ICRISAT at 35

Triumphant Journey with the Poor in the Drylands

International Crops Research Institute for the Semi-Arid Tropics

Science with a Human Face

ICRISAT at 35

ICRISAT

Triumphant Journey with the Poor in the Drylands

ICRISAT
International Crops Research Institute for the Semi-Arid Tropics
Patancheru 502 324, Andhra Pradesh, India
www.icrisat.org

Commissioned by Director General Dr William D. Dar, this book is published by the Communication Office, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru 502 234, Andhra Pradesh, India

November 2007

The ICRISAT Team

Director of Communication	Rex L Navarro
Editor-in-Chief	Lydia Flynn
Editors	Anjana John Smitha Sitaraman
Production and Administrative support	VVS Satyanarayana MNR Ramesh
Graphic and layout artists	Ch Vengala Reddy K Chandrasekhar Rao
Photographic assistance	L Vidyasagar PS Rao Swapna Gogineni Veerender Reddy T David

The production team gratefully acknowledges the enthuastic and helpful input and comments from staff members in Africa and Asia towards preparation of this book. They know who they are.

The ASK Resource Group, comprising DS Bisht, SK Dasgupta and PM Menon, undertook initial selection of material from the vast records of the past five years and made suggestions for pictures to be used in this book. We appreciate their assistance.

Cover: Aerial picture of ICRISAT Headquarters, Patancheru, India taken from a helicopter by L Vidyasagar on 4 October 2007.

Contents

Foreword

Five years ago, on the occasion of our 30th anniversary, we published ICRISAT's first history book. This book was a chronicle of institutional memories – the early years of building up, the teething problems, the first set of challenges and the initial successes. Essentially, it captured the birth and growth of an institution with a noble mission to help stakeholders of semi-arid agriculture, especially the poor.

As we commemorate ICRISAT's 35th year, we have put up a sequel to the aforementioned book. This edition takes off from the first one and focuses on the four themes, which are the hallmarks of our achievements in the last 35 years: innovations, information, institutions and impact.

I am most honored to mention that our 35-year journey in the semi-arid tropics has led to scientific triumphs that have vastly improved the lives of the poor. Moreover, national research and extension systems have been strengthened through our capacity building programs, research networks and innovative information sharing initiatives.

As a global center of scientific excellence for dryland agriculture, ICRISAT is staffed with dedicated experts who have keenly studied the needs of poor farmers especially in Asia and sub-Saharan Africa. Let me emphasize we have not been alone in this journey. I am proud to acknowledge the unwavering support of our partners from various disciplines and sectors across the globe.

Henceforth, ICRISAT further pursues its excellence and relevance by continuously striving to improve the livelihoods of the poor people of the semi-arid tropics.

Over the last 35 years, we have recognized the vulnerability of poor farming communities in harsh and unyielding environments. As if semi-arid environments were not punishing in themselves, we find that the poorest of the poor are concentrated in the drylands. It is a vicious circle – dryland denizens are poor because the land is poor, and the land becomes poorer from continuous degradation and over farming, making the poor even poorer. Out of this, we are empowering dryland people to mitigate and adapt to emerging global challenges – climate change, desertification, drought, land degradation, loss of biodiversity, the aftermath of AIDS and wars, fuel shortages, and the ongoing and ever-present need for food.

During the last 35 years, ICRISAT has indeed made a big difference. Consequently, ICRISAT is encouraged by its scientific triumphs as much as by the smiles of pride and joy brought to the faces of poor farm families in Asia and sub-Saharan Africa.

I thank you for your interest in ICRISAT. I hope you enjoy reading about our history as Team ICRISAT, partners and stakeholders have enjoyed the journey of making it.

William D. Dar
Director General

Chapter 1
In the beginning...

*The chronology of events unfolded in this chapter is a synopsis of the book "**ICRISAT at 30: The Historic Journey to the Semi-Arid Tropics**" that ICRISAT brought out on the occasion of its 30th anniversary in 2002. This chapter is included here to ensure completeness of the ICRISAT history at age 35, but does not, in fact cannot, do justice to the vast and varied tale of ICRISAT's first 30 years, which is described lovingly in the book mentioned above.*

Director General Dr William Dar presents the President with the first copy of the History book.

Germination of an Institute

In the period 1969-70, steps had been initiated by international agricultural experts to organize a *Consultative Group on International Agricultural Research (CGIAR).* A final decision to launch the CGIAR was taken at Bellagio, Italy, and it was agreed that the Food and Agriculture Organization of the UN (FAO), the United Nations Development Programme (UNDP) and the International Bank for Reconstruction and Development/World Bank (IBRD) would be the three co-sponsors of the CGIAR.

A consultation was held under the auspices of the Rockefeller Foundation at the International Rice Research Institute (IRRI), Los Banõs, the Philippines, in early 1971 to examine the scope for establishing an International Centre for Sorghum and Millets. The Rockefeller Foundation had also organized another consultation for developing an International Centre for Grain Legumes. There was considerable discussion about the nature of these institutions, and a decision was taken to create one institution to conduct research on four mandate crops. These were: sorghum, pearl millet, chickpea and pigeonpea.

Ralph Cummings, joint coordinator of the Sorghum Project in India at the time, and one of the prime movers for the creation of ICRISAT, was given the task to select a location for the new institution. He and his team visited several locations in Africa and India and chose Patancheru near Hyderabad city in southern India. They recommended to the Technical Advisory Committee (TAC) of the CGIAR at its meeting in October 1971 that an International Crops Research Institute for the Semi-Arid Tropics be established at Hyderabad. This recommendation was accepted, and the seedling ICRISAT took root.

Why Hyderabad? Dr Cummings explained:

Hyderabad has several desirable features: it is the center of the national coordinated sorghum, rice, and dry land farming research programs, with a general university in the city, an agricultural university some 10 miles away, and it is also the site of several important laboratories. Two important soil types are represented at this site... It has a large irrigation tank covering about 350 acres.

Mr Fakhruddin Ali Ahmed (later President of India) the Union Minister for Agriculture in India, gave approval for the Ministry of External Affairs and Ministry of Finance to give ICRISAT the status of an International Center under the UN Immunities and Privileges Act. The only condition was that the Constitution of ICRISAT had to be signed by the three co-sponsors of the CGIAR. The proposal received Cabinet approval early in February 1972, and was signed by Senior Representatives of FAO, UNDP and IBRD in June 1972 at the time of the first meeting of the institute's Board of Trustees.

Signing of the Constitution of ICRISAT. L to R: MS Swaminathan, RH Demuth of the World Bank, DL Umali of FAO, Fred Bentley. Ralph Cummings is standing.

Selection of the Director

The Search Committee considered several candidates, and finally decided to invite Dr CF Bentley, who was then working as temporary head of ICRISAT, to become the first DG of the Institute. He suggested Dr Ralph Cummings for the position. Cummings accepted the offer immediately. Bentley was appointed as the first Chairman of the ICRISAT Governing Board.

Selection of the Director – Fred Bentley couldn't accept, Ralph Cummings couldn't refuse!

Birth of ICRISAT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) was the first international institute that was established under the auspices of the CGIAR.

From the speech of Dr RW Cummings at ICRISAT's 10th Anniversary observance, 11 October 1982

"ICRISAT became a legally constituted bonafide, international institute on July 5, 1972. …"

At the first meeting of the CGIAR's Technical Advisory Committee in mid-1971, a team was commissioned to address this segment of world agriculture and develop suggestions for action by the Group. The team quickly focused its attention on the seasonally dry semi-arid tropics, where sorghum and millets, along with a range of pulses, are the major components of the cropping pattern and the major staple in the diets of the people. The report and recommendations were completed and presented to the TAC in October 1971, and were approved by the CGIAR in early December of the same year.

The Mandate of ICRISAT given by the CGIAR and later reaffirmed by its Governing Board was:

- To serve as world center to improve the genetic potential for grain yield and nutritional quality of sorghum, pearl millet, pigeonpea, chickpea, and groundnut.
- To develop farming systems which will help to increase and stabilize agricultural production through better use of natural and human resources in the seasonally dry semi-arid tropics.
- To identify socio-economic and other constraints to agricultural development in the semi-arid tropics and to evaluate alternative means of alleviating them through technological and institutional changes.
- To assist national and regional research programs through cooperation and support and to contribute further by sponsoring conferences, operating international training programs, and assisting extension activities.

The First Year

ICRISAT came into being on 5 July 1972 when its first Board met under the chairmanship of Dr Fred Bentley, who had also acted as CEO until then. The first Board meetings were to be held on 4 and 5 July under a *shamiana* erected at the ICRISAT-Patancheru site, but heavy rains on the previous day (3rd July) resulted in the venue being moved to the Ritz Hotel in the city.

First Governing Board meeting. Standing (L to R): UK Rao, Rubens Vaz da Costa, T Swaminathan, DW Thorne, AR Melville, RW Cummings, MH Mengesha, K Lampe. Sitting: RH Demuth, CF Bentley, MS Swaminathan, DL Umali.

The cropping season started in June-July as it normally does in the SAT (northern hemisphere). Bert Krantz and Bob Pomeroy, the two staff members provided by the Rockefeller Foundation and the Ford Foundation, commenced work at the Patancheru site. Bert Krantz planted the first agronomic trials near the area around the main gate with the help of SK Sharma, Mohan Reddy and Soudaiah. Bob Pomeroy started building the peripheral fence, the road, and the sheds (temporary offices) and was assisted in this by HC Tewari, DN Sharma, BK Sharma and DS Bisht. Cummings, as the first Director of ICRISAT had set the following priorities for the next 5-6 years:

- Evacuate the two villages and resettle the villagers elsewhere comfortably, in order to acquire land for the institute.
- Develop world-class research facilities and the experiment station.
- Organize research programs and hire some of the best scientists in the world to lead them.

As told by Professor MS Swaminathan, World Food Prize Laureate, architect of the Green Revolution, eminent agricultural scientist, and one of ICRISAT's founding fathers.

MS Swaminathan.

To start with, he (Cummings) got hold of JS Kanwar, an eminent soil scientist, DDG of ICAR who played a key role in setting up the Central Research Institute for Dryland Agriculture (CRIDA) in India, to head the research team as Director of Research. Bert Krantz and Jacob Kampen were brought in to lead the Farming Systems Program, Hugh Doggett to lead the Cereals Program (sorghum and millets), John Green for the Pulses Program (pigeonpea and chickpea), and Jim Ryan to lead the Socio-economics group. A fifth crop goundnuts were included later and Rom Gibbons led this program.

Land Acquisition

To help the Institute acquire the land, the Government of India seconded Mr Verma, a senior IAS officer to ICRISAT. Mr Verma, with the help of the District Collector and other local officials identified alternative land as well as suitable compensation for the villagers who were living on the land allocated to ICRISAT.

Finally, at the completion of the rehabilitation process in 1974, Ralph Cummings, SC Verma and Mr Baig signed the handing and taking over documents for the land under the shade of a vast tree in Manmool village. Ralph Cummings performed the groundbreaking ceremony for the construction of the Institute by breaking a coconut as is customary in this part of India.

Many ancient statues and artifacts were found during land development. These beautiful statues and relics are now displayed in the serene surroundings of the Academic Court on ICRISAT Campus, courtesy of the Archeological Society of India.

One of the rare finds was a large statue of Lord Ganesha (The Elephant Headed Hindu God), which was installed under the cool shade of a mango tree on ICRISAT Campus.

Manmool Castle was a unique and imposing structure in the village. The village 'Patel' or the headman was said to have used it as a meeting place and as a village courthouse. Manmool Castle was used by the Institute for the regular Friday seminars, meetings and for the first Quinquinial Review, before the campus was built.

The temples and the mosque in Manmool village were left intact and repaired, to remind us of the tranquil relationship between the various religions in the village. To this day, these places of worship continue to be used in harmonious coexistence.

Prime Minister Gandhi with Lord Ganesha.

A World-Class Research Facility

Agricultural research needs two basic facilities to complement each other, the laboratories and the fields. Therefore the task was to develop a campus, which would house well-equipped laboratories, a gene bank, library, computer section and the infrastructure to support them. Secondly, it was essential to also develop precision research fields, which would enable field trials with minimal errors.

One of the first and foremost tasks was to demarcate the ICRISAT boundary of 1394 hectares. It was an arduous task with little or no access roads along the farmers' fields and over growth of bush. The job had to be done walking on foot

and locating revenue stone markers along with officials of the Revenue department of the State looking at the age-old maps. Bob Pomeroy and his team did a commendable job of demarcating the boundary in record time.

In 1973, a request was placed for a large contingent of agro-industry operators and supervisory staff and a requisition for bulldozers, loaders, dump trucks and road graders to undertake the land development

Constructing the fence.

As related by Dr Fred Bentley, eminent international Soil Scientist, one of ICRISAT'S founding fathers and the first Chairman of ICRISAT's Governing Board

One of the early development needs at ICRISAT was a quality, enduring fence to surround the entire property. After widespread solicitations of costs, it was decided to use hand-hewn granite fence posts. For some reason, some office in Washington was informed of the intention to use granite fence posts. The reaction was swift!

What was ICRISAT thinking of? If steel posts were good enough for other institutions, why not for ICRISAT? A long correspondence ensued.

ICRISAT: Granite posts are less costly.

Washington: Nonsense! Steel posts cost only $xyz each in such a large quantity.

ICRISAT: Granite posts cost only half as much as steel.

Washington: IMPOSSIBLE!

But the Washington office became believers only when a certified true copy of the contract for granite posts was submitted by ICRISAT.

Fred Bentley, January 1975.

Fred Bentley, aged 93, June 2007.

work under the guidance of ICRISAT engineers. All the development equipment came from USAID surplus equipment yards in West Germany and Salt Lake City, USA. These were old, World War II surpluses that were reconditioned and made available at dirt cheap prices. USAID was very helpful in those early years of building and establishing the Institute.

The Survey of India, Hyderabad office conducted a topographic survey and produced a detailed contour map of ICRISAT farm. The map was used subsequently to prepare a master plan for the development of the 1394 ha piece of land. A Canadian ground water exploration team in Hyderabad was requested to drill exploratory bore holes to advise on availability of ground water.

Field under development.

The Master Plan for Land Development

Looking at the institute today, one is often struck by a kind of aesthetic balance between the various needs and uses that the land has been put to. The residential area, the campus buildings, the eastern boundary with its eucalyptus trees, the laying of power lines, disposal of waste, the fields, the bunds and the variety of trees all over the campus- are all the result of a series of intense brainstorming sessions in the early 1970s.

In 1978, the Indian Government agreed that ICRISAT would establish several substations in different parts of the country. This enabled us to extend the range of environments in which we worked and increased the number of crop generations we could produce each year. ICRISAT undertook land improvements at two of its substations – Hisar and Bhavanisagar.

Construction of the Campus

With the laying of the foundation stone by the Prime Minister of India, Mrs Indira Gandhi on 11 January 1975, the permanent research complex and headquarters of ICRISAT moved officially off the drawing boards and into the construction phase.

Said Mrs Gandhi, *"I am very happy to be here today because we give great importance to this Institute and the work that it is undertaking.*

"I am glad to lay the foundation stone of the building complex of this Institute which symbolizes the pooling of talents of scientists and technicians regardless of nationality, race or color in this greatest of all wars, the war against hunger. The Government of India will continue to extend full support to the aims and programs of this Institute and may I wish all of you success in your work."

Foundation stone laid by Indira Gandhi. Others present were MS Swaminathan, Fred Bentley, AP Chief Minister J Vengal Rao and Ralph Cummings.

February 1977: First Buildings Handed Over - In a colorful ceremony on 18 February 1977 the Director, Ralph W Cummings took possession of three (albeit temporary) buildings on the campus. They were the Library Building, and two international staff houses subsequently occupied by Jacob Kampen and Bert Krantz.

Dr Ralph W Cummings, after 20 years in international agriculture and 5 years as the Director of ICRISAT, retired from ICRISAT and its Governing Board in March 1977. Words cannot adequately describe all that he did for ICRISAT. To put it simply, he was just the best man that could have been found to put ICRISAT on the right road. His combined knowledge of international agricultural research and of India was unique.

Leslie D Swindale, aged 47, took over as the new Director, and led the Institute for the next 15 years.

Ralph Cummings and Les Swindale inspecting the site map.

Progress in the seventies

Bert Krantz's agronomic experiments in 1972 were the beginning of the Farming Systems Program. These experiments were subsequently put into the watersheds with a land and water management perspective by Jacob Kampen. RW Willey brought the intercropping perspective to the watersheds, which was hard to sell in the seventies but became very popular in the nineties.

On 18 December 1978 the Computer Services unit, established in 1975, moved from Banjara Hills in the city to the Patancheru campus. This was the first unit to occupy the new office buildings, and Jim Estes was aware that his department was the carrot to encourage other departments to move from their hitherto comfortable city offices to the new, though still dusty and noisy with ongoing construction, premises.

Prime Minister Charan Singh inaugurates ICRISAT Center.

The ICRISAT Center at Patancheru was formally inaugurated by Prime Minister Charan Singh on **30 August 1979**.

A major event of 1979 was the in-depth review of ICRISAT conducted by a panel of nine experts. The panel was highly commendatory of ICRISAT and its work and understood fully well the tremendous challenge the Institute faced in fulfilling the mandate towards improving the health, wealth and way of life of the people of the semi-arid tropics.

The seventies was a decade of great impact where research was concerned at ICRISAT. It was in this decade that scientists at ICRISAT developed varieties, hybrids, breeding lines, and other material that resist pests and diseases, and also developed technologies that could be used by the SAT farmers.

In 1980, ICRISAT developed a new system of farming that enabled better rainy-season use of the deep vertisols (black soils) in areas of assured rainfall in India; millions of hectares of these lands, then left fallow in the rainy season, could produce two crops a year using the new technology. The technology included improvement in cropping patterns, varieties, fertilization, cultural practices, land and water management, and agricultural implements. The technology incorporated results of many years of research, some of it conducted even before ICRISAT came into being.

Genetic Resources

One of ICRISAT's most remarkable achievements in Genetic Resources is the vast collection of germplasm from all corners of the globe. A world repository for the genetic resources of the mandate crops, ICRISAT's collection has come a long way since the gene bank was started in January 1979 with short-term storage facilities. The gene bank also holds several hundred accessions of the wild relatives of ICRISAT's mandate crops. The collected material, now over 330,000 accessions, shows an amazing range of variability in color, shape, and maturity.

Training

The training program was expanded in 1976. Several groups of trainees from five Francophone African nations and a large number of Research Fellows, essentially post-graduates who worked toward their PhD degrees in collaborating universities, started work at ICRISAT under the direction of the Institute's scientists.

Trainee hostel inaugurated by Ralph Cummings, 19 April 1974.

Decade of excellence - the second decade (1983-1992)

This was the period when the Institute's activities were at its peak. The financial position of the Institute was very strong and several donor agencies were appreciative and eager to put in an increasing amount of funds into the Institute's research work. Easy availability of funds resulted in substantial expansion of the research work. More and more projects and programs were added and more staff members were recruited.

Reaching out to the world

African Program – The beginning

ICRISAT has a global mandate with a major role to play in Africa, because large parts of the continent fall within the semi-arid tropics.

The Swindales with her Royal Highness Queen Elizabeth and Prince Philip, at Patancheru on 19 November 1983.

ICRISAT'S program in Africa, supported by UNDP, started in 1975. By the end of 1976, 14 scientists were placed to work in the Sahelian zone of West Africa with active support form UNDP and USAID. Scientists were placed in two more Sahelian countries and in Sudan. The project headquarters was at Dakar, Senegal to coordinate the efforts in the Sudano-Sahelian zone of Africa. The program gained momentum in 1977 and 13 countries were involved in the coordinated research activities. ICRISAT scientists at this time were basically posted at national programs, as ICRISAT did not have any facility of its own.

In 1981, through an agreement with the Government of Niger, work on the establishment of our Sahelian Center on a 500-ha site, about 35 km south of Niamey, was started. This would be the base for work on millets and groundnuts and on farming systems in the Sahelian region of Africa.

Inauguration of ICRISAT Sahelian Center.

This was also the year when a beginning was made to extend the work to southern Africa. A fact-finding mission was sent to the Southern African Development Coordination Conference (SADCC), a group of nine Southern African states to examine the state of research and development of ICRISAT mandate crops.

ICRISAT responded to SADCC when the Heads of the Governments met at Lusaka and requested ICRISAT to tackle the urgent need for improved production of food crops in the region.

The first response was the program for groundnut improvement in Malawi, which got off the ground in 1982 with two scientists posted at Chitedze, near the capital city of Lilongwe, to find groundnut varieties resistant to rosette virus. The work got a breakthrough in the subsequent years, and covers the countries of Tanzania, Mozambique, Zimbabwe and Zambia and of course Malawi. This program was supported by International Development Research Centre (IDRC).

