Germinating the seeds of success in the semi-arid tropics

ICRISAT Annual Report 2005

International Crops Research Institute for the Semi-Arid Tropics


ICRISAT
Sowing the seeds of

Contents

Germinating the seeds of success in the semi-arid tropics

Message from the Chairman and the Director General

Last year, we sowed the seeds of success. This year, we have reaped a sweet and bountiful harvest. Our collective and untiring efforts to help empower the hundreds of millions of poor and unreached people in the dry tropics are paying off.

As we have further strengthened our global research themes, we continue addressing new challenges in the dry tropics. Among these are achieving greater research impact in sub-Saharan Africa (SSA), putting transgenic products in the public domain, addressing new horizons in crop improvement and protection, enhancing cross theme collaboration, promoting alternative uses of our mandate crops, developing new science tools and optimizing opportunities in ICT and e-learning.

Moreover, we are sustaining the momentum gained in 2004. We are going full blast in fine-tuning decentralization in the SSA hubs, intensifying strategic partnerships, alliances and South-South collaboration, and more importantly, strengthening inter-Center collaboration through the Alliance of Future Harvest Centers of the CGIAR.

The hard work of the past has now germinated into global research successes. The stories in the following pages reflect the innovative ways in which ICRISAT creates international public goods and cutting edge solutions with its partners to help empower the poor of the dry tropics. Our successes have reconfirmed the strength and relevance of our research themes.

In West Africa, our efforts at unlocking the genetic potential of the predominant sorghums in partnership with the Malian Institut d'Economie Rurale (IER), and the Institut National de l'Environnement et de Recherches Agricoles (INERA), Burkina Faso, have borne fruit. The first hybrid parents ever to be based on Guinea-race germplasm and adapted to West African conditions have been tested in the northern and southern Sudanian zones outyielded all the well-adapted check varieties in all research station trials. It is heartening to know that these yield advantages will provide farmers increased productivity while maintaining grain quality and retaining yield stability.

In Eritrea, ICRISAT scientists have breached the age-old disease barrier - downy mildew in pearl millet. Joint efforts with the Eritrean pearl millet program led to Hagaz, the first indigenously developed improved pearl millet cultivar, bred from a cross between the Eritrean landrace variety Tokroray and the ICRISAT-bred improved variety ICMV 221. Released in 2004, it will provide farmers with a higher yielding and slightly longer duration alternative to the introduced variety 'Kona' (ICMV 221), which was released in Eritrea in 2000. This is indeed another victory for the farmer.

The power of partnerships is an innovative way to address complex problems of the developing world. Hence, we are giving renewed impetus to partnerships aimed at producing strategic scientific breakthroughs, which

we will not be able to achieve alone. For instance, lack of seed is a perennial problem plaguing farmers in sub-Saharan Africa. A CFC-ICRISAT-NARS (Mali, Niger, Nigeria and Senegal) groundnut seed project aims to establish sustainable community-based seed systems by training farmers and other stakeholders along the commodity chain. This has stimulated the emergence of community-based associations at the village level. Four individual farmers and four associations in Kolokani have begun to produce seeds of selected varieties for sale in the community. Individual farmers and farmer associations in the pilot areas willing to multiply seed have come up with promising options for a sustainable community-based seed system.

Peas and peanuts provide prosperity. That's what farmers in the Yunnan and Guangxi provinces of southern China have experienced. ICRISAT-bred new pigeonpea material has been successful in changing the landscape in these regions, where soil erosion was the norm. Animal husbandry, the mainstay of the economy, got a boost when an evaluation of pigeonpea showed that variety ICPL 93047 produced 54 t ha-1 of fresh fodder with dry cuttings, bringing to an end the shortage of quality fodder. Pigeonpea has also been selected as an afforestation crop in major Government reconstruction.

Genetically modified (GM) crops – you will either love or hate them through the power of mass media. Therefore, how can the media accurately report crop biotechnology so that it will be accurately understood by the public? A series of media workshops we conducted in Patancheru (Andhra Pradesh), New Delhi (India), Dhaka (Bangladesh) and Niamey (Niger) set out to demystify biotechnology. Apart from initiating long-term interaction among journalists and scientists, the exercise helped enlighten journalists on crop biotechnology and sharpen their skills in reporting it to the public. The news and feature stories from the media workshop also established ICRISAT's agri-biotech research on the global media map.

We bagged the coveted King Baudouin Award for the fourth time, sharing it with the International Center for the Improvement of Maize and Wheat (CIMMYT), International Rice Research Institute (IRRI), International Water Management Institute (IWMI) and other national systems in the Rice-Wheat Consortium for the Indo-Gangetic Plains; won the Young Scientist Award for the second time, and also the World Bank's Development Marketplace Award for our biopesticide project. We have also achieved a budget surplus for the third year in a row.

On a broader front and in a very rare circumstance, ICRISAT was placed at the leadership of the Alliance of Future Harvest Centers of the CGIAR, set up to strengthen and guide the collective work of the independent Centers. During 2005, ICRISAT's leaders also served as leaders of the Alliance Board, the Alliance Executive and Center Deputy Directors Committee (CDDC). In this role, our leaders have carefully nurtured the seed of the Alliance that was sown in 2004. It is now germination time. The draft Principles and Procedures document is a major milestone, as is the mapping out of joint medium term plans for East and Southern Africa (ESA) and West and Central Africa (WCA). Also, if it were not for the strong support of the Centers, the formulation of the Systems Research Priorities would not have been as effective. Leading the Alliance of Future Harvest Centers has been a challenging task. We are happy to have facilitated the institutionalization of collective action among the Centers of the CGIAR.

On the whole, it has been a very satisfying year. But there are greater goals to be achieved and a noble mission waiting to be accomplished. We profoundly thank our donors and partners for sharing their commitment and providing funds to make our shared vision a reality.

The future further beckons... we are ready to shape it with our donors and partners.

Uzo Mokwunye
Chairman, Governing Board

William D Dar
Director General

Guinea-race sorghum hybrids: New prospects for West Africa

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

"How would you go about improving the productivity of sorghum in West Africa so as to improve food security and increase farmer's incomes, and do so by building on several thousand years of farmers' selection for adaptation and quality of grain?" This question was put to researchers from ICRISAT, the Malian Institut d'Economie Rurale (IER), and the Institut National de l'Environnement et des Recherches Agricoles (INERA), Burkina Faso back in the year 1999. Their answer, "lets work together to find ways of unlocking the genetic potential of the predominant sorghums of West Africa." These sorghums, an indigenous staple crop of West Africa belonging to the *Guinea*-race, combine excellent adaptation for these environments with high grain quality. Although having exceptional yield stability, their yield levels rarely exceed 2 tons/ha in farmer's fields.

One of the approaches researchers have pursued is the development of hybrids based on well-adapted Guinea-race parents. The benefits of hybrid vigor have long been reaped in India with widespread adoption of sorghum hybrids. The potential benefit of hybrid vigor under both favorable and drought prone conditions was shown experimentally by ICRISAT work in eastern and southern Africa. However, this progress has all been made with sorghum races other than Guinea, races that lack specific adaptive characteristics required for successful production in the main sorghum-growing belt of West Africa (the "Sudanian" zone).

Hybrid (top) and male parent from Zimbabwe (bottom).

The ICRISAT-IER-INERA team thus set out to create the first hybrid parents ever to be based on Guinea-race germplasm and possessing adaptation to the West African conditions. A search was begun to identify potential female parents (maintainer lines) through extensive test crossing of germplasm from three different sources: local varieties from Mali, inter-racial breeding lines from the IER program, and Guinea-race accessions of world-wide origin from the World Sorghum Collection in the ICRISAT genebank in India.

Many maintainer lines were identified and, through repeated backcrossing, "sterilized" to

produce the first series of hybrid female parents. This series of cytoplasmic male-sterile lines includes Malian varieties such as CSM 219, originating from the ICRISAT-IER collaborative germplasm collection and characterization work done in the 1980s, and varieties (Fambé and IPS001) developed by the Malian "Institut Politechnique Rural". Additional new female parents were also developed from ICRISAT genebank accessions originating in Senegal, Gambia, Burkina Faso, Malawi, Sudan and Uganda. These parents provide diversity not only for geographic origin but also maturity and grain size, ranging from 1.1 to 3.5 g per 100 seeds. Another dimension of diversity is added by the inter-racial male-sterile lines such as the dwarf 97-SB-F5DT-150 A/B, developed by IER through crossing the local variety Bimbiri Soumale with a Caudatum-race variety.

The first experimental hybrids were produced in 2004 on both the inter-racial (164 hybrids) and landrace-based female parents (159 hybrids). Multi-location testing of these hybrids was initiated in both the Northern Sudanian zone (IER-Mali, INERA-Burkina Faso, ISRA-Senegal) and the Southern Sudanian zone (IER-Mali, INERA-Burkina Faso, INRAN-Niger, ISRA-Senegal) with collaboration from national programs in the region.

The best hybrids significantly out-yielded all of the well-adapted check varieties in all of the research station trials. Despite the rains ending one month earlier than normal, average grain yield of the 22 highest yielding hybrids (top 20%) was nearly one ton higher (3.1 ton/ha) than the mean of three outstanding local varieties (2.3 ton/ha) in the ICRISAT-Mali trial. Even more important, the hybrid yield advantages in the first on-farm trial were identical to that observed in research station trials; an average advantage of 38% for the 20% highest yielding hybrids over a basket of three well-adapted local varieties.

These yield advantages are truly exciting as they provide what farmers are demanding – increased productivity while maintaining grain quality and retaining (or even enhancing) yield stability. And this is just the beginning. The Guinea-race of sorghum is the most diverse of sorghum races. We have just begun to explore the structure of diversity and patterns of heterosis (hybrid superiority over the parents). Initial results show that high, repeatable, heterosis can be obtained when parents from humid West Africa, East Africa, Southern Africa and even Asia are crossed onto a West-African tester. Accessions giving the highest heterosis in crosses with a West-African tester came from Cameroon, Zimbabwe and China.

The substantial financial and moral support from the Rockefeller Foundation that has made this work possible is greatly appreciated.

Farmers from Wobougou village selecting Guinea-race dwarf panicles from a population grown in their own field.

Hagaz the halcyon hybrid

Pearl millet (*Pennisetum glaucum*) is grown for grain and stover in tropical and sub-tropical regions of Africa and the Indian sub-continent. In Eritrea, pearl millet is the second most important cereal in the country after sorghum and is grown by smallholder farmers on over 80,000 hectares, mainly in lowland and middle elevation regions. With no improved cultivars available until very recently, farmers grow exclusively traditional landraces, which have many preferred traits and a modest grain yield potential, but are generally susceptible to downy mildew.

(Left to right) Normal and downy mildew infected pearl millet panicles and early infected plants.

Pearl millet downy mildew, caused by the pseudofungus *Sclerospora graminicola* is one of the major production constraints for this crop throughout most of the semi-arid tropics of Asia and Africa. Downy mildew is widely distributed in Eritrea. In the years 1999 and 2000, 30-50% of pearl millet plants were infected with downy mildew disease in most production areas surveyed in the Anseba and Gash Barka political subdivisions of Eritrea. This disease causes major yield reductions, estimated at 30% in Anseba in 2000.

In the 2004 rainy season, 7000 kg of Hagaz seed was distributed to farmers by the Eritrean extension service and Vision Eritrea, a collaborating NGO. Farmer response was very positive and a large demand for seed of Hagaz is predicted for 2005.

In 2004, seed production of Hagaz at Shambiko and Golij research stations resulted in the production of nearly 8 tons of foundation seed stocks for use in on-farm seed production in the rainy season of 2005. Certified seed production of Hagaz on contiguous village lands in the Hammelmalo and Shebek areas was organized by the extension service. This resulted in a total production of 30 tons of certified seed for sowing in 2005.

The Eritrean pearl millet variety Hagaz, released in 2004, is the first product of a type of partnership that ICRISAT sees as a model for its future work in Africa. It began in 1998 when Mr Negusse Abraha, now Eritrea's pearl millet breeder, did his MSc dissertation research at ICRISAT-Patancheru for his degree in plant breeding. When Mr Negusse returned to Eritrea, ICRISAT helped him to develop a breeding program designed to improve Eritrean landraces and to breed new varieties from crosses between selected local landraces (which provided local adaptation and farmer-valued traits) and ICRISAT varieties/populations (which provided disease resistance and a higher yield potential).

The partnership involves the Eritrean National Agricultural Research Institute, a donor agency with a commitment to the improvement of Eritrean agriculture, Plant Sciences Program of the University of Wales, Bangor, for downy mildew screening, and ICRISAT for seed and technical advice. Danida (initially) and the Syngenta Foundation (since 2002), have provided generous funding for the Eritrean Millet Program, including funds for technical support from ICRISAT.

The development of the pearl millet variety Hagaz has proceeded in parallel with the Eritrean pearl millet program itself. It is a genuine tribute to a small, but very effective partnership between four different agencies that share a common objective – to provide Eritrean farmers with the tools to improve their own livelihoods.

The Eritrean pearl millet breeding program started research and breeding activities in early 2000 at Hagaz Research sub-station. The objective of this program is to develop high yielding, disease resistant pearl millet varieties, adapted to local conditions and acceptable to farmers in order to help increase and stabilize millet productivity in Eritrea. In this effort, local landraces and exotic cultivars were tested for their disease resistance and yielding capabilities to identify promising parental material for the breeding program. Crosses were made between selected exotic cultivars and local landraces to improve disease resistance and productivity of the landraces. The first 25 such population crosses were tested on-station in 2000 and the best four population crosses (Table 1) from the initial evaluation were random-mated once and immediately advanced to on-farm trials in 2001.

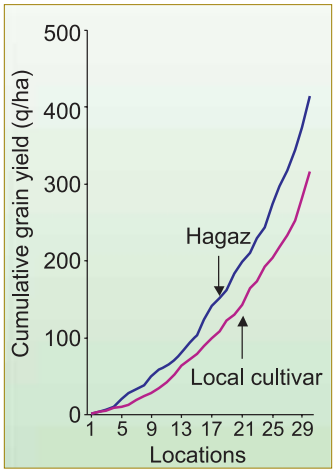
Table 1. Mean performance of the best four population crosses at Hagaz during the 2000 and 2001 rainy seasons.

Entry Name	Time (d) to 75% flower	Plant height (cm)	Grain yield (t/ha)	Downy mildew incidence (%)
Tokroray × ICMV 221	51	199	2.27	0.7
Tokroray × ICMP 96593	51	201	1.41	3.0
Gudmay × ICMP 95490	53	190	1.99	3.3
Gudmay × ICMP 96593	53	199	1.47	3.0
Tokroray pop (local)	54	218	1.57	38.3
Gudmay pop (local)	57	198	1.75	35.6
ICMV 221 (exotic)	45	177	2.02	0.3
ICMP 96593 (exotic)	52	204	1.91	0.7
ICMP 95490 (exotic)	52	203	1.43	0.3

Table 2. Grain yield of four Eritrean landrace × introduced variety population crosses in three lowest and three highest yielding on-farm trials, and averaged across 30 trials in Eritrea 2001 (11 trials) and 2002 (19 trials).

Grain yield (t/ha)	Tokroray × ICMV 221	Tokroray × ICMP 96593	Gudmay × ICMP 95490	Gudmay × ICMP 96593	Local landrace
Lowest	0.55	0.54	0.56	0.49	0.51
Highest	2.45	2.28	2.42	2.24	1.82
Mean	1.37	1.17	1.30	1.15	1.01

The four population crosses were sown in on-farm trials, along with the farmer's local cultivar as a control, across 41 sites in Anseba and Gash Barkha during 2001 and 2002 to evaluate their performance in actual production environments. Data collected from 30 sites across the two years shows that the grain yields of the new population crosses were similar to those of the local farmers' landraces in the lowest yielding environments, and were higher in the higher yielding environments (Table 2).



Cumulative grain yield performance of Hagaz and local landrace cultivars across 30 locations.

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

The first Eritrean Research bred pearl millet variety - Hagaz.

Hagaz was released in 2004 by the National Agricultural Research Institute of Eritrea for cultivation in Eritrea. This is the first indigenously developed improved pearl millet cultivar to reach the farmers in Eritrea. It will provide farmers with a higher yielding and slightly longer duration alternative to the introduced variety 'Kona' (ICMV 221), which was released in Eritrea in 2000.

Relief, Development, or both?

Governments, research institutes, development agencies, donors... everyone struggles when they have to choose between relief and development. Where should their priorities lie? Short-term interventions to rescue communities affected by natural disasters such as drought? Or development investments (capacity building, markets etc) that will give bigger pay-offs, but only in the long term?

Scientist working with the community to ensure effective use of relief package.

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

Large-scale relief programs have been implemented in Zimbabwe during the last several years. Governments and donors provide not only food aid but also farm inputs to get small-scale farm communities back on their feet. But do these programs give value for the money invested? ICRISAT asked some basic questions:

- Are relief programs targeting the poorest people; and if not, how to ensure that they do?
- What inputs should be distributed – could a different 'package' give higher pay-offs?
- How to measure the impacts?
- Do beneficiaries have the knowledge to make effective use of relief aid; and if not, where should we focus training efforts?
- How can program design be improved?

Off target

A series of surveys were conducted, covering nearly 3000 households across 19 districts in Zimbabwe, with some surprising results. First, targeting was inadequate. Most NGOs had specific criteria to select beneficiary households – for example female-headed households, households caring for orphans or sick people, those without additional sources of income (eg remittances). There are two questions. Are these the right criteria? And can they be implemented under field conditions? Unfortunately, the answer to both questions is, probably not. For example, gender of household head, or number of orphans or sick family members, were not clear indicators of crop production (hence vulnerability or food insecurity). In any case, many of these criteria were simply not practical to implement by NGO staff pressed for time. For example, there were no differences between relief recipients and non-recipients in terms of household composition, income, or degree of food-insecurity.

One solution to both problems would be to use a different criterion – livestock ownership. The survey found that draft power was the key determinant of farming success. Households with adequate draft animals (2 cattle or 4 donkeys) planted 60% more land, and harvested 70% more grain, than households without draft power. Cattle ownership is a robust indicator of food security; cattle are traditionally a sign of wealth; and ownership is easy to establish. In short, use cattle ownership as the yardstick to identify which households should receive relief inputs. This would be quicker and fairer than currently used methods, and would identify the poorest households more accurately.

New seed, new horizons

Farmers are much better at handling seed than we give them credit for. The recent surveys (as well as earlier ICRISAT studies) show that even after severe drought, farmers are either able to save some seed stocks, or acquire them from neighbors or village markets. In fact, much of the relief seed is never planted, for various reasons – including poor quality seed, distribution of a poorly adapted variety – or even of a crop not normally grown in the area. Relief NGOs must provide not just any seed, but seed of new varieties. This is where the big impacts will come. ICRISAT and other partners have developed and tested a range of high-yielding, early-maturing, locally adapted varieties. Relief programs must select the right variety for each environment, ensure seed quality is good, and distribute it in clearly labeled bags. The emphasis should be on quality, not quantity – better to distribute high-quality seed of improved varieties to a few affected communities, rather than poor seed to all.

Improved, high-yielding variety of millet.

Seed or fertilizer?

ICRISAT has helped dispel the myth that fertilizer distribution does no good in low-rainfall areas. In fact, if it's done right, distribution of fertilizer gives more than double the returns from seed distribution, even in dry areas. The solution is micro-dosing: small quantities of fertilizer, applied directly to the plant, at the right time (5 to 6-leaf stage in cereal crops). On-station and on-farm trials in drought-prone areas in Zimbabwe have shown how farmers can get excellent returns from as little as *one-fourth* the 'ideal' dose recommended by government extension programs.

Relief programs are now helping to promote micro-dosing more widely. ICRISAT provides technical backstopping and monitoring for a DFID relief program in Zimbabwe. In 2004, over 160,000 farmers (45% women) received 25 kg of nitrogen fertilizer, together with a pamphlet in the local language, explaining how best to use this small quantity. In parallel, we implemented over 1200 demonstration trials across the country. The trials were planted and managed entirely by farmers – and the results were spectacular. Micro-dosing increased grain yields by 30 to 50%, and almost *every* farmer achieved significant gains. The 160,000 households increased their production levels by an estimated 40,000 tons. The program has significantly improved household food security, and saved US$7 million in food aid requirements. Most important, these gains went directly to many of the poorest farmers in the country.

Seed relief – a powerful development tool.

Logistics and linkages

ICRISAT economists are also looking for other ways to improve the efficiency and impacts of relief programs in Zimbabwe. The studies offered new insights on logistics, farmer perceptions, and impact monitoring; and specific recommendations to improve household coverage, cost-effectiveness, and return on donor investments. Building on the study, ICRISAT led an NGO consortium in developing a comprehensive set of guidelines covering design, implementation, monitoring, and coordination amongst relief NGOs. The guidelines have been adopted by all major international agencies in the country.

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

Village seed banks spark farmer-participation

A small-scale seed producer in Mali.

The Challenge

Investments by ICRISAT and partners have resulted in the development of a broad range of varieties. But, farmers have little access to seed of improved varieties, as the formal sector is unable to meet their needs. The private sector is not keen either. Is there a sustainable method to get past this bottleneck?

Empowering the farmers

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

Approach

A groundnut seed project funded by the Common Fund for Commodities (CFC) in partnership with ICRISAT and the national agricultural research systems (NARS) of Mali, Niger, Nigeria and Senegal, was initiated in 2003. The major thrust of this project is to establish sustainable community-based seed systems. Training farmers and other stakeholders along the commodity chain is an integral part of this strategy.

Participatory variety selection (PVS) trials were established in three pilot sites of the major groundnut zones of each country involving 45 locations – Kolokani, Keta and Kayes districts of Mali; the departments of Dosso, Maradi and Zinder of Niger; the states of Kaduna, Kano and Kastina in Nigeria; and in northern-, middle- and southern-groundnut basins of Senegal. The Mother and Baby trial approach was used for the on-farm evaluation of improved varieties supplied by ICRISAT and the respective NARS programs.

During the 2003 rainy season, 144 trials were established across the four countries. The number of varieties evaluated in each country varied from 3 to 6. In the 2004 crop season, the PVS trials were expanded to 200 in 45 pilot sites using the 2003 trial design. Farmers selected at least two improved groundnut varieties based on their preferences. The major criteria being early maturity, high pod and fodder yield, disease resistance, taste, drought tolerance and marketability.

Farmer to farmer visits.

Some of the varieties have already been released, while others such as ICGV 86124 (in Senegal) and Fleur 11 (in Mali) have been recommended for release. In Mali, Waliyartiga (ICG 7878), Fleur 11, JL 24 ICG (FDRS) 4 and Mossitiga have been the most preferred varieties. In Senegal, farmers selected ICGV 86124 for drought tolerance and ICGV 89063 as edible groundnut. The newly released varieties [SAMNUT 21, SAMNUT 22 and SAMNUT 23 (ICGV-IS 96894)] in Nigeria are highly appreciated by farmers because of their high pod and fodder

yield. More important, these varieties are resistant to the devastating groundnut rosette disease.

On-farm seed production.

Community-based seed production

Choosing a variety is only half the story. Equally important is to ensure that enough seed is available for all who want to grow it. This has stimulated the emergence of community-based associations at the village level. Four individual farmers and four associations in Kolokani have begun to produce seeds of selected varieties for sale in the community. A similar situation has occurred in the other countries. Most of the seed produced was distributed among members, and little was sold in the market. On the other hand, the individual farmers were linked to the national seed certification agency and the seed was sold to other farmers in the community.

In order to assess farmers' willingness to effectively demand groundnut seed, the four initial seed producers in Kolokani were linked to three small village retailers. Seed was sold in the markets of Kolokani, Toirobougou, Nosombougou and Djidjeni.

Highlights 2003 and 2004

- In each of the four countries, farmers are highly motivated by being directly involved in variety selection and seed production.
- There has been an increased awareness among farmers about the needs of processors and consumers, recognition of the importance of good quality seed, and willingness to pay higher prices.
- An information systems strategy comprising various pathways (flyers, newsletter, web site, technical bulletins/manuals, rural radios and formal publications) has been developed.
- Formal and informal seed systems have been studied and the information will be used in fine-tuning the institutional framework for sustainable community-based seeds systems in the region.
- Over 1000 farmers, extension agents, NGO staff were trained in
  - ➢ seed production and variety maintenance, and
  - ➢ preharvest and postharvest crop management.
- A hundred rural entrepreneurs (25 each from Mali, Niger, Nigeria and Senegal) were trained in small-scale seed business management.
- Ten socioeconomists from five countries (Burkina Faso, Mali, Niger, Nigeria and Senegal) were trained in impact assessment methodologies.
- To ensure a sustainable supply of breeder seed, revolving funds have been established in Niger and Nigeria.

Teaching farmers about seed quality and good practices.

On-farm PVS trials provide farmers with first hand information about the advantages of improved varieties and agronomic practices. The trials also empower farmers to select new varieties under their own management and using their own criteria. The trials are also a source of good quality seed, besides providing training to the farmers in seed production and variety maintenance. Individual farmers and farmer associations in the pilot areas willing to multiply seed have come forward with promising options for a sustainable community-based seed system.

Managing Mother Earth in East and Central Africa

Agricultural research and development experiences in Asia, especially through the work of ICRISAT in India, can provide answers to most of the natural resource challenges being faced in East and Central Africa (ECA). ICRISAT in partnership with the Soil and Water Management Research Network (SWMnet) of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) is working towards exploiting this potential.

The relationship between ASARECA and ICRISAT goes back to 1998 when ICRISAT, at the request of ASARECA, participated in the first planning meeting to initiate a network on soil and water management research. The proposal for the establishment of SWMnet was drafted at this meeting, and ICRISAT agreed to be the implementing agency (scientific partner) for SWMnet, with responsibility to provide both administrative and technical backstopping for the network. The proposal was accepted by the EU, who agreed to provide financial support. The network finally started activities in September 2003. In less than two years, SWMnet is proving to be invaluable by developing a regional agenda for natural resource management research, linking scientists and institutions in the region, leveraging funds to support the priority agenda, and more importantly, facilitating knowledge sharing and effective use of knowledge and technologies relevant to ECA.

The regional agenda developed by this partnership is based on the recognition that to achieve the ASARECA strategic goal of "increasing economic growth and improving social welfare in the ECA sub-region while enhancing the quality of the environment", there are three major challenges that need to be addressed –

- Climatic variability leads to unreliability in the soil-moisture available for plant growth, even in high rainfall areas. It is because of this variability that the sub-region has failed to convert its relatively large gross water resources into meaningful economic assets.
- The inherently low soil fertility of most soils in the region coupled with very low use of fertilizer causes a high rate of nutrient depletion leading to rapidly decreasing productivity of land and water resources in agricultural lands.
- The subsistence nature of smallholder farming limits investments in the development and sustainable management of land and water resources.

SWMnet and ICRISAT have not only developed effective programs to address these constraints but have also been successful in raising substantial funding support to implement this program.

Managing the variable climate

The climate problem is more severe in the countries with dry climates (Figure 1) where high year-to-year variability makes it difficult to maintain stable food supplies. Realizing the need to develop effective strategies to manage the uncertainty in production, ICRISAT and SWMnet developed a program to enable investors in rain-fed farming to better manage risks and opportunities associated with climate variability as well as change. ASARECA went one step further than endorsing the program by supporting a component aimed at demonstrating the potential and impact of seasonal climate forecasts, which enables farmers and their support agencies to plan and perform effectively in the semi-arid tropical areas of Ethiopia, Kenya and Madagascar through its competitive grant mechanism.

South-south collaboration for technology exchange

Considering the long term it would take to obtain impact from research, and the limited capacity of NARS in sub-Saharan Africa, the partnership laid emphasis on leveraging more benefits through adaptation of existing knowledge than from entirely new research. A global search for successful examples identified the Indian experiences as the most relevant to the region due to close similarity in climate, ecological, and socio-economic (livelihood, poverty and employment) conditions between the two regions.

ICRISAT in collaboration with IWMI and the Indian Council of Agricultural Research (ICAR) facilitated the visit of a SWMnet delegation to India in March, 2004 to gain first hand experience of the success stories in India, and to interact with the research managers, active researchers, and farmers, particularly of integrated watershed management and the Institute Village Link Programme. The members were thoroughly impressed by what they saw and recommended a strong partnership with ICAR. This was followed by two other mission trips, during which scientists from ICAR and ECA got an opportunity to understand each other well. While a MOU between ASARECA and ICAR to facilitate long-term collaboration is being prepared, Rwanda took the lead in formalizing its partnership with ICAR. The Government of Rwanda, through its agricultural research institute (ISAR), is working with ICAR to implement pilot sites for the adaptation and demonstration of Indian experiences in integrated management of watersheds. These sites will also serve as learning sites under SWMnet for the whole sub-region.

Empowering subsistence farmers to practice market oriented farming

Commercialization and enterprise-orientation of smallholders' production is important to foster self-reliance and empower them to contribute to economic development and poverty reduction. The challenge is to enable poor farmers and other actors to use improved management of soil and water resources to seize opportunities for profitable enterprises that ensure food security and increased incomes. This is something the agricultural research community has largely ignored until now. A more comprehensive effort is needed to help subsistence farmers understand the markets they are being called to enter. There is very little work to link improvement in soil, water and nutrients with issues of inputs and outputs markets. SWMnet and ICRISAT initiated efforts in this direction with a project titled *Market-oriented approaches for integrated management of soil-water and nutrients for crops in east and central Africa*. The project aims at institutionalizing among extension staff and farmers, systematic decision making at field levels, in relation to enterprise development and profitability in Ethiopia, Tanzania and Madagascar. Further, SWMnet-IFAD-ICRISAT developed another project to enhance the development impact of public and private investments in smallholder agricultural water management. This will be achieved through engaging in policy dialogue, assessing options for broadening and improving future engagement in agricultural water management, providing program implementation support to enhance impact, and promoting knowledge management and sharing of experiences.

Based on achievements so far, we can conclude that soil and water management research in ECA is moving towards a new phase. The partnership between ICRISAT and ASARECA, which is based on a shared commitment to work on issues important to the region, may very well be the turning point.

Prospering with peas and peanuts

About 90% of the land in southern China is covered with mountains, which lack vegetative cover, leading to soil erosion and frequent landslides. Each year tons of topsoil and valuable nutrients are lost and such areas have become unfit for agriculture. This problem has bothered the Chinese Government for years, but with the introduction of two ICRISAT crops, pigeonpea [*Cajanus cajan* (L.) Millsp.] and groundnut, (aka peanuts) [*Arachis hypogaea* (L.)], new signs of prosperity from agricultural lands are greatly evident in China.

Pigeonpea performs

Pigeonpea is not a new plant species in China. About 1500 years ago traders carried pigeonpea seeds from eastern India to southern China, where it was used for rearing the insect *Kerria lacca* Kerr., for production of lac, (a commercial resin), but its cultivation gradually ceased due to loss of the international lac market.

