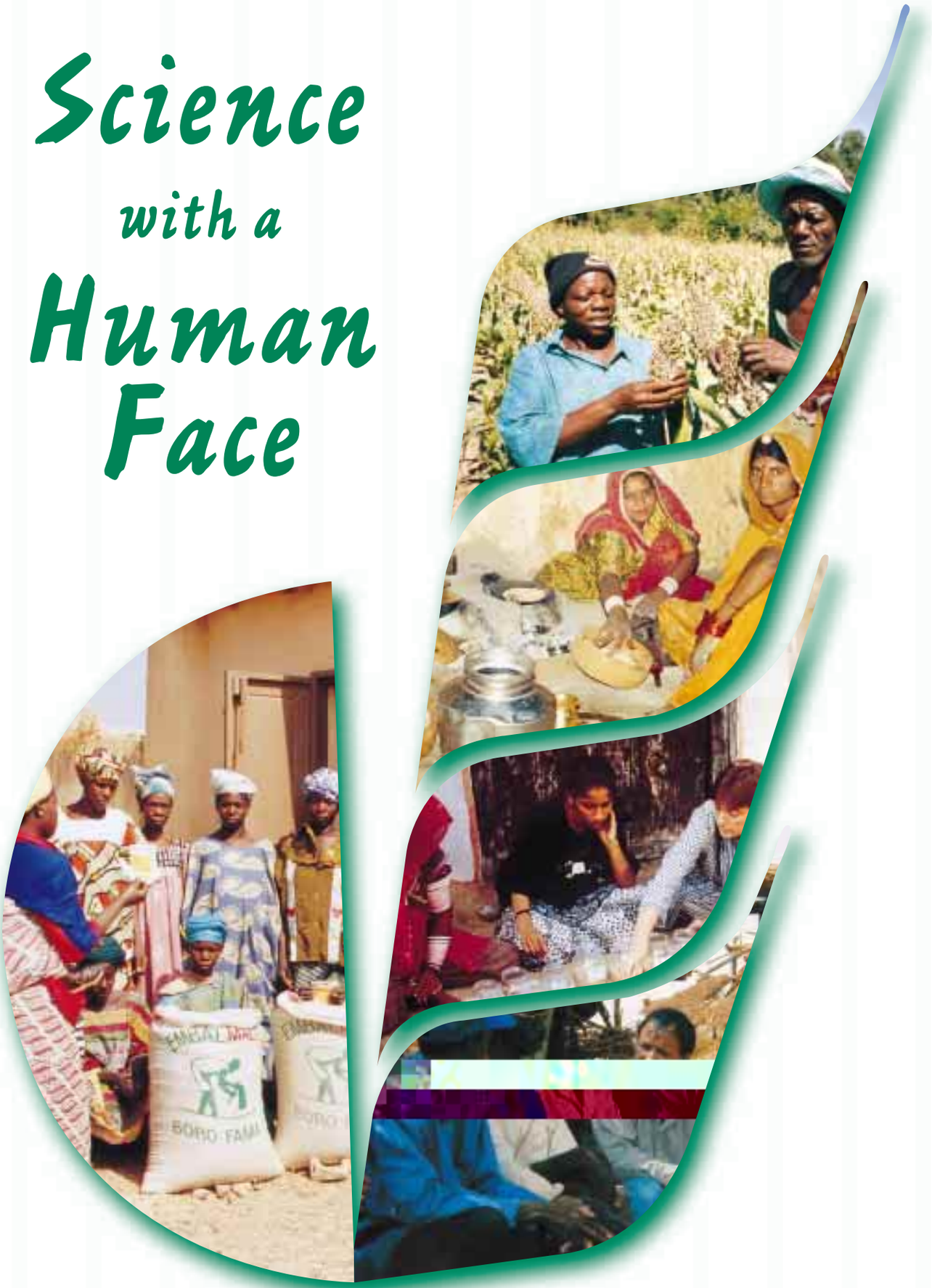
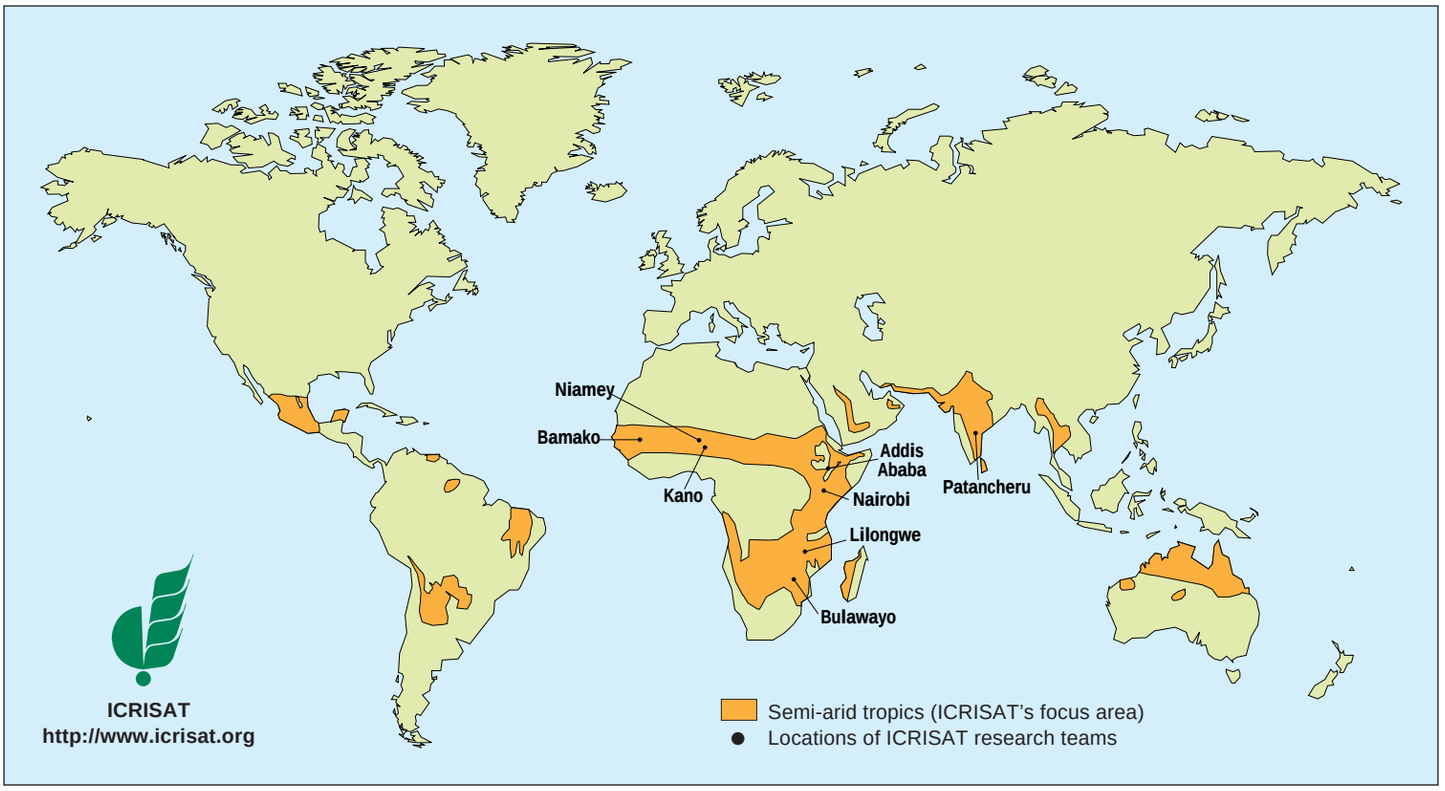
Science with a Human Face



ICRISAT
Annual Report
2000



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What is ICRISAT ?

A nonprofit, apolitical, international organization for science-based agricultural development. Established in 1972, it is one of 16 Centers supported by more than 50 donor governments, foundations, and development banks, through membership in the Consultative Group for International Agricultural Research (CGIAR). ICRISAT has approximately 1300 staff, and an annual budget of about US$ 26 million.

ICRISAT's mission and focus

To help developing countries apply science to increase crop productivity and food security, reduce poverty, and protect the environment. ICRISAT focuses on the farming systems of the semi-arid tropical areas of the developing world, where low rainfall is the major environmental constraint to agriculture. Special emphasis is placed on five crops that are particularly important in the diets of the poor: sorghum, millet, groundnut, chickpea, and pigeonpea.

ICRISAT's strategy

To form research partnerships with government, non-governmental, and private sector organizations in developing countries, and to link these partners to advanced research institutions worldwide. Each partner contributes its unique strengths to make the whole greater than the sum of its parts. ICRISAT excels in strategic research on global issues, and on international exchanges of knowledge, technologies, and skills. These products and services help partners enhance their capabilities to meet regional national, and local development needs.

Where is ICRISAT ?

Staff are based at eight locations across Africa and Asia, shown above. From these points, they travel extensively to work with partners across the semi-arid tropical world.

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The 'Science with a Human Face' icon at the top of this page was designed by Mr K Ramesh Kumar. The colors of dry soil and water suggest the major challenges as well as opportunities of agriculture in the dry tropics. The human image (cradling the ICRISAT logo) represents ICRISAT's people-first focus, as it carries out its international mission to reduce poverty, hunger, and environmental degradation.

ICRISAT's New Director General

Dr William D Dar took the helm at ICRISAT on 11 January, 2000. At 46 years, he is the youngest Director General in the Institute's history.

Dr Dar is well known in the international agricultural research community. He served as Chair of the Asia-Pacific Association of Agricultural Research Institutions (APAARI) and represented that region in the establishment of the Global Forum on Agricultural Research (GFAR). He has been a member of the Boards of CIMMYT and ACIAR, and was previously a member of the CGIAR Oversight Committee. He served on ICRISAT's Governing Board from 1997 to 1999.

Dr Dar was born into a smallholder farming family in Santa Maria, Iloros Sur, the Philippines, where he grew up helping cultivate rice and vegetables. He began his career in 1973 as a farm management technician in an agricultural extension center. Dr Dar received his BSc and MSc degrees in Agricultural Education and Agronomy, respectively from Benguet State University in the Philippines. He stayed on to serve the University as Instructor, rising to Professor and to Vice President for Research and Development Support Services. He achieved his PhD in Horticulture from the University of the Philippines, Los Baños in 1980, while continuing to teach and carry out farming systems research, and serving as the Director of the Highland Agricultural Research Center at Benguet State University.

In recognition of his distiguished service as Vice President at Beguet State, in 1987 Dr Dar was appointed by then-President Corazon Aquino to manage the Bureau of Agricultural Research of the Philippine Department of Agriculture. As its first Director, he led the formulation of the National Agricultural Research and Extension Agenda, and the rationalization of the agricultural research system of the country.

In 1994 Dr Dar became Executive Director of the Los Baños-based Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development (PCARRD), the apex agricultural research institution of the country.

In 1998, President Estrada of the Philippines appointed Dr Dar as the Acting Secretary of the Department of Agriculture (equivalent to the Minister of Agriculture). During his tenure, the nation's agricultural GDP reversed a declining trend to post a strong 2.7% growth rate. In August 1999, President Estrada appointed Dr Dar as Presidential Advisor on Rural Development in the Philippines, a capacity he served until joining ICRISAT.

Message from the Director General

Dr Dar and Dr Ragnhild Sohlberg, Governing Board Chair (right), explain ICRISAT's mission to the press at Bamako, Mali

Dear Friends of ICRISAT,

It is indeed a privilege and honor for me to be able to address the global family of ICRISAT's stakeholders and partners for the first time as your Director General. Although I am new in this role, my previous experience on your Governing Board and in the formation of regional and global NARS fora have made me well aware of your strong comittment to, trust in, and expectations of this remarkable Institute.

Focusing on the poorest of the poor in one of the harshest agro-ecosystems, ICRISAT arguably faces the most challenging agenda of any Center. Conditioned as we are to reciting the list of constraints of the semi-arid tropics, though, we should not forget that this zone is blessed with a number of positives: abundant sunshine, low humidity inhibiting pests and diseases, extensive grazing lands for livestock, gentle terrain for transportation and infrastructural development, and a long experience of civilization, creating a rich pool of indigenous knowledge that we can and must tap to enhance sustainable agricultural development. Through effective technologies, policies, infrastructural development, and – most important – the development of human potential, we see no reason that the semi-arid tropics cannot become as vibrant and important to the world as the dry areas of the temperate zones, such as the breadbaskets of the Great Plains of North America, the steppes of Asia, and the grain belt of Australia.

It is the latter element – the enormous human potential of the zone – that I would like to focus on for a moment. As a research Institute praised for its scientific achievements, including two consecutive King Baudouin Awards (the CGIAR's highest accolade), we sometimes get so excited about our progress in biophysical research that we forget to highlight its core purpose: to improve the livelihoods of the poorest, most marginalized people living in the semi-arid tropics.

To balance our laudable scientific enthusiasm, I have emphasized to all our staff and partners since joining that we should adopt a philosophy of **Science with a Human Face** – that is, we must formulate our workplan with a clear idea of how it will deliver real benefits to the poorest and most disadvantaged people in the semi-arid tropics.

This does not replace the need for high standards of scientific excellence – far from it. But it does emphasize that our science must be focused on the ultimate mission and objectives for which this Institute was established: to reduce poverty, hunger, and environmental degradation across the semi-arid tropics of the developing world.

To better illustrate the human face of our science, we have chosen for this millennium ICRISAT Annual Report to highlight the struggles and triumphs of a number of farmers as they test and adopt new agricultural technology. We hope you will find these real-life stories as fascinating and inspiring as we do, and as compelling reaffirmations of the relevance and importance of our work.

ICRISAT is about people – poor men, women, and children, struggling one day at a time trying to make ends meet, pitting their wits against difficult obstacles, experimenting and innovating – because to do otherwise would be to give up hope. We want to enhance that hope, and help them fulfill their aspirations to make a better life for their children and their communities. That is what Science with a Human Face is all about.

We seek your continued partnership and support for this noble cause. Together, we *will* build a better tomorrow, through Science with a Human Face.

Before closing, I must note that were deeply saddened on 30 January 2000 by the stunning loss of four scientists from our sister Centers IITA and ICRAF in the tragic crash of Kenya Airways flight 431 near Abidjan, Ivory Coast. This was the worst tragedy of its kind to strike the CGIAR. Our staff travel extensively in some of the most difficult areas of the world, and we perhaps tend to take for granted the considerable risks and hardships they face on a daily basis, without complaint, in pursuit of their passion – to help the poor and hungry of the developing world. These bright, committed, idealistic young scientists represented the human face of our science in its best and truest sense. They were our friends, part of us – and will not be forgotten.

Sincerely,

William D Dar

Chickpea: The Guaranteed Crop

The story begins in the early 1990s when the cotton crop failed repeatedly in many districts of Andhra Pradesh (AP). Reports began flowing in of desperate, debt-ridden farmers driven to suicide. Chilli and tobacco – the other two major cash crops – were also plagued by heavy pest damage, rising fertilizer and pesticide prices, and falling prices of these crops. Farmers began to urgently seek alternatives.

It was then that some interested farmers with the help of A Satyanaryana, the then Senior Pulses Breeder at the Andhra Pradesh Agricultural University's Regional Agricultural Research Station, Lam, in Guntur, conducted pilot demonstrations in Gottipadu of the ICRISAT kabuli type chickpea variety ICCV2 (released by the Government of India as *Swetha*), and the ICRISAT desi-type variety ICCC 37 (released as *Kranthi*). During the demonstrations, farmers harvested up to 2 t ha^{-1} of chickpea and became instant leaders. In the following years the area planted to this crop increased to over 1000 ha in Gottipadu village alone. Most of the produce was sold as seed to the neighboring villages. This farmer-to-farmer exchange increased the area under chickpea rapidly – by 1998, the area under chickpea in AP had more than doubled to 146 000 ha; and total chickpea production in the state during the same period increased nearly *nine-fold* (15 000 to 130 000 t), according to ICRISAT chickpea breeder Jagdish Kumar.

Following the Gottipadu example, many farmers adopted two new cropping patterns, soybean-chickpea and sesame-chickpea to replace cotton cultivation. Adopting chickpea helped farmers reduce costs of their purchased inputs such as fertilizers, pesticides, and labor – chickpea requires just 100 kg DAP (diammonium phosphate) per hectare as opposed to fertilizer-hungry cotton and chilli (the latter sometimes gets over a ton of fertilizer per hectare!). Farmers also increased their incomes as chickpea prices have been relatively high and stable. Further, the high-protein (20-21%) chickpea grain improved nutrition and helped diversify the diet of these farm families.

Moreover, extending kabuli cultivation to the tropics meant that the premium price obtained by farmers in the subtropics is also now available to these farmers.

No wonder G Koteswara Rao and his fellow farmers of Gottipadu village declare that "Chickpea has come to us as a real boon". "With cotton cultivation becoming a gamble, chickpea has come in as a savior. It is a guaranteed crop!"

