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Overview

Outcome highlights for 2006

Introduction

ICRISAT’s socioeconomic research through the Global Theme on Institutions, Markets, Policy and Impacts has essentially focused in 4 priority areas namely (1) strategic assessments of SAT futures; (2) rural livelihoods and development pathways; (3) Markets, situation outlooks and institutional innovations and (4) impact assessment and research priority setting. These priority areas are consistent with CGIAR system priority 5 “Improving policies and facilitating institutional innovation to support sustainable reduction of poverty and hunger.”

Following CGIAR’s basic principles of relevance and quality of science (CGIAR Science Council 2003), the relevance of the above work is articulated here in terms of

- undertaking strategic research on broader and major socioeconomic and policy constraints that affect investment and growth opportunities in SAT agriculture;
- providing an essential social science context and perspective to ICRISAT’s research; and
- lending critical support to research strategy development, research priority setting and the research uptake process at ICRISAT.

The research agenda of ICRISAT continues to evolve to address the research priorities for agriculture in the semi-arid tropics of sub-Saharan Africa and Asia. Through careful analyses of the needs of NARS and regional stakeholders (eg. APAARI, WCASRN, ASARECA, CORAF, FARA, SADC and NEPAD) emerging trends and opportunities for agricultural growth and poverty reduction in the region are being identified and prioritized. Strategic partnerships with the NARS, ARIs and other stakeholders enable the continuing alliances in setting priorities in the regions.

Based on analyses of emerging trends and future opportunities, the following **priority areas** for the future are identified:

- Develop and promote **policy options and strategies** to expand access to and utilization of new technologies and services for smallholder producers in order to improve the impact of agricultural innovations on poverty and livelihoods

- Assess the **structure, conduct and performance of rural markets and value chains and develop strategies that enhance the market opportunities and competitiveness of smallholder farmers** and agro-enterprises

- Evaluate the changing roles of farmer organizations and develop strategies for **strengthening rural institutions and their governance to empower smallholder farmers** in accessing markets and technologies and in coping with risks

- Undertake **strategic analyses of the dynamics of poverty** and the effectiveness of agricultural development and recovery programs, and identify development pathways and strategies that enhance the impacts of such investments in the SAT.

Related strategic opportunities that would further strengthen the quality, visibility and impact of social science and other ICRISAT research for poverty reduction and sustainable management of agroecosystems in the SAT are also explored.

The highlights of work in 2006 along the lines mentioned above are presented.
Outcome-1

**Outcome-Short Name:** Innovative, participatory and successful CCER of GT-IMPI and KMS

**Output:** GT-IMPI and KMS Report, Vol 1 and 2. Prepared for the Centre Commissioned External Review.

**Output listed:**
The Center Commissioned External Review of the Global Theme on Institutions, Markets, Policy and Impacts (GT-IMPI) and the Knowledge Management and Sharing (KMS) office at ICRISAT took place from 30 October - 19 November, 2006. The following outputs were developed for the CCER Panel.


5. Brochures, Flyers, posters and CD ROMS on various aspects of work of the two units.

**Who was influenced by the output?**
The CCER panel assessed the relevance and quality of science by an examination of the supporting evidences for that assessment prepared by the two programs. This included particularly i) review and evaluation of the focus and quality of current research; ii) GT IMPI’s role in supporting priority setting, the research uptake process, and strategy development of the Institute; assessment of the current institute-wide processes for knowledge sharing both internal as well as external; iv) strategic partnerships and cross-theme linkages throughout the research and development continuum; and v) future directions.

**How was output used and the nature of the influence?**
The panel was impressed with the achievements of GT-IMPI and KMS. They were supportive of the key priority areas identified by the two units that would better inform the strategies for improving livelihoods in the SAT. It was agreed upon that the future priorities will build from existing initiatives and help continue to undertake activities that will lead to a better understanding of the pathways for development given the potential of the SAT and its changing environment, and draw policy options and strategies to address current and future challenges. The recommendations will provide essential inputs into the 2008 EPMR process, so that the EPMR can become more focused on strategic issues.

**Evidence for outcome? What kind of study was conducted?**
The Panel visited the regional programs in Bamako (Mali) for WCA, Nairobi (Kenya) for ESA, and Patancheru (India) for Asia. In each of these sites, the Panel had extensive interactions with staff members, both in groups and individually. In addition the staff members made detailed presentations to the Panel. In
Each of the regions, the Panel met with the staff and management of ICRISAT and various partners with whom ICRISAT in general and GT-IMPI in particular are collaborating.

Outcome 2

Outcome-Short Name: Best practice in impact assessment

Output: Science Council Brief - Standing Panel on Impact Assessment entitled, ‘Spillover Benefits Increase Returns to Sorghum Genetic Enhancement’

Output listed: Science Council Brief and Book chapters


Who was influenced by the output?
CGIAR, development practitioners, researchers, and policy makers. The book serves as a valuable resource and will be of significant interest to those working in plant breeding, crop science and agricultural economics

How was output used and the nature of the influence?
Two of the impact studies of ICRISAT have been selected among the CGIAR ‘Performance Measurement Indicators’ submissions in 2005, featured by the CGIAR Standing Panel for Impact Assessments in the CGIAR AGM 2006. This is in recognition of the quality and rigor of the studies concerned, recognised as a good example of emerging ‘best practices’.

Evidence for outcome? What kind of study was conducted?
‘Sorghum genetic enhancement: research process, dissemination and impacts’ is a volume (Bantilan et al., 2004) that covers 32 years of sorghum research across ICRISAT in partnerships with NARS in Asia, Africa and Latin America. It throws light on the many facets of sorghum research impacts. The volume was the result of close collaboration among biological, natural and social scientists, and features a strategy for promoting sorghum research-for-development and innovative coalitions for partnership. This was reviewed by an international peer-review panel and published as a book in 2005. One chapter in this book was a synthesis of lessons learned from the spillover effects of ICRISAT-NARS technologies across regions and was cited by CGIAR SPIA as one of the best practice impact assessments in 2006.
Outcome-3

Outcome-Short Name: Leveraging international partnerships in social science research

Output: Idea Note for a Social science-based Challenge Program; VLS partner’s consortium developed for future research to determine socioeconomic mobility, agricultural and rural transformation

Output listed:

Who was influenced by the output?
The global partnership for Stimulating Market-led Agricultural and Rural Transformation (SMART) will blend the activities of multiple CGIAR Centers, national agricultural research systems (NARS), advanced research institutes (ARIs), think tanks, universities and non-governmental organizations (NGOs) in both developed and developing regions. This also includes donors, researchers and doctoral students from renowned Universities and Advanced Research Institutes (ARI)

How was output used and the nature of the influence?
A globally coordinated, goal-oriented and demand-driven research venture for Stimulating Market-led Agricultural and Rural Transformation (SMART) in poor developing regions is proposed as a Challenge Program of the CGIAR in response to Systems Priorities 5B/C. Positive and encouraging feedback and support was elicited in developing this further by CG centers, ARIs, think tanks, NGOs and universities.

The researchers and students are using the panel dataset for advanced analysis.

Evidence for outcome? What kind of study was conducted?
For at least twenty years, the ICRISAT (through its Village Level Studies) has long been the world’s premier source of collections of high quality, longitudinal micro-level data from carefully stratified geographical locations. The magnetizing role of this social science “germplasm” – wherein villages were used as real world laboratories to measure and observe the process of agricultural transformation – provide the necessary building blocks and analytical power to bring about a better understanding of the poverty nexus and the drivers of upward socioeconomic mobility. This long term, multigenerational perspective to agricultural and economic change offers an unrivalled tool to stimulate development in rural areas. With the availability of panel data on the dynamics of poverty and the drivers of institutional and socioeconomic transformation, integrated knowledge support systems that facilitate evidence-based decision making can be developed.

Outcome- 4

Outcome-Short Name: Leveraging rural institutions to improve rural markets

Output: ICRISAT Policy Brief, Research Report and Poster

Output listed:


Parthasarathy Rao P et al., 2006. Improving the livelihood of small-scale producers in Asia through innovative coalition approach. Poster submitted to GFAR Triennial Conference, 2006, New Delhi, India
under the theme ARD: Evidence of contributing to achieving the MDGs. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

**Who was influenced by the output?**
The results from the study on “Leveraging rural institutions for collective action” were presented in several workshops and seminars. The results are found to be useful to farmer organizations and decision makers interested to improve markets and empower smallholder farmers. In Kenya the study has informed the decisions taken by the Ministry of Cooperative Development and Marketing and other development partners.

The ‘Coalition approach for improving livelihoods’ highlighted building local innovation system capacity. For example, industry tailored methods of testing sorghum grain suitability for poultry feed and using commercial layer birds for feed trials enabled the buy-in from feed industry and poultry producers.

**How was output used and the nature of the influence?**
The studies have informed policy decisions on how rural institutions and producer organizations can play a role in improving markets for smallholders in less-favored rural areas. The policy brief has been circulated widely among decision makers, policy analysts, researchers and development agencies.

With the involvement of all stakeholders in the sorghum production and supply chain and all stakeholders working towards a common goal while at the same time meeting their sub-goals ensured sustainability of the outcome beyond the project life.

**Evidence for outcome? What kind of study was conducted?**
The study reviewed the emerging role of farmer organizations in the development debate in the post-liberalization Africa and examined how producer marketing groups (PMGs) could help reduce transaction costs faced by smallholder producers in semi-arid regions. The study identifies several policy options to harness the potential of such institutional innovations for improving market access to farmers in remote areas.

To promote sorghum use for poultry feed an innovative Coalition Approach between crop scientists, poultry nutritionists, feed industry, seed producers, farmers and bankers and other stakeholders in the sorghum production and supply chain was adopted. Participating farmers were supplied with seed of improved sorghum cultivars; training in the use of improved production technology; grading and bulking; scientific storage and collective marketing.

**Outcome – 5**

**Outcome- short name:** Best practices in building seed supply systems in West Africa

**Output:** Project proposal on “Development of sustainable groundnut seed systems in west Africa”

**Output listed:**

**Who was influenced by the output?** Development planners, governments and donors in West Africa are focusing on “community based seed supply schemes” that are more sustainable.
Output highlights for 2006

Project 1:
Improving policies and facilitating institutional innovation, markets and impact to support the sustained reduction of poverty and hunger in the SAT

System Priority 5: Improving policies and facilitating institutional innovation to support sustainable reduction of poverty and hunger

Priority 5 A: Science and Technology Policies and Institutions

Priority 5A, Specific goal 3: Improving incentives for technology generation, access and use

Priority 5A, Specific goal 5: Enhancing the structure, conduct and performance of knowledge-intensive institutions

Output 1A: Best innovative practices and mechanisms for harmonization and utilization of seed-related and biosafety regulations and policies suitable for the specific conditions of the SAT piloted, promoted and adopted by 2009 with new knowledge shared with partners annually.

1A.1. Guidelines prepared for the design and operation of efficient community seed production schemes by 2006.

Regional seed policy harmonization (SSA)

Seed policy harmonization has been cited as a means to increase seed trade and reduce seed costs in southern Africa for the past 15 years. However, little have been achieved over this period except the principled agreement that harmonization would be useful. There are three initiatives working towards harmonized seed trade in sub-Saharan Africa:

- Southern Africa: The initiative facilitated by the Southern Africa Development Community - Seed Security Network (SSSN),
- Eastern and central Africa: The initiative facilitated by the Association for Strengthening Agricultural Research in Eastern and Central Africa coordinated by the Eastern and Central Africa Programme for Agricultural Policy Analysis (ASARECA/ECAPAPA), and
- West Africa: The initiative facilitated through the collaboration between the Institut du Sahel (CILSS/INSAH), the West Africa Economic and Monetary Union (WAEMU), and the Economic Community of West African States (ECOWAS) in West Africa.

Although there has been effective intra-regional dialog between countries and in the case of West Africa between the three separate seed trade harmonization initiatives in that region, there has been very limited inter-regional dialog. This will limit seed trade between regions unless there is harmonization across the regions, and this is particularly important between the SADC block and countries in Eastern and Central Africa where there is already some seed trade and potential for a lot more.

There is strong pressure from commercial seed companies for the development and implementation of harmonized rules and regulations to facilitate seed trade across national borders, but to date these have been elusive because there has been limited effort to have the draft technical agreements politically approved. ICRISAT facilitated a linkage with the Seed Science Center of Iowa State University and the SADC Seed Security Network (SSSN) to establish a practical foundation for three regional regulatory harmonization agreements.
In April 2005 and again in August 2006 ICRISAT - in partnership with the African Seed Trade Association (AFSTA) - organized an inter-regional workshop to share experiences across the three initiatives, and to identify areas requiring further support.

Objectives: Work with SADC and other African countries to complete harmonization agreements on:
- seed phytosanitary standards
- seed certification standards
- regional variety release

Methodology: During the past two years, more than 10 workshops have been held bringing together public and private seed sector stakeholders from all 14 SADC countries to hammer out agreements on phytosanitary standards, certification standards, regional variety release and plant variety protection. This was supported by Africa wide efforts for a similar harmonization process in other sub-regions.

Main findings & policy implications: In September 2006, the Permanent Secretaries of Agriculture for the 14 countries of the Southern African Development Community (SADC) endorsed three major regional agreements for the harmonization of seed regulations in southern Africa. A Memorandum of Understanding is now being prepared by SADC to facilitate approval by the Heads of State.

Southern Africa will be the first African region to establish a Regional Variety Release System. This enables the development of a truly regional seed market by allowing any non-GMO plant variety released in at least two SADC countries to be sold in any other country in the region. Seed companies no longer have to pursue the time and budget consuming process of separate variety releases in each of the 14 SADC countries. This agreement will speed access of farmers to the best new varieties in southern Africa. And the agreement will help seed companies pursue scale economies in their regional breeding and marketing programs.

The second harmonization agreement establishes a common Seed Certification and Quality Assurance System. This defines common field and laboratory seed standards for the 13 most traded seed crops in southern Africa. In order to facilitate the implementation of this agreement, accreditation schemes have been created for each SADC member state based on detailed procedures manuals. Accreditation allows seed companies to conduct their own field inspections, sampling and testing, thus reducing the costs of regulatory inspections. Quality assurance manuals are being drafted for a range of smaller seed companies in order to help them quality for accreditation and assure the quality of seed they are producing.

The third harmonization agreement establishes a common Seed Quarantine and Phytosanitary System. This creates a new set of regional quarantine lists governing seed trade within the SADC region, and between SADC and countries outside the region. In the process, the number of quarantinable pests and diseases has been significantly reduced. This program has also helped each of the fourteen SADC countries develop their own seed import and export procedures manuals – based on common procedural standards. Again, this will contribute to reducing the costs of seed trade, while minimizing the risks of trans-border movement of seed transmitted crop diseases.

In addition, the Permanent Secretaries concurred that establishing common legislation governing Plant Breeder’s Rights in all SADC countries would promote greater investment in crop breeding and speed the development and trade of better varieties. The Permanent Secretaries received a draft of a regional agreement for the Protection of New Varieties of Plants in the SADC Region, which has been proposed as a basis for each country’s national legislation.

These agreements serve as an example for related efforts in eastern Africa and western Africa. ICRISAT is facilitating coordinated discussions about these harmonization efforts across the three African regions.

An important finding from the seed policy harmonization process in Africa is that not all initiatives have been linked to the political process at the level of regional economic communities, and hence getting political approval has been impossible. In addition, lack of technical capacity in some regions meant that technical agreements are incomplete and would be of little benefit even if implemented. This has
contributed to the slow progress in other regions. The new initiative under the project for Sustainable Commercialization of Seeds in Africa (SCOSA) has aimed to address this problem by pursuing a strategy that adds value to the ongoing initiatives through cross-fertilization of ideas and existing agreements between regions, and to provide targeted technical support. AFSTA with support from SCOSA has also started engaging with regional economic communities and political bodies including the NEPAD/CAADP to obtain the necessary political support to have these agreements approved and implemented. SCOSA is addressing the following issues:

1. Developing a web-based template for the regional variety catalogs that are needed to support the regional variety release systems being developed in all three regions
2. Contribute to the development/refining of technical agreements including the adaptation of technical manuals on seed import-export regulations and quarantine pest lists, biosafety testing procedures based on process management, regional variety release.
3. Facilitate the development of institutional arrangements and partnerships for improving seed systems through enhanced availability of breeder and foundation seeds and business development services for seed enterprises.

Presently 21 countries across sub-Saharan Africa are in the process of developing business plans for the establishment of Seed Enterprise Enhancement and Development Services (SEEDS) that are expected to produce and market foundation seed of publicly developed varieties, provide storage and processing facilities to seed entrepreneurs as well as technical support, seed certification (where accreditation is feasible) and business development services. This work is being done in partnership with AFSTA, which has the mandate to support the development of commercial seed trade on the continent. Business plans are expected to be finalized by the end of 2006 and efforts are underway to use these business plans to solicit resources to establish SEEDS.

This initiative recognizes the key role of the private sector. The public sector is important in creating an enabling environment. From time to time, consultations are made with the private sector through meetings to determine whether the initiatives being undertaken are facilitating the private sector to participate more effectively in fostering a vibrant seed sector. This is in effect business not as usual because in the past, the public sector was the leader but no longer.


Output 1B: SAT agricultural research database, impact evaluation methods, participatory, pro-poor monitoring and evaluation and institutional learning and change models generated, shared and capacity developed with national and sub-regional agricultural research systems by 2009 with new knowledge shared with partners annually

1B.1. District level database update (Asia)

ICRISAT is maintaining district level database for India that includes data on area and production under major crops, land use, crop wise irrigated area, source wise irrigation, farm harvest prices, fertilizer consumption, rainfall, infrastructure variables like road length, and markets, land holding size and census data relating to human and livestock population. The database spans 492 districts in India covering 16 states (now 19 states, with the formation of new states). The database available with ICRISAT for 13 states in India was updated in 2001 upto 1997-98 for all the variables in the file and expanded to include data for 3 more states i.e., from 13 to 16 states.
**Background:** Update of the database is essential to address issues at the aggregate or regional level. State level data are not suitable since states were created on linguistic and political grounds and are not homogenous in terms of agro-climatic and socioeconomic environment. Research resource allocations to various projects across regions have become critical due to availability of limited resources. Using district level data regions with pre-determined criteria (poverty, income, infrastructure etc) could be flagged that would help in more informed resource allocation to meet the goals and objectives of the research project.

**Progress:** In 2006 the database is being updated until 2004 for all the districts in the 19 states in the dataset. Updating the database is a herculean task involving travel to state Directorates of Economics and Statistics, Directorates of Agriculture, Marketing Departments, Animal Husbandry, etc located in each state capital for collection of data from published and unpublished sources. This was accomplished to a large extent for key variables in collaboration with CRIDA an ICAR institution that are partners in the update of the dataset. Data from only a couple of newly formed states is still in the process of being collected. To bring the data to usable form, coding, checking and inputting, processing and merging with existing database, and finally making the database compatible with GIS for spatial analysis etc are in progress and will continue in the first quarter of 2007.

Handling new districts: Since 1970, several new districts have been formed for various reasons (political, linguistic, etc.). Between 1970 and 1998, 150 new districts were formed. A satisfactory method for dealing with the problem of the formation of new districts had to be worked through, to accommodate both the need for continuity over a long-term, and the need for conducting spatial analysis (or operationalizing GIS) using the most recent data.

Since it is not possible to update the database by a single agency presently, we are updating the database in collaboration with CRIDA, Hyderabad, under the ICAR-ICRISAT collaborative projects. ILRI and IWMI are also collaborating in the update.

**1B.2. Coordinated impact database development in Asia and WCA**

**Training on impact assessment for agricultural technologies (Global)**

Research evaluation and impact assessment work is carried out in close partnership with the national programs and other partners. This is facilitated through training modules for capacity building and skill development. The earlier development of training modules on research evaluation and impact assessment was a collaborative project between ICRISAT and the Australian Centre for International Agricultural Research (ACIAR). Additional modules were based on ICRISAT’s ‘Training program on research evaluation and impact assessment (REIA)’ conducted for various countries in Africa and Asia. More modules were added during the ‘Training workshop on impact assessment’ held at Kasetsart University, Bangkok, Thailand. Another training workshop on ‘Impact assessment of agricultural technologies in West Africa’ in 2005 included new modules and case studies (Ndjeunga et al., 2006). French versions of all modules were presented to the participants of this workshop.

The modules completed include basic methodology, empirical issues, research evaluation, minimum data sets, research costs in project-level evaluations, cost analysis, adoption, research lags, probability of success, research spillovers, new products, supply-shift assumptions, validity of claims on impact and other methodological issues. Hands-on exercises using research evaluation models have also been developed and piloted in several workshops held in Asia and Africa. The completion of the training manual for impact assessment is important particularly in strengthening the capacity of NARS partners to conduct impact assessment studies. This facilitates the technical backstop function of ICRISAT as it seeks to undertake joint impact studies with national program partners.

The last training in West and Central Africa involved sixteen participants from ICRISAT and the national programs in Burkina Faso, Mali, Niger, Nigeria and Senegal. It primarily covered country studies for assessing impacts of groundnut, sorghum and millet technologies as well as natural resource management. This is a joint activity with GT-CI, under the Groundnut Seed Project (GSP). National programme representatives identified specific jointly-developed technologies that should be targeted for impact


1B.3. Vision for SAT research to 2015 - Analysis of strengths, weaknesses, challenges, opportunities and threats (linked to GT BT, CI, AES and MG) (Global)

The overarching goal of ICRISAT has been to provide custodianship to six mandate crops and improve germplasm, and options for the diversification of SAT farming systems that will contribute to development policies of national sub-regional institutions and donors aimed at meeting the Millennium Development Goals. The core value is to improve wellbeing of the poor of the semi-arid tropics through agricultural research for impact. Through extensive discussions and information gathering, a framework for analyzing ICRISAT’s strengths and weaknesses was developed to guide the process of formulating a core value and strategy of ICRISAT to 2015. The inventory of ICRISAT’s internal strengths and opportunities (as well as areas for improving identified weaknesses) explored directions and implications of future R&D. Wide-ranging regionally oriented bottom up in-house planning exercise and interactions with stakeholders identified pressing issues both in research and research management. An open-ended SCOT questionnaire format gave opportunities to gain feedback from scientists, managers and stakeholders and to explore and analyze the recent changes in the international research environment, as well as current environmental, socio-economic-political situation (especially those affecting agricultural research) and trends. It also paved a way to figure out the trends associated with identified scenarios to strengthen our strategic and tactical decision-making. The major core competencies and constraints of ICRISAT identified in the SCOT analysis are listed in Box 4.

Collaborating Scientists:
All scientists from all global themes, units and regions, ICRISAT.


Report on impact assessment of sorghum and millet research in West and Central Africa: A synthesis and lessons learnt

Rationale: In a time of increasing scrutiny about the usefulness of investments in agricultural research, impact assessment studies assist to demonstrate the value of continued investments in research. Lessons learnt from impact assessments can be used to improve future research strategies, plans and management. This paper reviews and synthesizes the findings of various studies on the adoption and impact of sorghum and millet technologies research in West and Central Africa (WCA).