In 1997, ICRISAT-bred new pigeonpea material was tested for the first time in Yunnan province, thus beginning the rebirth of pigeonpea in China. After initial trials at several locations, the Yunnan and Guangxi provinces were selected for research on the role of pigeonpea in various cropping systems, not for food, but for controlling soil erosion and rehabilitating eroded soils. ICRISAT played an important role in this endeavor by providing suitable seed material, a package of production technologies, and training to Chinese scientific and extension staff.

Animal crackers!

Southern China's rural economy relies heavily on animal husbandry too, so shortage of quality fodder is a perennial problem, particularly in the postrainy season. Pigeonpea to the rescue! Its tender leaves and branches make excellent fodder, which provides high protein (20–22%) for domestic animals. An evaluation of pigeonpea in Guangxi showed that variety ICPL 93047 produced 54 t ha^{-1} of fresh or 29 t ha^{-1} of dry fodder with five cuttings. Fodder pigeonpea is primarily fed to cattle, sheep, goats, and rabbits, the boiled seeds are used to prepare feed mixtures with other ingredients for pigs, and raw seeds are fed to chickens.

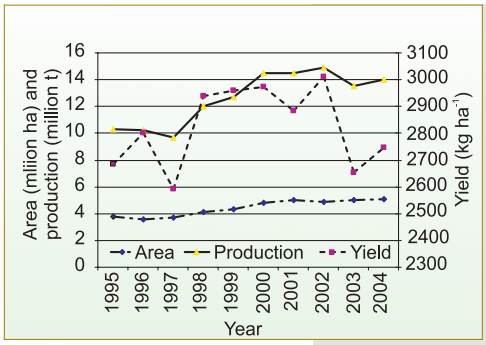
Greening the slopes

Joint efforts by ICRISAT and the Chinese Government have renewed hopes of greening the barren mountain regions of southern China. The reclaimed lands (over 25 m ha degraded mountain slopes are available for reclamation) can be used to cultivate other food crops. Pigeonpea has also been selected as an afforestation crop in major Government reconstruction projects, and can now be seen growing on roadsides, hillsides and riverbanks. Efforts are now on to popularize green pigeonpea for human food. Chinese food technologists have developed a number of food items using dry and green seeds, a pigeonpea training center has been established in GxAAS, Nanning, and a Pigeonpea Farmers' Association was established in 2004 to promote marketing and seed production.

Groundnut's rapid rise

Groundnut production in China has grown by leaps and bounds from 1995 to 2004. The annual growth rate of groundnut area was 4.35%, production increased by 4.69%, and productivity rose by 0.33%. In contrast, the world's

groundnut growth rates for the same period were 1.84%, 2.27%, and 0.42% for area, production and yield. With wider use of improved varieties and production technologies, the average groundnut productivity in the country has reached 2.7 t ha^{-1}. However, there are still large areas where groundnut yields are low. ICRISAT's collaboration with the Chinese Academy of Agricultural Sciences (CAAS), the Oil Crops Research Institute (OCRI), the Shandong Peanut Research Institute (SPRI), the Crops Research Institute (CRI), and other groundnut institutions dates back to the early 1980s.



Genetic Enhancement

Nearly half of the introduced groundnut germplasm in Chinese genebanks comes from ICRISAT. OCRI developed an elite breeding line, R 1549, using an ICRISAT line, ICGV 86699, as one of the parents. ICRISAT introduced about 2200 germplasm lines, breeding populations and advanced breeding lines into South China. Among these, 226 are highly resistant to rust, 49 are highly resistant to bacterial wilt, 10 are highly resistant to both rust and bacterial wilt, 8 are resistant to *Aspergillus flavus* (responsible for aflatoxin contamination), 35 are tolerant to drought and 83 have good oil and protein qualities. Utilizing these sources, CRI and its collaborating institutions have released 10 groundnut varieties, which now cover a large cultivation area in South China.

The technology using polythene mulch and bacterial wilt resistance sources were given to other partners in the region. The Chinese also provided leadership to the Groundnut Bacterial Wilt Working Group in Asia. The research on bacterial wilt and groundnut viruses at OCRI won national recognition in China. Under an ADB-supported project at ICRISAT, OCRI identified SSR and AFLP markers for resistance to bacterial wilt and seed invasion by *Aspergillus flavus*.

Capacity building

Human resource development is essential for sustainable research. To date, ICRISAT has trained 59 Chinese scientists in various scientific and technological aspects of groundnut. In addition to holding joint workshops/meetings in China, many Chinese scientists have participated in regional and international groundnut events.

Involving the farmers

Since 2002, an IFAD TAG 532-ICRISAT project (Programme for farmer participatory improvement of grain legumes in rainfed Asia) is in operation in Hubei and Guangdong provinces of China. Technologies that contribute to higher productivity in Hubei have covered more than 10,000 ha in Hongan, Dawu and nearby counties in Hubei, resulting in an estimated 15 million Yuan (1 US$ = 8.25 Yuan) economic benefit to poor farmers. Under a poverty alleviation program, the support for poor farmers from the local governments was in cash, which was short lived and unsustainable. Now the local governments are paying more attention to capacity building of farmers. Because of the farmer participatory project, the groundnut area under improved varieties has increased considerably, leading to establishment of several food processing factories. The income of participating farmers has, on average, shown a 15% increase.

Long-term plan

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

Sorghum – linking farmer, feed-manufacturer, fellow scientists and fowl

Traditional sorghum grown in the rainy season is often vulnerable to grain mold attack, making it unfit for human consumption. But with improved sorghum cultivars that are less susceptible to molds, all would not be lost. Also, grain harvested in the rainy season can still fetch a profit from the brewing industry (whiskey), and at a more basic level, from the poultry feed industry, which is growing at a rate of 15-20% per annum. The estimated maize requirement (principal poultry feed) by 2020 AD will be around 31 million tons compared to the present 3.5 million tons, revealing a large gap that can be filled by sorghum – even moldy sorghum to a certain extent.

Project leader Dr Belum VS Reddy with happy project participant farmer couple in Mahabubnagar District.

Until recently, apprehension about energy levels of sorghum-based feed has been the major cause for its limited use. To address this issue and to create a sustainable market link between rainy season sorghum farmers and the poultry industry, ICRISAT developed a project titled *Exploring marketing opportunities through a research, industry and users coalition: sorghum poultry feed (DFID- R8267).* The main objective of this project is to create marketing opportunities by developing sustainable economic linkages in the sorghum-poultry feed chain through innovative coalition systems.

The four outputs set out for the project are:
1. Poultry feed formulations with available sorghum cultivars,
2. Formation of a sustainable farmer-scientist-industry coalition,
3. Technology access to the target groups accelerated, and
4. Understanding the coalition system as a process.

A unique feature of the project is the “coalition approach”, ie, the process in which distinct/ independent entities/institutions/partners work together right from the project conception stage to the concluding stage towards a common goal with synergistic effect.

Partners: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India along with Acharya NG Ranga Agricultural University (ANGRAU); Federation of Farmers Associations (FFA); Andhra Pradesh Poultry Federation (APPF); and a private poultry feed manufacturer (Janaki Feeds) implemented this project.

Project activities

Under the project, smallholder sorghum growers from four villages of Mahabubnagar and Ranga Reddy districts of Andhra Pradesh, India were selected and supplied with the seed of improved sorghum cultivars for rainy season 2003. The crop performance was monitored regularly and farmers were advised on the production practices to be followed for increased productivity. After harvest, the grain was bulked cultivar-wise and supplied to the feed manufacturers by the farmers. Feed formulations were prepared in the feed manufacturer’s mill and supplied to ANGRAU, who conducted Poultry Feed Trials (PFTs).

The reaction was reassuring. Not only farmers participating in the project, but other farmers of the villages also expressed their satisfaction with regard to the grain and fodder productivity of these improved cultivars. Noting the enthusiasm and positive response of the farmers, more than

500 smallholder sorghum growers spread over 12 villages in the target districts were supplied with seed of the improved cultivars in the 2004 rainy season. The ICRISAT-private sector consortium was also involved in supplying the seed to participant farmers. This ensured the participation of the private sector seed industry in the project implementation. Preliminary attempts to link farmers to the feed manufacturer were immediately successful, in that the farmer groups collected the surplus grain for marketing, which poultry feed manufacturers then purchased.

Hens fed on sorghum-based diets.

Salient results

A steering committee chaired by the representative from the feed industry (Janaki Feeds) was formed to closely monitor all aspects of the PFTs and buying-in of the results by the poultry industry. During one of the review and planning workshops held at ICRISAT, Janaki Feeds indicated the need to conduct additional PFTs, which would be of more relevance to the poultry industry. Based on the perceptions of poultry producers and recommendations of the steering committee, ANGRAU completed the feed trial, ie, part-by-part replacement of maize with sorghum. To improve the skin and shank color of birds and yolk color of eggs, *Stylo* was also included in one of the treatments. In another meeting the APPF representative expressed the need to repeat the layer trial with commercial layer strains, which was also conducted with appreciable results. The results proved that maize could be replaced 100 per cent with sorghum for both layers and broilers. The trial results were disseminated to a larger group of poultry producers/feed manufacturers through stakeholders' mini-workshops, which provided for wider acceptance.

Broilers performance (Cobb method)

- Body weight gain and feed consumption on sorghum diets at all inclusion levels were comparable to control (maize) diet
- Better feed efficiency compared to maize diets was found with sorghum cultivars CSV-15, CSH-16, PSV-16 and a local variety at 100% inclusion level.
- Cost of sorghum-based feed (in rupees) per kg live weight gain was less than maize diets.

Layers performance (ILR 90 Jubilee method)

- Comparable results obtained with control and sorghum diets with respect to body weight and feed conversion ratio (FCR) up to the 8th week of age
- Birds fed on sorghum diets attained standard body weight of 1.2 kg by the end of the 18th week
- Egg production performance of layers fed on sorghum diets was comparable to maize diets
- Progressive levels of inclusion of sorghum in diets caused proportionate decrease in egg yolk yellow color.
- However, egg yolk color was partially recovered by addition of S*tylo* leaf meal in the diets at 3%.

Conclusion

The coalition system thus helped to present the right kind of incentives to benefit the poor sorghum farmers, feed manufacturers, poultry producers, and the scientists.

All partners benefited from this project –

- The crop breeder got feedback on the cultivar traits preferred by the farmers.
- The poultry scientists developed new sorghum-based feed formulations for poultry in lieu of maize, which will benefit the poultry producers as well as poor farmers.
- The poor sorghum farmers benefited from the collaborative help/guidance from researchers and from cultivation of improved cultivars.

Media workshops: Demystifying biotechnology

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

Explaining the concept in the lab.

Though there was enough polemics, there was a deemed dearth of information for journalists who wished to write about the transgenic technology itself. Something needed to be done. In 2004, the Communication Office at ICRISAT initiated a unique and innovative series of media workshops on agri-biotechnology. The objective: provide a platform for ICRISAT scientists, external experts, stakeholders and journalists to interact, discuss and debate agri-biotechnology, and more particularly the transgenic technology.

As a public-funded international agricultural research institute generating international public goods, ICRISAT felt the need to communicate transgenic technology. At the media workshops, ICRISAT scientists had detailed interactions with journalists and took them through the biotechnology laboratories and fields, enthusiastically giving detailed explanations in response to questions. The journalists came, they saw and they communicated.

The first in the series of agri-biotech media workshops was organized at ICRISAT headquarters at Patancheru (near Hyderabad in southern India) in October 2004. The three-day event was organized in collaboration with the United Nations Education, Scientific and Cultural Organization (UNESCO); the International Service for the Acquisition of Agri-Biotech Applications (ISAAA), and the Asian Media Information and Communication Center of India (AMIC-India).

This media workshop attracted 30 middle- to senior-level specialist journalists from India, Bangladesh, Sri Lanka and Nepal. In addition to the resource persons from ICRISAT, the workshop also attracted international resource persons. Additionally, it brought together diverse stakeholders on agri-biotechnology – government agencies, regulators, scientists, intellectual property experts, civil society leaders, farmers’ representatives and the seed industry.

Inaugurating the workshop.

A second media workshop was held at New Delhi in India in April 2005. This two-day workshop, organized in collaboration with ISAAA and the Indian Council of Agricultural Research, met the needs of a different clientele – journalists from North India writing and reporting in Hindi. The questions were more region-specific and down-to-earth, and so were the responses.

A third media workshop was organized at Dhaka, in Bangladesh, during the last week of August 2005. Again, this was organized in collaboration with ISAAA, and had a high participation from Bangladeshi journalists, besides journalists from Sri Lanka and Pakistan.

A fourth workshop, scheduled for the last quarter of 2005, will move the action to an entirely different continent – sub-Saharan Africa. This workshop will cater to the needs of French-speaking journalists from Burkina Faso, Ivory Coast, Mali, Niger and Senegal. Organized in collaboration with ISAAA and UNESCO, the workshop will be held at ICRISAT's regional hub in Niamey, Niger.

Journalists' day out.

The series of media workshops have yielded interesting results. For the first time, ICRISAT scientists had the opportunity to spend quality time with journalists, thereby getting a better understanding of their journalistic needs to develop an interesting story. They initiated long-term interaction between journalist-participants and the resource persons. On the other hand, journalists came to understand the science of biotechnology, sharpen their skill in science reporting and develop stories on this for release to the media. An e-mail discussion group was initiated, which continues the interaction in cyber space.

The first media workshop generated many news stories in the national and international media. Journalist-participants had been reporting on the workshop from the first day onwards. One of the participants, representing the *Agence France Presse* bureau in New Delhi, wrote a report that was picked up by 50 international media outlets, including the International Herald Tribune and the Hong Kong Times.

The news and feature stories from the media workshop established ICRISAT's agri-biotech research on the global media map, which appeared in many subsequent news stories:

- In the New Scientist magazine as part of its special cover feature on technological growth in India
- In the *Earth Report* on GM crops transmitted by BBC-World
- In the *Superquark* program of the Italian Rai TV, (telecast in September 2005)
- In the special feature on agri-biotechnology published by Business India
- Kiran Sharma, Principal Scientist (Biotechnology) listed as one of the 10 outstanding young scientists by Outlook magazine.

By investing in long-term relationship with the media, the workshops will continue to deliver results in the future, chiefly making the mysteries of biotechnology open to a wide spectrum of stakeholders.

Media workshop participants at Patancheru.

ICRISAT Governing Board

Augustine Uzo Mokwunye, *Nigeria*
Chairman of the Board (From Apr 2003)
3, 4th Ayiku Lane (Behind Barclays Bank)
Baatsonaa
Accra
GHANA
Tel: 823835/0244-313243
Email: mokwunye@ghana.com
u.mokwunye@cgiar.org

Mangala Rai, *India*
Vice-Chairman (From Mar 2003)
Secretary, Government of India
Department of Agricultural Research and Education, and Director General, Indian Council of Agricultural Research (ICAR)
Krishi Bhavan, New Delhi 110 001, India
Tel: 91-11-23382629
Fax: 91-11-23384773
Email: mrai@icar.delhi.nic.in

William D Dar, *Philippines*
Director General
International Crops Research Institute
for the Semi-Arid Tropics (ICRISAT)
Patancheru 502 324
Andhra Pradesh, India
Tel: 91-40-30713222
Fax: 91-40-30713072
Email: w.dar@cgiar.org

Gladys MN Mutukwa, *Zambia*
(until March 2004)
Gladys Mutukwa & Associates
PO Box 33717
Lusaka, Zambia
Tel: 260-97-786642
Fax: 260-1-293009
Email: msodzi@hotmail.com

Simon G Best, *UK*
6B Wester Coates Road
Edinburgh
EH12 5LU
UK
Tel: +44-131-313-3260
Email: drsimonbest@ifb.co.uk

Joao Ambrosio de Araujo Filho, *Brazil*
(From Apr 2002)
Empresa Brasileira de Pesquisa Agropecuaria
Centro Nacional de Pesquisa de Caprinos
Fazenda Tres Lagoas
Estrada Sobral-Groairas, Km 4
Caixa Postal D-10, Sobral, Ceara
Brazil, CEP 62011-970
Tel: 88-6777033
Fax: 88-6777055
Email: ambrosio@cnpc.embrapa.br

Roger N Beachy, *USA*
President
Donald Danforth Plant Science Center
975 N Warson Road
St. Louis, MO 63132, USA
Tel: 1-314-587-1201
Fax: 1-314-587-1301
Email: rnbeachy@danforthcenter.org

Mohan Kanda, IAS, *India*
Chief Secretary, Government of Andhra Pradesh
Secretariat, Hyderabad 500 022
Andhra Pradesh, India
Tel: 91-40-23452620
Fax: 91-40-23453700
Email: csap@ap.nic.in

Norah K Olembo, *Kenya*
Biotechnology Trust Africa
Family Health Plaza
PO Box 1285, 00100
Nairobi
Kenya
Phone: 254-20-603-983
254-20-600-040
Email: bta@swiftkenya.com

Stein W Bie, *Norway*
Imsroa
N-2480 Koppang, Norway
Tel: 47-624-61030
Email: steinwbie@online.no

Osamu Ito, *Japan*
Director
Crop Production and Environment Division
Japan International Research Center for Agricultural Sciences
1-1 Ohwashi, Tsukuba
Ibaraki, 305-8686 Japan
Phone: 81-29-838-6306
Fax: 81-29-838-6651
Email: osamuito@jircas.affrc.go.jp

Caroline Pestieau, *Canada*
Appt. 2107
556 Laurier Avenue West
Ottawa, Ontario K1R 7X2
Canada
Tel: 1-613-241-5259
Fax: 1-613-241-5259
Email: Cpestieau@rogers.cc

Radha Singh, *India*
Secretary, Government of India
Department of Agriculture and Cooperation
Ministry of Agriculture
Krishi Bhavan
New Delhi 110 001, India
Tel: 91-11-23382651/8444
Fax: 91-11-23386004
Email: secyagri@krishi.delhi.nic.in

Khauhelo D. Raditapole, *Lesotho*
(From 1 Apr 2005)
C/o National Assembly
PO Box 190
Maseru
Lesotho
Phone: 266-22-323035
Email: parliam@ilesotho.co

ICRISAT in the News

THE HINDU, Monday, February 14, 2005

'India will be ready for GM crops soon'

By Our Staff Reporter

HYDERABAD, FEB. 13. The Director-General of ICRISAT, William D. Dar, said ICRISAT's Agri-Science Park had established itself as a hub for commercialisation of frontline research in agriculture, he told a press conference at WoAsia 2005 here on Saturday.

K.K. Sharma, Head of Transgenic Research, ICRISAT, highlighted the various advances in ... and emerging crops in the coming few years.

Venkataram Balaji, stressed the need for bio-safety education of farmers as India already had large acreage under genetically modified crops. He spoke about ICRISAT's experience in this and willingness to share it with others.

Dr. Dar listed bio-pesticide research, Agri-Biotech Park and Agri-Business Incubator as among the success stories of the Agri-Science Park.

Food safety labs

Aventhagen and Suri Sehgal Foundation had already started facilities at the Agri-Biotech Park. ICRISAT was setting up the Acharya N.G. Ranga Agricultural University, he said. The Andhra Pradesh Government was partnering with ICRISAT for setting up a special facility to test aflatoxin contamination in food crops.

A consortium of 10 companies was working to commercialise ICRISAT technologies on bio-pesticides, which would reduce the need for chemical pesticides while 29 companies from various countries had joined ICRISAT's other consortia on sorghum and pearl millet research.

Four companies had joined the Agri-Business Incubator to commercialise production of ethanol from sweet sorghum, transgenic cotton and vegetables. Development of fermentation ...

THE HINDU BUSINESS LINE, Wednesday, February 9, 2005

Icrisat develops hybrid pigeonpea variety

Our Bureau

Hyderabad, Feb. 8

THE International Crops Research Institute for the Semi-Arid Tropics (Icrisat)has developed a technology to produce hybrid pigeonpea variety.

Plant breeders can now use the technology, which involves crossing the wild relative of pigeonpea Cajanifolius with a cultivated variety to produce stable, cytoplasmic male-sterility based hybrids for commercialisation. The new hybrids can almost double the ... about 3 tonnes per hectare, in comparison to released commercial varieties. According to Dr William Dar, Director General, Icrisat, the new hybrid technology has been made possible through partnership with the Indian Council of Agricultural Research and private sector companies.

According to Dr K.B. Saxena, principal pigeonpea breeder at Icrisat, three varieties have been developed and were ready for use. While the ... duration ... ones mature between 160 and 180 days, and the long-duration ones take more than 250 days.

In evaluation, these hybrids showed near-doubled productivity, high stability and no plant deformity.

Pigeonpea (also known as tuvar dal or arhar dal in India) is annually grown over 4 million hectares by resource-poor farmers. In ...

THE HINDU BUSINESS LINE, Wednesday, August 10, 2005

Invest more in dry land farming: Icrisat

Our Bureau

Chennai, Aug. 9

INVESTMENTS to develop dry land farming need to be increased to levels in irrigated farming for rural development and for the benefits of modern technology, including biotechnology to reach the rural poor, according to Dr William Dar, Director-General, International Crops Research Institute for the Semi-Arid Tropics (Icrisat).

In a presentation on Icrisat's work to journalists from *The Hindu* group of publications, Dr Dar said, "On a scale of 1-10, investments in dry land farming would rate one and in irrigated farming 10." While maintaining the commitment to irrigated agriculture, investments in dry land agriculture have to be hiked, he said.

In this direction, Icrisat, which works exclusively on dry land crops, will commercialise the first genetically engineered groundnut resistant to the peanut clump virus in 2008. "This would be the world's first transgenic groundnut," he said.

Icrisat is also working on commercialising transgenic pigeonpea and chickpea that would be resistant to pod borers. It hopes to enhance the social acceptance of biotechnology by working with the stakeholders, particularly farmers and the civil society organisations. Farmers' acceptance of biotechnology would have a decisive impact on social acceptance, he said.

"India is one of the rising stars of biotechnology," Dr Dar said. A strong Government policy backed by support from farmers would help increase its acceptance. Biotechnology is a modern tool that will accelerate breeding of beneficial crops. "Who would not like to use less pesticides. Who would not like to grow crops that have more nutrients than those at present," he asked.

Responding to a query, he said that extending the benefits of such development to dry land farmers would have a telling impact on rural development. India is importing huge quantities of oilseeds and pulses, but most of its research work is directed towards rice and wheat, he pointed out.

As of now, it is only the rich farmer who has benefited from the developments in irrigated farming. The focus should be more on the smallholder farmer, he said.

Icrisat is advocating this point of view to the policy makers. "It can only advocate." It is up to the Government to carry it forward, he said.

Dr William Dar, Director-General, International Crops Research Institute for the Semi-Arid Tropics (Icrisat), at a presentation on Tuesday. – V. Ganesan

Icrisat, which is one of the 15 institutions under the CGIAR (Consultative Group on International Agriculture Research) and the only one with its headquarters in India, is supported by over 60 countries and foundations. It is a non-profit, non-political, international organisation for science-based agricultural development.

Its research is dedicated to the small farmers and rural poor in Asia and Sub-Saharan Africa. Established in 1972, it works out of two regional hubs, Kenya and Niger, in Africa apart from a number of Asia countries and its headquarters is in Hyderabad, Andhra Pradesh.

Dr Dar said that its work does not stop with development of crop varieties but ensures that it is commercially utilised by the small farmers. It works on five major crops in the dry lands – sorghum, pearl millet, groundnut, chickpea and pigeonpea.

In India, over 145 improved crop varieties could be traced to the parental lines developed by Icrisat, he said. It provides over 12,000 germplasms annually to the National Agricultural Research System. In addition, it is involved in watershed development, agri-business incubator park for commercialisation of technologies and has a set up a Virtual Academy for Semi Arid Tropic using information and communication technology to reach farmers. Experts in Icrisat have assisted students from academic and research institutions, he said.

Healing wounds through farm research

Business Standard

accént Andhra

WEDNESDAY 9 FEBRUARY 2005 HYDERABAD

Icrisat develops new pigeonpea hybrid seed production technology

OUR REGIONAL BUREAU

Hyderabad, 8 February

The International Crops Research Institute for the Semi-Arid Tropics (Icrisat) has developed the technology to produce cytoplasmic male-sterility (CMS) based hybrid pigeonpea from a cross involving cajanus cajanifolius, a wild relative of the cultivated pigeonpea.

Plant breeders can now use ... ogy to produce stable ... cialisation, which ... ductive" ... compa ...

With a pre... pigeonpea ... that takes ... quantum. T... of the limita... pigeonpea hybr...

The newe... Icrisat 's partn... cil of Agricultur... vate-sector com... gy, Icrisat develo... 200 hybrids.

Using the CMS ... gy, pigeonpea expe... been developed for a ...

Icrisat...

... groups for the crop, KB Sa... rus, principal pigeonpea br... er at Icrisat, said.

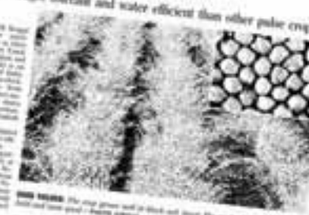
While the short-dur... pigeonpea varieties ma... between 120 and 140 day... medium-duration one... ture between 160 an... days, and the long-du... ones take more than 25...

The institute has rai... CMS system as the B... CMS System in Pigeon... nouring B ... ma...

FARMER'S NOTEBOOK

High yield chickpea for dry regions

The crop is drought tolerant and water efficient than other pulse crop...



The Times of India, Hyderabad, Thursday, March 3, 2005

Farmers to benefit from resistant pearl millet

It is plenty amid scarcity in Kothapally

ICRISAT aided community project helps watershed management

THE HINDU BUSINESS LINE

Wednesday, September 15, 2004

Icrisat launches Strategy 2010

Our Bureau

Hyderabad, Sept 14

THE International Crops Research Institute for the Semi-Arid Tropics (Icrisat) has launched Strategy 2010 to strengthen research and research delivery to improve agricultural production and livelihoods in the dry land areas of Asia and sub-Saharan Africa.

The strategy was approved by the governing board of Icri... met at Niamey in ...

10 AGRI-BUSINESS

Icrisat biopesticide project gets World Bank award

Our Bureau

Hyderabad, May 27

A PROJECT developed by the International Crops Research Institute for the Semi-Arid Tropics (Icrisat) for managing pigeonpea pod borer (Helicoverpa armigera), through the production and use of the biopesticide, nuclear polyhedrosis virus (NPV), ... duction of NPV builds on the traditional farmers' practice of vigorously shaking pigeonpea plants to dislodge caterpillars (Helicoverpa larvae) and collect to use them for the virus multiplication in a village," says Dr G.V. Ranga Rao, Icrisat Project Scientist ...

Icrisat, MSSRF working on salt-resistant seed varieties

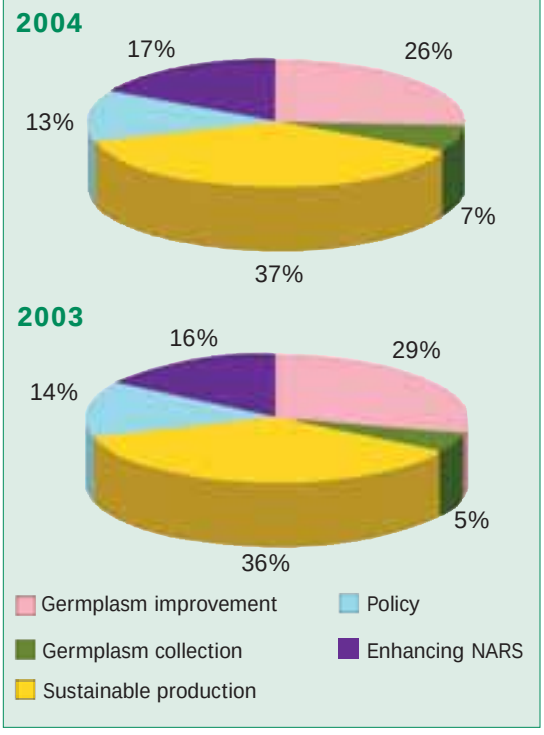
Financial Summary

Balance sheet

US$ thousands

	2004	2003
Assets		
Cash and cash equivalents	4311	5,389
Investments	20,394	10,283
Accounts receivable	5,790	6,484
Inventories	512	618
Prepaid expenses	202	313
Property and equipment - net	5,515	5,900
Other assets	774	6,927
Total Assets	**37,498**	**35,914**
Liabilities		
Accounts payable	4,300	4,317
Accruals and provisions	1,328	990
Payments in advance from donors	5,976	6,951
In-trust funds	-	140
Long-term liabilities	9,428	7,212
Total Liabilities	**21,032**	**19,610**
Net Assets		
Unrestricted		
Unappropriated	4,247	4,117
Appropriated	10,133	9,133
Permanently restricted	2,086	3,054
Total Net Assets	**16,466**	**16,304**
Total Liabilities and Net Assets	**37,498**	**35,914**

Expenditure by CGIAR Activity



Operating results and movements in net assets

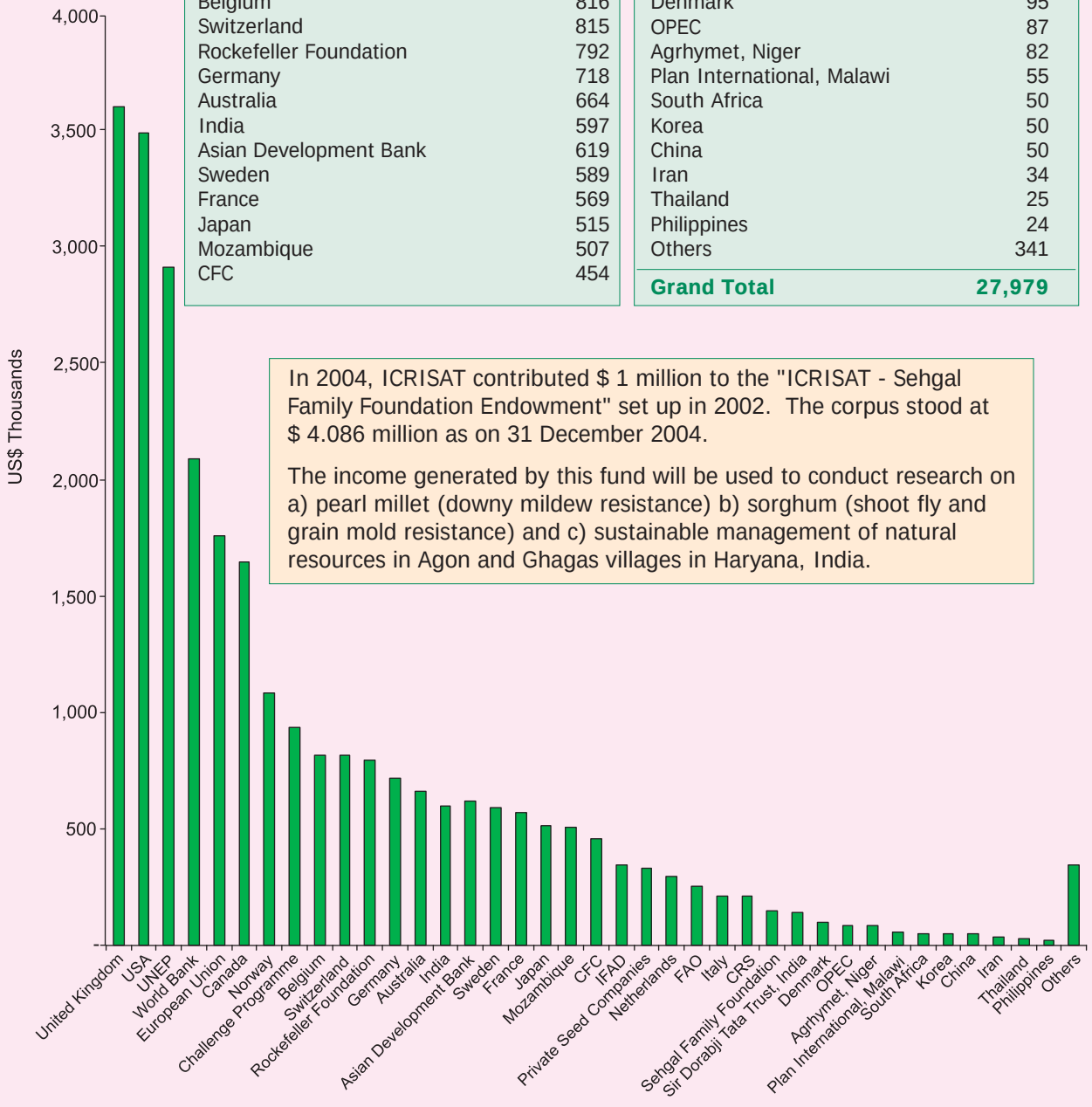
(US$ '000)

	2004	2003
Operating results		
Revenue	30,301	24,204
Expenditure	27,004	23,654
Change in net assets, operational	**3,297**	**550**
Net assets - unrestricted		
Unappropriated		
Balance, beginning of the year	4,117	3,021
Operating (deficit)/surplus for the year	3,297	550
Improvements to physical facilities	-	(63)
Transfer from appropriated net assets	-	63
Changes in accounting policies		
Employee benefits (Pension Fund & Gratuity)	(3,167)	-
Special Purpose housing loan fund	-	281
Reclassification of loans granted from erstwhile housing loan fund	-	203
Additions to special purpose housing loan fund	-	62
Balance, end of the year	**4,247**	**4,117**
Appropriated		
Balance, beginning of the year	10,133	9,477
Changes in accounting policies		
Acquisition of Physical facilities	-	(63)
Special purpose housing fund	-	(281)
Transfer to net assets - Permanently Restricted	-	1,000
Total Net Assets - Unrestricted	**10,133**	**10,133**
Net Assets - Permanently Restricted	**2,086**	**2,054**
Total Net Assets	**16,466**	**16,304**

Grant income from donors for 2004

Donor	$ '000
United Kingdom	3,598
USA	3,486
UNEP	2,913
World Bank	2,091
European Union	1,760
Canada	1,643
Norway	1,080
Challenge Programme	932
Belgium	816
Switzerland	815
Rockefeller Foundation	792
Germany	718
Australia	664
India	597
Asian Development Bank	619
Sweden	589
France	569
Japan	515
Mozambique	507
CFC	454

Donor	$ '000
IFAD	345
Private Seed Companies	327
Netherlands	294
FAO	250
Italy	209
CRS	208
Sehgal Family Foundation	151
Sir Dorabji Tata Trust, India	144
Denmark	95
OPEC	87
Agrhymet, Niger	82
Plan International, Malawi	55
South Africa	50
Korea	50
China	50
Iran	34
Thailand	25
Philippines	24
Others	341
Grand Total	**27,979**



In 2004, ICRISAT contributed $ 1 million to the "ICRISAT - Sehgal Family Foundation Endowment" set up in 2002. The corpus stood at $ 4.086 million as on 31 December 2004.