The SADDC/SMIP (Sorghum and Millet Improvement Project) was formally launched in 1983 with USAID funding and it started functioning from April 1984, when Dr LR House joined as the Executive Director at Bulawayo, Zimbabwe. Construction work started in 1986 and was completed in late 1987.

The East African program gained momentum with the posting of a scientist in Kenya who worked closely with Semi-Arid Food Grain Research and Development (SAFGRAD), largely funded by USAID. The work was coordinated for Sudan, Ethiopia, Somalia, Kenya, Uganda, Rwanda, Burundi and Tanzania.

In the mid-eighties the Farming System Research program started in Ethiopia for the deep vertisols in the country. The experience in managing deep vertisols in India was successfully transferred in a cooperative project with a generous funding from the Dutch Government. The Ethiopian Ministry of Agriculture, the institute of Agricultural research, the International Livestock Center for Africa and the Aleymaya University joined hands in this project.

Also in the mid-eighties regional networks involving cereals were initiated in Africa.

Research starts at SADCC/SMIP. Bholonath Verma and Tunde Obilana.

The Asian cooperation

Bangladesh, Pakistan, Sri Lanka and Thailand were the first Asian countries where cooperation started. In India, the All India Coordinated Projects on the ICRISAT mandate crops were the main institutions for close cooperation.

In 1977-78 cooperative programs also started in the Middle East – in Saudi Arabia, Yemen and Syria. A scientist with specialization in chickpea was placed at ICARDA to work on kabuli chickpea.

LD Swindale, CLL Gowda and RS Paroda – making the strong ICAR-ICRISAT partnership even stronger.

The Asian Grain Legume Network (AGLN) was formed with the signing of an MOU with Sri Lanka in 1986. The Legume On Farm Testing program (LEGOFTEN) started in 1987 with the request from the Government of India to extend improved package of practices on legume crops in the farmers' field. Five Indian states took part in this very successful program of testing improved practices.

Latin American initiative

During 1975-76 collaborative programs were launched in Brazil with support from the Ford Foundation. In 1982, ICRISAT posted an agronomist at CIMMYT to work on cold-tolerant sorghum.

The efforts put in by ICRISAT in Latin America resulted in the release of three sorghum varieties by Mexico in 1982, two varieties in El Salvador and seed production in Venezuela and Nicaragua.

In April 1985, ICRISAT received a certificate in recognition of its work during 1981-85 on sorghum in Latin America and the Caribbean, from an organization of nine countries in the region. Similar recognition had been received earlier for its work in 1977-81.

Review of research and management by external panels

ICRISAT was evaluated by two external review panels in August-September 1984 for the CGIAR. Both the panels commended the institute for the way it was carrying out its research and managing its resources.

The Review Report was assessed in May of 1985 by CGIAR headquarters and forwarded to its Chairman Shahid Husain. The covering letter from the CG's Executive Secretary, Curtis Farrar says: *The Panel's overall judgment about ICRISAT's management is that it meets the most demanding standards of excellence. This high mark for management performance is attributable to the following key factors: - a broadly defined but well interpreted mandate and a set of research priorities, strategies and goals; a well informed and strong board which maintains good communication, a healthy distance and appropriate control over the center's management; a strong and able Director General in the person of Dr Leslie Swindale, who is clearly in command of all important aspects of managing ICRISAT; a high quality staff, dedicated to ICRISAT's goals and loyal to its leaders; excellent relations and mutual respect with the Government of India; and simple but adequate systems for financial and personal management and administrative services which are constantly improving…..*"

15th Anniversary

For ICRISAT, 1987 marked an important milestone with the completion of 15 years of international service. The Institute celebrated its 15th anniversary on 16 October 1987, the day dedicated as the World Food Day by the FAO of the UN to resource poor farmers.

LD Swindale greeting AP Governor Ms Kumud Behn Joshi at ICRISAT'S 15th Anniversary celebrations.

JS Kanwar Retires

In early 1988, the first Deputy Director General, Dr JS Kanwar, retired after 15 years of distinguished service to the institute. He continues to be associated with ICRISAT as Deputy Director General (Emeritus), an honor bestowed on him by the Governing Board.

TAC and Center Directors' meeting

The 46th meeting of the Technical Advisory Committee (TAC) of the CGIAR and the Center Directors' meeting were held at ICRISAT headquarters during 13-21 June 1988. These meetings were attended by representatives of all 13 CGIAR Centers; 18 members of TAC and its Secretariat and 6 members of the Secretariat of the CG, together with special advisors, donor representatives and invitees – 90 in all – attended the meetings.

At the end of the meetings, Dr Alexander F McCalla, the Chairman of TAC, wrote,

On behalf of the Members of the TAC, I wish to put on record our sincere appreciation and thanks to the ICRISAT staff for the warm hospitality and excellent reception given to us during our entire stay at ICRISAT for TAC 46. The organization of the meeting was superb, and our needs and wishes were promptly and generously taken care of…

An external evaluation team concluded in its report in 1988 that the SADCC/ ICRISAT Regional Program in Zimbabwe *"has made excellent progress in addressing most of the objectives anticipated in the project design, and is ahead of schedule and had produced results earlier than expected in a number of areas".*

This followed a similar positive report in 1987 of an external evaluation of the work done by ICRISAT in Mali.

Decade of change and hope (1990-2002)

In 1990, research to develop genome maps of sorghum and pearl millet was commenced with collaboration in Italy, UK and USA. A Geographical Information System (GIS) that could manage and display multiple levels of spatially distributed data was installed at ICRISAT-Patancheru.

Dr LD Swindale honored by Indian Government

Dr LD Swindale, the Director General of ICRISAT, was one of the 23 eminent personalities honored with the "Padma Bhushan" on India's Republic Day in 1991.

Padma Bhushan is the third highest civilian award given by the President of India after the Bharat Ratna and Padma Vibhushan. This award, which was also a title, is often reserved for eminent public figures for significant contributions to the lives of the Indian people.

LD Swindale receiving the Padma Bhushan *from President R Venkatraman.*

A New Director General

Dr James Garrett Ryan, an Australian, assumed responsibility as the Director General of ICRISAT on 19 August 1991. He was the third Chief Executive of the 19-year-old Institute succeeding Drs Ralph Cummings and Leslie Swindale. He was formally given charge of heading one of the most important Centers of the CG with a symbolic handshake from Dr William Mashler, Chairman of the ICRISAT Governing Board.

World's first pigeonpea hybrid

Pigeonpea hybrid reaches farmers' fields.

ICRISAT scientists bred ICPH 8, the world's first hybrid pigeonpea plant. It was notified in June 1991 by the Indian Government for use by farmers in central India. This technological breakthrough was significant because for the first time a hybrid of a pulse crop had been developed. Hybridization in pulses had been difficult because pulse flowers have a structure that is conducive to self-pollination. Pigeonpea is an important source of protein not only in the diet of people living on the Indian subcontinent but in parts of Africa and the Caribbean. However, 90% of the world production of the crop comes from India.

Highlights in Africa

On 17 December 1993, USAID formalized a grant amendment providing the SADC/ICRISAT Project in Zimbabwe, with US$10 million for its Phase III activities from September 1993 to September 1998, an action that indicated faith in our southern African program.

In 1994 the Desert Margin Initiative (DMI, now DMP) was launched to combat desertification in sub-Saharan Africa and Asia. The year 1994 also was significant for the southern African region as South Africa dismantled the apartheid regime and re-joined the world community. It also formally joined the SADC (Southern African Development Community – changed from SADCC of the eighties). South African scientists joined two workshops held in Swaziland and Botswana.

ICRISAT celebrates its 20th Anniversary

Mr PV Narasimha Rao, Prime Minister of India, was the Chief Guest at ICRISAT's 20th anniversary celebrations on 29 August 1992. Mr Rao arrived at the ICRISAT Center by helicopter. He was greeted by Prof Eric Roberts, Chairman of the Governing Board, and Dr James Ryan, the Director General. At the commemorative program, Mr Rao congratulated the scientists for their efforts on behalf of the people who live in some of the world's most difficult agricultural regions. He called on ICRISAT and other research institutions to foster closer liaisons with farmers. A perfect mixture of the farmers' "robust common sense" with the application of basic scientific research, he felt, was necessary to develop agriculture in India.

Prime Minister Narasimha Rao visits the Genetic Resources Unit at ICRISAT.

Major Changes

Changes in the external environment and reduced and uncertain funding in the 1990s was affecting all centers throughout the CGIAR system. Faced with funding shortfalls and the necessity to rationalize programs and reduce staff and other resources, reorganization became essential.

During the second half of 1994, ICRISAT went through a severe reduction of staff in the Asia region. The altered funding situation and the need to preserve the future of the Institute led ICRISAT to implement a voluntary retirement scheme in August 1994. As a consequence, 381 nationally recruited staff and 169 workers from the Regular Work Force (RWF) left the Institute. Some of them had served the Institute for more than 20 years and their contributions were highly acknowledged.

The nineties was a decade of major changes. The African program was also affected badly due to reduction in funding. The program in Africa was consolidated into 7 locations – ISC at Niamey, ICRISAT-Kano in Nigeria, ICRISAT-Bamako in Mali, SMIP in Zimbabwe, ICRISAT-Malawi at Lilongwe, Malawi, ICRISAT-Nairobi in Kenya and Joint Vertisol Project with ILRI in Ethiopia

1996 was a year of major awards bagged by ICRISAT scientists, some hope despite the gloom and shadows cast by financial constraints. ICRISAT won international recognition for its scientific achievements. Crowning the year was a "double first" for the Institute – two awards received at the International Centers' Week, the annual gathering at the CGIAR. ICRISAT won the much-coveted King Baudouin Award, in recognition of its "outstanding achievements in the development of disease-resistant, yield-increasing pearl millet in collaboration with advanced institutions and national research programs".

The other award was a new one inaugurated by the Chairman of the CGIAR to recognize outstanding achievements on the part of locally recruited professionals at the Centers. This was awarded to Dr SB Sharma, a senior scientist in our Crop Protection Division, for his work on nematode parasites of food legumes.

Director General JG Ryan receives the King Baudouin Award, 1996.

This was also the year that ICRISAT joined the "IT Superhighway". After much discussion, ICRISAT, like most of the other CG Centers, became part of the Integrated Voice and Data Network (IVDN) of the CGIAR. Not only would ICRISAT enjoy the obvious benefits of transmitting and accessing email and data at much faster rates than before, but most importantly, ICRISAT would finally have access to the Internet. Director General Ryan was on official travel, so Deputy Director General YL Nene inaugurated the IVDN on 17 May 1996.

Changing of the guard

Dr Ryan left the institute after six years at the helm of affairs of ICRISAT.

In September 1997, Dr Shawki Barghouti, a native of Jordan (then the Chief of the Agriculture and Water Operations Division, South Asian Country Department at the World Bank in Washington, DC, USA,) was appointed the new Director General of ICRISAT

In 1998, ICRISAT became the first Center in CGIAR history to be awarded the System's highest accolade, the King Baudouin Award for a second consecutive turn. Following the 1996 award for pearl millet improvement, the 1998 award heralded the innovative science and partnership achievements in the pigeonpea improvement initiative. The award notification praised the contributions made towards enhanced food security, poverty alleviation, and sustainable agricultural development in both Africa and Asia.

Awards were also bestowed upon individual scientists. Dr KN Rai bagged the CG Chairman's award for locally recruited scientists; and Dr AK Singh, and Dr HC Sharma for their work in their respective field of research. ICRISAT also bagged numerous other awards in this decade.

A new Director General takes charge

The Chairperson of the ICRISAT Governing Board, Dr Ragnhild Sohlberg announced that Dr William Dollente Dar had been appointed the next Director General. It was a happy day when he joined the Institute on 10 January 2000. Born in the Philippines in 1953, William Dar was the youngest Director General in the Institute's history.

Prior to joining ICRISAT, Dr Dar had achieved his existing position of Presidential Advisor on Rural Development in the Philippines after a steep and steady rise in his career.

Ragnhild Sohlberg and Dr Dar being interviewed.

Chief Minister seeks ICRISAT's help

Following the momentum built by the call of the State of Andhra Pradesh for help from ICRISAT in spreading new technologies to manage the drought, the Director General met the Chief Minister of Andhra Pradesh, the honorable Chandrababu Naidu, together with Drs Wani, Winslow, Mr Parthasarathy and Mr Bisht.

The Chief Minister, globally recognized for his pro-development policies (which attracted US President Bill Clinton to make a special stopover in Hyderabad on his visit to India), emphasized his interest in strengthening ties with ICRISAT. "I want to use your services in a big way for total transformation of the entire State", he told Dr Dar and the ICRISAT delegation. "We need you to help develop a future for us. Watersheds, water harvesting, IPM, productivity increases, training…we are interested in all aspects." The Chief Minister, known for his use of information technology to keep a constant finger on the pulse of activity at offices across the state, suggested immediate means to put the collaboration into operation.

Chief Minister Chandrababu Naidu visits ICRISAT.

The sun rises again – Looking ahead

Selecting an ICON

Director General Dr William Dar introduced the phrase "Science with a Human Face" during his first speech to staff and throughout Work Planning Week, as a metaphor to capture ICRISAT's new vision focused on how our work directly benefits the lives of the poorest of the poor.

To represent this appealing concept in artistic form for all ICRISAT publications as well as for other public awareness tasks, ICRISAT explored the hidden talent among its staff and The Icon Committee finally recommended ***SCIENCE WITH a HUMAN FACE***

May 2001: Grey to Green Revolution:

ICRISAT's 2001 Annual Report entitled "Grey to Green Revolution" was launched during the CGIAR Mid-Term Meeting in Durban. The traditional Green Revolution had remarkable impact but depended on high levels of costly inputs. The Grey to Green way, in contrast, is all about making better use of locally available, affordable resources, complemented by modest but practical inputs from beyond. In the Grey to Green approach, ICRISAT helps the poor put the home-grown resources to much better use, so they can grow their own way out of poverty.

ICRISAT Vision and Strategy to 2010:

Challenges and Issues for the Semi-Arid Tropics is the title of the Institute's new vision document, approved by the Governing Board in October 2001. The document identified emerging challenges and issues of the semi-arid tropics, scans the changing agricultural research environment, and maps out our new vision, mission and mandate from which are drawn out six global research themes and corresponding deliverables. Director General Dr Dar, in his memo to staff, "enjoins everyone to internalize our new vision and strategy and work closely together towards its effective implementation".

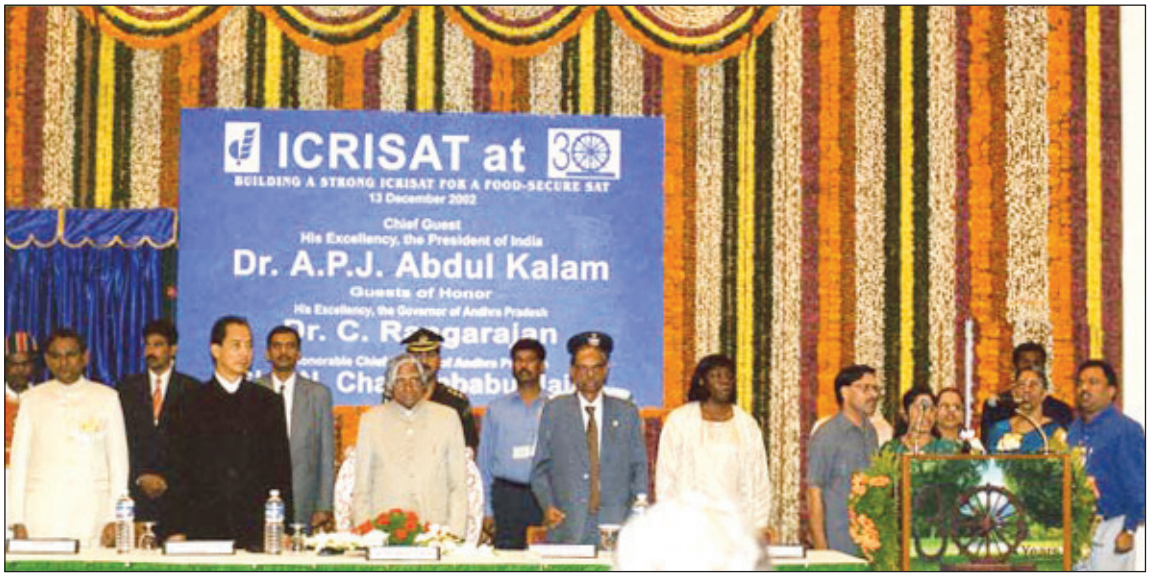
Director General Dar taking the pledge at the launch of the Team ICRISAT movement on 13 February 2002.

ICRISAT celebrates 30 years

On 20 December 2002, ICRISAT celebrated 30 years of its existence with great pride and pomp. His Excellency Dr APJ Abdul Kalam was the Chief Guest at the celebration. Other guests included Dr C Rangarajan, Governor of Andhra Pradesh, and dignitaries and senior scientists from India and other parts of the world.

In his keynote address, President Kalam urged India to apply scientific methods to ensure soil fertility, and said that integrated soil nutrient and water management are focal issues in drylands. He asked ICRISAT to address possible agricultural technologies and water conservation technologies in such areas, keeping in mind that solutions to these problems may be beyond the scope of only agriculture and may need to extend to animal husbandry, poultry and agroprocessing, and other related activities.

Dr Dar said that despite numerous successes over the past three decades, many challenges remain. One of the biggest is finding ways to improve conditions for the world's poorest people. Turning adversities into opportunities is the heart of a movement spearheaded by ICRISAT, the Grey to Green Revolution, and guided by Science with a Human Face.



All stand to attention as the Indian National Anthem is sung at the 30th Anniversary celebrations.

Chapter 2
Innovations and Improvements

Improving livelihoods of resource poor farmers in the drought prone rain-fed areas with poor soil fertility is a huge technological challenge. Improving scientific techniques and developing new ways of boosting funding also requires thought, planning and much skill to remain in a win-win situation. However, improvements have been made with innovative thinking and scientific perseverance. Natural resource management, new technologies, suitable cropping systems, effective policies and new management strategies can make a difference. The following success stories speak for themselves.

Biotechnology brings new shades of green

Dr Nalini Mallikarjuna examines the progress of a tissue culture plant.

The sequencing of the human and many other genomes of organisms opens exciting new applications for crop improvement. With the support of the Department of Biotechnology, Government of India, ICRISAT will formally launch its "Center of Excellence in Genomics" in early 2008. The Center will provide state-of-the-art molecular genomic technology, including high-throughput, low-cost marker services and bioinformatics support, for crop research and breeding. Many ongoing projects using genomics to improve crops for drought tolerance and disease resistance will be greatly aided by having access to such facilities. An exciting feature of the new Center is the offering of training courses to provide opportunities for scientists and students to gain the expertise in the applications of molecular technologies. ICRISAT is also working at the Biosciences for Eastern and Southern Africa (BecA) laboratories in Nairobi on genetic diversity, drought tolerance and *Striga* resistance in sorghum and millets.

When sources of improved traits are lacking, ICRISAT initiates research to develop transgenic versions of our crops – groundnut against the Tobacco Streak Virus, and pigeonpea and chickpea against the Helicoverpa pod borer pest. These genetically modified crops have now moved out of the laboratories into greenhouse and research fields, and are now in advanced stages of testing.

The government of Andhra Pradesh, ICRISAT's host state in India, also has ambitious plans for biotechnology. The state's Genome Valley Project is a far-sighted venture involving research institutes, universities and private companies. Because Genome Valley itself is largely focused on industrial biotech, the Chief Minister in 2002 asked ICRISAT to take the lead in agricultural biotechnology. Today, ICRISAT's Agri-Science Park, started in 2003, is thriving with several private sector partners operating on the ICRISAT campus.

Modern weapons against downy mildew

Pearl millet, grown for grain and stover in the hottest and driest areas of Africa and south Asia, is particularly vulnerable to downy mildew (DM) disease caused by the pseudo-fungus *Sclerospora graminicola*. DM is the most important pearl millet disease, causing national production losses up to 30% during epidemics.

HHB 67, released in 1990 by CCS Haryana Agricultural University (HAU) was a single-cross pearl millet hybrid to resist DM, but recent surveys have indicated that this hybrid is starting to succumb to DM (up to 30% incidence in farmers' fields).

To make a better DM resistant hybrid, scientists chose parental lines of HHB 67. Scientists then backcrossed additional DM resistance genes into the female parent using conventional progeny-based greenhouse screening of pot-grown seedlings. Conventional backcross transfer of DM resistance took nearly nine years (1991–1999), while the more modern marker-assisted backcross transfer was completed in just over three (1997–2000).