Recovering Indigenous Knowledge: The Pigeonpea Shake-Down

Eighty-year-old Mr Bitchappa's advice was almost easy beyond belief: shake the infamous podborers off pigeonpea plants, and save US$ 310 million annually – the estimated worldwide pigeonpea crop losses due to the podborer *Helicoverpa.* Mr Bitchappa's fellow farmers in Hamsanapalli village, in Mahabubnagar district of Andhra Pradesh (AP), had come to him because pigeonpea losses in their village were becoming intolerable – between 20 and 100 percent of their crops were lost to the deadly podborer.

Over 4 million ha worldwide, mainly in southern Asia and eastern Africa, are under pigeonpea. This grain legume is a major source of inexpensive protein (20%), fodder, and fuel in the tropics and the subtropics. By 1993, 100% of pigeonpea farmers were using chemical control in India. Applying 3-6 sprays of chemicals became common practice. While this worked fine to start with, soon yields began to decline, and the high insecticide investment began to hurt farmers. Enter Mr Bitchappa.

In a farmer-participatory discussion organized in Mr Bitchappa's village by the NGO, Research in Environment, Education and Development Society (REEDS), the village elder recalled how, in the pre-insecticide days, pigeonpea plants were gently shaken, and podborer larvae dropped off the plants. The larvae were collected in a sheet which was dragged along the ground in the interspace between rows of pigeonpea plants. A few hens were allowed to follow this sheet, and the plump worms provided a high-protein feast for the voracious birds!

However, private agencies were skeptical about the applicability, efficiency, and economics of this "shake-down" technique. So, during the 1998-1999 season, this indigenous technology was evaluated in a 15-ha research watershed at ICRISAT-Patancheru, with support from IFAD and in collaboration with ICAR, ANGRAU, MAU, and NGOs under the coordination of CWS.

The results were spectacular: when plants were "shaken down" an 85% reduction in insect population was achieved, while the larval population in the adjacent, chemically sprayed plots remained high throughout the cropping period. The "pigeonpea shake-down" wins hands down on the cost-front too: it costs just Rs 280 (US $ 6) per hectare to have 7 people to shake pigeonpea plants, and collect larvae; and each chemical spray costs Rs 500-700 (US $ 11-16) per hectare.

This technology, initiated at a few locations during 1997, rapidly spread to more than 100 villages involving several thousand farmers in three states of southern India within 2 years. All these farmers continue to use the method. "We are working with farmers, NGOs and the NARS to include this simple indigenous cultural practice as a critical component of our IPM strategy for pigeonpea" says ICRISAT entomologist G V Ranga Rao.

Knowledge Sharing: A Two Way Street

Working with farmers can be richly rewarding – and sometimes yield quite unexpected results, too. That is what Anja Christinck and Kirsten vom Brocke, Special Project Scientists from ICRISAT discovered when they lived alongside millet farmers in Rajasthan, along the harsh fringe of the Thar Desert in northwestern India. Along this desolate margin only millet, the ultra stress-tolerant cereal, can withstand the heat and drought and produce a good crop without irrigation.

Anja and Kirsten were conducting a study on how farmers manage their seed stocks, and how researchers can use this knowledge to breed varieties that farmers will readily accept. As part of their study, they organized a workshop where all the participants were farmers. Women had been especially invited because of their prominent role in selecting and maintaining seed, and their deep knowledge of millet. For example, Hira Bai, a woman farmer from the village Aagolai, could immediately spot her own millet population out of 81 experimental plots in the field trials!

The farmers were invited to evaluate field trials in which their millet populations were grown alongside commercial varieties and breeding lines from ICRISAT. These farmers had earlier taken part in participatory breeding trials coordinated by ICRISAT in collaboration with the Indian national research organizations, such as ICAR's Central Arid Zone Research Institute, Rajasthan Agricultural University, and Rajasthan Department of Watershed Development, as well as NGOs.

During these trials, the farmers received seeds of ICRISAT breeding lines for testing. Most of the farmers had included this material into their own seed stocks, and in some cases they had carefully selected plant types from those co-mingled stocks over the years. "In this way, the farmers had attempted to improve their own traditional landrace populations – or perhaps they were improving the ICRISAT material," remarked Kirsten.

In the workshop, the farmers praised their landrace (locally known as *desi*) populations, which they said had all the desirable qualities except the high yield potential exhibited by the modern varieties under good rainfall conditions. Some of the farmers described *desi* millets as perfectly adapted to erratic rainfall conditions, drought, and local soils. They also thought that it was good for both food and fodder and that it was more nutritious and tasty than the commercially available varieties. "Only by eating this *desi* have we grown up to what we are today," one woman proudly exclaimed.

One of the interesting findings of the study was that farmers and ICRISAT scientists had independently bred towards similar plant types. "These plant types are adapted to a wide range of conditions yet maintain the farmers' quality requirements, while providing higher yields than the original landrace under favorable conditions," observed Anja and Kirsten.

Learning from this experience, ICRISAT breeders have widely participatory breeding methods across all crops, involving farmers in key stages of plant evaluation and selection. They have found that sharing ideas with farmers is a win-win exercise for everyone involved.

Bringing Hope to the Makindu Orphans

You could call it an irony of fate. Pigeonpea was once called an 'orphan crop', neglected by commercial interests because it was a just a food of the poor. This changed when ICRISAT adopted it as one of its focus crops for improvement. Now, the orphan crop has itself become a symbol of hope for real orphans of the Children's Center at Makindu, a village in Kenya.

The Makindu Center was established to assist the local community in caring for orphans, some of whom have lost their parents to AIDS. Its founder, Diana Nzomo, is a born leader and a farmer-entrepreneur. She is no stranger to ICRISAT. Since 1992, she has been a regular visitor to the nearby Kenya Agricultural Research Institute (KARI) Station at Kiboko, where ICRISAT scientists have been improving pigeonpea varieties through support from the African Development Bank.

Searching for new ways to help the orphans, in 1998 Diana took up a suggestion to grow short-duration pigeonpeas on a piece of land that the Center had rented from a local farmer. The suggestion was made by Omari Karuru, Head of the ICRISAT team at KARI. "The peas will be useful for both food and sale," Karuru told Diana. "You can also plant two crops a year, and harvest fresh pigeonpeas just 3 months after planting."

Green pigeonpea is highly sought-after in the region, because it is tasty and nutritious and is available when other green vegetables are in short supply. It also holds export potential to the UK where it is in demand from people of Asian and Caribbean origin – a chance for poor Kenyan cultivators to earn hard cash.

So sound was Karuru's advice to Diana that even before her first crop had flowered, Everest Enterprises, a horticultural export company, showed keen interest to buy her pigeonpeas for export to the UK. ICRISAT scientist Richard Jones reports that Everest was especially interested in peas from the recently-released, ICRISAT-derived variety 'KARI Mbaazi 1' (ICPL 87091).

The fresh peas also became a great hit with the Center's children. Because pigeonpea is high in protein, it improved the children's health. Diana was so pleased with the result that she wanted to give them a diet of pigeonpeas year-round. This required storing the dried harvest of mature pigeonpea seeds. However, unlike the fresh green pigeonpeas, dried pigeonpeas have a bitter taste if the seed coat is not removed.

In India, where the crop originated, the seed coat is traditionally removed with a simple household grinding stone known as a *chakki* which also splits the grains, making them easier to boil. ICRISAT researchers decided to import *chakkis* from India to test in Kenya. A collaborative project was funded by USAID to train artisans to manufacture *chakkis*, and to train rural Kenyan women to prepare dhal, an appetizing, nutritious, and easily-digestible thick soup.

The experiment was a big success. Under Diana's leadership, the Makindu Center is now manufacturing and selling cement *chakkis*, in addition to earning income through the sale of green pigeonpeas. They are also feeding the children dhal year-round.

An orphan crop helping real orphans. The case of the Makindu Center is a living example of how crops are intertwined with the lives of the poor and dispossessed – and how agricultural innovation can help them gain the health and security they need for a brighter future.

Barefoot Scientists Help Their Communities Grow

Food production doesn't come much harder than the Manama area, south of Gwanda in the driest part of Zimbabwe. The granite outcrops tell one immediately that the soils hold little water, and even less nutrients. Traditionally, only the very stress-tolerant pearl millet crop is worth cultivating in this area.

Perhaps it is this adversity that helps partnerships thrive. Mr and Mrs Johnson Nkomo are working with ICRISAT to help themselves and their neighbors lift their food production to undreamt-of levels. Johnson Nkomo, a leading figure in the local farmers' union, volunteered for on-farm experiments before they really began, stimulated interest among neighbours, and helped organize the inaugural farmers' meeting. The Nkomos volunteered to conduct five on-farm experiments.

More than 50 farmers are currently working in partnership with ICRISAT and Zimbabwean national scientists to find practical and effective methods for improving soil fertility and soil water management. Work has so far focused on combining farmyard manure with limited amounts of inorganic fertilizer to improve the efficiency of both, and using legumes in crop rotations to raise fertility without purchased inputs. It also includes the use of modified tied ridging, `dead-level contours' and infiltration pits to retain soil moisture.

Mrs Nkomo is not just a supporting figure, she is an active researcher too. While Mr Johnson is not always able to be there when scientists Walter Chivasa and Bob Myers visit, Mrs Nkomo certainly is – often with her two youngest in tow, spreading farmyard manure, applying fertilizer, helping with the scientific measurements, and explaining the experiments to visitors. When it was time for a field day to show off their results, their fellow farmers quickly selected the Nkomo farm as one of the main sites to be visited.

Their reward for all of this? They achieved sorghum grain yields of about 1.5 t ha^{-1}, about 5 times the average for this district! This inspired many more farmers to plan to join the program next year.

Following suit, their neighbors the Moyos volunteered to tackle two problems in their on-farm research. One was a complex trial in which fertilizer, manure and a technique for increasing water infiltration were to be tested simultaneously.

Initially things did not go well. Heavy early rains caused severe damage to the experiments. After some discussion with researchers Geoff Heinrich and Doubt Gumbondzvanda, together with some ideas he picked up by visiting a field day in another district, Mr Moyo installed erosion prevention measures that resulted in a recovery that astonished his scientist-partners. His sorghum yielded an impressive 3 t ha^{-1}, far surpassing the average yields in his area.

Mr Moyo, a man of action rather than words, was content to stand back and enjoy listening to Mrs Moyo explain the amazing results to their neighbors in her native Ndebele language. But later he confided to the scientists that they could expect even better next year – he had a few more ideas to improve his system.

`Barefoot scientists' like the Nkomos and Moyos have found that research is not just the province of those holding PhD degrees – that they too can apply its techniques to change their lives, and the lives of those around them, for the better.

Small is Beautiful

Ernest Sibanda grows sorghum and groundnuts on a two-hectare plot in a remote village in Zimbabwe's Gwanda district. This year for the first time he planted seed of two new high-yielding varieties. He had first learned of these varieties two or three seasons earlier, but had not been able to find seed. "Until this year, I had to go all the way to Gwanda town to get sorghum seed", says Mr Sibanda. "The journey takes me the whole day, and I usually have to make more than one trip, because either seed is not available at all, or not available in the right quantities." The "right" quantity is a small, affordable packet of 5 kilograms each of one or two varieties.

According to ICRISAT economist David Rohrbach, improved grain seed is conventionally sold in 25 or 50 kg bags – ideal for large-scale commercial farmers, but too costly for smallholders who can barely make ends meet. A new initiative by ICRISAT and Seed Co, a private seed company in Zimbabwe, could completely change all this. The aim is to make sure farmers can get seed of the crops and varieties they want, in the quantities they want, without traveling long distances – and doing this on a commercial basis, without subsidies.

The success of this pilot program is also helping to disprove a popular myth – that smallholder farmers will not buy seed of open-pollinated (non-hybrid) crops. However, two conditions must be met. First, the seed has to be easily available, preferably in the village. Second, it must be sold in small packages that farmers can afford.

The program used a combination of small packs, broader marketing, and credit support to sell over 2 t of improved seed varieties. It was sold in packs ranging in size from 500 g to 5 kg. To encourage village retailers to keep stocks, they were offered revolving credit for up to 1 t of seed.

Most retailers were surprised sales were so high. Japhet Ndlovu of Gwanda is looking forward to the next season. He plans to expand the range of small pack seed in his village shop. " I think the small packages are really important for two reasons," he says. "They can help farmers get new varieties, and anyone can afford them. I used to lose many customers because they couldn't afford to buy even 5 kg of sorghum, let alone the full 25-kg bag. Last year many farmers bought groundnut seed in packets as small as 500 g to plant in their gardens." Nelson Moyo, a retailer in Tsholotsho was even more emphatic. "I will stock the small packs even if Seed Co does not give me credit."

After one year of the program, over 90% of the farmers who bought the small packs say they will buy more next season. Retailers like Ndlovu and Moyo are trying to push sales even higher. "We need better advertising", says Moyo. "Give us colorful posters – we will put them up ourselves, and more farmers will buy the seed. Give the varieties nice names – not just numbers – and people will be able to remember the names."

If the small-is-beautiful concept continues to succeed the way it has in its first season, agricultural development could accelerate for tens of thousands of farmers like Sibanda all over southern Africa.

Joining Hands to Halt Soil Erosion

The village of Chefe Donsa is located in a picturesque but rugged Ethiopian Highland wheat growing area. Given the high water-holding capacity of the predominant Vertisol black clay soils, even a modest 900 mm average annual rainfall is sufficient to make this a potentially very productive environment.

But appearances of lush bounty are deceiving. When wet, these soils become so heavy and sticky that animals and people cannot effectively walk through or plow them, so farmers traditionally delay planting until the second half of August. By that time more than half of the amount of seasonal rain has soaked the bare plowed fields, resulting in severe erosion and deep gullies that destroy the productivity of the land forever.

In March 1999 about a hundred farmers of the Chefe Donsa village met with ICRISAT and Ministry of Agriculture `Joint Vertisol Project' staff, together with the District Team Leader for Development and local development agents to seek solutions. Farmers expressed their thoughts, and decided to create farmer research groups to address issues including soil and water conservation and agro-forestry, weed management problems, fertilizer use, and the use of the broad bed maker (a special tillage tool) to improve field drainage, as well as the need for improved varieties.

ICRISAT scientist Michael Klaij and partners from the Ministry of Agriculture worked with the development agents and farmers to help them map about 30 ha of their watershed. The farmers' central concern was to increase productivity of their fields to provide food and income for their family. However, they were also very worried about poor drainage and erosion, especially about the gullies creeping into their fields. Following discussions, they agreed to work together to improve the major communal drains, so that the runoff water could be directed away from everybody's fields.

In May 1999, farmers worked jointly to improve the waterway. Two small stone drop structures were essential to stabilize two ominous gully heads. They also brought the heavy stones needed for the construction of the drop structures.

Their labor was put immediately to the test. The 1999 rains came hard and fast, exceeding a level expected only once every 20 years. It included a single-day rainfall daily event of 70 mm, expected only once every 30 years.

Fortunately, the drop structures withstood the pressure well. Farmers were gratified as just a few hundred meters downstream beyond where they had worked, the heavy rainfall caused a two-meter deep, three-meter wide gully to advance by about 12 m, which amounts to over 70 t of soil lost.

Seeing is believing. The handiwork of the farmers of Chefe Donsa has convinced them to continue to work together to preserve their rich yet fragile land heritage – the key to sustainable prosperity for themselves and for their descendants.

Amazing Grace Does It All

Life has taken a turn for the better for Grace Moffat. She farms a 1-ha plot of land in Sankhani, a village near the Malawian capital of Lilongwe. Grace is 42 years old and has three school-going children, one of whom she adopted under a foster-parent program run by PLAN International, an NGO dedicated to child-centered community development. Like many women in the village she is a single parent struggling to make ends meet, and must somehow set aside a little money each season for school fees and other expenses.

Groundnuts mean a lot to Grace. "Chitedze Mtedza (groundnut) saved my children. I harvested a bumper crop in 1999 and sold enough groundnuts to pay school fees and buy clothes for my children."

In 1999, Grace was one of 1000 farmers who received 5 kg seed of CG 7, a high-yielding, improved groundnut variety developed by ICRISAT. The seed came from the village seed bank, initiated through ICRISAT/PLAN collaboration and managed by the community. It was given as a loan, with twice the quantity of the loan as seed to be repaid after harvest. The seed she received was enough to plant just one-tenth of a hectare. But she tended the plot carefully, using most of the recommended practices (early planting, recommended spacing, proper weeding) she learned from the project technicians. She actively participated in project field days in farmers' fields around her village. Her own field was chosen as a demonstration plot. "I have learned a great deal about groundnuts through these demonstrations and field days, thanks to your staff," Grace told Pala Subrahmaniyam, ICRISAT groundnut scientist.

The hard work paid off. She harvested 18 bags (360 kg) of groundnut, sold 10 bags (200 kg) in the local market, and made MK 4500 (US$ 100). She used this money to buy books, clothes, and pay school fees for her children. She repaid the seed loan (10 kg) to the community seed bank by providing two farmers in her village with 5 kg each of good quality seed. In addition she distributed over 20 kg of seed to three of her sisters in the village, and encouraged them to grow groundnut. The remaining seed was planted in her own field the following season, and today Grace is the proud owner of a well-managed 0.5 ha groundnut field. "I hope to harvest about 2 tons this year, and then I can feed my children well and give them a good education. For this I must thank Chitedze Mtedza," said Grace.