The income generated by this fund will be used to conduct research on a) pearl millet (downy mildew resistance) b) sorghum (shoot fly and grain mold resistance) and c) sustainable management of natural resources in Agon and Ghagas villages in Haryana, India.

ICRISAT Senior Staff

(Name, Designation, *Nationality,* (Location))

Patancheru (Headquarters)

Director General's Office

William D Dar, Director General, *Philippines*

C Geetha, Senior Manager, *India*

Prabhat Kumar, Director, Business and Country Relations, *India,* (New Delhi)

Communication Office

Rex L Navarro, Director, Communication Office and Special Asst to the DG, *Philippines*

Lydia Flynn, Editor-in-Chief, *India*

Project Development and Marketing Office

Barry I Shapiro, Director, Project Development and Marketing, *USA*

Internal Audit

TN Menon, Head, *India*

Human Resource and Operations

IR Nagaraj, Director, Human Resources and Operations, *India*

AJ Rama Rao, Senior Manager, *India*

C Narasimha Reddy, Senior Manager-Medical Services, *India*

Housing and Food Services

K Ravi Shankar, Head, Housing and Food Services, *India*

Transport Services

K Jagannadham, Senior Manager, *India*

Security Office

TD Peter, Head, Security Service, *India*

Purchase, Supplies and Disposal Services

T Kulashekar, Senior Manager, *India*

Financial Services

Rajesh Agarwal, Director-Finance, *India*

S Sethuraman, Head, Financial Services, *India*

Deputy Director General's Office

JDH Keatinge, Deputy Director General-Research, *Ireland*

Global Theme - Agroecosystems

JVDK Kumar Rao, Special Project Scientist, *India*

Rosana P Mula, Special Project Scientist, Post Doctoral, *Philippines*

Prabhakar Pathak, Principal Scientist Soil & Water Management, *India*

A Ramakrishna, Senior Scientist Agronomy, *India*

Piara Singh, Principal Scientist Soil Science, *India*

TK Sreedevi, Scientist, Watershed Development, *India*

Suhas P Wani, Principal Scientist Watersheds, *India*

Global Theme - Biotechnology

David A Hoisington, Global Theme Leader, *USA*

Vanamala Anjaiah, Special Project Scientist, *India*

Jayshree Balaji, Scientist, Bioinformatics, *India*

Subhash Chandra, Principal Scientist, Statistics and Head Bioinformatics, *India*

CT Hash, Principal Scientist, Breeding, *USA*

Junichi Kashiwagi, Associate Scientist (Drought Tolerance), Crop Physiology, *Japan*

Lava Kumar, Special Project Scientist, Virology, *India*

Nalini Mallikarjuna, Senior Scientist, Cell Biology, *India*

T Nepolean, Special Project Scientist, *India*

S Masood Rizvi, Special Project Scientist, *India*

N Seetharama, Senior Scientist, Physiology, *India*

S Senthilvel, Special Project Scientist, *India*

Kiran K Sharma, Principal Scientist, Cell Biology, *India*

Vincent Vadez, Senior Scientist, Physiology, *France*

Rajeev K Varshney, Senior Scientist AGL, *India*

Farid Waliyar, Advisor to the DG and Principal Scientist Pathology, *France*

Global Theme - Crop Improvement

CLL Gowda, Global Theme Leader, *India*

Ashok S Alur, Project Co-ordinator, CFC, *India*

FR Bidinger, Visiting Scientist, Crop Physiology, *USA*

PM Gaur, Senior Scientist, Breeding, *India*

VN Kulkarni, Visiting Scientist, Pearl Millet, *India*

Jagdish Kumar, Principal Scientist, Breeding, *India*

SN Nigam, Principal Scientist, Breeding, *India*

S Pande, Principal Scientist, Pathology, *India*

P Parthasarathy Rao, Senior Scientist, Economics, *India*

RPS Pundir, Visiting Scientist, Genetic Resources, *India*

KN Rai, Principal Scientist, Breeding, *India*

S Ramesh, Visiting Scientist, Sorghum breeding, *India*

GV Ranga Rao, Special Project Scientist, IPM, *India*

CH Ravindra Reddy, Visiting Scientist, CFC, *India*

Belum VS Reddy, Principal Scientist, Breeding, *India*

Aruna Rupakula, Scientist, Breeding, *India*

OP Rupela, Senior Scientist Microbiology, *India*

KB Saxena, Principal Scientist, Breeding, *India*

HC Sharma, Principal Scientist, Entomology, *India*

RP Thakur, Senior Scientist, Pathology, *India*

HD Upadhyaya, Principal Scientist, (Genetic Resources) Genebank, *India*

Global Theme - Markets, Policy and Impact

MCS Bantilan, Global Theme Leader, *Philippines*

P Parthasarathy Rao, Senior Scientist, Economics, *India*

K Purnachandra Rao, Principal Scientist, VLS, *India*

Agri Science Park

Raghavendra Prasad, CEO, Agri Science Park, *India*

Karuppan Chetty, Manager, Agri Business Incubator, *India*

Knowledge Management Sharing (KMS)

V Balaji, Head, KMS, *India*

S Srinivas, Head, Library and Documentation Services, *India*

PJ Modi, Manager, Information Systems Unit, *India*

Sreenath Dixit, Manager, Virtual Academy for the Semi-Arid Tropics (VASAT), *India*

Farm and Engineering Services

NSS Prasad, Head, Farm and Engineering Services, *India*

M Prabhakar Reddy, Head, Farm Services, *India*

KRC Bose, Manager, Engineering Services, *India*

West and Central Africa (WCA)

Niamey, Niger

Saidou Koala, Director-WCA, *Burkina Faso*

Ramadjita Tabo, Asst Regional Director, WCA, and Principal Scientist, Agronomy, GT-Agroecosystems, *Chad*

Youssouf Camara, Post Doctoral Fellow, *Ivory Coast*

MS Diolombi, Regional Finance Officer and Administrator, *Nigeria*

Bruno Gerard, Senior Scientist, GT-Agroecosystems, *Belgium*

Bettina Haussmann, Senior Scientist, Pearl Millet Breeding, *Germany*

Marie-Julie Menard, Project Manager, VASAT, and Regional Information Officer, *Canada*

Jupiter Ndjeunga, Senior Scientist, Economics, GT- Markets, Policy and Impacts, *Cameroon*

Albert Nikiema, Post Doctoral Fellow, *Burkina Faso*

Dov Pasternak, Principal Scientist, Desert Margin Issues, GT-Agroecosystems, *Israel*

Lennart Woltering, Associate Professional Officer, Water Management Specialist, *Netherlands*

Bamako, Mali

BR Ntare, Country Representative, and Principal Scientist, Breeding, GT-Crop Improvement, *Uganda*

Eva W Rattunde, Principal Scientist, Sorghum Breeding and Genetic Resources, GT-Crop Improvement, *Germany*

HFW Rattunde, Principal Scientist, Sorghum Breeding and Genetic Resources, GT-Crop Improvement, *USA*

Margret Loeffen, Associate Professional Officer, Socioeconomics, *Netherlands*

Pierre CS Traore, Manager, GIS, GT-Agroecosystems, *Mali*

Tom Van Mourik, Associate Professional Officer, Agronomy-Striga, *Netherlands*

Eastern and Southern Africa (ESA)

Nairobi, Kenya

Said N Silim, Director ESA & Principal Scientist Breeding, *Uganda*

RB Jones Assistant Regional Director, *Nairobi*

Peter Cooper, Principal Scientist, *UK*

A Debelo, Regional Network Coordinator-ECARSAM, *Ethiopia*

Eastonce Gwata, Post Doctoral Fellow, *Zimbabwe*

R Folkertsma, Project Coordinator-Striga Project, GT-Biotechnology, *Netherlands*

N Hatibu Regional Coordinator, SWMnet, *Tanzania*

Mary A Mgonja, Principal Scientist, Breeding, GT-Crop Improvement, *Tanzania*

Barnabas N Mitaru, Regional Coordinator-ECARSAM, *Kenya*

Philip Ndung'u, Regional Administrator, *Kenya*

KPC Rao, Special Project Scientist, GT-Agroecosystems, *India*

Bekele Shiferaw, Senior Scientist, Resource and Development Economics, GT- Markets, Policy and Impacts, *Ethiopia*

Santie M de Villiers, Regional Scientist, Legume Cell Biology, GT-Biotechnology, *South Africa*

Bulawayo, Zimbabwe

David D Rohrbach, Country Representative, and Principal Scientist, Economics, GT- Markets, Policy and Impacts, *USA*

Steven J Twomlow, Global Theme Leader, GT-Agroecosystems, *UK*

Jane Alumira, Associate Scientist, Impact Assessment, GT- Markets, Policy and Impacts, *Kenya*

Joseph Rusike, Special Project Scientist, GT- Markets, Policy and Impacts, *Zimbabwe*

John P Dimes, Senior Scientist, Farming Systems Modeling, GT-Agroecosystems, *Australia*

Paul Belder, Associate Professional Officer, Dryland Agrohydrology, *Netherlands*

Sabine Homann, Post Doctoral Fellow, *Germany*

Lewis Hove, Post Doctoral Fellow, *Zimbabwe*

K Mazvimavi, Post Doctoral Fellow, *Zimbabwe*

Andre F van Rooyen, Regional Coordinator, Desert Margins, GT-Agroecosystems, *South Africa*

Ajay Varadachary, Regional Information Officer, Communication Office, *India*

Lilongwe, Malawi

Moses Siambi, Country Representative, and Senior Scientist, Agronomy/Seed Production, *Kenya*

ES Monyo, Principal Scientist, Legumes Breeding, *Tanzania*

Janneke Verheijen, Associate Professional Officer, Sociology, *Netherlands*

Maputo, Mozambique

Carlos E Dominguez Otero, Country Representative, and Seed Systems Specialist, *Colombia*

Joel I Cossa, Project Manager, *Mozambique*

Collaborative Staff

CIP

Sarathchandra G Ilangantileke, Post Harvest Specialist, *Sri Lanka*, (New Delhi)

CIRAD

B Clerget, *France*, (Bamako)

Fabrice Sagnard, *France*, (Bamako)

IFPRI

Karl M Rich, Assistant Scientist, Post Doctoral, *Germany*, (New Delhi)

ILRI

Michael Blümmel, Project Team Leader, South Asia, *Germany* (Patancheru)

Akira Kamidohzono, Soil Scientist, *Japan*, (Niamey)

Augustine Ayantunde, Team Leader, *Nigeria*, (Niamey)

Oumar Diall, Veterinary Scientist, *Mali*, (Bamako)

Peter G Bezkorowajnyj, Project Manager, *Canada,* (Patancheru)

William Thorpe, Regional Representative for Asia, *UK*, (New Delhi)

IPGRI

PN Mathur, Principal Scientist–IPGRI, *India*, (New Delhi)

International School of Hyderabad

Helge Gallinger, Head Teacher, International School of Hyderabad, *Germany*

IWMI

Madar Samad, Theme Leader, *Sri Lanka,* (Patancheru)

Celio Mattia, Researcher, (APO), *Switzerland,* (Patancheru)

JIRCAS

Ryoichi Matsunaga, Team Leader and Soil Scientist, *Japan*, (Niamey)

Keiichi Hayashi, Soil Scientist, *Japan*, (Niamey)

ODI

C Longley, ODA, *UK*, (Nairobi)

ROCARS

Aboubacar Toure, Associate Coordinator, *Mali*, (Bamako)

Suri Sehgal Foundation

MD Gupta, Technical Director, *India*

WWF

Biksham Gujja, Special Project Scientist, *India*

Development Investor Partnerships Initiated in 2004

Supplementing the CGIAR's core support to carry out new targeted projects

Donor	Project	Collaborators
Australia	Improving the quality of pearl millet residues for livestock	International Livestock Research Institute (ILRI)
	Resistance identified in the wild chickpea species *Cicer reticulatum*	Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia
Canada	Increasing the impacts of soil fertility research in Southern Africa	NARS in Southern Africa International Development Research Centre (IDRC), Canada
	Strengthening ICRISAT's research for development program in East and Southern Africa	IDRC, Canada
	Research into the Development and Effective Use of ICT-enabled Rural Extension System in Afghanistan	Ministry of Agriculture and Livestock, Government of Afghanistan
	Gestion Communautaire Des Pasturages (GCP) En Zone Sahelienne Et Soudano-Sahelienne Au Fakara Au Niger	La Federation des Unions des Groupements Paysans du Niger (FUGPN), Niger Centre régional de formation et d'application en agrométéorologie et hydrologie opérationnelle (AGRHYMET), Niger
FAO	Monitoring and assessment of agricultural relief programmes in Zimbabwe	NARS and NGOs in Zimbabwe
	Development of set of options for governments, donors and NGOs in relief and recovery programmes designed to strengthen crop-livestock systems in the context of drought	NARS and NGOs in Zimbabwe
	Support for implementation of Junior Farmer Field Schools in HIV/AIDS affected communities in Zimbabwe	NARS and NGOs in Zimbabwe
	Support for sustainable conservation and enhanced utilization of genetic diversity in foxtail millet germplasm collections held in trust by ICRISAT	NARS in India
	Support for global plan of action on the conservation and sustainable utilization of plant genetic resources for food and agriculture	
	Support of the regeneration, characterization and long-term conservation of the designated accessions of the small millets germplasm collections held in trust by ICRISAT	NARS in semi-arid tropics
Germany	Arresting the scourge of Striga on sorghum in Africa by combining the strengths of marker-assisted backcrossing and farmer-participatory selection	University of Hohenheim, Germany; NARS in Eritrea, Kenya, Mali and Sudan

Donor	Project	Collaborators
IFAD	Desertification, Drought, Poverty and Agriculture Challenge Programme	Global Mechanism of UNCCD; Italy; ICARDA, Syria; Wageningen University, Netherlands; Purdue University, USA; NARS in sub-Saharan Africa
	Accelerating technology adoption to improve rural livelihoods on the rainfed gangetic plains	International Rice Research Institute (IRRI), Philippines; NARS and NGOs in India
India	Towards research, equipment and training support to the Agri-Science Park at ICRISAT, to develop new technologies	Government of Andhra Pradesh and Private Sector Companies
Norway	Enhancement of groundnut production in the non-traditional and dryland areas of Malawi for improved nutrition and poverty alleviation	Development Fund, Norway; NARS in Malawi
Philippines	Enhancing adoption of ICRISAT legume varieties and technologies in the Philippines	Bureau of Agriculture, Department of Agriculture, Philippines; The Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), The Philippine Agriculture and Resources Research Foundation, Inc. (PARRFI), Philippines
Rockefeller Foundation	Pigeonpea Improves Livelihood: Diversification of Pigeonpea Genetics to Enhance productivity in Eastern and Southern Africa	NARS in Eastern and Southern Africa
	Breaking the yield barrier: Heterosis in West-African pearl millet – a preliminary assessment	NARS in West Africa
Switzerland	Development and evaluation of transgenic chickpea for tolerance to drought stress by using P5CSF gene and Drought Responsive Regulatory Elements	University of Basel, Switzerland; Bose Institute, India; University of Delhi, India; Jawaharlal Nehru University, India; Madurai Kamaraj University, India
UK	Technical support to DFID funded NGOs implementing the Protracted Relief Programme	NARS and NGOs in Zimbabwe
	Institutionalised scaling-up and uptake promotion of outputs from soil and water management research in East and Central Africa	Ethiopian Agricultural Research Organization, Ethiopia; Department of Research and Development, Tanzania; Kenya Agricultural Research Institute, Kenya; Agricultural Research and Technology Corporation of Sudan, Sudan.
	Synthesis and promotion of post-harvest innovation systems in South Asia	Centre for Research on Innovation and Science Policy (CRISP), India
	Policy and strategy for up-scaling of chickpea ICM in Nepal	Natural Resources Institute, UK; Department of Agriculture, Nepal Agricultural Research Council, Nepal
	Enhancing chickpea establishment and productivity through seed priming	NARS in Kenya

Donor	Project	Collaborators
USA	Technology-based responses to market challenges of smallholder farmers in Malawi	National Smallholder Farmers' Association of Malawi
	Pod borer resistant chickpea for Bangladesh	Bangladesh Agricultural Research Institute, Bangladesh; Sathguru Management Consultants, India
	TSV Resistant Oil Seeds – Bio-Engineered sunflower and peanut genotypes with resistance to Tabacco Streak Virus	Donald Danforth Plant Science Center, USA; Mahyco Research Foundation, India; Sathguru Management Consultants, India
	Regional node for Southern African Strategic Analysis and Knowledge Support System (SA-SAKSS)	International Water Management Institute (IWMI), Sri Lanka NARS in Southern Africa
	Africa Seed Network	Iowa State University, USA; International Fertilizer Development Center, USA
	Identification and functional validation of genes conditioning broad-spectrum disease resistance in rice and pearl millet	International Rice Research Institute (IRRI), Philippines; University of Georgia, USA
	Improving the drought tolerance of maize and sorghum through comparative genomics, germplasm analysis and marker-assisted breeding	CIMMYT, Mexico; Kansas State University, USA
	Comparative analysis of functional and anonymous SNP diversity in pearl millet and sorghum: PCR-based tools for accelerated direct (gene-based) and indirect (marker-based) selection across the cereals	Kansas State University, USA; University of Georgia, USA
	Enhancing sustainable productivity of sorghum and rural income in West and Central Africa through Research and networking	NARS in West and Central Africa
	Improving rural livelihoods in Southern Africa	International Institute of Tropical Agriculture (IITA), Nigeria; NARS in southern Africa
	Initiative on bio-diesel plantation (Asia)	NGOs in India
	Introduction of African Market Garden to the semi-arid tropics of West and Central Africa	NARS in sub-Saharan Africa
	Support for collaborative activities	University of Georgia
World Bank	Implement the survey of farming households in the districts of Mahabubnagar and Ananthapur	NGOs in India
Others		
Seed Companies	Diversification of sorghum hybrid parents for increased stable production	Seed companies
Seed Companies	Diversification of pearl millet hybrid parents for increased stable production	Seed companies
Seed Companies	Diversification of pigeonpea hybrid parents for increased stable production	Seed companies

Donor	Project	Collaborators
Biopesticide Companies	Protecting crops and promoting businesses, eco-friendly materials for protecting crops of SAT farmers	Biopesticide companies
Effem India Pvt Ltd	To promote collaborative research and related activites	NARS, NGOs in India
Plan International, Malawi	Groundnut and pigeonpea project	NARS and NGOS in Malawi
CINS, Nairobi	Technical support in the preparation of training modules on farm-level sorghum seed management in Somalia	NARS, Farmers, Seed Traders in Somalia Cooperazione Italiana Nord-Sud; Kenya; Somalia Aid Coordination Body, Somalia
COSV, Zimbabwe	Support to COSV programs in Hwange, Lupane and Nkai Districts, Zimbabwe	Coordination of Organizations for Voluntary Service (COSV), Zimbabwe
	Seed quality assessment	NARS in Zimbabwe
Syngenta Foundation	Support to the Eritrean millet breeding program for 2004-2006	NARS in Eritrea
	Breaking the yield barrier: Heterosis in West-African pearl millet – a preliminary assessment	NARS in West Africa
Sehgal Foundation	To conduct reserch on comparative genomes of drought tolerance in sorghum and maize.	Suri Sehgal Foundation, India
TVS Agri-Science Research Institute	Technical backstopping under TVS-SRI-ICRISAT collaboration	TVS Agri-science Research Institute, India
Consortia of donors (via CGIAR)		
CIMMYT – Generation Challenge Program	Unlocking genetic diversity in crops for the resource poor	ICARDA, Syria; University of Agricultural Sciences, Dharwad; India; UAS Regional Research Station, Bijapur, India; Marthwada Agricultural University, Parbhani, India
IWMI – Water and Food Challenge Program	Enhancing rainwater and nutrient use efficiency for improved crop productivity, farm income and rural livelihoods in the Volta basin	Centro International de Agricultura Tropical (CIAT), Colombia; Tropical Soil Biology Fertility Institute of CIAT (TSBF-CIAT), Colombia The United Nations University (UNU), Ghana The Center for Development Research (ZEF), University of Bonn, Germany The Semi-Arid Food Grain Research and Development (SAFGRAD), Burkina Faso Savanna Agricultural Research Institute (SARI), Ghana Institut de l'Environnement et de Recherches Agricoles (INERA), Burkina Faso
	Empowering farming communities in Northern Ghana with strategic innovations and productive resources in dryland farming	Savanna Agricultural Research Institute, Ghana
	Development of technologies to harness the productivity potential of salt-affected areas of the Indo-Gangetic, Mekong, and Nile River basins	International Rice Research Institute (IRRI), Philippines

Donor	Project	Collaborators
CGIAR/ICT-KM Program	Information and communication technology (ICT) – Global public goods program: VASAT	CG Centers
	Information and communication technology (ICT) – Global public goods program: Desktop video conferencing	CG Centers
	Implementing research activities for the 2nd level Connectivity Project under the CGIAR ICT-KM Program	CG Centers
	CSI project under the CGIAR ICT-KM Program Meta-data inventory and on-line meta-data server	CG Centers
CIMMYT	Soil Fertility Consortium for Southern Africa (SOFECSA) – Characterization and Synthesis Activities	NGOs in Zimbabwe
IFPRI	Study on Revitalizing agricultural policies to accelerate growth in Andhra Pradesh	NARS and NGOs in Andhra Pradesh, India
	Study on rationalization of subsidies in AP Agriculture	NARS and NGOs in Andhra Pradesh, India
	Impact of HIV/AIDS on inter- and intra-generational information flows among smallholder farmers	Chancellor College, Malawi; Overseas Development Institute, UK, NARS in Malawi and Mozambique
	Institutional and Organizational Innovations for Accessing Markets and Empowering Communities: Collective	Centre for Economic and Social Studies, India; Institute of Policy Analysis and Research (IPAR), Kenya
	Action and Property Rights for Poverty Reduction in Rainfed Systems	NARS in SAT
ILRI/SLP	Identification of forage type pigeonpea germplasm for wide range of environments	
	New dual-purpose sorghums for the Savannah zone of Western Africa: Establishing the basis for enhanced dry-season feeding and increased crop-livestock integration	NARS in West Africa
IPGRI	Institutional Learning and Change (ILAC): Watershed research at ICRISAT: Innovation histories and experiences of action learning in practice	Centre for Research on Innovation and Science Policy (CRISP), India
	Enhancing farmer livelihoods through improved on-farm management of plant genetic resources: Developing an innovative conceptual, methodological and operational framework	NARS in Mali

Attributed support for core programs from Canada, Commission of the European Communities (CEC), Iran, Japan, France, and South Africa is not listed but is included in the Financial Summary.