Two improved versions of HHB 67 were subsequently compared with the original for agronomic performance in three years (2002–2004). In these three years of testing, farmers expressed a clear preference for one of the two improved hybrids, which is slightly taller (15–30 cm), later (2–3 days), and has higher grain and stover yields (5–10%) than the original HHB 67, as well being more resistant to DM and having easily recognizable long, thin panicles with short bristles (like the "designer stubble" of popular Hindi film actors!).

In January 2005 Haryana State Varietal Release Committee approved release of this improved version for cultivation in Haryana. Its State Release as **HHB67 Improved** was approved by the Central Plant Variety Release Committee in June 2005, and this was quickly followed in July by approval of its All-India Release (notified in the Gazette of India in November 2005).

HHB67 Improved is the first product of marker-assisted breeding to reach cereal producers in India. It is also among the first public-bred marker-assisted breeding products commercialized in developing countries globally, following the 2001 release in Indonesia of rice varieties bred by this technique.

Accompanied by CT Hash (in hat) scientists identify an off-type plant in a field of HHB67 Improved.

The power of pigeonpea in East Africa

For years, we have talked about pigeonpea as an 'emerging' crop in East Africa. The news is that the crop is no longer emerging. It has arrived.

Generations of East Africans have been eating pigeonpeas from birth. In Kenya, it has become mandatory at Kikuyu wedding feasts, regardless of cost. In large areas of central and northern Tanzania, it is hard to find a farmer who does *not* cultivate it. In Malawi, it provides income for women and nutrition for children.

Jane Mulinge (right) *and Consolata Mueni* (left) *of Mulala village near Nairobi display pigeonpea dishes at lunchtime.*

No doubt about it, pigeonpea research in eastern Africa has come a long way. The crop is more important to farmers than ever before and its importance increases every year. The close rapport between the ICRISAT teams based at our eastern African hub in Nairobi and their colleagues at our southern African hub in Bulawayo, Zimbabwe, along with their national agricultural system (NARS) counterparts, and with NGOs and farmers, has been immensely successful.

In recent times with more and more improved varieties, farmers have realized the potential of fresh pigeonpea in the domestic market. The pigeonpea matures when food reserves are low, making it a popular crop to stave off hunger. Thanks to its high local demand, most of the pigeonpea grown is now being sold as green peas at prices almost twice that of the dry grain. Farmers have taken to calling it "our beef", alluding to its high protein content. Dry pigeonpea is exported to India (whole or as dhal), adding income to farmers and foreign exchange to the government. Bumper sales of pigeonpea are allowing farmers to own valuable assets ranging from mobile phones to productive land and livestock, and is opening viable pathways to exit poverty in this formerly impoverished part of the world.

Staff from ICRISAT-Nairobi in a field of ICEAP 00554 medium-term pigeonpea, known for its broad seeds.

Guinea-race hybrids for West Africa

"How would you improve the productivity of sorghum in West Africa so as to improve food security and increase farmer's incomes, and do so by building on the farmers' choices of several thousand years?" In 1999, researchers from ICRISAT, the Malian Institut d'Economie Rurale (IER), and the Institut National de l'Environnement et des Recherches Agricoles (INERA), Burkina Faso agreed to work together to find ways of unlocking the genetic potential of the predominant sorghums of West Africa.

The Guinea-race sorghum is a staple of West Africa and combines excellent adaptation for this environment with high grain quality, but yield levels rarely exceed 2 tons/ha in farmer's fields.

Sorghum breeders from Mali and Burkina Faso collaborating in the development of Guinea-race sorghum hybrids.

The ICRISAT-IER-INERA team thus set out to create the first Guinea-race hybrid. A search was begun to identify potential female parents from three different sources: local varieties from Mali, inter-racial breeding lines from the IER program, and Guinea-race accessions of world-wide origin from the World Sorghum Collection in the ICRISAT genebank in India.

Additional female parents were also developed from germplasm accessions originating in Senegal, Gambia, Burkina Faso, Malawi, Sudan and Uganda. Another dimension of diversity was added by the inter-racial male-sterile lines such as the dwarf line developed by IER through crossing the local variety Bimbiri Soumale with a Caudatum-race variety.

The first experimental hybrids were produced in 2004 on both the inter-racial and landrace-based female parents. The best hybrids significantly out-yielded the well-adapted check varieties in all of the research station trials. Despite the rains ending one month earlier than normal, average grain yield of the 22 highest yielding hybrids (top 20%) was nearly one ton higher (3.1 ton/ha) than the mean of three outstanding local varieties (2.3 ton/ha) in the ICRISAT-Mali trial.

These yield advantages are truly exciting as they provide what farmers are demanding – increased productivity while maintaining grain quality and retaining (or even enhancing) yield stability. And this is just the beginning.

Prospering with peas and peanuts

About 90% of the land in southern China is covered with mountains. Each year tons of topsoil and valuable nutrients are lost due to erosion and landslides and such areas have become unfit for agriculture. This problem has bothered the Chinese Government for years, but with the introduction of two ICRISAT crops, pigeonpea and groundnut, (aka peanuts), new signs of prosperity are greatly evident in China.

About 1500 years ago traders carried pigeonpea seeds from eastern India to southern China, where it was used for rearing the insect *Kerria lacca* Kerr., for production of lac, (a commercial resin), but its cultivation gradually ceased due to loss of the international lac market.

Pigeonpea on hill slopes.

In 1997, new ICRISAT-bred pigeonpeas were tested for the first time in Yunnan province, thus beginning the rebirth of pigeonpea in China. Interestingly, the Chinese started using pigeonpea in their cropping systems, not for food, but for controlling soil erosion and rehabilitating eroded soils. Whats more? The tender leaves and branches make excellent fodder, which provides high protein (20–22%) for domestic animals. Today, pigeonpea in China can be seen growing on thousands of hectares on roadsides, hillsides and riverbanks.

Groundnut cultivation is another success story in China. Nearly half of the introduced groundnut germplasm in Chinese gene banks comes from ICRISAT. In collaboration with the Chinese Academy of Agricultural Sciences, the Oil Crops Research Institute, the Shandong Peanut Research Institute and the Crops Research Institute (CRI) ICRISAT introduced about 2200 germplasm lines, breeding populations and advanced breeding lines into South China. Utilizing these sources, the CRI and its collaborating institutions have released 10 groundnut varieties, which now cover a large cultivation area in southern China.

Dr SN Nigam with Chinese scientists in Guangdong province of China.

Pigeonpea and groundnut have made their mark on the Chinese landscape, and the Chinese Government has sought further support from ICRISAT for transferring scientific knowledge to their scientists, thereby helping to sustain the prosperity.

Hagaz the halcyon hybrid

In Eritrea, pearl millet is the second most important cereal after sorghum and is grown by smallholder farmers on over 80,000 hectares. With no improved cultivars available until very recently, farmers grew traditional landraces, which have many preferred traits and a modest grain yield potential, but are generally susceptible to downy mildew disease.

The Eritrean pearl millet variety Hagaz, is the first product of partnership that ICRISAT sees as a model for its future work in Africa. It began in 1998 when Mr Negusse Abraha, now Eritrea's pearl millet breeder, did his MSc dissertation research at ICRISAT-Patancheru for his degree in plant breeding. When Mr Negusse returned to Eritrea, ICRISAT helped him to develop a breeding program designed to improve Eritrean landraces and to breed new varieties from crosses between selected local landraces (which provided local adaptation and farmer-valued traits) and ICRISAT-bred varieties/ populations (which provided disease resistance and a higher yield potential).

The first Eritrean Research bred pearl millet variety – Hagaz

Hagaz, bred from a cross between the Eritrean landrace variety Tokroray and the ICRISAT-bred improved variety ICMV 221, and named after the location where the crosses were first made, was identified for its superior grain yield and downy mildew resistance (1% infection vs. 38% for Tokroray). In on-farm trials conducted in 2001 and 2002, the cumulative mean grain yield across all environments in 30 test sites showed that it was clearly superior to the local landrace.

Hagaz was released in 2004 by the National Agricultural Research Institute of Eritrea for cultivation in Eritrea. This is the first indigenously developed improved pearl millet cultivar to reach the farmers in Eritrea. It will provide farmers with a higher yielding and slightly longer duration alternative to existing varieties.

Pursuing the super-early chickpea

Chickpea is grown in over fifty countries in a wide range of environments. An important component to be considered for crop adaptation to the different environments is the time to flowering, podding and maturity. In at least two-thirds of the chickpea growing areas, the available crop-growing season is short (90-120 days) due to risk of drought or temperature extremities towards the end of crop season, which coincides with the pod filling stage of the crop. So, in order for the crop to escape stress at the end of the season, it is important to cultivate early maturing varieties for these areas.

ICRISAT and partners have developed many early maturing, high yielding and fusarium wilt resistant varieties of chickpea. The first landmark variety was ICCV 2, which is perhaps the world's earliest maturing variety of kabuli chickpea. It flowers in about 30 days and matures in about 85 days at Patancheru near Hyderabad.

Two super-early desi varieties ICCV 96029 and ICCV 96030, were developed that mature in 75 to 80 days in southern India. These lines provided further opportunities for expansion of chickpea cultivation in new niches. Experiments on super early lines to see if they were suitable for cultivation in northern India as a vegetable showed that they could be grown after harvest of rice and before planting of wheat as a short duration catch crop. This will provide extra income to farmers, and inclusion of a legume in a rice-wheat cropping system will have beneficial effects.

Three major genes were identified for early flowering that will improve precision and efficiency of chickpea breeding for desired maturity. Scientists have also succeeded in improving fusarium wilt resistance and seed size of super-early lines. The improved super-early lines will be available to farmers in the not too distant future.

Director General Dar and senior scientists compare the early variety to the traditional varieties surrounding the plot.

Of stalk and livestock

The International Livestock Research Institute (ILRI) and ICRISAT have an important common interest. ILRI studies ruminant livestock, which contribute to human welfare by providing food, draft power and manure. ICRISAT studies crop residues, which are consumed by livestock as fodder. It's a marriage made in heaven – common ground for collaborative research.

An Indian farmer feeding his livestock with a feedblock made from sweet sorghum residues.

ICRISAT and ILRI embarked on collaborative efforts to improve fodder value of crop residues at source through multidimensional plant breeding and selection. The collaboration has shown that nutritionally important differences in fodder quality exist among cultivars. Furthermore, fodder quality differences, for example, differences in digestibility, can be exploited in most rainfed crops without detriment to grain/pod yields.

Recently, the ICRISAT-ILRI collaboration engaged with a local feed manufacturer to add value to the sweet sorghum varieties developed by ICRISAT and partners. Besides being increasingly used in industrial bio-fuel production in India, the bagasse (stalk residue after juice extraction in the distilleries) can be used in the novel "food blocks" made by the feed manufacturer, thus making even this last "drop" of the crop a useful component.

Who benefits? Well, for one the farmers earn more income from selling the stalks to the distilleries (besides sales of grain), and livestock owners gain from the ready-made feed blocks, which, besides costing less than conventional feed, are supplemented with extra nutrition for their cattle.

What goes in, must come out. Livestock scientists examine both.

Sweet sweet surrender

Sorghum used to be a poor man's cereal, eaten by those who couldn't afford maize in Africa, and by those who couldn't afford wheat and rice in India. Of late, sorghum is surrendering many of its latent secrets, and is on an upward trajectory of becoming one of the more popular cereals cultivated by poor farmers.

Traditional sorghum grown in the rainy season is often vulnerable to grain mold attack, making it unfit for human consumption. But with improved sorghum cultivars that are less susceptible to molds, all would not be lost. Also, moldy grain harvested in the rainy season can still fetch a profit from the brewing industry (whisky). Research has shown that grain mold-infected sorghum is almost as good as quality grain in a brewery, as the mold-derived compounds are converted to harmless metabolites during the manufacturing process. Smallholder farmers reeling from crop losses due to mold can now salvage a good part of their harvest and convert it into a profitable enterprise.

We have already read about sorghum stalks being used as fodder. Well, grain from this versatile plant can also be used as poultry feed. The estimated maize requirement (principal poultry feed) by 2020 AD will be around 31 million tons compared to the present 3.5 million tons, revealing a large gap that can be filled by sorghum. And that's not all.

Take sweet sorghum, a pro-poor biofuel resource. At an international brainstorming session organized in the USA, on 19 and 20 March 2007, Director General William Dar highlighted ICRISAT's initiatives with the commercial production of ethanol from sweet sorghum, making a point that poor and marginal farmers of the drylands can generate improved incomes from the global biofuel revolution without losing out on food production. Sorghum juice from stalks produces ethanol and the grain contributes to the food basket.

ICRISAT, in partnership with a local distillery, is now promoting its "ethanol from sweet sorghum" technology in India, the Dominican Republic, the Philippines, Mexico, Uganda and most recently in Mozambique. Additionally, industries from Hungary, Indonesia and Australia have also made enquiries about the technology, and the trend is continuing.

Drs William Dar and Belum VS Reddy in a sweet sorghum field in the ICRISAT-Patancheru campus.

Rebuilding the groundnut pyramids

Everybody knows that groundnut, or peanuts as they are known in many countries, provide a tasty snack. But few people in the developed world are aware that groundnuts are also an essential part of the diets of millions of poor people. In West Africa, groundnut, which is rich in protein, oil, amino acids and vitamins, is both an important food and cash crop.

Nowhere is groundnut more important than in Senegal where groundnut occupies 40% of land. The crop is also hugely important in Nigeria, which produces a third of Africa's total production.

Serious problems had plagued both countries. In Senegal, area sown to groundnut decreased by 20% during the 1980s. In Nigeria, production plummeted during the same period. The main reason for the decline was a nasty virus disease called groundnut rosette. Rosette, which is endemic to Africa, retards plant growth leading to low yields. The disease wreaks havoc throughout sub-Saharan Africa.

The most effective control measure against plant viruses is the use of resistant cultivars. The introduction of elite lines of groundnut developed by ICRISAT in collaboration with partners from the national research programs of Nigeria, Senegal and Malawi has worked wonders for groundnut farmers.

From a pitiful total of only 0.7 million tons in 1986, Nigeria's groundnut production totaled nearly 3 million tons in 1997. It was not until 1990 that resistance to initial infection was reported by a plant breeder with Nigeria's Institute for Agricultural Research. The research focus incorporated early maturity into the breeding material, which was a resounding success. Armed with new resistant products, farmers were able to sow groundnut once again.

The groundnut pyramids of Kano, which disappeared due to rosette in the 1980s, have risen again.

Small-scale industries, which were forced to close by rosette, have revived. West African oil mills that lay idle for nearly a decade are now making profits from both edible oil and groundnut cake, which is used for poultry feeds. Today, great mounds of groundnut, piled high like pyramids, are not an uncommon sight in the markets of these African countries.

Bug eats bug

Helicoverpa armigera, the dreaded pod borer insect, is the single most important pest in modern agriculture. It attacks nearly 200 crops, including cotton, legumes, cereals, vegetables and fruit. Losses across the world amount to a whopping $2 billion every year. That's not all. An additional $500 million is spent annually on insecticides to control this voracious caterpillar. But even these vast amounts of poisons cannot stem the tide.

One of the more promising answers is biopesticides; specifically nuclear polyhedrosis virus (NPV), a naturally occurring fatal viral disease for the pest. The process of making NPV is simple – gruesome, but simple. You gather the carcasses of caterpillars killed by NPV, liquefy them, then spray the stuff on your crops. Fresh populations of Helicoverpa eat the treated crops, then die, providing more carcasses!

Women shaking pigeonpea plants to dislodge the pests.

NPV preparation also happens to be a very lucrative business proposition. Industrial production of chemical insecticide costs about $17 per hectare. But with NPV, costs are only about $3.40 per hectare (if it is produced at the village level), one fifth that of the alternative. Plus, it's not hazardous to human health at all. This is what the experts call "eco-friendly" pest management.

ICRISAT in partnership with the Centre for World Solidarity (CWS – a Hyderabad based NGO working on integrated pest management), State Agricultural Universities and the Indian Department of Agriculture, established the production and use of Helicoverpa nuclear polyhedrosis virus at the village level through a World Bank funded project. The project proposal won the World Bank Development Marketplace award for 2005.

Helicoverpa larvae on the rampage.

Protecting us from poison

Mycotoxins are poisonous substances produced by fungi. Aflatoxin, a poison from the fungus *Aspergillus flavus*, grows on crop produce after they have been harvested. Groundnut, maize, chillies, pistachios, cassava and several other food products get contaminated with aflatoxin year after year. Ingestion of aflatoxin is extremely harmful and can cause cancer in humans.

Aflatoxin contaminated groundnut.

During 2004, an outbreak of acute hepatotoxicity in Kenya with 317 cases and 125 deaths was one of the largest and most severe outbreaks of aflatoxicosis documented worldwide. The outbreak was the result of aflatoxin poisoning from ingestion of contaminated maize. Therefore, the detection and quantification of mycotoxins has crucial implications for both human and animal health and trade.

Until recently, the cost of testing for mycotoxins exceeded $9 per sample. ICRISAT developed an inexpensive ELISA-based tool, reducing the cost of testing per sample to $1.

In India, the Janaki Feeds Company (based in Hyderabad) now makes huge savings by using this technology to monitor aflatoxin contents in animal feeds as part of their quality control system. In southern Africa, this technology is a crucial element of the aflatoxin management system for groundnuts in the region. The establishment of this system is benefiting over 10,000 farmers in Malawi as they are able to export groundnut to Europe.

Vimala Feeds, the second largest poultry manufacturer in Andhra Pradesh, benefits from use of the ELISA kits.

A new Sahel – sun, sand and salvation

The Sahel… in Arabic the word means coastline, or edge. The Sahel is the great dry land belt underlying the Sahara Desert, the northern perimeter of sub-Saharan Africa; in other words, the desert margin – a bleak, unforgiving landscape.

The battle to mitigate the problems of the Sahel has been joined on many fronts. Countries identify their particular constraints and priorities, and a range of partners – donors, research institutes, NGOs – help them identify the appropriate expertise to move ahead. Solutions are multi-pronged. Two particularly notable initiatives are the African Market Garden and the Sahelian Ecofarm.

The **African Market Garden** (AMG), a low-cost drip irrigation farming model, costs $60 to outfit an 80m^2 area, and pays for itself in six months through high-value crop production. More than 1800 AMG units are now in use across western Africa.

A row of A. colei *surrounds the field in the Sahelian Ecofarm.*

Ingeniously planned, the **Sahelian Ecofarm** features strategic choices in the placement of trees, hedges, grass and annual crops. Consider this model:

Acacia colei trees are planted at 2-meter intervals along the perimeter of a 1-hectare field. Acacia produces substantial biomass for mulch, fixes nitrogen, and its seeds can be used as a constituent of poultry feed. Two rows of Acacia are alternated with one row of *Zizyphus mauritiana* (pomme de Sahel). These are planted in beds shaped like halfmoons, called demi-lunes. The apple-like fruits are harvested for income generation, and the demi-lunes are shaped for water retention around the base of each tree.

Long shelf-life tomatoes.

This Sahelian rainfed tree-shrub-crop model generates $680 per hectare in revenue – 13 times more than the $50 received from the traditional sole millet crop – and is far more environmentally sustainable.

High value crop diversification

High value crops not only provide for higher incomes, but can also be tailored to become channels of better nutrition. Keeping this in view, and following its Governing Board decision in 2002, ICRISAT started an intensive program in Niger on fruit trees for the SAT. By August 2006 ICRISAT-Niger had become the custodian of 131 accessions of fruit trees, the largest available worldwide collection of fruit tree germplasm adapted to adverse climatic conditions of the dry tropics.

Combined with the low-pressure drip irrigation, ICRISAT started a program for crop diversification that is geared towards increasing the income of Africa's rural communities, this time, with emphasis on regional and international exports. Newly introduced plants are planted in a drip-irrigated "mother plantation", where they undergo screening for suitability to the local soil and climate to strengthen capacity building among lead farmers. ICRISAT trains about 200 nursery personnel in nursery methods each year.

The outstanding tree species are the domesticated *Zizyphus mauritiana* (that we call *Pomme du Sahel* or Apple of the Sahel in francophone West Africa, or *ber* in India), dates, figs, grapes, pomegranates, and various citrus species.

In collaboration with the World Vegetable Center, we have enabled the commercial integration of fruits, vegetables and trees in the dry Sahel. Quality vegetable varieties adapted to the high temperatures in the Sahel are being selected. Long shelf life tomatoes for regional exports have been introduced, and the healthy lettuce, onions, cowpeas and Roselle provide quick income while waiting for the trees to produce.

Pomme du Sahel.

A processing unit for value-added products from medicinal and aromatic plants was inaugurated at Patancheru, further strengthening the concept of diversification of the rainfed agriculture system by commissioning a demonstration-cum-training unit for distilling the active ingredients from medicinal and aromatic plants. The Watershed Team has undertaken a new initiative to diversify rainfed agricultural systems and increase the incomes of farmers using medicinal and aromatic plants.