Methodology: The review covers Burkina Faso, Cameroon, Chad, Mali, Nigeria and Niger where relatively more breeding research has been conducted. The information is mainly drawn from studies on the diffusion and impacts of varieties carried out by ICRISAT and National Agricultural Research Systems (NARS) of WCA.

Results: Findings from reviewed studies show that returns to research (and diffusion) investments are quite high, but the performance varies across countries. However, if improved technology is to make a
meaningful impact at the farm level, it must be accompanied by at least three complementary factors: 1) an effective extension service; 2) an efficient input distribution system, and (3) appropriate economic incentives. These results are essential for priority setting of research and development interventions.

Impact assessment of sorghum and pearl millet varieties in Northern Nigeria (WCA)

Rationale: Nigeria is ranked first in terms of pearl millet and sorghum production in West Africa. It accounts for about 50% of total sorghum or pearl millet production. However, productivity of these crops that are essential to ensure food security for smallholder farmers in the Sahel is still low. Since 1990, ICRISAT in partnership with IAR developed a large range of pearl millet and sorghum varieties and hybrids that are preferred by farmers and some of these varieties have the traits required by the markets. However, little is known about the level and extent of the level of adoption of these improved varieties and constraints to adoption. As the first step, this study evaluates the adoption of sorghum and millet varieties in selected states in Northern Nigeria.

Methodology: Six states (Borno, Jigawa, Gombe Kaduna, Kano and Katsina) in northern Nigeria were selected based on the relative importance of sorghum and millet. Following a PRA, a structured survey was carried out covering 840 small-scale farmers. The varieties investigated include ICSV400, ICSV111, SK5912, ICSSH9002NG, ICSSH9009NG, NSSH91001 and NSSH91002 for sorghum cultivars and SOSAT-C88, GB8735, EX BORNO, LCIC9702, LCIC9703, ICMV-189305 and GWAGWA for millet cultivars.

Results: Adoption survey results showed that yields from improved varieties are significantly higher than the local landraces. The average yield for improved pearl millet varieties is estimated to about 1126 kg per hectare against about 940 kg/ha for the local for the period 2003-2005. This represents a yield advantage of about 20%. As for sorghum, the productivity gains are estimated to about 31% (1324 kg per hectare for improved cultivars and 1011 kg for local varieties). The gains are realized from the reduced productivity loss as a result of drought and disease resistance of improved varieties. Kano State enjoyed the highest yield increase (43%) for sorghum whereas the mean yield (1474 kg per hectare) from improved millet cultivars was highest in Borno State.

The overall rates of farmers growing improved sorghum varieties were estimated to 78% for ICSV400, 66% for ICSV 111, 92% for SK5912 and 66% for KSV8. Concerning improved millet varieties, the rates of awareness were 91% for Ex-Borno, 76% for SOSAT-C88 and 67% for GB8735. On average, about 56% (1.28 ha) of the total area under sorghum in 2004/05 was planted with improved sorghum and 47% (1.07 ha) of the total area under was planted with improved millet varieties. These represented increases of 21% (1.05 ha) for sorghum areas and 30% (0.82 ha) for millet areas relative to the preceding 2003/04 cropping year. It is worth noting that of all the cultivars investigated; ICSV 400 and SOSAT-C88 have the highest proportions of cultivated allocated them. They were respectively 47% and 31%.

The most important drivers for adoption of improved sorghum varieties were different from the ones cited for adopting improved millet varieties. For sorghum, high yield was ranked first followed by early maturity, selling price, storage ability, food quality and drought/disease resistance. For millet, early maturity ranked first, followed by high yield, food quality, selling price and drought/disease resistance. The high ranking of early maturity trait is a confirmation that drought is the major constraint to pearl millet production in northeastern part of Nigeria. In effect, most farmers are small-scale and semi-subsistence farmers whose major goal is to ensure food security for their families. Early maturing cultivars provide an early end to the annual hunger period (June’s first rain to September’s first harvest). The high ranking of the high yield trait for sorghum can be explained by the fact in Kano and Kaduna, sorghum competes with high yielding crops such as maize.

Early adoption of groundnut varieties in Northern Nigeria (links to SP2) (WCA)

Rationale: Nigeria is the 4th largest groundnut producer in the world and the first in West Africa. Groundnut averages 2,730,000 tons in 1997-2001 accounting for about 9% of world production and 34% of Africa production. Nigeria has lost its production share with 11.87% of production share in 1961-65 to 8.51% in 1997-01. Despite this loss, groundnut remains the most important source of vegetable oils and fats in West Africa. Groundnut production has suffered major setbacks from the rosette virus that significantly affected productivity. This led Nigeria to loose its shares in the international and regional markets. To regain its shares, groundnut yield would have to increase substantially, using yield enhancing technologies including varieties tolerant or resistant to rosette.

Since 1990, ICRISAT and IAR have developed, tested or adapted 44 groundnut varieties. These varieties were tested in multi-locational trials in partnership with ADPs and NGOs in the regions of Samaru, Bagrauda, Minjibir, Shika, Kano, Katsina and Maiduguri. In 2001, 3 groundnut varieties (SAMNUT 21; SAMNUT 22 and SAMNUT 23) were released. Since then, there is limited knowledge on the level of use of these varieties. This study assesses the diffusion and preferences of farmers for varieties recently released in 2001. Information on other improved varieties is also available.

Methodology: A structured survey was conducted in 4 northern states of Nigeria mainly Kano, Jigawa, Katsina and Kaduna in December 2004. These states account for more than 70% of groundnut production in the Sahelian zone of Nigeria. Three groundnut varieties (SAMNUT 21, SAMNUT 22 and SAMNUT 23) were targeted for the study. Eleven local government areas were purposely selected on the basis of the importance of groundnut production. In each LGA, 2 villages were on the same basis and in each village, a random sample of 25 farmers was chosen. Therefore, a total of 480 farmers were interviewed.

Results: Survey results show that 12.13% of groundnut area is planted with improved varieties, ie. SAMNUT 21 accounting for 7.20%, SAMNUT 22 for 3.07% and SAMNUT 23 for 1.85%. Other varieties were reported to be grown as well. These include the varieties 55-437 on 12.23% of area planted, 12.26% for RMP 12, 2.69% for RMP 91 and 7.80% for RRB. The major constraints limiting the adoption of modern released varieties include the poor access and availability of seed and lack of information. Other minor constraints are low yield, susceptibility to diseases and pests, and poor market value.


Assessing diffusion of pearl millet varieties in Niger (WCA)

Rationale: From 2002-04, ICRISAT initiated a large multi-locational pearl millet participatory variety selection trials in Niger with major objective to evaluate performance of new varieties on farmers’ fields, identify farmers’ preferences on varietal traits, as well as identify production and adoption constraints. Following the introduction of pearl millet varieties little is known on the adoption of these varieties. This study assesses the levels of adoption and factors affecting farmers’ adoption decision, and formulates ways in which research, extension, and policy could improve their adoption.

Methodology and data: A study was initiated in two major millet growing regions of Niger, namely Dosso and Maradi. Data were collected from primary and secondary sources in the departments of Ague, Madarounfa and Dogon-Doutchi were the trials were implemented. Secondary sources included published and unpublished information about agricultural production in particular and the study area in general. The survey was conducted in April 2005 and it involved farmers who had participated in PVS on-farm trials and demonstrations during 2000/2001 to 2002/2003 cropping seasons. A total of 300 households were interviewed from 13 villages.

Results: The major improved pearl millet varieties grown in the study areas include SOSAT-C88, HKP, P3KOLLO, ZATIB and CIVT. The area covered by improved varieties is estimated to 15% (0.57ha /
production unit). The main sources of information about improved varieties vary across locations. In Doutchi, most farmers (60%) have been linked to NGOs (CRS and CARE), 20% to a seed center and 20% to the “Projet de Gestion des Ressources Naturelles” (PGRN). In Madarounfa and Aguei (the Maradi region) INRAN dominates (around 85% of farmers reported so) as the main source information about improved millet varieties. This could be explained by the strong presence of INRAN in Maradi.

Farmers’ rating of the different criteria varied across the study sites. High yielding, early maturing and ability of a variety to perform well under low soil fertility, and drought conditions were reported as the choice criteria in all sites. The factor limiting adoption include low soil fertility, lack of financial resources to purchase inputs and high prices of the inputs (especially fertilizers and seed), and low technical know-how. Other constraints enumerated are pests and diseases, vagaries of weather, unavailability of inputs, poor access to agricultural extension services, and poor marketing of both inputs and outputs. Farmers also ranked highly markets access (i.e. distance to the Nigerian border), information and unreliable rainfall as key constraints because they believed that alleviation of these constraints would lead to alleviation of many other constraints.


Impacts of inventory credit, input supply shops and fertilizer microdosing in the drylands of Niger (links to SP4) (WCA)

This study investigates the impacts of access to inventory credit (warrantage), input supply shops, fertilizer micro-dosing demonstrations, and other factors on farmers’ use of inorganic and organic fertilizer in Niger, and the impacts on crop yields. We find that access to warrantage and input shops and participation in fertilizer micro-dosing demonstrations have increased use of inorganic fertilizer. Access to off-farm employment and ownership of traction animals also contribute to use of inorganic fertilizer. Use of organic fertilizer is less affected by these factors, but is substantially affected by the household’s crop mix, access to the plot, ownership of durable assets, labor and land endowments, and participation in farmers’ associations. Land tenure influences both inorganic and organic inputs, with less of both on sharecropped and encroached plots.

Inorganic fertilizer has a positive impact on millet yields, with an estimated marginal value-cost ratio greater than 3, indicating significant profitability. Organic fertilizer has a positive impact on millet-cowpea yields. We find little evidence of complementarity between inorganic and organic fertilizer. Since warrantage (inventory credit scheme), input supply shops and fertilizer micro-dosing demonstrations increase use of inorganic fertilizer which in turn increases millet yields, these interventions indirectly increase millet yields, although the impacts are relatively small. These findings support promoting increased input use through promotion of inventory credit, input supply shops and fertilizer micro-dosing demonstrations. Other interventions that could help to boost productivity include promotion of improved access to farm equipment and traction animals and improved access to land under secure tenure.


1B.5. Report on impact assessment of soil and water conservation methods in Burkina Faso completed (Linked with SP4) (WCA)

Rationale: Substantial progress has been made in the development, testing and dissemination of potentially profitable technologies for improved soil and water management in West Africa. There is growing evidence that some of these technologies (e.g. rock lines, branch barriers, small dikes, vegetative bands, compost pits) are beginning to be widely adopted. However, the full extent of this adoption remains uncertain. There have been no systematic efforts to evaluate the degree or quality of adoption (i.e., correct use of techniques). Little is known about how many farmers are adopting these technologies, and there are no
known attempts to record the extent of dis-adoption over time (e.g. when the special development project ends).

Past research by ICRISAT has raised a range of hypotheses about the levels and determinants of the adoption of soil and water management technologies in West Africa. Few studies on adoption of soil and water conservation technologies have been conducted. This study aims at analyzing the levels and determinants of adoption of soil and water management (SWM) technologies and evaluates the impacts of SWM/fertilizer adoption on productivity, incomes, and the environment and the determinants of adoption.

**Methodology:** Data collection on impacts of soil and water conservation methods in Burkina Faso completed. A PRA was undertaken with main objective to gather relevant information on soil and water conservation technologies practiced by farmers in Northern Plateau of Burkina Faso, determine the incentives and motivations to use these technologies; pre-assess the impacts and pre-identified the constraints to uptake of these technologies. PRA tools were used to gather information from key resource persons from 2 contrasting villages: Ziga in the Yatenga province and Rissiam in the Bam province.

PRA results show that stone bunds and zaï were the most widely used technologies in the Ziga villages whereas, stone bunds, small dikes, and dikes were the most widely used technologies practiced by farmers in Rissiam. Farmers often used more than one conservation technology to maximize benefits from conservation structures. According to farmers’ groups interviewed, there have been impacts due to the use of these technologies and translated by land recoveries, regeneration of land cover, increase in the water table, improvement of households’ production and revenues and population fixation. However, constraints to adoption have been reported as insufficient labor, lack of organic manure, lack of equipment and plants.

This PRA was followed by a structured survey in the North, centre-north and centre regions of Burkina Faso. In each region, 7 villages were selected on the basis on population densities, and market access and relative assessment of uptake. In each village, 1 village with high adoption, 2 with average adoption, 2 with low adoption and 2 control villages were purposely selected. In each village, on average 15 households were randomly selected. Therefore a total of 405 households were interviewed. Four questionnaires were developed to gather information at (1) village level, (2) project level, (3) household and plot levels, and (4) research and extension costs. Information will be used to assess impact using the economic surplus and the econometric models.

**Results:** Preliminary results indicate that farmers are well aware of NRM technologies such as the stone bunds (81%), zaï (65%), manure pits (61%), sowing in line (60%). But they are less aware of half moon (9%), vegetative bands (15%), compost (26.17%) or small dikes (3%). The main information sources are rural development projects and NGOs involved in soil and water conservation (62%), other farmers (41%), and the traditional extension services (39%). Minor sources include research institutions (8%), radios and television (4%).

The proportion of surveyed farmers reporting using stone bunds is estimated to 70%, 50% for the zaï, 5% for half- moon, 4% for vegetative bands, 21.5% for compost and 12% for rotation. Constraints to dis-adoption of these technologies reported by farmers include the lack of agricultural equipment (60.3%), lack of labor (13.2%), low yield (8.8%), poor training (7.4%), and poor access to inputs. Farmers claimed that the reasons why they are continuing to use or maintain the technologies is because they derive high productivity gains (80%), or they are linked to rural development projects that provide equipment or food for work (55%) or they have access to agricultural equipment (45%).

**1B.6. Other NRM impacts**

**Stochastic dominance analysis of soil fertility restoration options on sandy sahelian soils in Southwest Niger (WCA)**

The poor fertility of sandy Sahelian soils remains one of the major constraints to pearl millet (Pennisetum glaucum) production in West Africa. On-farm trials under farmers’ management were conducted in two rainfall zones of Niger in 1996 and 1997 to evaluate the risk characteristics of six soil fertility restoration
options. Stochastic dominance analysis was used to compare the fertilizer treatments tested. Results showed that the farmers’ traditional method (no fertilizer control), Tahoua phosphate rock (PRT) alone applied at 13 kg P ha$^{-1}$ broadcast, and a combination of PRT broadcast at 13 kg P ha$^{-1}$ and single super phosphate (SSP) hill-placed at 4 kg P ha$^{-1}$ had the most desirable risk characteristics and were acceptable to risk averse decision-makers in both rainfall zones. At current input–output price ratios, most fertilizer-using farmers would choose the combination of PRT broadcast and SSP hill-placed. If the availability of SSP was limited, some farmers would use PRT alone. The demand for risk efficient alternatives could significantly increase if farmers could bear less than half the fertilizer costs at the current output price, although further research is required to say if a fertilizer subsidy could be justified on broader economic or social grounds.

Evaluation of economic returns of drip irrigation and local irrigation system: From June 2002 to May 2003, 827 drip irrigation systems were distributed and disseminated in Niger by ICRISA T and partners. Two types of systems were developed including the Thrifty system (TS) of 80 sq meters and a large commercial system (CS) of 500 sq meters. These systems were targeting two segments of the population based on gender. The small systems were targeted to women who are often excluded from the cash economy in rural and urban areas. The large systems were made to target vegetable producers some of which are located in peri-urban areas where the demand and income are relatively high. Development project partners found very appropriate to use these systems to address community deficiencies in basic nutrients and others used these as students – field- schools to teach students of biology and agronomic principles. These systems were distributed in the regions of Agadez, Tahoua, Zinder, Tillabery, Dosso (60 CS+173 TS) and the peri-urban Niamey (50 CS + 276 TS).

Since then, there was little monitoring and little was known on the level of uptake and use of these technologies. As a step towards a study on diffusion of drip irrigation systems in Niger, 2 zones were targeted: the peri-urban Niamey and the Dosso region where 130 CS and 363 TS were distributed. These areas differ significantly by the level of monitoring and evaluation. While in peri-urban Niamey, little monitoring and technical support was provided, in Dosso, these systems were largely supported by the Projet de Development Integree de la Region de Dosso and the “Ecole de Sante” projects funded by the Luxemburg government.

In the region of Dosso, 47 systems were visited out of the 233 systems distributed. Overall, 44 systems i.e. (94%) were still functioning. In peri-urban Niamey, 97 systems were randomly visited out of the 326 systems disseminated. It was found that 56 systems (58%) were still functioning.

In order to assess the perception of users, the returns to using drip irrigation compared traditional practice as well the range of constraints facing users, a survey of 92 systems used by 68 producers was carried out in Dosso and Niamey. In addition, 21 producers using the traditional technology were surveyed.

In general, it was found that the economic returns to land for those using the drip irrigation systems was estimated to 526 FCFA/m$^2$ against 336 FCFA/m$^2$ for those using the traditional practice. The returns to water, labor and fertilizers were perceived to be high by farmers. In general, to enhance uptake of the drip irrigation systems, (1) the diffusion points need to be well targeted, (2) people need to be well trained at fabricating water tanks that do not leak especially for small systems, (3) the technology has to be flexible to accommodate different types of crops, (4) the systems have to be larger because most vegetable growers own on average more than 80 sq meters, some of them who were given the small system did not find this useful, (5) access to cleaned water has to be improved, (6) the need for more demonstration. In effect, many farmers had the perception of low supply of water to plants and had to supply additional water with watering cans, (7) better use of the technology, only 2 have used the technology during 2 seasons during the year, (8) the need to link producers to better vegetable markets, more than 20% claimed to experience marketing problems and (9) the need to link farmers to credit markets as many farmers found the start-up capital very high.

In Dosso where NGOs have technically supported the systems, practically all systems are still operating. Around Niamey when no technical support and follow up was given about 60% are still operating. The diffusion of this technology is limited producers were because of limited monitoring and poor access to
capital by producers. Policy and programs that will favor access to credit by producers is essential to enhance uptake of African market garden.

**Uptake of Soil and Water Conservation Technologies in the Office de la Haute Vallée du Niger (OHVN) in Mali (links to SP4) (WCA)**

**Rationale:** In many agricultural based developing countries, land degradation may occur at any time in any geographical region of the planet. It is limited neither by space and time nor by a particular natural circumstance. Among the various types of land degradation, soil erosion is the most important and an ominous threat to the food security and development prospects of many other developing countries. It induces on-site costs to individual farmers and off-site costs to society. Due to the presence of externalities arising from soil erosion, market prices do not reflect resource scarcity and individual farmers will have insufficient incentives to practice soil conserving agricultural practices. Accelerated soil erosion can be reduced by a combination of proper land management systems and appropriate soil and water conservation efforts. Incentives to promote soil and water conservation measures are, therefore, appropriate areas of intervention to mitigate the adverse effects of irrigation. Physical soil conservation structures technically have the potential to reduce soil loss by decreasing overland flow of water and to mitigate yield variability by reducing moisture stress on plant growth through retention of rainwater that would otherwise be lost to runoff.

Substantial progress has been made in the development and testing of potentially profitable technologies for improved soil and water management in West Africa. There is growing evidence that some of these technologies (e.g. rock lines, branch barriers, small dikes, vegetative bands, compost pits) are beginning to be widely adopted. However, the full extent of this adoption remains uncertain. There have been no systematic efforts to evaluate the degree or quality of adoption (i.e., correct use of techniques). Little is known about how many farmers are adopting these technologies, and there are no known attempts to record the extent of dis-adoption over time (e.g. when the special development project ends).

Past research has raised a range of hypotheses about the levels and determinants of the adoption of soil and water management technologies in West Africa. Questions have also been raised about whether this adoption is the result of incentives associated with specific types of development projects, the presence of cash crops, or some combination of the two. The purpose of study is to highlight socio-economic aspects of soil and water conservations (SWC) as it applies to subsistence farm households in the Office de la Haute Vallée du Niger (OHVN) in Mali.

Specific research questions addressed in this study are: What is the level of uptake of soil and water management (SWM) technologies? 2. What is known about the determinants of uptake and the relative importance of factors such as cash crops and technology promotion projects? 3. How do the levels of uptake vary by zone, household, and farm characteristics? Are some technologies more suited to wealthier farmers or to farmers with lower labor costs or to farmers with better access to product markets? 4. Are changes in household welfare, food security or total assets perceived by farmers? 5. Which drivers are most important for stimulating uptake?

**Methodology:** Following a participatory rural appraisal in 7 villages of the Office de la Haute Vallée du Niger (OHVN) involving about 100 farmers, a structured survey of households was conducted from 25 October 2002 to 15 November 2002. Twenty-six villages were selected purposely in the OHVN zone based on OHVN agents’ perception of level of average uptake of soil and water management technologies in the village. Thus, 5 villages were assumed to have a high level of uptake, 6 villages with average level of uptake and 15 villages with low level of adoption of soil and water conservation methods.

In each village, an average of 20 households was randomly selected based on the census provided by the chief of village or constructed by the enumerator in the village. A total 531 rural households were selected and inter-viewed from October 25, 2003 to November 25, 2003. Households’ decisions to use soil and water conservation methods are influenced by a number of factors. The effects of these factors are influenced by the nature of rural market imperfections. When market distortions occur, the subjective price of the good may fall within the price ban and make consumption and production decision non-separable.
This implies that investments in soil and water conservation methods will compute with resources needed for current production or consumption decisions. To the extent that assets and factors differ across households market imperfections may also lead to differential investment in soil and water conservation technologies. Imperfections in credit/capital markets may also imply that households with higher savings or productive assets will be able to invest more in conservation methods. Overall, when market imperfections are important, the theory of investment behavior suggests inclusion of household characteristics and assets.

Results: Survey results showed that about 38% of surveyed farmers have adopted at least a soil and water management technology. Among these, stone bunds and stone lines were the most used representing about 11% and 22% of households respectively. In addition, more than 55% of households surveyed used inorganic fertilizers. Results from a Probit model showed that the decision to use stone bunds is explained by involvement in cotton production, access to product markets, credit, equipment and the perception of productivity gains. Governments and donors support policies should target poor households by enhancing access to credit and agricultural equipment that are necessary to enhance uptake of soil and water conservation technologies.


Production systems and Socio-Economic constraints in the Fakara (WCA)

Rationale: Frequent food deficits are still current in the Fakara region despite significant research efforts in the region. Farmers have developed economic strategies and social network that help them go through these difficult periods. Due to uncertainty (weather, prices) they have developed production system that allows them to minimize investment even though it compromises the level of production surplus.

The main objective of the study was to conduct an evaluation of farmers’ strategies of agricultural production systems through understanding of farmers’ behavior towards food deficiency in Sahel zone of West Africa. The study was then set to categorize Fakara households and draw implications for new technology development and dissemination in the region.

Methodology: The study was conducted in three villages of the Fakara region (Canton of Diantiandou). The villages chosen were Banizoumbou, Kodey and Tchigo Tagui. The three villages are quite the same in terms of agricultural production conditions. They were also already on-farm trial sites for the JIRCAS project. In each village, a sample of 30 farmers was drawn from a list of key informant used by the project. Thus a total of 90 households were interviewed using a set of questionnaires.

