Au-delà de l'Agriculture de Subsistance

Faits saillants 2013

ICRISAT
West and Central Africa
2013 Highlights

Moving beyond Subsistence Farming
About ICRISAT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. Covering 6.5 million square kilometers of land in 55 countries, the semi-arid tropics have over 2 billion people, and 644 million of these are the poorest of the poor. ICRISAT and its partners help empower these poor people to overcome poverty, hunger, malnutrition and a degraded environment through better and more resilient agriculture. ICRISAT is headquartered at Patancheru, near Hyderabad, Telangana, India, with two regional hubs and five country offices in sub-Saharan Africa. ICRISAT is a member of the CGIAR Consortium.

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The cover shows farmers during harvest season and a young lady playing a musical instrument. It is common in Mali, and more generally in West Africa, to play music both to encourage field workers and to celebrate the harvest.
ICRISAT has started a smart food campaign to show the additional health benefits from the semi-arid tropic (SAT) crops such as millet and sorghum. We are delighted to see a growing interest in these ‘poor man’s crops’ that are very important given conditions for our farmers in WCA.

The power of partnership in advancing food security and poverty reduction remains crucial to our interventions, and 2013 saw partnership strengthening with regional organizations and APEX bodies in WCA. A highlight was the partnership forum held by ICRISAT, the Senegalese Agricultural Research Institute (ISRA) and the West and Central African Council for Agricultural Research and Development (CORAF/WECARD), during ICRISAT’s Governing Board meeting in Senegal in April when new Memoranda of Understanding were signed with regional bodies such as CORAF/WECARD and the West African Centre for Crop Improvement (WACCI).

Throughout the year we put together strategies to better strengthen relationships with the national agricultural research systems and explored ways of enhancing funding both from external and national sources. A prime example is the case of Nigeria where the groundnut value-chain project is one of the signed agreements between ICRISAT and the Federal Government of Nigeria towards creating wealth through value chains. The main project objective is to rebuild Nigeria’s groundnut pyramids through the science-based approach embedded in IMOD and drive the development of the groundnut pyramids.
subsector in conjunction with stakeholders to improve production, processing, marketing and exports.

The second agreement signed in 2013 by ICRISAT and the Nigerian government covers “Boosting sorghum production, commercialization and industrial utilization through value-chain, public-private-partnerships”. Spillover effects from the Nigerian experience are also expected to bring increased bilateral funding into our research activities in sub-Saharan Africa (SSA).

Research is not a sprint but a marathon. Reaching the forgotten poor of the dryland tropics of SSA involves investing in long-term issues. With guidance from our Governing Board, we have taken several decisions over the past 12 months to prepare for the institute’s long-term future especially in sub-Saharan Africa. We initiated and are following up on an external review looking at how best we can structure the organization and the overall functioning of the institute to better deliver impact on the lives of our target, the smallholder farmers in sub-Saharan Africa. Gender mainstreaming is now at a critical crossroads and the relevance of addressing gender in development and implementation of ICRISAT’s overall research activities.

Finally, we are thankful to each and every one of our partners for their contributions to the ICRISAT Mandate. We deeply appreciate and value your thoughtful inputs towards improving the livelihoods of small-scale farmers.

William D Dar
Director General
were organized on nutrition, integrated soil fertility and *Striga* management, and integrated management of aflatoxin, as well as capacity building for producers organizations to promote resilience and adaptation to climate change. A significant number of women attended and benefited from these training sessions. More than ever before, climate change is affecting the region, and has led to late rains, periods of drought during the cropping season, and heavy rains causing extensive damage in the region. In turn, we continued our research on adaptation to climate change, with focus on the selection of appropriate varieties, natural resource management, and technology transfer in partnership with several institutions under the CGIAR Research Programs on Dryland Systems (DS) and on Climate Change, Agriculture and Food Security (CCAFS). Furthermore, several initiatives were undertaken with support from our financial partners; for example, the Farmer-managed seed enterprises project (FARMSEM), funded by USAID and aimed particularly at improving cereal productivity and promoting the emergence of a seed industry to make improved seeds of sorghum and other crops available and accessible to producers and their organizations through more extensive use of the seeds of new and improved varieties.