An "Oasis" in the desert

The hitherto dry, degraded and even deserted lands in some of the hottest harshest places in Africa are now being rehabilitated and made productive through a Desert Margins Program. The target is to make 30,000 hectares productive for 250,000 families in four West African and three eastern and southern African countries. Six CGIAR Centers, advanced research institutes, and nine sub-Saharan African NARS have joined forces for this initiative.

As a new initiative, and as of this writing, the priorities and strategy are still evolving. So far the following areas are central to the Oasis initiative:

- Understanding the human causes and dynamics of dryland degradation
- Better landscape management to increase the productivity of soils, water, crops and all living things in the region
- Overcoming policy, market and institutional constraints to sustainable dryland management
- Avenues of development that can reward dryland inhabitants for better land care, and
- Sharing knowledge for increased impact that will benefit the poor.

The initiative is being expanded and strengthened into a new research program positioned to become a Challenge Program with the International Center for Agricultural Research in the Dry Areas (ICARDA) headquartered in Syria, and other centers and partners.

Women weeding gardens in Bagoundie.

Miracles with microdosing

Research done at ICRISAT shows that poor soil fertility, more than drought, is the major food-production constraint across much of sub-Saharan Africa. When plants are malnourished their weak root systems cannot collect the rainwater that falls, and thus suffer for it.

This situation can be remedied by rectifying the severe phosphorus and nitrogen deficiency of these soils through tiny doses of fertilizer – just one-sixth or less of the rates used in the developed world – which will allow the plants to capture more water and increase yields. So a Coca Cola bottle cap's worth of fertilizer is all it takes.

This is called 'microdosing' – applying small amounts of fertilizer with the seed at planting time thereby increasing fertilizer use efficiency, rather than spreading the fertilizer all over the field.

Microdosing has reintroduced fertilizer use in Zimbabwe, Mozambique, and South Africa in the southern part of the African continent; and Niger, Mali and Burkina Faso in western Africa. Farmers in ICRISAT's project countries have developed innovative techniques to apply microdoses of the appropriate fertilizer. While the farmers in southern Africa use fertilizer measured out in an empty soft drink or beer bottle cap, in western Africa the farmers measure fertilizer with a three-finger pinch and apply it in the same hole in which the seed is sown.

Mr Seydou Boubacar, a 39-year-old farmer from Bokki, a village 80 km to the south of Niamey, practices the microdosing technique on his farm. At first, in 2002, he experimented with this technique on a 0.5 ha patch with millet, and got a yield of 570 kg. Previously he had grown millet on 1.5 ha and got just 450 kg. This astonishing increase on just one-third the land speaks volumes!

Compare the field on the left, which received microdosing, with that on the right. Inset: Applying small amounts of fertilizer.

Climate change

We know that continued global warming is inevitable, and that it will have major future impacts on rainfall distribution patterns worldwide. Whilst the exact nature of such changes remains uncertain, it is universally accepted that the adverse impacts on poor rain-fed farmers in developing countries will be especially harsh. We must help them.

The poor can also help us to help them. They have learned to cope with variable rainfall. We now aim to work with them to improve their current coping strategies and livelihood resilience. In fact, ICRISAT believes that our immediate priority is to build the livelihoods of vulnerable and risk averse farmers to enable them to cope better with current rainfall variability as an essential first step if they are to be able to adapt to future climate change. This pragmatic approach was endorsed by NEPAD in 2005 as an integral component of their Comprehensive Africa Agriculture Development Programme (CAADP).

Scientists are working towards systems that can beat the vagaries of climate change.

We have now partnered with meteorological services and leading climate modeling researchers worldwide in a series of projects centered around the purpose of climate risk management. We blend their knowledge with our expertise on tropical dryland farming systems using climate-driven risk analysis. This involves the use of leading-edge tools such as weather-driven crop, soil and water simulation models, spatial weather data generators, and seasonal climate forecasting approaches.

Many of these projects focus on mitigating climate risk through making better use of natural resources. Take water, for example. Much of the rain that falls on the drylands, paradoxically, is 'wasted' from a farming point of view— flood surges don't allow plants to pick up water as soils are unable to absorb it. In infertile soils, underdeveloped crop roots cannot use all the water that is potentially available. We are helping farmers devise ways to manage landscapes, soils and crops so that more of the water and nutrient resources are stored and used more efficiently and over a longer time period.

Looking to the longer term, and recognizing the certainty of a warmer world, we need to re-attune our crop improvement strategies accordingly. Along with many of our sister Centres, we have identified the necessary breeding strategies that must be put in place to adapt our mandate crops through providing them with higher temperature tolerance.

Watershed management

If water is not managed properly, it causes degradation of the soil through runoff and soil loss, or through water logging on one hand and water scarcity during dry spells, leading to significant problems with crop growth and productivity. Thus, managing water is essential to agriculture and much more to life. At ICRISAT, a watershed-based farming system was developed that captures rainwater that would otherwise be lost as runoff and deep drainage, and several ways to usefully employ the captured water have been developed.

Adarsha in Kothapally near Hyderabad – an ideal watershed.

ICRISAT and partners have also developed a participatory consortium approach to develop model watersheds that have been successfully implemented in poor rural communities with outstanding results. Yields have increased by 2.5 to 4 times and incomes by up to 77% (India) and 45% (in Southeast Asia). More than 200,000 families across India, China, Vietnam, Thailand, the Philippines and Rwanda have adopted the technology, and have benefited greatly.

Activities in the model watersheds involve the testing and refining of natural resource management options in the farmers' fields and carbon sequestration. Team members evaluate suitable cropping systems based on the agro-ecological potential of the region and adopt improved soil, water, nutrient and pest management technologies.

A recent initiative of the watershed team is the raising of bio-diesel plantations in degraded lands unsuitable for cropping. Oilseed trees such as *Pongamia* and *Jatropha* are planted on wastelands providing employment to rural dwellers and source material for bio-diesel to industries. This is going above and beyond the "watershed management" with amazing results and positive impacts on livelihoods.

The Farm and Engineering Services has rolled out microprocessor based automatic sediment sampling devices for the watershed team. These units are extensively used for assessing the topsoil erosion during the rainy season, and several units have been purchased by State Governments/ agricultural universities of Andhra Pradesh, Delhi, Karnataka, Madhya Pradesh, Rajasthan and Tamilnadu in India, and by Agricultural Departments/reseach institutes of China, Ethiopia, Laos, the Philippines, Thailand and Vietnam.

Relief, Development, or both?

ICRISAT's work in Zimbabwe shows that relief and development are not mutually exclusive. With support from a wide range of partners, scientists are showing how relief investments can be structured so as to yield both short- and long-term impacts.

Seed relief – a powerful development tool.

A series of surveys were conducted, covering nearly 3000 households across 19 districts in Zimbabwe, with some surprising results. But, were these the right criteria? And could they be implemented under field conditions? Unfortunately, the answer to both questions is, probably not.

One solution to both problems would be to use a different criterion – livestock ownership. The survey found that draft power was the key determinant of farming success. Households with adequate draft animals planted 60% more land, and harvested 70% more grain. In short, use cattle ownership as the yardstick, which would identify the poorest households more accurately.

The surveys also show that much of the relief seed given to farmers is never planted, for various reasons. ICRISAT and other partners have developed and tested a range of high-yielding, early-maturing, locally adapted varieties. Relief programs must select the right variety for each environment.

ICRISAT has helped dispel the myth that fertilizer distribution does no good in low-rainfall areas. In fact, if it's done right, distribution of fertilizer gives more than double the returns from seed distribution, even in dry areas. Micro-dosing increased grain yields by 30 to 50%, and almost every farmer achieved significant gains. The 160,000 households increased their production levels by an estimated 40,000 tons.

ICRISAT and its partners are looking at different components of relief programs: improving design, fine-tuning implementation, and even redesigning the basic relief paradigm. As a result, donors and implementing NGOs are redesigning their programs. Relief programs are no longer simply ad hoc or stopgap interventions. They are becoming a powerful development tool to fight hunger and poverty in southern Africa.

Spreading seeds of success

Poor farmers in drought-prone regions are tired of continued reliance on relief seed; they need sustained access to high quality seed of improved varieties and complementary inputs that can assist them to grow their way out of poverty. Commercial seed production and input supply systems in sub-Saharan Africa remains undeveloped despite the millions of dollars invested by donors and international development agencies.

In West Africa, a public-private sector alliance is being forged to tackle this challenge, The alliance (called the *West Africa Seed Alliance*, WASA) brings together a diverse group of organizations that will develop a competitive seed industry providing small-scale farmers with affordable, timely, and reliable access to high quality seeds and planting materials. The initial focus will be on Ghana, Mali, Nigeria, Burkina Faso, and Niger for an initial period of five years.

Across Africa, ICRISAT and her national partners including the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) and the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) are working to establish and pursue efficient breeding programs that integrate the best of modern science and local knowledge to improve ICRISAT's mandate crops.

Building on the cooperation begun under WASA, as well as in Mozambique and elsewhere, ICRISAT, the Seed Science Center of Iowa State University, and CNFA, Inc. are launching the *Eastern and Southern Africa Seed Alliance* (ESASA) to support the development of commercial seed production and marketing systems in this part of the world.

ESASA will operate at two levels; multilaterally through the Southern African Development Community (SADC) and the Common Market for Eastern and Southern Africa (COMESA), and bilaterally with several countries but starting with Malawi, Mozambique and Tanzania where these organizations are already engaged. The development of ESASA is being supported by USAID through the program for the Sustainable Commercialization of Seeds in Africa (SCOSA).

The business-like approach of the alliances will support local entrepreneurs produce and market seed and the complementary inputs needed to maximize productivity of hundreds of thousands of farmers.

Multiplication of high quality sorghum seeds.

Managing institutional health

The last five years have seen a complete turnaround in management practices and processes at ICRISAT. After the slump in the 1990s, burgeoning buds of betterment, indicating a very healthy metabolism, are evident across various facets of management.

In the first place, excellent financial management has provided a budget surplus every year for the past four years, and reserves have gone from $6.9 million to $10.4 million. Net expenditure has grown from $21.4 million to $34.1 million, and grants have increased from $20 million to $32.4 million from 2002 to 2006.

Responding to ICRISAT's regional needs of Asia and sub-Saharan Africa and following a Governing Board decision in 2004, the management was decentralized, providing regional Directors of two major ICRISAT hubs – Eastern and Southern Africa (ESA) and Western and Central Africa (WCA).

Institutional visibility has been enhanced tremendously. Management innovations improved morale leading to more intensive resource mobilization and strategic communication. Media workshops in both Asia and sub-Saharan Africa have assisted in many more of the institute's successes and activities being reported in both the print medium and on radio and television. The institute is host to more and more leaders and heads of Governments, and this in turn has brought the institute to the attention of more donors and partners for even more progress – and closer to our vision of "Improved livelihoods for the poor of the semi-arid tropics".

Governing Board meeting in progress.


International
Newsletter

Chapter 3
Information

Communication is an extremely important and serious activity in any organization. Without communication we can neither inform nor be informed. Information and Communication Technology (ICT) is now an integral part of our everyday lives. Using ICT, information can flow almost immediately to the farmer, to the donor, to the scientific community and in fact to all stakeholders. We also strategically use the spoken word, the printed word, television and radio to disseminate information, teach and train. Here are some inspiring stories about how we gather information, give information and contribute to capacity building.

High tech for an old problem

Drought is possibly the most complex and least understood of natural hazards. The effects of drought accumulate slowly and linger for years. It is estimated that 380 million people, 38% of the world's rural poor, live in the arid and semi-arid tropics (SAT). Of those who are vulnerable to drought, more than 90% are either smallholder farmers or landless laborers.

An Indian farmer ekeing out a living in a drought year.

Rural women in Knowledge Society Project

Development researchers are concerned that the ICT approach may further marginalize rural women. However, pilot or experimental projects in Asia indicate that innovative processes for inclusion are available.With the support of the Regional FAO for the Asia-Pacific, ICRISAT's Information Services Unit (ISU) is preparing a concept paper to identify new opportunities for rural women in the Asian semi-arid tropics. This is a part of the emerging process called the Knowledge Society Project. The ISU is organizing a study in Asia that analyzes such processes so that the new inclusive paradigms can be adapted.Our hope is that we can offer insight and concepts derived from such comprehensive studies as a contribution to the preparatory processes for the World Summits on Information Society in Geneva (2003) and in Tunis (2005).

Information and communication technologies (ICTs) can play an important role in mitigating the effects of drought in remote SAT regions. Contemporary ICTs can rapidly collect, analyze and disseminate data to assist farmers in responding to environmental threats. Experts can predict local climate changes by analyzing meteorological and hydrological data. Early warning systems can advise farmers on appropriate action.

Because ICRISAT has been involved in agricultural research in the dry tropics for three decades, it is an ideal information provider on the problem of drought. Our knowledge base provides a sharp focus around which a system can be developed with global coverage and an emphasis on sub-Saharan Africa and South Asia.

The NGO-led movement for the establishment of rural telecenters, information kiosks and village information centers provides crucial support in this effort.

VASAT: The right information for the right people at the right time!

When it comes to coping with drought, sharing the right information and knowledge at the right time can mean the difference between life and death for the tens of millions of farmers who periodically face severe drought.

The Virtual Academy for the Semi-Arid Tropics (VASAT) is a non-formal distance education coalition led by ICRISAT to help vulnerable rural communities and their intermediaries cope better with drought and desertification. It explores how information and communication technologies (ICTs) can be used in open and distance learning (ODL) for innovative information and knowledge sharing.

President of India, His Excellency APJ Abdul Kalam inducted Ms Sushma Reddy of VASAT as a Fellow of the Jamshedji Tata National Virtual Academy for Rural Prosperity at an impressive convocation held at New Delhi on 11 July 2005.

The Commonwealth of Learning (COL), an inter-governmental organization promoting open and distance learning in Canada, collaborates with ICRISAT in the design, testing, implementation and evaluation of these programs for agricultural researchers, extension workers and farm families in the semi-arid tropics. The ICT-KM program of CGIAR has extended financial support, while ILRI and IWMI are the other partners from CGIAR.

VASAT has been using a hub-and spokes model tested by the MS Swaminathan Research Foundation, in South Asia, especially in India. The “hub”, which connects to the Internet, is located in a village with access to good communication infrastructure, while smaller villages, the “spokes”, connect to the hub using terrestrial wireless technologies and thus get access to information.

The principal partners are major open universities and agricultural research agencies such as the Central Research Institute for Dryland Agriculture (CRIDA) of the Indian Council for Agricultural Research (ICAR).

In Africa, the interface of low-frequency and solar powered FM community radio stations, established by RANET (a RAdio and InterNET international collaboration), serve as VASAT’s hubs. In West and Central Africa, a group of inter-continental, regional, national and local organizations comprise the VASAT coalition partners.

ICRISAT has helped the Philippine national agricultural research and extension system to establish an Open Academy for agriculture in the model of VASAT. An MoU was signed to launch the project on 28 July 2004 at Manila.

Media workshops: Demystifying biotechnology

In the past 10 years, genetically modified (GM) crops have generated active media interest. There have been news and feature stories hailing GM crops as the greatest technological gift to world agriculture juxtaposed with media reports referring to GM crops as "Frankenfoods". There have also been stories that straddled the middle ground, quoting proponents and opponents of the technology.

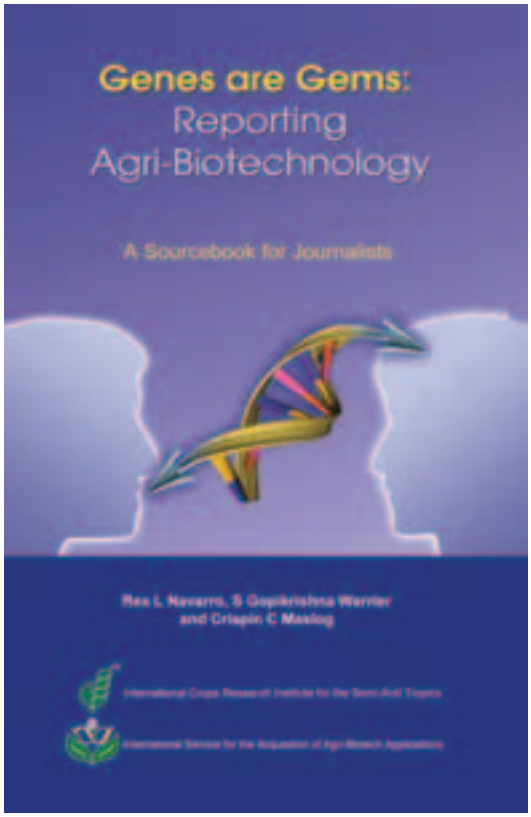
In 2004, our Communication Office initiated, along with partners, a unique and innovative series of media workshops on agri-biotechnology. The objective: provide a platform for ICRISAT scientists, external experts, stakeholders and journalists to interact, discuss and debate agri-biotechnology, and more particularly the transgenic technology. A series of six workshops were held between 2004 and 2006.

The first in the series of agri-biotech media workshops was organized at ICRISAT headquarters in October 2004. The three-day event attracted specialist journalists from India, Bangladesh, Sri Lanka and Nepal. International resource persons joined resource persons from ICRISAT. Additionally, it brought together diverse stakeholders on agri-biotechnology – government agencies, regulators, scientists, intellectual property experts, civil society leaders, farmers' representatives and the seed industry.

The other media workshops were held in New Delhi in April 2005, Bangladesh during the last week of August 2005, Niger in November 2005, during the AGM at Morocco in December 2005 and the last one at ICRISAT-Patancheru in August 2006.

The news and feature stories from the media workshop established ICRISAT's agri-biotech research on the global media map, and spawned several other news stories in the print and electronic media around the world.

A product that emerged from the media workshop series was a sourcebook for journalists on agri-biotechnology. Called *Genes are Gems*, the sourcebook published in collaboration with the International Service for the Acquisition of Agri-Biotech Applications (ISAAA), is already popular with journalists writing on the subject.



Turning Data into Knowledge: The Impacts of Bioinformatics

Biotechnologists at ICRISAT employ a range of modern genomic technologies to enhance crop improvement. Since the speed at which data is captured, validated, analyzed and turned into useful knowledge is a critical step in genomics, ICRISAT's Bioinformatics Unit is striving to solve this problem by providing the software platforms for handling large volumes of data. They focus on three key areas: (a) the development of an appropriate platform for storage and retrieval of data; (b) the development of efficient protocols for handling and validating the large volumes of data; and (c) the development of high-throughput sequence analysis tools and methodologies for purposes such as the identification of molecular markers, and as aids to annotation or comparative genomics.

The impacts of the Bioinformatics Unit can be demonstrated by these examples of its activities:

Explaining the concept in the lab.

- The Unit has developed a Laboratory Information Management System (LIMS) that meets the needs of a moderately high-throughput molecular genotyping facility.
- The LIMS helps to reduce concerns of errors being introduced at various levels of data generation by validating data entry, checking for inconsistencies and annotating data at every step of the workflow.
- One of the first steps is to break down the analysis into single components and identify measures needed to improve the efficiency of the entire process. This may be through building pipelines of software or implementing applications in parallel.
- Students from various universities and institutions in India have shown increased interest to work in ICRISAT's Bioinformatics Unit. Ten graduate students working towards a degree in biotechnology or bioinformatics are accommodated in training programs every year.
- Links with the corporate sector are important. ICRISAT has been working with scientists of the advanced Technology Centre, the R&D wing for bioinformatics at the Tata Consultancy Services, a leading global IT organization, to build partnerships in the areas of software platform development, high-throughput comparative biology and systems biology.

Reviving the Think-Tank in West Africa

Village level studies in Niger, one of the poorest nations, show that despite donor and government investments in R&D during the last 30 years, the aggregate impacts of agricultural research are limited, and food insecurity remains widespread. There is a need to reassess agricultural research priorities and development interventions to transform the agricultural sector.

In 1982-85, ICRISAT collected a dataset on 114 households for 4 years in 4 villages in western Niger. In 2004, a participatory rural appraisal was carried out to study changes in livelihood strategies and outcomes that might have occurred in these villages. From 2004 to 2006, data was collected from 182 households, of which 86 households were originally interviewed in 1982-85.

Information management systems available on the intranet for local users and for download by external users.

Survey results indicate that villages with easy access to roads (higher rainfall zone) have experienced significant economic improvement, whereas farmers in villages with low rainfall report their inability to secure food for their families. Households in the high rainfall zones have accumulated more assets, are using more modern technologies and are diversifying more within and outside the agricultural sector than those in the low rainfall zones. There was an increase in livestock in less favorable agricultural areas compared to the more favorable rainfall zones, while the use of modern varieties remained limited in all areas. Also, only limited yield gains were obtained from the adoption of most new varieties, as this was not linked with the adoption of improved management practices.