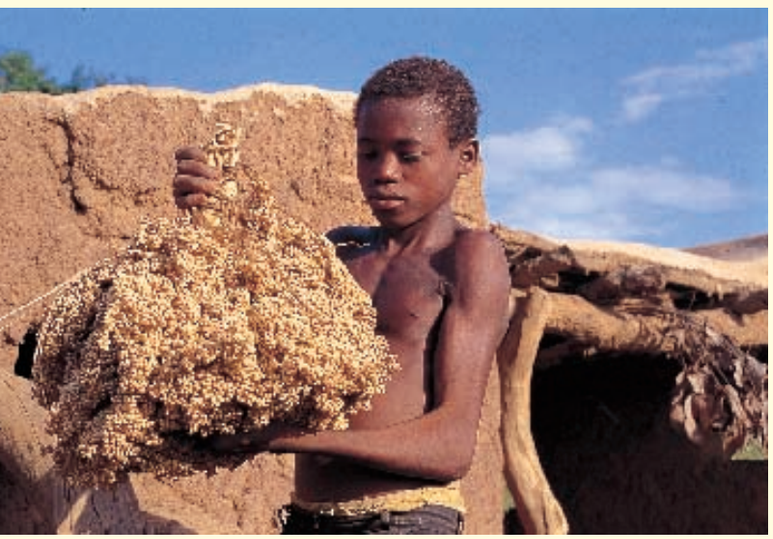
The ICRISAT-PLAN project shows that international research institutes can maximize the impact of their work through partnership with national programs, farmers, and NGOs that are 'plugged into' rural systems and farming communities. Grace is one of several thousand beneficiaries of this effort in the Lilongwe, Kasungu, and Mzuzu areas of Malawi. During the life of this project (1998-2001), 150 field technicians will be trained to relay the new varieties and technologies to an estimated and about 19,000 farmers representing about 13,000 households through demonstrations and farmers' field days.

It is amazing to realize how important Chitedze Mtedza is to so many lives – and how much more it can deliver to them through science-based the agricultural development.

Smart Sorghum Outwits Floods

A sorghum variety that outwitted floods! Sounds strange – sorghum after all is a crop of dry areas – but Malam Sule can testify to it. Malam is a sorghum farmer from Gamgam Village in Sokoto State in the northwest of Nigeria. Farmers in Sokoto mainly live close to the course of the massive Niger River, subjecting their fields to the risk of floods, in addition to droughts from the unpredictable rainfall.

He discovered this new variety when he was ready to migrate to a different village in order to be able to grow sorghum once again and eat his favorite dishes. He could not afford to grow the crop any longer near his home village because year after year, floods from tributaries of the Niger river, which courses through the State, were taking an increasing toll from his harvests. About 80% of the agricultural land in Gamgam is located in flood-prone lowlands. Traditional sorghums grown in the area mature so late that fields often become flooded before they can be harvested.



Extension agents of the Sokoto Agricultural and Community Development Projects sponsored by the International Fund for Agricultural Development convinced Malam to try out a new sorghum variety, 'ICSV 111', an early-maturing variety that developed jointly by ICRISAT and national researchers. Early maturity not only helps the variety escape drought when the rains end early – it also allows it to escape the floods.

To his astonishment, the variety was ready for harvest in late August, before the floods had fully set in. Malam was even more surprised when he saw that the yield of ICSV 111 was thrice that of the local varieties, with twice the flour production.

"I have decided not to leave the village but to make a living out of this variety," said Malam. Many of his neighbors and other villages in the area are now adopting ICSV 111 for the same reason.

Breeding for adaptation to local conditions, climate, pests and diseases – these are the bedrock fundamentals of applied plant breeding that deliver significant improvements in quantity and stability of grain production, enhancing farmers' incomes and food security. As Malam's case illustrates, the increased flexibility provided by new varietal options for staple crops can make a real and direct impact on smallholders' capacity to remain committed to their land, and to their community.

Harvesting Naira From Millet

Yusuf Ali, a farmer from the Borno State of Nigeria, couldn't believe his eyes when for the first time in his life, he held 50 000 Naira (US$ 500) in his hands – money he had received from selling seed of SOSAT-C 88, a pearl millet variety that he had grown on just half a hectare. But even more remarkable was the fact that it had taken him only 1 year to achieve this. With the money from that sale, Yusuf could fulfill his long-cherished dream of buying a plot in Maiduguri, the capital of Borno State, in the parched northeastern corner of the country.

In January 2000, SOSAT-C 88 was released by the Nigerian National Variety Release Committee for cultivation throughout the country under the varietal name LCIC-MV1 (Lake Chad Research Institute/ ICRISAT Millet Variety 1). The release of a new variety creates opportunity not only for farmers to increase the yields and stability of their staple food crops – but also for village enterpreneurs to reap rewards by multiplying and spreading the seeds far and wide.

Yusuf had come to know of SOSAT-C 88 from the on-farm trials on improved varieties conducted jointly by ICRISAT and the Lake Chad Research Institute. As part of these trials, he had also been trained in seed production technology. Following the training, he decided to produce and sell the seed of SOSAT-C 88. It was a decision that changed his fate.

In 1998, Yusuf produced 1.3 t of good quality seed from the small amount of breeder seed he had received from ICRISAT. While multiplying the seed, he organized several open-house field days with the astuteness of an expert salesman, inviting farmers and NGOs to see his SOSAT-C 88 field for themselves. He also wrote about it to several agriculture-related organizations in his area. "All those who visited my field were very impressed. When it was time to source for seed for the 1999 cropping season, buyers from far and near kept trooping to my house to buy the seed," Yusuf said, describing how he managed to sell the seed at six times the price of millet grains.

"This year, SOSAT-C 88 seed is available to sow in several thousand hectares in Nigeria as it was produced by many seed growers, such as Yusuf," said ICRISAT scientist S C Gupta, who coordinates the on-farm trials. By providing an opportunity for hard-working entrepreneurs like Yusuf, new crop varieties contribute to the establishment of grass-roots rural agroindustry – triggering a virtuous circle of investment in new technology that can help transform rural poverty into prosperity.

Finding the Missing Piece in the Jigsaw Puzzle

Musukura Diarra is the busiest person in her family – one of the 85 households in the Village Djeni that is situated in the Koulikoro region of Mali. The first to get up in her house, she draws water from the village well, pounds sorghum and millet grains to prepare meals, fetches firewood, feeds her six children and her husband, gathers shea nuts to make butter, and when the groundnut harvest is good, makes soap out of groundnut for her household.

Musukura grows rice, groundnut, and cowpea in the little plot that her husband has given her. She also helps her husband in his sorghum field and works with the village women in the piece of land that they collectively cultivate. She gathers animal manure for her husband who uses it in his field and when needed takes care of the goats and sheep that he owns.

Yet, despite all this, Musukura has largely remained invisible, like the rest of the village women in the discussions on agricultural issues that sometimes take place between the villagers and extension workers. Why? Because she doesn't own any land or cattle.

For this very reason, even the new project on the intensification of integrated crop-livestock system that has chosen the Village Djeni to test on-farm a "best bet" technology package would have bypassed Musukura and the other village women. Fortunately, ICRISAT, ILRI, IITA, IFDC, and IER – the project partners in Mali – are keen that the technology should benefit all the farmers, including women, of the target region. The project, which is funded by the Systemwide Livestock Program, is therefore, making a special effort to find out the views of the village women.

The aim of the project is to increase the productivity and sustainability of the mixed crop-livestock system that is practiced by most farmers in this region. It also addresses some of the major problems that such farmers are facing because of increasing pressure on marginal lands. "Our farms are not producing enough food these days for our family. Earlier everything used to be produced here; we did not have to buy anything from the market," said 64-year old Kougouri Coulibaly, reminiscing about her youth. "Another major problem of these farmers is dry season feeding of cattle," said R Tabo, the Coordinator of the project and his IER counterpart B Traore.

To overcome such complex problems, the project is using an integrated approach, exploiting the synergy between the different components that make up the jigsaw puzzle of the mixed crop-livestock system. And now by taking into consideration the perceptions of rural women such as Musukura, the project is putting in place the piece that was missing until now from the puzzle.

Seeds of Dignity

"Seed is a farmer's dignity and without seed, a farmer is a potential migrant," said Saley Younissi, a farmer from Tera in Niger, at a meeting that took place in early 1999 at ICRISAT's Niamey location. Younissi was expressing his gratitude for an emergency seed supply program that had saved him and his family from misery, because he received seed just when they were about to flee to cities after a terrible drought had ravaged his crops. For those who had been closely involved with the program, it was a very special moment.

The situation in the dry belt of West Africa was so desperate that if no action had been taken, it might have spun out of control. The West and Central Africa Millet Research Network (ROCAFREMI) launched the emergency seed program in close collaboration with ICRISAT and with support from USAID. The national agricultural research systems of Niger, Mali, Burkina Faso, Mauritania, and Senegal, along with a host of other partners helped implement the program. The group decided to distribute urgently seed of millet, sorghum, and cowpea for the 1998 sowing.

K Anand Kumar, ICRISAT Scientist at Niamey explained, "When such disasters strike, farmers use any seed that is available – seed of varieties that are not adapted to the region. Planting such seeds risks crop failure and significant long-term effects on food supply."

For the emergency program, scientists were careful to ensure that only varieties that had performed well in on-farm trials and had proven acceptable to farmers were distributed. Their success was reflected in a subsequent impact study found on average that 30% of the farmers in the relief zone in Niger continued growing the varieties that were distributed in 1999, and nearly 4,000 families in the country benefited from the program.

The experience has helped development practitioners gain valuable lessons on how to cope with similar crises in the future: "We have now an effective mechanism in place if something like this ever happens again," said B Ouendeba, ROCAFREMI Coordinator.

Women Seize the Moment

Little did the people who initiated the emergency seed program in 1998 realize that a year later, a women farmers' association in a tiny village in Mali would benefit from it. The association, which is led by a 70-year old dynamic woman – Nassera Sanogo – has benefited not by receiving emergency seed but by getting an opportunity to become contract seed producers.

In 1999, ROCARS, the Sorghum Network in the region, whose Coordination Unit is based at ICRISAT's Bamako location, approached the women's association through the National Seed Service of Mali to explore possibilities of an innovative collaboration.

Explaining why ROCARS became interested, I Akintayo, ROCARS Coordinator, explained, "In 1999, we had a little money left from the emergency program. ROCARS decided to use it to help farmers produce sorghum seed, to reduce the shortage of seed in the region in the following years.

"When we heard about the women farmers' association, we were interested, because women here are very well organized", he added. This was confirmed by Namori Keita, a staff of the National Seed Service of Mali, who helped train the women farmers in seed production technology. "This association is one of the best organized farmers' groups here. It has already developed a seed bank in the village of Mamaribougou," he said.

Apart from the women's association, ROCARS has also approached other farmer groups through IER. Once they are identified, the farmers are trained in all aspects of seed production. Justifying the value of such a project, Akintayo said, "When research institutes do this work, it is very expensive. But when farmers take it up, not only is the production much cheaper and sustainable, but it is also a learning process for them."

Learning by Doing – and Succeeding

Will his experiment be a success or a failure? Namakan Keita waited eagerly for the result, anxious at times when things seemed to go wrong, but the excitement of his discovery at the end made up for all the worries he had felt during the experiment.

Namakan is not a scientist, but a farmer from Gonsolo village in the Mande region in Mali. But like most farmers, he is also a researcher in his own right, experimenting with new crop varieties and ways of growing them. This time, Namakan was trying out a new sorghum variety as part of a research project on participatory breeding jointly conducted by ICRISAT, the Institut d'Economie rurale (IER), and the Institut Polytechnique rural (IPR) with the help of Adaf Gallé, a nongovernmental organization.

Out of the 15 new sorghum varieties that Eva Weltzien, ICRISAT sorghum breeder showed him, Namakan chose ICSV 901, a short-duration improved variety belonging to the caudatum race (short-stemmed plants with an erect panicle). As the farmers in that region grow traditionally the guinea (long-stemmed) race, this variety was completely new to Namakan.

He planted the new variety in a plot next to his own short-duration guinea so that he could compare the two. He was happy when the seedlings of the new variety emerged well. However, insect damage made him worry, as some seedlings started to die. Fortunately he could fill the gaps in the field by transplanting plants from spots that were not damaged.

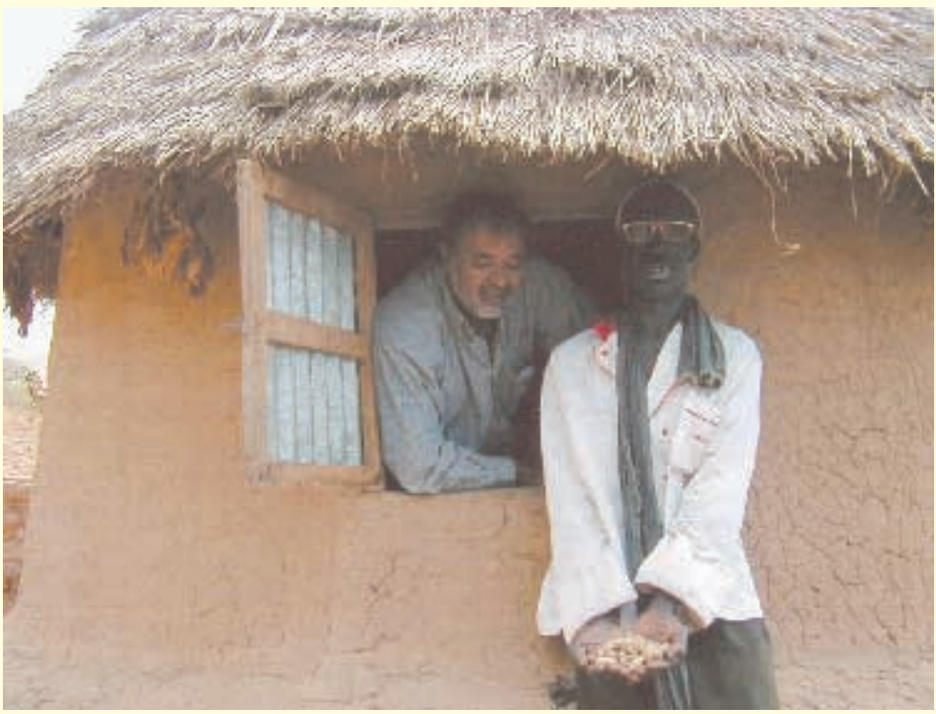
The plants of the new variety grew quickly and formed grains before any other sorghum in the village. Namakan began to worry once again – what if the grains matured while the heavy rains continued, what if the birds attacked since this was the only plot, which had grains?

Despite all these threats, the new variety produced a grain yield that he had never seen before: 117 kg from only 100 g of seed. He was thrilled with the bumper harvest, but he had to still find out if the variety tasted good. His wife found that threshing was very easy, but dehulling the grains was tough. However the taste of the *to* and the *couscous* – popular local preparations – was superb, and made up for the extra labor.

Namakan is pleased to have discovered this variety, which yields well and matures at a time when his grain store is usually empty and the cost of the grain is high in the market. He has carefully saved seeds of the new variety that he has nicknamed *Kessniyoni*, for sowing in the next season. But to avoid problems of rain and birds, he wants to sow it a little later next year. It seems that even farmer-researchers can't resist the urge to tinker, as they seek ways to improve the welfare of their families and the security of their future.

Why Bagui and Assitan Treasure Groundnut

He hoards it as an investment for the future. She sells it to pay her children's tuition fees. Bagui Traore and Assitan Konate are farmers from two villages in Mali who grow groundnut, or *tiga* as it is known in the local Bambara language.