ICRISAT attended the Sixth Science Week of the Forum for Agricultural Research in Africa (FARA) held in June 2013. Among the key personages present was the President of the International Fund for Agricultural Development (IFAD), Dr K.F. Nwanze, who delivered a strong message of hope for the agricultural sector in Africa. He particularly underscored the key role of research in agricultural development, and mentioned how technologies, such as fertilizer microdosing developed by ICRISAT, can significantly increase the yields of certain cereals. ICRISAT also had the honor of receiving the IFAD President at Sadoré Research Station in Niger, where he had served both as a scientist and as Director.

Our cooperation agreements with the Federal Ministry of Agriculture in Nigeria helped to establish research work on value chains for sorghum and groundnut. The implementation of activities under these agreements will increase the production and productivity of these very important crops in Nigeria.

As regards scientific research, our research teams carried out significant work, of which some results are presented in this report. Our researchers also allocated major resources to training; several training sessions were organized on nutrition, integrated soil fertility and *Striga* management, and integrated management of aflatoxin, as well as capacity building for producers organizations to promote resilience and adaptation to climate change. A significant number of women attended and benefited from these training sessions.

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Message from ICRISAT Director for West and Central Africa

The year 2013 was marked by major events for ICRISAT West and Central Africa. For the first time in the regions, the ICRISAT Governing Board meeting was held outside the Institute’s research stations. Indeed, with the support of the Senegalese Agricultural Research Institute (ISRA) and the West and Central African Council for Agricultural Research and Development (CORAF/WECARD), the ICRISAT Governing Board meeting was held in Dakar in April 2013. This event also witnessed the conclusion of cooperation agreements with Senegal, and strengthened our cooperation with CORAF/WECARD.
ICRISAT continues to enhance its contribution to the region, as shown by its capacity to attract funding from development partners. Among key projects in our portfolio are the Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) Project funded by USAID and currently being implemented in Mali; the main program objective is to identify and validate suitable options for sustainable intensification of key farming systems to increase agricultural production and improve the livelihoods of small-scale farmers, as well as safeguard or improve the natural resource base.

Other major projects are funded by the McKnight Foundation, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the International Fund for Agricultural Development (IFAD), the European Union, the International Development Research Centre (IRDC), “Harnessing Opportunities for Productivity Enhancement” (HOPE) global project, and the tropical legumes project (TL2), which is drawing to a close and intends to embark on a new phase. We are working with many partners to improve cereals and legumes, including national agricultural research systems (NARS) and sub-regional umbrella organizations such as CORAF/WECARD in the implementation of seed system programs in West Africa (WASP) funded by USAID and the Australian Agency for International Development (AusAID).

Partnership is the key to success not only for developing appropriate technologies but also for helping to transfer them to our farmers. In 2013, several cooperation frameworks were defined and memoranda signed. Several other collaborative projects with NARS, NGOs, farmer associations and the private sector were implemented. A Memorandum of Understanding was signed with the Senegalese Agricultural Research Institute, as well as with the West African Centre for Crop Improvement (WACCI). The institute also helped to establish partnership ties between producers and members of the private sector in the marketing of agricultural products in Mali and Niger, and sustained efforts are being made to strengthen these ties which are consistent with the inclusive market-oriented development (IMOD) strategy adopted by ICRISAT for 2020.

At the close of my tenure as ICRISAT Director for West and Central Africa, I wish to thank all our partners with whom I had the pleasure of working to improve productivity among farmers in the region. I thank all the partners who supported our activities at the technical and financial levels, and all those who bestowed their confidence in us. May ICRISAT continue to make efforts towards a radiant West and Central African tropical zone.

Farid Waliyar
ICRISAT Director for West and Central Africa

Moving beyond subsistence farming
Contracts to help farmers step up to market-oriented agriculture by linking them to markets

Contracts between grain producers and processors negotiated before harvest in less risky producing areas and based on cash payment and grain quality checking are a step from subsistence towards market-oriented agriculture.

Linking farmers to markets, particularly in the dryland areas, is critical to agricultural transformation, according to the scientists who conducted a study¹ of the contractual preferences of grain producers in Niger and Nigeria. Farmers do not have easy access to inputs and product markets in the Sahelian countries. As a result of these missing input markets and lack of market opportunities for the main crops (sorghum, pearl millet and groundnut), there are few incentives to use modern technologies. Consequently, only a small amount of farmers’ production is traded. When assured of a ready market, farmers are willing to adopt supply-enhancing technologies and achieve more marketable surpluses. Any institutional or policy innovation that could provide farmers and others with ready markets is likely to bring improvement.