In high rainfall areas, there may be more potential to promote pearl millet based technologies provided farmers diversify and derive more income and cash to be able to purchase inputs. Technologies such as the African Market Garden are viable options to pursue, provided farmers have access to credit. Policies and programs that could help address the credit constraints will facilitate uptake of technologies.

In the low rainfall areas, a combined effort to develop crop production technologies that will increase the supply of feed resources, and to identify and develop institutions and policies that will enhance the development of the livestock sector is necessary. The use of biotechnology to address the drought stress issues in germplasm is highly desirable.

Capacity building for impact

ICRISAT programs and processes in knowledge sharing and capacity strengthening have had two kinds of impact: triggering major new projects among the partner institutions, and demonstrating "empowerment" (information empowerment) effects.

In January 2005, ICRISAT joined a forum organized by the Commonwealth of Learning (COL) and a number of Indian State Agricultural Universities (SAU) to discuss open and distance learning in agriculture. At the invitation of five SAUs, ICRISAT organized a workshop on learning management systems with support from COL in late 2005. ICRISAT used audio and video conferencing methods to involve resource persons from five countries. This successful event led to the formation of a consortium for an online agricultural knowledge grid. At present, seven agricultural universities and four institutions specializing in IT research have come together with ICRISAT serving as the facilitator.

Dr William Dar and Sir John Daniel, President, COL, at a Roundtable Discussion on Educational and Extension Materials, and Capacity Strengthening (Jointly organized by ICRISAT and the COL).

ICRISAT trained women workers of the Adarsha Mahila Samaikhya in essentials of IT and in natural resource management for three weeks, partly online. They were soon able to spot problems in farmers' fields and to accurately convey them to the experts online.

Two of them were elected in 2005 to the fellowship of the Indian National Virtual Academy for Rural Prosperity, and were felicitated by the President of India. The Indian Space Research Organization (ISRO), impressed with their dedication and performance, donated a package of two-way video-conferencing equipment to their organization and to ICRISAT to help develop the model learning support programs online.

Programs of the University of Florida (UFl), pioneer in the area of applying distance learning methods in agricultural sciences, cover supplementary as well as graduate education in various topics, especially soil and water science. During 2005, extensive discussions with the UFl led to a new agreement to offer UFl courses in the distance mode involving the participation of ICRISAT scientists. In this regard, ICRISAT and CIAT are the two CGIAR centers working in collaboration with the UFl. The first course on GIS in land management was held in 2006. An MOU with Stanford University has been signed to prototype new methods of learning for development.

Protecting our Research Products

In late 2005, ICRISAT signed a Memorandum of Agreement (MoA) with the European Patent Office (EPO) based in the Netherlands. This MoA enables ICRISAT to disseminate knowledge of its research products in the EPO's Non-Patent Literature (NPL) database, which is in line with ICRISAT's strategy of making its intellectual property rights (IPRs) "prior art", approved by its Governing Board in September 2004 ("prior art" is the legal term used for all previous inventions in the field of an invention for which a patent is being sought. Prior art is used by the Patent Office to decide whether the invention is sufficiently unique and non-intuitive to qualify for patent protection).

B Hanumanth Rao of IP office at ICRISAT explaining to NARS scientists how ICRISAT manages its Intellectual Property Rights.

In line with its commitment to deliver international public goods to its stakeholders, ICRISAT effectively manages its intellectual property rights on research products by placing them in the public domain and making them prior art, thus preventing others from infringing on ICRISAT's rights. While publishing is carried out through journal articles and/or conference papers in internationally recognized journals, there are several publications (both external and internal) that ICRISAT produces, such as Technical Reports, Annual Reports and Monographs, which would be useful additions to materials included in the EPO's NPL database. The EPO shares its NPL database with other patent offices such as the United States Patent and Trademarks Office (USPTO), and those in Brazil and Canada.

To mark this historical collaboration, a first in the entire CGIAR system, ICRISAT provided a few publications on a trial basis in January 2006 for evaluation, which were successfully downloaded by the EPO and included in its NPL database. Full-fledged documentation was then shared through the Internet during May 2006, which paved the way for periodical sharing in future.

Library largesse

ICRISAT's library at its Patancheru Campus (established in 1973 and renamed the Jaswant S Kanwar Library during the 30th Anniversary celebrations in 2002) is almost as old at the Institute. It is one of the best and most accessible agricultural research libraries in India and plays a vital role in supporting research, education, and applied agriculture. In its international role, the Library serves as the center for world agricultural information on sorghum, pearl millet, finger millet, chickpea, pigeonpea and groundnut. It also develops a comprehensive collection of information in various formats relevant to ICRISAT's mandate crops, and a selective collection of information on disciplines, techniques, and methodologies.

The library offers reference, circulation, current awareness, literature search, inter-library loan and photocopying services. Library also manages a central reprographic service with both black&white and color printers.

The SAT e-library, launched on 2 April 2002, has direct access to bibliographies, abstracts and digital documents by ICRISAT's scientific community and partners from NARS. The user-friendly electronic library consolidates access to various resources and services available in-house and on the Internet.

Under the CG Libraries Consortium the library has been providing access to electronic full text journals to ICRISAT globally. Researchers can browse the website https://www.swetswise.com/ to open the web page that contains a hyperlink to the fulltext, and login via IP authentication.

Since 2005 the Library has been working on a Document Management System – NewGenLib – to integrate all the electronic resources developed in-house, including resources available at the Niamey library. The same System is also being tested towards creating an Open Archives system for an Institutional repository.

The library has also been associated with projects from FAO to develop scripts that run on the AGROVOC database to normalize lexical forms of the terms used, revise Japanese terms used, and export data in OWL format; and on digitization of Institutional publications under the Million Books Project.

Farmers Days

No other form of ICRISAT's communication activities is more gratifying than that experienced through the famous Farmers Days. These days, held every year from 1 to 5 days, is a time when it is "open house" for the farmers from surrounding regions. Farmers spend about 4 hours on the campus and are taken through demonstration plots, video programs and Question and Answer sessions with scientists.

The first Farmers Day was held on 4 September 1979, and more than 500 farmers from Andhra Pradesh, Maharashtra and Karnataka participated. This became an annual practice but stopped in the mid-nineties when ICRISAT was going through a financial crunch.

Director General William Dar revived the practice in September 2001. This time ICRISAT hosted 1901 farmers and 84 VIP guests. As Dr Dar observed, "We now have two thousand more ambassadors of our mission and work."

Encouraged by the unprecedented success of the Farmers Days, and wishing to expose farmers from other states to the technologies we develop, ICRISAT began holding Farmers Days in other states of India. On these occasions we assisted tremendously by partnering with the local NARS and universities.

Farmers Days were organized for the first time in three African countries – Malawi, Zimbabwe and Niger in 1993. The practice soon spread to other countries in sub-Saharan Africa.

It is heartening to hear, year after year, about the success of ICRISAT Farmers Days -- days when our scientists learn about new problems or new agricultural techniques from the farmers almost as much as the farmers learn from the Institute.

ICRISAT in the News

There is no doubt about it – ICRISAT's profile is much larger today, and our visibility much more widespread than it was 5 years ago. Changes in management style led to a more conscious decision to promote the institute's image, innovations, and emerging issues in the semi-arid tropics through the media. ICRISAT's Communication Office enthusiastically undertook to raise the visibility with the best media mix of newspapers, journals, radio, television and Internet.

ICRISAT considers the media as a partner in development. Media is the message multiplier, building bridges with the stakeholders – policy makers, donors, research institutes, universities, civil society and farmers.

When the Science magazine wrote a two-page story on ICRISAT's hybrid pigeonpea, news about ICRISAT's breakthrough reached a high-profile readership across the globe. The most popular television channel in India – NDTV 24X7 – covered the news in its prime-time news.

In a special issue, the New Scientist magazine included a story on ICRISAT's transgenic chickpea. When the Indian Ministry of Science and Technology commissioned the National Geographic Channel to do an hour-long program on India's technological achievements since Independence, the team covered ICRISAT's work on transgenics and eco-friendly biopesticides.

The Hindu Survey of Agriculture 2006 carried a cover picture from ICRISAT. When the Hindu Business Line wrote a comprehensive report on ICRISAT's ethanol from sweet sorghum project, it got a very high readership impact both in the print and the Internet edition.

The impact extends to Africa. Many media outlets – national and international – in Africa picked up stories on the successful Babati pigeonpea in Tanzania and ICRISAT's low cost aflatoxin detection kits in Malawi. Similarly, when ICRISAT Director General signed a Memorandum of Understanding with his counterpart from the national agricultural research system of Mozambique for establishing an agri-business incubator in Mozambique, there were many reports in the media.

ICRISAT has also been an opinion leader through the media. Director General William Dar has been contributing Op-Ed pieces, which have been published by The Hindu newspaper.

President of India Dr Abdul Kalam commended ICRISAT in Republic Day speech of 2003. He spoke about ICRISAT's short duration, disease and drought resistant varieties of important crops beneficial to Indian farmers. He said that the various tillage practices and nutrition management techniques they developed would enable India to reclaim 5 more million hectares of the 33 million hectare of wasteland

Thresher thrashes polygamy?

As part of its capacity building efforts at community level, ICRISAT donated a thresher to the farmers association of Kulumusenza, a severely drought-prone area in Zimbabwe's Tsholotsho district. The community is a target area for the ICRISAT-USAID-LEAD project. Dr CLL Gowda, who was on a short visit to the country, handed over the thresher, during a project field day attended by a host of local dignitaries and over 250 farmers.

Why a thresher? The LEAD project focuses on commercialization – providing technical advice and market linkages to empower smallholder farmers to move from subsistence to commercial agriculture. Smallholder farmers thresh their grain by hand. In the process the grain is usually contaminated with dirt and stones. The buyers are unsatisfied and offer low prices. The solution – a threshing machine – is too expensive for most smallholder farming communities.

The farmers of Kulumusenza have been successfully applying ICRISAT technologies – improved varieties as well as crop and soil/water management practices – and growing improved pearl millet crop. The thresher donated by ICRISAT will be jointly owned by the community, and used to thresh the village's entire cereal harvest.

The thresher promises other benefits too. Ms Dube, one of the active farmers, said: "After working with ICRISAT, our harvests have become much larger. Threshing and winnowing millet is the woman's job, so we had a lot of extra work. In our culture, when the wife is overloaded, the man simply gets a second (or even third) wife. Thanks to ICRISAT, no wife in Kulumusenza will fear that her husband will bring home another woman!"

The "Wife-saving" thresher!

Newsletters

Happenings: A weekly in-house newsletter published every Friday informs every staff member across all ICRISAT locations about highlights of the week, new staff members, official announcements and interesting family news. Softcopies of Happenings are available on the ICRISAT Intranet.

SATrends: Started with the new millennium, this monthly e-newsletter published through the Institute's web page features both trends and highlights in research activities. Contact information for the concerned scientists is provided, and this has invited comment and communication from peers in other establishments of agricultural research. All issues are available on the ICRISAT web site.

What ICRISAT Thinks: Letters from the Director General to a targeted audience exploring major current opportunities for sustainable development in the drylands, reflecting ICRISAT's long experience as a leader in this field and often challenging the conventional wisdom. So far the letters have discussed the following topics:

Biofuel crops; Climate change; Defeating dryland risk; Hope from high-value crops; Safe and healthy dryland food and Dryland development pathways. All the letters are available on the ICRISAT web site.

Project Development Re$ourcEs: This monthly electronic newsletter from the Project Marketing and Development Office serves as a vehicle to invite concept notes for competitive grants and informs about funding obtained for projects.

Space bridges expert-farmer gap

When the President of India, His Excellency APJ Abdul Kalam, inaugurated the First National Virtual Congress of Farmers on 5 January 2006 from Hyderabad, India, he created a unique linkage. The First Citizen of India was answering the down-to-earth questions of the farmers from villages across the country. And, he was using hi-tech space technology to reach the remote villages from Hyderabad.

In February 2005, the Virtual Academy for the Semi-Arid Tropics (VASAT) facilitated a videoconference between the groundnut farmers of Pudukottai, Dindigal and Pondicherry, and experts via the Indian Space Research Organization (ISRO) satellite link available with the MS Swaminathan Research Foundation (MSSRF).

Encouraged by the outcome of this videoconference, an elaborate plan was drawn to connect some of the most disaster-prone areas of the country with the centers of expertise such as MSSRF and ICRISAT. ISRO readily agreed to share the bandwidth of one of its most advanced satellites EDUSAT and provide video link facility to Koraput in Orissa, Pokhran in Rajasthan, Anandwan and Waifad in Maharashtra, Addakal in Andhra Pradesh, besides the already existing facility at Pudukottai and Nagapattinam in Tamil Nadu.

Once the facility was up and running, the First National Virtual Congress of Farmers was launched at the Acharya NG Ranga Agricultural University, Hyderabad as part of the 93rd Indian Science Congress. Spontaneous and articulate, President Kalam needed no time to strike a chord with the farm families who were virtually connected from across India. He also facilitated discussions between the experts located at ICRISAT-Patancheru and MSSRF, Chennai.

This unique interaction between the President of the country and the poor farm families was broadcast live on the Indian national television channel.

ICRISAT continues to provide farm families with expert advice from time to time. It also conducts periodic discussions with farmers to assess its impact.

Chapter 4
Institutions

Individuals and organizations specialize in the area of their expertise, however, today's complex socio-economic problems require a holistic outlook to resolve them. No one institution has the capability or the capacity to deal with these complex issues. Therefore, collaboration and partnership amongst organizations has attained prime importance. Collaborators help in pooling resources, complement each others' efforts, reduce duplication and look at the problems from different points of view. The following examples of partnership, collaboration and support make it amply clear.

The Agri-Science Park@ICRISAT

The Agri-Science Park@ICRISAT (ASP) was set up in December 2003 as the flagship initiative of ICRISAT that would act as the umbrella for all the partnership-related work done at ICRISAT in order to integrate the approach into one framework. ASP signed an agreement with the Government of Andhra Pradesh, positioning itself as the Ag-Biotech Hub of the Genome Valley project of the government.

Through the ASP, ICRISAT aims to achieve its mandate to develop agriculture in the SAT, and thereby reduce poverty and hunger, as well as protect the environment.

Prior to the formation of ASP, ICRISAT realized the potential and importance of the involvement of the private sector in development, and introduced several such initiatives. These later evolved into full-fledged projects, driven mainly by the private sector, and include the Hybrid Parents Research Consortium, Agri-Business Incubator and Bioproducts Research Consortium, which later became components of the ASP.

The Agri-Business Incubator (ABI) was developed in partnership with the National Science and Technology Entrepreneurial Development Board (NSTEDB) of the Department of Science and Technology, Government of India. The idea behind ABI is to invite fledgling businesses to the campus and nurture them by providing facilities, technology, equipment and expert advice until they're ready to move out and take flight on their own. In other words, we're using the word "incubate" literally. We optimize the use of our facilities by sharing them with an array of partners, while simultaneously disseminating our research results.

The Ag-Biotech Innovation Center (AIC) serves as the platform for housing Ag-biotech and Agri-business companies to kick-start their ventures by bridging the gestation period and is supported by the Government of Andhra Pradesh

Public-Private Sector-Farmer Consortia

In recent years there has been a remarkable growth in the private sector investments in research and development for crop improvement, especially in crops that provide hybrid cultivar options. The Hybrid Parents Research Consortia (HPRC) is a joint initiative of ICRISAT, the private sector and Indian NARS that was formed so that poor farmers have greater scope of accessibility to better hybrids.

HPRC currently includes consortia on sorghum, pearl millet and pigeonpea, and involves 46 companies as members. The consortia deals with development of high yielding, disease and pest resistant hybrid parents, and training for transfer of hybrid seed production technology.

Biopesticides have shown great potential to replace or supplement chemical pesticides, which create problems like resurgence of secondary pests, environmental pollution and pesticide residues in food, drinking water and even milk. To this end, ICRISAT and interested biopesticide companies formalized the Biopesticides Research Consortium in 2005. It was later renamed as the Bioproducts Research Consortium (BRC) to recognize the role of balanced crop nutrients in enhancing soil health. BRC also aims at delivering research outputs and technologies relevant to biofertilizers and organic farming.

ICRISAT's new technology of breeding cytoplasmic male sterility (CMS)-based pigeonpea hybrids is being transferred to the NARS and private sector hybrid parent research consortium partners working on pigeonpea.

ICRISAT initiated the Sweet Sorghum for Ethanol Research Consortium in 2007, to enhance our partnership with the private sector to serve the poor farming communities in the SAT. Our anticipatory breeding programs have enabled ICRISAT to stay ahead and respond to future needs. For example, the revival of the sweet sorghum improvement program in 2003 has provided the promising varieties and hybrid parents for initiating the partnership with the private sector ethanol industry.

Agro-Ecotourism

ICRISAT's research has made it an expert on the rich bio-diversity in India's varied climatic regions, placing it in a prime position to educate farmers and nature lovers about the semi-arid environment, including its wildlife.

An agro-ecotourism complex has come up within the ICRISAT-Patancheru campus. Launched on 11 September 2006, the complex is located at the site where Manmool village formerly stood, and consists of a castle, temples, mosque, chapel, a golf driving range, a running track, a lake and a conference facility. With protection and conservation measures implemented at ICRISAT, the place offers a placid ambience amidst a scenic dryland agrarian environment to visitors.

The location of the complex at Manmool is historic, since it is the original site where ICRISAT's research activities began. According to Hindu legends, Manmool is believed to have been a town called "Mandagola". Etymologically, folklore has it that "Manmool" is adapted from the original village name "mandu-moola", where "mandu" stands for 'medicine' (cure and healing) and 'mool' means 'roots'. Manmool, in this context, could mean the "roots of healing".

Clockwise from top left: Lake ICRISAT near Sunset Park, Manmool Castle, temple, chapel, mosque, golf range, gazebo at Sunset Park.

Blasting away the badness from finger millet

Finger millet, native to East Africa, is entwined in the local culture and traditions. Unfortunately, this crop ranks very low in government priorities. Research and extension budgets are negligible. Markets and market information are lacking. Farmers cannot find buyers for their grain, while processors cannot find enough grain to run their milling plants efficiently. Finger millet remains a smallholder crop, planted on a small portion of the household's fields, for family consumption.

One big problem is grain quality – the grain sold to processors is contaminated with stones and soil, partly because millet is threshed by hand, on dirt floors. Another more serious problem is blast disease, a fungal infection that can strike different parts of the plant at different stages. Blast-resistant varieties are available, thanks to research by ICRISAT, the University of Warwick, and others. But seed production and dissemination must be strengthened.

The effects of blast – poor grain setting and shriveled grain.

Recognising the importance of finger millet in East Africa and the serious lack of knowledge of the blast disease and technologies for its management, the UK Department for International Development (DFID) Crop Protection Programme (CPP) funded projects that were implemented in Kenya and Uganda to understand and manage blast.

A workshop, the first ever in sub-Saharan Africa devoted to finger millet, was held in Nairobi, Kenya in September 2005. It brought together the full range of players – national research and extension services from Uganda, Kenya and Tanzania, regional networks, private milling companies, universities, farmers, NGOs, international research centers, and development investors.

The workshop looked at constraints and opportunities from different perspectives; and developed a comprehensive R&D framework for finger millet in East Africa. Most important, it has put finger millet on the policy map, creating the conditions necessary for governments, NGOs and the private sector to invest in promotion of the crop more widely throughout East Africa.

Porridge made from finger millet is a favorite in East Africa.

Birds of a feather flock to seed

Life is never easy for Africa's smallholder farmers, but partnerships can conquer even the most formidable challenges. Consider the recent work in various countries involving research institutes, NGOs, governments and local communities – specifically, ICRISAT, Kenya Agricultural Research Institute (KARI), the UK's Overseas Development Institute (ODI), CARE International, Catholic Relief Services (CRS), regional Governments and small-scale seed producers and traders.

Short-term seed needs can nearly always be met locally.

In war-torn Sudan, farmers did not appreciate seeds distributed by relief agencies. They already had seed systems to meet short-term needs. What they lacked were modern varieties. ICRISAT, ODI and CRS started an initiative to overcome this need. CRS purchased two modern varieties of groundnut from ICRISAT, and started a farmer-participatory testing program.

In Somalia, following an ODI-ICRISAT study in 1998, seeds of modern varieties were marketed through traders. ICRISAT provided breeder seed, which CARE multiplied, and 10 tons were distributed through 30 traders.