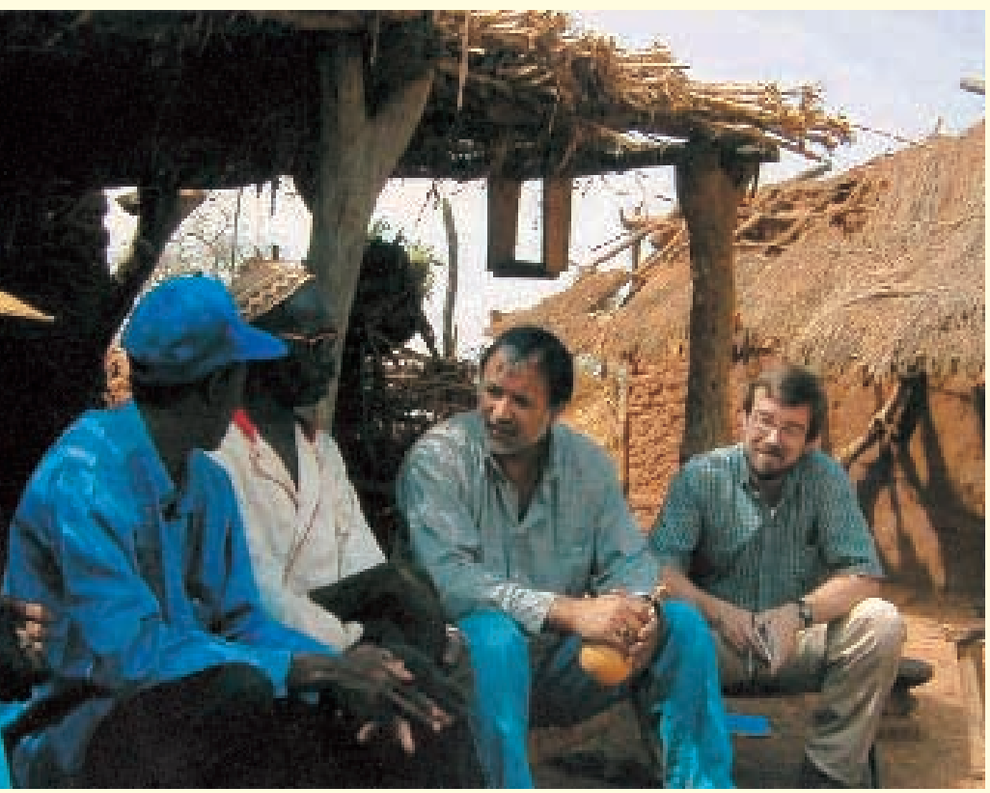


Bagui lives in Bambabougou and is the head of a 12-member family. Assitan lives in Ouenzindougou and is the mother of 11 children. Both treasure groundnut, especially ICRISAT varieties-but for entirely different reasons.

His Story

Fired with an ambition to become a seed producer, Bagui refuses to sell any part of his harvest from a groundnut variety that he has christened *Waliyar-tiga* after Farid Waliyar, the ICRISAT scientist who gave him the seeds, as part of on-farm trials. Bagui liked the variety so much that he wanted to distinguish it from other groundnuts by giving it a special name.

Waliyar-tiga, or ICG 7878, is a variety that was identified by Waliyar from ICRISAT genetic resource collections. After testing it at the ICRISAT Research Station at Bamako, Waliyar found that it was tolerant to early and late leaf spots and rust – the three most destructive diseases in the region. The variety also gave high pod and haulm (stem, used for cattle fodder) yields. He therefore included it in on-farm trials that he conducts with farmers' participation in collaboration with the Institut d'Economie rurale (IER) in Mali.



"From the 500 grams seed that ICRISAT gave me, I have made it to more than 1 ton," Bagui said proudly. "I have already got a long list of farmers who want to grow *Waliyar-tiga*. Like me they admire its big pods and seeds. *Waliyar-tiga* is not attacked by diseases and in our house we like its sweet taste." He also added that it is easy to identify the variety from a distance, because the crop looks unusually green and healthy.

Bagui is touched by all the benefits he has got from interacting with ICRISAT. He declared "I feel committed to the Institute and I am eager to try out any new variety that it will give me."

Her Story

"I keep half of my groundnut harvest for paying my children's school fees," said Assitan. She has sent all her 11 children for schooling, five of whom have completed their school final.

Groundnut is known as a woman's crop in West Africa. In many parts of the region, it is sown and managed by them. They value it because it is a source of high protein and energy for their children, oil for cooking, and high-quality feed for cattle. Groundnut paste, known as *tigadege* is the most popular ingredient for making sauce in the region. Groundnut is above all a vital source of cash income for them.

Explaining why groundnut has become the mainstay for women farmers, Assitan said, "Very often our men migrate to cities, leaving us to fend for our children and ourselves. It is then that groundnut becomes critically important to us, because it can be sold at any time – as raw or roasted grains or paste."

She added that groundnut haulms also fetch high prices, especially before festivals such as Tabaski, when people use it to fatten their sheep and goats. Even the empty groundnut shells are not discarded because they are used to form compost for fertilizing the soil.

A year ago, Assitan was invited to take part in ICRISAT's on-farm trials. From her harvest, she carefully kept the seeds of ICGV 92088 and ICG (FDRS) 4, two high-yielding varieties from ICRISAT that are tolerant to foliar diseases. She is planning to sow them in the next season as part of her own choice to get better harvests that will allow her to fulfill her dreams for her children.

Program Highlights[1]

A brief update of recent program strategies, activities, and accomplishments

Genetic resources and enhancement

A lead genetic resources scientist was transferred to Zimbabwe to catalyze an initiative on conservation and on-farm management of agrobiodiversity in Africa. Regional genebanks holding landraces and improved breeding material adapted to the continent are being planned at Niamey for groundnut and pearl millet; at Bamako (or Kano) for sorghum in West and Central Africa; at Nairobi for pulses; and at Bulawayo for all mandate crops except chickpea. These banks will conserve, regenerate, distribute, evaluate, use, and document African genetic resources held in trust by ICRISAT.

An MOU was signed and a material transfer agreement format was defined to facilitate the exchange of germplasm between the USA and ICRISAT.

Core collections have now been defined for sorghum, chickpea and groundnut. Progress was also made in the development of a core collection of pearl millet.

Databases for descriptors of germplasm collections of sorghum, millet, chickpea, pigeonpea, and groundnuts were enhanced and added to the Systemwide Information Network for Genetic Resources (SINGER) initiative. An on-line crop information system was created, providing web access to agronomic trait data on over 36,000 accessions of sorghum and 17,000 accessions of chickpea. Systems for online pedigree management of elite parental lines, and a tutorial on sorghum improvement were created. An accelerated effort was agreed with the NARS of India, ICAR, to restore a copy of Indian FAO-designated germplasm to the new ICAR genebank in Delhi.

A new international staff position was created and filled to initiate an Applied Genomics Laboratory at Patancheru headquarters. New polymorphic markers were identified or mapped in groundnut, sorghum, and chickpea. Progress was made in characterizing genetic variability of pathogens and monitoring their virulence in diseases affecting pearl millet, pigeonpea, and chickpea. Downy mildew resistance gene candidates in pearl millet were isolated and mapped. Putative quantitative trait loci (QTL) for drought/heat tolerance and stover quality were also identified.

A protocol for producing transgenic "Spanish" type groundnuts was successfully tested. Several groundnut transformants carrying the coat protein gene of Indian peanut clump virus have been generated and are being tested in the glasshouse, where 40% of the putative transgenic plants have tested positive for the inserted genes. This frequency appears to be the highest reported in the groundnut crop. A transformation protocol for pigeonpea to incorporate novel genes is in the final stages of development. Considerable progress has been made in protocols for sorghum tissue culture and genetic transformation. New Bt toxins have been tested satisfactorily against cereal stem borers.

Construction of a P2-level quarantine greenhouse for testing of genetically transformed plants was completed. The facilities and procedures used in transgenic research at ICRISAT comply with international standards. All transactions such as the import, development and use of GMOs are cleared officially through the Government of India. Any field testing of these transgenic plants would only be attempted if permission is granted by the Government of India.

In pest/disease diagnostics and resistance breeding, resistances to head bug and midge insects of sorghum were combined. Components of resistance to pod borers in pulses were elucidated. New sources of disease and insect resistance were observed for cultivated chickpeas and groundnuts, and in wild *Arachis, Cicer,* and *Sorghum* species. Progress was made in resistance screening techniques for sorghum grain mold; in the quantification of resistance to late blight in groundnut; and in the development of a cost-effective diagnostic tool for aflatoxin contamination of groundnut. The causal virus of pigeonpea sterility mosaic, a disease causing in excess of US $ 90 million worldwide, was characterized after 25 years of research at ICRISAT.

In physiology research, selection criteria for terminal drought tolerance and seedling heat tolerance were tested in pearl millet. Research in crop residue quality (fodder value) was begun in pearl millet and sorghum in close collaboration with ILRI.

In developing adapted genepools, progress continued in broadening the genetic base of the mandate crops in both Asia and Africa. Over the past quarter century, nearly 400 improved plant cultivars derived from ICRISAT breeding populations have been released by national institutions worldwide, delivering significant benefits to the overwhelmingly poor smallholders that cultivate these under-researched crops.

Natural resources management

Simulation modeling was used to devise a range of potential treatments for participatory on-farm research in four agroclimatic areas in Zimbabwe and Malawi. It is focusing on combining soil fertility (integrated nutrient and soil organic management) with water conservation techniques.

ICRISAT research in both Southern and West Africa confirmed that hill placement of as little as 4 kg of P fertilizer can double yields of sorghum and millet farmers in the SAT and increase incomes by 30-50%.

Analyses of soil samples from a 16-year Vertisol (heavy black clay) watershed experiment at Patancheru, India suggested that pigeonpea-based systems sequester more carbon in the top 0-15 cm layer than other crop alternatives, improving biological, chemical, and physical properties of the soil.

An Asian Development Bank-funded watershed project in Asia was launched at five sites in India, Thailand, and Vietnam. Participatory watershed-scale development and crop research activities form the focus of the project. A simple, inexpensive terrain mapping tool for watershed development was successfully tested on-farm.

Boron (B) deficiency was identified as a major yield constraint for grain legumes in the inner Terai region of Nepal. On-farm trials confirmed large yield responses (40-360%) of chickpea and mustard to B-application.

An improved method for making rice straw compost suitable for a village-level enterprise was introduced in India. It significantly decreased composting time and increased yields by 19% after 3 years.

In the Kalakani region of Mali, large-scale on-farm trials involving a disease-resistant groundnut variety, a limited use of fungicide (2 applications), and a doubling of planting density multiplied pod yields by a factor of four and improved animal feed quality

1. Detailed Program annual reports are available online at http://www.icrisat.org. Hard copies can be obtained upon request by writing to Distribution Services, Public Awareness Unit, ICRISAT, Patancheru 502 324, Andhra Pradesh, India or by email request to imailist@cgiar.org. Please indicate the Program of interest.

(disease free haulm), resulting in at least 50% net increase in income.

Through supplemental funding from IFAD, a new project was launched in West and Central Africa to integrate natural resource management innovations with improved sorghum and pearl millet varieties to increase on-farm productivity. The project is being implemented by ICRISAT with five NARS partners (Burkina Faso, Ghana, Mali, Niger, and Nigeria).

Also through IFAD sponsorship, a partnership-based project to promote the use of integrated pest management in grain legumes organized participatory on-farm trials in 30 locations with 400 farmers in India, Nepal and Bangladesh. Insecticide application was reduced by up to 93% without reducing yields through the combined use of improved seed, neem spray, and nuclear polyhedrosis virus sprays, and low-labor manual shaking of pigeonpea bushes to remove the dreaded larvae of the pod borer *Helicoverpa armigera.*

Chickpea cultivation in rice fallow lowlands of Nepal has been declining in recent years due to pest and disease pressures. Following joint ICRISAT/NARS on-farm demonstrations of a practical, affordable integrated pest management package to control *Botrytis* gray mold and pod borer insect pests, an estimated 700 farmers have re-introduced the crop in five districts.

Socioeconomics and policy

With the shift of staff to Africa and a special focus on poverty, a workshop was held in Bulawayo, Zimbabwe on approaches to reviving ICRISAT's renowned village-level studies to identify critical issues and opportunities for poverty reduction for SAT Asia and Africa.

The Situation and Outlook Report, FAO/ICRISAT's joint mechanism for assessing current and future trends for mandate commodities, focused on groundnut in 1999. Demand for groundnut, formerly an export crop in Africa, was found to now be largely driven by population growth there, reflecting its increasing role as a household food security crop for the poor, especially women. This contrasts with Asia, where demand is driven by income growth and urbanization – groundnut is increasingly a purchased crop, and is losing share in the oil market while gaining as a confectionery item.

Global trade reforms in the coming years are likely to put pressure on developing-country producers to increase efficiency and commercial orientation. New uses of SAT crops are needed (industrial, food, feed) to increase demand so that higher production does not lead to market price weakness. But even where current demand is high, adoption of already-available improved technologies for SAT food legumes (groundnut, pigeonpea, and chickpea) by subsistence farmers was found to be limited. Greater efforts to overcome technology adoption bottlenecks are warranted. Biohazards such as aflatoxin risk in groundnut, for example also constrain access to global markets, foregoing a major export earnings opportunity.

Despite declines in crop area in recent years (countered by yield increases), sorghum remains central to rural SAT livelihoods in India. Besides being a cheap food source for the poor, sorghum is of increasing importance as fodder and as a raw material for industrial use.

Jointly with national partners, ICRISAT completed a typology of agricultural systems in India incorporating socioeconomic and agro-ecological factors. This was developed as a policy planning support tool at the request of the Government of India.

Studies in Africa found differing constraints for the adoption of improved technologies for cereals than for legumes. For pearl millet and sorghum in Tanzania, the major hindrances were low and variable productivity, uncompetitive prices, and high marketing costs. For pigeonpea in Kenya, major marketing constraints were: low volume traded, poor storage facilities, lack of quality standards, poor access to credit, and weak infrastructure. Marketing studies in Kenya showed that farmers receive the lowest share of the total gross marketing margins in all channels. ICRISAT will link with the NGO Technoserve to test alternative marketing arrangements to reduce transaction costs and deliver a higher share of benefits to farmers, who are largely women.

The limited use of inputs by poor smallholders is a main bottleneck to increasing their productivity and food security. Studies of fertilizer and seed input constraints during 1999 showed that farmers were willing to adopt both, but limited availability and affordability precluded them from doing so. Increased adoption of fertilizer was documented in Kenya as policy constraints were alleviated, although application rates continue to be far less than extension services recommend.

However, studies showed that there are substantial opportunities for improving crop productivity even using small quantities of fertilizer. Researchers can foster increased adoption by disseminating "best bet options" even though these may not give maximum yields. The importance of input and product market development for SAT crops, which were historically grown mainly for subsistence, is highlighted. This will require bringing in additional partners from the commercial, regulatory, and trade sectors, as well as farmer's groups.

Studies of emergency seed relief programs in Zimbabwe, Zambia, Malawi, and Niger studies found that sponsors are often fragmented in their approach and tend to repeat errors due to insufficient planning. Under time pressure to meet emergencies, they often over-estimate seed requirements and deliver seed of varieties that are not well adapted to the target area, creating an additional risk for farmers. Fears that drought-induced crop failures risk a loss of genetic diversity were not supported by the data. Village seed systems were efficient at maintaining germplasm, although farmer-to-farmer sharing of diversity was less than commonly thought. Community seed cooperatives were found mostly not to be sustainable.

Information resource management

A Center-Commissioned External Review of Information Resource Management and of Partnerships, chaired by H K Jain was completed in late 1999. Echoing the sixth recommendation of the CGIAR System Review and ICRISAT's Fourth External Programme and Management Review, the panel of five urged ICRISAT to build a core competency in knowledge management, capitalizing on the new tools of information technology, both to enhance research-for-development and also improve knowledge-sharing with partners, clients, and stakeholders. The Institute responded by creating a new Information Resource Management Program, with three major thrusts: public awareness, information systems, and learning systems.

ICRISAT moved closer to achieving a global interconnectivity during 1999. Internet connectivity was achieved at Bamako, and improvements were underway at Bulawayo, Lilongwe, and Niamey. Microsoft Exchange (an advanced messaging system) now interconnects Patancheru, Bamako, and Niamey with the CGIAR's global network of Centers.

The Y2K rollover went smoothly across all locations, a result of careful preparations during 1999.