Research Scholars

Names	Country	Degree	Topic
Completed in 2004			
B Pushpavathi	India	PhD	Pathogenic and genetic diversity in populations of *Sclerospora graminicola*, the incitant of downy mildew in pearl millet
B Santha	India	PhD	Tissue culture and genetic transformation of dryland cereals with emphasis on pearl millet
P Ramu	India	MSc	Marker assisted back crossing of stay green QTL into elite sorghum lines
T Nepolean	India	PhD	QTL mapping of grain and stover yield in pearl millet
B Padmaja	India	PhD	Identifying effective cropping systems for carbon sequestration and their effect on soil organic matter in semi-arid tropics
D Anitha Kumari	India	PhD	Mechanisms and diversity of resistance to Helicoverpa in pigeonpea
P Satish Kumar	India	PhD	Marker-assisted back cross transfer of QTLs for terminal drought tolerance between elite pearl millet maintainer lines
P Sri Lakshmi	India	PhD	Characterization of Isolates of *Trichoderma* spp. for their biocontrol ability against *Aspergillus flavus* in groundnut
H Abdullahi Nur	Somalia	PhD	Management of aflatoxin contamination in groundnut through biological control, host plant resistance and botanicals
Surinder Kumar Gulia	India	PhD	QTL mapping and marker assisted improvement of downy mildew resistance in ICMB 89111
N Sridevi	India	MSc	Marker-assisted backcrossing of a stover quality QTL in pearl millet
Scott Ryan Nelson	USA	PhD	Emerging partnerships in biotechnology the remaking of Indian agriculture in the twenty-first century
R Chandra Mouli	India	MSc	Assessing opportunities for marker-assisted backcrossing of stay-green QTLs from sorghum donor E36-1
Mohan Prakash Bhagwat	India	PhD	Inhibition of Helicoverpa gut proteases by trypsin inhibitors from wild relatives of pigeonpea and chickpea
Ch Ashok Kumar	India	MSc	Improved early maturity in groundnut
D Prabhakar Reddy	India	PhD (Discont)	Introgression of pod borer resistance in to pigeonpea (*Cajanus cajan*) using incompatible wild relatives
G Manisha	India	PhD (Discont)	Development of new PCR-based sequence specific co-dominant markers for groundnut and molecular genetic characterization of ICRISAT groundnut germplasm
Y Venkanna	India	MSc	Bioefficacy of certain new insecticides against pest complex of groundnut
D Guruva reddy	India	MSc	Research on validation of available IPM components against groundnut pest complex in Andhra Pradesh
P Varalakshmi	India	PhD	Construction of integrated genetic maps in pearl millet
Luu Minh Cuc	Vietnam	PhD	Molecular tagging of a resistance gene to groundnut bacterial wilt/late leaf spot/rust pot rots
Jiang Huifang	China	PhD	Genetic diversity and molecular markers of resistance to bacterial wilt in groundnut

Names	Country	Degree	Topic
P Vasudeva Reddy	India	MSc	Effect of eco-friendly insecticides on *Helicoverpa armigera* (Hübner) and its natural enemies in chickpea ecosystem
Latha Nagarajan	India	PhD	Millet Biodiversity and seed systems study
Ylva Besemer	USA/Sweden	PhD	Role of Arbuscular mycorrhizal fungi in subsistence agor-ecosystems of the semi-arid tropics of Zimbabwe
Jean-Marie - Kileshye Onema	DRC	MSc	Hydrological assessment of land use changes and human effects on water resources in semi-arid Zimbabwe : The case of Insiza sub Catchment.
Norman Masiri	Zimbabwe	MSc	An on-farm evaluation of the effects of low cost drip irrigation on water and crop productivity, compared to conventional surface irrigation systems.
Jean-Maria Mwenger Kahinda,	Zimbabwe	MSc	Water productivity and yield gap analysis of water harvesting systems in the semi-arid Mzingwane catchment, Zimbabwe
Lindane Mkandla	Zimbabwe	BSc	The Response of Cowpeas (*Vigna Unguicuilata* L.) to Different Phosphorus Levels Applied to a Sandy Soil
Continuing in 2004			
J Sailasree	India	PhD	Microbiological and molecular characterization of microorganisms for the management of Helicoverpa armigera
G Sujana	India	PhD	Studies on mechanisms of resistance to pod borer in wild relatives of pigeonpea (*Cajanus cajan* (L))
Ch Anuradha	India	PhD	Genetics and Molecular Marker Studies in Chickpea (*Cicer arietinum* L.)
Dev Vart	India	PhD	Genetics of cytoplasmic - nuclear male sterility and molecular markers of their restorer genes in pearl millet
S V Siva Gopala Swamy	India	PhD	Pigeonpea transgenics for resistance to *Helicoverpa armigera*
V Girija Shankar	India	PhD	Bioinformation of sorghum explants using Bt and other gene constructs
D Ramgopal	India	PhD	Studies on phenotypic and molecular characterization and evaluation in Cicer wild species and their interspecific populations
Hameeda Bee	India	PhD	Studies on agriculturally beneficial microorganisms: Diversity and dynamics in cropping systems contrasting for crop residues and pest management
Mukesh Kumar	India	PhD	Effects of cytoplasmic male - sterility on expression of resistance to Sorghum shoot fly
Santhosh P Deshpande	India	PhD	QTL analysis for shoot fly resistance in sorghum (*Sorghum bicolor* L Monech.)
M Swathi Sree	India	PhD	Analysis of biochemical and physiological response of legumes to drought
A Ramakrishna Babu	India	PhD	Evaluation of transgenic chickpea for resistance to pod borer *Helicoverpa armigera* Hubner
D Srinivasa Reddy	India	PhD	Gene expression in groundnut transgenics under abiotic stress conditions
G Sreelatha	India	PhD	Genetic transformation for pod borer resistance through Agrobacterium in pigeonpea [*Cajanus cajan* (L.)]
T Jyothi	India	PhD	SSR-marker assisted backcross introgression of QTL's for host plant resistance to Shoot fly in sorghum

Names	Country	Degree	Topic
R Prathibha	India	PhD	Molecular mapping of Ascochyta blight resistance in chickpea
S Chander Rao	India	PhD	Studies on transgenic resistance to viral diseases in groundnut
S Nedumaran	India	PhD	Assessing the impacts of policy and technological interventions in micro-waterhses A bio-economic modeling approach
M Pooja Bhatnagar Mathur	India	PhD	Studies on the development of abiotic stress tolerance in groundnut *Arachis hypogaea* by genetic transformation
M Jyostna Devi	India	PhD	Identification of mechanisms for drought response in groundnut (*Arachis hypogaea* L.)
V Lakshmi Narayanamma	India	PhD	Genetics of resistance to pod borer *Helicoverpa armigera* in chickpea
K Sireesha	India	PhD	Determination of efficacy of different HaNPV strains and standardization of production procedures
Bongani Ncube	Zimbabwe	PhD	Improving Legume Cultivation and Residual Nitrogen Benefits to Subsequent Sorghum (*Sorghum bicolor*) under Semi Arid Conditions in Southern Zimbabwe
Patricia Masikate	Zimbabwe	MPhil	Tillage and Manure Interactions Under Dryland Cropping in Semi-Arid Zimbabwe
Joined in 2004			
S Srinivasan	India	MSc	Allelic relationships penetrance and expressivity of genes controling number of flowers per axis in chickpea
Vanam Sunitha	India	MSc	Population dynamics and management of Maruca vitrata on short duration pigeonpea
V Raja Ram	India	MSc	Development of TRAP markers for genes in carotenoid biosynthesis pathway in sorghum and pearl millet
S Venkateswara Rao	India	MSc	Marker assisted backcrossing of sorghum staygreen QTLs
Ch Siva Kumar	India	PhD	Biochemical mechanisms of resistance to sorghum shoot fly *Atherigona soccata*
Damaris Achieng Odeny	Kenya	PhD	Development of SSRs and mapping of resistance to Fusarium wilt in pigeonpea
Reshma Rizvi	India	PhD	Physiology genotypic variation and marker assisted selection for efficient soil phosphorus acquisition in pearl millet
G Velu	India	PhD	Genetic variability for iron and zinc content in pearl millet
Shivaji Pandurang Mehtre	India	PhD	Genetic diversity analysis QTL mapping and marker-assisted selection for shoot fly resistance in sorghum
Vijay Abarao Dalvi	India	PhD	Study genetics cytology and stability of cytoplasmic genetic male sterility system in pigeonpea
V Thirumala Rao	India	PhD	Breeding approaches to exploit heterosis for grain mold resistance in sorghum
Sarbani Mukherjee	India	PhD	Impact of subsidies on natural resource extraction - with special reference to groundwater
Tsunashima Hiroyuki	Japan	PhD	Low input agriculture for sustainable development and ecosystem maintenance
G Kalyani	India	PhD	Transgenic groundnut with resistance to foliar diseases
S Mathiyazhagan	India	PhD	Etiology and biological control of collar rot disease of chickpea

Names	Country	Degree	Topic
K Baskaran	India	PhD	Use of SSR markers in characterizing responses to population improvement during breeding of released pearl millet variety
M Rupasree	India	PhD	Salt stress tolerance in pearl millet and development of molecular markers
Raja Shekhar Kachapur	India	PhD	Breeding approaches to exploit heterosis in sweet sorghum for ethanol production
David Love	Zimbabwe	PhD	Multi-scaled scenario modelling of agricultural, climatic and land use changes and water resources in the Mzingwane Catchments, Limpopo Basin"
Walter Mupangwa	Zimbabwe	PhD	Water Management Systems For Risk Mitigation and Improved Crop Yields In Rainfed Cropping Systems of the Semi-Arid Tropics.
Lenardt Woltering	Netherlands	MSc	Assessment impact of land use and land management changes on the hydrology using a conceptual model, case of the Mzingwane River
Richard Moyo			Potential and constraints of low-cost drip irrigation kits in improving rural livelihoods: A case study of water scarce areas of Mzingwane Catchment

Workshops, Conferences, Meetings during 2004

Event/Topic/Date	Location	Participants	Participating countries/Institutes	Resources and collaborative support
Fodder Innovation Project Annual Review Meeting, 16 to 18 January	Patancheru ICRISAT			
World Bank Study Tour/Hub Training for East and South Asia Staff, 18 to 23 January	ICRISAT, Patancheru		WB Directors & Managers, eight countries from Asia and Africa	World Bank
Workshop on the fertilizer micro-dosing project, 20 to 24 January	Ouahigouy, Burkina Faso	22	Mali, Burkina Faso, Niger	IFDC
A Consultation workshop on Millet and Sorghum based systems in West Africa, 27 to 30 January	ICRISAT, Niamey	100	20 Countries	ICRISAT – Niamey and INRAN
ICRISAT–NATP review and planning workshop, 23 to 24 February	ICRISAT, Patancheru	16	ICRISAT, NBSS & LUP (India)	NATP-ICRISAT – Patancheru
West African Groundnut Seed Project steering committee meeting, 2 to 4 March	ICRISAT, Bamako		Mali, Niger, Nigeria and Senegal	ICRISAT - Bamako
A National Workshop on Drought Management Strategies, 18 to 19 March	ICRISAT, Patancheru	60	ICRISAT, APRLP	APRLP-ICRISAT
Workshop on 'Writeshop', 11 to 12 March	ICRISAT, Patancheru	16	IDE-India, MG State institute for Rural Development ICRISAT	

Event/Topic/Date	Location	Participants	Participating countries/Institutes	Resources and collaborative support
Inception Workshop for the WATERNET led Water and Food CP17, 15 to 19 March 2004	Mozambique	28	ICRISAT, IWMI, Zimbabwe, Mozambique, RSA, Netherlands	ICRISAT and Water and Food CP
Second project steering committee meeting of the Program for farmer participatory improvement of grain legumes in rainfed Asia, 5 to 11 April	China	40	China, India, Nepal and Vietnam	IFAD
Meeting of ICRISAT-Private Sector Hybrid Parents Research Consortia Members, 21 April	ICRISAT, Patancheru	25	India	ICRISAT
Tata – ICRISAT – ICAR project review and planning workshop, 21 to 23 April	ICRISAT, Patancheru	50	India	Tata – ICRISAT – ICAR
Governing Board meetings from 26 to 29 April	ICRISAT, Patancheru	11	ICRISAT	ICRISAT
The Biopesticide Research Consortium meeting, 4 May	ICRISAT, Patancheru	> 37	ICRISAT, Private sector companies, India	
Project review and planning workshop for the ADB Funded project on watershed development, 6 to 8 May	ICRISAT, Patancheru	> 65	India, China, Vietnam and Thailand	ADB Project
Sahelian EcoFarm field day, 7 May	ICRISAT Niamey	> 30	Niger	ICRISAT Niamey
Joint Workshop by ICRISAT and ICAR on VLS, 26 to 28 May	ICRISAT, Patancheru	45	ICRISAT, ICAR (NCAP)	ICRISAT, ICAR
16th Parliamentary Forum of the Southern African Development meeting, 1 June	Namibia	>100		SADC Parliamentary Forum
ICT-KM workshop on Online Learning Resources, 14 to 18 June	ICRISAT, Patancheru	> 20	Heads of training in all the CG centers	ICRAF
South Asian regional workshop on Good practices in Information and Communication Technology for Development (ICT4D): Their relevance in agricultural extension and communication, 28 to 29 June	ICRISAT, Patancheru	40	Canada, India, Nepal, Pakistan, Philippines, USA	COL, ICT-KM of CGIAR, and ICRISAT
A training workshop on the use of Decision Support Systems (DSS), 21 to 25 June	Ougadougou, Burkina Faso	20	Burkina Faso, Mali, Niger and Senegal	IFDC and ICRISAT/DMP
A training workshop on Impact assessment tools in West Africa, 12 to 17 July	ICRISAT, Bamako, Mali	17	Burkina Faso, Mali, Niger Nigeria and Senegal	Common Fund for Commodities and GT Sat Futures

Event/Topic/Date	Location	Participants	Participating countries/Institutes	Resources and collaborative support
The first Zimbabwe Spatial Data Infrastructure (ZSDI) Outreach Workshop, 18 June	ICRISAT Bulawayo	>50	Govt. and non govt. orgn. and Private orgns.	GIS, ICRISAT Bulawayo
FARA CP Pilot Learning Site Regional Workshop for SADC, May	Gaborone Botswana	>30	NARES reps from SADC Region, ICRISAT and IWMI	FARA CP Funds/SADC and ICRISAT
FARA CP Pilot Learning site Pan Africa workshop, June	FARA ACCRA	15	FARA/SROs and IARCS	FARA
CIMMYT/BMZ Conservation Agric Inception Workshop, June	Harare Zimbabwe	>40	Tanzania, Zimbabwe, Zambia, Malawi, CIMMYT, ICRISAT	BMZ and CIMMYT
Stakeholder workshop Limpopo Province, 23 to 24 June	Polokwane	>40	LPDA, ARC, Agri-business, UNDP, CSIRO, ICRISAT	ACIAR, Progress Millling, Sasol
ASARECA NRM Strategy and Priority Setting, Expert Consultation & Advisory Committee Meeting, July	Nairobi	>40	ASARECA member states, IARCs, ARIs	ASARECA/EU
Workshop on VLS and reality check, 21 to 27 July	ICRISAT Patancheru		UK, France, Japan and NCAP, CRIDA and ICRISAT	IFAD and ICRISAT
Final OSWU Review Workshop, 27 to 28 July	Pretoria	>20	Kenya, B. Faso, Niger, Zim, RSA, ICARDA, ICRISAT	System-wide Prog. INRM
APRLP-ICRISAT Project "Strategy for Productivity Environment" Workshop, 29 to 30 July	ICRISAT, Patancheru	70	Five APRLP districts and17 other villages	APRLP-DFID and ICRISAT
Technical review of fertilizer Recomm, 30 August	Polokwane	>20	LPDA, ARC, LIMPAST, Sasol, Pannar	ACIAR
ADB-ICRISAT initiative three-day workshop for stronger agri-research partnership, 3 to 5 September	New Delhi		Donor and International organizations national governments and NARS from South Asian countries	ADB-ICRISAT
ADB-ICRISAT Project Travelling Seminar-cum-Field Visit To Benchmark Watersheds in Asia, 5 to 23 September	Thailand, Vietnam, China and India	18	Thailand, Vietnam, China and India	ADB-ICRISAT
Pearl Millet Scientists' Field Day, 20 to 21 September	ICRISAT, Patancheru	40-50	India	ICRISAT
Sorghum Scientists' Field Day, 22 to 23 September	ICRISAT, Patancheru	40-50	India	ICRISAT

Event/Topic/Date	Location	Participants	Participating countries/Institutes	Resources and collaborative support
Brainstorming Workshop on Harnessing Gender Power in Integrated Watershed Management Approach "Harmony and Prosperity", 27 to 28 September	ICRISAT, India	50	India, China and Vietnam	ADB-ICRISAT
Research Need Assessment and Agricultural Research Priorities for South and West Asia, 7 to 8 October	Patancheru	42	Country Representatives, CG Centers, Donors, Farmers' Organizations, NGOs, Private Sector, Agricultural Universities, Research Institutions	APAARI-ICRISAT
Rockefeller Soil fert Consortium for Southern Africa Review and Planning Meeting, October	Harare Zimbabwe	>30	Zimbabwe, Zambia, Mozambique, Malawi	Rockefeller/ CIMMYT / ICRISAT/ ICRAF/ TSBF-CIAT
Inception Workshop Mzingwane Catchment, October	ICRISAT Bulawayo	>20	Zimbabwe NARES, ICRISAT, IWMI, WATERnet	WFCP 17 and ICRISAT
VIP Field day at Bamako, 27 October	ICRISAT Mali			
Asia In-house review meetings, 24 to 36 November	ICRISAT-Patancheru		ICRISAT	
Integrated Management of Watersheds to Promote Market-Led Smallholder Agriculture and Natural Resource Management in the Semi-Arid Areas of Eastern and Central Africa, 6 to 7 December	ICRISAT, Nairobi	39	ICRISAT, SWMnet, NARS from India, Tanzania, Kenya, Ethiopia, Rwanda and Madagascar and NGO CRS	ICRISAT, SWMnet/ ASARECA
Pigeonpea Scientists' Field Day, 9 December	ICRISAT, Patancheru	25	India	ICRISAT
One-day Colloquium on Public and Private Sector Breeders on Creation of Molecular Breeding of Community Practice in Asia in collaboration with Mahyco Research, 14 June 2004	ICRISAT-Patancheru	80	National Agricultural Research Systems (NARS), Representatives from Universities, Research Institutes, and participants of ADB Final Review Workshop (Bangladesh, China, India, Pakistan,Vietnam, Germany, The Phillippines)	ICRISAT/ Mahyco Research Foundation
Final Review Workshop of ADB-funded project Rapid Crop Improvement for poor farmers in SAT, 15 to 17 June	ICRISAT-Patancheru	50	Scientists and staff from the collaborative partners and External Reviewers of the project from Germany and The Phillipnes	Asian Development Bank funded project

Training Courses held during 2004

Title	Venue	No. of Participants	Participating countries	Resources/ collaborators
Training course on *Sorghum Hybrid Production and Development*, 2 to 6 February	ICRISAT, Patancheru	15	Ethiopia, Iran, India, and Indonesia	ICRISAT
Down Scaling Climate Information for Agricultural Applications in the Greater Horn of Africa, 11 to 22 February	DMC, Nairobi	15	ECA countries	Drought Monitoring Centre (DMC) Nairobi
Training course on *Tree propagation techniques and nursery management*, 24 February to 2 March	ICRISAT – Sadore	36	Senegal, Mali, Burkina Faso, Niger	
Training Workshops on ICT-based information exchange to support watersheds and rural livelihoods, 25 February	ICRISAT, Patancheru	13	India	ICRISAT
APSIM training, 29 March to 2 April	ICRISAT, Bulawayo	5	DRC, Sweden, Zimb	ICRISAT, Waternet
Training course on *Serological and nucleic acid based methods for the detection of plant viruses,* 12 to 20 April	ICRISAT, Patancheru	10	India	ICRISAT, DFID
Limpopo Extension staff exposure to ICRISATS Crop Management options for southern Africa, 17 to 18 May	ICRISAT, Bulawayo	23	Zimbabwe	ICRISAT
APSIM training, 11-25 July	ICRISAT, Bulawayo	3	Burkina Faso, Niger	OSWU
Training in *Principles of Conservation Agriculture with River of Life,* September	Harare Zimbabwe	>70	NARES and NGOs from Zimbabwe	FAO/ROL/ ICRISAT/DFID
Practical Training in Conservation Agriculture and Low Input Fertilizer, October	ICRISAT, Bulawayo	38	Zimbabwe	ICRISAT/DFID
Training course on *New strategies for efficient management of climate variability and simulation modeling using APSIM*, 3 to 13 October	ICRISAT, Nairobi	3	Ethiopia, Tanzania	ICRISAT/ ICRAF
Bridge Training Course on *IPM in Groundnut and Pigeonpea*, 5 to 6 October	ICRISAT, Patancheru	13	India	ICRISAT
Bridge Training Course on *IPM in Groundnut and Pigeonpea*, 26 to 27 October	ICRISAT, Patancheru	10	India	ICRISAT

Title	Venue	No. of Participants	Participating countries	Resources/ collaborators
Training Program on *Chickpea Cultivation in Rice Fallows of Eastern India with Emphasis on IPM of* Helicoverpa armigera, 27 to 28 October	ICRISAT Center, Patancheru	24	India	ICRISAT
Training course on *Research Station Management*, 1 to 6 November	ICRISAT, Patancheru	24	India	ICRISAT, ASK
Training workshop on *Molecular breeding (MAS) in sorghum*, 28 November to 18 December	ICRISAT, Nairobi	20	East, Central and Southern Africa (Nigeria, Ghana, Rwanda, Kenya, Sudan, Ethiopia, Zimbabwe, Uganda and Cameroon)	ICRISAT
Training program on Chickpea production, 16 to 23 December	ICRISAT Center, Patancheru	4	Mozambique and Malawi	ICRISAT
Training Program on Medicinal and Aromatic Plants, 22 December	ICRISAT, Patancheru	21	India	ICRISAT

Publications

ICRISAT Publications in 2004

Book Chapters

Aruna R, Reddy LJ and **Chandra S.** 2004. Assessment of phenotypic and genotypic diversity in *C. scarabaeoides,* a wild relative of pigeonpeas. Pages 149-154 *in* Assessment of Risk of Loss of Biodiversity in Traditional Cropping Systems: A Case Study of Pigeonpeas (*Cajanus cajan* L. Millspaugh) in Andhra Pradesh (P Bramel, ed.). International Crops Research Institute for the Semi-Arid Tropics, ICRISAT, Andhra Pradesh, Patancheru, India. ICRISAT, India.

Bai Changjun, Liu Guodao, Wang Dongjun, Daida Krishna, Qudratullah, Prasad VLK, Rama Rao SV, Parthasarathy Rao P, Ramesh CR, Balagopal R and **Gopalan A.** 2004. *Stylosanthes* leaf meal for animal industries in China and India. Pages 243-252 *in* High-yielding anthracnose-resistant Stylosanthes for agricultural systems (Chakraborty S, ed.). Canberra: Australian Center for International Agricultural Research.

Bantilan MCS, Anupama KV and **Joshi PK** 2004. Assessing economic and environmental impacts of NRM technologies: An empirical application using economic surplus approach. Chapter 11 *in* Natural resource management in agriculture: Methods for assessing economic and environmental impacts (Shiferaw B, Freeman HA and Swinton SM, eds.). Wallingford, UK: CAB International.

Bantilan MCS, Deb UK, Gowda CLL, Reddy BVS, Obilana AB and **Evenson RE.** 2004. Introduction. Pages 5–18 *in* Sorghum genetic enhancement: research process, dissemination and impacts (Bantilan MCS, Deb UK, Gowda CLL, Reddy BVS, Obilana AB and Evenson RE, eds.). Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Bantilan MCS, Deb UK, Gowda CLL, Reddy BVS, Obilana AB and **Evenson RE.** 2004. Future directions for food security and diversity: partnership and research strategy for sorghum. Pages 263–268 *in* Sorghum genetic enhancement: research process, dissemination and impacts (Bantilan MCS, Deb UK, Gowda CLL, Reddy BVS, Obilana AB and Evenson RE, eds.). Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Beta T, Chisi M and **Monyo ES.** 2004. Sorghum, harvest, storage and transport. Encyclopedia of Grain Sciences (Wrigley C, Walker C and Corke H, eds.), Academic Press, UK. 3:119-126.

Carberry P, Gladwin C and **Twomlow S.** 2004. Linking simulation modeling to participatory research in smallholder farming systems. Pages 32-46 *in* ACIAR Proceedings No.114 (Delve and Probert, eds.). Modeling Nutrient Management in Tropical Cropping Systems.

Carsky RJ, Sanginga N, Schulz S, Douthwaite B, Manyong VM, Diels J, Vanlauwe B and **Keatinge JDH.** 2004. The ability to fix N is not the only key to delivery of the benefits of BNF to farmers: Experience of IITA in the Savannas of Africa. Pages 145-162 *in* Symbiotic Nitrogen Fixation: Challenges and Future Prospects for Application in Tropical Agroecosystems (Serraj R, ed.). Oxford & IBH, New Delhi, India.

Crouch JH, Buhariwalla HK, Blair M, Mace E, Jayashree B and **Serraj R.** 2004. Biotechnology-based contributions to enhancing legume productivity in resource-poor areas. Pages 47-65 *in* Symbiotic Nitrogen Fixation: Challenges and Future Prospects for Application in Tropical Agroecosystems (Serraj R, ed.). Oxford & IBH, New Delhi, India.

Dar WD and **McGaw EM**. 2004. A Gray to green revolution in the semi-arid tropics of Asia and Africa. Pages 35-46 *in* Challenges and strategies for dryland agriculture, CSSA Special Publication no.32, Crop Science Society of America and American Society of Agronomy.

Davidson JA, Pande S, Bretag TW, Lindbeck KD and **Kishore GK.** 2004. Biology and management of *Botrytis* spp. in legume crops. Pages 295-318 *in* *Botrytis*: Biology, Pathology and Control (Elad Y *et al*, ed.). Kluwer Academic Publishers, The Netherlands.

Deb UK, Bantilan MCS, Bantilan FT and **Gowda CLL.** 2004. Spillover impacts of sorghum research. Pages 237–260 *in* Sorghum genetic enhancement: research process, dissemination and impacts (Bantilan MCS, Deb UK, Gowda CLL, Reddy BVS, Obilana AB and Evenson RE, eds.). Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Deb UK, Bantilan MCS, Evenson RE and **Roy AD.** 2004. Productivity impacts of improved sorghum cultivars. Pages 203–221 *in* Sorghum genetic enhancement: research process, dissemination and impacts (Bantilan MCS, Deb UK, Gowda CLL, Reddy BVS, Obilana AB and Evenson RE, eds.) Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Deb UK, Bantilan MCS, Hash CT and **Ndjeunga J.** 2004. Adoption of improved sorghum cultivars. Pages 181–198 *in* Sorghum genetic enhancement: research process, dissemination and impacts (Bantilan MCS, Deb UK, Gowda CLL, Reddy BVS, Obilana AB and Evenson RE, eds.) Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Deb UK, Bantilan MCS, Reddy BVS, BRAMEL PJ and **Kameswara Rao N.** 2004. Impact of improved sorghum cultivars on genetic diversity and yield stability. Pages 225–234 *in* Sorghum genetic enhancement: research process, dissemination and impacts (Bantilan MCS, Deb UK, Gowda CLL, Reddy BVS, Obilana AB and Evenson RE, eds.). Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Deb UK, Bantilan MCS, Roy AD and **Parthasarathy Rao P. 2004.** Global sorghum production scenario. Pages 21–42 *in* Sorghum genetic enhancement: research process, dissemination and impacts (Bantilan MCS, Deb UK, Gowda CLL, Reddy BVS, Obilana AB and Evenson RE, eds.) Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Dua RP, Gowda CLL, Shiv Kumar, Saxena KB, Govil JN, Singh BB, Singh AK, Singh RP, Singh VP and **Kranthi S**. 2004. Breeding for resistance to *Helicoverpa*: Effectiveness and limitations. Pages 229–248 *in* *Helicoverpal Heliothis*: Management Strategies for the Future (Sharma HC, ed.). New Delhi, India: Oxford & IBH/ Enfield, USA & Plymouth, UK: Science Publishers Inc.

Dwivedi SL and **Nigam SN. 2004.** Breeding methods of cultivar development in groundnut. Pages 17-23 *in* Groundnut Research in India (Basu MS and Singh NB, eds.). National Research Centre for Groundnut, Junagadh, Gujarat, India.

Fatondji D, Zougmore R, Brussard L, Bielders C and **Martius C.** 2004. Restoring Soil Fertility in Semi-Arid West Africa by Mando A. Chapter 27 in Biological Approaches For Sustainable Soil Systems.

Freeman HA, Shiferaw B and **Swinton S.** 2004. Assessing the impact of natural resource management in agriculture: concepts, issues and challenges. Pages 3-16 *in* Natural Resource Management in Agriculture: Methods for Assessing Economic and Environmental Impacts (Shiferaw B, Freeman HA and Swinton S, eds.). CABI Publishing.

Gaur PM and **Chaturvedi SK**. 2003. Genetic options for managing biotic stresses in pulse crops. Pages 91-111 *in* Pulses in New Perspective (Ali M, Singh BB, Kumar S and Dhar V, eds.). Kanpur, India: Indian Society of Pulses Research and development.

Gowda CLL. 2004. *Helicoverpa*—The global problem. Pages 1–6 *in* *Helicoverpal Heliothis*: Management Strategies for the Future (Sharma HC, ed.). New Delhi, India: Oxford & IBH/ Enfield, USA & Plymouth, UK: Science Publishers Inc.

Gowda CLL. 2004. Objectives of the Expert Meeting on Alternative Uses of Sorghum and Pearl Millet in Asia. Pages 10-13 *in* Alternative Uses of Sorghum and Pearl Millet in Asia: proceedings of the Expert Meeting, ICRISAT, Patancheru, Andhra Pradesh, India, 1-4 Jul 2003. CFC Technical Paper No. 34, P.O. Box 74656, 1070 BR Amsterdam, The Netherlands: Common Fund for Commodities; and Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 364 pp.

Gowda CLL. 2004. Welcome and objectives of the Meeting. Pages 1-2 *in* Role of Legumes in Crop Diversification and Poverty Reduction in Asia. Proceedings of the Joint CLAN Steering Committee Meeting, 10-12 November 2003. ICRISAT, India. Patancheru, Andhra Pradesh 502 324, India: International Crops Research Institute for the Semi-Arid Tropics. 234 pp.

Hall A, Yoganand B, Crouch JH and **Clark NG.** 2004. The evolving culture of science in the Consultative Group on International Agricultural Research: concepts for building a new architecture of innovation in agri-biotechnology. Pages 135-162 *in* Innovations in innovation: reflections on partnership, institutions and learning (Hall AJ, Yoganand B, Sulaiman RV and Clark NG, eds.). ICRISAT, CPHP & ICAR, India.

Koala S and **Pasternak D.** 2004. Introduction and cultivation of the Date Palm in the Sahel *in* The Date Palm. From Traditional Resource to Green Wealth. The Emirates Center for Strategic Studies and Research 2003.

Liu Guodao, Bai Changjun, Wang Dongjun, Ramesh CR and **Parthasarathy Rao P.** 2004. Leaf meal production from Stylosanthes. Pages 253-256 in High-yielding anthracnose-resistant Stylosanthes for agricultural systems (Chakraborty S, ed.). Canberra: Australian Center for International Agricultural Research.

Maredia MK, Rohrbach DD and **Mgonja MA.** 2004. Justification for regionalized plant breeding and variety registration. Pages 83-103 *in* Seed Trade Liberalization and Agro-biodiversity in Sub-Saharan Africa (Rohrbach David and Howard Julie, eds.). ICRISAT: Bulawayo.

Monyo ES and **Mgonja MA.** 2004 Setting a community based seed production system – a case study: Schools for Seed, A New Approach in Tanzania *in* Successful community based seed production strategies (Setimela et al, eds.). Mexico D.F.: CIMMYT.

Monyo ES, Mgonja MA and **Rohrbach DD.** 2004. Current Analysis of Seed Systems Development with special reference to smallholder farmers in Southern Africa: Issues and Challenges *in* Successful community based seed production strategies (Setimela et al, eds.). Mexico D.F.: CIMMYT.

Monyo ES, Rohrbach DD and **MGONJA MA.** 2004. New partnerships to strengthen seed systems in Southern Africa: Innovative community/ commercial seed supply models *in* Successful community based seed production strategies (Setimela et al, eds.). Mexico D.F.: CIMMYT.

Nalini Mallikarjuna. 2004. Wide hybridization in important food legumes. Pages 155-170 *in* Biotechnology for the Improvement of Legumes (Jaiwal PK and Singh RP, eds.). Kluwer Academic Publishers.

Nikiema A, Pasternak D and **Maesen van der GLH.** 2004. Identifying wild food plants for sustainable agroforestry *in* Sustainable Agriculture Systems for the Drylands (Omanya G and Pasternak D, eds.). ICRISAT, Patancheru.

Parthasarathy Rao P, Ramesh CR, Pathak PS, Mohan Rao Y and **Nagarathna Biradar.** 2004. Recent trends in *Stylosanthes* seed production by smallholders in India. Pages 235-242 *in* High-yielding anthracnose-resistant Stylosanthes for agricultural systems (Chakraborty S, ed.). Canberra: Australian Center for International Agricultural Research.

Pasternak D, Nikiema A, Fatondji D, Ndjeunga J, Koala S, Dan Goma A and **Abasse T.** 2004. The Sahelian Eco-Farm. Pages 286-296 *in* Sustainable Agriculture Systems for the Drylands 2004 (Omanya G and Pasternak D, eds.). ICRISAT, Patancheru.

Paterson AH, Stalker HT, Gallo-Meagher M, Burow MD, Dwivedi SL, Crouch JH and **Mace ES.** 2004. Genomics and genetic enhancement of peanut. Pages 97-109 *in* Legume Crop Genomes (Wilson RE, Stalker HT and Brummer EC, eds.). AOCS Press, IL, USA.

Pathak P, Sahrawat KL, Rego TJ and **Wani SP.** 2004. Measurable biophysical indicators for impact assessment: changes in soil quality. Pages 53-74 *in* Agriculture: Methods for Assessing Economic and Environmental Impacts (Shiferaw B, Freeman HA and Swinton SM, eds.). CAB International Publications.

Pathak P. 2004. Improved land and water management for achieving food security in the rainfed areas. Pages 36-

44 *in* CRIDA-AP Water Vision: CRIDA, Santoshnagar, Hyderabad.

Podile AR, Kishore GK, Manjula K, Anil K and **Neeraja Ch**. 2004. Chitinolysis and biological control of fungal diseases of plants - A critical assessment and future directions. Pages 26-28 *in* Biotechnological approaches for sustainable development. (Reddy MS and Khanna S, eds.). Allied Publishers Pvt. Limited. New Delhi, India. (ISBN 81-7764-669-9).

Rao KPC. 2004. Socio-economic and ethical implications of various agricultural bio-technology interventions. Pages 104-130 *in* Biotechnology for Sustainable Agriculture (Venku Reddy S, Suryamani M, Srivasthava KL and Govardhan Reddy T, eds.). B.S.Publications, Hyderabad.