In Mozambique, following a devastating flood, more than US$ 8 million was spent on distributing relief seed, but farmers benefited only marginally – some varieties were unfamiliar, others poorly adapted to local conditions. ICRISAT suggested that farmers be allowed to procure seed themselves, locally. CRS, a pioneer of seed fairs, trained two Mozambicans on how to plan and implement seed fairs. At seed fairs, farmers are given vouchers that can be exchanged for seed from a choice of crops and varieties, sold by other farmers, traders and commercial seed companies. This initiative, first launched by CRS in Uganda, has also been successful in Burundi, Kenya, Sierra Leone, Tanzania and Sudan.

In Tanzania, ICRISAT's alliance provides technology and seeds directly to smallholder farmers besides linking them to high-value niche markets. The partnership is complementary – CRS provides the direct link to smallholder farmers; ICRISAT provides the relevant technology and seeds.

ICRISAT, KARI and other partners jointly developed an intervention to help smallholder farmers cope with droughts. The main thrust is to provide seeds of early-maturing varieties that escape drought, thus providing food security.

These partnerships have also borne fruit in Ethiopia, Eritrea and other countries.

Rebuilding Afghanistan's agriculture

Afghanistan's years of war and civil strife, aggravated by three debilitating years of drought, resulted in the collapse of agricultural production systems. Responding to the problem, several CGIAR centers formed a consortium led by ICARDA. Center scientists met to establish research activities and set research priorities in collaboration with national partners and international agencies.

One of the CGIAR projects is called *Strengthening seed systems for food security in Afghanistan*. Funded by Canada's International Development Research Centre (IDRC), the project is devoted to understanding the damage inflicted on the indigenous seed system and germplasm resource base.

The project is being implemented by a multi-disciplinary team comprising representatives of IARCs, NGOs and Afghan institutions spanning disciplines and experience in plant breeding, social anthropology, seed technology, crop production and crop economics. ICRISAT scientists Farid Waliyar (an Afghan by birth), Richard Jones and Kate Longley provided inputs to the drafting of the project.

To help link farmers with national and international markets, Mr Nad Ali, an officer with Afghanistan's Ministry of Agriculture was provided training in information and communication technology for three months at ICRISAT, with funding from IDRC.

Kate Longley in the field with Afghan enumerators in Kunduz.
(Photo: Abdul Sabur, Afghan Survey Unit.)

Seeds of Life in Timor-Leste

Timor-Leste, the world's newest country, was formerly a Portuguese colony and subsequently an Indonesian province. When its inhabitants overwhelmingly voted for independence in August 1999, terrible civil strife ensued, resulting in widespread damage to infrastructure and disruption of farming activities.

The Australian Centre for International Agricultural Research (ACIAR) was charged with the profoundly difficult job of rekindling agriculture after the violence. ACIAR called the new project *Seeds of Life*. The three-year project is a collaborative effort among ACIAR; Timor-Leste's Ministry of Agriculture, Fisheries, and Forestry (MAFF); Catholic Relief Services; and five CGIAR centers: CIAT, CIMMYT, CIP, ICRISAT and IRRI.

The special objectives of the project included evaluating the adaptation of several crops to a range of soils and climatic conditions, identifying and multiplying better-adapted lines, improving farmers' access to high quality seeds of the best-adapted cultivars, developing a crop performance database over a range of environments for future development programs and building capacity of local institutions and staff in evaluation, production and distribution of improved germplasm and integrated crop management.

ICRISAT's involvement with *Seeds of Life* was initially confined to groundnut. However, as sorghum is grown sporadically throughout the country, MAFF showed interest in getting improved sorghum varieties into the hands of Timor-Leste farmers. Sorghum is known as *batar ainas*, which means `tall corn' in the local language. Tall indeed at about 4.5 m, the crop is mixed with maize and eaten, and is also fed as both grain and biomass to livestock.

ICRISAT's improved groundnut varieties (left) dwarf the local varieties (right).

The African Market Garden

Partnerships have been the lifeline of the African Market Garden (AMG), which has now been adopted by about 4000 farmers all across the Sudano-Sahel. The AMG is a small-scale horticultural production package based on low-pressure drip irrigation, requiring just $60 to outfit an 80 m² area, and paying for itself in the first year. The AMG possesses the advantages of precise water application, fertigation, optimization of soil water status and increased salt tolerance, all at a fraction of the cost. Manifold boosts in income are possible from cultivating date palm ($100/year/tree), papaya ($50/year/tree), table grapes, figs, citrus, pomegranates and vegetables – for both domestic and international markets.

Israel is one of ICRISAT's primary partners in the AMG project. Through the International Program for Arid Land Crops (IPALAC), a joint program of ICRISAT and the Ben Gurion University of the Negev in southern Israel that seeks to promote economic development in desert prone regions, Israel has promoted the installation of about 2000 AMG units in Cape Verde, Senegal, Gambia, Guinea Bissau, Mali, Niger, Burkina Faso, Chad and parts of Nigeria over the last few years. About 300 AMG units have also been installed so far in nine Sahelian countries through a project co-funded by Israel's Center for International Cooperation, MASHAV and the Vatican through the Jean Paul II Foundation. In 2002, a regional training course on the AMG and seed multiplication was also held at the ICRISAT Sahelian Center with their funding.

The USA is another important partner in this project. The USAID Regional Economic Development Services Office for East and Southern Africa (REDO/ESA) funds the project on *Introduction of the African Market Gardens to the semi-arid tropics of West and Central Africa,* providing an answer to the constraints faced by existing market gardens.

The Swiss Corporation in Burkina Faso is yet another partner in the AMG project and sponsored 40 AMGs in the Ouahigouya area in 2005 by helping the beneficiary farmers to build reservoirs and by providing them with extension work and supervision.

Juicy grapes and dates.

Village Seed Banks spark farmer participation

Investments by ICRISAT and partners have resulted in the development of a broad range of crop varieties. But, farmers have little access to seed of improved varieties, as the formal public sector is unable to meet their needs. The private sector is not keen either.

The key to overcome this problem is to make available a range of modern varieties to farmers and train them to efficiently produce seeds of selected varieties, using modern technologies. This would not only complement the formal sector in meeting farmers' needs for seed, but also promote improved technologies and increase rural incomes.

To this end, a groundnut seed project funded by the Common Fund for Commodities (CFC) in partnership with ICRISAT and the national agricultural research systems (NARS) of Mali, Niger, Nigeria and Senegal was initiated in 2003.

Participatory variety selection (PVS) trials were established in three pilot sites of the major groundnut zones of each country involving 45 locations. The "Mother and Baby" trial approach was used for the on-farm evaluation of improved varieties supplied by ICRISAT and the respective NARS programs.

During the 2003 rainy season, 144 trials were established across the four countries, following which some varieties were released.

To ensure that enough seed is available for all who want to grow it, community-based associations were set up at the village level. Individual farmers as well as associations in different countries have begun to produce seeds of selected varieties for sale in the community. While the associations distributed most of the seed among its members, farmers were linked to the national seed certification agency and the seed was sold to other farmers in the community.

The result? Farmers are highly motivated by direct involvement in variety selection and seed production. They are more aware and keenly understand seed production and the need for good quality seed and related aspects.

Farmer to farmer visits.

A delta of development investors

When you talk of improving livelihoods, the word “watershed” immediately springs to mind. And the ICRISAT-established consortium for watershed management involves a widespread set of collaborators from various disciplines of various countries, chiefly in southeast Asia, but also more recently from a few countries of sub-Saharan Africa.

The consortia espouses participatory integrated genetic and natural resource management (IGNRM) for sustainable development. The consortium approach has vastly improved the livelihoods of 250,000 poor people in watersheds of 368 villages across Asia. Vulnerable groups, such as women and the landless, are empowered to undertake livelihood activities, including the rehabilitation of degraded common lands with biodiesel plantations.

CGIAR Centers – IWMI, ILRI, IFPRI, IPGRI, ICARDA, CIP; WWF and international and national CSOs such as Bhartiya Agro-Industries Foundation (BAIF), Mysore Rural and Development Agency (MYRADA) and Catholic Relief Services have become ICRISAT’s main allies in the consortium. Partners from the Department of Agriculture, Thailand; the Academies of Agricultural Sciences of Vietnam, and Yunnan and Guizhau of China were invaluable in implementing the project work in those countries. Similarly, regional networks such as the Association for Strengthening of Agricultural Research in Eastern and Central Africa (ASARECA) and the Cereals and Legumes Asia Network (CLAN) served as effective avenues for technology exchange and collaboration.

Through improved resilience with water availability, private investments by individuals and industries increased substantially. In India, the Government’s planning commission recommended Private-Public Partnerships in semi-arid/arid areas for sustainable development. The Dorabjee Tata Trust joined hands with ICRISAT and the Indian Council of Agricultural Research in a project to combat land degradation in Madhya Pradesh and eastern Rajasthan.

The consortium attracted global attention from the BBC, the World Resource Report of 2006 and the Stockholm International Water Institute, which highlighted ICRISAT’s consortium approach in its Human Development Report for UNDP and Sage publication.

Improving Grain Legumes in Rainfed Asia

Rainfed agriculture (practiced in dry environments as it depends largely on rain water for irrigation) is highly diverse in types of crops grown and the environments where they are grown. For the most part, dryland agriculture involves smallholder and marginal farmers with very little or no resources other than their own family labor. Unless the technology is customized for each field and harmonized for individual circumstances of each farmer, its sustainability will be short-lived. It is essential that these farmers be empowered with knowledge for long-term sustainable growth in rainfed agriculture.

A far-reaching project supported by the International Fund for Agriculture and Development (IFAD), identifies farmer-preferred legume varieties and environment-friendly integrated crop management technologies (ICM).

The project selected legumes as the intervention in rainfed agriculture. The project activities covered nine legumes (groundnut, pigeonpea, chickpea, lentil, soybean, mungbean, urdbean, cowpea and commonbean) at 42 locations involving 31 partners and local governments in four countries – China, India, Nepal and Vietnam.

ICRISAT facilitated the exchange/transfer of technologies among the countries. The project is a successful example of inter-disciplinary, inter-country and inter-organization research and development partnership for the betterment of resource poor farming communities engaged in rainfed agriculture.

Accomplishments: In China pigeonpea and groundnut have ushered in security against land erosion and increased productivity in several provinces. In India income from these crops has generated acceptance of modern cultivation methods among tribals in Chhattisgarh, Jharkhand and Orissa states. In Nepal the ICM technology gave upto 94% higher yields and 75 to 168% more income. In Vietnam the technology raised productivity by 0.5 to 1.0 t ha^{-1}.

Integrated disease management is helping Nepal keep chickpea farming alive.

Touched by the Rays of the Rising Sun

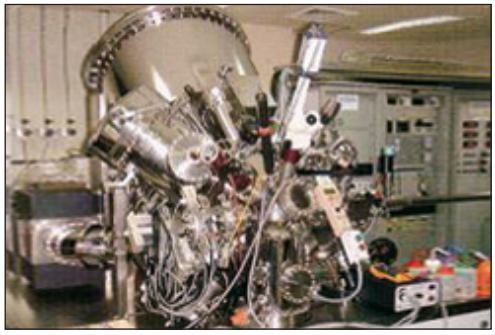
ICRISAT has been working with the Government of Japan through the Ministry of Foreign Affairs (MOFA), Ministry of Agriculture, Forestry and Fisheries (MAFF) and Japan International Research Center for Agricultural Sciences (JIRCAS) to improve agriculture in the dry tropics. Japan has invested in ICRISAT's core research activities and has also funded special projects and provided technical assistance. Several years ago Japan provided assistance to set up the genebank and the current collaboration is through JIRCAS scientists who come to ICRISAT to work on special projects.

Our partnership with Japan is in the areas of germplasm conservation, natural resource and integrated watershed management and desertification control.

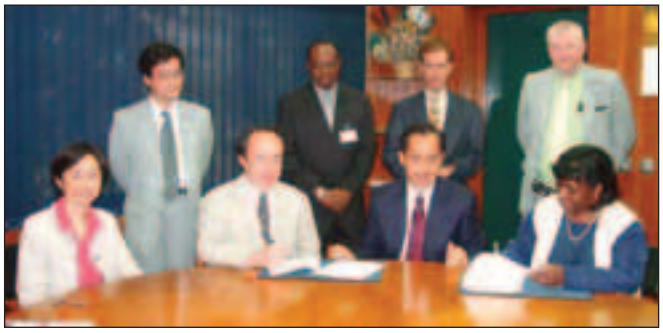
S Uchida of JIRCAS, who was with ICRISAT from 1995 to 1997, made considerable enhancements to ICRISAT's GIS laboratory. Equipment and software for remote sensing and GIS, GPS receivers and computers donated by Japan have augmented the center's efficiency.

Junichi Kashiwagi (affectionately known as "Negi") works at ICRISAT headquarters in India on 1) mapping root trails, 2) breeding lines and potential hybrid parents developed, evaluated and disseminated; and on drought improvement through the root system.

Keiichi Hayashi, JIRCAS Special Project Scientist, joined ICRISAT-Niamey in 2002 and has been working on soil fertility management in the dry tropics of West Africa. He was joined by Ryoichi Matsunaga to conduct a project on farmers' knowledge of soil fertility management and nutrient dynamics under a crop-livestock mixed system.



Electron Spectroscopy for Chemical Analysis (ESCA) in ICRISAT-Niamey.



At the MOU signing: (Sitting L to R) H-T Watanabe, O Ito, WD Dar, MB Stone (Standing) K Nakamoto, AU Mokwunye, BI Shapiro and D Keatinge.

Banking on a bank in South Asia

The Asian Development Bank (ADB) and ICRISAT have been partners in research and development in the Asian semi-arid tropics since 1984. In the last two decades ADB has supported several ICRISAT projects through Regional Technical Assistance (RETA) grants, which are in accordance with its own objectives: economic growth, reducing poverty, supporting human development, improving the status of women and protecting the environment.

Reducing land degradation and improving productivity is an ICRISAT research priority. In recent years, ICRISAT and ADB have partnered for the project *Participatory Watershed Management for Reducing Poverty and Land Degradation in SAT Asia.* This project focuses on evaluating various institutional, socioeconomic and technical models that work through sharing knowledge and strengthening on-farm interaction with farmers. Reducing land degradation and improving soil quality will eventually sustain productivity, thereby increasing rural incomes of the people who depend on these lands.

Therefore, through this partnership, the gaps in the process of stimulating development through agricultural growth can be identified and steps taken to plug them.

Dr Dar at the meeting with the ADB President Haruhiko Kuroda and Andhra Pradesh Chief Minister YS Rajasekhara Reddy. Second from right is Dr Masao Uno, Chief Advisor to the ADB President.

Facilitating processes with the Philippines

Although ICRISAT efforts are usually directed at countries with large arid and semi-arid areas and less advanced agricultural research programs, the Institute has collaborated closely with the Filipino agricultural research system on crops important to both partners – especially chickpea, pigeonpea, groundnut and sorghum – under tha aegis of the Cereals and Legumes Asia Network (CLAN) hosted by ICRISAT.

Director General William Dar signed Memoranda of Understanding (MOU) in April 2004 to collaborate on enhancing adoption of legume technologies in the Philippines, and in June 2005 to establish integrated watershed benchmark sites aimed at increasing productivity and incomes of rainfed farmers. In 2006 Dr Dar signed five MoUs with enterprises in the Philippines to form a Sweet Sorghum for Ethanol Consortium.

Dr Rex Navarro with the Vice Chancellor and Director of Public Relations of the University of the Philippines Los Baños.

The collaboration has been further boosted with a visit of Communication Director Rex Navarro to the Philippines, where he had several meetings with officials of higher education, research and agricultural training to assess accomplishments and map moves for enhancing the capacity of the Philippine national research and extension system. It also paved the way for collaboration in developing and piloting a postgraduate distance learning program on agro-ecology.

So far ICRISAT together with the Philippine Commission on Higher Education (CHED), Agricultural Training Institute (ATI) and the Bureau of Agricultural Research (BAR) have trained almost 600 faculty members, researchers, trainers and key government staff – a total investment by the Philippines of $97 per participant.

On behalf of ICRISAT Navarro also discussed plans to establish a food safety analysis laboratory with the Isabela State University. On behalf of the Global Open Food and Agriculture University, he and the Philippines Open University developed a postgraduate distance learning program on agro-ecology. Officials of the Open Academy for Philippine Agriculture discussed developments in this ICRISAT-inspired initiative. ICRISAT has also initiated discussions with the University of the Philippines, Los Banõs (UPLB) on improving internal and external communication at the university.

Seeds of substance in India

Agricultural research has been going on in India since time immemorial. The early era concentrated on improving yield and productivity – ie, "quantity" was the focus of research. In recent years the focus has shifted to "quality".

Crop scientists at ICRISAT are at present involved in four projects to develop improved varieties of chickpea, pigeonpea and groundnut, and an improved Seed System. The projects fall under the Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize, or ISOPOM for short. The collaboration is with the Department of Agriculture and Cooperation under the Ministry of Agriculture, Government of India.

To reduce this dependence on imported edible oil while improving the well-being of poor groundnut farmers in drought prone regions of India, ICRISAT and the Indian Council of Agricultural Research (ICAR) are collaborating in a project called *Farmer-participatory Groundnut Improvement in Rainfed Cropping Systems.* Funding for this project is from the Government of India through ICAR.

ICAR and ICRISAT have been partners since the inception of the Institute, and it is a matter of pride that the last five years have witnessed joint seed releases in India for improved varieties of chickpea (13), pigeonpea (5) and groundnut (6).

The largest kabuli chickpeas grown in India weigh about 40 g per 100 seeds. The chickpea project under the ISOPOM scheme is to develop extra large chickpeas, which will weigh above 50 g per 100 seeds.

The mandate for the pigeonpea scientists is to perfect the hybrid technology and to identify high-yielding pigeonpea varieties that can be adapted to the different agro-ecological zones in India. This is being done in collaboration with ICAR.

The fourth project in this partnership is to develop an informal seed system model. An early version of this model is at present being tested with farmers. The first three projects are for three years from 2006 and the Seed System project is for four years.

Bringing farmers back into breeding

ICRISAT's 1996 economic impact assessment of sorghum and pearl millet breeding in Mali revealed that farmers' adoption of newly bred varieties, particularly those representing different plant types than the local guinea landraces, was very low. ICRISAT realized that a complete re-orientation of the sorghum breeding program in West Africa was necessary. Consequently, a project to support farmers in their efforts to improve productivity and stability of sorghum production by enhancing access to new varieties was started.

Collaborators in the project are: Institut d'Economie Rurale (IER), farmer groups, NGOs, Government extension services, and the University of Hohenheim, Germany. Funding is provided by the CGIAR and the German Ministry for Economic Co-operation and Development (BMZ). In 2005, additional funding was granted by USAID for the Mandé zone (PRODEPAM project), and by IFAD through an IPGRI managed Technical Assistance Grant on managing diversity on-farm.

The project activities are concentrated in two regions of southern Mali: Mandé and Dioila cercle. It had become clear that farmers were in need of higher yielding sorghum varieties that are well adapted to the main agro-climatic conditions, and the predominant soil fertility constraints with the associated parasite problems. Both ICRISAT and IER programs were in a phase of shifting emphasis to achieve these goals.

Starting from 2003 the project organized variety testing in 12 villages. Participating farmers chose fields for the trials – one common to the village and one of specific interest to the farmer. Farmers visited the ICRISAT research station and were shown diversified guinea-race populations from which they selected entries for the trials.

Trials have been very encouraging since then. Many of the farmers are highly committed and working with them has been rewarding. Project members are now addressing the increasing demand for seed by increasing opportunities for village groups to conduct farmer-managed trials. The National Association of farmer groups (AOPP) is also active to influence the policy process towards facilitating farmer-managed seed production and diffusion of locally bred varieties.

Support from down under

In October 2004, the Chief Executive Officer, Council of Grain Growers' Organization (COGGO), the Director Centre for Legumes in Mediterranean Agriculture (CLIMA), the Leader of the Grain Legumes Program, Department of Agriculture, Western Australia (DAWA, later the Department of Agriculture and Food) met with ICRISAT Director General Dar and scientists.

The meetings and subsequent communication culminated in the signing of a project document on *Accelerated genetic improvement of desi chickpea*. This project is aimed at developing desi (native) chickpea breeding lines with early maturity, market-preferred seed traits and resistance to Ascochyta blight, botrytis gray mold and fusarium wilt, and will run from 2005 to 2009.

COGGO is formed by ten Western Australian grain growers organizations, and receives voluntary contributions from the grain growers to support research on crop varieties development and improvement of farm income. COGGO is currently funding two projects on chickpea, one mentioned above and a second, two-year project (2006-07), *Improvement of salinity and boron toxicity tolerance in chickpea*.

Breeding materials were generated from over 100 crosses, which involved several popular cultivars and elite breeding lines from Western Australia. At the moment they are at various stages of advancement, and over 250 selected lines have been supplied to Western Australia for further evaluation. Also, ICRISAT has standardized methods for screening against salinity and boron toxicity. The most salinity tolerant lines identified from this project will be used in the breeding program of the first project.

