people in the world, the challenge is to create a new paradigm for development. It requires innovation, partnerships, new business models, process re-engineering, new products, and new services. It should also take into account the free flow of information and sharing of ideas between people. Investments, infrastructure and technology are very much needed but they will not make much impact if there is no matching participation of the public. Relevant information and applications can only be developed with the participation of the public. It should be for the people and by the people. Mobilizing the public however is the biggest challenge and is not easy to come by. Big changes in the mindset of the people and in the work culture will have to be brought about. Strong leadership and enabling policy guidelines are urgently needed to bring about this great cultural change.

In order to effectively mainstream ICT in the agriculture sector we need to put in place a number of things:

- A conducive policy environment is necessary to foster the use of ICT to enhance rural livelihoods;
- The use of standards and common or compatible systems is beneficial to make information easily accessible for end-users;
- Awareness on the potential impact of ICT on poverty alleviation must be raised;
- Evidence of impact and on-the-ground experiences of ICT pilot projects must be collected, documented, and shouted from the rooftops; and
- Multi- stakeholder networks to bring in experiences of ICT projects and user perspectives from the agricultural sector must be involved.

ICRISAT has been a leader in the area of knowledge management. Quite early on, it realized the importance of digital content and the need of information architecture for content aggregation and management. It became a reality when ICRISAT together with IIT-Kanpur conceptualized and developed Agropedia in 2009.

Agropedia was created under NAIP as an innovative knowledge sharing platform, expected to serve as a one-stop-shop for things related to agriculture. It has been widely acclaimed the world over. It is built on open access, has a digital library and a social networking site, besides other features. ICRISAT and IIT-K had a major role in the development of the Rice Knowledge Management Portal which was launched by the Prime Minister of India last year. Similarly, by using the Agropedia framework, ICRISAT and IIT-K are working jointly in developing KM Portals on Fisheries, Oilseeds and Horticulture.

The great vision of Agropedia is to have several 'mini' Agropedias, one for each and every crop, animal, commodity and discipline. We count on ICAR to step up its efforts to adopt Agropedia in a big way. Each of its institutes has a definite mandate to cover a crop, animal or a particular discipline. Each institute should develop a Digital Knowledge Repository related to its mandate using the Agropedia framework. The vast amount of data, information and knowledge found in different places, forms, and in different languages should be collated and organized in a scientific way for easy access and quick retrieval of needed information. The participation of academia, civil society organizations, farmers and other stakeholders in content development will make the content more refined and wholesome. The co-development will also make the content more relevant and localized.

Although many ICT4D initiatives have been launched in the past, very few have survived beyond their project period. The success and the sustainability of an open



access public portal, such as Agropedia, is dependent on the commitment and participation of the user community.

What we are doing today is to raise awareness and build capacity, which are critical in achieving success for ICT4D. I am happy that KSI has organized this sensitization workshop involving the research scholars and fellows of ICRISAT.

This activity will not only benefit you immensely, but I believe that your participation will benefit Agropedia as well. I urge you to enrich Agropedia with your contributions, inputs and suggestions.

Let us together shatter the digital divide in agriculture and create new digital opportunities for our farmers, particularly in the semi-arid tropics of Asia and Africa.

Thank you!



About ICRISAT



The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. Over 2 billion people, of whom 644 million are the poorest of the poor, live in the semi-arid tropics, which cover 55 countries. ICRISAT (a non-profit non-political organization) and its partners help empower these poor people to overcome poverty, hunger, malnutrition and a degraded environment through better and more resilient agriculture.

ICRISAT is headquartered in Patancheru near Hyderabad, Andhra Pradesh, India, with two regional hubs and five country offices in sub-Saharan Africa.

ICRISAT is a member of the CGIAR Consortium. The CGIAR is a global research partnership for a food secure future.

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