Reddy BVS and **Seetharama N.** 2004. Integrating Traditional Breeding and Transgenic Research Methods in Sorghum Improvement. Pages. 145-151 in Sorghum Tissue culture and Transformation (Seetharama N and Ian Godwin, eds.). Oxford and IBH Publishing Co.Pvt. Ltd. New Delhi

Reddy BVS, Rai KN, Sarma NP, Kumar Ish and **Saxena KB.** 2004. Cytoplasmic-nuclear male-sterility: Origin, evaluation and utilization. Pages 473-499 in Plant Breeding-Mendelian to Molecular Approaches (Jain HK and Kharkwal MC, eds.). Narosa Publishing House Pvt. Ltd., New Delhi, India.

Rohrbach DD, Howard J and **Zulu E**. 2004. Harmonization of seed laws and regulations in southern Africa. Pages 124-147 *in* Seed Trade Liberalization and Agro-biodiversity in Sub-Saharan Africa (Rohrbach David and Howard Julie, eds.). ICRISAT: Bulawayo.

Rohrbach DD, Minde IJ and **Howard J.** 2004. Looking beyond national policies: regional harmonization of seed markets. Pages 14-36 *in* Seed Trade Liberalization and Agro-biodiversity in Sub-Saharan Africa (Rohrbach David and Howard Julie. eds.). ICRISAT: Bulawayo.

Rohrbach DD, Mupeti ZJ, Ncube B, Mwaipyana H and **Ngowi P.** 2004. Commercialization of sorghum and pearl millet in southern Africa. Pages 78-98 in A foundation for the future: the Sorghum and Millet Improvement Program (SMIP) in Southern Africa (Heinrich G, ed.). ICRISAT: Bulawayo.

Rusike J, Snapp SS and **Twomlow SJ.** 2004. The Mother Baby Trial approach for Developing Practical Soil Water Fertility and Management Technologies. Chapter 34 in Sourcebook on Participatory Research and Development. Manila: International Potato Center.

Sahrawat KL, Padmaja KV, Pathak P and **Wani SP.** 2004. Measurable biophysical indicators for impact assessment: changes in water availability and quality. Pages 75-96 *in* Natural resource management in agriculture: methods for assessing economic and environmental impacts (Shiferaw B, Freeman HA and Swinton SM, eds.). Wallingford, UK: CAB International.

Saxena KB, Tikka SBS and **Mazumder ND.** 2004. Cytoplasmic genic male-sterility in pigeonpea and its utilization in hybrid breeding programme. Pages 132-146 in Pulses in New Perspective. (Masood Ali, Singh BB, Shiva Kumar and Vishwa Dhar, eds.). Indian Society of Pulses Research and Development, IIPR, Kanpur, India.

Serraj R, Adu-Gyamfi J, Rupela OP and **Drevon JJ.** 2004. Improvement of legume productivity and role of symbiotic nitrogen fixation in cropping systems: overcoming the physiological and agronomic limitations. Pages 67-97 *in* Symbiotic Nitrogen Fixation: Prospects for Enhanced Application in Tropical Agriculture (Serraj R, ed.). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Serraj R, Gaur PM, Krishnamurthy L, Kashiwagi J and **Crouch JH.** 2004. Drought management in pulse crops. Pages 471-479 *in* Pulses in New Perspective (Ali M, Singh BB, Kumar S and Dhar V, eds.). Kanpur, India: Indian Society of Pulses Research and Development.

Sharma HC, Ahmad R, Ujagir R, Yadav RP, Singh R, and **Ridsdill-Smith TJ.** 2004. Host plant resistance to Helicoverpa: The prospects. Pages 171 – 213 in Cotton bollworms/Legume podborers, Helicoverpa/Heliothis Management: Emerging Trends and Strategies for Future Research.(Sharma HC, ed.). New Delhi, India: Oxford &IBH/Enfield, USA & Plymouth, UK: Science Publishers Inc.

Sharma HC, Stevenson PC and **Gowda CLL.** 2004. Strategies for *Helicoverpa/ Heliothis* management: Prospects and problems. Pages 479 – 485 *in* Cotton bollworms/Legume podborers, *Helicoverpa/Heliothis* Management: Emerging Trends and Strategies for Future Research. New Delhi, India: Oxford &IBH/Enfield, USA & Plymouth, UK: Science Publishers Inc.

Sharma HC. 2004. Biotechnological approaches for crop improvement with special reference to host plant resistance to insects. Pages 230 – 244 *in* Recent Advances in Host Plant Resistance to Insects (Chhillar BS, Singh R, Bhanot JP and Ram P, eds.). Hisar, Haryana, India: Centre for Advanced Studies, Department of Entomology, CCS Haryana Agricultural University.

Sharma HC. 2004. Host plant resistance in insect pest management *in* Pest Management (Singh J, ed.). Varanasi, Uttar Pradesh, India: Department of Entomology, Banaras Hindu University.

Shiferaw B and **Holden S.** 2004. Assessing economic and environmental impacts of soil and water conservation technologies: A stylised farm-level bio-economic modelling approach. Pages 269- 294 *in* Natural Resource Management in Agriculture: Methods for Assessing Economic and Environmental Impacts (Shiferaw B, Freeman HA and Swinton S, eds.). CABI Publishing.

Shiferaw B, Freeman HA and **Navrud S.** 2004. Valuation methods and methodologies for assessing NRM technology impacts Pages 19-51 *in* Natural Resource Management in Agriculture: Methods for Assessing Economic and Environmental Impacts (Shiferaw B, Freeman HA and Swinton S, eds.). CABI Publishing.

Singh RP, Rizvi SMH, Usha Sonia and **Jaiwal PK**. 2004. Genetic engineering for enhancing abiotic stress tolerance. Pages 223-243, Volume 10A *in* Focus on Biotechnology Improvement Strategies of Leguminosae Biotechnology (Jaiwal PK and Singh RP, eds.). Kluwer Academic Publisher, The Netherlands.

Stevenson PC, Green PWC, Simmonds MSJ and **Sharma HC.** 2004. Physical and chemical mechanisms of plant resistance to *Helicoverpa*: Recent Research on Chickpea and Pigeonpea. Pages 215 – 228 *in* Cotton bollworms/Legume podborers, *Helicoverpa/Heliothis*

Management: Emerging Trends and Strategies for Future Research. (Sharma HC, ed.). New Delhi, India: Oxford &IBH/Enfield, USA & Plymouth, UK: Science Publishers Inc.

Swinton S, Shiferaw B and **Freeman HA.** 2004. Towards comprehensive approaches in assessing NRM impacts: what we know and what we need to know. Pages 361-375 *in* Natural Resource Management in Agriculture: Methods for Assessing Economic and Environmental Impacts (Shiferaw B, Freeman HA and Swinton S, eds.). CABI Publishing.

Thakur RP and **Hash CT.** 2004. Biotechnology in the management of pearl millet downy mildew. Pages 247-261 *in* Biotechnological Approaches for the Integrated Management of Crop Diseases (Professor LV Gangawane Festschrift Volume) (Mayee CD, Manoharachary C, Tilak KVBR, Mukudam DS and Deshpande J, eds.). Daya Publishing House, New Delhi 110035.

Thakur RP, Sivaramakrishna S, Kannan S, Rao VP, Hess DE and **Magill CW.** 2004. Genetic and pathogenic variability among isolates of *Sclerospora graminicola*, the downy mildew pathogen of pearl millet. Pages 179-192 *in* Advances in Downy Mildew, Vol. 2 (Spencer-Phillips P and Jeger M, eds.). Kluwer Academic Publishers. The Netherlands. ISBN 1-4020-2657-9.

Thakur RP. 2004. Infection events and resistance mechanisms to grain mold in Sorghum. Pages 64-73 *in* Vistas in Applied Botany: Prof. H. Shekar Shetty's 60th Birthday Commemorative Volume" (Prakash HS, Niranjana SR and Kini KR, eds.). University of Mysore, Manasagangotri, Mysore, India.

Twomlow SJ. 2004. Increasing the role of legumes in smallholder farming systems The Future Challenge. Pages 29-46 *in* Symbiotic Nitrogen Fixation: Challenges and Future Prospects for Application in Tropical Agroecosystems (Serraj R, ed.). Oxford & IBH, New Delhi, India.

Upadhyaya HD. 2004. Core collections for efficient management and enhanced utilization of plant genetic resources. Pages 280-296 *in* Plant Genetic Resources Management (Dhillon BS, Tyagi RK, Lal A and Saxena S, eds.). Narosa Publishing House, New Delhi, India.

Wani SP, Piara Singh, Dwivedi SL, Navalgund RR and **Ramakrishna A.** 2004. Biophysical indicators of agroecosystem services and methods for monitoring the impacts of NRM technologies at different scale. Pages 23-54 *in* In methods for assessing economic and environmental impacts (Shiferaw B, Freeman HA and Swinton SM, eds.). CAB International.

Books and Journal Volumes

Bantilan MCS, Deb UK, Gowda, CLL, Belum VS Reddy, Obilana AB and **Evenson RE (eds.).** 2004. Sorghum genetic enhancement: research process, dissemination and impacts. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

CFC and **ICRISAT.** 2004. Alternative Uses of Sorghum and Pearl Millet in Asia: proceedings of the Expert Meeting, ICRISAT, Patancheru, Andhra Pradesh, India, 1-4 Jul 2003 (Gowda CLL, Reddy BVS, Rai KN, Parthasarathy Rao P and Farid Waliyar, eds.). CFC Technical Paper No. 34, P.O. Box 74656, 1070 BR Amsterdam, The Netherlands: Common Fund for Commodities; and Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 364 pp.

Gowda CLL and **Pande S. (eds.)** 2004. Role of Legumes in Crop Diversification and Poverty Reduction in Asia. Proceedings of the Joint CLAN Steering Committee Meeting, 10-12 November 2003. ICRISAT, India. Patancheru, Andhra Pradesh 502 324, India: International Crops Research Institute for the Semi-Arid Tropics. 234 pp.

Koala S and **Tabo R. (eds.)** 2004. Turning adversity into opportunity: The Desert Margins Program – Towards sustainable management of the desert margins of sub-Saharan Africa. Project Document 2002-2008; International Crops Research Institute for the Semi-Arid Tropics.

Kumar PL. 2004. *Aceria cajani*: alien invasive species. CABI Crop Protection Compendium. CABI, Wallingford, England.

Longley C, Kanfidéni B and **Diakité L.** 2004. Relief or agricultural development? Emergency seed projects, farmer seed systems and the dissemination of modern varieties in Mali and Niger. Working Paper. ICRISAT, PO Box 39063, Nairobi 00623, Kenya. 107pp.

Setimela PS, Monyo ES and **Banzinger M. (eds).** 2004. Successful community based seed production strategies. Mexico D.F.: CIMMYT.

Omanya G and **Pasternak D. (eds.).** 2004. Sustainable Agriculture Systems for the Drylands. Proceedings of the International Symposium for sustainable Agriculture Dryland Systems. 2-5 Dec 2003. ICRISAT Sahelian Center, Niamey, Niger: International Crops Research Institute for the Semi-Arid Tropics. 336 pp.

Rohrbach David and **Howard Julie.** (eds.). 2004. Seed trade liberalization and agro-biodiversity in Sub-Saharan Africa. International Crops Research Institute for the Semi-Arid Tropics: Bulawayo. 167 pp.

Sharma HC. 2004. Cotton bollworms/ Legume podborers, *Helicoverpa/ Heliothis* Management: Emerging Trends and Strategies for Future Research. Oxford & IBH, New Delhi, India/Science Publishers Inc., Enfield, USA & Plymouth, UK. 486 pp.

Shiferaw B, Freeman HA and **Swinton S. (eds.)** 2004. Natural Resource Management in Agriculture: Methods for Assessing Economic and Environmental Impacts. CABI Publishing, 382 pp. ISBN: 0851998293

Thakur RP. 2004. International Sorghum and Millets Newsletter 2004, Vol. 45 (Dahlberg JA and Thakur RP, eds.). International Crops Research Institute for the Semi-Arid Tropics. 88 p.

Upadhyaya HD. 2004. International Chickpea and Pigeonpea Newsletter No. 11. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 59 pp.

Brochures/Pamphlets

Bantilan MCS. GT-SAT Futures Brochure. 2004.

Bantilan MCS. GT-SAT Futures Publication Catalog. 2004.

Chandra S and **Jayashree Balaji.** Bioinformatics@ICRISAT

Chandra S and **Rupa Sridevi K.** Biometrics@ICRISAT

Chandra S. GenStat Case Study in collaboration with VSN International UK

Dominguez C. ICRISAT IN Mozambique: "Good partnerships for better farming". Published also in Portuguese: ICRISAT EM MOÇAMBIQUE: "Melhores Opções para os camponeses Moçambicanos através de parcerias productivas".

Gaur PM and **Gowda CLL.** 2004. Technologies for increasing chickpea production in Karnataka [in Kannad language]. Pages 16-17 in Krishik Bandhu, Nov 2004 Issue. Vasundhara Publications, Hyderabad 500 082, India.

Jones RB. 2004. Brochure on "ICRISAT and Tanzania" .

Jones RB. 2004. Brochure on "ICRISAT in Mozambique".

Kashiwagi J. ICRISAT Genebank: (Flyer in Japanese): For introducing ICRISAT activities to Japanese Government, research institutes and another organization.

Kashiwagi J. ICRISAT watershed program (Flyer in Japanese): For introducing ICRISAT activities to Japanese Government, research institutes and another organization.

Kashiwagi J. Japan and ICRISAT relationship (Flyer in Japanese): For introducing ICRISAT activities to Japanese Government, research institutes and another organization.

Kumar PL and **Jones AT.** 2004. Green Gold. In Positive Developments. Ed Benedikte Siderman-Wolter. NR International, Kent, UK. pp50-51. [Runner Up in Photographic Exhibition by NR International in association with The Eden Project, Held at the Eden Project 16-25 May 2004, England, UK.]

Kumar PL. 2004. ICP7035: A dual-purpose pigeonpea variety with broad-based resistance to sterility mosaic disease. Information Broacher for Pigeonpea Scientists Meeting at ICRISAT, 9 December 2004, ICRISAT, Patancheru, India. 1pp.

Kumar Rao JVDK. 2004. Growing chickpea in rice fallows. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 4 pp.

Nigam SN. Groundnut: A health-enhancing food

Nigam SN. Stem Necrosis Disease of Groundnut (in Telugu)

Pande S. Diseases of chickpea and their management in Chattisgarh (in Hindi)

Pande S. Diseases of chickpea in Andhra Pradesh and their management (in English)

Pande S. Diseases of chickpea in Andhra Pradesh and their management (in Telugu)

Pande S. Diseases of groundnut in Andhra Pradesh and their management (in English)

Pande S. Diseases of groundnut in Andhra Pradesh and their management (in Telugu)

Pande S. Improved package of practices and integrated pest mangement (IPM) for chickpea cultivation in Nepal (in Nepali)

Pande S. Managing the mold (SAT Trends, September 2004 issue)

Pande S. 2004. Diseases of chickpea in Andhra Pradesh and their management (in Telugu). Extension material for farmers' education during training programs organized in Anantapur during July 2004. 4pp.

Pande S. 2004. Diseases of groundnut in Andhra Pradesh and their management (in Telugu). Extension material for farmers' education during training programs organized in Anantapur during July 2004. 4pp.

Pasternak D. Crops Diversification

Pasternak D. The African Market Garden

Pasternak D. The Sahelian Eco-Farm

Pathak P, Wani SP and **Sudi R.** 2004. Field manual on gully control in SAT soils. ICRISAT, Patancheru 502 324, A.P., India. 36pp.

Rangaswamy KT, Kumar PL, Prameela PA, Raghavendra N and **Shankarappa S.** 2004. *Pigeonpea sterility mosaic disease resistant variety ICP7035 and crop management* (In Kannada Language). Information Broacher. University of Agriculture Sciences, GKVK, Hebal, Karnataka 560065, India. 4 pp

Reddy Belum VS. Profitable poultry feed rations from improved sorghum cultivars, 3 pages, 500 Nos.

Sharma HC, Hiremath IG, Franzmann BA, and **Henzell RG.** ICRISAT's Research on Sorghum Midge, *Stenodiplosis sorghicola*-Utilization of Midge-resistant Varieties for Integrated Pest Management and Environment Conservation.

Sharma HC, Manohar Rao, Stevenson PC, and **Green PWC.** Exploiting Wild Relatives of Pigeonpea for Resistance to *Helicoverpa armigera*

Sharma HC, Sharma JP, Ridsdill Smith TJ, and **Clements SL.** A Little Help From the Wild: Exploiting Wild Relatives of Chickpea for Resistance to *Helicoverpa armigera.*

Sharma HC. Techniques to Screen for Resistance to Insect Pests in Sorghum: Wide Adoption in Asia, Africa and Australia

Silim SN. ICRISAT's Science Assets for Eastern Africa

Silim SN. Market Oriented research for wealth creation in eastern Africa: Grain Legume Experience

Sreedevi TK, Shiferaw B and **Wani SP.** 2004. Adarsha watershed in Kothapally : understanding the drivers of higher impact. Global Theme on Agroecosystems Report No. 10, Patancheru 502 324, Andhra Pradesh, India : International Crops Research Institute for the Semi-Arid Tropic. 24 pp.

Thakur RP. Plant quarantine guidelines and procedures for germplasm exchange of ICRISAT mandate crops (ICAR & ICRISAT).

Traore A, Ntare BR and **Waliyar F.** 2004. Tigakise kunaliyabana kelecogo-Information brochure in Bambara.

Waliyar F. 2004. Managing aflatoxin in groundnut. Flyer in English

Waliyar F. 2004. Managing aflatoxin in groundnut. Flyer in French

Waliyar F. 2004. Managing aflatoxin in groundnut. Flyer in Hindi

Waliyar F. 2004. Managing aflatoxin in groundnut. Flyer in Telugu

Wani SP. APRLP-ICRISAT : Unlocking the potential of rainfed agriculture – English.

Wani SP. Crop Diversification through Medicinal and Aromatic Plants – Telugu.

Wani SP. Participatory watershed management to reduce poverty and land degradation in SAT Asia – English and Kannada.

Bulletins

Khairwal IS, Sehgal S, Rai KN and **Kawatra A.** 2004. Diversified Uses of Pearl Millet.All India Coordinated Pearl Millet Improvement Project (ICAR), ARS Mandor, Jodhpur, 14 pp.

Khandar RR, Desai S, Dhruj IU, Nigam SN, Thakur RP, Waliyar F and **Bandyopadhyay A.** 2004. Mapping and Management of Aflatoxin Contamination in Groundnut in Gujarat, Andhra Pradesh and Karnataka. Information Bulletin. Junagadh, Gujarat, India: MORS, GAU.

Ndjeunga J, Bantilan C, Rao KPC, Ntare B and **Camara Y.** 2004. Impact assessment of Agricultural Technologies in West Africa: Technical Notes and Exercises. Proceedings of a regional workshop on Impact Assessment of Agricultural Technologies in West Africa. 12-17 July 2004. Bamako, Mali.

Rusike J, Masendeke D, Heinrich GM and **Twomlow SJ.** 2004. The Impact of Farmer Field Schools on Adoption of Improved Soil Fertility and Water Management Technologies In Dry Areas Of Zimbabwe. Bulawayo: ICRISAT 20 pp.

Electronic modules and Websites

Bantilan MCS. GT-SAT Futures website. 2004.

Bantilan MCS. GT-SAT Futures, ICRISAT and APAARI**.** 2004. CD Modules and Proceedings of an International workshop on "Research need assessment and prioritization of agricultural research for development in south and west Asia." 7-8 October, 2004, International Crops Research Institute for the Semi-Arid Tropics.

Bantilan MCS. ICRISAT adoption and impact data: update 2004

Bantilan MCS. ICRISAT district level database: update 2004

Jayashree B, Buhariwalla H.K, Shinde Sanjeev, Vinod Kumar P and **Crouch JH.** Chickpea Root EST Database and tools accessible at: http://www.icrisat.org/gt1/Cpest/tools.asp

Kumar PL, Jones AT and **Waliyar F.** 2004. Serological and nucleic acid-based methods for the detection of plant viruses. Methods Manual on CD-ROM (also on Learning Systems Unit Website of ICRISAT). ICRISAT, Patancheru 502 324, AP, India.

Waliyar F. Aflatoxin website (www.aflatoxin.info)

Waliyar F. Groundnut seed project website (www.groundnutseedproject.org)

Wani SP. Integrated Watershed Management – A Success Story in Kothapally – Documentary in Kannada

Wani SP. Macro Benefits from Micro-nutrients – A Documentary in English, Telugu and Hindi

Manuals

Bantilan MCS, Ndjeunga J and **Rao KPC.** 2004. Impact assessment Training Manual for agricultural technologies in West Africa., 12-16 July, 2004. Bamako, Mali: International Crops Research Institute for the Semi-Arid Tropics.

D'Silva E, Wani SP and **Nagnath B.** 2004. The making of new Powerguda : community empowerment and new technologies transform a problem village in Andhra Pradesh Global Theme on Agroecosystems Report No. 11, Patancheru 502 324, Andhra Pradesh, India : International Crops Research Institute for the Semi-Arid Tropics. 28 pp.

Kumar PL Jones AT and **Waliyar F.** 2004. Serological and Nucleic Acid Based Methods for the Detection of Plant Viruses: Methods manual. ICRISAT, Patancheru 502 324, India, 120pp. (Also on CD ROM and http://www.icrisat.org)

Nagavallemma KP, Wani SP, Stephane Lacroix Padmaja VV, Vineela C, Babu Rao M and **Sahrawat KL.** 2004. Vermicomposting : Recycling wastes into valuable organic fertilizer. Global Theme on Agroecosystems Report No. 8, Patancheru 502 324, Andhra Pradesh, India : International Crops Research Institute for the Semi-Arid Tropic. 20 pp.

Nigam SN, Giri DY and **Reddy AGS.** 2004. Groundnut seed production manual. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 32 pp.

Pathak P and **Sudi R.** 2004. Manual of operation and instruction: Microprocessor-based automatic sediment sampler. ICRISAT, Patancheru, A.P., India. 12pp.

Policy Briefs

Bantilan MCS, Rao KPC, Singh K, Parthasarathy Rao P, Shiferwa B and **Padmaja R.** 2004. Overcoming poverty through dryland agriculture: A strategy for India. Policy Brief 6. Strategic assessment and development pathways for agriculture in the semi-arid tropics. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. April 2003. Patancheru, India. 4 pp.

Harris D and **Kumar Rao JVDK.** 2004. Rainfed rabi cropping in rice fallows – Chickpea in Eastern India. A Development brief prepared by the Centre for Arid Zone Studies, University of Wales, UK; Catholic Relief Services, India; Gramin Vikas Trust, India; ICRISAT, India. 7 pages.

Parthasarathy Rao P, Birthal PS and **Dharmendra K.** Increasing livestock productivity in mixed crop-livestock systems in South Asia. Policy Brief posted on SLP web page. Ethiopia, Systemwide Livestock Program, International Livestock Research Institute.

Software developed

Bantilan MCS, Padmaja R, Parthasarathy D, Gandhi BVJ, Chopde VK and **Balakrishnan R.** GT-SAT Futures, ICRISAT. 2004. Together We Sow, Together We Reap. A video documentary featuring the process of empowerment through technology uptake (duration 25 mins). Film and script developed and written under leadership of Bantilan MCS and social science research team. International Crops Research Institute for the Semi-Arid Tropics.

Purnachandra Rao K, 2004. Adaptation of CSPro for the village and household schedules of the World Bank sponsored-rainfall insurance study. The Census and Survey Processing System (CSPro) is a software package for entering, editing, tabulating and disseminating data from censuses and Surveys. One of the terms of references of the World Bank-sponsored Rainfall Insurance study was that the CSPro package be adapted to the village and household questionnaires developed for the study. The CSPro package is successfully adapted to the schedules.

The double entry method followed for data entry allows to compare the two sets of entry and facilitates correction. The programme was approved by the World Bank. It facilitates the data verification and can be adopted for many other surveys of similar nature.

Conference Proceedings

Adamou A, Bationo A, Tabo R and **Koala S.** 2004. Improving soil fertility through organic matter management, legume cultivation and cropping systems in Niger. Poster paper presented at the African Network for Soil Biology and Fertility Network (AfNet) International Symposium; Yaounde, Cameroon, 17-21 May 2004. [Abstract] Page 89 *in* the International Symposium of the African Network for Soil Biology and Fertility (AFNET) of TSBF Institute of CIAT, May 17-21, 2004, Yaounde Cameroon (Bationo A, Kimetu J and Kihara J, eds.).

Ajitkumar A, Naik MK, Waliyar F and **Reddy SV.** 2004. Use of indirect competitive ELISA technique for detection of aflatoxins B1 contamination in chilli. Pages 8-14 *in* Proceedings of Biotechnological Approaches for the Integrated Management of Crop Diseases (Mayee CD, Manoharachary C, Tilak KVBR, Mukandam DS and Jayashree DESHPANDE, eds.). Daya Publishing House, New Delhi.

Bantilan MCS and Padmaja R. 2004. Constraints on agriculture production in south Asia: Role of international collaborative research. Pages 89-95 *in* Prospects for food security and agricultural sustainability in developing regions- New roles of international collaborative research (Miyata S, Tada M and Koyama O, eds.). Proceedings of the 10th JIRCAS International Symposium. JIRCAS International Symposium Series No 12. Tsukuba, Japan: Japan International Research Center for Agricultural Sciences. 7 pp.

Bationo A, Ramisch J, Bado B, Kihara J, Adamou A, Kimetu J, Tabo R, Lompo F, Ouattara B and **Koala S.** 2004. Research highlights on integrated soil fertility management in the Sahel. Paper presented at the Consultation of McKnight Foundation Workshop on Millet and Sorghum-based Systems in West Africa. Niamey, Niger 27-29 January 2004. Pages 32-35 *in* Proceedings of the Consultation on Millet-and Sorghum-Based Systems in West Africa, 27-30 January 2004, Niamey, Niger (Lindasy, Kelly and Ag, Ayoya, Mohamed, eds.).

Blummel M, Waliyar F, Nigam SN, Upadhyaya HD and **Khan A.** 2004. Effects of cultivars-dependent groundnut haulms quality on liveweight gains and nitrogen retention in sheep *in* The 5th Biennial Conference of Animal Nutrition Association "New Dimensions of Animal Feeding to Sustain Development and Competitiveness" November 24-26 2004, NIAN&P, Adugodi, Bangalore 560 030.

Chandra S, Buhariwalla HK, Kashiwagi J, Harikrishna S, Rupa Sridevi K, Krishnamurthy L, Serraj R and **Crouch JH.** 2004. Selecting trait-linked DNA markers in marker-deficient crops *in* International Conference on "Future of Statistical Theory, Practice and Education" at ISB Hyderabad.

Dar WD, Bantilan MCS and **Padmaja R.** 2004. Partner Power in South Asia: Strengthening Agricultural Research and Rural Development Linkages. Paper presented by Bantilan C at ADB-ICRISAT workshop on "Strengthening partnerships for more effective planning, research, and development in agriculture", September 1-3, 2004, New Delhi, India.

Dar WD. 2004. Strategic Partnerships and Alliances: Key to Effective Planning, Research and Development in Agriculture in South Asia. ICRISAT-ADB Regional Workshop, New Delhi, India, 1-3 Sep 2004.

Dar WD, Gowda CLL and **Sharma HC.** 2004. The role of modern science and technologies in agriculture for poverty alleviation in South Asia. Pages 96-106 *in* South Asia Conference on Technologies for Poverty Reduction, 10-11 October 2003, British Council, New Delhi.

Dingkuhn M, Singh BB, Clerget B, Chantereau J and **Sultan B.** 2004. Past, present and future criteria to breed crops for water-limited environments in West Africa. New directions for a diverse planet *in* Proceedings of the 4th International Crop Science Congress, 26 Sep – 1 Oct 2004, Brisbane, Australia. Published on CDROM. Web site www.regional.org.au/au/cs.

Douthwaite B, Keatinge JDH and **Park J.** 2004. Stakeholder learning and innovation in rural technology change: An evolutionary model. European Farming and Rural Systems Research and Extension into the Next Millenium: Environmental, Agricultural and Soicio-Economic Issues. Pages 165-178 *in* Proceedings of the 4th European Symposium on Farming Systems Research, 3-7 April 2000 Volos, Greece (Koutsouris A and Zorini LO, eds.).

Gaur PM, Kumar J and **Gowda CLL.** 2004. Breeding kabuli chickpeas for tropical environments. Abstract no. 295 *in* 5th European Conference on Grain Legumes, 7-11 June 2004, Palais des Congrès, Dijon, France.

Gowda CLL and **Gaur PM.** 2004. Global scenario of chickpea research – Present status and future thrusts. Pages 1-22 *in* Pulses in New Perspective: Proceedings of National Symposium on Pulses for Crop Diversification and Natural Resource Management, 20-22 Dec 2003, Indian Institute of Pulses Research, Kanpur, India (Massod Ali, Singh BB, Shiv Kumar and Vishwadhar, eds.), Kanpur, India: Indian Society of Pulses Research and Development.

Green PWC, Stevenson PC, Simmonds MSJ and **Sharma HC.** 2004. What makes it tasty for the pest? Identification of *Helicoverpa armigera* feeding stimulants and location of their production on the pod-surfaces of pigeonpea*, Cajanus cajan in* the National Meeting of the Royal Entomological Society, 30 July 2004, Reading University, Reading, UK

Harinarayana G, Melkania NP, Reddy BVS, Gupta SK, Rai KN and **Sateesh Kumar P.** 2004. Forage potential of sorghum and pearl millet. Pages 292-321 *in* Alternative Uses of Sorghum and Pearl Millet in Asia. Proceedings of the Expert Meeting, ICRISAT Patancheru, Andhra Pradesh, India, 1-4 July 2003. CFC Technical Paper No 34. 364 pp**.**

Hatibu N, Mutabazi K, Senkondo EM and **Msangi ASK.** 2004. Economics of Rainwater Harvesting for Crop Enterprises in Semi-Arid Areas. New directions for a diverse planet *in* Proceedings of the 4th International Crop Science Congress, 26 Sep – 1 Oct 2004, Brisbane, Australia. Published on CDROM. Web site www.regional.org.au/au/cs.

Huda AKS, Ramakrishna YS, Desai S, Thakur RP, Singh P, Jagannathan R, Gadgil S and **Spooner-Hart R.** 2004. Use of climate

information for cost-effective management of late leaf spot of peanut in selected locations of India. [Abstract] CD-ROM, American Society of Agronomy Annual Meetings, Seattle, 31 Oct - 4 Nov, 2004, USA (Copies available from http://www.asa-cssa-sssa.org/cgi-bin/Web_store /web_store.cgi).