Australian team and ICRISAT scientists in the chickpea field.

IACD

Collaboration is not just about partnering with outside agencies for the greater good. The ICRISAT Association for Community Development (IACD), which celebrated its Silver Jubilee in 2005, draws from the wealth within.

Started in 1980 as the ICRISAT Ladies Association for the Welfare of Women and Children (ILAWWAC), IACD is a non-profit organization initially set up for the welfare of ICRISAT's female employees and their families. It later included the poor sections of surrounding villages. The association is run by volunteer ICRISAT staff members and staff spouses, and has over the years benefited thousands of poor people from the villages surrounding the ICRISAT-Patancheru campus.

Tailoring class at IACD.

IACD was set up with the initial contribution of Dr Klaus Lampe, a former member of the ICRISAT Governing Board. It receives donations from staff members and well-wishers, and the proceeds of the Mamta shop, a small gift shop on the campus. Initial activities included a primary school and a crèche for babies of farm laborers on the ICRISAT campus.

Since 1987, IACD has its own house on the ICRISAT campus, and its agenda has been tailored to suit the changing situations. The major activities today are skill development, adult literacy and health care. Computer training is one of the priorities, moving away from the "primary school" flavor to one of "self development".

Mrs Beatriz Dar in the Mamta Shop.

Mrs Beatriz Dar, the present Chairperson, Mrs Janet Hoisington, the President, and other office-bearers sustain the enthusiasm injected by the founders. Discouraging the dependence on charity alone, Mrs Dar urged the association to undertake revenue generation measures that would make IACD self-sufficient. Since 2005, IACD has implemented several revenue-generation activities – besides the Mamta shop, staff members make and sell soap powder and shampoo, grow organic vegetables for sale to ICRISAT staff, and conduct regular computer training, spoken English and tailoring classes at subsidized rates for the village community around ICRISAT.

The several "success stories" told by former students of IACD speak volumes about the usefulness of this small association.

Chapter 5
Impacts

"However beautiful the strategy, you should occasionally look at the results," said Sir Winston Churchill.

The ultimate measure of the success of innovations and resources invested is the impact it has on the target clientele. It is rare to have revolutionary outcomes in agriculture. Often they are incremental and need prolonged tracking. Impact of technologies also depends on the socio-economic and political scenario in a region. Here is a sampling of the salient impacts achieved through research and development by ICRISAT and its partners from 2002 to 2007, and, another measure of success, the awards and recognition bestowed on ICRISAT.

From tillage to table

Next to alleviating hunger, health is the ultimate goal of most agricultural research. New data in aflatoxin research reveals the extent to which this is true. Aflatoxin, a potent poison that contaminates groundnut and other crops, is very common but difficult to detect. A sample survey by ICRISAT researchers in Andhra Pradesh examined the extent of aflatoxin contamination in groundnuts, chillies and various spices. The results revealed that a frighteningly large number of groundnut byproducts such as chikkies (peanut crunch candy) were contaminated.

But, in its quest for impact, the Institute now extends its activities to the full chain of events that begins with planting and concludes with eating – from tillage to table. In the case of aflatoxin research, we tap the expertise of such new spheres as medical and veterinary services, private sector and commercial investors like feed and food suppliers as well as scientists. This is building partnerships to deal with the aflatoxin problem in its entirety.

ICRISAT's strategic plan for aflatoxin research includes genetic enhancement and integrated management practices such as the application of lime and FYM. Best-bet harvesting and drying techniques reduced aflatoxin contamination from 69 to 88% in Kolokani and from 63 to 84% in Kayes in Mali. ICRISAT is also exploring new sources of resistance using tools like the enzyme-linked immunosorbent assay (ELISA). ELISA kits enable technicians to screen more lines at less cost, and help to identify new sources of resistance.

Aflatoxin contamination levels are high during end-of-season drought.

Wonderful watershed welfare

The Innovative Farmer Participatory Integrated Watershed Management Model developed by ICRISAT and NARS partners, is the outcome of many years of research. It involves both natural and human resources in a watershed area and takes into account social, political and institutional factors to achieve specific socioeconomic and ecological objectives.

The model watershed in Kothapally village.

The model used is a multidisciplinary, multi-institutional consortium approach and was implemented in the Adarsha watershed that surrounds the village of Kothapally near Hyderabad. The technologies include low-cost soil and water conservation structures, environment- and farmer-friendly integrated pest, disease and nutrient management options, crop diversification with legumes, on-farm income generation for landless laborers, women and youth, and off-season off-farm income generation through innovative crops and cropping systems. The application of this model yielded remarkable results such as improved groundwater levels (5-6 m), improved green cover (from 129 ha in 1996 to 200 ha in 2000), increased productivity (from 1998 to 2001 maize production increased from 1500 to 3300 kg/ha, and sorghum from 1070 to 2600 kg/ha), and improved incomes (total income increased to Rs 20,500/ha with profits up to Rs 14,600/ha).

Another project outcome was spillover from Adarsha to neighboring areas. Farmers from nearby districts keenly observed what was going on, liked what they saw and adopted the technologies.

The Andhra Pradesh Rural Livelihoods Project wants to implement the model in three districts: Mahboobnagar, Kurnool and Nalgonda. Moreover the Sir Dorabji Tata Foundation is funding the implementation of the model together with ICRISAT, in two districts of in Madhya Pradesh and one in Rajasthan.

Says Dr SP Wani, leader of the watersheds initiative, “We are working in more than 300 watersheds across Asia and have positively and directly impacted the lives of 250,000 people in these areas. South-South collaboration between India and ASARECA in Eastern and Southern Africa in this area has been strengthened. ICRISAT’s impact on primary stakeholders, and through its enabling policies and institutions, is very evident and valued by our partners.”

Managing watersheds in Southeast Asia

Thailand and Vietnam may not be semi-arid, but watershed management technologies refined in drier areas have been applicable in niche situations, thanks to ICRISAT's partnerships with these rapidly developing Southeast Asian nations.

Mr Nuek Sangchan, a progressive farmer in Tad Fa, Thailand, has been working on the ICRISAT watershed project with the Department of Agriculture. Among the improved technologies that he and his neighbors have adopted are contour cultivation and the use of vegetative barriers like vetiver grass and fruit trees to retain precious soil, so that the slope becomes a series of terraces, with each terrace supporting a robust crop.

During 2003, 197 hectares in Tad Fa (68% of the total area) was planted with improved practices, resulting in higher productivity and less soil loss. Similarly, 5–6 hectares planted with no-till technology by eight farmers, including Mr Sangchan, led to lower land degradation. Using improved crops and cropping systems, seven farmers adopted rice bean (*Vigna umbellata*), a locally popular legume, as a relay crop with maize. Another 17 farmers sowed rice bean and 35 farmers cowpea as sequential systems after maize. Among the other measures adopted were the use of new crops such as confectionery sunflower that improved incomes, expansion of fruit tree cultivation, intercropping slower-growing fruit trees with the fast growing bananas, and local water harvesting and mulching practices that provide farmers with key inputs without significant cost.

Thriving on adversity. Working together, VASI and ICRISAT have found ways to make farming a prosperous activity in Vietnam's uplands.

In agrarian Vietnam, poverty, population pressure, and intense and abundant rainfall (averaging 2500 mm) are serious problems. Land erosion can be severe, calling for improved technologies. The Vietnam Agricultural Science Institute (VASI) sought ICRISAT's expertise in natural resource management. ICRISAT and VASI joined hands to develop technologies to conserve soil and water, and increase the productivity of sloping lands. The project also experimented with intensified production through techniques like intercropping and the promotion of micro- enterprises such as duck and pig husbandry to foster increased employment. The result? Groundnut, soybean, and maize produced higher pod and grain yield. In fact the maize yield was the highest ever. Also, farmers learned that groundnut fairs well on the top, middle and lower parts of the sloping toposequence, while mungbean and soybean do well on the top of the toposequence.

Yellow gold in Myanmar

Chickpea has exploded in popularity among farmers in Myanmar, with ICRISAT's warhorse ICCV 2 riding the crest of this wave. The area cultivated to this immensely successful variety has witnessed a spectacular fourfold increase over the past three years. Considering that the average yield of chickpea in Myanmar increased from 660 to 1007 kg/ha during this time span, such accelerated adoption is understandable.

The short-duration desi and kabuli varieties developed through partnership of ICRISAT and NARS in Myanmar have had wide adoption in Myanmar. During 2003-04, 93% of the chickpea area in Myanmar was under ICRISAT-bred

Myanmar's yellow gold is often intercropped with sunflower.

varieties. ICCV 2 and ICCV 3 are kabuli varieties and cover 44.4% and 9.7% area, respectively, while ICCV 88202 and ICCV 93944 are desi varieties and cover 28.5% and 10.6% area, respectively. The adoption of these varieties has led to increase in chickpea area from 101,000 ha to 207,000 ha and productivity from 670 kg ha^{-1} to 1152 kg ha^{-1} during 1998-99 to 2003-04. Myanmar is now one of the leading chickpea producing and exporting countries in the world.

Burmese farmers prefer ICCV 2 for its short duration (it matures in 85 days); its early maturity helps it escape terminal drought; being a kabuli type, it fetches a higher market price; and it is resistant to fusarium wilt.

The success of ICCV 2 in Myanmar reflects a similar pattern in other countries: India, Nepal, Ethiopia, Bangladesh and others. The world's shortest-duration kabuli chickpea cultivar, ICCV 2 was developed by ICRISAT from a multiple cross that involved five parents. It was the first kabuli chickpea successfully grown in tropical environments.

Macro impact with micro-dosing

In Burkina Faso, Mali and Niger a study between 2002 and 2004 showed that sorghum and millet yields increased by 44 to 120%, and farmers' income increased by 52 to 134% when they used the fertilizer microdosing and the warrantage inventory credit system.

Warrantage allows farmers to store a part of their harvest as collateral on a loan from a community bank. The stored grains are then sold at higher prices later during the year. The profits are used to pay off the loan and buy inputs the following year, creating a cycle of increasing prosperity.

In West Africa the microdosing technology reached more than 12,000 farm households, field technicians and farmers were trained, and public awareness was heightened through the media.

Fertilizer distribution in Chivi district, Zimbabwe, under the USAID-LEAD-ICRISAT Project.

In Zimbabwe an experimental strategy started with simulation modeling backed by on-farm trials. In 2003/04, this was extended by having donors distribute 25 kg packs of ammonium nitrate to 170,000 farmers in drier parts of the country under national drought relief programs. In 2004/05 and 2005/06 approximately 100,000 farmers were provided with small packs (a decline in part to fertilizer shortages).

In 2004 and 2005, 30-50% grain yield gains were broadly achieved. Microdosing has contributed an estimated 70,000 t of additional grain, valued at almost $12 million, to the food security of poorer farmers in drought prone regions of the country. Fertilizer companies in Zimbabwe and South Africa have been stimulated to initiate an associated set of pilot programs for small pack fertilizer sales.

Boost from basins

Conservation agriculture sounds like old hat, but it is breathing new life into African smallholder farming. Broadly, it's a suite of land and crop management practices to improve productivity, profitability, and sustainability. ICRISAT is working with NGO partners in Zimbabwe to promote an easy-to-implement conservation agriculture package, ideally suited to smallholder farmers in drought-prone areas. The program is supported by the Department for International Development (DFID), UK, and is being practiced across 48 districts.

The central component in the package is the planting basin. Seeds are planted not along the usual furrow, but in small basins – simple pits, about 15 cm across and 15 cm deep. These basins can be dug without having to plough the field – remember that the majority of smallholder farmers struggle to plough their fields because they lack draft animals.

Basins are dug during the dry season before the rains.

The principle is straightforward: rather than spreading nutrients and water uniformly over the field, concentrate them in the basins to maximize yield for a given level of inputs. Basins are prepared during the dry season, when demands on family labor are relatively low. When the rains begin, the basins are soon flooded with water – if you plant now, you are ensured of good germination and a healthy crop stand, even if a dry spell follows.

The planting basin is maintained by other management practices such as use of crop residues, which protect against loss of topsoil and enriches the soil with nutrients, fertilizer microdosing, timely weeding, application of manure, and crop rotation.

Farmers practicing this technology have realized yield advantages exceeding those of conventional practices by between 10 and 100 percent, depending on input levels, the experience of the farm household and seasonal rainfall. A study conducted to better understand the impacts of conservation farming has concluded that this technology contributes to increased yields across all agroecological zones and can thus make a major contribution to household food security.

Two plants per basin – being boosted with small amounts of fertilizer..

Old crops, new horizons

Drought has stalked southern Africa for a long time, victimizing smallholder farmers who have to deal with nutrient-starved soils and scant access to modern technologies, markets or credit. But thanks to partnerships engendered by ICRISAT and implemented through the SADC/ICRISAT Sorghum and Millet Improvement Program (SMIP), farmers can hope to prosper.

Through ICRISAT and partners, nearly 50 improved sorghum and pearl millet varieties were released in eight SADC countries, compared to only 24 releases during the 20 years preceding SMIP. Adoption of these materials increased steadily over the two decades of research. Improved varieties now occupy 25-30% of the sorghum and pearl millet area across the region, and as a result food security and nutrition have improved enormously.

Take the story of Jacob Masunda – Jacob is a smallholder farmer in Mhandamabwe, a village in one of Zimbabwe's driest areas. He is part of a smallholder seed cooperative that grows ICRISAT's sorghum variety Macia, on contract to a multinational seed company.

A Zimbabwean breeder evaluating a regional Macia trial.

'I have been growing sorghum all my life,' says Masunda. 'But Macia is the highest-yielding variety I have ever planted.' His 5-hectare field is remarkably productive because he uses not just improved varieties but the full range of crop, soil and water management technologies that ICRISAT promotes – winter plowing to improve soil structure, weed control to maximize yields, manure-fertilizer combinations, water-harvesting pits and tied ridges for water conservation. So astute a farmer is Mr Masunda that even in his low-rainfall area, during a drought year, there were moist patches in his field – moisture accumulated and retained for two and half weeks following the last rainfall. 'This used to be dry land,' he says. 'I have converted it into a wetland – maybe next season I can even plant rice!'

African Market Garden: A Sahelian Success

The African Market Garden (AMG), a low-pressure drip irrigation system has many advantages – irrigation based on crop water consumption, accurate and uniform water delivery, application of fertilizers with each irrigation (fertigation), savings in labor, fuel, water, fertilizers and pesticides, higher crop yields and higher quality products.

Member of the Sadoré village women association with new, ICRISAT selected bolting tolerant lettuce produced in a commercial AMG.

Over the last five years, ICRISAT has helped disseminate the AMG in nine Sahelian countries. The first dissemination drive was carried out in Niger with the support of the World Bank's Development Marketplace program.

But the drip irrigation system is only half the story. What do they irrigate? So far ICRISAT has selected and started to disseminate seeds of quality varieties of vegetables and is in the process of screening improved varieties of fruit trees. Each year, ICRISAT trains about 200 nurserymen and vegetables seeds producers and helps them build their nurseries. It is the cultivation of these quality products that spell the success of the AMG.

It was generally found that the economic returns to land for those using the drip irrigation systems were estimated to be 826 FCFA/m^2 against 336 FCFA/m^2 for those using the traditional practice. The returns to water, labor and fertilizers were perceived to be high by farmers, and this is where the real success lies – the impact on the farmers.

This boy at Golinga Dam, Ghana, smiles standing next to an ICRISAT-initiated African Market Garden. His father bought him a bicycle from the income he made by growing vegetables in the garden instead of rice.

WD Dar elected Chair of Global Desertification Science Body

The Conference of Parties (COP) of the United Nations Convention to Combat Desertification (UNCCD) elected Director General William Dar as the new Chairman of its Committee for Science and Technology (CST) on 3 September 2007, the opening day of the 8th COP session in Madrid, Spain. Dr Dar was nominated by the Asian States Group as a distinguished citizen of the Philippines on behalf of that region.

Dr Dar at the meeting in Madrid.

This influential assignment is a well-deserved honor. The CST is responsible for advising the CCD on all scientific issues. Signed by 191 countries, the CCD embodies the world's commitment to combat desertification. It was created as an outcome of the 1992 United Nations Conference on Environment and Development, popularly known as the Rio Earth Summit. Its importance was underscored by the 2000 Millennium Summit, which issued the Millennium Development Goals, and by the 2002 World Summit on Sustainable Development.

Informed of this prestigious appointment just as he arrived, Dr Dar immediately picked up the Chair's gavel and guided the CST plenary session. This was a moment of opportunity within the CCD and CST, with a new 10-year plan paving the way for fundamental reform and re-invigoration of the global desertification pact. In his opening statement, Dr Dar urged the body to be open to reforms and to widely engage stakeholders from all sectors.

While elected in his role as a Filipino citizen, not as the Director General of ICRISAT, Dr Dar commented that he naturally provides a contact point for the Alliance of CGIAR Centers to the CCD. The Alliance carries out research that is highly relevant to the CCD through inter-center initiatives such as the Oasis Challenge Program candidate and the Desert Margins Program.

ICRISAT is bursting with pride. Although their Director General is well acquainted with honors and recognitions, this new position demands a large and serious responsibility, and they are certain that the selectors have chosen well.

A Nobel Laureate in our midst

Ramadjita Tabo is probably ICRISAT's tallest staff member, and not just because of his 6'5" frame, but because of the awesome recognition bestowed on him through his participation in the United Nations Inter-governmental Panel on Climate Change (IPCC).

The 2007 Nobel Peace Prize announced in mid October 2007 was won jointly by former US Vice President Al Gore and the UN-IPCC for their efforts in spreading awareness of man-made climate change and laying the foundations for counteracting it. The Nobel Peace Prize thus went to all members of the IPCC group.

Dr Ramadjita Tabo, Assistant Regional Director and Principal Agronomist at ICRISAT-Niamey, became a member of the IPCC in 2004. He was one of the lead authors for the chapter on Africa, which is one of the 20 chapters covered in the IPCC Working Group II (WG II) Fourth Assessment Report. This report, which took more than three years to write, will be available to the public in the near future. Since 2004, Dr Tabo, a national from Chad, attended several IPCC WG II Group writing meetings in Vienna, Austria; Cairns, Australia; Merida, Mexico; Cape Town, South Africa; and Cairo, Egypt with financial support for these travels from the IPCC. He represented ICRISAT well within the IPCC.

File picture of Dr Saidou Koala giving Ramadjita Tabo a certificate.

In his letter to the members of the IPCC, Dr Pachauri, Chairman of the IPCC, congratulated the members and said, "I have been stunned in a pleasant way with the news of the award of the Nobel Peace Prize for the IPCC. This makes each of you a Nobel Laureate and it is my privilege to acknowledge this honour on your behalf." He also thanked them for the achievement and recognized their "knowledge, hard work and application."

ICRISAT congratulated Ramadjita Tabo for becoming a Nobel Peace Prize Laureate as a member of the IPCC. This outstanding achievement is indeed a great honor to Tabo in particular and to ICRISAT as a whole.

Rewarding hard work and recognizing ability

Awards received 2002-2007:

2002

- ICRISAT wins the King Baudouin Award in partnership with ICARDA for producing improved varieties of chickpea. The award, the highest accolade for science by the CGIAR, is given every two years. ICRISAT won this award for pearl millet research in 1996 and pigeonpea in 1998.

2003

- Acharya NG Ranga Agricultural University awards the Jannareddy Venkat Reddy Prize to Dr KN Rai for his outstanding contributions toward the development of pearl millet varieties.
- Bangladesh recognizes Director General William Dar and ICRISAT's team of scientists for their contribution to legumes research and development in Bangladesh.
- Dr Dar is conferred the honorary degree of Doctor of Science by the Mariano Marcos State University, Philippines, for his significant achievements in agricultural research and development.
- ICRISAT bags the CGIAR Promising Young Scientist Award for 2003.
- ICRISAT undergoes two external panel reviews; panels commend ICRISAT's work, outstanding science quality and sound and excellent management.
- The Vietnamese Government honours Dr SP Wani for his service to agriculture and rural development in Vietnam.
- The Vietnamese Government confers on Dr Dar the "For the Sake of Agricultural and Rural Development in Vietnam" Award.
- Dr Dar receives a Plaque of Recognition from the Philippines Bureau of Agricultural Research for his outstanding accomplishments and invaluable contributions to the Bureau as its first Director.
- Dr Uzo Mokwunye, Chair, ICRISAT Board, is elected Chairman of the Committee of Board Chairs of the 16 CGIAR Centers.
- Rashid Serraj and his team receive a recognition award from ISDRD for leadership in stress physiology.