Publications during 1999

Publications reflect the productivity and scientific quality of ICRISAT's scientists and programs

Scientific Journal Articles/Book Chapters/Conference Papers

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ICRISAT DG, William Dar (center) visits the CGIAR stall at the World Book Fair, New Delhi, India, Feb 2000

Development Investor Partnerships: Targeted Projects

Development investors supplement the CGIAR's core support to carry out targeted projects on subjects of particular interest

Donor	Project	Collaborators
African Development Bank	Improvement of pigeonpea in eastern and southern Africa	NARS of Kenya, Malawi, Mozambique, Namibia, Sudan, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe
	Improving crop productivity in the semi-arid tropics of West and Central Africa with more efficient, environment friendly crop and pest management options	NARS of Niger, Mali, and Burkina Faso
Asian Development Bank	Strengthening regional collaboration on cereals and legumes research in Asia	NARS of Bangladesh, China, India, Indonesia, Myanmar, Nepal, Pakistan, the Philippines, Thailand, Sri Lanka, Vietnam, NGOs, and private sector
	Legume-based technologies for rice and wheat production systems in south and southeast Asia	NARS of India, Nepal, Bangladesh, Pakistan, Sri Lanka, Vietnam
	Improving management of natural resources for sustainable rainfed agriculture	International Board for Soil Research and Management (IBSRAM); Central Research Institute for Dryland Agriculture (CRIDA), Jawaharlal Nehru Krishi Vishwa Vidyalaya, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Marathwada Agricultural University, BAIF Development Research Foundation, India; Field Crops Research Institute, Khon Kaen Field Crops Research Centre, Department of Land Development, Thailand; Ministry of Agriculture and Rural Development, Vietnam; Vietnam Agricultural Science Institute
Australia	Increasing the effectiveness of research on agricultural resource management in the semi-arid tropics by combining cropping systems simulation with farming systems research	APSRU (Australia), ICAR-NARS (India), Kenya Agricultural Research Institute
	Impact assessment and research evaluation activity in Thailand	Department of Agriculture, Thailand; Kasetsart University, Thailand; ACIAR, Australia
	More efficient breeding of drought resistant peanuts in India and Australia	ACIAR, Australia; ICAR, India; Queensland Department of Primary Industries, CSIRO, Australian National University, Peanut Company of Australia, Australia
	Development and use of molecular genetic markers for enhancing the feeding value of cereal crop residues for ruminants	ILRI, ICARDA, CIAT, La Trobe University, Australia; NARS of India, Morocco, Tunisia
	Management of white grubs in peanut cropping systems in Asia and Australia	NARS of India; Grains Research and Development Corporation, Peanut Company of Australia; University of Queensland, Queensland Department of Primary Industries, Australia
	Quantifying the value of grain quality traits in the Indian chickpea market	Muresk Institute of Agriculture
Belgium	Integrated control of *Polymyxa graminis*, a vector of peanut clump virus	Université catholique de Louvain, Louvain-la-Neuve (Belgium), NARS of India, Pakistan, Senegal, Burkina Faso
	Vrije Universiteit Brussel (VUB)/ICRISAT collaborative project on biotechnology	Vrije Universiteit Brussel
Canada	Desert margins initiative (Africa)	NARS and NGOs of Burkina Faso, Kenya, Botswana
CFC	Conservation, evaluation and dissemination of groundnut germplasm, and foundation seed production and distribution for the West African Region	CIRAD (France), NARS of Senegal, Burkina Faso, Niger, Nigeria
CFC and World Bank	Preservation of wild species of *Arachis* in South America	CENARGEN (Brazil)
DANES A/S	Training activities of students from Eritrea	Royal Veterinary and Agricultural University, Denmark
Danida/DANAGRO	Breeding programme for sorghum and millet	NARS of Eritrea
European Union (DG XII)	Impact of climate variability on agro ecosystems and water resources in drylands	SC-DLO, The Netherlands; IIED, UK; UNIPAD, UNICAIRO, Egypt; ECRI, Egypt; CRICYT, INTA, Argentina; CAZRI, HAU, India; LIPAP, LIGG, IDRAS, GRIWC, China; ACMAD, Niger
FAO	Rapid composting of rice straw	NARS of India
France	Constitution of a sorghum core collection	CIRAD/ORSTOM
Germany	Promotion of sorghum and millet cultivation in Southern Africa Promotion of leguminosae cultivation (Groundnut) in the SADC region (Phase IV)	NARS, NGOs, private sector seed companies, farmers NARS in 12 SADC member states, NGOs,
	Striga resistance in sorghum	University of Hohenheim, Eberhard-Karls Tubingen University (Germany)
	Enhancing the quality, diversity, and productivity of farmers' pearl millet genetic resources in Rajasthan, India	NBPGR, CAZRI, Rajasthan Agricultural University (India), University of Hohenheim (Germany)
IFAD/World Bank	Collaborative research of sorghum based crop production systems in eastern lowland Wadis of Eritrea	NARS of Eritrea
IFAD	Development of an integrated pest management (IPM) program for the management of pulse pests in southern Asia	Indian Institute of Pulses Research, National Centre for Integrated Pest Management, GB Pant University of Agriculture and Technology, Acharya NG Ranga Agricultural University (India), Centre for World Solidarity, NGOs, ICIPE
	Farmer participatory testing of technologies to increase sorghum and pearl millet production in the Sahel	NARS in Burkina Faso, Ghana, Mali, Niger and Nigeria

Donor	Project	Collaborators
Inter-American Development Bank	A research and network strategy for sustainable sorghum production systems for Latin America	NARS of Latin America, CIAT
Iran	Joint collaborative projects and receipt of germplasm for the improvement of pulses production in the arid regions of Iran Training activities for Iranians at ICRISAT Patancheru	NARS of Iran Acharya N G Ranga Agricultural University, Central Research Institute for Dryland Agriculture (CRIDA) (India)
Japan	Sustainable cultivation of upland crops in the semi-arid tropics	Japan International Research Center for Agricultural Sciences (JIRCAS), Ministry of Agriculture, Forestry, and Fisheries (MAFF), Japan
MAHYCO	Development of cytoplasmic male-sterility in pigeonpea	ICAR, India
Netherlands	Systemwide Resource management for improving and sustaining crop and livestock production on highland vertisols in Ethiopia	Institute of Agricultural Research, Alemaya University of Agriculture (Ethiopia), ILRI
	Evolving transgenic sorghum with suitable Bt gene constructs, resistant to stemborer	National Research Center for Sorghum, India, National Research Center on Plant Biotechnology, India
	Development of disease resistant transgenic pigeonpea	Osmania University, India
OPEC	Increase groundnut productivity for rural prosperity in Asia	Asian NARS
Rockefeller Foundation	Methodology to develop practical soil fertility technologies through farmer/researcher partnerships	NARS of Malawi and Zimbabwe
	Support for a seminar on the use of molecular markers in cereal improvement breeding programs and workshop on breeding for *Striga* resistance in cereals at IITA, Nigeria	NARS in West and Central Africa
START, USA	Climate prediction for sustainable rainfed groundnut production in the dry tropics	Indian Institute of Science, India, Acharya N G Ranga Agricultural University, India
Switzerland	West- and Central-African millet research network- ROCAFREMI	National extension workers, NGOs and farmers, INTSORMIL
UK	Enhancement of resistance to botrytis grey mould of chickpea using PGIP genes	Scottish Crops Research Institute (SCRI), University of Auckland (New Zealand), ICAR (India)
	Assessment of the genetic variation within and between populations of *Aceria cajani*, the mite vector of the agent of sterility mosaic of pigeonpea, in different regions of Asia	SCRI (UK), ICAR (India), NARS of Nepal and Myanmar
	What makes it so tasty for the pest? Identification of *Helicoverpa armigera* (Hübner) feeding stimulants and the location of their production on the pod service of pigeonpea (*Cajanus cajan* (L.) Millsp)	Natural Resources Institute, UK, Royal Botanic Gardens, UK
	Safe to eat or why chickens die? Developing low-cost and simple technologies for aflatoxin estimation in foods and feeds	Scottish Crops Research Institute, UK, Janaki Feeds, India, Department of Agriculture, Government of Andhra Pradesh,India
	Linking seed producers and consumers: diagnosing constraints in institutional performance	Overseas Development Institute, UK; NARS and NGOs of Kenya, Malawi, Zambia, and Zimbabwe
	Sorghum in India (a) technical, policy, economic and social factors affecting improved utilization, (b) quality and safety of traditional foods, (c) postharvest losses and quality of sorghum for food and feed in rural areas	NRI (UK), National Centre for Research on Sorghum (NRCS), Indian Grain Storage Research Institute, Central Food Technology Research Institute (India)
	Groundnut rosette disease epidemiology	Natural Resources Institute, UK, NARS of Malawi and Uganda
	Principal pod-boring pests of tropical legume crops: economic importance, taxonomy, natural enemies and control	CABI Bioscience, UK; Agricultural College and Research Institute, Madurai, India; Department de Formation en Proctection des Vegetaux, Niger; Universidade Federal do Parana, Brazil
	Will women farmers invest in improving their soil fertility management? Participatory experimentation in a risky environment	Silsoe Research Institute, UK; NARS and NGOs in Malawi and Zimbabwe
	Modelling the risk of introducing transgenics into traditional cropping systems: a case study with pigeonpea	University of Birmingham, UK; National Bureau of Plant Genetic Resources, India
	Genetic enhancement of feed quality and quantity in sorghum and millet	International Livestock Research Institute, UK; Indian NARS, Institute of Grassland and Environmental Research, UK; Rowett Research Institute.
	Evaluation of the effects of plant diseases on the yield and nutritive value of crop residues used for peri-urban dairy production on the Deccan Plateau in India	Natural Resources Institute, UK; International Livestock Research Institute, Kenya; Acharya N G Ranga Agricultural University, India; University of Greenwich, UK
	Contiguous segment substitution lines: new tool for elite pearl millet hybrid parental lines enhancement	Centre for Arid Zone Studies, UK; All-India Coordinated Pearl Millet Improvement Project, India; Indian Agricultural Research Institute, India
	Use of molecular markers to improve terminal drought tolerance in pearl millet	Instiute of Grassland and Environmental Research, UK
	Marker-assisted improvement of pearl millet downy mildew resistance in elite hybrid parental lines for Africa and Asia	CCS Haryana Agricultural University, India; Tamil Nadu Agricultural University, India; Centre for Arid Zone Studies, UK; All-India Coordinated Pearl Millet Improvement Project, India; Central Arid Zone Research Institute, India
	Indo-British collaborative project — Participatory varietal selection in Rabi Sorghum	Centre for Arid Zone Studies, UK; and NARS in India
	Characterization of the causal virus of pigeonpea sterility mosaic disease: a step towards attaining sustainability of pigeonpea production in the Indian subcontinent	Scottish Crop Research Institute, UK; University of Agricultural Sciences, India; Sri Venkateswara University, India
	Groundnut rosette disease management	Natural Resources Institute, UK; University of Georgia, USA; NARS of Uganda and Malawi

Donor	Project	Collaborators
	Biology and control of armored ground cricket in Southern Africa	Natural Resources Institute, UK; Plant Protection Research Institute, South Africa; Ministry of Agriculture, Water and Rural Development, Namibia; Rothamsted Experimental Station, UK; Grain Crops Institute, South Africa; Department of Agricultural Research, Botswana, University of Pretoria, South Africa
	Participatory testing of on-farm seed priming in Zimbabwe	Farmers in two villages of Zimbabwe
	Review of technical and institutional options for sorghum grain mould management and the potential impact on the poor	Natural Resources Institute, UK; Central Food and Technological Research Institute, India; Long Ashton Research Station, UK
	Optimising institutional arrangements for demand driven post-harvest research, delivery, uptake and impact on the livelihoods of the poor through public and private sector partnerships	Natural Resources Institute, UK; University of Strathclyde, UK; National Centre for Agricultural Economics and Policy Research, India
	Provide logistical support and conduct field trial to compare oviposition by *H. albipunctella* on different varieties and stages of millet	Natural Resources Institute, UK; Imperial College, UK
	Promotion of chickpea following rainfed rice in the Barind area of Bangladesh	University of Wales, UK; Peoples Resource Oriented Voluntary Association, Bangladesh; Bangladesh Agricultural Research Institute, Bangladesh
PLAN International	Groundnut project in Malawi	NARS and NGOs of Malawi
UNDP	Comparative study on factors critical to the adoption of ICRISAT/NARS groundnut and sorghum innovations	University of Arizona (USA), OPI (Vietnam), NRCG (India), NARS of India and Nigeria
UNDP and USA	Impacts of ICRISAT/NARS germplasm research for sorghum, groundnut and pearl millet	Yale University, USA
UNEP	Survey and evaluation of networks to support the implementation of the convention to combat desertification	The University of Arizona, World Meteorological Organization, United Nations Development Programme Office to Combat Desertification
USA	Seeds for Freedom. Angola agricultural recovery program: an international, World Vision/CGIAR plan for the rapid recovery of food production systems in Angola	CIAT, CIMMYT, IITA, ISNAR, CIP, World Vision, NARS of Angola, in-country NGOs, and farmers
	Strengthening national agricultural research systems in Africa through collaborative research networks	NARS of participating countries, NGOs, and private sector
	Regional sorghum and millet research project for southern Africa Chickpea molecular marker/mapping work	NARS, NGOs, private sector seed companies, farmers Washington State University (USA)
	Molecular markers for crop improvement in groundnut	University of Georgia (USA)
	Search for *Striga* resistance in wild relatives of pearl millet	Univesity of Georgia (UGA)/ USDA-ARS Forage and Turf Research Unit, UGA Coastal Plain Experiment Station (USA)
	Assessing hydrology and crop production in a spatially variable terrain	Michigan State University (USA)
	Biotechnological tools for improving sorghum for *Striga* resistance	Purdue University (USA)
	Biotechnological approach to grain mold resistance in sorghum	Texas A&M University (USA)
	Identification of peanut genes and gene products important in the peanut seed	Texas A&M University (USA)
	Population structure and genetic diversity of *Sclerospora graminicola* : keys to stable production of pearl millet	Texas A&M University (USA)
	Fulfilling seed requirements in famine threatened areas in West Africa: a need for emergency seed distribution	NARS of West Africa
	Strengthening drought mitigation work in southern Africa	NARS of southern Africa
	Rural prosperity is nation's economic stability: a partnership approach to attain sustainable production of groundnut and pigeonpea in smallholder agriculture for quality diet, household food security, and poverty alleviation in Malawi	Ministry of Agriculture and Irrigation, Malawi; NARS, NGOS and farmers in Malawi
	Strategic marketing of sorghum and millet food products in West and Southern Africa	University of Illinois, USA, NARS in West and Southern Africa
	Seeds for survival: increasing the effectiveness of emergency seed aid programs in enhancing seed security in the Greater Horn of Africa	Catholic Relief Services, Uganda; NARS and NGOs in Uganda and Sudan
	Diversity in the sorghum ergot pathogen in India	Foreign Disease and Weed Science Research Unit, USDA, USA; National Research Center for Sorghum, India
Consortia of donors (via CGIAR Systemwide Programs)	Optimizing seed water contents to improve longevity in ex-situ genebanks	IPGRI, University of Reading (UK), National Seed Storage Laboratory (USA), National Genebank of China
	Resource use optimization at village and district levels in the desert margins of West Africa	IER, Mali; INERA, Burkina Faso; INRAN, Niger, ICRAF, ILRI, IFDC; ITC and Wageningen Agricultural University (the Netherlands),
	Improving crop-livestock productivity through efficient nutrient management in mixed farming systems of semi-arid West Africa	ILRI, IER, INERA, INRAN, ISRA, IFDC
	ICRISAT/IITA/ILRI/IFDC/NARS project on crop-livestock system in Mali	ILRI, IER
	Research activities on groundnut and on management of drought in chickpea, targeted to the Central Asia and the Caucasus (CAC) region.	ICARDA
	Improving the quality and range of data available on ICRISAT's genetic resources collections (SINGER Phase II)	IPGRI
	Increasing livestock productivity in mixed crop-livestock farming systems in South Asia	ILRI

Attributed support for Core Programs from Brazil, Japan, Switzerland, and UK is not listed — but is included in the Financial Summary.