Johansen C, Musa AM, Kumar Rao JVDK, Harris D, Ali MY and **Lauren JG.** 2004. Molybdenum response of chickpea in the High Barind Tract of Bangladesh and in Eastern India (Tuladhar JK, Karki KB, Anderson P and Maskey SL, eds.). Pages 52-54 *in* Book of Abstracts – "Micronutrients in South and South East Asia" An International Workshop on "Agricultural Strategies to Reduce Micronutrient Problems in Mountains and Other Marginal Areas in South and South East Asia" held at Kathmandu, Nepal, during 8-10 September 2004.

Jones RB, Estrada-Valle J, Cossa J, Siambi M, Silim SN and **Freeman HA.** 2004. Improving markets for groundnuts and pigeonpeas in Malawi and Mozambique: results and lessons from market institutional innovations. [Abstract] Page 22 *in* Proceedings of a Workshop on Markets to Raise Incomes of Poor Farmers in Africa, 5-8 April 2004, The Rockefeller Foundation, Nairobi, Kenya.

Jones RB. 2004. What is meant by food security? [Abstract] Pages 14-15 *in* Proceedings of the Consultation Workshop on Millet- and Sorghum-Based Systems in West Africa, 27-30 January 2004, The McKnight Foundation, Minneapolis, USA. ICRISAT, Niamey, Niger. Niamey, Niger: INRAN.

Kashiwagi J, Krishnamurthy L, Gaur PM, Chandra S, Serraj R and **Crouch JH.** 2004. Phenotyping for drought avoidance root traits in chickpea. [Abstract] Page 43 *in* Workshop on phenotyping water deficit, challenge program generation, 5-9 July 2004, Agropolis, Montpellier, France.

Kaya B, Niang A, Tabo R and **Bationo A.** 2004. Performance evaluation of various agroforestry species as short duration improved fallows for enhancement of soil fertility and sorghum crop yields in Mali. Poster paper presented at the African Network for Soil Biology and Fertility Network (AfNet) International Symposium; Yaounde, Cameroon, 17-21 May 2004. [Abstract] Pages 62-63 *in* the International Symposium of the African Network for Soil Biology and Fertility (AFNET) of TSBF Institute of CIAT, May 17-21, 2004, Yaounde Cameroon (Bationo A, Kimetu J and Kihara J, eds.).

Koala S and **Pasternak D.** 2004. The African Market Gardens as an alternative livelihood option for the desert margins of the Sahel. Paper presented at the Launching of the thematic programme network on the promotion of sustainable agricultural farming systems within the framework of the regional action action programme to combat desertification in Africa (TPN 6/RAP/UNCCD). Tunis 22-24 November 2004.

Kumar PL, Jones AT and **Waliyar F.** 2004. Pigeonpea sterility mosaic – an enigma resolved. [Abstract] Page 3 *in* Proceedings of National Symposium on Molecular Diagnostics for the Management of Viral Diseases, 14-16 October 2004, Indian Agricultural Research Institute, New Delhi 110 012, India.

Kumar PL, Jones AT, Kimmins F and **Waliyar F.** 2004. An example of DFID supported natural resource research from the Crop Protection Programme: Sterility Mosaic Disease in Pigeonpea - An Overview. 2004 *in* Summaries of "Teach-In" Meeting Presentations at Department for International Development (DFID) to Sir David King. January 28, 2004, DFID, Palace Street, London, UK.

Mgonja MA, Monyo ES, Rohrbach DD and **Maredia MK.** 2004. Regional Plant Breeding and Variety registration: a case of southern Africa. Pages 65-80 *in* Seed Trade Liberalization and Agro–biodiversity (Rohrbach DD and Howard J, eds.). Proceedings of a workshop on: Impacts of seed Trade Liberalization on Access to and exchange of Agro-biodiversity, 5-6 December 2002, Matopos Research station, Bulawayo, Zimbabwe. PO Box 776, Bulawayo, Zimbabwe. International Crops Research Institute for Semi Arid Tropics. 172 pp.

Mgonja MA. 2004. Pathway of technology development, uptake and impact as possible road map to a Green revolution in Africa: The case for sorghum and millet in southern Africa. Pages 15-16 *in* United Nations Economic and Social Council -Economic Commission for Africa (UNECA) ECA/SDD/Ad Hoc/ST/3. Report of the Ad Hoc expert group meeting on science and technology for sustainable development: Towards a green revolution in Africa: Addis Ababa Ethiopia 10-12 June 2003.

Myers RJK, Heinrich GM and Rusike J. 2004. Can Manure Lift Crop Production in Communal Lands of Semi-arid Zimbabwe? Page 7 *in* Paper presented at the 4th International Crop Science Congress In conjunction with 5th Asian Crop Science Conference and the 12th Australian Agronomy conference "New Directions for a Diverse Planet" Brisbane Convention and Exhibition center, Queensland, Australia, Sunday 26 September to Friday 1 October 2004.

Myers RJK, Heinrich GM and **Rusike J.** 2004. Soil Water and Nutrient Management for Raising Productivity and Profitability on Small-scale Farms in Degraded Lands of Southern Zimbabwe. Page 5 *in* Paper presented at the 13th International Soil Conservation Organization Conference "Conserving Soil and Water for Society: Sharing Solutions." Brisbane, July 2004.

Ndjeunga J, Diakite L, Kergna A and **Gerard B.** 2004. The competitiveness of sorghum and pearl millet in the cereal food systems in the semi-arid tropics of West Africa *in* Paper presented at the Consultation Workshop on Millet and-Sorghum Based Systems in West Africa. McKnight-ICRISAT-INRAN. 27-30 January 2004. Niamey, Niger. http://mcknight.ccrp.cornell.edu/participants/wkshpwafrica04.html

Ndjeunga J, Jones R, Amara K, Sogodogo D, Zarafi MA and **Weltzien E.** 2004. Local village seed systems in the semi-arid tropics of West Africa: current practices, constraints and opportunities *in* Paper presented at the Consultation Workshop on Millet and-Sorghum Based Systems in West Africa. McKnight-ICRISAT-INRAN. 27-30 January 2004. Niamey, Niger. http://mcknight.ccrp.cornell.edu/participants/wkshpwafrica04.html

Ndjeunga J, Kelly V, Sylla ML, Traore B and **Tessougue M.** 2004. Determinants of Uptake of Soil and Water Conservation Options in the Office de Haute Vallee du Niger *in* Paper presented at the Regional Workshop on "Institutional Innovations and Technological Development in a Decentralized and Sustainable Management of Natural Resources" organized by SANREM. Palais de

Congres a Bamako, Mali, 24-26 February 2004. www.sanrem.uga.edu/sanrem/database/pdf/WAFWorkshopFinal.pdf

Omanya GO, Weltzien-Rattunde E, Zangre R, Sogodogo D, Guero Y and **Ndahi W**. 2004. Variety Improvement of Pearl millet in West Africa: Lessons learnt. Full paper in CD and [Abstract (hardcopy)] on Pages 45-46 *in* Proceedings of the Consultation Workshop for Sorghum and Pearl millet based Production systems, 27-30 January 2004, Niamey, Niger.

Padmaja R, Bantilan MCS and **Gandhi BVJ.** 2004. Gender dimensions in social capital formation with implications for technology transfer. Paper presented at the FAO Expert Consultation on Gender Dimensions in Asian Rice Livelihood Systems in Changing Milieu of Technologies and Economy, 9–12 March 2004, Bangkok, Thailand.

Pande S and **Gowda CLL.** 2004. Role of legumes for poverty reduction in Asia. pages 204-219 *In* Role of Legumes in Crop Diversification and Poverty Reduction in Asia *in* Proceedings of the Cereals and Legumes Asia Network Co-ordination meeting, 10-12 Nov 2003 (CLL Gowda and S Pande, eds.) : International Crops Research Institute for the Semi-Arid Tropics 230 pp.

Pande S, Kishore GK and Rao JN. 2004. Integrated management of groundnut diseases India *in* Integrated Pest Management: Principles and Applications. Ed. O P Sharma. National Centre for Integrated Pest Management (NCIPM) Indian Council of Agricultural Research (ICAR), IARI, 110012, India.

Pande S, Kishore GK, Ramsay G, Williamson B, SENTHIL G, Shivram LP, MALLIKARJUNA N, Gaur PM and **Rao JN.** 2004. Biology and epidemiology of botrytis grey mould of chickpea in Proceedings of the XIII International Botrytis Symposium, Antalya, Turkey, 25-31 October 2004.

Pande S, Rao JN and **Kishore GK.** 2004. Rehabilitation of chickpea in the rice wheat cropping system of the Indo-Gangetic plains of India through integrated pest management *in* Proceedings of a brain storming session on "Chickpea production and productivity constraints", NCIPM, IARI Campus, New Delhi 110 012, India: National Center for Integrated Pest Management .

Pande S, Rao JN and **Kishore GK.** 2004. Legumes in rainfed rice ecosystems: Constraints and Opportunities *in* Proceedings of the International Symposium on Rainfed Rice Ecosystems: Perspective and Potential, 11-13 October, 2004, Indira Gandhi Agricultural University, Raipur, Chattisgarh, India. p. 155.

Parthasarathy Rao P, Hall A and **Bantilan MCS.** 2004. Dynamics of cereal markets, trade and coalitions: sorghum and millets in Asia. Pages 93-112 *in* Proceedings of the Experts Meeting on Alternative Uses of Sorghum and Pearl Millet in Asia, 1- 4 July 2003, ICRISAT, Patancheru, Andhra Pradesh, India. CFC Technical Paper no. 34. Amsterdam, The Netherlands: Common Fund for Commodities; and Patancheru, Andhra Pradesh, India: International Crops Research Institute for Semi-Arid Tropics. 364pp.

Ranga Rao GV, Nandagopal V, Rameshwar Rao V and **Reddy YVR.** 2004. Insect Pheromones of Legume Pests in India: Current Status and Future Requirements. Pages 84-95 *in* Proceedings of the National Seminar on Trends in Pheromone Research and Technology, 6-7 February, 2004, Junagadh, Gujarat, India.

Ranga Rao GV, Reddy YVR and **Rameshwar Rao V.** 2004. Integrated pest management in grain legume crops in India. Present status and future prospects. Pages 207-216 *in* Proceedings of National seminar on 'Resource management for sustainable agriculture, 28-30 January, 2004. Agricultural College, Bapatla, A.P.

Rao KPC and **Okwach G**. 2004. Coping with climate variability: can seasonal climate forecasts help? *in* Proceedings of KARI 9th Biennial Scientific Conference, 8–12 November 2004, Kenya Agricultural Research Institute, Nairobi, Kenya.

Rego TJ and **Wani SP.** 2004. Watershed approach in increasing the productivity of soils in rainfed areas *in* Invited paper commemonation souvenir of 69th Annual Convention of Indian Society of Soil Science Meeting held at Hyderabad, Oct 27-30, 2004.

Ridsdill-Smith J, Sharma HC and Cotter S. 2004. Novel sources of resistance to *Helicoverpa* in wild chickpea species *in* Paper presented at the Annual Meeting, Grains Research and Development Corporation, Perth, Western Australia, Australia.

Rupela OP, Gowda CLL and Wani SP. 2004. Lessons from non-chemical treatments based on scientific and traditional knowledge, in a long-term experiment. [Abstract] Page 90 *in* International Conference on Agricultural Heritage of Asia, 6-8 Dec 2004.

Rupela OP, Singleton PW, Wani SP and Bhattacharyya P. 2004. Production and quality control of microbial inoculants: some perspectives. Pages 8-21 *in* Proceedings of National Conference on Quality Control of Biofertilzers (Bhattacharyya P and Dwivedi V, eds.). National Biofertiliser Development Centre, Department of Agriculture and Cooperation, Uttar Pradesh, India.

Rusike J and Dimes J. 2004. Effecting Change through Private Sector Client Services for Smallholder Farmers in Africa. New directions for a diverse planet *in* Proceedings of the 4th International Crop Science Congress, 26 Sep – 1 Oct 2004, Brisbane, Australia. Published on CDROM. Web site www.regional.org.au/au/cs.

Sharma D and Saxena KB. 2003. Hybrid pigeonpea – a reality. Pages 33-40 *in* Souvenir, National Symposium on Pulses for Crop Diversification and Natural Resource Management, IIPR, Kanpur, India.

Sharma HC and **Crouch JH.** 2004. Molecular marker assisted selection: A novel approach for host plant resistance to insects in grain legumes *in* National Symposium on Pulses for Crop Diversification and Natural Resource Management, 20 - 22 Dec 2003. Kanpur, Uttar Pradesh, India: Indian Institute for Pulses Research.

Sharma HC, Clement SL and Ridsdill-Smith J. 2004. Getting help from the wild: Exploitation of wild relatives of crops as source of novel genes for resistance to insect pests. [Abstract] *in* Strength in Diversity, Proceedings of the XXII International Congress of Entomology, 15 to 21 Aug 2004. Brisbane, Queensland, Australia; http;//www.ice2004.

Sharma HC, Dhillon MK, Naresh JS, Ram Singh, Pampapathy G and **Reddy BVS.** 2004. Influence of

cytoplasmic male-sterility on the expression of resistance to insects in sorghum *in* New Directions for a Diverse Planet: Proceedings of the 4th International Crop Science Congress, 25 Sept to 1 Oct 2004, Brisbane, Queensland, Australia (Fisher T, Turner N, Angus J, McIntyre L, Robertson M, Borrell A and Llyod D, eds.). Brisbane, Queensland, Australia: http;// www.cropscience.org.au. pp. 6.

Sharma HC, Pampapathy G and **ARORA R.** 2004. Transgenics in integrated pest management *in* All India Workshop on Insect Resistance Management (IRM) Strategies for Bt Cotton in India, 29 to 30 March 2004. University of Agricultural Sciences, Dharwad, Karnataka, India.

Sharma HC. 2004. Transgenics: Biosafety considerations and risk assessment *in* Paper Presented at the National Meeting on Setting a Research Agenda on Agricultural Biotechnology and Biosafety in Asia, 19 Oct 2004, Colombo, Sri Lanka.

Shiferaw B. 2004. Markets policy and institutional issues as critical components of integrated management of watersheds: - needs for research, outreach and capacity building. Page 7 *in* ICRISAT-ASARECA Planning Workshop on Integrated Management of Watersheds to Promote Market-Led Smallholder Agriculture and Natural Resource Management in the Semi-Arid Areas of Eastern and Central Africa, 6-7 Dec 2004, Nairobi Kenya.

Singh BB, Larbi A, Tabo R and **Dixon AGO.** 2004. Trends in development of crop varieties for improved crop-livestock systems in West Africa (Williams TO, Tarawali, SA, Hiernaux P and Fernandez-Rivera S, eds.). Sustainable crop-livestock production for improved livelihoods and natural resource management in West Africa. Page 536 *in* Proceedings of an international conference held at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, 19-22 November 2001. CTA (Technical Centre for Agricultural and Rural Cooperation) ACP-EC, Wageningen, The Netherlands and ILRI (International Livestock Research Institute), Nairobi, Kenya.

Smith JW, Keatinge JDH, Smalley M and **Quiroz R.** 2004. The System-wide livestock programme (SLP): A promising research-for-development concept *in* Proceedings of the ILRI/IITA Crop-Livestock Systems in West Africa workshop. Ibadan November, 2001.

Srilakshmi P, Thakur RP and **Satya Prasad K.** 2004. Morphological and molecular diversity in *Trichoderma* isolates antagonistic to *Aspergillus flavus* in *g*roundnut. [Abstract] Pages 156-157 *in* Proceedings of the 26th Annual Conference & National Symposium on Advances in Fungal diversity and Host pathogen Interactions, 7-9 Oct 2004, Dept of Botany, Goa University, Goa 403 206. Indian Society of Mycology and Plant Pathology, Udaipur, India.

Tabo R, Bationo A, Gerard B, Ndjeunga J, Marchal D, Amadou B, Annou G, Sogodogo D, Taonda JBS, Hassane O, Maimouna K Diallo and **Koala S.** 2004. Improving the productivity of sorghum and millet and farmers income using a strategic application of fertilizers in West Africa. Paper presented at the African Network for Soil Biology and Fertility Network (AfNet) International Symposium; Yaounde, Cameroon, 17-21 May 2004. [Abstract] Pages 99-100 *in* the International Symposium of the African Network for Soil Biology and Fertility (AFNET) of TSBF Institute of CIAT, May 17-21, 2004, Yaounde Cameroon (Bationo A, Kimetu J and Kihara J, eds.)

Tabo R, Koala S, Cheruiyot H, Gandah M, Soumare A, Mharapara I, Tamba A, Kayombo B, Kellner K, Ouedraogo S and **Kruger B.** 2004. The Desert Margins Program: Elements of agro-biodiversity conservation and use in the desert margins of Sub-Saharan Africa. Keynote paper presented at the regional Conference on Plant Genetic Resources and Food Security in West and Central Africa; held at the International Institute of Tropical Agriculture, Ibadan, Nigeria; 26-30 April 2004. [Abstract] Page 34 *in* the Regional Conference on Plant Genetic Resources and Food Security in West and Central Africa, 26-30 April, Ibadan, Nigeria (Atta-Krah, K, ed.).

Tarawali SA, Keatinge JDH, Powell JM, Hiernaux P, Lyasse O and **Sanginga N.** 2004. Integrated natural resource management in the context of crop-livestock systems in west Africa. Sustainable crop-livestock production for improved livelihoods and natural resource management in West Africa. Pages 349-370 *in* Proceedings of the ILRI/IITA Crop-Livestock Systems in West Africa workshop. Ibadan November, 2001. ILRI, Nairobi.

Thakur RP and **Huda AKS.** 2004. Climate Information to Screen Pearl Millet Downy Mildew Risk Environment-A case study. Presented at the International Workshop on Climate Information for Plant Disease Risk Management, 26-28 May 2004, University of Western Sydney, Hawkesbury Campus, Australia.

Thakur RP. 2004. Plant pathogen diversity in response to climate change. [Abstract] Pages 159-160 *in* Abstract of the 26th Annual Conference & National Symposium on Advances in Fungal diversity and Host pathogen Interactions, 7-9 Oct 2004, Dept of Botany, Goa University, Goa 403 206. Indian Society of Mycology and Plant Pathology, Udaipur, India.

Twomlow SJ and **Lilja N.** 2004. The role of evaluation in successful integrated natural resource management. Page 12 *in* New directions for a diverse planet *in* Proceedings of the 4th International Crop Science Congress, 26 Sep – 1 Oct 2004, Brisbane, Australia. Published on CDROM. Web site www.regional.org.au/au/cs.

Waliyar F, Reddy SV and **Thakur RP.** 2004. Effects of mycotoxins on cereals grain feed and fodder quality. Pages 128-140 *in* Proceedings of CFC and ICRISAT, 2004. Alternative Uses of Sorghum and Pearl Millet in Asia: proceedings of the Expert Meeting, ICRISAT, Patancheru, Andhra Pradesh, India, 1-4 July 2003. CFC Technical Paper No. 34, P.O. Box 74656, 1070 BR Amsterdam, The Netherlands: Common Fund for Commodities; and Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 364 pp.

Wani SP, Balloli SS, Kesava Rao AVR and **Sreedevi TK.** 2004. Combating drought through integrated watershed management for sustainable dryland agriculture. Pages 39-48 *in* Regional Workshop on Agricultural Drought Monitoring and Assessment using Space Technology on 4 May 2004, Hyderabad, India.

Wani SP, SREEDEVI TK, Ramakrishna YS, Rego TJ, Ramakrishna A, Singa Rao M and **Pande AB. 2004.** A Consortium

Approach for Sustainable Watershed Management for Increasing Productivity of Rainfed Systems : Potential and Challenges. Pages 161-171 *in* National Seminar on Creativity in Water Management. 27 to 28 February 2004 at Bhopal, Madhya Pradesh, India.

Weltzien E, Rattunde F, Toure A, and **Clerget B.** 2004. A breeding program based on patterns of landraces diversity: Case of Sorghum in West Africa. CD of Abstracts. American Society of Agronomy.

Witcombe JR and **Hash CT.** 2004. Breeding new varieties aided by biotechnology. Pages 232-248 *in* Proceedings (CD-ROM) Symposium 2003 on the Sahel: Sustainable Agriculture Lessons and Opportunities, December 01-04 2003, Palais des Congres, Bamako, Mali. La Fundation Syngenta pour une Agriculture Durable: Bale, Switzerland and Bamako, Mali.

Invited Seminars / Lectures

Chandra S, Buhariwalla HK, Kashiwagi J, Harikrishna S, Rupa Sridevi K, Krishnamurthy L, Serraj R and **Crouch JH.** 2004. Identifying Trait-linked Loci in Marker-deficient Crops. Invited seminar delivered to 45 students and faculty members of Genetics Department at Osmania University.

Chandra S. 2004. DUS Testing – Biometric Aspects. Invited seminar delivered to 18 participants of ANGARAU Training course on DUS Testing.

Chandra S. 2004. Linkage Mapping and QTL Analysis. Six invited lectures delivered to 11 ANGRAU MSc Biotechnology students.

Christinck A, Vom Brocke K and **Weltzien E.** 5 April 2004. Understanding Farmers' Seed Management: Entry Point for Participatory Breeding and Sustainable Seed Supply. Project Planning Workshop on Sorghum Geneflow in Niger, Ethiopia and South Africa, Purdue Univ. USA.

Crouch JH. Building Productive Crops in Harsh Environments. IRRI, Los Banos, Phippines, 21 January 2004

Crouch JH. Driving Genomics Innovations into Farmers' Fields. GCP Needs Assessment Workshop, Costa Rica, August 2004

Crouch JH. Gene Transfer and Crop Improvement. GCP Bioinformatics Workshop, IPGRI, Rome, Italy. 16-20 February 2004

Crouch JH. Molecular Breeding Status Report. GCP Annual Research Meeting, Brisbane, 22-24 September 2004.

Crouch JH. Strengthening Legume Molecular Breeding and Seed-Technology Delivery. Asian Development Bank, Manila, Philippines. 20 January 2004

Crouch JH. Trait Capture for Crop Improvement. GCP Crops with Appropriate Gene Technologies Workshop ILRI, Nairobi, Kenya. 26-30 April 2004

Dar Willam D and **Bantilan MCS.** 2004. Linking National Professional Associations to International Research Organizations . Paper delivered by William Dar, Director General of ICRISAT at the 45th National Convention of the Philippine Agricultural Economics and Development Association, 12 Oct. 2004, Bureau of Soils and Water Management, Quezon City, Philippines.

Dar William D and **Steve Twolmlow.** 2004. Managing Agricultural Intensification the Role of International Research. 4th International Weed Science Conference, Durban, South Africa.

Dar William D. 2004. Transforming Gray Fields to Green Fields: Research Initiatives and their Impact in South Asia. Annual Symposium of the Department of Agriculture (ASDA 2004) Plant Genetic Resource Center, Kandy, Sri Lanka, 30 Sep - 1 Oct 2004.

Dar William D. 2004. Transforming the Dryland Agriculture of West Africa: The New Sahel, Japan International Research Center for Agricultural Sciences (JIRCAS) and Japan Association of International Development, 15-16 Jul 2004.

Dar William D. 2004. Agenda 2007: Every Village a Knowledge Center. MSSRF-TATA National Virtual Academy, Chennai, Tamil Nadu, India, 19 May 2004.

Dar William D. 2004. Transgenic Crops for Sustainable Agriculture. BioAsia 2004. Hyderabad, Andhra Pradesh, India, 26 Feb 2004.

Dar William D. 2004. Access to Germplasm: ICRISAT's experience in India. International Conference on Agricultural Biotechnology sponsored by the Federation of Indian Chambers of Commerce and Industry (FICCI) , New Delhi, India, 10 Aug 2004.

Dar William D. 2004. Agricultural Technologies for Rural Development. International Training Program on Agricultural Technologies for Rural Development, National Institute of Rural Development (NIRD), Hyderabad, India, 2 Aug 2004.

Dar William D. 2004. Approaches for improving food security and economic transformation in tropical drylands: agricultural technologies and policy options. National Commission on Farmers: Stabilizing and Elevating the Production and Profitability of Rainfed and Dryland Farming, Hyderabad, 20 Sep 2004.

Dar William D. 2004. Building a strategic alliance for stronger research management. The 14th PHILARM National Convention, Santiago City, Isabela, Philippines, 14 Apr 2004.

Dar William D. 2004. Challenges and opportunities in resource generation at the global level. PCARRD Scholars Association, Inc. (PSAI) forum on "Enhancing Resource Generation for Agro- and Forestry-based Enterprise;" Bureau of Soils and Water Management, Quezon City, Philippines; 9 Nov 2004.

Dar William D. 2004. ICRISAT & Partners: Sowing Seeds of Success in the SAT. SDC, Switzerland, 9 Mar 2004

Dar William D. 2004. ICRISAT & Partners: Sowing Seeds of Success in the SAT. Ministry of Foreign Affairs Norway, 12th Mar 2004

Dar William D. 2004. ICRISAT & Partners: sowing seeds of success in the SAT of Southern Africa. 16th SADC Parliamentary Forum in Windhoek, Namibia, 1 Jun 2004.

Dar William D. 2004. ICRISAT & Partners: Sowing Seeds of Success in the SAT, Washington State University, Pullman, 14 Jun 2004.

Dar William D. 2004. ICRISAT & US Universities Strengthening Partnerships. SLO/Linkages Program Conference, Davis, California, USA, 8 Jun 2004.

Dar William D. 2004. INRM for Sustainable Agriculture and Rural Development: the CGIAR Perspective. Regional Conference of Lowland Rainfed Farming Systems, Philippines, 19-21 Jul 2004.

Dar William D. 2004. International Institutional Outreach: a CGIAR Perspective. Cornell-in-India and Sathguru Agri and Food Business Management Program, Hyderabad, 12 May 2004.

Dar William D. 2004. Linking National Professional Associations to International Research Organizations. 45th National Convention of the Philippine Agricultural Economics and Development Association, Bureau of Soils and Water Management, Quezon City, Philippines. 12 Oct 2004.

Dar William D. 2004. Macro Benefits from Micronutrients: Winning the Gray to Green Revolution. The IFA International Symposium on Micronutrients, New Delhi, 23 Feb 2004.

Dar William D. 2004. Nurturing the youth for a responsible and conscientious citizenry. Annual Commencement Exercises of the Central Luzon State University, Muñoz, Nueva Ecija, Philippines, 16 Apr 2004.

Dar William D. 2004. Open and Distance Learning for Agriculture: A Perspective from CGIAR. Workshop on Open and Distance Learning for PG Education in Agriculture, New Delhi, India; 29 Mar 2004.

Dar William D. 2004. Out-scaling Fodder Technologies for the Benefit of Poor Livestock Farmers. Workshop on Strategies for Targeting and Scaling-out Fodder Technologies for Small-Scale Farmers in Developing Countries, Patancheru, India, 21 Sep 2004.

Dar William D. 2004. Resource Conservation and Agricultural Productivity. National Symposium on Resource Conservation and Agricultural Productivity, Punjab Agricultural University, Ludhiana, Punjab, India, 22-25 November 2004.

Dar William D. 2004. The Virtual Academy for the Semi Arid Tropics (VASAT): harnessing the power of partnerships and contemporary information technology to enhance food and livelihood security in the SAT. Dr. B.P. Pal Memorial Lecture, New Delhi, India, 5 Aug 2004.

Dar William D. 2004. Transforming BSU as a Premiere Institution of Higher Learning. 17th Anniversary of the Benguet State University, 12 Jan 2004, Benguet, Philippines.

Gowda CLL. 10 March 2004 UAS Dharwad: Crop Improvement research at ICRISAT

Gowda CLL. 17 Aug :Penn State Univ, University Park, USA: ICRISAT and Partners: Sowing the Seeds of Success

Gowda CLL. 17 October: Beijing, China: Genetic resources research at ICRISAT: future prospects

Gowda CLL. 19 Aug: INTSORMIL, Nebraska, USA: Opportunities for collaboration between ICRISAT and US Universities

Gowda CLL. 19 October: Peanut Research Institute, Qingdao, China: ICRISAT and Partners: Sowing the Seeds of Success

Gowda CLL. 24 May: AREO, Tehran: Public-private partnership research at ICRISAT

Gowda CLL. 26 May: Gorgan university of Agri, Gorgan, Iran: ICRISAT vision and research strategy

Gowda CLL. 3 Feb 2004, ICWG-GR, Penang: Progress of genetic resources research at ICRISAT.

Howitt RE, Msangi S, Reynaud A and **Knapp KC.** 2003. "Estimating Intertemporal Preferences for Natural Resource Allocation" *submitted to American Journal of Agricultural Economics.*

Karupanchetty SM and **Sharma KK.** 2004. Agri-Business Incubator at ICRISAT and opportunities for business development, In: workshop on consortium for biological pesticides, ICRISAT, June 2004.

Kasiwagi J. The research strategy on drought tolerance and significance of root traits to improve the drought avoidance in chickpea. 26 July 2004, Hokkaido University, Japan and 30 July 2004, Mie University Japan.

Longley K. 2004. Agricultural Rehabilitation, INTECH UN University, 14 September, Maastricht.

Longley K. 2004. Kenya case study presentation prepared for Workshop on Human and Social Capital in Low External Input Agriculture (with Nelson Mango and Wilson Nindo), 22-23 June 2004, London.

Longley K. 2004. Legumes commercialization, seed systems and agricultural rehabilitation (with Richard Jones, ICRISAT), 13 February 2004, USAID, Nairobi.

Longley K. 2004. Agricultural Rehabilitation (Sierra Leone case study and comparative insights), Ministry of Agriculture Forestry and Food Security, 11 November 2004, Freetown.

Longley K. 2004. Policy Frameworks for Longer-term Food Security in Protracted Crisis Situations (with Gunter Hemrich, FAO), 20 April 2004, SACB workshop, Naivasha.

Longley K. 2004. Cash Relief Experiences, NOVIB Cash Relief workshop, 19 October 2004, Nairobi.

Longley K. 2004. Agricultural Rehabilitation (with Ian Christoplos and Tom Slaymaker), EC - DG Dev, 13 September 2004, Brussels.

Longley K. 2004. Agricultural Rehabilitation (with Ian Christoplos and Tom Slaymaker) 15 September, Rome.

Longley K. 2004. Livelihoods Approaches in Relief and Development, Keynote Address for AU-IBAR/Tufts workshop on Livestock & Livelihoods, Nairobi, 24 August 2004.

Pathak P. 2004. The prospects of improving water use efficiency in dryland agriculture. Presented at the University Grants Commission Refresher Course on "Water Management". 9 February 2004 at JNTU, Hyderabad.

Rai KN, Vadez V and **Kulkarni VN.** 2004. Genetic Improvement and Crop Cultivar Development for Hot Deserts. Paper presented at the NIRD Workshop on "Poverty reduction strategies in hot desert areas" 13-15 Sept 04. (Paper presented at the Workshop on Poverty Alleviation Strategies for Hot Desert (Sept. 13-15, 2004, National Institute of Rural Development, Hyderabad, Andhra Pradesh)).