Based on the data collected households are classified in three categories. The primary classification criterion is household assets. The study used the reported type of livestock possession to categorize the household into no livestock category, those with small ruminants only and those with large ruminants (cattle). It should be noted that households with cattle often also have small ruminants. Large livestock owners are expected to be the wealthiest of all, with the small ruminant only group following and the poorest will the group with no livestock at all. This categorization is important and follows farmers’ classification of wealthy people. In fact in the local language for the region, there is a word used for wealth and livestock are the same time.

Results: Manure is quite widely used by these farmers and its use depends on resources of the household. While 85% of the livestock group members use manure, the percent users is as high as 98% of the large ruminant group members. Inorganic fertilizer use is quite different for the three groups. While only 25% of no livestock group has reported buying inorganic fertilizer, up to 50% of the other two groups have purchased some. However, average quantity purchased is only 36 kg per household for the large ruminant group, 24 kg for the small ruminant group and only 7 kg per household for the no livestock group. Given that inorganic fertilizer is the most expensive purchased agricultural input in the region, its quantity used can be a good proxy for amounts farmers are investing and/or are willing to invest in agriculture.
The first group (no livestock) is expected to be the one most concerned with food shortages. All household resources are primarily geared toward making sure enough food is available for the year. This group would be most likely to have few adopters of agricultural innovations. The behavior is justified by lack of all resources to devote to agricultural innovations. For this group extra labor will most likely serve as laborer in other farmers’ fields and capital is almost not available to them.

The second group is composed of households with only small ruminants in their herds. For this group agriculture will be the most important activity and their often looking for options to improve their production. They are not food constrained as the first group. Farmers in this category are expected to be able to invest additional labor and/or small amount of capital into agricultural innovations. Adoption rate of new technology in this group is expected to be high especially for labor intensive ones and those requiring limited cash investment.

The third group is that of the wealthiest farmers with animal herds composed of small ruminants but also cattle. Farmers in this third group are often very influent in the village. Even though they have crop production activities, it is not necessarily their most important one. They are often looking for opportunities to invest in lucrative activities. They will adopt agricultural innovations if profitability of such investment can be demonstrated to them.

Technology development for this region should take into account the fact that households are different in their investment and risk handling capabilities. Technologies that require cash investments will have a smaller number of potential adopters unless strategies are devised to increase liquidity and risk handling capacity for those farmers. Labor intensive ones can also run into availability constraints because poor households are often too busy making sure that enough food is made available immediately that they do not devote enough time to their crops. Very poor farmers (most often without any assets) have limited investment risk bearing capacity and are more unlikely to invest in technologies requiring cash investments.


Priority 5B: Making international and domestic markets work for the poor

Priority 5B, Specific goal 1: Enhanced livelihoods and competitiveness for smallholder producers and food safety for consumers influenced by changes in national and international markets

Priority 5B Specific goal 2: Improved marketing environment for smallholders by improving the efficiency of domestic markets

Output 1C. Strategies that encourage investment in dryland agriculture, that enhance the competitiveness and quality standards of farmer products, that facilitate innovative methods to improve coordination in market chains, that ensure profitable marketing channels and outlets for ICRISAT mandate crops in domestic and international markets identified and promulgated by 2009 throughout the SAT with new knowledge shared annually with partners
1C.1. Policy brief on reenergizing agriculture through diversification using the example of SAT India

Diversification of agriculture towards high value crops: role of urbanization and infrastructure (Asia)

Objectives: 1. Document current trends in agricultural diversification towards HVCs 2. Identify major factors driving or impeding diversification

The study hypothesizes that demand for HVCs is driving their production while lack of adequate infrastructure and market support impedes their supply

Results: In India, demand for high-value food commodities (HVCs) such as fruit, vegetables, milk, meat, fish and eggs are fast increasing as compared to food grains. This is an opportunity as well a challenge for millions of smallholder farmers who are over 81% of total farm population in India. High-value agriculture has a comparative advantage over staples in production and labor use, and thus is reckoned as an important strategy for income augmentation and employment generation. Besides, integration of global markets is creating export opportunities for HVCs in developing countries.

Urbanization is a key determinant of demand for HVCs because of higher per capita income, change in tastes and preferences and greater participation of women in labor markets. About 28% of India’s population lives in urban areas and by 2020, the urban population is expected to be 35% of the total population.

In general, incidence of high-value agriculture is more in districts close to urban demand centers. The share of HVCs in total value of agricultural production declines as one moves away from the major urban districts, except fruit, which appear to be more prominent in near-urban districts. This is because fruit are grown in their niche production regions due to agro-climatic factors besides being close to demand centers. The magnitude of high-value agriculture in near-urban districts is variable and could be explained by the existence or lack of transportation connectivity. The near-urban districts identified in this study were grouped into three categories based on the number of national highways passing through them, i.e., no highway, one highway, and 2 or more highways. It is found that 25 near-urban districts are not connected with any highway, 45 with one highway and 21 with 2 or more highways (Table 2). Interestingly incidence of high-value agriculture is more in the near-urban districts connected with one or more highways (37%) compared to districts with no highways (28%).

Rained areas, lagging far behind from the irrigated areas, are emerging important domains for HVCs to augment employment and income. Promoting rained areas through appropriate infrastructure development for agricultural diversification would have far reaching implications on the developmental and poverty alleviation programs. However, infrastructure required for high value agriculture is different from that of staples and non-food commodities. Being perishable, HVCs require refrigerated transport, cold storage and immediate processing. Considerable public / private investment is required to facilitate such investment and will have to be matched with the demand drivers and also supply side factors.

Options to mitigate market risks and reduce transaction costs include establishment of special markets for high value commodities in rural areas and linking farmers to industry / retail chains etc through institutions such as producers associations, cooperatives and contract farming. The modification of the existing Agricultural Produce Marketing Act, 1966, by the government of India is a step in the right direction.

Parthasarathy Rao P, Birthal PS and Joshi PK. 2006. Diversification of agriculture towards high value commodities: role of urbanization and infrastructure; Economic and Political Weekly vol. XLI (26) 2747-2753

IC.2. Synthesis report on strategic assessments of commercialization of market opportunities for SAT crops

Report on Domestic, regional and international groundnut market prospects in (WCA)

This report reviews the domestic, regional and international market prospects for groundnut in WCA. In West Africa, though all the countries that produce groundnut are prone to Aflatoxin contamination, Africa in general, is considered particularly problematic by international buyers because the production chain in each country (with the exception of South Africa) is fragmented, production systems have been insufficient to address the problem, Aflatoxin monitoring by crop is virtually nonexistent, and pre-shipment inspection services are perceived to be lacking in reliability.

Unfortunately, international trade in groundnut is based on confidence and reliability in terms of supply as well as product quality. The current EU regulations on Aflatoxin have certainly contributed to an increasingly conservative tendency among European buyers, who are unlikely to take any unnecessary risks with West African based products.

To re-enter the world groundnut market (and particularly the European market, which offers perhaps the greatest potential), export prices would have to compete favourably with Chinese groundnut, which is abundant, cheap, and enjoys a favourable reputation in terms of reliable supply and reliable quality. As recent prices for Chinese groundnut are on the order of $650 per MT – the same price as production of a ton of edible groundnut under irrigation in Senegal, the current and foreseeable margins of return are not in any case favourable to the re-entry of West African exports on to the world market.

On the other hand, although the trade linkages are not as established (or as cheap) as those between West Africa and Europe, the South African market does represent a significant opportunity for West African producers. Due to a poor harvest in 2003, South Africa has been importing groundnut from Southern Africa and even Argentina at premium prices – over $700 per MT (unsorted and CIF) in Malawi. There may be scope for entry into the South African market once Aflatoxin has been addressed by improved management and monitoring of product quality at the crop level.

The primary conclusion of this study is that there is a need for West Africa to improve the production chain of the groundnut sector with initial emphasis on production to satisfy national, sub-regional and even regional demand.


IC.3. Seed supply systems in WCA: Lessons learned for R4D published

Groundnut seed systems in West Africa: current practices, constraints and opportunities (WCA)

During the last 30 years, donors and governments have invested more than US$ 125 million in variety development, seed production and distribution projects in Mali, Niger, Nigeria and Senegal. More than 39 groundnut varieties were developed, adapted, introduced and released. However, the returns to these investments are low due to limited uptake of newly bred modern varieties. This is explained by limited access to seed of new varieties, limited supply of breeder seed, uncertain demand, missing or poorly functional national variety release committee, lack of integration between input and product markets, and lack of enabling policies and institutional environments. There are opportunities to exploit regional seed trade, enhancing the utilization of the large seed infrastructure, improving the interface between the public and local village seed systems and establishing sustainable community based seed systems.

The major constraints limiting the performance of groundnut seed systems include:
Limited access to seed of newly bred varieties; Limited supply of breeder / foundation / certified and commercial seed of varieties preferred by farmers or required by the markets; production subsidies and inefficiency; thin and uncertain demand; missing or non-functional national variety release committees are missing, or meet irregularly; weak integration between seed and product markets and Lack of enabling policy and institutional environments.

These factors have largely contributed to the under-development of the seed industry. However, there are opportunities around which sustainable seed supply systems could be developed. These include potential for regional seed trade, availability of seed infrastructure within countries, a large number of farmers already trained at seed production techniques through various rural development projects, NGOs or research institutions and large oil processing companies. These opportunities include the potential to exploit the regional market, the existing large seed infrastructure, fostering interface between the public, private and community-based systems, and overall the development of sustainable community based seed systems.

1C.4. Study on institutional arrangements for collective marketing in groundnut and pigeon pea in Malawi completed by 2006.

Linking smallholder pigeonpea and groundnut farmers to product markets in Malawi (Linked with GT-CI) (ESA)

A draft monograph on “Livelihoods and market linkages: Social capital in linking smallholder pigeonpea and groundnut farmers to product markets in Malawi” is under revision for publication. The study assessed institutional and social factors that condition smallholder collective marketing. The study investigated why some smallholder groundnut and pigeon pea marketing clubs performed better than others. Three specific objectives were pursued: (i) To identify constraints to and opportunities for groundnut and pigeonpea production and marketing; (ii) To investigate why some marketing clubs succeeded while others did not; and (iii) to draw lessons that inform research and development policy.

Results showed that the marketing strategies for both grain legumes bore some similarities and differences. Whereas groundnut marketing was more organized and in terms of marketing clubs and an assured market through NASFAM, pigeon pea marketing was dependant on a multiplicity of actors (vendors, middlemen, buying and processing companies) in the market chain and greatly influenced by local processing companies.

Collaborating Institutions and Scientists:
NASFAM : Field extension officers
ICRISAT : J Alumira


1C.5. Markets and Commercialization of Legumes (ESA)

After a critical reflection from the experiences of SMIP and review of the legume sub-sector studies in the region, it was decided in late 2003 to develop a regional program on commercialization with interest to explore opportunities for improving market access for tradables (mainly focusing on legumes) considered to have better domestic, regional and international market opportunities. Grain legumes and oil crops are important food and cash crops for smallholder farmers because of their adaptation to marginal biophysical conditions and are grown by resource poor farmers without requiring substantial external inputs. Grain legumes, particularly chickpea and pigeonpea are widely adapted to diverse agro-ecologies of the region and are together grown in about 1 million ha. Groundnut is an important legume and oil crop that is grown in about 3.7 million ha in the region. Groundnut is a major source of cash for smallholders and is adapted to areas of low and unreliable rainfall.
Improving the value chains for these legumes would help poor farmers overcome severe nutritional deficiencies that result from diets lacking in protein and oil. They are especially beneficial for growing children who suffer from widespread malnutrition and cannot consume huge quantities of starchy staples. Higher cash incomes and better nutrition can reduce household vulnerabilities to climatic shocks (e.g. drought) and diseases (e.g. HIV/AIDS and malaria). Apart from direct cash income benefits, diversification into grain legumes also provides environmental sustainability benefits through fixing atmospheric nitrogen that will benefit other crops (sorghum, maize, finger millet) in the system. The crop byproducts also serve as feed and fodder for livestock and allow smallholders diversify livelihoods through crop-livestock integration. Owing to their deep root systems, pigeonpea and chickpeas draw water from subterranean levels, allowing farmers to secure a harvest when most other crops fail.

The initial assessments seemed to show that overall the dryland legumes together offer a good opportunity for farmers and agribusinesses in semi-arid areas to benefit from markets for increasing their cash incomes and diversifying their livelihoods. Given these opportunities, the research on legumes commercialization aimed to assess the real potentials and constrains that these crops offer in the context of liberalized markets and the strategies for improving market access and competitiveness of smallholder producers in domestic and international markets.

**Objective:** Assess the structure and performance of the markets for dryland legumes and identify the major constraints and opportunities for improving market access and competitiveness in domestic and international markets

**Methodology:** Commodity sub-sector studies that involved farm level technology adoption and marketed surplus studies, market and value chain analyses and pilots to test alternative institutional arrangements for linking farmers to markets

**Main findings & policy implications:** The results from these studies have shown that the marketing channels for legumes are characterized by long and complex marketing chains and high transaction costs which considerably lower the farmers’ share of the final consumer price. The marketed volumes remain small and highly variable depending on weather conditions, but in some areas up to 70% of the produce is marketed. For pigeonpea, the domestic market demand remains limited, but exports to India represent a significant market outlet for pigeonpea, making ESA the second largest exporting block for pigeonpea in the world. Export competitiveness to the Indian market is largely limited by pigeonpea exports from Myanmar and other competing substitutes (yellow pea imported from Canada and France). The technology adoption studies verified that compositeness can be enhanced through adoption of improved high-yielding, disease resistant (Fusarium wilt), and consumer-preferred varieties (e.g. large seeds with cream color widely adopted in Babati district and eastern Kenya). For chickpeas and groundnuts, the domestic markets are more developed and export opportunities more diversified (including the Middle East, south Asia, Europe and the USA). In the international markets, there is stiff competition for exports from several major producing countries and major players in export markets. The value of exports is significantly higher for Kabuli types and prices are closely correlated with the grain size. Since the cost of production and agro-climatic requirements are similar between the Desi and the newly developed Kabuli types adapted to tropical conditions, there is a higher incentive for farmers to switch to growing Kabuli types. With increased availability of profitable and pest and disease resistant Kabuli types, this trend is now already apparent in all the major growing countries (e.g. Ethiopia and Tanzania).

For groundnuts, there are growing domestic and regional markets but export opportunities are limited by food safety and quality concerns associated with aflatoxin contamination (a carcinogenic substance caused by the fungus, Aspergillus flavus). This has promoted new research efforts to reduce aflatoxin contamination and establishment of low-cost testing, traceability and certification systems. This has allowed Malawi to re-enter the export market for groundnuts after many years of non-competitiveness in these markets. The studies have also identified the different quality requirements for groundnuts used in the growing confectionary industry and edible groundnuts and for oil extraction. The availability of cheaper substitutes (soya and palm oils) has also contributed to declining demand for groundnut oils.
Overall the market assessments have shown that improving competitiveness requires access to high quality seeds of market preferred varieties and other production inputs that increase yields, save on resource costs and improve product quality to meet the increasingly stringent and dynamic market requirements (especially for export markets). Facilitating the development and adoption of good agricultural practices, quality control and grading systems is an important factor in enhancing competitiveness. Along with the need to expand the volume of trade, competitiveness requires cutting production and marketing costs and enhancing the reliability of supply.

On market access for smallholder farmers, the studies have shown that marketing channels in many rural areas are characterized by long and complex marketing chains and high transaction costs which considerably lower the farmers’ share of the consumer price. In Eastern Kenya, about 45% of the grain sold and 36% of the transactions are undertaken at the farm-gate. About 90% of the grain sold by farmers is transacted at the farm-gate or adjacent village markets. The study also shows that rural wholesalers and brokers jointly control over 80% of the grain sold by farmers. About 75% of the grain was sold immediately after harvest when local supply is high and prices are low. Asymmetric information is pervasive in grain pricing and most rural traders do not pay a premium for better grain quality.

A pilot study on the potential of producer marketing groups to increase market participation and competitiveness showed that indeed such groups can play a significant role in facilitating vertical and horizontal coordination in input and output marketing for small producers. The prices paid to farmers by the groups after covering marketing costs were about 20-25% higher than prices paid by brokers and millers in rural villages. This was possible through quality control, bulking, temporal arbitrage and direct access to buyers at the upper end of the value chain (urban wholesalers and processors).

The policy challenge is to facilitate the emergence of efficient and effective farmer organizations that accelerate the uptake of improved technologies and open market opportunities for small producers often trading in small volumes in areas with limited market access. Such groups and rural institutions are however unlikely to emerge and attain economic viability on their own without the support of governments and other external agents. Market orientation, competitiveness and business motives should be the guiding principles for such groups. Mechanisms that facilitate the transition of such groups into effective business cooperatives are highly needed in many countries in the region.


Linking Farmers to Markets: Diagnosis of Constraints and Opportunities for Expanding Groundnut Marketing in Malawi

While farmers in southern Africa have been relatively responsive in adopting new and early maturing varieties, firm linkage to markets have been weak. This has tended to compromise the rates of continuous adoption of several technologies and in some cases even leading to some dis-adoption.

The history of agricultural technology development and transfer in Africa depicts a map of heavy concentration on facilitating farmers to adopt technologies but with almost no business in enabling such farmers to link to markets so that the vent for surplus can be realized. It has been assumed that the invisible hand would take its course but apparently the market imperfections are too huge to be assumed away. At best socio-economic researchers would come in and conduct some agricultural marketing studies for those targeted commodities but those have largely remained academic because of the failure to adopt a participatory private sector approach. Practical solutions to address the missing link between farmers and product markets are therefore a significant objective of this study.

Objectives: Identify production and marketing constraints of groundnut farmers along the lakeshore of Malawi
Explore options for linking groundnut farmers to product markets for more sustained adoption and improved incomes.

Methodology: Ninety smallholder groundnut farmers were interviewed along the lakeshore in Malawi with a view to understand the production constraints and how these are linked to marketing. Marketing challenges facing groundnut farmers were also investigated. This was followed immediately with a traders’ survey. About 30 traders of different commodities were tracked for about one month in the peak of groundnut marketing season. It was necessary to deal with traders of all types of commodities—and not only for groundnuts because the latter hardly exist.—The interest was to assess the different marketing functions from the farm gate to the trader to the processor or exporter and evaluate the pricing and quality control dynamics including price determination at different levels. An investigation of the policies, rules and regulations affecting the groundnut trade was also carried out to determine the extent to which they are facilitating or constraining the viability of the groundnut sub-sector.

The role of the private sector—whole sale buyers, processors and exporters was also investigated by visiting and discussing with prominent firms in Lilongwe to establish their role in the marketing chains and to determine areas and ways in which the two could be more amicably linked.

Preliminary Findings: Most of farmers maintained less than one hectare of groundnuts raised from improved seed provided by ICRISAT. Yields are low averaging about 400kg of shelled groundnuts. There are generally very poor marketing arrangements. Contract farming is unheard of in groundnuts although cotton contract farmers can be found in the same groundnut growing communities. In fact if contracting for groundnuts is to be initiated, there are lessons to obtain from cotton. Price formation is poor and farmers seem to be facing a big price risk at marketing time. In the first place, a significant amount of groundnuts is sold on the farm before harvest, mainly because of hunger. Farmers need money to buy food and other essential commodities before the groundnuts mature. Obviously, given the circumstances, they would be willing to go for any price the buyer declares because they are desperate at that time.
At normal harvesting time, farmers are invaded with a swarm of “buyers” or practically assemblers who have been sent with cash from big traders and transporters or processors from the cities of Lilongwe and Blantyre as well as from the border posts. Price negotiation is through the head men but the ceiling is already set by the masters. It would appear that the lower they could get the more credit for them from their masters. It is envisaged that these prices are normally lower than what they could be under normal competitive conditions. As a result the margins are likely to be quite big between farm gate and export prices even after taking into account transport and transportation costs.

In effect, there is a wide gap between actual and potential conditions in the marketing conditions of groundnuts and especially price formation. The first steps are to facilitate, train and empower farmer groups at the village level to enable them, in the first place to have the basis to negotiate for better prices as well as training them to recognize that better quality groundnuts can also have a premium price from the processors.

A great potential exists to improve farmers’ incomes and food security from groundnuts in Malawi and there is need to continue with this work in the future.


1C.7. Value chain analysis completed for pigeonpea and chickpea in Kenya and Tanzania

Pigeonpea sub-sector study in Kenya

This study was summarized and synthesizes several fragmented studies on pigeonpea in Kenya. It targeted to identified the constraints that limit full exploitation of the potential of pigeon peas for dryland agriculture. The methodology adopted was that of a sub-sector approach to examine several actors from the pre-production to the marketing and utilization chain. The result is expected to be the source book for the pigeon pea sub-sector in Kenya and facilitate similar synthesis of the legumes sub-sectors at the regional level. Development partners like TechnoServe and Catholic Relief Services have already started using these findings for as part of their ongoing efforts for improving legume productivity and market access in semi-arid regions.

This study has informed policy decisions on strategies for enhancing competitiveness of pigeon pea production in East Africa in general and in Kenya in particular. It has identified strategies, constraints and opportunities for for promoting high value pigeonpea varieties in Kenya and in the region. The findings of this study have contributed to enhanced communication and partnerships with the private sector in Kenya for the development of the legumes sub-sector.

Similar to the chickpea study in Ethiopia, this study involved extensive consultations and interactions with a range of stakeholders including farmers, farmer organizations, private sector, extension departments, NGOs, researchers and government officials. The study used a sub-sector approach to identify constraints and opportunities at different points in the pigeonpea production, processing, marketing and consumption chain. It reviewed the existing literature and brought together a set of recommendations for harnessing the opportunities that lie in the pigeonpea sub-sector. A value chain analyses approach was used to assess the structure and functioning of pigeonpea markets. Availability of such information has facilitated the interactions with the private sector and is becoming useful in linking smallholder producers with wholesalers, processors and exporters. Development partners (e.g. TechnoServe and Catholic Relief Services and donors (e.g. USAID and IFAD) have also benefiting from the findings.

**Chickpea sub-sector study for Ethiopia**

This study is expected to lay the foundation for better understanding of the constraints and opportunities facing the chickpea sub-sector in ESA region. It was undertaken based on the request of the Ethiopian Farmers Project (IPMS) jointly undertaken by the Ministry of Agriculture, Ethiopian Institute of Agricultural Research and ILRI. The study is expected to influence future priorities and strategies of Farmer Organizations and pulse traders, processors and exporters in Ethiopia. The methodology and the approach used are very useful to researchers and policy analysts.

This study has informed policy decisions on strategies for enhancing competitiveness of chickpea production in Ethiopia and helped the IPMS project and the Ministry of Agriculture define new approaches for promoting high value chickpea varieties. It has also informed the Farmers’ Union on how best to organize its chickpea production and marketing options and highlighted the challenges faced by Ethiopian pulse exporters.