Workshops, Conferences, Training Courses

ICRISAT convened skills-sharing events around the world in 1999 to build scientific capacities for sustainable agricultural development

Event/Topic/Date	Location	Participants	Participating countries/Institutes	Resources and collaborative support
Workshops/Meetings				
Workshop on Multi-scale Decision Support Systems, 6-14 April,	Burkina Faso	36	Burkina Faso, Mali, and Niger	ICRISAT, ITC, Netherlands
Consortium Workshop and Steering Committee meeting on Optimizing Soil Water Use (OSWU) constituent-consortium of the system-wide Soil, Water and Nutrient Management Program, 9-13 May	Jordan	15	10 countries from Sub-Saharan Africa and West Asia and North Africa	ICRISAT/ICARDA, Governments of Germany, Netherlands, Norway, Switzerland, and UK
Improving soil management options for women farmers in Malawi and Zimbabwe: regional workshop on DFID-supported project "Will women farmers invest in improving their soil fertility management? Participatory experimentation in a risky environment," 17-19 May 1999	ICRISAT-Bulawayo, Zimbabwe	22	Malawi, Zimbabwe, CIMMYT, Silsoe Research Institute, UK, ICRISAT	DFID and NARS Zimbabwe + Malawi, CIMMYT
Seed Stakeholders Meetings, 15 and 25 June	Kenya, Malawi, Zambia, and Zimbabwe	20-30	Kenya, Malawi, Zambia, and Zimbabwe	DFID and NARS
The Soil Fertility Network and ICRISAT workshop on "best-bet" soil fertility technologies, 26-28 August	Malawi	42	Malawi and Zimbabwe, but also from Zambia, Kenya, and the UK.	ICRISAT, ACIAR, DFID, USAID, CIMMYT, Zimbabwe, DR & SS
The second annual work planning meeting between The 'Institut d' Economie Rurale (IER)' and ICRISAT, 30-31 March	ICRISAT-Mali		Mali, Niger, Kenya	ICRISAT/IER/ICRAF
The ICRISAT-CIRAD annual meeting, 25 November	Mali			ICRISAT/CIRAD
National Workshop on Soil and Water Conservation, 3-7 May	ICRISAT-Niger	30	Niger	DED, INRAN and Department of Geography, University of A. Moumouni
"A network for promoting sustainable agricultural farming systems in the context of the regional action program to combat desertification", 23-26 March	ICRISAT-Niger	53	Africa	Government of the Federal Republic of Germany, Government of Finland, Convention to Combat Desertification (CCD), ICRISAT through the Desert Margins Program (DMP)
Regional Wind Erosion Research Proposal Development Workshop, 6-8 April	ICRISAT-Niger	20	Senegal, Mali, Burkina Faso, Niger and Nigeria, and International Organizations	NORAD, ICRISAT and DMP
Workshop on "Aerial Photography using Kites", 21-28 April	ICRISAT-Niger	20	Niger, Germany	ICRISAT, DED
IFAD Project Workshop on "Improving Income and Food Supply in the Sahel: On-farm testing of Sorghum and Pearl Millet Technology Innovations", 24 - 26 February 1999 and 4 national workshops: 6-7 May in Niger, 11-12 May in Mali, 27-28 May in Burkina Faso, 1-2 June in Ghana	ICRISAT-Niger, Mali, Burkina Faso, Ghana and Nigeria	30-60 at each Workshop	Mali, Burkina Faso, Niger, Nigeria, Ghana,	ICRISAT-Niger/IFAD
Workshop on Legumes in Tropical Rice-based Cropping Systems – constraints and opportunities, 18-20 January	ICRISAT-Patancheru	13	Cambodia, India, Indonesia, Myanmar, Thailand, Philippines, Sri Lanka, and Vietnam	ICRISAT/ADB
Livestock Programme Group (LPG) Meeting, 19-21 April	ICRISAT-Patancheru	9	Colombia, Peru, Nepal, Kenya, and Ethiopia	ILRI
ICRISAT/ILRI stakeholders planning workshop on "Increasing Livestock Productivity in Mixed Crop-Livestock Systems in South Asia", 15-17 November	ICRISAT-Patancheru	22	Bangladesh, India, Nepal, Sri Lanka, ILRI-Ethiopia, NRI: UK, CIMMYT-Kathmandu	ILRI/NRI

Event/Topic/Date	Location	Participants	Participating countries/Institutes	Resources and collaborative support
ICRISAT/JIRCAS International Workshop on Food Security in Nutrient-Stressed Environments: Exploiting Plant's Genetic Capabilities, 27-30 September	ICRISAT-Patancheru	30	Australia, Japan, Kenya, Niger, Dubai, Indonesia, South Africa, Philippines, USA, Ghana, Zimbabwe, Venezuela, UAE, Netherlands, Newzealand	ICRISAT/JIRCAS
CLAN Steering Committee Meeting, 7-10 December	ICRISAT-Patancheru	30	Bangladesh, China, India, Indonesia, Iran, Pakistan, Philippines, Nepal, Myanmar, Sri Lanka, Thailand, Vietnam, and Yemen	ADB/ICRISAT
Workshop on factors affecting sorghum utilization in India	ICRISAT-Patancheru	31	India and NRI, UK	DFID Crop Post Harvest Programme
Workshop on "Towards a sustainable sorghum production, utilization, and marketing in West and Central Africa," from 19-22 April	Togo	65	16 WCA countries	ICRISAT/ITRA/CILSS/ CIRAD/WCASRN/IFDC/ USAID/INTSORMIL/ ROCAFREMI/UNECA
SMIP Steering Committee Meeting in Bulawayo, 6-7 October	ICRISAT-Zimbabwe	20	Botswana, Mozambique, Namibia, Tanzania, and Zimbabwe	USAID, GTZ/BMZ, and SADC, ICRISAT
Regional workshop of stakeholders – Will women farmers invest in improving their soil fertility management? Participatory experimentation in a risky environment", 17-19 May.	Zimbabwe	28	Malawi, Zimbabwe, and the UK	SMIP and Rockefeller funded ICRISAT research, Ministry of Agriculture in Zimbabwe and Malawi
International Workshop on Revival of ICRISAT's Village Level Studies in Africa and Asia, 6-8 December 1999	ICRISAT-Zimbabwe	30	Five CG centers (ICRISAT, CIMMYT, ICARDA, IITA, IRRI), World Bank, Yale University, University of Arizona, University of Pennsylvania, University of Oxford, Zimbabwe, University of Delhi, Indian Institute of Management (IIM), Lucknow	ICRISAT
Workshop on Economic Impacts of Genetic Resources Enhancement, 8-9 December 1999	ICRISAT-Zimbabwe	34	Five CG centers (ICRISAT, CIMMYT, ICARDA, IITA, IRRI), partners from US Universities, IAEG representatives	ICRISAT

Event/Topic/Date	Location	Participants	Participating countries/Institutes	Resources and collaborative support
Training Courses				
Groundnut production technologies, 4-8 March	ICRISAT-Malawi	60	Malawi	ICRISAT/PLAN International
Participatory Research – Training Program on Farmers' involvement in variety evaluation, 20-25 September.	ICRISAT-Mali	14	8 countries	ICRISAT/ROCARS/IER
Sorghum tissue culture, transformation, and genetic engineering, 8-9 March	ICRISAT-Patancheru	50	Australia, Iran, Sri Lanka, India	ACIAR-ICAR-APNBP-ICRISAT
Training Workshop on Database Management System for Sustainable Rainfed Agriculture, 15-26 November.	ICRISAT-Patancheru	10	India, Thailand, Vietnam	ICRISAT/ADB
Philippines In-country Training Workshop on Geographic Information Systems, 22-26 March	PCARRD-Philippines	17	Philippines	CLAN/ICRISAT/ADB/ PCCARD
In-country Training Course on Integrated Participatory Watershed Management, 7-16 October	VASI-Vietnam	15	Vietnam	ICRISAT/ADB
Groundnut production technologies, 6-8 September	ICRISAT-Zimbabwe	15	Zimbabwe	SADC/ICRISAT
Training Workshop on "Analysis of data on Genotype x Environment (GxE) interactions, and the use of Geographic Information Systems (GIS)", 4-19 October	ICRISAT-Zimbabwe	16	Botswana, Malawi, Mozambique, Namibia, Republic of South Africa, Tanzania, Zambia, and Zimbabwe)	ICRISAT-Zimbabwe

Research Scholars

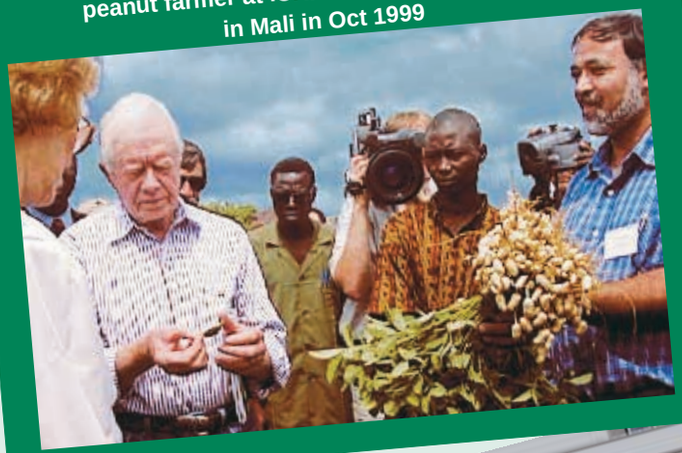
Promising young scientists come to ICRISAT to carry out their research for advanced degrees in the agricultural sciences

Name	Country of origin	Degree sought	Study topic
Md Yusuf Ali	Bangladesh	PhD	Influence of fertilizer, phosphorus, and water regimes on the roots/ stems development, nutrient uptake, growth dynamics and yield of chickpea
Kenga Richard	Cameroon	PhD	Inheritance of grain yield and its components of sorghum
T Abraha Negash	Eritrea	MSc	Selection methods and genetic variability for traits related to drought resistance in sorghum
N Abrahaa Russom	Eritrea	MSc	Effect of some genes on bird damage stover digestibility, flowering time, and yield of pearl millet composites ICMB 155
Michael Krajewski	Germany	MSc	Bio-control rhizobacteria for root-rot fungi
Anil Verma	India	BSc	Biological and molecular characterization of *Fusarium oxysporum* f. sp. *ciceri* causing vascular wilt of chickpea (*Cicer arietinum*)
V Kishore Kumar	India	MSc	Host plant resistance in sorghum against stem borer
D. Kiran Mayi	India	MSc	Incidence of Aflatoxin contamination in selected spice samples of Andhra Pradesh
T Ratna Rajesh	India	MSc	Effect of temperature and humidity on the components of resistance to late leaf spot on groundnut
M Suganthy	India	MSc	Development of IPM strategies for the management of chickpea pod borer *H. armigera*
B Padmasri	India	MSc	Seed traits in relation to plant stand establishment in chickpea (*Cicer arietinum* L.)
Sonali Shukla	India	MSc	Evaluation of *Bacillus thuringiensis* and other insecticidal genes for their effectiveness against *Helicoverpa armigera*
G. Arvind Reddy	India	MSc	Cultural control of pigeonpea pod borer and its flexibility to fit into IPM
P B Ramakrishnan	India	MSc	Assessing hydrology and crop production using digital terrain modeling
Lakshmi Pathi Srigiriraju	India	MSc	Oviposition behavior and integrated management of *Helicoverpa armigera* in chickpea and pigeonpea
Suvarna	India	MSc	Genotypic response to drought stress in groundnut
N V Muthusubramanian	India	MSc	Studies on diversity of sorghum ergot pathogen isolates occurring in India
N V S Viijayalakshmi	India	MSc	Genetic studies on flower colour, protein content and some important qualitative and quantitative characters in two crosses of chickpea (*Cicer arietinum* L.)
R K Srivastava	India	MSc	Penetrance and expressivity of gene for double podding and genetic study of some important yield contributing traits in chickpea (*Cicer arietinum* L.)
Manohar Bhukta	India	MSc	Effects of photoperiod on growth and partitioning in groundnut
Shuvendu Hazra	India	MSc	Pathogenic variability of anthracnose diseases of sorghum
G Raghu	India	PhD	The effect of earliness gene efl-1 on chickpea traits
K P Nagavallemma	India	PhD	Evaluation of land surface management practices on nutrient budgeting and soil properties of Vertic Inceptisols in soybean-based cropping systems
Kamala Venkateswaran	India	PhD	Genetic and molecular characterization of wild and cultivated species of sorghum for transferring resistance to biotic stresses
B U Singh	India	PhD	Host plant resistance to shoot fly, stem borer, or head bug in sorghum
M Ajitha	India	PhD	Characterization of chickpea genotypes identified for core collections
C Sudha Rani	India	PhD	Development of castor model for crop response to water, nitrogen, sowing dates and cultivars
Geetha Senthil	India	PhD	Enhancement of resistance to *Botrytis* gray mold of chickpea using PGIP genes
K Kanaka Durga	India	PhD	Cytoplasmic systems and hybrid type studies on yield characters in sorghum
K Thirumala Devi	India	PhD	Detection tools for Aflatoxins and Ochratoxin
K Sailaja	India	PhD	Effect of glycine betaine in the alleviation of oariotic stresses in groundnut genotypes
M Bharathi	India	PhD	Integrated approach for the management of pigeonpea wilt caused by *Fusarium udum*
K L N Reddy	India	PhD	Epidemiology of peanut bud necrosis virus

Name	Country of origin	Degree sought	Study topic
T Rupa Singh	India	PhD	Vascular arbuscular mycorrizae in relation to pigeonpea
P Lava Kumar	India	PhD	Assessment of genetic variation within and between populations of *Aceria cajani*, the mite vector of the agent of sterility mosaic of pigeonpea in different regions of Asia
A Sunitha Daniel	India	PhD	Groundnut transformation for GRAV resistance by using coat protein and satellite genes
B Sandhya	India	PhD	Genetic transformation of groundnut with chitinase and glucanase
P Azhaguvel	India	PhD	Mapping and marker-assisted backcross transfer of downy mildew genes in pearl millet
G Sunitha Dayal	India	PhD	Genetic transformation studies in pigeonpea
R Sucharitha	India	PhD	Simulation of the effects of the manure quality, soil type, and climate on nitrogen and phosphorus supply to sorghum and pigeonpea in semi-arid tropical India.
K Anupama	India	PhD	Genetic and molecular markers in chickpea
B Pushpavathi	India	PhD	Variability of *Sclerospora graminicola*
D Harsha Vardhan	India	PhD	Biotechnological approaches for development of disease resistance on sorghum
K Vijaya Gopal	India	PhD	Modeling high temperature stress in groundnut
K Srinivas	India	PhD	Simulation modeling of the soil-plant system
T Srinivas	India	PhD	On-farm evaluation of IPM of *Helicoverpa armigera* on chickpea
V Visalakshmi	India	PhD	Effect of IPM components on natural enemies in chickpea with special emphasis to NPV
Arun Sharma	India	PhD	Development and application of marker-assisted selection in pearl millet
Ranjana Bhataarcherjee	India	PhD	Describing the phenotypic and genotypic diversity of pearl millet in ICRISAT collections
Renuka S Singru	India	PhD	Molecular studies on plant pathogen interaction in pearl millet downy mildew
V Maruthi	India	PhD	Evaluation of suitable cropping systems under different Land management practices in a Vertic Inceptisol watershed
B Jayanand	India	PhD	Regeneration in chickpea
T Shyamala Rani	India	PhD	Tissue culture studies in pearl millet with special reference to production of haploids
S H Sabaghpour	Iran	PhD	Genetic studies on qualitative and quantitative traits in chickpea (*Cicer arietinum* L.)
Gospel G Omanya	Kenya	PhD	Evaluation of indirect vs. direct selection methods for *Striga* resistance in sorghum
Boubacar Tankari	Niger	MSc	Analytical methods in a soil & plant chemistry laboratory
Abdou Habou	Niger	MSc	Modeling stem borer population dynamics
Bake Hamden	Niger	MSc	Caracterisation des epis & caryopses de quelques varietes du petit mil
Idrissa Leko	Niger	MSc	Utilisation de l'eau et lessivage de l'azote dans le Zai
Hima Amadou Ousmane	Niger	MSc	Socio economy
Mme Binti Ibrahim	Niger	MSc	Productivite et utilisation de l'eau du Zai
Gourouza Marou	Niger	MSc	Determination des facteurs d'alteration des eaux du cont terminal CT3/Ny
Hama Hima	Niger	MSc	Erosion eolienne/base de données sur la conservation des eaux et des sols
Daouda Hamidou	Niger	MSc	Resistance varietale au foreur de tige
Hamidou Zeinabou	Niger	PhD	Utilisation des isothermes d'abs du Phosp (P)
Siaka Boureima	Niger	PhD	Potential of pearl millet topcross hybrids in Niger
O James Jayeoba	Nigeria	MSc	Water balance study in a sorghum-based cropping system in the Sudano-Sahelien zone of Nigeria using APSIM
Etim Sam Okpo	Nigeria	PhD	Evaluation of grain legumes in rotation for the control of *Striga hermonthica* (Del.) Benth. In sorghum (*Sorghum bicolor* L.).
O G Olabanji	Nigeria	PhD	Growth and productivity of pearl millet and cowpea in mixture as influenced by component crop proportion and cowpea sowing date
Yakubu Yahaya	Nigeria	PhD	A study of combining ability and heterosis of some male-sterile lines and their restorers in pearl millet
Francis A Showemimo	Nigeria	M Sc	Host-plant resistance in sorghum to *Eurystiylus* sp.
Djidinga Rirabe	Tchad	MSc	Selection mil

ICRISAT on the Web

President Jimmy Carter, the world's most famous peanut farmer at ICRISAT's groundnut trials in Mali in Oct 1999



DECCAN Chronicle ESQ

Inside

Workwise: Dr William D Dar

A role in the life of the poor

From his Danuman West village in the Philippines' Iloco Sur province, little William had to walk four kilometres every day to his primary school. Since his parents could not afford to educate him further, he did odd jobs to be able to pay for his college fee. He completed his studies, thanks mainly to the scholarships he picked up.

After an illustrious career as an agricultural scientist and as an administrator, Dr William D Dar left for Patancheru in Andhra Pradesh, to guide a premier agricultural research institution. Dr Dar, director-general of the International Crop Research Institute for the Semi-Arid Tropics is revolutionising the institution.

At 46, he is the youngest head of any institute under the Consultative Group on International Agricultural Research. Since the time Dar has taken over as (January, 2000) he has given Icrisat a new mantra: Science with a human face in the new millennium.

Excerpts:

Business Line

Financial Daily from THE HINDU group of publications

Monday, May 01, 2000

ICRISAT to tap MNCs, pvt sector for funds

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ANALYSIS
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Scientists champion drought-tolerant crops in India

May 2, 2000
Web posted at: 38 PM EDT (1738 GMT)

NEW DELHI, India (Reuter) -- An agricultural research group said on Tuesday it has pioneered two drought-tolerant chickpea varieties that have reversed the failures of poor farmers in one of five Indian states suffering from an acute water shortage.