Ranga Rao GV. ICRISAT contributions to agricultural science. Medak district science fair, 8 November, 2004.

Ranga Rao GV. IPM in chickpea. State Agricultural Management and Extension Training Institute (SAMETI), 28 July, 2004.

Ranga Rao GV. IPM in groundnut. State Agricultural Management and Extension Training Institute (SAMETI), 2 December, 2004.

Ranga Rao GV. IPM in pigeonpea. State Agricultural Management and

Extension Training Institute (SAMETI), 10 August, 2004.

Rao KPC and **Ambenje PG.** 2004. A nexus between Climate Change, Land Degradation and Poverty in Eastern and Central Africa. In Expert consultation and advisory committee meeting on ASARECA NRM priority setting, 13 – 15 July 2004, Nairobi, Kenya.

Rao KPC and **Okwach G.** 2004. Coping with variable climate using seasonal climate forecasts: A case study *in* 13th GHA climate outlook forum, 23-24 February 2004, Nairobi, Kenya.

Rao KPC. 2004. 'Viability of Dryland farming in Andhra Pradesh ' in the seminar on "Identification of Sustainable Technologies for Rainfed Agriculture in different Agro-eco-sub regions of Andhra Pradesh" – organised by CRIDA and Water Conservations Mission, AP on August 24, 2004.

Rattunde HFW, Vom Brocke K, Toure A, Sansan D, Weltzien E, Kapran I, and **Dagnoko S.** 2004. Heterosis in Guinea Sorghum Hybrids. Cornell University

Rolf Folkertsma. AMMANET (Dares Salaam, Tanzania, 15-16 July): Molecular breeding of sorghum at ICRISAT; a quelea's perspective.

Rolf Folkertsma. Genomics Momentum (Rotterdam, The Netherlands, 29 August – 1 September): Biotechnology in Africa; challenges ahead.

Serraj R, Hash CT, Yadav RS and **Bidinger FR.** 2004. Recent advances in marker-assisted selection for drought tolerance in pearl millet. Page 115 *in* Abstracts of the 4th International Crop Science Congress, Brisbane, Australia, 26 Sept. - 1 Oct. 2004.

Sharma HC, Pampapathy G and **ARORA R.** 2004. Transgenics in integrated pest management. In: All India Workshop on Insect Resistance Management (IRM) Strategies for Bt Cotton in India, 29 to 30 March 2004. University of Agricultural Sciences, Dharwad, Karnataka, India.

Sharma HC. 2004. Biotechnological approaches for crop improvement with special reference to host plant resistance to insects *in* Recent advances in Host Plant Resistance to Insects. Hissar, Haryana, India: Centre for Advanced Studies, Department of Entomology, CCS Haryana Agricultural University.Sharma, HC. 2004. Transgenics for insect resistance. Paper Presented at the Refresher Course on Plant Biotechnology, 10-30 Sept 2004, Osmania University, Hyderabad, Andhra Pradesh, India.

Sharma HC. 2004. Transgenics: Biosafety considerations and risk assessment. Paper Presented at the National Meeting on Setting a Research Agenda on Agricultural Biotechnology and Biosafety in Asia, 10 Oct 2004, Colombo, Sri Lanka.

Sharma KK and **Sharma HC.** 2004. Evaluation and Deployment of transgenic crops under ICRISAT-DBT, Presentation made to special steering committee of DBT for project formulation and funding from DBT, Oct. 27, 2004.

Sharma KK, Sharma A and **Tyagi AK.** 2004. Development of transgenic plants of groundnut and chickpea expressing cholera toxin B for oral vaccination, Presentation made to the Medical Steering Committee of DBT, New Delhi, June 11, 2004.

Sharma KK. 2004. Advancing Frontiers of Molecular Genetics Exploring New Horizons, Symp. Organized by XV Genetics Congress Trust, National Academy of Agricultural Sciences, IARI, New Delhi, January 21-22, 2004.

Sharma KK. 2004. Biotechnology for food security in Asia: priorities and challenges. In: Regional Cooperation for Ensuring Access and Capacity Building, Second Conference on Biotechnology for Asian Development, Research and Information Systems for the Non-Aligned and Other Developing Countries (RIS) and DBT, April 7-8, 2004.

Sharma KK. 2004. Chairman for Technical session on Crop Protection at "Intl Symposium on Rice: from Green revolution to Gene revolution" ANG Ranga Agricultural university, Hyderabad, Oct. 4-6, 2004.

Sharma KK. 2004. Current status of chickpea transgenics for insect resistance and groundnut transgenics for TSV resistance. In: ABSPII steering committee meeting, October 9, 2004, ICRISAT.

Sharma KK. 2004. Development and deployment of transgenic crops at ICRISAT: Current status and issues. In: ABIC 2004 held in Cologne, Germany, Sept. 12-15, 2004.

Sharma KK. 2004. Development and deployment of transgenic crops at ICRISAT: Current status and challenge. In: 2nd PBS Annual Program Meting held at IFPRI, Washington D.C., Sept. 20-24, 2004.

Sharma KK. 2004. Genetic transformation for crop improvement: Status, Issues and Future Directions. In: Covering Biotechnology: media workshop, October 11-13, 2004.

Sharma KK. 2004. Genetic Transformation of Crop Plants: Technology and issues, In: Training Course on "Sorghum Hybrid Production and Development", 2 to 6 February 2004, ICRISAT, Patancheru.

Sharma KK. 2004. Genetic transformation of legumes at ICRISAT. In: Indo-German bilateral Symposium (INSA-DFG), IARI, New Delhi, April 4-9, 2004.

Sharma KK. 2004. Strategies for the genetic transformation of grain legumes. Seminar Presented at the School of medicine, University of Ottawa, June 2, 2004.

Sharma KK. 2004. Transgenic Crops at ICRISAT: Current Status and Future Strategies. Presentation made at the Department of Biology and Biotechnology, Ohio State University, Columbus, Ohio, USA, January 15-16, 2004.

Sharma KK. 2004. Transgenic plants for tolerance to abiotic stresses, University of Geneva, Sept. 17, 2004.

Shiferaw B. FARA workshop for Building African Scientific and Institutional Capacity (BASIC), 6 – 8 September 2004, Addis Ababa, Ethiopia.

Shiferaw B. Regional planning meeting for Eastern and Southern Africa (ESA), 22-24 March, Bulawayo, Zimbabwe.

Shiferaw B. Village Level Studies and Reality Check in Asia and Africa: A mini-workshop, 21-27 July, ICRISAT Campus, India.

Suresh Pande. International Symposiuim on Rainfed Rice Ecosystems: Perspective and Potential, 11-13 October, 2004, Indira Gandhi Agricultural University, Raipur, Chattisgarh, India.

Suresh Pande. XIII International Botrytis Symposium, Antalya, Turkey, 25-31 October 2004.

Thakur RP. 2004. Pearl millet downy mildew: biology, epidemiology and management. ICRISAT, Patancheru, 20 Aug 2004.

Thakur RP. 2004. Climate information and crop disease risk management. School of Environment and Agriculture, University of Western Sydney, Hawkesbury campus, in Australia, 02 July 2004.

Thakur RP. 2004. Management strategies for pearl millet diseases. Centre for Horticulture and Plant Sciences, University of Western Sydney, Australia, 3 June 2004.

Tom Hash and Rolf Folkertsma. First sorghum/millets annotation and improvement workshop (Tucson, USA, 12-14 November): Sorghum and Millet improvement at ICRISAT with emphasize on application of molecular markers.

Twomlow S. 2004. Low input soil fertility management in Zimbabwe - presentation to Zimbabwe Crop Science Society 25th Feb 2004 and AREX 12th August 2004

Upadhyaya HD and **Gowda CLL.** 2004. Peanut genetic resources collection, diversity and their use in the improvement programs, University of Georgia and USDA collaborative Plant Experiment Station, Tiftan, USA, November 9, 2004.

Upadhyaya HD and **Gowda CLL.** 2004. Plant genetic resources conservation and enhancing their use in crop improvement programs, November 11, 2004, Taxas A&M, Lubbock, USA.

Upadhyaya HD. 2004. A strategy for the development of global chickpea composite collection for diversity studies in SP1CL1. In "Generation Challenge Program Annual research Meeting", September 22, 2004, Brisbane, Australia.

Upadhyaya HD. 2004. Breeding early-maturing groundnut varieties. Aiyura, Papua New Guinea, February 18, 2004.

Upadhyaya HD. 2004. Enanching use of germplasm in plant breeding. QDPI, Kingaroy, Australia, February 11, 2004.

Upadhyaya HD. 2004. Progress on assembling data sets on chickpea germplasm and on selection of markers in activities 1 in SP1C1. In "Data Analysis Workshop of SP1 of Generation Challenge Program" Zargosa, Spain, June 22, 2004.

Weltziene E and **Tesfa M.** 2004. Germplasm Restoration: Analysis of Case Study on pearl Millet Germplasm in Eritrea Presented at Germplasm Restoration workshop, Nairobi 26 June - 1 July 2004.

Weltzien E, Omanya G and **Rattunde F.** 2004. Consultation workshop on Millet – and Sorghum-based Systems in West Africa. McKnight Foundation, ICRISAT, INRAN. Held in Niamey, Niger, 27-30 Jan 2004.

Weltzien E, Rattunde HFW, Vom Brocke K, Toure A, Sansan D, Kapran I and **Dagnoko S.** 19 April 2004. New Sorghums for West Africa, American University Beirut.

Weltzien E. 2004. Germplasm Restoration: Analysis of Case Study on Finger Millet in the state of Karnataka, India. Presented at Germplasm Restoration workshop, Nairobi 26 June - 1 July 2004.

Weltzien E. 2004. Systeme semencier et la Biodiversite agricole. Presented at IPGRI – IFAD Tag activity planning workshop , April 2004, Bamako, Mali.

Weltzien, E, Christnik A, Vom Brocke K and **Diakite S.** 2004 Comprendre le systeme semencier paysan: Point de depart pour une selection participative et systeme d'approvisionnement en semence durable. IPGRI GEF Project Planning Workshop, Rome. Italy, 26-29 March 2004.

Journal Articles

Anitha K, Chakrabarty SK, Prasada Rao RDVJ, Girish AG, Thakur RP, Varaprasad KS, Khetarpal RK. 2004. Interceptions of bacterial wilt of groundnut from introduced germplasm – a case study. Indian Journal of Plant Protection 32:93-97.

Bantilan MCS, Chandra S, Mehta PK and **Keatinge JDH.** 2004. Dealing with diversity in scientific outputs: Implications for international research evaluation. Research Evaluation. 13(2): 87-93.

Birthal PS and **Parthasarathy Rao P.** 2004. Intensification of livestock production in India: patterns, trends and determinants. Indian Journal of Agricultural Economics 59 (3): 555-565.

Clerget B, Dingkuhn M, Chantereau J, Hemberger J, Louarn G and **Vaksmann M.** 2004. Does panicle initiation in tropical sorghum depend on day-to-day change in photoperiod. Field Crops Research 88:21-37.

Coyne DL, Sahrawat KL and **Plowright RA.** 2004. The influence of mineral fertilizer application and plant nutrition on plant- parasitic nematodes in upland and lowland rice in Cote d'Ivoire and its implications in long term agricultural research trials. Experimental Agriculture 40:245-256.

Dar WD. 2004. ICRISAT – Using biotechnology to improve crop productivity in the semi-arid tropics of Asia and sub-Saharan Africa. Advanced Biotechnology 3(6):16-19.

Dar WD. 2004. Role, achievements and future program of ICRISAT in dryland farming. Pages 1-3 *in* Journal of Arid Land Studies. Special issue – Desert Technology VII (Sanjay Kumar, ed.), Vol. 14, S. October 2004, Jodhpur, India.

Dharmaraj PS, Narayana YD, Kumar PL, Waliyar F and **Jones AT.** 2004. Pigeonpea sterility mosaic disease: an emerging problem in northern Karnataka, India. International Chickpea and Pigeonpea Newsletter 11:47-49.

Ferguson ME, Bramel PJ and **Chandra S.** 2004. Gene diversity among botanical varieties in peanut (*Arachis hypogaea* L.). Crop Science 44:1847-1854.

Folliard A, Traoré PCS, Vaksmann M and **Kouressy M.** 2004. Modeling of sorghum response to photoperiod: a threshold-hyperbolic approach. Field Crops Research 89(1):59-70.

Gaur PM, Gour VK, BABBER A, GUPTA O, Kumar J and **Rao BV.** 2004. JGK 1: a new large-seeded, short-duration, high-yielding *kabuli* chickpea variety for central India. International Chickpea and Pigeonpea Newsletter 11:16-18.

Girish AG, Deepti S, Rao VP and **Thakur RP.** 2004. Minimizing the risk of seed borne grain mold fungi in sorghum germplasm exchange. International Sorghum and Millets Newsletter 45: 31-33.

Girish AG, Rao, VP and **Thakur RP.** 2004. Diversity of grain mold fungi on selected sorghum genotypes. Indian Phytopathlogy 57: 84-87.

Gowda CLL, Gaur PM, Saxena KB, Masood Ali, Muhammad Bashir, Azizur Rahman, Neupane RK, Zong Xuxiao, Aung May Than, Samaratunga H, Ketema Daba, Knights, EJ and **Tom Warkentin.** 2004. Future research priorities for chickpea and pigeonpea improvement. International Chickpea and Pigeonpea Newsletter 11:3-5.

Gowda CLL, Reddy BVS, Rai KN and **Saxena KB.** 2004. ICRISAT collaboration with the seed industry in Asia. Asian Seed & Planting Material 11(4): 38 pp.

Hall A, Blummel M, Thorpe W, Bidinger FR and **Hash CT** 2004. Sorghum and pearl millet as food-feed crops in India. Animal Nutrition and Feed Technology 4:1-15.

Holden ST and **Shiferaw B.** 2004. Land degradation, drought and food security in a less-favoured area in the Ethiopian highlands: A bio-economic model with market imperfections. Agricultural Economics 30(1): 31– 49.

Jones AT, Kumar PL, Saxena KB, Kulkarni NK, Muniyappa V and **Waliyar F.** 2004. Sterility Mosaic Disease - the "Green Plague" of Pigeonpea: Advances in Understanding the Etiology, Transmission and Control of a Major Virus Disease. Plant Disease 88:436-445.

Jones RB and **Longley K.** 2004. Post conflict agricultural rehabilitation: what role for crop biodiversity? The case of southern Sudan. Currents 35/36:60-63.

Joshi PK, Pangare V, Shiferaw B, Wani SP, Bouma J and **Scott C.** 2004. Watershed development in India: synthesis of past experiences and needs for future research. Indian Journal of Agricultural Economics 59(3): 303-320.

Kenga R, Alabi SO and **Gupta SC.** 2003. Yield stability of sorghum hybrids and parental lines. African Crop Science Journal 11: 65-73.

Kenga R, Alabi SO and **Gupta SC.** 2004. Combining ability studies in tropical sorghum (*Sorghum bicolor* (L.) Moench). Field Crops Research 88:251-260.

Krishnamurthy L, Seeraj R, Kashiwagi J, Panwar JDS, Koteswara Rao Y and **Kumar J.** 2004. Mulitilocation analysis of yield and yield components of chickpea mapping population grown under terminal drought. Indian Journal of Pulses Research 17:17-24.

Kulkarni NK, Reddy AS, Lava Kumar P, Vijayanarsimha J, Rangaswamy KT, Muniyappa V, Reddy LJ, Saxena K, Jones ATB and **Reddy DVR.** 2003. Broad-Based Resistance to Pigeonpea Sterility Mosaic Disease in Accessions of *Cajanus scarabaeoides*. Indian Journal of Plant Protection 31: 6-11.

Kumar SM, Kumar BK, Sharma KK and **DEVI P.** 2004. Genetic transformation of pigeonpea with rice chitinase gene. Plant Breeding 123: 485-489.

Kumar SM, SYAMALA D, Sharma KK and **DEVI P.** 2004. *Agrobacterium tumefaciens*-mediated genetic transformation of pigeonpea [*Cajanus cajan* (L.) Millsp.]. Journal of Plant Biotechnology 6: 69-75.

LAKSHMITULASI S, Rajashekher Reddy A, Raghunadha Reddy G, Prasad VLK, Raju MVLN, Rao CLN, Reddy BVS, Parthasarathy Rao P and **Ramachandraiah D.** 2004. Performance of broilers on sorghum-based diets. International Sorghum and Millets Newsletter 45: 37-39.

LATHA R, Thiyagarajan K and **Senthilvel S.** 2004. Genetics, fertility behaviour and molecular marker analysis of a new TGMS line, TS6 in rice. Plant Breeding 123(3): 235-240.

Legrève A, Delfosse P, Vankeerbergen T, Van Hese Viviane and **Maraite H.** 2004. *Polymyxa graminis*, a promiscuous vector of viruses on crops in tropical areas. Meded. Zin K. Acad. Overzeese Wet./ Bull. Séanc. Acad. R. Sci. Outre-Mer 50(2004-2): 115-126.

MACE ES, Buhariwalla HK and **Crouch JH.** 2004. A High Throughput DNA Extraction Protocol for Tropical Molecular Breeding Programs. Plant Molecular Biology Reporter 21:459a-459h. [also available at http://pubs.nrc-cnrc.gc.ca/ispmb/PR21-04.html]

Manjula K, Kishore GK, Girish AG and **Singh SD.** 2004. Management of stem rot disease of groundnut by integrated use of *Pseudomonas fluorescens* with *Trichoderma viride* and thiram. Plant Pathology. 20:75-80.

Mudemu MV, Machibya MD, Lankford B, Hatibu N and **Kadigi RMJ**. 2004. Conjoining rainfall and irrigation seasonality to enhance productivity of water in rice irrigate farms in the Upper Ruaha river basin, Tanzania. Physics and Chemistry of the Earth 29:1119–1124.

Naab JB, Piara Singh, Boote KJ, Jones JW and **Marfo KO.** 2004. Using the cropgro-peanut model to quantify yield gaps of peanut in the Guinean Savanna zone of Ghana. Agronomy Journal Vol. 96:1231-1242.

Nalini Mallikarjuna and **Deepak Jadhav.** 2004. Premature-precocious hybrid embryo development in an interspecific derivative between *Arachis hypogaea* and *A. cardenasii.* International *Arachis* Newsletter 24:9-10.

Nalini Mallikarjuna, 2004. Meiotic study of intersectional hybrids between *Arachis hypogaea*, *A. duranensis* and *A. diagoi* with *A. glabrata*. International *Arachis* Newsletter 24:7-8.

Nalini Mallikarjuna, Deepak Jadhav, Keshav R Kranthi and **Sandhya Kranthi,** 2004. Influence of foliar chemical compounds on the development of *Spodoptera litura* (Fab.) on interspecific derivatives of groundnut. Journal of Applied Entomology 128(5): 321-328.

Ndjeunga J and **Bationo A.** 2004. Stochastic Dominance Analysis of Soil Fertility Restoration Options on Sandy Sahelian Soils in Southwest Niger. Experimental Agriculture 41(2):1-18.

Ndjeunga J and **Nelson CH.** 2004. Towards Understanding Farmers' Preference for Pearl Millet Varieties in Niger. Agricultural Economics 32:1-16.

Nigam SN. 2004. Groundnut and other legumes for crop diversification in the Central Asia and Caucasus region. Grain Legumes 39:25-26.

Ntare BR. 2004. News from West Africa. International *Arachis* Newsletter 24:3-4.

Omanya GO, Haussmann BIG, Hess DE, Reddy BVS, Kayentao M, Welz HG and **Geiger HH.** 2004. Utility of Indirect and Direct Selection Traits for Improving *Striga* Resistance in Two Sorghum Recombinant Inbred Populations. Field Crops Research 89(2-3):237-252.

Pande S, Kishore GK and **Rao JN.** 2004. Evaluation of chickpea lines for resistance to dry root rot caused by *Rhizoctonia bataticola*. International Chickpea and Pigeonpea Newsletter 11:37-38.

Pande S, Rajesh TR, Rao KC and **Kishore GK.** 2004. Effect of temperature and leaf wetness period on the components of resistance to late leaf spot disease in groundnut. Plant Pathology. 20:67-74.

Parthasarathy Rao P, Raghunadha Reddy G, Belum VS Reddy and **Krishna Reddy K**. 2004. Economics of Improved Sorghum Cultivars in Farmers Fields: Andhra Pradesh. International Sorghum and Millets Newsletter 45:40-42. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for Semi-Arid Tropics.

Parthasarathy Rao P. 2004. Marketing of livestock and poultry products in India. Chairman's Report. Indian Journal of Agricultural Marketing 18(3): 290-294.

Pathak P, Wani SP, Singh Piara and **Sudi R.** 2004. Sediment flow behaviour from small agricultural watersheds. Agricultural Water Management 67:105-117.

Pooja Bhatnagar Mathur, Jyostna Devi M, Serraj R, Yamaguchi-Shinozaki K, Vadez V and **Sharma KK.** 2004. Evaluation of transgenic groundnut lines under water limited conditions. International *Arachis* Newsletter 2004.

Pundir RPS. 2004. Second Pigeonpea Workshop in South Africa – a note in International Chickpea and Pigeonpea Newsletter 11:2.

Rai KN, Gaur PM, Hash CT, Sharma KK, Gowda CLL and **Serraj R.** 2004. Development of crop cultivars for increased and stable production in dry Lands of the Semi-arid Tropics. Journal of Arid Land Studies 14 S: 69-72.

Rai KN, Kulkarni VN and **Singh AK.** 2004. Performance of a male-sterile F1and its inbred parental lines in pearl millet. International Sorghum and Millets Newsletter 45: 43-45.

Rai KN, Kulkarni VN, Thakur, RP, Singh AK and **Rao PV.** 2004. Effectiveness of within-progeny selection for downy mildew resistance in pearl millet. International Sorghum and Millets Newsletter 45: 45-47.

Ramakrishna A, Wani SP, Srinivasa Rao Ch, Tirupathi Reddy G and **Ramarao M**. 2004. Participatory selection of groundnut genotypes under rainfed conditions in Kurnool district of Andhra Pradesh. International Arachis Newsletter 24:17-18.

Ramakrishna A, Wani SP, Srinivasa Rao Ch, Tirupathi Reddy G and **Ramarao M.** 2004. Economic impact of improved pearl millet production technology in resource poor rainfed areas of Kurnool district of Andhra Pradesh. International Sorghum and Millets Newsletter 45: 75-77.

Ramakrishna A, Wani SP, Tirupathi Reddy G, Ramarao M and **Srinivasa Rao Ch.** 2004. Improved production technology in rainfed grondnut helps reap rich benefits by resource-poor farmers in Andhra Pradesh. International Arachis Newsletter 24:50-52.

Ranga Rao GV and **Shireen Meher K.** 2004. Optimization of in vivo production of *Helicoverpa armigera* NPV and regulation of malodor associated with the process. Indian Journal of Plant Protection 32(1): 15-18.

Rao VP and **Thakur RP.** 2004. Downy mildew incidence and oospore production by *Sclerospora graminicola* in Pearl Millet Hybrids in Maharashtra and Rajasthan. International Sorghum and Millets Newsletter 45: 57-61.

Reddy BVS, Ramesh S and **Reddy PS.** 2004. Nucleus and breeder seed production in sorghum. International Sorghum and Millets Newsletter 45: 13-16.

Reddy BVS, Ramesh S and **Reddy PS.** 2004. Sorghum breeding research at ICRISAT —Goals, strategies, methods and accomplishments. International Sorghum and Millets Newsletter 45:5-12.

Reddy SV and **Kumar PL.** 2004. Transmission and properties of a new luteovirus associated with chickpea stunt disease in India. Current Science 86:1157-1161.

Rockstrom J, Folke C, Gordon L, Hatibu N, Jewitt C, Penning de Vries F, Rwehumbiza F, Sally H, Savenije H and **Schulze R**. 2004. A watershed approach to upgrade rainfed agriculture in water scarce regions through water systems innovations. Physics and Chemistry of the Earth 29:1109–1118.

Romeis J, Sharma HC, Sharma KK, Das S and **Sarmah BK**. 2004. The Potential of transgenic chickpeas for pest control and possible effects on non-target arthropods. Crop Protection 23: 923-938.

Sahrawat KL. 2004. Iron toxicity in wetland rice and the role of other nutrients. Journal of Plant Nutrition 27:1471-1504.

Sahrawat KL. 2004. Nitrification inhibitors for controlling methane emission from submerged rice soils. Current Science 87:1084-1087.

Sahrawat KL. 2004. Organic matter accumulation in submerged soils. Advances in Agronomy 81:169-201.

Sahrawat KL. 2004. Terminal electron acceptors for controlling methane emissions from submerged rice soils. Communications in Soil Science and Plant Analysis 35:1401-1413.

Serraj R, Buhariwalla HK, Sharma KK, Gaur PM and **Crouch JH.** 2004. Crop improvement of drought resistance in pulses: A holistic approach. Indian Journal of Pulses Research 17:1-13.

Serraj R, Krishnamurthy L and **Upadhyaya HD.** 2004. Screening of chickpea mini-core germplasm for tolerance to soil salinity. Int. Chickpea and Pigeonpea Newsletter 11:29-32.

Serraj R, Krishnamurthy L, Jyostna Devi M, Reddy MJV and **Nigam SN.** 2004. Variation in transpiration efficiency and related traits in a groundnut mapping population. International Arachis Newsletter 24:42-44.

Serraj R, Krishnamurthy L, Kashiwagi J, Kumar J, Chandra S and Crouch JH. 2004. Variation in root traits of chickpea (*Cicer arietinum* L.) grown under terminal drought. Field Crops Research 88:115-127.

Sharma HC, Sharma KK, Seetharama N and **Crouch JH.** 2004. Genetic transformation of crops for insect resistance: Potential and limitations. CRC Critical Reviews in Plant Sciences 23:47-72.

Sharma HC, Sullivan DJ, Sharma, MM and **Shetty SVR.** 2004. Influence of weeding regimes and pearl millet on parasitism of the Oriental armyworm, *Mythimna separata* (Walker) Lepidoptera: Noctuidae). BioControl 49 (6): 689-699.

Shiferaw B and **Bantilan C.** 2004. Rural Poverty and Natural Resource

Management in Less- Favored Areas: Revisiting Challenges and Conceptual Issues. Journal of Food, Agriculture and Environment 2(1): 328-339.

Singh RP, Tripathi RD, DABBAS S, Rizvi SMH, Ali MB, Sinha SK, Gupta DK, Mishra S and **Rai UN**. 2003. Effect of lead on growth and nitrate assimilation of *Vigna radiata* (L.) Wilczek seedlings growing in a salt affected environment. Chemposphere 52:1245-1250.

Sriveni M, Rupela OP, Gopalakrishnan S and **Krajewski M.** 2004. Spore-forming bacteria, a major group among potential antagonists isolated from natural sources such as termitaria soil and composts used by organic farmers. Indian Journal of Microbiology 44 (2): 95-100.

Thakur RP, Huda AKS and **Rao VP.** 2004. Using weather information to identify pearl millet downy mildew risk environments in India. International Sorghum and Millets Newsletter 45: 62-63.

Thakur RP, Rao VP, Navi SS, Garud TB, Agarkar GD and **Bhat Bharathi.** 2003. Sorghum grain mold - variability in fungal complex. International Sorghum and Millets Newsletter 44: 108-112.

Thakur RP, Rao VP, Wu BM, Subbarao KV, Shetty HS, Singh G, LUKOSE C, Panwar MS, Sereme Paco, Hess DE, Gupta SC, Dattar VV, Panicker S, Pawar NB, Bhangale GT and **Panchbhai SD.** 2004. Host resistance stability to downy mildew in pearl millet and pathogenic variability in Sclerospora graminicola. Crop Protection 23: 901-908.

Thakur RP, Reddy BVS, Rao VP, Garud TB, Agarkar GD and **BHAT BHARATHI.** 2003. Sorghum grain mold - resistance stability in advanced B-lines. International Sorghum and Millets Newsletter 44: 104-108.

Umeh VC, Waliyar F, Ajayi O and **Omar B.** 2004. Critical periods of soil pest damage to groundnut in intercropping groundnut/sorghum in Northern Nigeria. African Entomology 12(2):165-170.

Waliyar F, Traoré A, Fatondji D and **Ntare BR.** 2004. Effect of Water Deficit on Aflatoxin Contamination of Peanut in Sandy Soil of Niger. Peanut Science 31.

Wani SP, Ramakrishna A and **Sreedevi TK.** 2004. Unlocking the Potential of Rainfed Agriculture Through Integrated Watershed Management. Journal of Financing Agriculture 36:15-20.

Yadav OP, Weltzien-Rattunde E and **Bidinger FR.** 2004. Diversity among pearl millet landraces collected in northwestern India. Annals of Arid Zone 43 (1): 45-53.

Yadav RS, Hash CT, Bidinger FR, Devos KM and **Howarth CJ.** 2004. Genomic regions associated with grain yield and aspects of post-flowering drought tolerance in pearl millet across stress environments and testers background. Euphytica 136:265-277.

Monographs

Bantilan MCS, Chandra S, Keatinge D and **Mehta P.** 2004. Research Quality at ICRISAT: Separating the grain from the chaff. Socioeconomics and Policy Working Paper Series no. 19. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. April 2003. Patancheru, India. 52 pp.

Bantilan MCS. 2004. Managing the turnaround- ICRISAT's external review. Synthesis of 48 EPR documents developed into a Monograph ICRISAT, Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Brennan JP, Bantilan MCS, Sharma HC and **Reddy BVS.** 2004. Impact of ICRISAT research on sorghum midge on Australian agriculture. Impact Series no. 11. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 36 pp.

Clerget B. 2004. Le rôle du photopériodisme dans l'élaboration du rendement de trois variétés de sorgho cultivées en Afrique de l'Ouest. Thèse doctorale. Institut National Agronomique Paris-Grignon, Paris, France. 103 pp.

Diakite S, AVEC Weltzien E and **Diawara M.** 2004. Le systeme semencier local: description , evaluation et valorization (cas du sorgho dans sept village au Mali) Working Papers on Local Knowledge Nr. 2. Point Sud, Muscler le Savoir Local. Bamako, Mali.

Freeman HA, Ronoh-Tuimising W, Rohrbach D, Chinembiri F, Dijkmann J and **Van Rooyen A.** 2004. Disaster mitigation options for livestock production in communal farming systems in Zimbabwe. 2. Farmers' perceptions of the impact of drought: a reconnaissance survey. PO Box 776, Bulawayo, Zimbabwe: ICRISAT; and Rome, Italy: FAO. 28 pp.

Hiernaux P and **Ayantunde A.** 2004. The Fakara: a semi-arid agro-ecosystems under stress. Report of research activities of ILRI in Fakara (1994 – 2002), South western Niger. 95 pages.