The study involved extensive consultations and interactions with a range of stakeholders including farmers, farmer organizations, private sector, extension departments, NGOs, researchers and government officials. The methods involved literature reviews and data collection using formal and informal approaches. A value chain analyses approach was used to assess the structure and functioning of chickpea markets. Some of the results have already been presented at the IPMS workshop on agri-business development and contributed to the inclusion of chickpeas by the Ministry of Agriculture and EIAR under the priority commodities identified for technology scaling up in the country. Availability information has also started to attract funding and other partners (e.g. Catholic Relief Services and the Ethiopian Seed Enterprise) to improve productivity and market access for chickpeas.


**Output 1D. Forecasting models, market linkage models and analytical tools developed and promulgated in collaboration with other CG centers and partners for situational analysis and outlook in commodities & livestock including phyto-sanitary standards (SPS) and technical specifications for international trade by 2009 and new knowledge shared annually with partners**

**1D.1. Market linkage studies and capacity building measures for institutional innovation and strengthening of public-private sector linkages undertaken.**

**Institutional innovation and strengthening of public-private sector linkages: Coalition approach for effective market linkages (Linked with GT-CI)**

The objectives of this study are a) to conduct an evaluation of the emerging patterns of institutional partnerships for effective market linkages and b) to provide policy and programme guidance on the optimal arrangements involving public and private partnerships. A unique feature of this study is the coalition approach, i.e., the process in which distinct or independent entities/institutions work together as a single unit while keeping their identity, for the common goal with synergistic effect. The coalition approach helped to present the right kind of incentives to benefit the poor sorghum farmers, feed manufacturers, poultry producers, and the scientists. The following are the key issues based on the study.
Research, practice and coalition building: The small-scale poor sorghum producers with less than 1 ha of land are faced with inherent weak social capital and poor access to markets, which restricts their ability to influence market demand. Besides improved sorghum technology for higher yields and returns the study explored institutional arrangements to establish an organic linkage between research, producers and end users (industrial users of sorghum) that will lead to the overall welfare of producers and end users. Various ‘policy networks’ have been identified in research on knowledge utilization and policy-making ranging from ‘policy communities’, with access to privileged information and decision-making, to ‘advocacy coalitions’ that share beliefs and aim to change policy. The sorghum ‘coalition’ is a ‘network’ in the sense that the participants have voluntarily entered into the collective, they also remain part of autonomous organizations, and they come together for mutual or joint activities. As a group of organizations with different values and interests, the Sorghum Poultry coalition could also be labeled as an ‘issue network’. Alternatively, as distinct but related organizations, including private companies, who have come together to improve their performance or position, it might be categorized as a ‘strategic alliance’. Although such labels are only of limited use, they can be helpful in exploring how different types of networks or coalitions will require different strategies for successful innovation, learning and communication to ensure impact on poverty reduction.

Shared and complementary interests: The sorghum coalition’s shared interest at the level of overall goal, and complementary interests expressed through outputs at the lower level, allowed it to work as a team. The decision-making is based on consensus building rather than advocacy or campaigning. This entailed the creation of incentives that drew each member into the coalition but also kept them investing in it. These incentives were primarily economic but not entirely.

Management and learning: Another aspect of planning that the coalition rightly took extremely seriously was selection of partners. It has been pointed out that it is better to have a small number of dedicated organizations in a network than dozens of marginally committed ones (Creech and Willard 2001). The coalition followed this model as well as monitoring a complete membership involved from start.

Communication and trust: It is in the area of communication that the biggest differences between networks can be found. The sorghum coalition members respect and trust each other, not necessarily in all senses and circumstances, but in ways that their enterprise requires. Newell and Swan (as quoted by Church et.al 2002) have distinguished between three types of trust:
- Companion trust: that exists in the context of goodwill and friendship
- Competence trust: trust in others’ competence to carry out the task agreed
- Commitment trust: made fast by contractual or inter-institutional agreements, that can be enforced.
In this case, the sorghum coalition achieved all three, but most particularly competence trust. Regular dialogue was critical, and nurturing relationships with courtesy was a feature, but equally important was the emphasis on results.

Scaling up: Private sector participation ensures the role of private seed industry in enhancing the technology access to poor sorghum growers. Poultry producers showing interest in partnering with the farmers by way of supplying poultry manure and purchasing the surplus sorghum grain making linkage more stronger.

Increased income for the sorghum growers: The sample farmers realized three to four fold increase in yields by adopting improved technology (improved cultivars and practices) with proportionate increase in net farm income (Parthasarathy Rao et.al. 2004).

Empowered local farmers associations: Village level farmers associations experienced new strengths in bargaining with industry. The practice of grading and bulking has the potential of opening new opportunities in other alternative uses.

Time lag in technology transfer is minimized because, at every stage stakeholder workshops were organized to disseminate and receive feedback. Sorghum crop scientists got feedback on farmers preferences in improved varieties and poultry scientists expanded their knowledge in matching their
research with end user (feed manufacturers) requirements. In a nutshell, the sorghum poultry coalition, Andhra Pradesh, India was successful because the partners have had a common goal and clearly defined roles and responsibilities. The ability to articulate problems and prospects, empathetic ability to fit themselves in broader objective, and enthusiasm to work in groups and sharing the synergies.

Clearly it will take some more seasons to judge the strength of the research-farmer-industry coalition. But if that proves sustainable, being generic in nature this ‘coalition approach’ can suitably be adapted to other crops and in other places, where market linkage is constraining crop production.

Collaborating institutions and scientists:
- ILRI: Michael Blummel
- ANGRAU: A Rajasekher Reddy
- Feed Industry: CLN Rao
- Farmers Federation: P Chengal Reddy
- Poultry Federation: Ch. Janardhana Rao


Linking small scale sorghum and pearl millet producers to processors through innovative market linkage models (Asia)

Purpose: The CFC project titled “Enhanced utilization of sorghum and pearl millet grains in the poultry feed industry to improve livelihoods of small-scale farmers in Asia” aims at improving the livelihood of farmers of coarse cereals in designated clusters of villages in Maharasthra and Andhra Pradesh states of India besides having its operations in China and Thailand by increasing their farm income by 15% in three years. The role of savings in marketing costs and increase in farm incomes has been considered to be important besides increasing productivity for enhanced income of farmers.

Background: Presently the farmers in the project area are following the traditional supply chain for sale of sorghum and pearl millet where the produce moves through a series of intermediaries who add cost at each successive step in the chain. The chain has incorporated many deficiencies and has become inefficient in course of time. Several innovations in supply chain of industrial products such as maize, cotton and barley are the result of either farmers uniting themselves as co-operative unions to empower themselves or corporate intervention for procuring their raw materials. There are many benefits for farmers as well as corporate sector in supply chain innovations. The farmer gets assured price, technical guidance and improved access to inputs and credit while the corporate sector gets assured supply of superior quality raw material.

Results: Drawing insights from various supply chain innovations and the features associated with marketing of sorghum and pearl millet for poultry feed, “bulk marketing” has been suggested as the best supply chain modification to be implemented in project areas for promoting sorghum and pearl millet for poultry feed. Besides increasing the bargaining capacity of farmers the advantages of bulk storage and marketing arise from seasonal increase in prices of coarse cereals as well as ability to cater to other industrial sectors (alcohol, breweries, starch etc.) now dominated by alternative cereals. Hence effective
storage management along with market intelligence to make sales decisions will be an important component of bulk marketing.

Bulk marketing refers to the process of selling bulked produce directly to the bulk buyer (processor) in order to minimize transaction cost and realize mutually beneficial price (for both the buyer and the seller). Under the conventional agricultural supply chain farmers sell their produce in the markets through commission agents. Product gets exchanged between many hands before reaching the final consumer.

The modified supply chain generated from the bulk marketing eliminates the drawbacks of the conventional supply chain and makes the market perfect for both the farmers and the buyer. The supply chain generated out of bulk marketing eliminates many conventional middlemen by directly linking the farmers with the processors or the bulk buyers. Since the farmers get united, their requirement of inputs is also in bulk and they get linked with the input dealer. This ensures supply of quality inputs at reasonable prices. The input dealers also save the money spent on distribution and publicity. This benefit of reduced costs is passed on to the farmers. Bulking of produce creates collateral security for the farmers’ produce against which the banks can extend loans. This prevents exploitation of the moneylenders. The source of information also gets enhanced, as the farmers are able to get the first hand information on market prices and quality of produce from the ultimate buyers.

This enhanced supply chain provides tremendous scope for linking the buyers with the farmers. As bulk marketing ensures assured supply of quality produce at reasonable rates, buyers come in direct contact with the farmers and give their quality requirements for the produce which the farmers tries to maintain. As the involvement of middlemen is eliminated the transaction costs are cut down paving way for better profits to the buyers. The benefits of bulk marketing would directly come to farmers and result in enhancing their income, thereby fulfilling the goal of increasing income of small-scale sorghum and pearl millet farmers. It is suggested that the local arhatiyas (commission agents) and the brokers should be made a part of the modified chain in the initial 2-3 years for smooth transition. The presence of three critical inputs has been advocated for successful implementation of bulk marketing during the project implementation period:

- Constant knowledge support and guidance by ICRISAT and project partners
- Strong and sustained association among farmers
- Exploitation and utilization of value proposition of coarse cereals.


**Parthasarathy Rao P et al.,** 2006. Improving the livelihood of small-scale producers in Asia through innovative coalition approach Poster submitted to GFAR Triennial Conference, 2006, New Delhi, India under the theme ARD: Evidence of contributing to achieving the MDGs.


**1D.2. Price trends and competitiveness of mandate crops (Preliminary work completed)**
Prices of agricultural products are inherently volatile because of they are susceptible to both supply and demand shocks in the world agri-food market. On the demand side, the price of an agricultural product is influenced by a number of factors. These include incomes, urbanization, health issues, people’s tastes and preferences and values, and relative prices of substitutes or complements. On the supply side, production costs and improved technology, weather and disease related shortcoming, or conversely, the production of bumper crops work together to determine agricultural product prices. When the cost of production rises they are passed on in the form of higher prices for agricultural products. There are also other variables that impact on agricultural product prices. These include exchange rate changes and government macroeconomic and trade policies. The rising incomes, falling transportation costs, improved technology, and evolving international agreements have led to substantial growth in the volume of trade in agricultural products, thus causing fluctuations in world agricultural product prices.

According to FAO 2004, in spite of recent strengthening of agricultural commodity prices after a prolonged decline since mid eighties, continue to be at historically low levels and their long term decline relative to manufactured goods continues. Real prices have also fluctuated considerably along the long term declining trend. The ICRISAT mandate crops are no exception to this with real prices of all mandate crops declining. The real prices of sorghum, chickpea, pigeonpea and groundnut (measured as unit value of exports) has declined by 2-3 % between 1970 and 2004. Only between 2000-2004 there has been a reversal in the trend particularly for sorghum and groundnut. Several factors contribute to the decline as also the year to year fluctuations.


**1D.3. Commodity situation and outlook reports developed for the vision and research agenda for sorghum, pearl millet, chickpea, pigeonpea and groundnut (linked with GT BT and CI) (Global)**

The vision and strategy for ICRISAT cereals, pulses and oilseed was redrafted to reflect the changing scenario for these crops both on the demand and supply side that would enable identification of potential areas of focus research up to 2015. The socioeconomics team enabled the Crop Improvement (CI) scientists to update the trends in area, production, productivity, utilization and trade of mandate crops. Using these trends as a basis, future areas of thrust and research were developed for each crop. These were subsequently reflected in the overall strategy of the Crop Improvement Theme. For example, socioeconomists highlighted the changing consumption patterns of crops like sorghum and pearl millet from food use to other uses at the same time highlighting niche areas where food use will continue to be important. The faster growth in edible groundnut use compared to groundnuts for oil was notable as well.

Collaborating institutions and scientists:

**1D.4. Book on mixed crop-livestock systems in South Asia: enhancing livestock productivity to benefit the poor (Asia)**

Objectives: To synthesize the results and key findings from the ICRISAT – ICAR collaborative project on increasing livestock productivity in mixed crop –livestock systems in South Asia
Update data in tables and graphs and data analysis from earlier reports as appropriate
Rewrite sections from earlier reports as appropriate

Background: From the perspective of poverty reduction it is important to identify agricultural activities that are accessible by the poor, are labour intensive, generate sufficient income, and have enough potential for growth. Livestock fit well in this scheme of poverty reduction. They play a multiple role in enhancing the livelihood of the poor and enabling them to climb up the ladder of poverty reduction. About 70 percent of the rural poor in the developing world are associated with livestock production and they receive a higher share of their income from livestock than do the rich (Delgado et al 1999). As a source of food, they contribute towards reducing the problem of malnutrition particularly among the children and lactating
mothers. Delgado et al (1999) found a negative relationship between per capita animal protein intake and incidence of undernourishment in developing countries.

Most developing countries experienced rapid increases in per capita income and urban population during this period, which eventually translated into disproportionate increase in demand for animal food products. These trends are likely to continue on account of three main factors. First, the current per capita consumption of animal food products is much less in developing world than in developed world. Second, the factors underlying demand growth in the recent past have been quite robust, and are unlikely to diminish in the near future. Third, the spreading of supermarkets provides an easier access to ready-to-eat convenience animal based foods. The projections indicate a substantial increase in demand for livestock food products by 2020 (Delgado et al). Besides, increasing integration of global markets is also opening up new opportunities for exports of animal food products. With unfolding of the process of globalization the volume of world trade in livestock products has been increasing. Evidence indicates that many developing countries are competitive in production of livestock products, but they lose in the international markets because of heavy protection to livestock production in major exporting countries such as EU and the US, lack of compliance of sanitary and phyto-sanitary standards and inefficiency in processing.

Livestock in most developing countries are raised as a part of mixed farming systems wherein there is considerable synergy among the system components. This leads to a more efficient use of farm resources. What is needed is a coherent picture of the characteristics of crop and animal production within mixed farming systems, and the way these systems are changing in different regions. There is a paucity of information on farming systems research that incorporates animals interactively with cropping systems. Research, policies and institutional interventions will be more effective in promoting agricultural growth and rural development if these:
- Recognize strong nexus between crop and animal production.
- Appreciate the complexities of mixed systems and the need for differential interventions in different systems.
- Have a better understanding of the prevailing patterns of animal ownership and management.

Objectives for the book: This book provides an analytical description of the prevalent mixed farming systems in South Asia and follows a systems approach that incorporates crop and livestock production together with agro-ecological conditions, risks and returns from different farm activities, soil management and socioeconomic conditions that influence farmers’ choice of enterprises. Specifically the books provides:
- A comprehensive and integrated view of the structure and dynamics of livestock sector in South Asia and its role in poverty reduction.
- A Typology of mixed crop-livestock farming systems for South Asian countries.
- A agro-ecological and socioeconomic characterization of each of the systems identified in the typology.
- An understanding of the relative importance of agro-ecological, technological and socio-economic factors in influencing the type and density of species, adoption of livestock technologies, and productivity of the system.

1D.5. Future outlooks of the dryland crops using IMPACT-WATER model

In response to socioeconomic and biophysical changes over time, SAT agriculture has undergone significant changes - the share of dryland cereals in the total cultivated area has declined globally and especially in Asia. Investment in irrigation and changing consumption patterns induced by income growth and urbanization have prompted farmers to diversify production into other crops like maize, oilseeds, soybean, cotton and rice, thereby lowering the relative importance of dryland crops. To the extent that the share of these crops in consumption, production and marketed surplus of the poor is declining over time, their future role and contribution for poverty reduction and livelihoods might also decline significantly. As ICRISAT develops its long-term strategy for SAT agriculture, there are several key questions that need to be addressed. What are the alternative futures and outlooks for dryland commodities under changing population and income growth scenarios? What kinds of policies are required to counter the potential impacts of water scarcity, land degradation and climatic variability and to accelerate sustainable
intensification and diversification of agriculture in the SAT? What is the potential impact of changing consumption patterns and growing preferences for rice, wheat and maize and livestock products on the production, supply and trade opportunities for dryland commodities? This necessitates careful analyses of future outlooks and plausible futures for dryland commodities.

Based on the recommendation of the previous CCER’s for ICRISAT to strengthen its strategic research and to continue to scan and monitor changes in the wider SAT environment, ICRISAT in collaboration with IFPRI has initiated a joint project to assess the alternative futures for SAT agriculture.

Objectives: Examine detailed scenarios, and project plausible futures for dryland agriculture and the potential impacts that global economic and environmental changes will have on dryland agriculture.

Methodology: The extended version of the global food and water policy modeling framework of IMPACT-WATER is being used to explore the future outlooks for dryland crops and gain useful foresights about alternative adaptation and investment strategies. The model explicitly introduces dryland crops (sorghum, millets, chickpea, pigeon pea and groundnut) along with a complete set of other crop and livestock commodities into the global food and water models which allows a more realistic simulation of cross-commodity price and income effects. In response to certain policy scenarios, the model allows supply, demand for different uses (food, feed, and other), and prices to be determined within each country and regional sub-models and linked at the global level through trade. The model also projects area, production and yield trends for each country, sub-region and at the global level.

Main findings & policy Implications:

Sorghum: When we look at the historical trends over the last four decades, the area of this crop has been declining globally but increasing slowly in all sub-regions of sub-Saharan Africa (SSA), and North Africa and West Asia (WANA). The global area of sorghum declined from 50 million ha in the late 1960s to about 44 million ha in the recent past (2003-2005). The harvested area declined gradually in South Asia, North America, and South America. Despite the global decline in area cultivated, production of sorghum has been growing over the last four decades. Global production has increased from 40 million tons in the early 1960s to about 58 million tons during the last three years (2003-05). Yields in China for example have increased from less than 1 t/ha to over 4 t/ha. Unfortunately, no such transformation has taken place in other developing regions (SSA, South Asia and WANA). Yields in these areas remain very low (less than 1 t/ha) and generally stagnated or even declined in some areas. While a slight positive trend is evident in South Asia (since the late 1980s) and SSA (since the late 1990s), sorghum yields declined in the WANA region. The positive yield growth rates for South Asia and SSA indicate that new varieties (including hybrids in Asia) are beginning to have a visible effect on production. The low yields in the two regions however mean that much more needs to be done in making sorghum production in these areas economically attractive to small producers. The IMPACT projections under the business-as-usual scenario to 2025 (compared to the 2000 baseline) indicate that similar trends would continue globally. Sorghum area is projected to increase in the ASARECA regions (ECA) from 8 to 10 million ha, in the SADC region from about 0.85 to 1.12 million ha, in Western and Central Africa (WCA) from about 13 to 16.5 million ha, and in South Asia decline from 10.3 million to about 8.5 million ha.

Millets: The overall trend in area of millets is similar to that of sorghum. The harvested area declined gradually in all regions except in SSA and WANA, which explains the decline in the global area of the crop. The global area declined from 43 million ha in the early 1960s to about 35 million ha in the last three years (2003-2005). The area of the crop declined in South Asia, China and transition economies (Ukraine and Russia). Despite the increase in production in the 1960s from 25 million to over 30 million tons, the overall pattern in global production has also largely stagnated around 27 million tons since the early 1970s, indicating that the declining area has not been offset by growth in yields in the major growing regions. Millet yields in China have doubled (from about 1 t/ha to 2 t/ha). Yields also doubled in South Asia where it started from a low base of 0.4 t/ha to about 0.8 t/ha. The lowest increase comes from SSA which accounts for over half of the global crop area - yields have improved marginally from about 0.5 t/ha to about 0.6 t/ha over the period of four decades. However, there is an evident upward trend in the yield of millets in SSA and South which offers some hope for improving food security and incomes to smallholder farmers in the
dry tropics. The IMPACT base model projections to 2025 by region show the following trends: in ECA the area will increase from about 3.5 to 4.6 million ha, in SADC from 0.83 to 1.1 million ha, in WCA from 15.7 to about 20 million ha, and in South Asia decline from about 13.5 to 11.2 million ha.

Groundnut: The global area of groundnuts registered a substantial increase over the last four decades from about 15 million ha in the early 1960s to over 25 million at the turn of the 21 century. Like wise production has also increased from less than 15 million tons to over 35 million tons. The crop area expansion is more evident in China and lately in all sub-regions of SSA, but declined in South America partly because of competition from soybean as source of meals and oils. The trend in South Asia is not so clear; despite the variability over the last few decades, groundnut area in South Asia seems to be on a slightly upward trend. While groundnut also remains important in the USA, the area of the crop seems to have reached a long term stable equilibrium around 0.5 million ha. When we look at trends in yields, there seems to be a growing trend in all regions. The most dramatic increases have occurred in the USA and China where yields have increased from less than 1.5 t/ha in the early 1960s to over 3.5 t/ha and about 3 t/ha at the turn of the century. Yields are lowest in all sub-regions of SSA where a marginal increase from 0.6 t/ha to 0.7 t/ha had taken place. The yields in South Asia started from a low base similar to SSA, but gradually increased to about 1 t/ha in the last few years. The IMPACT projections to 2025 show that the area of groundnut would increase in ECA from 2.42 to 3.42 million ha, in the SADC from 1.05 to 1.26 million ha, in WCA from 6.2 to 8.9 million ha, but decline in South Asia from 7.30 to about 7 million ha. The area in China will however increase from 4.7 to 5.2 million ha. Increasing trends are also projected for Myanmar and Indonesia.

Chickpea: The global area of chickpea has declined from about 12 million ha in the early 1960s to about 10 million ha at the beginning of the 21st century. This is mainly due to the gradual decline in the area of the crop in the major growing region of South Asia. However, there has been slight growth in WANA, ESA, Canada and Australia over the last decade. The growth rate in global production shows an overall positive trend, but production has not increased substantially partly because of the extreme variability in global supplies in the 1980s and 1990s and partly due to the slow growth in yields in South Asia where much of the crop area is concentrated and where the crop area registered a declining trend. Yields have doubled in Central America (mainly Mexico) from about 0.8t/ha to 1.6t/ha, which has enhanced the competitiveness of Kabuli chickpea from this region in international markets. Yields have improved gradually in South Asia (mainly India) and in SE Asia (mainly Myanmar). Despite the expansion in area, chickpea yields largely stagnated around 0.6t/ha or even declined in eastern and southern Africa and WANA. While yields are relatively higher in Australia and Canada, incidence of diseases like Ascocyta blight had led to extreme variability or even declining trends. The IMPACT base model projections to 2025 show that in ECA the area will increase from 0.35 to 0.60 million ha, in the SADC from about 0.1 to 0.17 million ha, and in WANA from 0.9 to 1.3 million ha, but decline in South Asia from 7.8 to about 7 million ha.