2004

- Director General William Dar is awarded the Golden Grain Award by the Central Luzon State University, Philippines, for his outstanding accomplishments in the challenging field of agricultural research.
- The Doreen Mashler Award is presented to Drs HD Upadhyaya, SP Wani and Farid Waliyar on behalf of ICRISAT and its partners, by Board Chair D. Mokwunye and Dr Dar.

- Dr Dar is conferred the Research Leadership Excellence Award from the Philippine Association of Research Managers (PhilARM).
- Dr Dar becomes the Chair of the Steering Committee and the Executive Committee of the CGIAR Consortium for central Asia and Caucusus (CAC).
- An ICRISAT paper titled "Pathogenic and genetic diversity among Indian isolates of *Scelerospora graminicola* from pearl millet" by S Sivarakmakrishnan, RP Thakur, Seetha Kannan and VP Rao is selected for the MJ Narasimhan Medal Award for the best research paper published during 2003. The paper was published in Indian Phytopathology.
- ICRISAT scientists Aruna Rupakula and VN Kulkarni are individually awarded the Jawaharlal Nehru Award, the former for her Doctoral thesis research and the later for the best thesis in genetics and plant breeding.
- Dr HC Sharma bags the Lifetime Achievement Award at the Annual meeting of the Academy of Environmental Biology at Gulbarga University, Karnataka, India.
- Dr SN Nigam is appointed Guest Professor of Fujian Agriculture and Forestry University, People's Republic of China, for his contribution to groundnut breeding and crop improvement and for his efforts towards improving groundnut productivity in the country.

HC Sharma receiving the award from His Excellency Shri Basavaraj Horatti.

- Dr Dar wins the Philippine Council for Agriculture and Resources Research and Development Scholars Association Inc. (PSAI) Award in recognition of his critical role in establishing the PCARRD Scholars Association, Inc.

2005

- Director General William Dar is Chair of the Alliance Executive of the Alliance of Centers of the CGIAR.
- Yet again, for the record fourth time, ICRISAT wins the King Baudouin Award, sharing it with CIMMYT, IRRI, IWMI and other national systems in the Rice-Wheat Consortium for the Indo-Gangetic Plains.
- Dr P Lava Kumar of ICRISAT bags the CGIAR Promising Young Scientist Award for 2004; a second time for ICRISAT.
- ICRISAT wins the World Bank's Development Marketplace Award for its project titled "Traditional technology with a modern twist" on controlling pigeonpea pod borer, Helicoverpa armigera, through the production and use of the biopesticide Nuclear polyhedrosis virus (NPV). Dr GV Ranga Rao receives the prize.

GV Ranga Rao on his return from Washington, shares the Award with Drs William Dar, Dyno Keatinge and CLL Gowda.

2006

- Dr SP Wani is nominated member of the Working Group on Dryland/Rainfed Farming Systems constituted by the Planning Commission of the Government of India.
- The President of India, His Excellency APJ Abdul Kalam, symbolically hands over to the President of the Philippines, Her Excellency Gloria Macapagal-Arroyo foundation seeds of improved peanut and sweet sorghum developed by ICRISAT.
- ICRISAT and its partners in Zimbabwe win two prestigious awards – the Doreen Mashler Award and the ICRISAT Millennium Science Award - for research-for-development work that uses innovative approaches to increase the impact of agricultural relief programs. Drs Twomlow and Rohrbach receive the prizes.
- Director General William Dar is awarded the KALSA: Most Distinguished Alumnus Award from the Benguet State University in the Philippines, the first recipient of this highest award from BSU.

Steve Twomlow and David Rohrbach with the awards.

- ICRISAT's Agri-Business Incubator (ABI) was awarded the National Award for Technology Business Incubators for 2005, by the Ministry of Science and Technology, Government of India.

Team ICRISAT receives the ABI award from Dr Montek Singh Ahluwalia.

- The Government of Burkina Faso honors ICRISAT with Decoration des Palmes Academiques. The Minister of Scientific Research and Higher Education confers the title on ICRISAT for Best Research and Development Partnership.
- Dr RP Thakur of ICRISAT wins the CGIAR Outstanding Scientist Award for his work on managing major diseases in pearl millet and sorghum.

- On behalf of the dryland farmers of China, the Chinese Academy of Agricultural Sciences, the Regional Institute of Resource Insects, the Yunnan Academy of Agricultural Sciences, the Guangxi Academy of Agricultural Sciences and the Pigeonpea Farmers Association of Yuanmou, Yunnan province presented a wooden plaque to ICRISAT. Dr KB Saxena received the award on behalf of ICRISAT.
- ICRISAT, along with 10 other CGIAR centers, wins the CGIAR Outstanding Partnership award, in recognition of its work pertaining to gene banks.

2007

- Dr HC Sharma bags the HariOm Ashram Trust Award conferred by ICAR for research contributions in agriculture.
- The World Bank rates ICRISAT as 'Outstanding' for its performance in 2006 among the 15 CGIAR centers. The rating takes into account outputs, impact, quality and relevance of research, institutional and financial health, and stakeholder perception.
- Director General William Dar gets the Outstanding Professional of the Year Award conferred by the Professional Regulation Commission (PRC) of the Philippine Government upon a professional as recommended by his/her peers for having amply demonstrated professional competence of the highest degree contributing to the advancement of the profession and significantly to the effective discharge of the profession's social responsibility.

Dr Dar receives the award from the Chair of PRC, Ms Leonor Tripon Rosero.

- Dr Dar is elected Chair of the Committee on Science & Technology (CST) of the United Nations Convention to Combat Desertification (UNCCD).
- Dr Dar receives an honorary Doctor of Resource Management Degree from the Benguet State University, Philippines.
- ICRISAT scientists Drs CLL Gowda, PM Gaur and Ch Srinivasa Rao are awarded the Indian Society for Pulses Research and development (ISPRD) recognition awards.

The Philippine Commission on Higher Education Chairman Dr S Ocampo awards the Honorary Doctorate to Dr William Dar.

CLL Gowda

PM Gaur

Ch Srinivasarao

Chapter 6
In short...

It is not easy to decide where one has to conclude the history of an Institution extant -- research goes on, targets are being met, a small success is achieved here, a bigger one there, even as we write. It is fitting though to recognize the immense support received from friends and partners of ICRISAT, to appreciate the recognition bestowed on ICRISAT from leaders of countries and global institutions, and in turn to publicly recognize and reward outstanding leaders and supporters of the Institute. This chapter salutes all members of the staff both past and present, the Management, the Governing Board, and all those friends and stakeholders who have contributed and continue to contribute to ICRISAT's evolving history.

Backstage Heroes

ICRISAT's vision is *the continued improvement of the well-being of the poor through agricultural research for impact*. The onus is on the scientists, and the scientists are usually the ones who take center stage when a target is met, or when a breakthrough is achieved. Scientists need an infrastructure to carry on their work and, to a very large extent, the support units of the institute provide this assistance. These are the heroes of the backstage, without whom, the ever-turning wheels of agricultural science would get mired in the mud and eventually grind to a halt. Though these services are offered on a smaller scale in our African locations, the major services units are housed at headquarters in Patancheru, yet provide service to ICRISAT globally.

*The **Communication Office*** communicates ICRISAT's work and impact to the primary audience, especially donors and partners in tandem with PDMO. Our basic strategy is to promote and reposition the Institute through focused message themes revolving around the new vision and strategy to 2015, including emerging issues such as biotechnology, climate change and biofuels.

K Chandrasekhararao and Ch Vengala Reddy of Communication Office design the History Book.

Farm and Engineering Services (FES): FES significantly contributes to research support through farm operations – tillage, irrigation, crop sowing and cultivation, plant protection, harvesting, and processing. It is also responsible for electrical maintenance, electronic requirements, communications and mailing, carpentry, machine and vehicle maintenance, and for developing and maintaining farm-land, grounds, and water resources.

FES supports research through farm operations.

The ***Field Medical Unit*** at Patancheru provides quality medical aid to staff members in the campus. It also attends to emergency cases in the campus and refers some cases to bigger hospitals when necessary. The unit also takes proactive measures in preventive health care by organizing health awareness talks and camps.

The Financial Services team.

Financial Services: ICRISAT's financial health has continued to improve over the last five years. In terms of expenditures, this has grown from US$23.654 in 2003 to US$34.098 in 2006 (highest level since 1991). Similarly, ICRISAT had a surplus budget performance from 2003 to 2006. Likewise, the reserves of the Institute have gone up from US$6.914 million in 2002 to US$10.470 million in 2006.

Housing and Food Services (H&FS): Napolean famously said that an army marches on its stomach. ICRISAT's H&FS provides food and more to fuel the energies of ICRISAT staff, partners and guests – accommodation, conferencing facilities, campus housing and recreational facilities.

Human Resources Services (HRS): During the last five years, HRS has revamped the compensation and performance management system and installed a simpler and effective policy framework for administering HR services. HR has also implemented the CGIAR's gender and diversity initiatives by organizing team building and cultural orientation programs.

Project Development and Marketing Office (PDMO): From 2002 to 2006, ICRISAT increased annual special project funding from US$7 million to US$20 million. This was achieved by increasing proposals submitted from 81 in 2000 to 121 in 2006 while maintaining an average success rate of over 60% (the average success rate for public and private funding is normally about 20%). We have PDMO to thank.

The ***Purchase, Supplies and Disposal Services*** provides important support to research and is responsible for services such as procurement of goods and services, shipping and insurance and inventory control.

Security Unit: The 52-person strong unit protects ICRISAT's assets at the Patancheru campus and at other key locations in Hyderabad city.

The ***Transport Unit*** at Patancheru provides efficient, safe and cost-effective transport to all units of the Institute.

A ***Travel Office*** smoothly facilitates the travel needs of ICRISAT's traveling community.

Stalwarts of Science and Agriculture visit ICRISAT (2002-2007)

Professor MS Swaminathan, one of ICRISAT's founding fathers, leader in India's Green Revolution, and at present Chairman of the Indian National Commission on Farmers (besides being the Chairman of the MS Swaminathan Research Foundation), generously visits ICRISAT on several occasions.

Dr William Dar, Prof MS Swaminathan and Dr Suhas Wani at the Tata-ICRISAT-ICAR project review and planning workshop

Biotech gurus visit genomics lab – Edwin Southern (extreme left) *and Sonia Morgan, with Jonathan Crouch.*

Prof. Edwin Southern, father of Biotechnology visited ICRISAT in February 2002, accompanied by Dr Sonia Morgan. He wrote in the Visitors book, "Congratulations on a job well done. An impressive set of facilities and people."

Dr Kevin Crockford, Department for International Development (DFID), visited on 30 April 2003.

Dr Bruce Alberts, President, National Academy of Science, Washington DC, USA, visited ICRISAT Patancheru on 12 January 2005.

Mr Arnold Parzer, Agricultural Counselor, Netherlands Embassy visited on 18 April 2005.

Hon Sangay Ngedup, Min. of Agriculture, Bhutan, visited on 26 March 2005 and said, "We are impressed by your focused approach to research, which will impact so many poor farmers."

Hon Sanginova Sadokat Rahmatovna, Dy Min. of Agriculture, and D Sanjinov Sanginboy Rajabovich, Director Soil Science Research Inst. Tajikistan, visited on 27 June 2005.

Dr Nickey Iyambo, Min. of Agriculture, Water and Forestry, Namibia visited on 6 December 2005 and wrote, "ICRISAT is an institute serving humanity. Please keep it up."

Dr Jacques Diouf, Director General of the Food and Agriculture Organization (FAO) of the UN, visited on 4 January 2006.

Dr William Dar and Dr Jacques Diouf during the FAO Director General's visit to ICRISAT-Patancheru in January 2006.

Hon Adamou Bello, Minister of Agriculture, Nigeria visited on 11 June 2006.

Mr Umeo Koganemaru, Japan International Cooperation Agency, visited on 6 November 2006 and said, "I hope for future cooperation with ICRISAT for enhancement of sustainable agricultural development in Africa."

Dr Martin Elia Lomuro, Minister of Agriculture, Southern Sudan, visited on 23 May 2007, and hoped that the work by the ICRISAT-led consortium in Southern Sudan would lay down the foundation of research destroyed by 20 years of war.

Leaders from Governments visit ICRISAT (2002-2007)

His Excellency Professor APJ Abdul Kalam, President of India, visited ICRISAT on the occasion of ICRISAT's 30th Anniversary. This was celebrated on 12 December 2002 at ICRISAT Headquarters at Patancheru, India.

Mr Tan Zhonghua, Chinese Embassy, New Delhi, visited on 4 February 2003.

His Excellency Teketel Forssido, Ethiopian Ambassador to India, visited on 22 March 2004 and said, "What ICRISAT is doing to develop and transfer technologies that will change the lives of millions of farmers in developing countries is indeed commendable."

His Excellency U Kyi Thein, Myanmarese Ambassador to India visited on 13 August 2004.

His Excellency Yasukuni Enoki, Ambassador of Japan in India, visited on 15 December 2004 and said, "I am very much happy to have witnessed how effectively Japanese contribution is being used in this Institute."

Her Excellency Milena Santana Ramirez, Venezuelan Ambassador to India, visited on 7 June 2005 and said about ICRISAT's work, "We are opening a path ahead of us."

Hon Ousmane Issoufi Maiga, Prime Minister of Mali, visited on 6 June 2006 and said, "I thank ICRISAT for increasing the productivity of groundnut and sorghum in Mali."

Hon Ousmane Issoufi Maiga, Prime Minister of Mali

Her Excellency Bernadette M Allen, US Ambassador to Niger visited on 22 June 2006 and said, "It is very satisfying to see ICRISAT's innovative work in Sadore with the African Market Garden and the Sahelian Eco Farm."

Ambassador del Rosario and Dr Dar with a group of Filipinos who reside and work in Hyderabad city

Her Excellency Laura Del Rosario, Philippine Ambassador to India, visited on 4 August 2006.

His Excellency Bingu wa Mutharika, State President of the Republic of Malawi, visited ICRISAT on 23 August 2006 and said, "ICRISAT's research has been successful in Malawi. I am grateful to ICRISAT for its support."

His Excellency Gilbert Bukenya, Vice President of Uganda, visited on 28 August 2006.

Names Carved in Stone and Shine

Starting in the year 2001, Director General Dr William Dar started the practice of naming special halls and laboratories of the Institute after former Directors and present supporters of ICRISAT.

6 December 2001

The ***Ralph W Cummings Auditorium.*** Dr Ralph W Cummings, ICRISAT's first Director, had passed away in June 2001. His son, Ralph Cummings Junior officiated on his behalf.

The ***C Fred Bentley Conference Center.*** Dr Bentley was the Chairman of ICRISAT's first Governing Board.

The ***MS Swaminathan Applied Genomics Laboratory.*** Dr Swaminathan is one of the three founding fathers of ICRISAT.

12 December 2002

ICRISAT celebrated its 30th anniversary and the occasion was marked with the naming of the ***Board Room***, the ***Genebank*** and the ***Library*** after the eminent men who have done so much for ICRISAT – ***Dr LD Swindale, Dr R Paroda and Dr JS Kanwar.*** They were all present with members of their families.

12 December 2003

The ***Jim Ryan Recreation Center.*** Dr James G Ryan was ICRISAT's Director General from 1991 to 1997. His wife, Wendy Ryan accompanied him for the occasion.

14 December 2004

The ***Charles Renard Analytical Services Laboratory***. Dr Renard was the Executive Director of ICRISAT's Asian Region from 1994 to 1996.

The Great Lakes Conference Room and ***The New Sahel Conference Room*** were so named to honor the regions of East Africa and West Africa. The shiny new plaques were also unveiled on 14 December 2004.

14 December 2005

The Shawki M Barghouti Conference Room. Dr Barghouti was ICRISAT's Director General from 1997 to 1999.

Dr Barghouti unveils the plaque at the conference room.

Governing Board members (2002 – 2007)

2002

Sitting L to R: *Augustine Uzo, Bo Bengtsson, William D Dar, Martha B Stone, Panjab Singh, Gladys M N Mutukwa, Donald R Marshall.*
Standing L to R: *P V Rao, J N L Srivastava, Simon G Best, Marc Latham, Jose T Prisco, Tadakatsu Yoneyama.*
Not in picture: *Augustine Uzo Mokwunye, Joao Ambrosio de Araujo Filho, Roger N Beachy.*

2003

Sitting L to R: *Sathi Nair Augustine Uzo Mokwunye, Donald R Marshall, Martha B Stone, William D Dar, Marc Latham, Gladys MN Mutukwa.*
Standing L to R: *Norah K Olembo, Mohan Kanda, Roger N Beachy, Mangala Rai, Joao Ambrosio de Araujo Filho, Simon G Best, Osamu Ito.*
Not in picture: *Panjab Singh, PV Rao, JNL Srivastava, Bo Bengtsson, Tadakatsu Yoneyama, Caroline Pestieau, Stein W Bie, RCA Jain.*

2004

Sitting L to R: *Roger N Beachy, Mangala Rai, Augustine Uzo Mokwunye, William D Dar, Gladys MN Mutukwa, Stein W Bie.*
Standing L to R: *Mohan Kanda, Radha Singh, Norah K Olembo, Caroline Pestieau, Osamu Ito.*
Not in picture: *Simon G Best and Joao Ambrosio de Araujo Filho.*

2005

L to R: *Mangala Rai, Radha Singh, Mohan Kanda, Khauhelo D. Raditapole, Stein W Bie, Osamu Ito, Simon G Best, Augustine Uzo Mokwunye, William D Dar, Norah K Olembo, Roger N Beachy, Caroline Pestieau.* Not in picture: *Gladys MN Mutukwa, Joao Ambrosio de Araujo Filho.*

2006

L to R: *Philip Ikeazor, J Hari Narayan, Norah K Olembo, Stein W Bie, Caroline Pestieau, William D Dar, Simon G Best, Mangala Rai, Radha Singh, Khauhelo D Raditapole and Osamu Ito.* Not in picture: *Roger N Beachy.*

2007

L to R: *Osamu Ito, J Hari Narayan, PK Mishra, Mangala Rai, Simon G Best, William D Dar, Stein W Bie, Caroline Pestieau and Khauhelo D Raditapole.* Not in picture: *Philip Ikeazor, Norah K Olembo.*

Senior Staff Members

Our most valuable asset – the staff members of ICRISAT.

The New ICRISAT

2004-05
- Fourth King Baudouin Award
- Rated Superior by CGIAR
- US $ 30 M budget
- High staff morale
- Budget surplus

2006-07
- New vision and strategy to 2015
- Two CGIAR Science Awards
- Fourth year of budget surplus
- High staff morale
- Rated Outstanding by CGIAR
- US $ 35 M budget (2007)

2002-03
- Team ICRISAT
- Third King Baudouin Award
- External reviews
  - Quality science
  - Sound management
- Institutional innovations
- Budget surplus (2003)

Mid 90s:
- Financial and human resource challenges
- Declining support

2000-01
- Institutional transformation through Science with a Human Face
- Grey to Green Revolution
- US $ 22 M budget

ICRISAT

International Crops Research Institute for the Semi-Arid Tropics

About ICRISAT®

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Centers of the Consultative Group on International Agricultural Research (CGIAR).

Contact Information

ICRISAT-Patancheru (Headquarters)
Patancheru 502 324
Andhra Pradesh, India
Tel +91 40 30713071
Fax +91 40 30713074
icrisat@cgiar.org

Liaison Office
CG Centers Block
NASC Complex
Dev Prakash Shastri Marg
New Delhi 110 012, India
Tel +91 11 32472306 to 08
Fax +91 11 25841294

ICRISAT-Nairobi (Regional hub ESA)
PO Box 39063, Nairobi, Kenya
Tel +254 20 7224550
Fax +254 20 7224001
icrisat-nairobi@cgiar.org

ICRISAT-Niamey (Regional hub WCA)
BP 12404
Niamey, Niger (Via Paris)
Tel +227 20722529, 20722725
Fax +227 20734329
icrisatsc@cgiar.org

ICRISAT-Bamako
BP 320
Bamako, Mali
Tel +223 2223375
Fax +223 2228683
icrisat-w-mali@cgiar.org

ICRISAT-Bulawayo
Matopos Research Station
PO Box 776,
Bulawayo, Zimbabwe
Tel +263 83 8311 to 15
Fax +263 83 8253/8307
icrisatzw@cgiar.org

ICRISAT-Lilongwe
Chitedze Agricultural Research Station
PO Box 1096
Lilongwe, Malawi
Tel +265 1 707297/071/067/057
Fax +265 1 707298
icrisat-malawi@cgiar.org

ICRISAT-Maputo
c/o IIAM, Av. das FPLM No 2698
Caixa Postal 1906
Maputo, Mozambique
Tel +258 21 461657
Fax +258 21 461581
icrisatmoz@panintra.com

Visit us at www.icrisat.org

ISBN: 978-92-9066-503-8 BOE 046 217-2007