An Indian farmer displays a chickpea harvest

CGIAR at the World Book Fair, New Delhi, India -- 5-13 February 2000

Inaugurating the World Book Fair in New Delhi at Pragati Maidan the Prime Minister Mr Atal Behari Vajpayee said "Books will survive the cyber age". (Picture courtesy: Press Trust of India)

Among the various dignitaries participated in this inaugural function were Professor Milton Israel, reputed historian from Canada. The Consultative Group on International Agricultural Research (CGIAR) secretariat and its 5 Centers -- ICRISAT, IFPRI, ISNAR, IWMI, and WARDA -- displayed some of their major research publications at the World Book Fair.

Despite the bad weather a large number of book lovers visited the CGIAR Centers display. Dr Bruno Donn, on his visit to the CGIAR stall on the inauguration day, said, "The CGIAR Center at the International Book Fair at New Delhi permits a person to understand at a single glance the importance of their mission in the world and the quality of their work and publications". Dr Bruno Donn is presently the Head of Economic Department, French Centre for Human Sciences (CSH) in New Delhi.

A 13-year old student, Apoorva Shukla, said, "The CGIAR Centers' display is very good. There are many books which [illegible] farmers and help them to increase [illegible]

ICRISAT Inaugurates Containment Glasshouse for Transgenic Plants

"It is only with new science that ICRISAT can address the urgent need for more food for the poor of the world" said Dr Ragnhild Sohlberg, Chair, ICRISAT Governing Board. She was inaugurating the new Transgenic Plants Containment Glasshouse at the ICRISAT-Patancheru Campus today. Also present were Dr R S Paroda, Director General, Indian Council of Agricultural Research (ICAR), and Dr William D Dar, Director General, ICRISAT.

Introducing the facility, Dr D V R Reddy, Principal Scientist (Virology) said that this US $ 40,000 containment facility for transgenic plants conforms to P2 levels of biosafety standards (these international standards, P1 through P4 of increasing stringency, are based on guidelines developed by the Environmental Protection Agency, USA). Features of this 1,200-square-foot containment facility include: insect-proof conditions; pollen filters; decontamination chambers for personnel and equipment; negative pressure to prevent air-borne dispersal; and an effluent treatment plant to prevent soil and water-borne dispersal.

ICRISAT's Biosafety Committee includes two high-ranking

President and Prime Minister of Niger Visit ICRISAT's Display

The Conseil de l'Entente, a regional organization comprising five countries, sponsored a function on Saturday 8 April, at the Palais des Congres in Niamey, Niger, to present awards to the best farmers in Niger for 1999. ICRISAT and IRAN (NARS of Niger) were requested to put up stands for the event.

Talents stand highlighted work on sorghum hybrids and transformation of manioc. ICRISAT exhibited pearl millet varieties, products from pearl millet grain, and two posters, including the one on "Science with a Human Face". When President Tandja Mamadou and Prime Minister Hama Amadou visited the ICRISAT stand, the Leader Amand Kumar highlighted the collaboration with IRAN in the areas of dissemination of improved technologies, reconventions on improving soil fertility, and the work of the wrest African millet Research Network (ROCAFREMI) on grain transformation. Research Technician ada Abarchi showed improved millet varieties. The President and Prime Minister were presented with copies of the two volume joint IRAN-ICRISAT publication on Technologies Utilisables et Conséquences des Innovations', The President, a farmer himself, indicated that he would call a meeting of the all research institutes to discuss transfer of improved technology to the farmers.

Earlier, President Tandja gave away awards to five best farmers in categories that included agriculture, livestock

ICRISAT in the News

Providing science a human face

By G. Venkataramani

CHENNAI, MARCH 3. "Our new agenda is science with a human face for improving the livelihood of the 300 million poor inhabiting the semi-arid tropics (SAT) across the globe," said Dr. William D. Dar, new Director-General of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Patancheru near Hyderabad.

In an exclusive interview, the 46-year-old Filipino scientist-administrator, who took charge in mid-January, said that beyond producing quality and cutting-edge science or relevant research, the work the ICRISAT did in cooperation with its partners must benefit the marginalised, the disadvantaged, and the hungry. "This is the human face of the science and agricultural research we do. This will be the over-arching theme of our efforts, the paramount motive of our endeavours," he said.

Dr. William D. Dar

and catalyst. With the advantage of a neutral, publicly- funded international centre with scientific excellence, it can act as a bridge between Asia and Africa. It will use its international character to act as a trusted broker between NARS and various other stakeholders.

Dealing with the mandate crops, the ICRISAT is the world's largest repository of food crop germplasm. This collection is held in public trust on behalf of the Food and Agricultural Organisation following the global Convention on Biodiversity.

As germplasm becomes increasingly entwined with issues of intellectual property rights protection, ICRISAT's holdings assure the security of the germplasm heritage of SAT, and ensure free access to this genetic wealth among nations.

Dwelling on the recently formulated "ICRISAT's Africa Agenda", Dr. Dar said he saw more opportunities in the region. "We have to convert the challenges into opportunities." While some are pessimistic about trends in Africa, the ICRISAT views the continent as one with enormous potential while admitting that the challenges are far from trivial.

The Africa Agenda is formulated through participatory ap-

ICRISAT scientist wins award

HYDERABAD, DEC. 9. Dr. Chris Johansen, Principal Scientist (Agronomy), at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has been conferred a medal by the Vietnamese Government for his distinguished contribution to groundnut development in that country.

The Medal for Agriculture and Rural Development and a citation were presented to him by Dr. Tran Dinh Long, Deputy Director General, Vietnam Institute of Agricultural Science, at a simple ceremony at the Institute's campus near here on Wednesday.

He is the second ICRISAT scientist after Dr. C. L. L. Gowda to receive the Vietnamese medal.

Dr. Chris Johansen

Recherches

L'ICRISAT OUVRE SES PORTES

L'ICRISAT (Institut international de recherche sur les cultures des zones tropicales semi-arides) a ouvert ses portes mardi à une cinquantaine d'agents de services publics et d'organisations non gouvernementales (ONG). A travers cette opération «Portes ouvertes», l'ICRISAT selon son représentant au Mali, le Dr Farid Waliyar, désirait offrir à ses visiteurs l'occasion de connaître l'institut et ses techniques de production de semences, de recueillir le maximum d'informations sur les réalisations de cet organisme dont le siège est en Inde.

La journée a culminé avec la visite de 124 ha de champs dont 80 ha en expérimentation regroupant des parcelles de sorgho, d'arachide et de haute vive. On a ainsi appris que le sorgho diffère des autres céréales par la diversité inhabituelle des maladies dont il est sujet et qui affectent aussi bien le rendement que la qualité des grains et du fourrage. En Afrique de l'Ouest et du Centre, le sorgho est attaqué par de nombreuses pathogènes foliaires, cannulaires et des tiges, des maladies fongiques systématiques ainsi que des maladies virales et bactériennes, sans oublier le parasite striga. Les recherches liées à la pathologie des céréales constituent une partie des activités conjointes IER/ICRISAT.

Un accent particulier est mis sur recherche sur le striga, en collaborat

L'ICRISAT RÉUSSIT LA RÉVOLUTION VERTE

En 27 ans l'Icrisat a aidé à la diversification de l'agriculture africaine. Il continue cependant son combat pour la sécurité alimentaire

Dans le cadre de la 43è session de son conseil d'administration l'Institut international de recherche sur les cultures des zones tropicales semi-arides (Icrisat) a tenu vendredi dernier au Grand Hôtel une journée de partenariat placée sous le thème reconstruire son économie agricole en renforçant ses cultures de sorgho. Le Dr William D. Dar rappellera également qu'en Afrique orientale et australe, l'Icrisat a aidé à vulgariser la culture du pois d'Angole, et qu'en Afrique occidentale, les variétés de sorgho l'Afrique». Rappelons que cette stratégie, basée sur le partenariat, considère que l'amélioration de la fertilité des sols constitue un facteur qui pourrait largement bénéficier aux pauvres, tout en améliorant la sécurité alimentaire et la protection de l'environne-

Education Spurs Agriculture

By Sridhu Sitaraman

THE US is looking forward to working with partners to raise a level to the profile of agricultural research. This means better tools and mechanisms to achieve food quality, nutrition, safety and affordability without harming the environment. The measures would also address consumer sustainability, viability and develop markets. To achieve this, education, especially awareness about agriculture among the masses, is important.

"Our attention is, in working with partners, to look at how we continue to raise a level in the profile of agricultural research, outreach and extension components. And education is a part of that, especially in the US, where we have a large population that is not accustomed to agri production. We need to tell them where the food comes from, so we need to educate them in that agenda and work early on," said L Mikey Gonzalez, Undersecretary of Agriculture for Research, Education and Economics, United States Department of Agriculture, who was in Hyderabad recently.

"Involve high school students in agricultural research; if you get these folks involved in the research arena early on, they will gravitate towards it," said the visiting official.

Gonzalez, who visited the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) ventured on an informal gathering that those who work on the global agenda of

"Involve high-school students in agricultural research; if you get these folks involved in the research arena early on, they will gravitate towards it"

- Gonzalez, Undersecretary For Agriculture, US

L Mikey Gonzalez (left) and ICRISAT Director-General William Dar (right)

establishing linkages have to establish relationships first.

Replying to a query on the US' scaling down of funding, Gonzalez opined that "moving the dollars around" involved identifying the highest priorities and was also a matter of looking at mutual benefit. "I don't believe that if you are not with us, you are against us," he said, as if remembering ruffled feathers, and added that sometimes the first seeking partner are referred to other organisations.

Gonzalez presently heads the research, educa-

which consists of four agencies: Agricultural Research Service; Cooperative State Research, Education and Extension Service; Economic Research Service; and National Agricultural Statistics Service.

The Cooperative State Research, Education and Extension Service serves as a direct link to the university community in the States, with 148 land-grant universities being part of it. Recently a law was passed allowing them to forge partnerships with other colleges and universities.

They are meeting global competitive pressures everywhere, i.e., trying to ensure that we have the tools and mechanisms to make our producers sustainable and economically viable; attention is fixed, safety, quality, affordability; human nutrition and how we produce more food and fibre in an environmentally-friendly way in the production and processing component. And finally, how we maintain in the world across the economic sustainability and viability not only of the p... so but also develop a marketplace where th... more competitiveness. And knowing that ... of the answers to research are elsewhere ... just in our traditional partnerships, we are ... moving to promote that."

Asked if there are any new agri-projects ... wanted to fund in India, Gonzalez, who ... directing the United States' 66-year-old col... ration with India in agriculture, especially ... tutions and research, acknowledged that ... would be new projects. "There would be re... result of the dialogue on what would be mu... ly beneficial. However, there is tremend... opportunity, especially in biotechnology."

Expressing a bit, Gonzalez then went on to tackle the sociological part of the agri sector. Citing the producers lured to people's acceptance of previously-eschewed organisms, he stressed the fact that the discussion on the impact of ... issue has not been done in a very acceptable ... the general public. "The sociological part of ... discussion is an important part of the overall ... science that we have," he emphasised.

Earlier, ICRISAT Director-General William Dar, elaborating on the emerging mandate of institutes, science with a human face, emphasised that their goal was to

इक्रीसेट ने मनाया अप

(मिलाप ब्यूरो)

हैदराबाद, 17 दिसम्बर -

इक्रीसेट के महानिदेशक डॉ. लेस्ली डॉ. स्वीन्डेल ने आज यहाँ संस्थान की गतिविधियों तथा पिछले एक वर्ष में उसके द्वारा अर्जित की गयी उपलब्धियों पर संतोष जताया तथा विश्वास व्यक्त किया कि यह कार्य आगे भी जारी रहेगा।

डॉ. स्वीन्डेल, हैदराबाद के बाहरी इलाके पटनचेरू में स्थित संस्थान के 27वें वार्षिक दिवस समारोह में अपने विचार व्यक्त कर रहे थे।

अवसर पर भारतीय कृषि अनुसंधान ... के ... डॉ. ... के ... ओम

ICRISAT draws up strategy to combat drought

By T.Lakshmipathi

HYDERABAD, MAY 2. For over a quarter century now, the International Crops Research Institute for Semi-Arid Tropics (ICRISAT), with its headquarters at Patancheru near here, has been engaged in ... drought- resistant ... against 25 per cent (in case of conventional system), and water loss through bare soil evaporation and deep drainage was reduced to 19 per cent of rainfall, against 45 per cent.

Rainwater use efficiency for crop production was increased to 67 per cent from 30 per cent and ... reduced to 1.5 tonnes ... grains per hectare and in case of sorghum-pigeonpea intercrop, the yield was 1.5 tonnes of grains. The watershed committee of the villages undertook construction of water storage structures and gully control structures.

But it was the adoption of the two drought-tolerant chickpea varieties of ICRISAT that brought out what is described by farm scientists as a "silent pulse revolution" in Andhra Pradesh in the last decade.

The chickpea production in the State increased seven- fold in the last ten years, from 20,000 tonnes to 1.40 lakh tonnes. Farmers of Guntur and Prakasam districts share the view that chickpea came as a saviour when cotton cultivation turned a gamble.

The continuous growing of cotton, year after year, in the same field by many farmers in the two districts led to many problems. The cost of cultivation grew, yields diminished and the price fluctuations in the market made it less profitable.

Investment in cotton cultivation worked out to more than Rs 25,000 to Rs 30,000 per hectare. Yield averaged at 2.25 tonnes per hectare and it was sold at Rs 17,000 per tonne. By comparison, chickpea cultivation costs Rs 7,500 per hectare, yields a minimum of 1.75 tonnes per hectare and is sold at Rs 12,500 a tonne.

In the semi-arid tropics, drought occurs roughly in two out of every five years. The rainfall (varying from 500 mm to 1900 mm per annum) is erratic. Further, only 30 to 60 per cent of the rainfall is used effectively for crop production and the remaining 40 to 70 per cent is lost as runoff, evaporation and deep drainage, the ICRISAT Director General explains.

It is for the Governments to go in for increased adoption of the drought-resistant varieties developed by the institute. About 45 drought-resistant breeding lines have been distributed by ICRISAT under its groundnut programme. From the ICAR-ICRISAT groundnut releases in India, three varieties are tolerant of end-of-season drought and two are tolerant of mid- season drought.

زرعی شعبہ کی ترقی میں اکریسات کی نمایاں خدمات

27ویں سالانہ تقریب سے ڈاکٹر سوئنڈلے اور ڈاکٹر پروڈہ کی مخاطبت

ICRISAT adopts new vision agenda for semi-arid tropics

By Our Special Correspondent

HYDERABAD, DEC. 15. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has adopted a new vision agenda charting out a three-pronged approach to help people of Semi-Arid Tropics (SAT) make better use of their resources.

It includes understanding the potential of SAT resources, generating and ensuring knowledge and technologies that promote better use of these resources with a balance between commodity and eco-regional approaches. It also aims at sharing assessed technologies with partners and studies on technology adoption.

This was stated by Dr. L. D. Swindale, Director-General of ICRISAT here on Tuesday, on the eve of the 27th Annual Day of ICRISAT. He said the world over, agriculture had become a risky business but nowhere the uncertainties were so pronounced and farmers so vulnerable to crop failure as in the semi-arid tropics. These regions covered almost 20 million square kilometres in 48 developing coun-

constant threat — it occurs two years out of five in 40 per cent of these areas. Soils were poor. Poverty and food insecurities were widespread. Population was growing rapidly straining land and water resources to their limit.

Agricultural development offered small-scale farmers a chance to escape from the downward spiral of land degradation, declining yields and poverty. "And ICRISAT and its partners have shown that no matter how formidable the problems, good science, effective partnerships and long-term commitment will provide solutions", Dr. Swindale said.

Collaborative research and technology exchanges with these strengthened partners had ... have shown that ... worth more than ... price of SAT cere... longer than the ...

The ICRISAT ... bargain, multi-re... goal that helps ...

Dr. Swindale said the ICRISAT, one of ... International Agricultural Research ... (IARC) under the Consultative Group of ... national Agricultural Research, had been ... ing closely with developing countries ... the food and ecological security challe... the new millennium.

Its job had been to help the national ... tions and people of the Asian and Afri... areas to achieve food security and eco... ity without destroying the natural ... ment.

The IARC cannot be complacent ... did lead ... help the ... new mi...

Icrisat book on pest management

The International Crops research Institute for the Semi-Arid Tropics has released a book *Identification and management of pigeonpea and chickenpea insect pests in Asia*, on integrated pest management. The book, by G V Ranga Rao and T G Shanower, was released by S Mathur of the International Fund for Agricultural Development.