Pigeonpea: Unlike sorghum, millets and chickpea, the global area for pigeonpea has shown a significant increase during the last four decades. The area of the crop increased from 2.5 million ha in the early 1960s to over 4.5 million ha at the turn of the 21st century. This increase in area was registered in all regions. In India, the crop has found a niche in the rice-wheat fallows as short duration varieties that can be grown in rotation with cereals have been introduced. The crop has also gained popularity among smallholders in Eastern and Southern Africa. The growing export demand from South Asia (mainly India) seems to have triggered interest among dryland farmers to grow the drought tolerant and multipurpose crop. While yield has increased gradually as a result of adoption of new varieties in all regions, average yields remain very low, ranging between 0.6t/ha to 0.8t/ha. Over the last two decades, global production of pigeonpea has more than doubled from about 1.5 million to over 3 million tons, the combined effect of area expansion and yield growth. The IMPACT base model projections to 2015 show that in ECA the area will increase from about 0.3 to 0.5 million ha, in the SADC from about 0.13 ha to 0.20 million ha, and in South Asia from 3.90 to 4.20 million ha.

ID.6. Methodology to analyze impact of technological and policy interventions for micro-watershed in Semi-Arid India: A bioeconomic modeling approach (Linked with GT-AES, Sub-project 3) (Asia)

The overall objective of the study is to develop a methodology to analyze the possible impacts of technology change and policy incentives on household welfare and the sustainability of the natural resource base in the SAT regions. The previous impact studies of watershed development in India have hardly ever integrated the biophysical factors with economic factors to assess the complementarities and the tradeoffs within the framework of farm household economic behavior. So it is important to apply a holistic and integrated approach like bio-economic modeling to simultaneously assess and evaluate impact of watershed development on the welfare of the poor and the natural resource conditions at a micro level and also to identify effective policy instruments and institutional needs for enhancing the effectiveness of the watershed approach. The benchmark watershed in Kothapally village, Ranga Reddy district, Andhra Pradesh is selected as the study region because of the unique availability of both biophysical and socioeconomic data covering a period of 5-6 years. The data provides an opportunity to integrate both biophysical and socioeconomic data to develop a bioeconomic model to study simultaneously the impact of the technological and policy interventions on household welfare and quality of the natural resource base in the watershed.

The baseline model serves as a starting point for policy experiments to assess the likely impact of alternative policy intervention. The bioeconomic model used in the study analyses the combined effects of land degradation, population growth and market imperfections on household production, welfare and food security.

Collaborating institutions and scientists:
TNAU : K Palanisami, Nedumaran
ICRISAT : B Shiferaw, SP Wani, TK Sreedevi

ID.7. Development of a dynamic non-linear bioeconomic model with crop-livestock integration (Linked with GT-AES, Sub-project 3) (Asia)

Bioeconomic models are useful tools in policy analysis because they can reflect the biophysical as well as socioeconomic conditions essential for decision making within specific “bioeconomy”. They may be used to explore the linkages between ecology and the economy and the dynamic effects of these linkages over time. In this study a watershed level dynamic non-linear bioeconomic model with crop-livestock integration is developed for the Kothapally watershed. This model maximizes the income of the whole watershed, which include three types of households based on land endowment (small, medium, large), who are spatially disaggregated into six different segments in the watershed landscape [three types of soils based on soil depth (shallow, medium and deep) and two types of land (dryland and irrigated land)]. The model maximizes the aggregate net present value of income of the watershed over a 10 year planning horizon. The income of the household groups is defined as the present value of future income earned from different livelihood sources (like crop, livestock, non-farm, etc) subject to constraints on level, quality and distribution of key production factors (e.g., land, labour, capital, bullock power, soil depth), animal feed requirement and minimum subsistence food requirements for the consumers in each household group.

The crop production in the model is affected by change in soil depth, which is reducing due to soil erosion. The erosion level in the watershed is estimated for predicted land use pattern and through transition equation soil erosion reduces the initial soil depth of the land. By using econometric method the yield-soil depth response is estimated and used in the production function in the bioeconomic model. The nutrient balance in the watershed is estimated by using nutrient balance equation in the model. This equation estimates the nutrient balances for simulation period based on inflow (fertilizer and manure application, biological fixation and atmospheric deposition) and outflow (crop grains and residual yield, erosion and leaching) of nutrients in the watershed.

The baseline model serves as a starting point for policy experiments to assess the likely impact of alternative policy intervention. The bioeconomic model used in the study analyses the combined effects of
land degradation, population growth and market imperfections on household production, welfare and food security.

The study, which is a Ph.D dissertation, concludes that increase in price of dryland crops and increasing the yield of the dryland crops by introduction some high yielding drought tolerance varieties can be effective technological and policy instruments for slowing down the process of land degradation and improve the welfare of the farmers in the watershed. The results from the Kothapally watershed study should be useful to policymakers and others seeking to reduce poverty and improve land management in SAT regions of India. This model can also be used as a decision support tool to develop an optimum farm plan for different households in the watershed with available resource without affecting the natural resource base. Beyond this, the bioeconomic modeling approach used in this study can be usefully adapted and applied in many other settings.

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Priority 5C. Rural institutions and their governance

Priority 5C, Specific goal 1: Identify mechanisms for the strengthening of producers’ organizations and for modes of participatory research

Priority 5C, Specific goal 2: Identify new forms of partnerships with NARS, the private sector, public extension agencies, NGOs and producers’ organizations, and public agencies from other sectors, such as environment and health to enhance the conduct and impact from agricultural research

Output 1E. Alternative institutional innovations and topologies to strengthen rural institutions that facilitate and enhance adoption of technological and market innovations and policy recommendations for formal and informal social networks to address vulnerability, gender and social exclusion in SAT farming systems developed and shared by 2009. Developments shared annually with partners.

1E.1. Social exclusion and gender surveys executed and reported

Social exclusion and gender surveys were completed as part of the study on “gender and social capital mediated technology uptake” and published as Impact Series 12. This study explores gender-differentiated benefits from the social capital buildup in technology uptake, and the decision-making patterns of men and women with respect to production, consumption and household tasks; and allocation of resources. The background research examined women’s role in developing social capital, and research developed a case study of the groundnut producing areas of Maharashtra in western India, and compared ‘with’ and ‘without’ technology situations, and ‘before’ and ‘after’ situations in relation to the package of groundnut production technology introduced in the region in 1987. The paper addresses three aspects: (1) social networks in technology adoption, (2) the gender-based activity pattern, and (3) build-up of social capital leading to improvements in the welfare of farmers and the farming community with a gender perspective. Available evidence suggests substantial differences in networks of men and women, particularly in composition. The evidence suggests that men belong to more formal networks reflecting their employment or occupation status, while women have more informal networks that are centered on family and kin. Findings show that women who are engaged in agriculture and allied activities develop bonding social capital characterized by strong bonds such as that found among family members or among members of an
ethnic group. Men who are engaged in agriculture, on the other hand, develop bridging social capital characterized by weaker, less dense but more crosscutting ties such as with farmers, acquaintances, friends from different ethnic groups and friends of friends. Women’s employment opportunities significantly improved with the introduction of technology. Finally, the study concludes that while technology development and exchange can build upon social capital as a means of empowering women, much more needs to be learned about the approaches that foster build-up of social capital.


IE.2. Architecture of social networks in SAT villages documented

Evolution and returns to social networks (Asia)

Earlier case studies at ICRISAT on Groundnut Production Technology (GPT) uptake systematically documented the process by which farmers – both men and women - as well as the whole community became empowered through the build-up of social capital which facilitated access to resources, information and technology. The build-up of social capital played an important role in influencing impacts from the technology because of the ways in which social networks and social relationships facilitated technology dissemination. Gender-based social analysis revealed the dynamic interplay between individuals within households and institutions, the evolving relationships and access, allocation and control of resources.

The differing social networks and correspondingly different levels of access to information, led to men and women experiencing different consequences. Networks facilitated communication, coordination, and the provision of information/knowledge regarding agricultural production, income generation, skill enhancement and food security of the family. The study highlighted that social networks played a crucial mediating role in the process of technology uptake.

Appealing to the concept of social capital as networks and relationships, new research is proposed that will examine the types of social networks that marginalized groups associate with, the networks that the powerful groups have access to, and the relationship between the two groups. Establishing the network architecture (including networks developed either through formal organizations, kinship groups, neighborhoods networks, work groups, self-help groups, or informal interactions), it is proposed to look into the role of social networks and power relations in the village in ensuring any risk and poverty reducing impacts of particular programs / interventions apart from the role of mutual support networks in risk management by poor rural households, including via migration or other strategies. Using an HIV/AIDS lens in research on the dynamics of shocks (HIV/AIDS), the research will also look into which communities, families and individuals are best able to minimize the damage due to HIV/AIDS and why? How can social networks help in coping with this shock?

By creating social networks within the community among the landless, the vulnerable, and tribals both men and women and linkage with the external agencies especially the market, it is envisioned to create more opportunities for the vulnerable community and empower them. As the networks are developed there are more resources available to the communities, which will lead to an improvement in the well being of rural marginalized communities and thus bring them into the mainstream of development. Acknowledging the role of social capital in the nexus of technology exchange/interventions presents both substantial challenges and opportunities to understand the complex gender relationships.

Social networks – sociological and theoretical perspectives
The needs of different populations (whether defined by gender, age, ethnicity, or some other criterion) in areas such as agriculture, health, employment, and education are not exactly the same, and policy interventions developed to meet these needs are the most effective when they are sensitive to, and incorporate, the values and aspirations of a target population. This requires that policy be based on an accurate understanding of the ways in which the cultural (in the broadest sense) characteristics of a particular population influence the relationships that its members have with other fields or domains within the wider society. The study of social networks is important since it helps us to better understand how and why we interact with each other, as well as how technology can alter this interaction.

From the review of literature it can be summarized that while some theorists looked at social networks as an explanation of how norm consensus and norm directed behavior was achieved, the others saw profit-maximization as the goal of individual actors while interacting with others.

Essentially, network analysis focuses on patterns of relations between actors. Both relations and actors can be defined in many ways, depending on the substantive area of inquiry. For example, network analysis has been used to study the structure of affective links between persons, flows of commodities between organizations, shared members between social movement organizations, and shared needles between drug users. What is central is an emphasis on the structure of relationships, which serves to link micro- and macro-level processes.

Social network analysis has emerged as a key technique in modern sociology, anthropology, social psychology and organizational studies, as well as a popular topic of speculation and study. Though network analysis is an interdisciplinary endeavor, its roots can be found in classical anthropology and sociology. Research in a number of academic fields have demonstrated that social networks operate on many levels, from families up to the level of nations, and play a critical role in determining the way problems are solved, organizations are run, and the degree to which individuals succeed in achieving their goals.

Collaborating institutions and scientists:
Indian Institute of Technology, Bombay : D Parthasarathy, Sudha Vasan, R Robinson
ICRISAT : R Padmaja, MCS Bantilan


Social networks and safety nets: village-level perspectives (Asia)

The study on social networks using the VLS commenced in 2005. Village level pilot surveys were conducted in four villages of Aurepalle, Dokur, Shirapur and Kanzara villages to elicit information on the social groups and networks existing in the village. The questionnaires implemented were on social networks with emphasis on existing village organizations and development activities in the village including the beneficiaries of these activities. Complementary informal discussions and focus group meetings revealed that if social networks are to be successfully harnessed to implement policy or alter existing behaviour of members within the network, then it is important to understand the dynamics of the uptake of the new products and activities. Household level or individual level questionnaires were also piloted for a more in-depth inquiry on membership in organizations, credit, support and share cropping networks, information networks, income transfers and collective action and exclusion. It was noted that analysis of the network architecture and linkages among public programmes and informal networks need further inquiry to gain more complete understanding of how social networks may help or hinder policy interventions and change.

Collaborating institutions and scientists:
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IE.3. Multi-sectoral approach to address HIV and AIDS implemented

Multi-sectoral approach to address HIV and AIDS

In the context of the HIV epidemic increasing in the semi arid tropics (SAT) and causing the rural SAT to be further marginalized, ICRISAT is initiating a multi-sectoral and partnership based initiative to mainstream HIV/AIDS in its research agenda.

This study aims to understand and clarify less understood aspects of the relationship between livelihoods, food insecurity and HIV/AIDS. A set of six case studies is planned to examine the dynamics of risk behavior and the spread of the HIV epidemic. This paper gives initial insights and key findings from this initiative in Bhongir and also throws light on preliminary observations made from the reconnaissance visit in Kolar, Karnataka.

The initial analysis and readings of the ethnographic data present unique dimension to the way HIV/AIDS have been perceived and this paves the way to look at the connections between HIV/AIDS, rural livelihoods and agriculture. Majority of the people who were tested are involved in agricultural labor or owned lands and cultivated. A majority of these people from agricultural background, who visited VCTC even though they were not tested to be HIV positive suffered from STDs. There remains many questions, some of which may be answered with the quantitative analysis and some may require in depth ethnographic study. The questions that arise are: What are the migratory patterns of these men and women. How do they tap the sex network in the city in which they migrate and what are the local sex networks. Since most of them are temporary migrants who come back to the village after working in the cities, what facilities can be made or how can technology innovations including agricultural and NRM interventions be harnessed to improve their livelihoods, create a strong income and asset base to cope with the disease and provide additional and supplementary nutrition. The case studies thus pave the way for further in depth analysis of the HIV – poverty – rural livelihood linkages, to better understand the gaps in order to enable targeted interventions.


Several studies have been conducted on targeting technology interventions for HIV/AIDS to improve rural livelihoods within the agricultural sector:

Seed Systems and HIV and AIDS Impacts
HIV and AIDS impact mitigation: convergence of short-term humanitarian and longer-term development interventions
Harnessing Social Capital for HIV and AIDS Impact Mitigation: Implications for Agricultural Technology Targeting
Scaling out agricultural technologies to HIV and AIDS orphaned and vulnerable children
Mainstreaming HIV/AIDS and gender in the challenge program Water for Food project in the Limpopo river basin

Objectives: The overall objective was to understand the impacts and to inform research and development policy both at ICRISAT and for partners in the process of designing and implementing effective technology delivery systems for scaling up/out.

Main findings and policy implications:

Seed systems: Commodity-specific extension by the private sector (NASFAM) contributed significantly to the transfer of information and knowledge on seed particularly for crops with relatively high market value within generations. The two main inter-generational pathways utilised focused on interventions involving kinship ties particularly grandparents through involvement and teaching-by-doing. The alternative pathway utilised formal schools as institutions.
Action research and short-term versus long-term interventions: Action Research will be useful across the short-term, transition and long-term phases. In the short-term, AR should be applied to aid the targeting process and to specifically identify entry points into communities. It should further be utilised to set priorities upon which the transition phase will build.

Social capital in HIV and AIDS impact mitigation: Two main forms of social capital were most useful to the communities: community-based networks and meso-level formal organizations working with the communities. The implication is that agricultural development and research institutions need to engage formal and informal community-based networks and the health sector in addressing the effects of HIV and AIDS.

Scaling out of agricultural technologies: The study recommended that for interventions that offer direct gains to orphaned and vulnerable children to succeed, several important issues ought to be considered: understand the socio-demographic characteristics of the communities; inclusive beneficiary targeting process; the choice of project interventions based on proper appraisal and targeting; and stronger partnerships and synergies with formal and informal local networks.

Scaling out of agricultural technologies: This ongoing piece of work uses qualitative and quantitative approaches using formal and informal surveys to cover key issues on gender and health along with adoption and adaptation of crop varieties and management practices, soil fertility enhancement, soil and water management and conservation, institutional arrangements and access to information and to input and output markets. A paper on HIV/AIDS and gender mainstreaming was presented in the CPWFPI inception workshop in Polokwane, South Africa.


IE.5. Searching for appropriate institutional arrangements for common watershed management in the semi-arid tropics in India

In the present research the main question is “Which institutional alternatives enable a successful implementation of watershed projects in villages in the semi-arid tropics?” A watershed implementation is seen as successful if: 1) villagers appreciate the implementation process; 2) villagers received some direct or indirect benefits; 3) the watershed community organizations founded during the implementation process will sustain even when the implementation process is completed.

According to the theoretical framework it is argued that the main reasons for the lack of success in watershed projects are coordination failures between local actors/appropriators (collective action problems). To overcome such coordination failures three different institutional alternatives are discussed: a) the market approach; b) the central government c) community governance.

In the course of the research project three watershed villages, Dokur, Sripuram and Zainallypuram, in the Mahaboobnagar district were analyzed to understand the impact the three above mentioned institutional alternatives had on the success of the watershed implementation process in the concerning villages. For the data collection 137 household interviews, 8 key-person interviews and 3 focus group meetings were conducted.

Collaborating institutions and scientists:
Collective action (CA) lowers the transaction costs for the farmers in the rural areas. It enables them to make investments to improve both the private and common property resources, which is otherwise a costly affair. But, the property rights to both privately and commonly held resources need to be well defined and respected. While some communities/societies engage in CA successfully and benefit from such activities, others fail. This study makes a attempt to (a) conceptualise and measure CA for watershed management in India, and (b) identify the determinants of successful CA.

Methodology: Eighty-seven watersheds were randomly selected from six districts [representing two from each of the low (less than 700 mm), medium (700 mm to 900 mm) and high (more than 900 mm) rainfall zones of the state of Andhra Pradesh in India]. All the sample watersheds were implemented following the 1994 guidelines for watershed development. Data were collected at the community level from leaders, user groups and key informants on a range of issues that characterized the village and the watershed groups.

The main hypothesis of this study is that, the level to which communities can act collectively varies. The primary data of the proxies was collected. Different variables representing CA were aggregated. The scoring coefficient was obtained through the principal component factor analysis.

Conclusions: A huge variation of the capacities to engage in CA exists among the sample watersheds. The following are a few factors, which explain the variation:

High levels of CA exist among the experienced groups. The finding supports the hypothesis that individuals of the group develop trust and are more forthcoming to participate in CA irrespective of the kind of goal pursued.

Presence of conflict resolution mechanisms improves the LCA.
Distance to input and output markets are positively and significantly associated with the LCA. Selling the produce and buying the inputs significantly minimizes the costs.


**IE.7. Guidelines for more effective implementation and monitoring of drought relief programs drafted and disseminated by 2005/6**

**Improving the Efficiency of Relief Seed (ESA)**

Whereas markets can be enhanced to offer opportunities for the poor to move out of poverty, the nature of SAT production systems indicates that a significant proportion of households would not be in a position to benefit significantly from market-led interventions alone. This includes the chronically poor and vulnerable households in marginal and remote locations, as well as households under transitory emergencies. In addition, evidence suggests that HIV/AIDS may be contributing to an increase in the proportion of rural populations trapped in such chronic food insecurity and poverty. To achieve sustainable food security, many of these households require sustained access to agricultural innovations in addition to the type of agricultural assistance more usually supported under emergency interventions.

Past ICRISAT research also revealed that most farmers only received access to new varieties of sorghum and pearl millet through relief seed programs. Commercial interest in the multiplication and sale of these seed crops was closely linked with the pursuit of tenders for the supply of relief seed. By the same token, questions began to emerge about the quality of this seed and the impacts of its distribution. ICRISAT was asked to help assess relief seed programs in Zimbabwe in order to identify ways to improve their payoffs.

**Objectives:**
1. Assess strategies for the supply of relief seed to small-scale farmers in drought prone environments.
2. Assess quality constraints apparent in some relief seed, and propose strategies for resolving quality problems.

**Methodology:** Led a review of the quality of relief seed in partnership with ICRISAT breeders and national regulatory authorities. Multiple surveys have examined the need for and payoffs to relief seed distribution. Further surveys are examining alternative voucher based strategies for the supply of relief seed and other agricultural inputs.

**Main findings & policy implications:** We estimate that at least 50% of the seed internationally traded in southern Africa is headed for relief programs in one country or another. This includes virtually all of the seed trade for secondary food crops such as sorghum, pearl millet, groundnut, and cowpea. Relief seed commonly accounts for 15 to 70 percent of national seed trade depending on the year, and the size of both government and donor programs.

Despite this, ICRISAT research has consistently shown that relief seed needs tend to be over-estimated. Farmers are remarkably good at saving their seed even after severe drought. And community seed systems are reasonably good at facilitating trade from seed surplus to deficit households after natural disasters. In this context, farmers look to relief programs as means to gain access to new varieties, or to seed they might otherwise want to purchase (e.g. for hybrid maize). By corollary, the impacts of relief seed on household food security and incomes tend to be small. We could find no evidence that the distribution of relief seed contributes to an increase in crop area planted. Rather, this tends to displace seed that might have been otherwise obtained from alternative sources – either own stocks or the village market. The relief seed industry remains strong, in part, because farmers have been conditioned to claim they have no seed in order to qualify for free handouts (and food aid). Also, seed companies see these programs as an opportunity to sell large lots while avoiding the costs of wholesale and retail trade. And relief seed handouts are an easy solution for NGOs.
ICRISAT was asked to sample the quality of relief seed lots being distributed in Zimbabwe after evidence of the past distribution of poor quality sorghum and groundnut seed. Two years of sampling revealed common problems of low genetic purity and poor germination. These studies are highlighted the poor quality of labeling of most relief seed which makes it difficult to hold companies responsible. While the majority of seed tested was of adequate quality, some of this seed undoubtedly worsened the food security of recipient households. ICRISAT drafted a protocol ultimately adopted by FAO in Zimbabwe, and all major seed companies trading in the country, to improve relief seed quality and labeling. A national review of this problem resulted in a series of recommendations for regulatory and practical reform designed to minimize this problem in the future. These stand as an example for all countries in southern Africa.

These economic research results have been used to argue against the direct distribution of free seed to small-scale farmers. These programs undermine investments in wholesale and retail seed trade. In fact, there has been an increase in the number of seed companies in southern Africa with no retail trading networks. Rather, these new companies aim simply to pursue a shifting array of tenders for relief seed in various countries in the region. In order to qualify for these tenders, many cut corners, buying grain for sale as seed. Our research has clearly diagnosed these constraints provided a warning to NGOs and donors to pursue stricter criteria on their tenders.

ICRISAT research is also encouraging the testing of alternative voucher based strategies for seed distribution. This started with a review of seed fairs, an increasingly common strategy being promoted (in part by ICRISAT) throughout eastern and southern Africa. The study revealed that contrary to common assumption, seed fairs do not necessarily strengthen local markets, but may undermine these markets. They contribute to seed price inflation. While seed fairs are suppose to provide farmers a broader choice of seed varieties to purchase, this choice is often constrained by how the market is organized. Seed fairs may be justified if commercially available varieties commonly distributed through free handouts are poorly adapted to the agro-ecology targeted by the relief program. But they unjustifiably undermine local and commercial markets where adapted varieties are available.

ICRISAT has responded by encouraging more experimentation with vouchers redeemable for a choice of seed (and other agricultural inputs) from retail shops. Initial research here has proved promising, though difficult in the context of Zimbabwe’s hyperinflation.


**Economic Analysis of Alternative Seed Delivery Systems for Agricultural Recovery Programs in Zimbabwe**

**Background:** Recurrent droughts in Zimbabwe have often led to loss of food production and the subsequent need for recovery. Seed has traditionally been donated to smallholder farmers struggling to recover from drought as a surest way of ensuring that households immediately start up crop production. However, there is now growing debate on the rationale for seed aid, because vulnerable communities are unable to withstand even small disasters and their farming systems have remained less resilient despite the continued supply of free seed. More attention is now placed on adoption of seed fairs as an alternative to direct free seed distribution under relief and recovery programs in Zimbabwe.