Joshi PK, Pangare V, Shiferaw B, Wani SP, Bouma J and **Scott C.** 2004. Socioeconomic and Policy Research in Watershed Management in India: Synthesis of Past Experiences and Needs for Future Research. *Global Theme on Agroecosystems* Research Report No.9, International Crops Research Institute for the Semi-Arid Tropics. 80 pp.

Koala S and **Tabo R.** (eds.). 2004. Turning adversity into opportunity: The Desert Margins Program – Towards sustainable management of the desert margins of sub-Saharan Africa. Project Document 2002-2008; International Crops Research Institute for the semi-arid Tropics

Kumar PL and **Martelli GP**. 2004. Pothos latent virus. In Descriptions of Plant Viruses. (Adams M, Robinson DJ, Boonham N, Jones AT, Mumford R and Antoniw J, eds.). Association of Applied Biologist, Wellesbourne, Warwick, UK. CD-ROM Publication.

Monyo ES, Ngereza J, Mgonja MA, Rohrbach DD, Saadan HM and **Ngowi P**. 2004. Adoption of improved sorghum and pearl millet technologies in Tanzania. PO Box 776, Bulawayo, Zimbabwe: International Crops Research Institute for the Semi-Arid Tropics. 28pp.

Parthasarathy Rao P, Birthal PS and **Dharmendra K.** 2004. Increasing livestock productivity in mixed crop-livestock systems in South Asia. Summary report posted on SLP web page. Ethiopia, Systemwide Livestock Program, International Livestock Research Institute.

Parthasarathy Rao P, Birthal PS, Dharmendra K, Wickramaratne

SHG and **Shrestha HR.** 2004**.** Increasing livestock productivity in mixed crop-livestock systems in South Asia. Report of a Project. New Delhi, India: National Center for Agricultural Economics and Policy Research; Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 168 pp.

Parthasarathy Rao P, Birthal PS, Joshi PK and **Kar D.** 2004. Agricultural diversification in India: role of urbanization. IFPRI Discussion paper no. 77. Washington, International Food Policy Research Institute.

Rao KPC, Bantilan MCS, Singh K, Subrahmanyam S, DESHINGKAR P, Parthasarathy Rao P and **Shiferaw B** – Overcoming Poverty in Rural India : Focus on Rainfed SAT, ICRISAT, 2004

Rohrbach DD, Charters R and **Nyagweta J**. 2004. Guidelines for Agricultural Relief Programs in Zimbabwe. ICRISAT and FAO: Bulawayo and Rome.

Rohrbach DD, Van Rooyen A and **Hargreaves SK**. 2004. Disaster mitigation options for livestock production in communal farming systems in Zimbabwe. 3. Final Report. PO Box 776, Bulawayo, Zimbabwe: ICRISAT; and Rome, Italy: FAO. 28 pp.

Shiferaw B and **Jayakumar PN.** 2004. Adapting the Global Food and Water Models for Analysis of SAT Futures and Development Opportunities. Technical Manual No. 9. International Crops Research Institute for the Semi-Arid Tropics. 115 pp. ISBN: 92-9066-468-1

Shiferaw B, Bantilan MCS, Gupta SC and **Shetty SVR.** 2004. Research Spillover Benefits and Experiences in Inter-Regional Technology Transfer: Assessment and Synthesis. International Crops Research Institute for the Semi-Arid Tropics. 131 pp. ISBN: 92-9066-469-X

VAN KOPPEN B, Sokile CS, Hatibu N, Lankford BA, Mahoo H and **Yanda PZ**. 2004. Formal water rights in rural Tanzania: deepening the dichotomy? IWMI Working paper 71.

Winslow M, Shapiro BI, *Thomas R* and **Shetty SVR.** 2004. Desertification, drought, poverty and agriculture: research lessons and opportunities. Aleppo, Syria; Patancheru, India; and Rome, Italy: joint publication of the International Center for Agricultural Research in the Dry Areas (ICARDA), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and the UNCCD Global Mechanism (GM). 46 pp.

Youssouf Camara, Bantilan MCS and **Jupiter Ndjeunga.** 2004. Impacts of Sorghum and Millet Research in West and Central Africa (WCA): A Synthesis and Lessons Learnt. Working paper series no 21. Niamey, PO Box 12404, Niger: International Crops Research Institute for the Semi-Arid Tropics.

News Articles

Chandra S. 2004. Testing seed health: getting the numbers right. SATrends 48, November 04 ***(e-newsletter on*** *http://www.icrisat.org****).***

Dar WD. 2004. Bridging the relief-development gap. SATrends 43, June 04 ***(e-newsletter on*** *http://www.icrisat.org****).***

Dimes J. 2004. New ACIAR project in S.Africa. SATrends 40, March 04 *(e-newsletter on http://www.icrisat.org).*

Diwakar B and **Balaji V.** 2004. Lets talk about the weather. 2004. SATrends 46, September 04 ***(e-newsletter on*** *http://www.icrisat.org****).***

Dominguez, C. Colheitas de germoplasma. Boletin do INIA, No 37. Ministério de Agricultura e Desenvolvimento Rural; Outubro - Dezembro 2004.

Gerard B, 2004. Et maintenant, onse permet de rentrer... SATrends 41, April 04 ***(e-newsletter on*** *http://www.icrisat.org****).***

Gujja B and **Shapiro BI.** 2004. WWF and ICRISAT. SATrends 42, May 04 *(e-newsletter on http://www.icrisat.org).*

Hanumanth B and **Keatinge JDH.** 2004. Managing intellectual assets. SATrends 41, April 04 ***(e-newsletter on*** *http://www.icrisat.org****).***

Hanumanth B and **Keatinge JDH.** 2004. Plant varieties protection in India. SATrends 42, May 04 *(e-newsletter on http://www.icrisat.org).*

Hash CT. 2004. Molecular markers and marker-assisted selection for pearl millet in India. Page 14 *in* The State of Food and Agriculture 2003-04. Part I. Agricultural biotechnology: meeting the needs of the poor? (Raney T, ed.) Food and Agriculture Organization of the United Nations: Rome, Italy.

Jayashree B. 2004. Bioinformatics and sequence analysis. SATrends 47, October 04 ***(e-newsletter*** *on http://www.icrisat.org****).***

Kashiwagi J. 2004. Getting to the root of the problem. SATrends 43, June 04 ***(e-newsletter*** *on http://www.icrisat.org****).***

Koala S. 2004. Un laboratoire de point au milieu du Sahle. SATrends 43, June 04 ***(e-newsletter*** *on http://www.icrisat.org****).***

Krishnamurthy L and **Vadez V.** 2004. Peppered with salt! SATrends 47, October 04 ***(e-newsletter*** *on http://www.icrisat.org****).***

Kumar PL. 2004. Sterility to fertility. SATrends 41, April 04 ***(e-newsletter*** *on http://www.icrisat.org****).***

Kumar PL. 2004. Tackling Asia's pigeonpea plague. AGFAX, Communicating Science for Sustainable Development, February 2004, WRENmedia World Radio for the Environment (Interviewed by Ms Susan Thrope). http://www.agfax.net

Maruca M and **Koala S.** 2004. Programme sur les zones en marge du desert. SATrends 40, March 04 ***(e-newsletter*** *on http://www.icrisat.org****).***

Maruca M and **Koala S.** 2004. Un guide electronique pour les visiteurs. SATrends 44, July 04 ***(e-newsletter*** *on http://www.icrisat.org****).***

McGaw EM, FLYNN LA and **Dar WD.** 2004. Turning ICRISAT Around. SATrends 43, June 04 ***(e-newsletter*** *on http://www.icrisat.org****).***

Monyo ES. 2004. More crops per drop. SATrends 38, January 2004 ***(e-newsletter*** *on http://www.icrisat.org****).***

Nigam SN and **ARUNA R.** 2004. Mysterious groundnut disease arrested. SATrends 46, September 2004 ***(e-newsletter*** *on http://www.icrisat.org****).***

Ntare BR. (ed.). 2004. Sustainable Seed systems for West Africa-a CFC funded project (Eng. Fr). Groundnut News 1.16pp

Pande S. 2004. Managing the mold. SATrends 46, September 04 ***(e-newsletter*** *on http://www.icrisat.org****).***

Pasternak D. 2004. Moringa the miracle tree. SATrends 45, August 04 ***(e-newsletter*** *on http://*

www.icrisat.org)**.**

Ranga Rao GV and **Gowda CLL.** Pest population Dynamics. SATrends 38, January 04 ***(e-newsletter on*** *http:// www.icrisat.org*)**.**

Ranga Rao GV. Kharif pest situation on cotton. Eenadu, 21 August, 2004.

Rao KPC. 2004. Expanding collaboration for VLS. SATrends 40, March 04 ***(e-newsletter on*** *http:// www.icrisat.org*)**.**

Reddy BVS. 2004. Sweet sorghum for ethanol. SATrends 45, August 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Rohrbach D. 2004. Do relief programs really relieve? SATrends 48, November 04 ***(e-newsletter on*** *http:// www.icrisat.org*)**.**

Rupela O. 2004. Consorting to correct. SATrends 49, December 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Rupela O. 2004. Killing me softly! SATrends 45, August 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Rupela O. 2004. Minding your N and P! SATrends 48, November 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Rusike J. 2004. Crops on contract. SATrends 39, February 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Rusike J. 2004. Iron sharpens iron. SATrends 47, October 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Rusike J. 2004. Knowledge and culture. SATrends 41, May 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Saxena K. 2004. The Barwale CMS system in pigeonpea. SATrends 49, December 04 ***(e-newsletter on*** *http:// www.icrisat.org*)**.**

Shapiro BI. 2004. Market driven agriculture in SSA. SATrends 44, July 04 ***(e-newsletter on*** *http:// www.icrisat.org*)**.**

Sharma KK. 2004. Hitch your hatch to a star! . SATrends 39, Febraury 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Srinivas S and **Balaji V.** 2004. SAT electronic library. SATrends 40, March 04 ***(e-newsletter on*** *http:// www.icrisat.org*)**.**

Tabo R. 2004. Micro-dose d'engrais pour la prosperite. SATrends 48, November 04 ***(e-newsletter on*** *http:// www.icrisat.org*)**.**

Thakur RP. 2004. Fungi versus Fungi. SATrends 45, August 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Thakur RP. 2004. Know thine enemy. SATrends 47, October 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Twomlow S. 2004. Spreading the word on fertilizer. SATrends 41, April04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Vadez V (Serraj R). 2004. Symbiotic nitrogen fixation. SATrends 40, March 04 ***(e-newsletter on*** *http:// www.icrisat.org*)**.**

Walia S, Ram Kumar B and **Balaji V.** 2004. SAT data from satellites. SATrends 38, January 04 ***(e-newsletter on*** *http://www.icrisat.org*)**.**

Waliyar F. 2004. Taking away the toxins. SATrends 39, February 04 (***e-newsletter on*** *http://www.icrisat.org*)**.**

Poster Papers

Chandra S, Buhariwalla HK, Kashiwagi J, Harikrishna S, Rupa Sridevi K, Krishnamurthy L, Serraj R and **Crouch JH.** 2004. Identifying QTL-linked markers in marker-deficient crops. International Crop Science Congress, Brisbane.

Chari MS, Rajashekar G, Vagmare G, Raghunath TAVS, Kumar PL, Saxena KB, Waliyar F and **Jones AT.** 2004. Village-level implementation of eco-friendly IPM and IDM methods for sustainable pigeonpea production. Pages 482-483 *in* Proceedings of National Seminar on Resource Management for Sustainable Agriculture, January 28-30, 2004, Agriculture College, Bapatla, Guntur, AP, India. The Andhra Agriculture Journal 50.

Chari MS, Ranga Rao GV, Ali SMA, Ram Prasad S and **Humayun P.** 2004. Empowerment of NGO's for the sustainable pest management in pigeonpea. Poster presented at the National Seminar on Resource Management for Sustainable Agriculture held during 28-30 January 2004 at Agriculture College, Bapatla, Guntur, Andhra Pradesh, India.

Debelo A, Manyasa E and **Jones R.** Miracle African crops for household food security in the semi-arid environments of eastern and central Africa. Poster presented at the joint ASARECA/ COMESA ministerial and committee of directors of ASARECA meeting from 13-17th October, 2004 held in Nairobi, Kenya.

DEEPTI S, Girish AG , Rao VP and **Thakur RP.** 2004. Minimizing the risk of seed borne grain mold fungi in sorghum germplasm exchange. Annual Meeting, Indian Phytopathological Society, New Delhi, Feb 2004.

Delisle L, Traoré PCS, Ballo A, Doumbia MD and **Yost RS.** 2004. Estimating soil organic carbon stocks at the field-level using GIS and geostatistics, Poster, 2004 ASA-CSSA-SSSA International Annual Meetings, Seattle, WA, Oct. 31-Nov. 4, 2004.

Diva P, Kumar PL, Rangaswamy KT and **Muniyappa V.** 2004. Detection of *Pigeonpea sterility mosaic virus* in floral parts and seeds. [Abstracts] Pages 51-52 *in National symposium on Molecular Diagnostics for the Management of Viral Diseases*. IARI, New Delhi 110 012, India.

Folkertsma RT, Rattunde FW and **Hash CT.** 2004. Genetic variation among guinea-race *Sorghum* bicolor (L.) Moench accessions as reveals with SSR markers. Plant & Animal Genome XII, Jan 10-14 2004, Town & Country Hotel, San Diego, CA, USA. Final Abstracts Guide. P232.

Girijashankar V, Swathisree M, Sharma KK, Sharma HC, Bhat BV, Sivarama Prasad L, Royer M, Narasu ML and **Seetharama N.** 2004. Production of Transgenic Sorghum Plants Expressing a Synthetic *Cry1Ac* Gene Showing Protection Against Sorghum Spotted Stem Borer (*Chilo partellus* Swinhoe) via Particle Bombardment. 2004 World Congress on In Vitro Biology, San Francisco, USA, May 22-26. Abstract No. E1058.

Gowda CLL, Reddy BVS, Rai KN, Saxena KB and **Sharma HC.** 2004. Public-private sector partnership – A novel institution building for supporting agricultural research and enhancing impacts. Page(s) 5 *in* New Directions for a Diverse Planet: Proceedings of the 4th International Crops Science Congress (Fisher T, Turner N, Angus J, McIntyre L, Robertson M, Borrell A and Llyod D, eds.), 25 Sep-1 Oct 2004, Brisbane, Queensland, Australia.

Hatibu N, Rao KPC and **MATI B.** 2004. Making smallholder agro-enterprises more productive by integrating the management of agricultural water and trade. A poster presented at the COMESA Ministers of

Agriculture Conference, Nairobi 13 – 15 October 2004.

Hatibu N, Rao KPC and **MATI BANCY.** 2004. Making Smallholder Agro-enterprises more productive through Water Management and Trade *in* COMESA (Common Market for Eastern and Central Africa) meeting 12-14 October 2004, Nairobi, Kenya.

Hatibu N, WAMUONGO JW, Lutkamu M, Dawelbeit SE, Dubale PS and **Kilewe AM.** 2004. A culture of promoting uptake, scaling-up and effective use of results from S&WM research. A poster presented at the COMESA Ministers of Agriculture Conference, Nairobi 13 – 15 October 2004.

Kumar Rao JVDK, Harris D, Johansen C and **Musa AM**. 2004. Low-cost provision of molybdenum (Mo) to chickpeas grown in acid soils. Abstracts: in CD of IFA International Symposium on Micronutrients, 23-25 Feb 2004, New Delhi, India (International Fertilizer Industry Association – publications@fertilizer.org – www.fertilizer.org).

Latha R, Senthilvel S and **Thiyagarajan K.** 2004. Critical temperature and stages of fertility alteration in thermo-sensitive genic male sterile lines of rice. Poster paper, 4th International Crop Science Congress, Brisbane, 26 September-01 October 2004, www.cropscience.org.au

Latha TKS, Kumar PL and **Doraiswamy S**. 2004. Studies on *Pigeonpea sterility mosaic virus* isolate in Tamil Nadu, India. [Abstracts] Pages 24-25 *in* National symposium on Molecular Diagnostics for the Management of Viral Diseases. IARI, New Delhi 110 012, India.

Manonmani S, Senthilvel S, Fazlullah khan AK and **Maheswaran M.** 2004. RAPD and Isozyme markers for genetic diversity and their correlation with heterosis in Rice (*Oryza sativa* L). 4th International Crop Science Congress, Brisbane, September 2004, Poster paper, 4th International Crop Science Congress, Brisbane, 26 September-01 October 2004, www.cropscience.org.au

Mgonja M, Chikodzore D and **See Rafidiarisoa M.** 2004. Mitigating Food Insecurity in Southern Madagascar: Challenges, Opportunities and Strategies: Poster Presented at the FAO/FOFIFA workshop –26 June –6 July 2004 Antananarivo Madagascar.

Mgonja MA and **Mutangadura G.** 2004: Indicators for a green revolution in Zimbabwe. Poster presented at the UNECA workshop: Towards A Green Revolution in Africa: Harnessing Science and Technology for Sustainable Modernization of African Agriculture and Rural Transformation (SMART/AGRIC). Kampala Uganda 8-12 December 2003.

Mgonja MA and **Waddington S.** 2004. Smallholder livelihoods in the Limpoppo Basin. A Challenge program initiative for crop water and market development. Poster presented at the Challenge Program Water for Food-Baseline workshop: 1-4 November 2003 Nairobi Kenya.

Mgonja MA. 2004. Permanent Agricultural Recovery and Productivity growth: ICRISAT's contribution to the SADC region. Poster presented at the High-level policy dialogue for SADC Permanent Secretaries and Heads of Ministries responsible for Food, Agriculture and natural Resources. March 2004 Mauritius.

Nigam SN. An Integrated Approach to Control Stem Necrosis Disease of Groundnut (NATP PSR Project: ROPS-18). Poster presented in National Symposium cum Exhibition on "Enhancing Productivity and Sustainability in Rainfed Agro Ecosystem (NATP)", 24-26 March 2004, ANGRAU, Rajendranagar, Hyderabad.

Nigam SN. CAC-ICRISAT Partnership in Groundnut Research and Development. Poster presented in AGM (under CGIAR Program for CAC - Luncheon Meeting), 25 October 2004, Mexico.

Nigam SN. Seeds of Life – Increasing production of staple crops in East Timor. Poster presented in "New Directions for a diverse Planet", 4th International Crop Science Congress, 26 September to 1 October 2004, Brisbane, Australia.

Pasternak D. Sahelian Eco-Farm. Poster. Presented at the International Ecoagriculture Conference. Nairobi, Kenya, September 27-October 1, 2004.

Pasternak D. New Sahel Poster. Presented at the ECOWAS Ministerial Conference on Science and Technology in Agriculture, Ouagadougou 21-23/06/04

Raghavendra N, Kumar PL, Rangaswamy KT, Muniyappa V, Waliyar F and **Jones AT.** 2004. Studies on prevalence of Pigeonpea sterility mosaic virus – Bangalore isolate, and production of polyclonal antibodies. [Abstract] Pages 55-56 *in* Proceedings of National Symposium on Crop Surveillance, Disease Forecasting and Management, February 19-21, 2004, Division of Plant Pathology, Indian Agricultural Research Institute (IARI), New Delhi - 110 012, India. (poster)

Ranga Rao GV, Rameshwar Rao V, Subbaratmam GV and **Wani SP.** 2004. Integrated pest management of groundnut pests. Poster presented at Farmers' Day held at Dharwad, Karnataka during 1-4 October 2004; and at Karivemula, Kurnool, Andhra Pradesh on 14 October 2004.

Ranga Rao GV, Rameshwar Rao V, Subbaratmam GV and **Wani SP.** 2004. How to Manage Pod Borer *(Helicoverpa armigera)* in Pigeonpea? Poster presented at Farmers' Day held at Dharwad, Karnataka during 1-4 October 2004; and at Karivemula, Kurnool, Andhra Pradesh on 14 October 2004.

Ranga Rao GV, Rameshwar Rao V, Subbaratmam GV and Wani SP. 2004. Insect pests of castor and their management. Poster presented at Farmers' Day held at Karivemula, Kurnool, Andhra Pradesh on 14 October 2004.

Rao V Nageswara, Piara Singh, Balaguravaiah D and **Dimes P John.** 2004. Systems modeling and farmers' participatory evaluation of cropping options to diversify peanut systems in Anantapur region, India I: APSIM simulations to analyze constraints and opportunities *in* New directions for a diverse planet: Handbook and Abstracts for the 4th International Crop Science Congress, Brisbane, Australia (Fischer T et al.). 26 Sep - 1 Oct 2004.

Rao V Nageswara, Piara Singh, Padmalatha Y and **Rego TJ.** 2004. Systems modeling and farmers' participatory evaluation of cropping options to diversify peanut systems in Anantapur region, India II: Farmers' participatory field assessment of simulated peanut systems *in* New directions for a diverse planet: Handbook and Abstracts for the 4th International Crop Science Congress, Brisbane, Australia (Fischer T et al.). 26 Sep - 1 Oct 2004.

Rao VP, Lukose C and **Thakur RP.** 2004. Monitoring pearl millet hybrids for

resistance to downy mildew and its virulence in Gujarat. Annual Meeting, Indian Phytopathological Society, New Delhi, Feb 2004.

Reddy VSB, Reddy BS., Kumar PL, Saxena KB, Waliyar F and **Jones AT.** 2004. Sustainable pigeonpea production through empowering farmers to combat pathogens and pests in Kodangal area of Mahabubnagar District, Andhra Pradesh, India. Page 499 *in* National Seminar on Resource Management for Sustainable Agriculture, January 28-30, 2004, Agriculture College, Bapatla, Guntur, AP, India. Abstract The Andhra Agriculture Journal 50 (Golden jubilee special issue). (poster)

Rizvi SMH and **Serraj R.** 2004. Response of Leaf gas exchange to soil water defficits in pearl millet (Pennisetum glaucum (L.) R. Br.) at IAEA meeting in Beijing, China.

Saxena KB. 2004. Exploitation of hybrid vigor in food legumes - a success story of pigeonpea. Poster presented at 5th International Conference on Grain Legumes and the 2nd International Conference on Legume Genomics and Genetics. June 7-11, 2004. Congress Palace Dijon, France.

Senthilvel S, Govindaraj P, Arumugachamy S, LATHA R, Malarvizhi P, Gopalan A and **Maheswaran M.** 2004. Mapping genetic loci associated with nitrogen use efficiency in rice (*Oryza sativa* L.). Poster paper, 4th International Crop Science Congress, Brisbane, 26 September-01 October 2004, www.cropscience.org.au

Senthilvel S, Mahalakshmi V, Sathish Kumar P, Reddy AR, Markandeya G, Reddy MK, Misra R and **Hash CT.** 2004. New SSR markers for pearl millet from data mining of Expressed Sequence Tags. Poster paper, 4th International Crop Science Congress, Brisbane, 26 September-01 October 2004, www.cropscience.org.au

Senthilvel S, Mahalakshmi V, Sathish Kumar P, Reddy AR, Markandeya G, Reddy MK, Misra R, and **Hash CT.** 2004. New SSR markers for pearl millet from data mining of Expressed Sequence Tags. Page 232 *in* Abstracts of the 4th International Crop Science Congress, Brisbane, Australia, 26 Sept. - 1 Oct. 2004.

Sharma HC, Dhillon MK, Naresh JS, Ram Singh, Pampapathy G and **Reddy BVS.** 2004. Influence of cytoplasmic male-sterility on the expression of resistance to insects in sorghum. New Directions for a Diverse Planet *in* Proceedings of the 4th International Crop Science Congress, 25 Sept to 1 Oct 2004, Brisbance, Queensland, Australia (Fisher T, Turner N, Angus J, McIntyre L, Robertson M, Borrell A and Llyod D, eds.). Brisbance, Queensland, Australia: http://www.cropscience.org.au.pp.6.

Sharma KK, Waliyar F, Lavanya M and **Reddy AS.** 2004. Development and evaluation of transgenic peanuts for induced resistance to the Indian peanut clump virus. World Congress on In Vitro Biology, San Francisco, USA, May 22-26. Abstract No. P1161.

Tabo R. 2004. Enhancing rainwater and nutrient use efficiency for improved crop productivity, farm income and rural livelihoods in the Volta Basin. Poster paper presented at the Challenge Program on Water and Food Project Leaders Workshop; South Africa 20-27 November 2004.

Tabo R. 2004. Strategic application of fertilizer for small farmer prosperity in the Sahel. Poster paper presented at Consultation of McKnight Foundation Workshop on Millet and Sorghum-based Systems in West Africa. Niamey, Niger 27-29 January 2004.

Traoré PCS, Bostick WM, Doumbia MD, Jones JW and **Yoroté A**. 2004. Monitoring landscape variability from space to optimize projections of carbon accretion by small agricultural communities, International Symposium of the African Network for Soil Biology and Fertility (AfNet) of the TSBF institute of CIAT, Yaoundé, Cameroon, 17-21 May 2004.

Varietal descriptors

Agrawal BL, Sharma HC, Abraham CV and **Stenhouse JW.** Registration of ICSV 88032 midge-resistant sorghum variety. International Sorghum and Millet Newsletter.

Khairwal IS, Rai KN, Yadav OP and **Bhatnagar SK**. 2004. Pearl Millet Cultivars. All India Coordinated Pearl Millet Improvement Project, Indian Council of Agricultural Research, Mandor, Jodhppur, Rajasthan. 22 pp.

Sharma HC, Agrawal BL, Abraham CV, Stenhouse JW and **Toe Aung**. Registration of ICSV 735, ICSV 758, and ICSV 804 sorghum midge-resistant varieties. International Sorghum and Millet Newsletter.

Training

Chandra S. One-week training course on *Design and Analysis of Participatory On-Farm Trials* at ICRISAT-Maputo for 18 NARES and ICRISAT-Maputo staff

Chandra S. Two day training for 14 ICRISAT-Bamako and IER-Bamako staff on concepts for *designing and analyzing on-farm participatory trials*.

Chandra S. 4-week *Biometrics and Biometric Computing* training for an Iranian Professor (Dec '04)

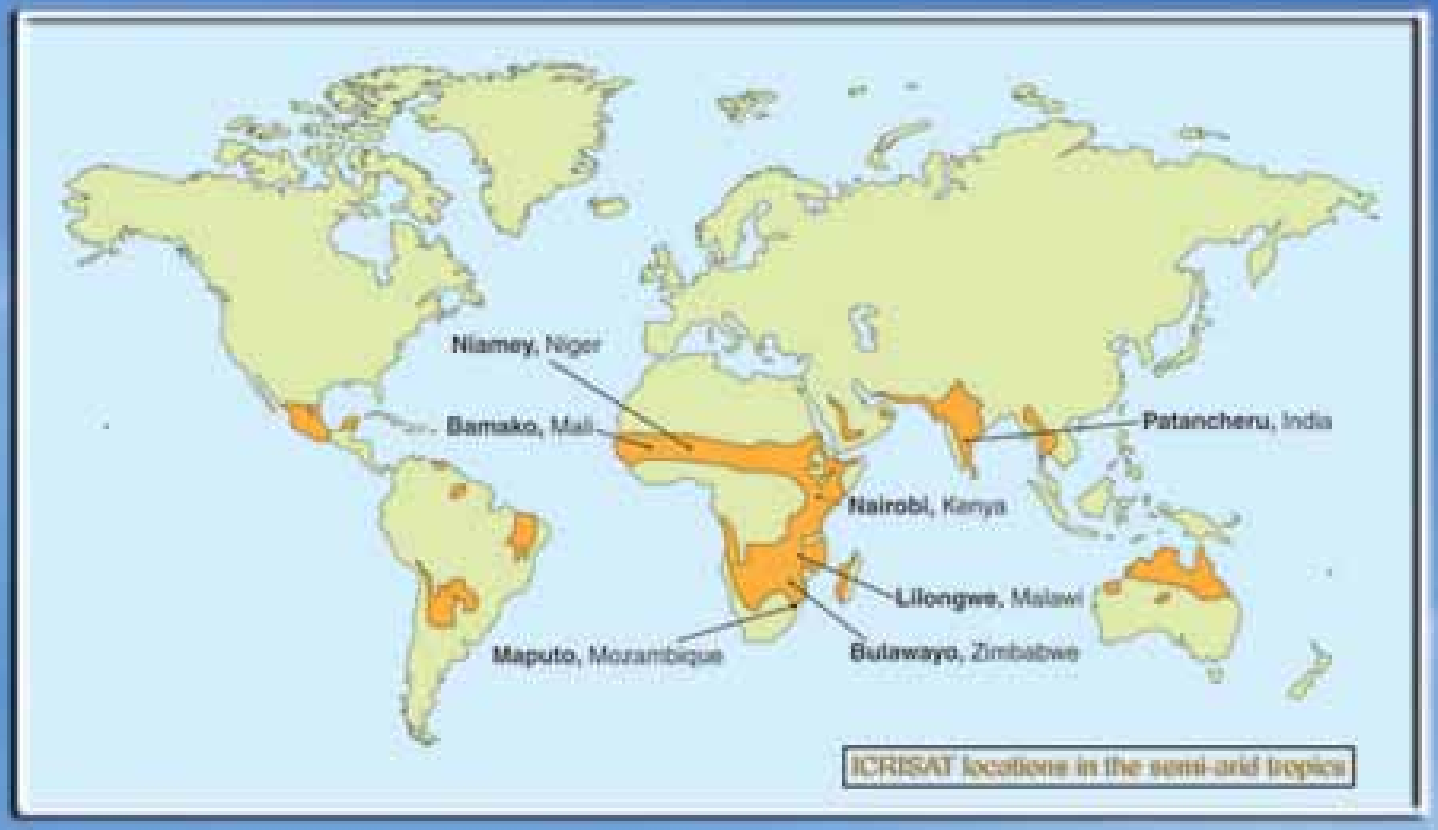
Chandra S. Invited to deliver and lead one-week GCP training course on *Linkage Mapping and QTL Analysis* at Nairobi (Dec '04) (20 participants)

Chandra S. Mr David Afribeh (Plant Breeder from Ghana) trained for 4 months in the design, data analysis and interpretation of pearl millet genetics and breeding trials**.**

Chandra S. Supervised two MSc (Statistics) Apprentices from Hyderabad University (2 months each): Topics were ***– REML analysis of designed experiments*** **and** ***Use of information theoretic measures in QTL mapping*****.**


Welcome
PAC PLANNING WORKSHOP
(May 11-12, 2005)
R. REX L. NAVARRO
DR. FERMINA TALENS


SHARAD PAWAR



About ICRISAT

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

Contact information:

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

Liaison Office
CG Centers Block
NASC Complex
Dev Prakash Shastri Marg
New Delhi 110 012, India
Tel +91 11 25849552/25842553/25841294
Fax +91 11 25841294

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

ICRISAT-Niamey (Regional hub WCA)
BP 12404
Niamey, Niger (Via Paris)
Tel +227 722529, 722725
Fax +227 734329
icrisatsc@cgiar.org

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

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

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

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

Visit us at **www.icrisat.org**

ISSN : 1017-9933 IRE 015 430–05