DECCAN CHRONICLE

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Socioeconomics and Policy

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1. Profiles of work and email contact addresses for ICRISAT staff are available on ICRISAT's website at http://www.icrisat.org

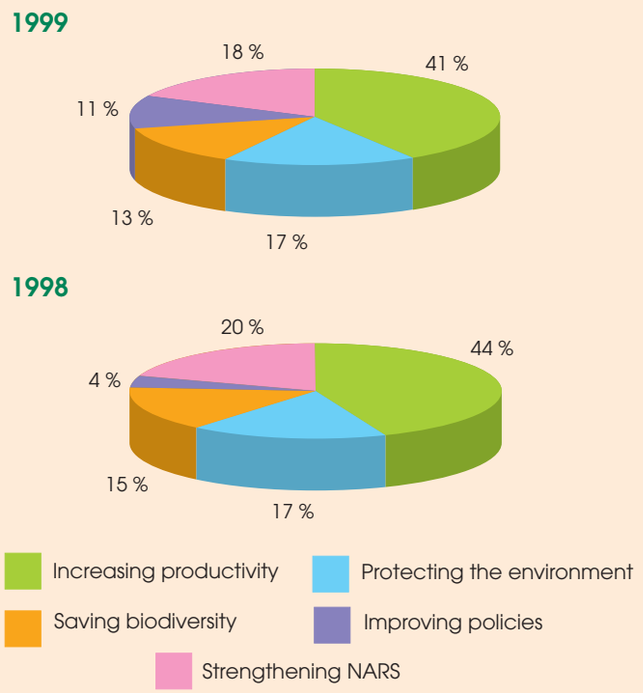
Financial Summary

Balance Sheet

US$ thousands

	1999	1998
Assets		
Cash and cash equivalents	23 510	19 663
Accounts receivable	4 116	6 816
Inventories	690	806
Prepaid expenses	196	290
Fixed assets - net	12 940	41 589
Other assests	505	562
Total	41 957	69 726
Liabilities		
Accounts payable	2 727	2 883
Accruals and Provisions	1 020	1 248
Payments in advance from donors	6 693	5 113
In-trust funds	88	48
Long-term liabilities	6 560	6 713
Total	17 088	16 005
Net Assets		
Unrestricted	19 179	48 016
Restricted	5 690	5 705
Total	24 869	53 721

Agreed Agenda Costs by CGIAR Undertaking



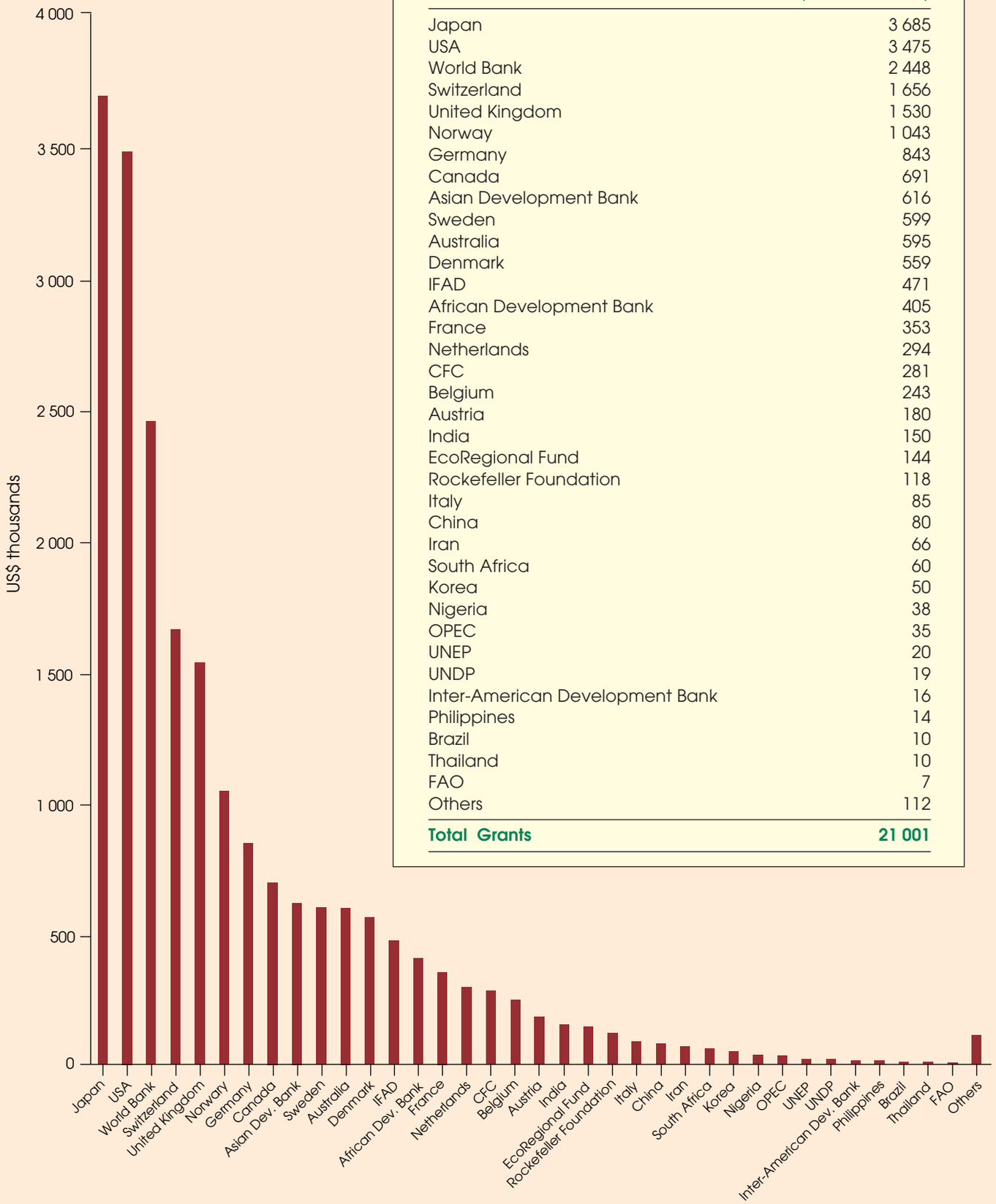
Operating Results and Movements in Net Assets

(US$ thousands)

	1999	1998	Variance Increase/(Decrease)
Operating results			
Revenue	22 402	24 027	(1 625)
Operating expenditure	23 002	22 081	921
Operating surplus/(deficit) before extraordinary items	(600)	1 946	(2 546)
Extraordinary items	(256)	3 785	(4 041)
Operating surplus/(deficit)	(856)	5 731	(6 587)
Net Assets – Unrestricted			
Opening balance	48 016	42 309	5 707
Surplus/(deficit) for the year	(856)	5 731	(6 587)
Sale proceeds of assets disposed	160	310	(150)
Interest earned on housing loans	41	9	32
Restricted grants for asset acquisition	79	6	73
Net book value of fixed assets –			
Deleted during the year	(27 862)	(297)	(27 565)
Disposed during the year	(226)	–	(226)
Additions to physical facilities	(66)	–	(66)
Housing loans disbursed	(87)	(25)	(62)
Prior Year charges	(20)	(27)	7
Closing Balance	19 179	48 016	(28 837)
Net Assets – Restricted			
Opening balance	5 705	6 066	(361)
Additions to fixed assets during the year	10	31	(21)
Fixed assets disposed during the year	(25)	(392)	367
Closing balance	5 690	5 705	(15)
Net Assets – Total	**24 869**	**53 721**	**(28 852)**

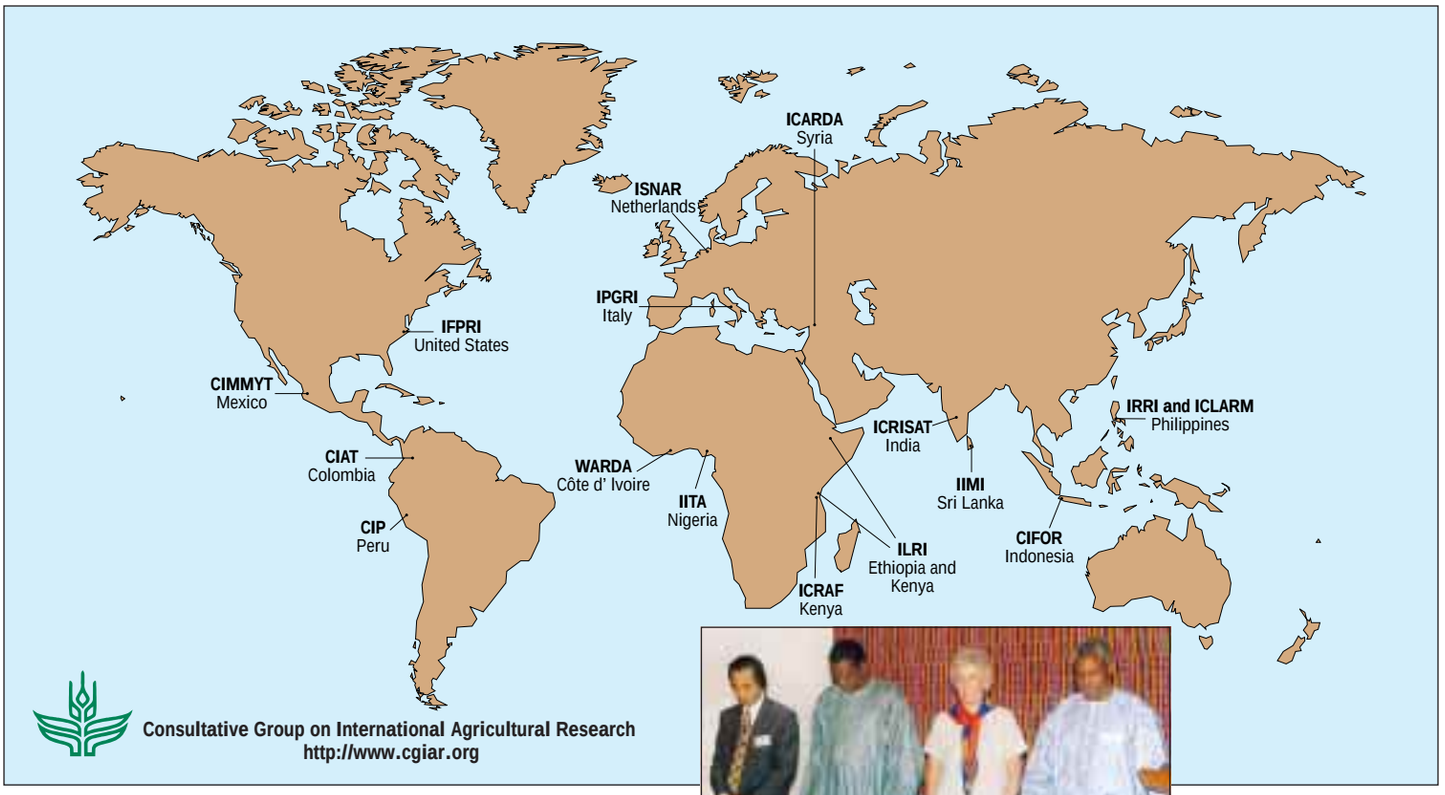
Grant Income from Agreed Agenda Donors
(for the year ended 31 December 1999)

Donor	Amount
	(US$ thousands)
Japan	3 685
USA	3 475
World Bank	2 448
Switzerland	1 656
United Kingdom	1 530
Norway	1 043
Germany	843
Canada	691
Asian Development Bank	616
Sweden	599
Australia	595
Denmark	559
IFAD	471
African Development Bank	405
France	353
Netherlands	294
CFC	281
Belgium	243
Austria	180
India	150
EcoRegional Fund	144
Rockefeller Foundation	118
Italy	85
China	80
Iran	66
South Africa	60
Korea	50
Nigeria	38
OPEC	35
UNEP	20
UNDP	19
Inter-American Development Bank	16
Philippines	14
Brazil	10
Thailand	10
FAO	7
Others	112
Total Grants	**21 001**



Acronyms

ACIAR	Australian Centre for International Agricultural Research
ACMAD	African Centre of Meteorological Applications for Development (Niger)
ADB	Asian Development Bank (Philippines)
ANGRAU	Acharya N G Ranga Agricultural University (India)
APAARI	Asia-Pacific Association of Agricultural Research Institutions (Thailand)
APNBP	Andhra Pradesh Netherlands Biotechnology Program
APSIM	Agricultural Production Systems Simulator (Australia)
APSRU	Agricultural Production Systems Research Unit (QDPI and CSIRO, Australia)
CABI	Centre for Agriculture and Biosciences International (UK)
CAZS	Centre for Arid Zone Studies (UK)
CCD	Convention to Combat Desertification
CENARGEN	Centro Nacional de Pesquisa de Recursos Genéticos e Biotecnologia (Brazil)
CAZRI	Central Arid Zone Research Institute (India)
CFC	Common Fund for Commodities (Netherlands)
CIAT	Centro Internacional de Agricultura Tropical (Colombia)
CILSS	Comité permanent inter-Etats de lutte contre la sécheresse dans le Sahel
CIMMYT	Centro Internacional de Mejoramiento del Maïz y del Trigo (Mexico)
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement (France)
CLAN	Cereals and Legumes Asia Network (ICRISAT)
CNEARC	Centre National d'etudes Agronomiques des Regions Chaudes (France)
CRICYT	Centro Regional de Investigaciones Cientificas y Technologicas (Argentina)
CRIDA	Central Research Institute for Dryland Agriculture (India)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
CWS	Centre for World Solidarity (India)
DED	German Development Service
DFID	Department for International Development, UK (formerly ODA)
DMP	Desert Margins Program
ECRI	Environment and Climate Research Institute (Egypt)
FAO	Food and Agriculture Organization of the United Nations (Italy)
GDP	Gross Domestic Product
GFAR	Global Forum on Agricultural Research
GIS	Geographical Information System
GRAV	Groundnut Rosette Assistor Virus
GRIWC	Gansu Research Institute for Water Conservation (China)
HAU	Chaudhary Charan Singh Haryana Agricultural University (India)
IAEG	Impact Assessment and Evaluation Group (CGIAR)
IBSRAM	International Board for Soil Research and Management (Thailand)
ICAR	Indian Council of Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas (Syria)
ICIPE	International Centre of Insect Physiology and Ecology (Kenya)
ICRAF	International Centre for Research in Agroforestry (Kenya)
IDRAS	Institute of Desert Research Academia Sinica (China)
IER	Institut d'économie rurale (Mali)
IFAD	International Fund for Agricultural Development (Italy)
IFDC	International Fertilizer Development Center (USA)
IIED	International Institute for Environment and Development (UK)
IITA	International Institute of Tropical Agriculture (Nigeria)
ILRI	International Livestock Research Institute (Ethiopia and Kenya)
INERA	Institut d'études et de recherches agricoles (Burkina Faso)
INRAN	Institut national de recherches agronomiques du Niger
INTA	Instituto Nacional de Tecnologia Agropecuaria (Argentina)
INTSORMIL	USAID Title XII International Sorghum/Millet Collaborative Research Support Program (USA)
IPGRI	International Plant Genetic Resources Institute (Italy)
IPM	Integrated Pest Management
IPR	Institut polytechnique rural (Mali)
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research (Netherlands)
ISRA	Institut sénégalais de recherches agricoles
ITC	International Trypanotolerance Center
ITRA	Institut Togolais de la Recherche Agronomique
JIRCAS	Japan International Research Center for Agricultural Sciences
KARI	Kenya Agricultural Research Institute
LCRI	Lake Chad Research Institute
LIGG	Lanzhou Institute of Glaciology and Geocryology (China)
LIPAP	Lanzhou Institute of Plateau Atmospheric Physics (China)
LPG	Livestock Programme Group (ILRI)
MAFF	Ministry of Agriculture, Forestry, and Fisheries (Japan)
MAHYCO	Maharashtra Hybrid Seed Company (India)
MAU	Marathwada Agricultural University (India)
NARS	National Agricultural Research Systems
NRCG	National Research Centre for Groundnut (India)
NBPGR	National Bureau of Plant Genetic Resources (India)
NGO	Non-Governmental Organizations
NORAD	Norwegian Agency for International Development
NPV	Nuclear Polyhedrosis Virus
NRI	Natural Resources Institute (UK)
OPEC	Organisation of Petroleum Exporting Countries (Austria)
OPI	Oil Plants Institute (Vietnam)
ORSTOM	Institut français de recherche scientifique pour le développement en coopération (France)
OSWU	Optimizing Soil Water Use
PCCARD	Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development
PGIP	Polygalacturinase Inhibiting Protein
QDPI	Queensland Department of Primary Industries (Australia)
REEDS	Research in Environment, Education and Development Society (India)
ROCAFREMI	Réseau ouest et centre africain de recherche sur le mil (WCAMRN, Niger)
ROCARS	Réseau ouest en centre africain de recherche sur le sorgho (WCASRN, Mali)
SACDP	Sokoto Agricultural and Community Development Projects (Nigeria)
SADC	Southern African Development Community (Botswana)
SCRI	Scottish Crop Research Institute (UK)
SINGER	System-wide Information Network for Genetic Resources (Italy)
SMIP	Sorghum and Millet Improvement Program (Zimbabwe)
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNICAIRO	University of Cairo (Egypt)
UNIPAD	Universita degli Studi di Padova (Italy)
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
VASI	Vietnam Agricultural Science Institute
VUB	Vrije Universiteit Brussel (Belgium)
WCASRN	West and Central Africa Sorghum Research Network (ROCARS, Mali)



A moment of silence during the 43rd Governing Board Meeting at Bamako (Mar 2000) for the four CGIAR scientists killed in the crash of Kenya Airways Flight KQ 431 off Ivory Coast on 30 Jan 2000.

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