**Objectives:** The major objective of the study was to methodologically assess whether seed fairs offer broader positive impacts compared to direct seed distribution. The study carried out a comparative analysis of seed utilization, crop diversity and the cost effectiveness of direct seed distribution and relief inputs delivered through seed fairs. Data for the study was obtained from ICRISAT surveys carried out during seed fair implementation and post planting period for households that participated either in seed fairs or recipients of direct seed distribution in eight districts of Zimbabwe.
Main Findings and Policy Implications: The results of the study showed that contrary to expectation, crop and variety diversity was not enhanced, \textit{a priori}, by the seed fair approach. Farmers obtaining seed through direct distribution planted more crop types and a smaller portion of their land to maize. Though a lot of diversity was offered at seed fairs, this did not transfer into production. However, farmers who acquired seed through seed fairs planted most of the relief seed they acquired, in fact seed fair beneficiaries planted 26 percent more in terms of the proportion of the relief seed they received compared to farmers who were not given a choice. On cost effectiveness of alternative relief input delivery systems, the cheapest means to distribute seed to needy households appears to be the option of using seed fairs. In effect neighbouring farmers were redistributing stocks of local seed to deficit households. This approach is almost 40 percent cheaper than the next best alternative of direct distribution of commercially supplied seed. The major constraint of community –sourced seed is that, it might not be available in large quantities and high quality hybrid seed cannot be provided from the community. However, the analysis could not conclude that direct distribution is inherently bad because it is important in delivering commercial seed and ensuring that large quantities of seed are available.

In supporting local livelihoods systems, seed fairs, \textit{de facto} lay the immediate ground for moving away from outside or external assistance and link relief and development aims from the early stages of a crisis. Policy makers should encourage seed fairs as a way of strengthening local seed markets and for distributing community seed whereas direct seed distribution will complement this effort by providing commercially sourced seed. Seller organized seed fairs coordinated by extension and local leadership can be created to ensure sustainable and reliable markets of local seed and this could also save buyers on the search cost of seed.

Tarisa Pedzisa. 2006. Economic Analysis of Alternative Seed Delivery Systems for Agricultural Recovery Programs in Zimbabwe, MSc Thesis submitted to the Department of Agricultural Economics and Extension. Supervised by ICRISAT Staff


\textbf{1E.8. Provision of public goods through participatory planning: an experimental exploration of the deliberative process}

Rural areas in developing countries mostly suffer from a dramatic underprovision of public goods. The widespread failure of central governments in meeting peoples’ demand led to a debate on the respective advantages and risks of privatization and regulation, but a third option still needs to be seriously analyzed: locally-based collective action to mobilize financial resources and local labour. This research project aims at evaluating the potential of village meetings to mobilize collective action for the provision of local public goods, in heterogeneous communities of rural India. Through variants of the public good game that will be played in the ICRISAT villages, there is a plan to assess in which measure the possibility of deliberation facilitates the realization of outcomes that are closer to the social optimum rather than the inefficient Nash equilibrium. The weight of caste/income/gender inequality and social norms on the possibility of achieving higher social efficiency throughout the deliberative process will be measured. The results could provide interesting suggestions for policy improvements regarding the organization and delivery of responsibilities to Gram Sabhas (GS), the grassroots institutions of decentralized economic planning according to the Indian Constitution.

Preliminary interviews in three VLS villages of Dokur (Mahboobnagar district in Andhra Pradesh), Shirapur and Kalman (Sholapur district of Maharashtra) were carried out to collect information regarding functioning and performance of local Gram Panchayat (GP), tax collection and the need for public meetings in the villages. Individuals were asked whether they performed any activity for the welfare of the village, especially as volunteers, and whether they participated in public meetings (formal or informal) where matters of public interest were discussed. The aim was to collect their perceptions on how decision-making was carried on in the village on matters that regarded groups of people or the entire village population, to understand if they had the option of participating in decision making, and to learn more about interaction and power balance between people of different castes. Direct evidence on the amount of
taxation that is locally extracted and the money saved through voluntary labour in collective activities for cleaning and maintaining village infrastructure was collected.

Documentation obtained in Maharashtra villages:

Annual state of accounts for 2005-06 of Shirapur and Kalman’s Panchayats with taxes collected by Gram Sevaks, governmental transfers received, and public expenses in the villages;
Amount of taxation collected by Talathis for the State Revenue Department in Shirapur and Kalman, in financial year 2005-06;
Official registration and minutes of Gram Sabhas conducted in Shirapur and Kalman in 2006;
Estimate of value of voluntary work provided by citizens of Kalman in 2002 during two weeks of activities to clean the village (Sant Gadghe Baba Gram-Swachyta Abhiyan)

Collaborating institutions and scientists:
Siena University : Martina Pignatti Morano, Neri Salvadori, Samuel Bowles
Oxford University : Stefan Dercon
ICRISAT : KPC Rao, MCS Bantilan

Priority 5D. Improving research and development options to reduce rural poverty and vulnerability

Output 1F. Changes in household economies in SAT Asia from 1975-2007 described from which a policy package of management strategies (both ex-ante and ex-post) for mitigating the impact of risks inherent in rainfed agriculture is developed by 2009 with associated capacity building for partners and policy makers in SAT Asia. New knowledge generated annually will be shared with partners.

IF.1. Microlevel assessments of shifting livelihood strategies in the rural SAT using VLS approach in India ongoing

25 percent of stated output and output targets in MTP 2007-2009 were achieved in 2006 these were based on 11 MTP projects and their summary achievements are given in the following narrative.

Rural households have become more nucleated and the average family size declined from 8.37 to 5.10 over the past 25 years. The literacy levels have improved sharply, particularly in case of women. The occupational structure has become more diversified. Both the ownership and operational holdings have become much smaller due to population pressure and sub-division of holdings. The incidence of poverty declined over the last twenty five years but still 35 per cent of the sample households live below the poverty line. The average per capita income is Rs. 6286 ($ 145) per year. Despite increases in income and consumption levels, still more than one half of the households are calorie deficient while about one-fourth of the households are protein-deficient.

Cropping patterns changed significantly in favor of cash crops. But farmers are unable to recover the costs in case of both food and cash crops on the rainfed lands. The crops which received irrigation support have yielded positive net returns mainly because of subsidies. Even in case of livestock, the returns over variable costs are quite meager. Despite low returns from crop and livestock enterprises, the net household incomes have increased due to higher contributions from non-farm sources, caste occupations, migration and other minor sources. Self-help groups of women are able to contribute to family incomes.

Farmers invested heavily on water exploration but under-invested on soil and water conservation. Most of the farmers displayed risk aversion and showed interest in purchasing well-designed rainfall insurance schemes. The rural households participated in the development and welfare programs of the government. A
household, on an average, received a benefit of Rs. 4288 over the 17 years period (1995-2002). Despite these programs, a substantial proportion of labor force is indulging in seasonal migration in search of work and livelihood.

**IF.2. First and second generation VLS data bases integrated and documented through tracking surveys**

One of the objectives of the Second Generation VLS (2001-07) was to establish comparability with the OLD-VLS (1975-84) sample. A systematic tracking survey was initiated in 2005 and continued in 2006. A lot of changes occurred in the demographic profile of sample villages between 1984 and 2005. Out of the 1998 individuals present in the sample households during first generation VLS, 432 persons died during the two decades period. 675 individuals migrated out of the village. Quite a few of them were the young women who moved out after their marriage with a person belonging to other village/town/city. But a considerable number of individuals have also moved out of the village in search of work. Many of them are seasonal migrants who come back to the village at least for some months in a year. Some of them have migrated permanently as they expect to get better opportunities for livelihood, employment and income. The remaining 857 members continued to stay in the village. Only 581 of them were included in the sample for second generation VLS during 2001-05. For a comparative analysis of the livelihoods, it is necessary to include the migrants and the people residing in the village but was not included in the sample. A two-pronged approach was used to establish comparability between the samples of the first and second generation VLS. The size of the sample was enhanced from 446 to 592 households. All the split-offs from the original households were added to the sample since 2005-06 in order to cover most of the individuals from the original sample. The results of tracking survey are presented in the table below.

**Tracking and attrition**

<table>
<thead>
<tr>
<th>Status by 2005</th>
<th>Full sample of individuals included in 1975-1984 with tracking information in 2005</th>
<th>Of which: Included in the 2001 survey, i.e. in the village and in the sample in 2001</th>
<th>Of which: Not included in the 2001 survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead by 2005</td>
<td>432</td>
<td>24</td>
<td>408</td>
</tr>
<tr>
<td>Migrated by 2005</td>
<td>675</td>
<td>45</td>
<td>630</td>
</tr>
<tr>
<td>In village by 2005</td>
<td>857</td>
<td>581</td>
<td>276</td>
</tr>
<tr>
<td>No information by 2005</td>
<td>34</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>1998</td>
<td>654</td>
<td>1344</td>
</tr>
</tbody>
</table>

Efforts were also made to collect information from the migrants who visit the villages for festivals, annual get-to-gethers and other social occasions. In case of the migrants who do not come back to the villages, a special survey was conducted to collect data from migrants residing outside the village. With the limited funds available, migrants staying in the villages near by to the VLS villages and those who are living around Hyderabad city were interviewed. Even after a great effort to locate the migrants, some could not be reached as they have moved to a new place by the time we try to contact them at their old address known to the people in the VLS villages. We are continuing our efforts to track them and elicit their responses to the questions designed for the purpose of the study.

**Migration Survey**

<table>
<thead>
<tr>
<th>Status of individuals</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total no. of migrants</td>
<td>858</td>
</tr>
<tr>
<td>2. No. of individuals interviewed</td>
<td>431</td>
</tr>
<tr>
<td>3. Individuals not available</td>
<td>90</td>
</tr>
<tr>
<td>4. Individuals to be interviewed</td>
<td>337</td>
</tr>
</tbody>
</table>
When we included the migrants and split-offs from the original households in the sample, the average incomes of the households increased substantially. Since the migrants typically included those who received better wages and settled in the service and the business sectors of the economy, their inclusion in the sample increased the income levels. The migrants are also better educated and have a better asset endowment. There are substantial transfers of money from the migrants and their family members living in the villages.

**Census Survey in Gujarat Villages:** We undertook a census survey in Boria and Rampura villages in Sabarkantha district of Gujarat. These villages were studied in the first generation VLS, 1980-84. The sample size covered in these studies was 40 each per village. We conducted group meetings in both the villages with the help of Field Investigator engaged for this purpose. We found that the number of households and population have increased significantly over the last two decades period. Many bore wells were sunk and the cropping patterns have radically shifted from food crops to cash crops. Dairy activity has flourished in both the villages. The overall development was substantial. We decided to take a census of all households in order to decide about the size and composition of the new sample. We designed a one page schedule for the purpose and organized data collection with the help of the investigator. Data were collected from 360 households in Boria and 190 households in Rampura. The data were checked and inputted to prepare a census list of households in these two villages.

**1F.3. Partnerships for policy and development strategies with US-universities**

**Progress on US-universities linkages**

Renewal of partnership with US Universities stimulated interest among researchers and analysts from universities including students. It met with enthusiastic response from more partners who developed proposals for undertaking VLS based studies. This includes 5 students for summer internship in 2006. A multiplier effect has also been created through the development of a proposal to undertake a similar linkage program of ICRISAT with other universities. Several concept notes were subsequently written by other university partners like University of Guelph in Canada to undertake further collaboration in the VLS, particularly one which encouraged a new linkage program amongst other Canadian university partners. This is a clear evidence of the external use, adoption or influence of this International Public Good by partners, stakeholders and clients.

**Collaborating institutions and scientists:**
- Yale University: Robert E. Evenson, Chris Udry
- Brown University: Andrew Foster
- Harvard University: Mark Rosenzweig
- University of Pennsylvania: Jere Behrman
- Michigan State University: Scott M. Swinton
- University of Arizona: Satheesh Aradhyula
- Rutgers, The State University of New Jersey: Carl E. Pray
- University of California at Berkeley: Ethan Ligon
- Oxford University: Stefan Dercon
- Chiba University: Nobuhiko Fuwa
- University of Guelph, CANADA: Harry Cummings
- Cornell University: Per Pinstrup Anderson,
- Felix Naaschold Purdue University: Kathryn Boys
- The World Bank: Hans Binswanger, Xavier Gine
- ICRISAT: MCS Bantilan, KPC Rao, J Ndjeunga, B Shiferaw, P Parthasarathy

**Research scholars and their research areas:**
- Martina Pignatti Morano - Provision of public goods through participatory planning: an experimental exploration of the deliberative process
- Andreas Gramzow – Policy measures to improve rural livelihoods in India
Exploring the dynamics of poverty in India’s Semi Arid tropics

The general trends which were found to be of particular relevance to the visited communities are issues related to water scarcity, urbanization, and globalization. Also crucial recent village transformation is the decreased interest in the agriculture, due to the lower potential for profits in this sector.

Overall it would seem that the welfare of households in the villages of Aurepalle and Dokur has increased since the last VLS iteration. It is impossible to draw any conclusions on the basis of such a short visit and limited number of observations. Through these visits one, however, is left with the general impression that income and access to public goods has improved, and that income disparity has not increased and potentially may be decreasing.

While poverty rates are useful indicators of the level of poverty in a country during a specific period of time, they do not provide the information concerning the extent of mobility in and out of poverty or about the length of time people remain in poverty. The degree and cause of poverty experienced by individuals and households has important policy implications, but is frequently masked by data aggregation and dependence upon stylized ‘facts’.

The purpose of this study is to compliment and extend previous work on trends in poverty and income distribution. By more closely examining the dynamics of poverty, one can explore which types of households stay longest below the poverty threshold and whether certain changes in household status are associated with transitions into or out of poverty.

Conclusions: Results suggest this analytical approach can offer useful insight into poverty dynamics. Differences exist in the type of events correlated with entry, exit and duration of poverty spells. Suggest alternative policies needed to remedy each ‘phase’ of poverty. Results suggest policies may be more effective at preventing entry into poverty than facilitating exit or shortening duration. ‘Medium Term’ poverty appears to be correlated with different events than long and short term poverty. Further consideration of issue needed

Collaborating institutions and scientists:
Purdue University : Kathryn A Boys, Wallace A Tyner
ICRISAT : MCS Bantilan, KPC Rao

Migration in the VLS : The missing link

The paper focuses predominantly on permanent migration; temporary migration in the context of trends in the VLS. Within the VLS villages, income and consumption has risen significantly between 1975-1984 and 2001-2004. The preliminary data has shown that the migrants differ from non-migrants in salient socio-economic characteristics. Without data on the standard of living of migrants, attrition bias is likely to be substantial. The impact of migration on consumption and income trends is likely to be a function of the reason for migration; whilst the size and direction of the bias can be estimated as a function of observable characteristics for some migrant populations (notably those migrating for work), for other migrant populations (including migrants for marital reasons or those repatriating with family) estimates of attrition bias using currently available data are likely to be inaccurate. By tracking migrants, the VLS has taken a step forward to understanding better the nature of poverty and income dynamics.

From a policy perspective, migration is increasingly being seen as an important livelihood option for poorer groups, and as a means of poverty reduction (Deshingkar, 2005). The data on migration will help us to better evaluate the alternative frameworks within which migration has been placed. Migration has been
posited to take a myriad of different forms: as a coping mechanism (Bantilan and Anupama, 2002), as an income diversification strategy (i.e. a long term plan, a permanent strategy to diversify income in the village) or as a permanent route out of poverty (i.e. permanent migration out of the village). Whilst econometrically the full identification of the different mechanisms would not be possible given that the sample consists of only six villages, from a more qualitative perspective the data will give us insight into the different forces driving migration.

Migration in the VLS – how to study it?

Migrant tracking was planned in three main phases. The first phase was to prepare the surveys and to pilot test the new modules. The first phase was coordinated to coincide with a festival in one of the villages to ensure that questions could be pre-tested on both temporary and permanent migrants (both of whom are likely to return at festival time). The second phase involved an incubation period of 6 months during the period of festivals in the village, to capture all migrants who returned to the villages. The third phase entailed finding the migrants at their current place of residence.

The preliminary data has shown that the migrants are different in salient socio-economic characteristics. Most notably, migrants can be identified by age, sex and educational attainment. Since educational attainment is likely to be linked to unobservable ability and innovation, and has also been shown to contribute directly to income growth (Mankiw et al, 1992), it is likely that the consumption and income trends for these individuals is different from those who have stayed in the village. Very little is currently know about the migrants for non-marital purposes, who make up over half of those who have migrated, since we are unable to judge the size of the attrition bias for these individuals due to the nature of migration; the new data will fill this lacuna.

In addition, much can be said for the impact of migration, in particular temporary or seasonal migration, at a village level. For example, it would be interesting to study whether the decision to migrate has an impact of child nutrition (Hildebrandt 2005) or child enrolment in educational institutions. McKenzie and Rappaport (2002) study the impact of migration on educational attainment in Mexico; they find that the low-skilled migration flows to the US have a negative impact on the number of years of schooling attained in given areas. Another pertinent research question is the impact of migration on technology adoption – do migrants act as an information flow, bringing knowledge and new technology home with them?

In ICRISAT, much has been done to ensure that the VLS dataset continues to expand in a methodologically sound manner. Ensuring that all further split-offs are included in the village level surveys will allow the VLS dataset to incorporate the dynamic elements of household formation, as well as ensuring that attrition bias is reduced to a minimum. The tracking of migrants that is currently in taking the concept of reducing attrition bias one step further, by providing a truly comprehensive data set.

Collaborating institutions and scientists:
Yale University : Reena Badiani
Oxford University : Stefan Dercon
ICRISAT : KPC Rao, MCS Bantilan

Village Level Impacts of Trade liberalization: A look at Dokur

This paper is intended to be a village level analysis of trade liberalization. Methodological questions were raised and data collection methods will be analyzed. The tenuous causal linkages between macro-level trade policy and micro-level village impacts ought to be critically analyzed to determine in what manner current theoretical frameworks are being extended. By using integrated regional and national commodity markets for common crops some have translated relative price changes directly into village level analysis including impact on income, employment, and migration. How is this meaningful? What social indicators ought to be reviewed? What are some questions and conclusions that current analysis poses?

Conclusion: Kuiper and van Tongeren (2005) is perhaps the most robust model in the literature examined.
Current literature on village level impact analysis, at least amongst Economists concerned with trade, are developing new models that are more robust but also more real. Issues such as missing markets, imperfect markets, or inadequate access to markets hinders the level of analysis given current data. New realms to explore would include more complex analyses of social indicators such as the HDI. However, on the whole devising tools that look beyond macro-level growth would give policy makers and scholars better insight into impacts, furthering the decision making process.

Collaborating institutions and scientists:
Cornell University : Ammad Naeem Bahalim
ICRISAT : KPC Rao, MCS Bantilan

The effects of major crop commodities on iron intake in rural India (1972 – 2002)

This research proposes to understand how the Green Revolution (GR), the agricultural programs which tripled rice and wheat yields, affected iron intakes in India from 1983 until 2002. Although food balance sheets show overall iron densities of available foods decreasing in South Asia during the period of the GR, it is not well understood what foods contributed to this decline and how this translated into dietary intakes among different segments of the population. A side effect of the sole promotion of rice crops was the concurrent decrease in per capita production of pulses (beans, lentils, chickpeas, etc.), which are relatively rich in iron, given the predominantly vegetarian diet. The specific aims of the project are to (1) describe trends in dietary intake of iron in the rural Indian diet over the past 20 years and (2) investigate the effects of prices as well as individual and household-level characteristics on iron intakes in rural India from 1983 to 2002.

Methodology: Using secondary data of the National Nutrition Monitoring Board (NNMB) and the ICRISAT District Level Database, trends in dietary intakes for iron as well as major agricultural commodities in the Indian population over the last twenty years will be analyzed.

IF.4. Nutrition orientation in agricultural research-ICRISAT perspectives (Asia)

Despite the considerable progress made in crop production in recent decades, many developing countries still fall short of the goal of providing adequate food and nutrition. While some countries in south Asia achieved food self-sufficiency through the green revolution, ensuring equitable access to food still eludes them. With over two billion people globally subsisting on diets that lack the essential vitamins and minerals required for normal growth and development, access to food and combating this “hidden hunger” continue to pose a serious challenge in south Asia. The paper entitled, “Food and nutrition security-perspectives on nutritional orientation, access and strategies” presents a background of the challenge facing the global community - ie, food and nutrition security, now one of the Millennium Development Goals (MDG). It analyses the prevailing food production and availability scenario in south Asia, the nutrition orientation in agricultural research, and policies to enable access to and affordability of food by the poor and vulnerable. This is discussed in the context of a strategy to reduce malnutrition and enable rural households to improve family health in sustainable ways. ICRISAT’s perspective on nutrition through biofortification of coarse cereals and legumes (eg, zinc and iron in sorghum and millets; and vitamin A in groundnut) and minimization of aflatoxin contamination are highlighted. Strategic approaches are discussed to broaden the interpretation of the MDG challenge on food and nutritional security to include economic, physical and social dimensions not only at the national level but also at the individual level of children, women and men.


IF.5. Livelihood insecurities in the SAT: Migration, risk behavior and impact of HIV on rural households in Andhra Pradesh (Asia)
This thesis looks at issues related to livelihood insecurities in the Semi Arid Tropics (SAT); the risks and vulnerabilities that hinder the growth process of households, with particular reference to sexual risk behavior and HIV linkages of migrant workers. A livelihood comprises of the capabilities, assets and activities required for people's means of living. In conditions of drought, migration is a major alternative livelihood strategy in the marginal semi arid environments of rural India. Recent reports by National AIDS Control Organization’s sentinel surveillance indicate that the semi arid tropics fall under high prevalent zones in terms of HIV. It also lists migrant workers as a high-risk group prone for the epidemic.

Livelihoods can be destroyed by the impact of HIV/AIDS when economically active people succumb to the disease and die. Consequently, children drop out of school to cultivate the land and care for ill parents. This hampers the children's ability to acquire skills that could make them employable in the formal sector. To pay for medicines, hospital care or other expenses due to HIV/AIDS, a family may sell stocks of food, land or other property, farming tools, or send their sons and daughters to the city to find work. This again leads to labor migration and hence leads to risk of infection again. These impacts of the poverty-livelihood-HIV nexus are clearly documented in studies in Africa. However, in India though there are sparse micro level information, an in depth analysis is yet to begin. Given the fact that HIV has high prevalence in the Semi Arid Tropics and is increasing constantly, this study aims at understanding the role of migration in the spread of the HIV epidemic in the rural SAT and aims to understand the socioeconomic conditions of the rural households involved in this process of migration. This kind of information is aimed at enabling policy makers to make informed decisions when it comes to planning for rural development or disease control for that matter.

The broad objective of this thesis is to understand the role of migration in enhancing the risk behavior of migrants and in the spread of the HIV epidemic among rural households in the SAT. The specific objectives are to understand 1) to what extent the livelihood insecurities in Dokur lead to migration, 2) to understand the risk behavior of migrant workers in the context of livelihood insecurities and 3) to map and analyze the patterns of migration and risk behavior.

The area of study planned is from the high prevalence state of Andhra Pradesh. Samples will be chosen from Dokur village in the heart of the rural SAT with high incidence of migration. Secondary data from Voluntary Counseling and Testing Centre will also be analyzed to gain more insight.

Collaborating institutions and scientists:
Indian Institute of Technology, Bombay : D Parthasarathy, R Robinson, K Narayanan
ICRISAT : BVJ Gandhi, MCS Bantilan

II.6. Strategic analysis of alternative futures for dryland agriculture

Dynamics, challenges and priorities for dryland agriculture (Global)

The marginalization of the dryland region of Asia and sub-Saharan Africa is reflected in the pervasiveness of poverty and continuing concerns about malnutrition, growing constraints of the natural resource base (water scarcity and land degradation), lack of infrastructure, poor dissemination of improved technologies and further economic liberalization. Dryland ecosystems, where most of the world’s poor live, are characterized by extreme rainfall variability, recurrent but unpredictable droughts, high temperatures and low soil fertility. Indeed, dryland areas present significant constraints to intensive agriculture. But despite extreme conditions, agriculture and related land use have always played a leading role in dryland economies and societies. Even as they are constrained by limited water and soil resources, optimization of these resources is often a matter of survival for dryland rural economies (FAO 1999).

The Green Revolution of the 1960s and 1970s, with its package of improved seeds, farm technology, enhanced irrigation and chemical fertilizers, was highly successful in meeting the primary objective of increasing crop yields and augmenting aggregate food supplies. In Asia and parts of North Africa, where
the package was most widely adopted, food production increased substantially during those decades. Despite its success in increasing aggregate food supply, the Green Revolution as a development approach has not necessarily translated into benefits for the lower strata of the rural poor in terms of greater food security or greater economic opportunity and well-being. It bypassed many areas with large numbers of rural poor (Freebairn, 1995, Pachico et al., 2000, Evenson and Gollin, 2003). In particular, vast expanses of dryland regions were bypassed by the Green Revolution. They have failed to attract investments in agricultural technology among smallholders as well as among the commercial sector due to small or nonexistent markets. So far, the policy regimes have favored the irrigated regions and failed to address the continuing marginalization of the drylands. Past policies on drylands have failed in another respect: they focused primarily on the presumed limitations of the natural resource base rather than on the people, their knowledge, skills and capacity for innovation in overcoming or circumventing environmental constraints (Anderson et.al, 2003).

Recognizing the need to reach the poor in marginal environments, development planners and policymakers are increasingly eyeing less-favored dryland regions, where agricultural transformation is yet to take off. The issues of equity, efficiency and sustainability compels the need for improving the productivity of dryland agriculture given that the growth opportunities in irrigated areas are slowly being exhausted. A well-targeted approach is sought to address the neglected rural dryland areas that are yet to benefit from improvements in agricultural technology and policy.

The study on the “Dynamics, challenges and priorities for dryland agriculture” summarizes the major challenges in achieving food security, income growth, poverty reduction and environmental sustainability, and identifies future strategies and priorities for dryland agriculture in Asia and sub-Saharan Africa. It highlights emerging issues that threaten the sustainability of agriculture and future sources of growth. The paper presents an overview of the dynamics of dryland agriculture followed by an analysis of the persistent challenges facing it, and identifies opportunities such as income diversification, market and rural/urban linkages, institutional innovations, private sector investments, trade liberalization and commercial orientation of agriculture. Implications for policy, research priorities and development pathways are drawn, followed by a vision for Asian and sub-Saharan Africa dryland agriculture.

Collaborating institutions and scientists:
SEARCA : Balisacan, Arsenio
ICRISAT : WD Dar, MCS Bantilan, P Anand Babu, KV Anupama, H Deepthi, R Padmaja


1F.7. Policy study on vulnerability and rainfall insurance

Rainfall insurance in India: How it can help farmers

The agricultural survey on rainfall insurance, which was commenced in 2004 in collaboration with the World Bank, has been completed in February, 2005. Quality data was validated and ensured. A supplementary mini-survey was conducted in June-July, 2005. This canvassed information from all the 1060 households in the sample from a simple one-page schedule. The data entry were completed by
August 2005. The data allowed analysis of the sources of risk, effects and strategies of farmers; the adverse impact of government policies on rainfed farmers; and policy implications.

Crop insurance is a major public policy designed to get at the source of the problem of yield variability. It is a contingency contract where participant farmers pay premium and collect indemnities when yields fall below an insured level. In India, crop insurance was introduced in mid-1980s as crop loan insurance, where the insurer covers a percentage of the loan for annual cultivation expenses of the participant farmer. As the crop loan insurance is largely tied to the institutional loans, it benefited the farmers with irrigation to a major extent.

Research carried out through the ICRISAT village level studies suggested that rainfall lotteries are better than the crop insurance schemes to diminish rural household income variability in a cost-effective manner in rainfed areas of India (Walker and Ryan, 1990). They would be a fair betting system and would be open to all households in the village. For instance, if landless labor households felt the demand for their labor was markedly reduced in low rainfall years, they could hedge their future labor income by purchasing tickets on the lowest or what they perceive to be the most adverse rainfall event. Rainfall may explain more of the variation in crop revenue when compared with the pure impact of yield variability as it also influences the area sown.

How can rainfall insurance help rainfed farmers? The facts presented in this Brief imply viable policy initiatives to help rainfed farmers face risks inherent in rainfed agriculture. Rainfed farmers have very little access to institutional credit as they are subjected to credit rationing by the institutions due to high-perceived risks. Hence they do not get much cover from the National Agricultural Insurance Scheme (NAIS), which focuses primarily on crop loan insurance. Well-designed rainfall insurance products can attract rainfed farmers to buy the policies and get adequate insurance coverage. At the moment, while the NAIS charges lower premium than the actuarial levels (particularly in the case of food crops and oilseeds), the rainfall insurance premiums charged by the ICICI Lombard or Agricultural Insurance Company of India are actuarial. The difference creates a disincentive to rainfed farmers, resulting to slow uptake rates. There is a compelling justification for subsidizing the premium for rainfall insurance products so that they get a level playing field in matters of insurance. To introduce the rainfall insurance concept to a wider clientele of smallholders, institutional arrangements facilitated by pilot programs can show how best insurance scheme benefits them. It can also feature the benefits to a wide range of beneficiaries including landless households and small producers in the rainfed regions. Ultimately, a well designed and appropriately subsidized rainfall insurance scheme will enhance the uptake rates and will improve the safety net against weather-induced risks, especially among the marginalized population who are dependent on rains for their livelihoods.

Rainfall Insurance study in 37 villages of Mahabubnagar and Anantapur districts of A.P

We collaborated with the Development Research Group in the World Bank, Washington D.C. to conduct a baseline survey in 2004 and a mini-survey in 2005. These surveys covered 37 villages from Mahaboobnagar, Narayanapet areas in Mahaboobnagar district and Hindupur area in Anantapur district. Our collaborators were very pleased with the quality of datasets provided by us. Our joint efforts have led to the preparation of the policy brief on ‘How can Rainfall Insurance help dryland farmers?’. Xavier Gine and James Vickery visited us in April and delivered a seminar at ICRISAT on the preliminary results from the Baseline survey, 2004. In the subsequent discussions, the World Bank Group asked us to carryout a marketing survey before the Rainfall Insurance policies are sold by the BASIX, a mini-survey after the onset of the monsoon to know the reasons for purchase and non-purchase of the insurance policies and a main survey to assess the impact of rainfall insurance after the harvest of kharif crops. We have completed the marketing and mini-surveys and send them the datasets. We commenced the main survey in November after training the investigators in the use of survey instruments and pre-testing. We completed the data collection work in Hindupur and Narayanapet areas and we are commencing the work in Mahabubnagar area. We have also developed the programs for data entry and obtained the concurrence of World Bank. We have also commenced the data entry and validation processes in order to deliver the databases on time.
A policy brief based on the above findings has been published and disseminated to stimulate policy dialogue.

Collaborating institutions and scientists:
World Bank : Xavier Gine, Donald Larson
ICRISAT : KPC Rao, MCS Bantilan, D Kumara Charyulu


Rao KPC, 2006. WTO Issues and Suggested Measures to be taken by Government and FAPCCI, Invited paper at the National Seminar on Agriculture and Processed Food Export –Emerging Trends Organised by Federation of Andhra Pradesh Chamber of Commerce and Industry (FAPCCI) and Agricultural and Processed foods Export Development Authority (APEDA), April 22, 2006 at Hyderabad


**IF.8. PRA on information flows and new technologies to enable intensification completed**

**Participatory rural appraisal report in 4 villages of Western Niger (WCA)**

Progress:

Methodology: This report is a description of potential changes in livelihood strategies and out-comes as perceived by farmers in 4 villages where the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) collected a longitudinal data from 1982 to 1987 in Niger. Participatory rural approaches were used to examine the potential drivers of agricultural transformation in the villages. Uptake of modern technologies (seed, fertilizers and other inputs), income diversification, farm and non-farm growth linkages, market and institutional development were discussed with farmers’ groups using PRA tools.

Results: Livelihood assets and technologies: PRA findings show that village assets and infrastructure have marginally increased in high rainfall zones (600-800 mm rainfall) of Gobery and Fabidji but have decreased in low rainfall zone (400 mm rainfall) such as village Sadeizi Koira. Access to cleaned water has improved as a result of NGO or rural project intervention but remains insufficient to satisfy the high demand due to population growth. There has been little changes in the types of crops grown, cropping systems and technological practices by farmers during the last 25 years. The use of modern technologies remains limited despite numerous efforts at developing and disseminating modern technologies by R&D institutions. There is virtually no systematic use of modern sorghum or pearl millet varieties, fertilizers and other inputs such as fungicides, insecticides and pesticides. However, the use of animal traction is one of the most significant break-through. Many more households own animal traction equipment especially in the more favorable rainfall areas. In low rainfall zones, farmers are complaining of loss of some varieties and crops due to the shortening of crop cycle and repeated droughts. The identification of constraints to uptake of modern technologies remains a major challenge for national and international research and development institutions. The potential losses in bio-diversity need to be proven as well as its impact on productivity and resilience. Research and development interventions likely to enhance agricultural productivity are essential.

Livestock: Livestock rearing is practiced in all the 4 villages surveyed. The extensive mode remains the most common and livestock is entrusted to shepherds who go in transhumance to look for grazing land. However, during the last 25 years, population density and subsequent reductions of grazing areas are forcing households to move into semi-intensive modes of livestock rearing. Livestock fattening is practiced by both men and women to different degrees depending on the village. In the less favorable zone of Samari and Sadeizi Koira, women are more involved in livestock fattening than men whereas in the average favorable area of Gobery and Fabidji, both genders equally take part on this activity. Small ruminants constitute house-holds store of values or savings schemes and are often used to smooth households’ consumption so as to ensure food security especially during production risk fail-ures or to finance social events such as marriages. According to groups of farmers, during the last 25 years, livestock density has decreased mainly due re-peated droughts (1973 and 1984) and low stocking rates on diminishing grazing areas. However, while cattle stocks owned have decreased per capita many more households own small ruminants such as sheep and goats. Households own more livestock in the low rainfall zone of Sadeizi Koira than the high rain-fall area of Gobery and Fabidji. Farmers are claiming that the share of income from livestock is higher than that of crops in the low rainfall zone than else. Crop-livestock interactions are stronger in the low rainfall zone than the high rainfall area. There is a need to develop crop and production technologies that will in-crease the supply of feed resources. There is also need to identify and develop institutions and policies that will enhance the development of the livestock sector especially in the low rainfall areas.

Income diversification: Income diversification is a strategy used by households to cope with climatic, production and price risks. Income diversification strategies change according to agro-climatic zone. In Gobery and Fabidji, the presence of the Dallol (with assured water) has provided opportunities to farmers to diversify within the agricultural sector especially into vegetable production especially during off-seasons. In addition, farmers have also well diversified much into the secondary and tertiary sectors mainly due to market opportunities offered by their proximities to a large market: Fabidji. Processing, handicrafts,
short and long-distance trading for livestock or natron exporters, cereal trade, and a range of petty jobs such as groundnut oil processing, vegetable sales, handicrafts. . . are also well developed. Whereas in low rainfall areas of Samari and Sadeizi Koira, there are few opportunities to diversify within the agricultural sector due to poor climatic conditions.

Farmers are diversifying outside the sector. Long distance trading of wood, cow-pea haulms or millet stalks and migration are the main survival strategies. In all the villages surveyed, income diversification options have changed in response to the development of markets opportunities, better use of resources (i.e. water in the dallol), or low returns to agricultural labor. There is a need to identify house-holds’ income diversification strategies and the necessary policy, institutions and technological changes that would affect the rural non-farm economy and translate these into research and development interventions that generate employment and reduce poverty.

Migration: Migration is practiced in all the 4 villages but its importance in improving livelihood outcomes varies by agro-climatic zone. There is short or long, seasonal or permanent migration. In Gobery and Fabidji, migration tends to move from seasonal to even permanent. It is practiced mostly by the young men in the households. According to groups of farmers interviewed, at least 1 out 3 households in the 2 villages has at least one member in temporary or permanent migration. Revenues from the migration are shared within the households and are partially used for investment or consumption purposes. In the low endowed areas of Sadeizi Koira and Samari, migration is a major survival strategy. Every year, at least one member of the household is engaged on seasonal migration. Revenues from migration are mainly used to secure household food security. Both men and women migrate. Migration patterns have not changed much during the last 25 years but their intensity and importance in livelihood strategy has significantly increased. The returns to migration, optimal migration pathways and its impact on agricultural production and rural livelihoods should be well investigated.

Farmers’ organizations and markets: During the last 25 years, in all the villages, institutional build-up has improved as a result of NGOs or rural development projects who have invested in building farmers’ organizations. Farmers are often organized around socio-professional groups with different socio-cultural and economic interests. In Samari, farmers have organized committees to help resolve a range of socio-economic problems that would otherwise involve high transaction costs. The role and impact of these institutions in economic development is not well researched. During the last 25 years, there has been a poor development of input and product markets despite market liberalization in the 1980s and currency devaluation in 1994. Except in Samari where a new market has emerged, in Sadeizi Koira, no market has been developed. In Gobery, the market created some 50 years has not expanded much but the market transactions in Fabidji have expanded considerably. Similarly, market frequencies have not changed and remain weekly mar-kets. Although all villages are connected to a set of markets, these markets are far away from those villages, thereby increasing trading costs except in Fabidji where transaction costs are low and market transactions have increased considerably. In Gobery, Fabidji and Samari, there are market niches for vegetable crops. Farmers report poor access to and availability of essential inputs such as seed of modern varieties or fertilizers. The role of markets in agricultural transformation needs to be well researched.

1F.9. Policy brief on changes in rural livelihood strategies and outcomes in West and Central Africa (Niger and Burkina Faso)

Poverty dynamics and development pathways (WCA)

As part of revival of village level studies, a three-year database was collected from 6 villages of western Niger namely Sadeizi Koira, Samari, Gobery, Fabidji, Faska and Hankoura. These villages are located in different agro-ecologies with Sadeizi Koira and Samari located in the area of about 400 mm rainfall on average; Gobery and Fabidji in the region of about 600 mm rainfall and Faska and Hankoura in the region of 800 mm. The data was collected from 2003/04 to 2005/06 and includes 15 modules as follows:

Module 0. General information and questionnaire identification
Module 1. Characteristics of production units
Module 2. Production unit land stocks
Module 3. Migration
Module 4. Agricultural equipment
Module 5. Use of technologies
Module 6. Labor use
Module 7. Credit transactions
Module 8. Diversification of revenues
Module 9. Crops: Flux and stocks
Module 10. Livestock: Flux and stocks
Module 11. Affiliation to associations, institutions and rural development projects
Module 12. Wealth indicators
Module 13. Risk coping mechanisms and responses
Module 14. Health risks of household members

The data entry is currently completed. Data documentation, exploration and analysis are forthcoming.


Cross-theme linkage outputs

Output 7B New approaches and technological options to create a strategy to diversify SAT systems using available water resources efficiently to grow high-value commodities that increase incomes for disadvantaged households identified and promoted by consortium partners to Government agencies, donors, NGOs, and CBOs in four countries in Asia by 2008.

7B.1. Strategies for watersheds reported for 4 countries

**Crop-livestock linkages in watersheds of Andhra Pradesh (Asia)**

**Objectives of the study:**
1. Examine the linkages between the crop and livestock sectors in the watersheds of Andhra Pradesh
2. Study the impacts of watershed development on crop and livestock sectors in terms of improving the livelihoods of the poor

**Methodology:** The study uses the data collected from six villages in Andhra Pradesh where watershed program has been initiated under the APRLP project. The impact of watershed development on crop and livestock sectors is examined by analyzing the data pertaining to two villages in Ranga Reddy district. One where watershed programs are on-going since 1999 and another from outside the program area. A sample of 60 households is selected randomly from each of these villages for analysis and recommendations.

**Results:** There are a number of studies that have looked at the impact of watershed programs on rural livelihoods with focus on crops and related activities. This study focuses on the crop-livestock linkages in dryland villages under watershed programs and zeros in on the impact of watershed intervention on crop-livestock linkages and its implication on rural livelihoods. For this study, baseline data collected from 6 watershed villages in Andhra Pradesh state under the APRLP project were analyzed with focus on livestock production systems, size and composition of livestock holdings, milk production and marketing, availability and utilization of feed within the context of the socioeconomic, agro climatic and agricultural backdrop of the villages.

The impact of watershed program on crop-livestock system was studied by selecting two villages with same agro-climatic conditions but one with watershed intervention and the other without any intervention. The findings indicate that the bovine sector is more advanced in the watershed village compared to the control village with a shift in composition from work to milk animals. Higher milk production in the watershed village is due to productivity improvements at the household level largely due to better feeding regime. On a dry matter basis the quantity of feed fed per adult livestock unit was about 65-70% higher in the watershed village compared to the control village. Interestingly, in the watershed village there is a steep increase in the quantity of greens fed substituting concentrate (agro-industrial by-products) feed. The higher production of greens could be attributed to more intensive cropping due to better moisture regime in the soils following watershed intervention.

Over all watershed program has a significant positive impact on per capita income, contributed by crop and livestock sector, more specifically by livestock sector. The yields of majority of crops have improved. Per capita income from the livestock sector improved by about 80% and its share in total income increased from 12.2% to 15.7%.

Finally, the report suggests a few simple indicators that can be easily measured for quantifying the impact of watershed programs on rural livelihoods with particular reference to crop-livestock linkages.
7B.2. **Options for diversification contributing most to food security of poorest and most vulnerable households characterized by 2006**

**Strategies for agricultural intensification and agro-ecosystem management (ESA)**

Integrated management of natural resources for poverty reduction and livelihood resilience has remained to be a major policy challenge in many SAT areas of the ESA region. A number of different nutrient management practices have been found to be technically and financially beneficial but they differ considerably as to their effectiveness and resource requirements. A review of African smallholder experiences with integrated soil fertility management practices finds growing use both indigenously and through participation in agricultural projects. Patterns of use differ considerably across agro-ecological conditions, communities and households but are stimulated by profitable commercially oriented agricultural opportunities. The first set of studies explored experiences for agricultural intensification and the potential for integrated soil fertility management to expand markets for organic inputs, labor, credit and fertilizer.

The second set of studies examined the potential for sustainable agricultural intensification through integrated management of watershed landscapes. Agricultural landscapes and watersheds are complex biophysical and socioeconomic units that require innovative policy options and institutional arrangements to stimulate and sustain local collective action. The lateral flows and interdependence of natural resources in a watershed implies the need for community action to internalize externalities and create incentives for individuals to participate in such group action. Such landscapes are often inhabited by diverse groups with diverging rights for access, utilization and control of resources, suggesting the need for innovative approaches and strategies that enhance both efficiency, equity and sustainability. When property rights for collective investments such as recharging of groundwater aquifers or community forests are clearly defined, rural communities in drought-prone areas can develop mechanisms for beneficial conservation of these resources.

Several countries in the ESA region have attempted diverse strategies for tackling the problems of land degradation and the poverty nexus in many densely populated parts suffering from constant depletion of the resource base. In many cases, traditional efforts for soil and water conservation have however failed to stimulate farmer conservation investments. The removal of agricultural subsidies following adjustment of policies and liberalization of economies in many countries has also raised questions on farmer ability and willingness to invest in improved land and water management. Along with several partners (IFPRI, ICRAF, ILRI, ARIs, NARS, etc), ICRISAT has evaluated the effectiveness of alternative approaches for enhancing farmer conservation investments and strategies for enhancing the use of improved technologies (e.g. fertilizer).

Based on its own experiences in South Asia and review of lessons across the ESA region, ICRISAT in collaboration with ASARECA/ SWM net and other key partners has taken the lead in developing new approaches and more effective strategies for integrated soil and water management in the ESA region.

**Major findings and policy implications:** A study undertaken on agricultural intensification (green revolution) in Zimbabwe provided an overview of plant breeding research, variety release and seed supply of staple food grains, and assessed the impacts of the new varieties on yields using national aggregate yield data. The paper also analyzed farm-level factors determining farmers’ adoption decisions in the semi-arid areas, where the mini-green revolution lagged behind more favorable areas. The results indicate that the adoption of improved crop varieties will not lead to substantial yield gains unless improved soil management methods, such as application of manure and fertilizer, are also adopted.
The review of experiences in integrated natural resource management and strategies for poverty reduction between countries in South Asia and those in ESA showed that much can be learned from sharing of experiences and lessons. In terms of development of such integrated technical interventions to improve rural livelihoods and natural resources in drought-prone areas, South Asia (especially India) has amassed extensive experience and lessons, especially in the area of integrated watershed management (IWM). The concept of IWM goes beyond traditional integrated technical interventions for soil and water conservation to include multiple crop-livestock and market related innovations that support and diversify livelihoods to better withstand risks induced by market and climatic variability. The concept ties together the biophysical notion of a watershed as a hydrological unit with that of the community and institutional factors that regulate resource demands and determine the viability and sustainability of such interventions. The hydrological approach helps to identify the appropriate technical interventions at the landscape level on the supply side while community participation is fundamental for creating and strengthening critical local institutions that coordinate and regulate resources use on the demand side. This indicates that effective implementation of an IWM program requires landscape level approaches that recognize the characteristics of watersheds both as biophysical and socioeconomic units and the implications for policy and institutional arrangements for improved management of these resources.

The Asian experience also shows that enabling policies and strategic public investments for IWM have contributed towards diversification of production into high-value products, reversal of resource degradation, growth in the incomes of the poor, and enhanced the ability to mitigate the effect of drought. Along with innovative institutional arrangements and local capacity building, these landscape and community-based technical and institutional innovations have stimulated integrated agro-ecosystem investments for soil and water conservation, rehabilitation of degraded lands and private investments for supplemental irrigation. When coupled with other infrastructure development initiatives (e.g., rural roads and electricity) and innovations for creating market linkages, such natural resource investments have accelerated diversification of production into market-led high-value products, thereby allowing smallholder producers benefit from emerging market opportunities through better integration of production into the market economy.

Governments and other stakeholders have a unique role to play in kick-starting the process through strategic natural resource investments that enhance local capacity for collective action and generate local public goods. Once stimulated through strategic public and other initiatives, such collective investments serve as building blocks for private productivity-enhancing investments as they enhance the profitability of divisible inputs (such as fertilizer and improved seeds) and encourage farmer adoption of innovations for conservation-based agriculture. Integrating multiple interventions in watersheds would however require a flexible learning alliance of institutions and cross-disciplinary teams with complementary skills and competencies.

Such inter-regional collaboration between India and the ECA region has now been initiated through the efforts of ICRISAT, SWM net, IWMI and the Indian Council of Agricultural research. Pilot programs for integrated agro-ecosystem management and poverty reduction have been designed and received support for implementation under the auspices of the subs-Saharan Africa Challenge Program (SSA-CP) in the Lake-Kivu zone and in the Limpopo basin under the auspices of the Water and Food Challenge Program (WF-CP) of the CGIAR.


Hatibu N. 2006. Watershed development and natural resource management experiences in eastern and central Africa and the need for partnerships with south Asia in Integrated Management of Watersheds for Agricultural Diversification and Sustainable Livelihoods in Eastern and Central Africa: Lessons and Experiences from Semi-Arid South Africa. (Shiferaw B and Rao KPC eds.).


Output 9A. New tools and methods for management of multiple use landscapes and climatic variability with a focus on sustainable productivity enhancement, developed and promoted in collaboration with NARES partners in Africa and Asia

9A.1. Forecast-based farming options are tested and evaluated in Kenya by 2006 (9A)

Conservation Agriculture Techniques

A range of crop and natural resource management technologies defined under the rubric of conservation agriculture are being promoted in southern Africa. One set of practices, in particular, has attracted widespread attention – the digging of planting basins, and targeting of manure and fertilizer to these pits. This technique is now practiced by thousands of farmers in Zambia, under the auspices of a commercial cotton production scheme. Significant yield gains have been measured, though some question whether farmers would apply this practice if this was not a precondition to gain access to cotton production inputs. Questions also remain about the sources of the yield gain.

Almost three years ago, DFID and FAO started promoting the adoption of the planting basins technology in Zimbabwe under the country’s relief programs. ICRISAT was asked to provide training and technical support for this program. Our interest is two-fold – to assess the payoffs to the technology per se, and to assess the practicality of using NGOs and relief funding to promote such complex and knowledge intensive technical packages.

Objectives: Economic assessment of conservation agriculture techniques
Assessment of the levels and determinants of adoption.

Methodology: In close partnership with a team of soil and water specialists, economists have helped organize the assessment of conservation farming technologies being promoted in Zimbabwe under the relief programs. In Zimbabwe some NGOs have been promoting a standard package of conservation farming techniques. The package is all inclusive of the following practices; winter plowing, crop residue application, planting basin, manure precision application, basal fertilizer precision application, top dress fertilizer application, timely weeding and crop rotation. Data were collected through a range of survey techniques to assess the demands for labor, the competing demands for crop stover, and the capacity of NGOs to promote the implementation of such knowledge-intensive technologies.

Main findings & policy implications: The technology of planting basins is being widely adopted in both high and low rainfall regions of Zimbabwe, though we remain uncertain about whether this will continue after the relief programs end, and farmers no longer receive free inputs. In all likelihood some farmers will continue to apply this technology given apparent grain yield gains of 40-60 percent. This gain largely accrues to the targeted application of manure and fertilizer.

Most of the households in both the southern and northern districts of were implementing conservation farming practices for the first time in the 2005/06 season. Apparently, most of these farmers lacked any conservation farming experience particularly in implementing the recommended crop rotational practices. Some farmers claimed they did not have alternative seed for rotation. Some farmers changed the location of plots and planting stations in successive years. The changing of plot sites was because of the need to try alternative fertile land and move to more secure plots while the changing of planting stations was because previous basins were no longer visible and that they would be planting a different crop. Some farmers complained that the plots were not well protected from animals, as some were a distance away from the homestead. This led to some households relocating the plots to areas with better protection or closer to the homestead.

There is no evidence from the survey data to show that the planted area under conservation farming increases with experience. Data from households that have been practicing conservation farming for three successive years show no significant change in area planted over time. Although there was a lack of expansion in the areas planted to CF plots over the particular period, it is difficult to attribute this to failure of adoption of the technology. Most of the farmers rely on NGO inputs for their CF plots while some still view these NGO efforts as external relief programmes. It would be expected that under such circumstances where farmers are semi-independent and still testing a technology, changes in planted area could be due to other factors that are dependent on the amount and types of inputs that would have been provided by the NGOs. Targeted vulnerable households normally face a labor constraint, and it would be difficult for such households to expand area under CF.

The CF technology appears profitable depending on the opportunity costs of labor. Farmers are coping better than expected with the high labor demands of establishing the basins and weed control. Assuming that labor use becomes more efficient with time, it is estimated that after about three years of experience with CF, labor demand for establishing basins and weeding declines by one third. Therefore, it can be postulated that the returns to labor for planting basin practices will increase with time.

Despite costing more to produce maize using CF techniques, the level of yield gains achieved with this method result in farmers earning more profit from planting basins than the conventional methods. It costs more to produce a ton of maize under planting basins (ZW$18 million) compared to the conventional animal tillage practice (ZW$14.5 million).

The main failure in this system has been in the allocation of crop residues. Farmer behavior, and economic analysis, shows it is more profitable to feed residues to livestock than to feed these to the soil. This bothers many in the conservation agriculture fraternity who insist that ‘conservation farming’ requires the maintenance of crop residues in the field.
The team surveys have also highlighted the difficulties underlying the use of NGOs and relief funding to lead the relevant extension programs. Though the relief funding for this exercise has been consistent for the past three years, NGO staff turnover remains high, and most of these staff have little or no agricultural training. While such efforts to pursue sustained improvements in food security are laudable, changes in the modalities of relief funding are required to assure higher and more consistent payoffs. ICRISAT is in the process of a series of dialogues with various donors (and NGOs) on these questions.


Output 9B. Affordable and sustainable crop management options (nutrients, water management, crop-livestock, IPM, cultivar, rotations) developed and promoted in collaboration with NARES partners in Africa and Asia

9B.1. Small-dose fertilizer options verified and scaled out in Zimbabwe project completed and reported

Fertilizer Options for Drought Prone Semi-Arid Farming Systems

Most national extension recommendations are irrelevant to farmers living in semi-arid agro-ecologies. These farmers need options, not single ideal recommendations. These options must cope with the severe poverty and risk aversion characteristic of most of these households. Collaborative work on crop systems modeling highlighted the unexpectedly high payoffs to even small quantities of nitrogen based fertilizer. On-farm trials had confirmed the modeling results. But we still needed to prove these results on a larger scale.

Objectives: Prove the value of micro-dosing with nitrogen based fertilizers on a large-scale
Assess strategies for scaling out the application of such technologies

Methodology: Backstop support in organizing and monitoring more than 160,000 farmers receiving 25 kg allotments of ammonium nitrate fertilizer, and advice on how to apply this as a micro-dose, under drought relief programs in Zimbabwe.

Testing of small pack fertilizer sales with a commercial company in Zimbabwe

Backstop support for a related program testing micro-dosing linked with commercial sale of small fertilizer packs in South Africa

Main findings & policy implications: ICRISAT’s initiative to promote the testing of micro-dosing with nitrogen based fertilizer provided more than 200,000 farmers with average yield gains of 30-50% in 2003/04, 2004/05 and 2005/06. Available data indicate 95% of the recipients of the small fertilizer doses and technical advice received positive yield and income gains. In effect, this technology is remarkably robust. This has significantly enhanced the welfare of many of the poorest and most food insecure farm households in Zimbabwe.

ICRISAT data has correspondingly highlighted the substantially higher payoffs to fertilizer as opposed to seed distribution under relief programs. Initially, donors and NGOs argued that fertilizer distribution was too risky in drier, drought prone regions. Some are now starting to acknowledge that the payoffs to fertilizer distribution, measured in terms of improved food security, may be highest in these drier regions where the gains accrue to poorer households in outlying areas who would normally have to pay higher prices to purchase food.
Unexpectedly, however, we continue to encounter resistance to the promotion of micro-dosing among professional agronomists in the national research service and regional community. Farmers and local extension workers are extremely enthusiastic. But these gains so contradict the disciplinary training of many agronomists that they refuse to accept them. ICRISAT continues to support this initiative, if only to gather such a preponderance of evidence of impact that the strategy cannot be ignored. In the process, we aim to encourage national (and some international) agronomists to re-think how technologies suited to the circumstances of small-scale farmers in risk-prone regions are defined.

The fertilizer trade was also initially skeptical about these results. They claimed they wanted to sell more fertilizer rather than less. However, two of the major fertilizer manufacturers in southern Africa (SASOL in South Africa and the Zimbabwe Fertilizer Corporation in Zimbabwe) have now expressed interest in investigating the pay-offs of packing fertilizer in smaller packs of below the 50kg bags. Both are linked with ICRISAT teams of economists and agronomists to test sales of smaller sized packs of fertilizer targeting first time users. These are being organized on commercial terms with rural retailers. The early results are promising.

In South Africa, specifically, distribution of small packs of fertilizer which had occurred in 2004/05 and 2005/06 seasons was evaluated in 2006. This was a result of a joint effort amongst four institutions—ICRISAT, SASOL Nitro (manufacturer of fertilizer), Limpopo Department of Agriculture (provider of public goods) and Progress Milling (collector of grain and distributor of mill meal among other products in Limpopo Province. Each one of these four have different mandates but agreed on a common purpose—making available small packs of fertilizer with a view to improve access by those cash constrained households.

Preliminary results indicate that there is no across the board preference for small packs—it is mainly a function of location, extent of the use of fertilizer in the area in the past, the type of land holding and farming practices. This therefore indicates that there is need to target the provision of the small packs. It was also established that better results of uptake could have been obtained had the fertilizer not arrived late. This was to be corrected in the following season. In addition, there is need for deliberate effort to strengthen knowledge and skills on fertilizer. More coordinated efforts amongst dev practitioners in the target areas—depot managers, extension officers and farmers. In a number of cases some people did not know that small packs of fertilizer had arrived in the depots.

A key challenge still remains—will the manufacturer (SASOL Nitro) and the distributor (Progress Milling) find the small packs a profitable venture? The distribution will again be repeated next season and more data will be collected to test this hypothesis.


**Isaac Minde J, Nicodemus Mailula and Tarisai Pedsiza.** 2006. Uptake of small packs of fertilizer by smallholder farmers in South Africa: How profitable is it?. A draft report

**9B.2. A suite of practical fertility management options for smallholder farmers in drought prone regions with varying resource levels and household objectives**

**Assessing the diffusion of point application of fertilizers in Niger (links to SP4) (WCA)**

Rationale: Poor fertility of sandy Sahelian soils remains one of the major constraints to cereal production. Yet, smallholder farmers in the Sahel consistently disregard fertilizer recommendations coming from scientists and extension to improve soil fertility. These recommendations are often not compatible with households’ resource levels. In an effort to develop technologies that are more likely to be adopted by smallholder farmers, scientists conducted research from 1994 to 1996 on point application of fertilizers or micro-dosing technology consisting of application of 4 grams of P hill placed next to- or in the planting hill.
with pearl millet seed. This technology was tested on-farm from 1996 to 1998 under farmers’ management. Extension agents, NGOs and rural development projects started disseminating this technology throughout Niger in 1996, but little is known about its current level of diffusion.

Methodology: A participatory rural appraisal (PRA) survey was carried out from December 2002 through February 2003 with main objectives to assess farmers’ perception of the strengths and weaknesses of the micro dosing technology in 12 villages from the regions of Tillabery, Maradi or Zinder in Niger. This was followed by a structured household survey between March and April 2003 in the villages where the PRA was undertaken. In addition, 6 villages were added to the sample in order to include villages where there were no demonstrations of the technology. This provided a counter-factual for assessing the diffusion of micro-dosing technology. Overall 18 villages were selected. This was followed by systematic selection of all demonstrators (farmers who did the demonstrations) in each of the 18 villages from 3 agro-climatic zones. Thus a total of 91 demonstrators were interviewed.

Results: Results showed that 19 percent of the demonstrators were using the technology outside the initial demonstration plots. The technology was applied on about 8 percent of the total area cultivated by demonstrators. The major strengths of this technology reported by farmers included large yield gains, good germination and high tillering. High labor requirements, plant burning and high fertilizer costs were reported as major weaknesses. In addition, poor information flow between demonstrators and non-demonstrators, the perception of their roles in technology transfer, limited experimentation, technological packaging, and high opportunity cost of labor at planting time are other important constraints to uptake.


Output 9C. Environmental impacts of livestock intensification reduced during droughts and the dry season by developing and promoting alternative feed and fodder strategies in crop-livestock systems

9C.1. Dual purpose food-feed trials progress report

Promotion of farmers’ participatory management of groundnut diseases for higher yield and nutritive value of crop residues (haulm) used for peri-urban dairy production on the Deccan Plateau in India (Asia)

Purpose: Dissemination and promotion of improved dual-purpose groundnut cultivar in the Deccan Plateau of India. The goal was to improve food security and increase incomes of peri-urban dairy producers from the sale of crop residues and livestock products.

Background: In the Deccan Plateau of India groundnut accounts for more than 70% of the cropped area. Groundnut haulms are an important source of animal feed. Income from livestock and sale of livestock products constitutes an important source of earnings for the landless, and small and marginal farmers. A major output from the earlier project was the identification of disease-resistant, dual-purpose cultivars capable of producing high yields of grain and nutritious stover / haulm, as part of an integrated disease management strategy. More than 1000 marginal and small farmers have been trained in the use of IDM technology and many more have been sensitized through demonstrations, leaflets, media, etc. Farmers adopting the technology are increasing their gross returns from groundnut crop due to higher pod and haulm yield and higher milk yield from dairy animals fed with straw of the improved disease resistant cultivars.

Based on past research farmers identified new groundnut cultivar ICGV 91114 resistant to foliar diseases to meet their multiple requirements. Secondly, resistance to foliar disease is found to be positively correlated with mycotoxin resistance, which is a serious threat to animal health and through milk to human health.
Progress: Under the current project the up scaling and out scaling of the improved technology was carried out through training and capacity building of NGOs, local organizations and farmer SHGs in disease management, seed production / distribution and crop management technology. The extension wing of the State Agricultural University based in Ananthapur, DATTAC, a partner in the project, is playing an important role in disseminating the new technology to local NGOs based in Ananthapur, Kurnool, and Chittoor districts in Andhra Pradesh. Another NGO partner RORES in Karnataka is taking the lead role in spreading the technology in Kolar and Tumkur districts of Karnataka. Concurrently, community based village level seed multiplication and distribution system are being strengthened under the supervision of local NGOs for their long-run sustainability.

Another important activity was tracking the spread of improved groundnut cultivar through reconnaissance surveys in the major growing areas of Andhra Pradesh and Karnataka. Findings indicate that the improved cultivar is being grown in more than 120 villages covering 4 districts in Andhra Pradesh state and 3 districts in the neighboring Karnataka state. A large majority of these villages fall in the low to medium rainfall regions indicating its importance for small farmers in marginal areas. The information on its widespread adoption will help in sensitizing the government officials about its popularity and the need for integration with the formal seed multiplication and distribution system. The short-term impacts of the adoption of the technology at the household level measured in terms of higher crop, haulm and milk yields are already visible. The medium and long term impacts on the overall quality of life of the farming community measured in terms of asset acquisition, health, education, investment in agriculture, etc., can be documented only after the technology has gone through its full course.

The project directly contributes to the purpose of developing pro-poor strategies to reduce the impact of key pests, improve yield and quality of crops, and reduce pesticide hazard in peri-urban systems. The ongoing livestock revolution will provide opportunities for increased production and marketing of milk and meat thus augmenting the income of marginal and small-scale farmers who derive a large share of their income from livestock activities.


9C.2. Design and implementation of evaluation systems of livestock relief and recovery interventions experience published by 2006

Crop-Livestock Systems Development (ESA)

Farm surveys conducted in Zimbabwe in the early 1990s revealed a farmer preference for investing in livestock enterprises in the country’s extensive semi-arid areas. While crops were commonly produced for food security (to reduce the need to purchase grains), livestock were viewed as a more profitable investment enterprise. ICRISAT hired a rangeland ecologist in 2003 as the coordinator of the Desert Margins Program. One former ICRISAT economist joined the International Livestock Research Institute (ILRI) to lead their Targeting Research and Development Opportunities Program. This created a basis for initiating a review of ICRISAT’s crop-livestock systems development priorities in southern Africa. This has evolved into a growing program on crop-livestock systems development. Underlying is the acknowledgement, that the potential of market-led technology development in crop–livestock systems has not been sufficiently exploited by research and development.

Objectives:
Assess the strategic prospects for the development of crop-livestock systems for enhancing productivity in southern Africa.
Develop and test strategies for linking livestock market development with investments in farm level inputs, especially animal feed and fodder.
Evaluate the impact of market driven intensification of feed and fodder management on farm income and equity.
Evaluate the impact of improved natural resource use and alternative feed systems on rangeland.

Methodology: A comparative assessment of the crop-livestock systems development strategies in 5 countries of southern Africa was conducted in conjunction with ILRI: Zambia, Zimbabwe, Botswana, Mozambique and Namibia. These were chosen to reflect the variation in agro-ecologies and markets in the region. Country level experts were used to collate existing data illustrating the recent (last 20 years) trends in number, production/productivity, demand for livestock products and support to the sector as well as country specific challenges and opportunities.

Results of the ICRISAT/ILRI study have led to hire a post-doctoral scientist (livestock farming systems development), in order to initiate a more detailed assessment of the evolution of crop-livestock systems in the SAT of Zimbabwe, focusing on market-led technology development in dry season feeding of livestock. A collaborative (including NARS and NGOs) baseline diagnosis of goat and cattle management and marketing was done through household surveys in six districts. The surveys were carried out from April to August 2005, covering the 2005/2006 production season. Data captured socioeconomic household characteristics, livestock functions and contributions to livelihoods, herd dynamics, management and marketing parameters, in order to characterize farm profiles of dry season feeding investment. These results have contributed to the development of a larger regional program on livestock and livelihoods in southern Africa (Mozambique, Namibia, Zimbabwe). A proposal submitted to SADC, Implementation and Coordination of Agricultural Research and Training (ICART), Competitive Regional Agricultural Research Fund (CRARF) was successful in late 2006. ICRISAT will collaborate with ILRI and NARS partners to analyze small-scale farmers’ opportunities in participating in livestock markets and alternative input delivery systems, and the relationship between market development and farmers’ investment patterns, especially in feeding technologies. Subsets of best bet feeding technologies will be developed, tested and demonstrated under local farming conditions and multi-stakeholder participation.

Main findings & policy implications: During the past 25 years, livestock production has tripled and per capita consumption has doubled in most of the developing world. The developing countries accounted for 80% of the growth in global livestock production. The ICRISAT/ILRI study shows that this “revolution” has however largely by-passed southern Africa, strong indication for a clear role for further research and development in the livestock sector in the region. Growth in livestock production in the SADC region has averaged less than 1.5% and per capita consumption of livestock products is falling. In some countries and sectors, export growth is being replaced by the pursuit of import substitution.
The failure of the livestock sector can be partly attributed to public under-investment. Though most farming systems are characterized as mixed crop-livestock enterprises, agricultural investment programs tend to emphasize crop production – even in the extensive systems and drought prone semi-arid regions. Furthermore, livestock policies have historically emphasized the pursuit of beef exports to Europe. The commercial sector has breeding and feed systems that meet European quality standards and veterinary controls to meet phyto-sanitary requirements. Public breeding and livestock management support is often targeted to large commercial producers. Programs targeting poorer smallholders emphasize disease control systems important to maintaining the national herd. Livestock management support is limited. Increased production is hampered by poorly developed input and support services, especially related to animal feed to maintain production during the dry season. In effect, most smallholders are viewed as residual suppliers of low value meat to the local market. Yet, the role of livestock is changing rapidly in most of the southern Africa with recent changes in governments and land reform strategies offering opportunities for small scale livestock keepers to enter in commercial markets.

The question remains how to facilitate the movement from extensive crop livestock farming systems to systems with higher in-puts achieving higher off-take and quality products. This interest has grown as these countries have begun to experience shortages of livestock products for domestic consumption. As populations, incomes, and urbanization has grown, the demand for livestock products has increased.

In Zimbabwe the production of beef has declined substantially. Fast track land reform has caused a reduction of the commercial cattle herd by 75% from 1996 to 2004, while recurrent droughts contributed to further losses of cattle in the small-scale farming sector. During the same time the goat population has increased, with more than 90% of the goats owned by small-scale farmers. Prices for goat meat are now at the same level as beef, offering opportunities for small-scale goat farmers to enter commercial markets.

Although traders are increasingly buying cattle from smallholder farmers, there has been limited improvement in animal condition and therefore product quality. The commercial market for goats and sheep remains grossly underdeveloped. Transaction costs are high and most trade remains on the informal market. Pig production remains concentrated in the hands of a few large-scale producers. While most smallholders keep poultry, almost all of the poultry meat and eggs flowing through the commercial market are derived from a small number of larger-scale enterprises. Similarly, though there have been a number of efforts to promote small-scale dairy production, most milk and related products are derived from a few larger producers.

The baseline diagnosis by ICRISAT and partners highlights that particularly goats contribute to income and food security of farmers. In the SAT of Zimbabwe 39% % of the goat keepers did not own cattle. Cash income from goats is crucial to cover day-to-day expenditures for food, education and human health. Cattle are more important for draft power and milk, and support subsistence cropping activities. In addition, many women own goats and actively participate in decision-making and management. Targeting women and vulnerable groups for improved market access and investment in goat production would significantly contribute to improving household nutrition and income. Yet, farmers cannot realize the full potential of their flocks. Only 11% of the goat flock is sold and 7% is slaughtered for household consumption, while mortality at 26% results in huge losses. 93% of the farmers cited dry season feed shortages as a major production constraint - this particularly affects farmers with small herds. Most farmers started using crop residues for their goats, although the nutritional value in the dry season is low. With limited access to markets and poor market information, farmers do not have the incentive to intensify feeding technologies, and livestock production and off-take remain low.

The regional project on livestock and livelihood is developing approaches to integrate small-scale farmers into commercial livestock markets and to illustrate how increased market participation can contribute to stronger investment in feed production. The pilot schemes for livestock intensification through market-led technology change target three countries, implemented by strong partnership between public and private sectors. Best bet technologies will be selected in the course of evaluating existing market systems. An important outcome of the project is documenting the process of multi-stakeholder dialogue for linking
farmers to markets. Lessons learned will be shared at a regional forum for judging potential transferability and wider application in other countries.