Better access to either inputs or product markets by linking value-chain actors is part of a dynamic process that allows farmers to move from a state of subsistence to market-oriented agriculture. Stakeholder meetings held in Niger and Nigeria on sorghum and pearl millet value chains indicate that the lack of a consistent supply of high quality grains from producers to processors is one of the major constraints limiting value-chain efficiency.

Contracts are essential in ensuring ready access of producers or processors to product and input markets. The major benefits of contract farming include access to high-value markets, provision of inputs at lower cost and of extension services, access to agricultural technology and access to credit. But, there are risks that small-scale farmers may be excluded; that decision-making may be displaced from the farmer to the other contracting party; and that contracts may not be enforceable. Therefore, more small farmers must participate in the contracting process and contracts must be based on the preferences of both contracting parties.

As a potential better strategy for linking producers to processors, contracts promote better coordination of the supply of high quality grain and provide producers with assured markets. Not every type of contract is sustainable; identifying contract attributes preferred by both producers and processors is essential to designing and ensuring sustainable contracts. An understanding of the contractual attributes is also essential to target the poorest of the poor.

Surveys were conducted in Niger and Nigeria to identify the contractual traits preferred by 975 grain producers and 195 processors. During the stakeholder meetings and formal groups’ interviews, six potential attributes were elicited, each with two or three levels. Identification of these attributes enabled 120 and 165 potential contracts, respectively, to be presented to respondents in Niger and Nigeria following a full factorial design. The high number of potential contracts meant an orthogonal design was used to extract an incomplete design of 10 alternative contracts in Niger and 11 alternative contracts in Nigeria from the full factorial design, while maintaining a high level of variability. Table 1 presents the contract attributes and levels in Niger and Nigeria.

Survey results showed that 65% of producers and 77% of processors preferred their reference alternative against the proposed contracts in Nigeria (Figure 1).
<table>
<thead>
<tr>
<th>Country</th>
<th>Attributes of contracts</th>
<th>No. levels of attributes</th>
<th>Levels of attributes</th>
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<td><strong>Niger</strong></td>
<td>1. Period of contract negotiation</td>
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<td></td>
<td>2. Quality of grain</td>
<td>2</td>
<td>Don’t check</td>
</tr>
<tr>
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<td>3. Mode of payment</td>
<td>2</td>
<td>Cash</td>
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<td>2</td>
<td>With the Police</td>
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<td>1. Location of delivery</td>
<td>3</td>
<td>Producers’ place</td>
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<td></td>
<td>2. Packaging size</td>
<td>2</td>
<td>100 kg</td>
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<tr>
<td></td>
<td>3. Price setting</td>
<td>3</td>
<td>Market price</td>
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<tr>
<td></td>
<td>4. Mode of payment</td>
<td>2</td>
<td>Cash</td>
</tr>
<tr>
<td></td>
<td>5. Quality of grain</td>
<td>2</td>
<td>Don’t check</td>
</tr>
<tr>
<td></td>
<td>6. Dispute resolution</td>
<td>2</td>
<td>With third party</td>
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producers, the most preferred contracts were those with the attribute “payment in cash”. As for processors, all the preferred contracts shared the attribute “quality checking”. Two contracts out of 10 matched the preferences of both producers and processors. These contracts particularly highlighted “quality checking”, “payment in cash” and “price set after harvest”.

However, the results revealed some significant differences in the contractual preferences of Niger’s poor and non-poor producers. Very few contracts matched the preferences of poor producers while non-poor producers were satisfied with most of the proposed contracts. In addition to the common traits preferred by all producers, poor producers were typically inclined to select contracts negotiated before harvest due to the perceived advantage of guaranteeing income or presenting lower income risks for the ensuing cropping season.

In both Niger and Nigeria, there were two important characteristics that producers and processors preferred, and around which contractual arrangements

Respondents adjudged some contracts as attractive based on higher prices but their association with payment on credit meant they were not necessarily preferred. The lower interest in these contracts was explained by the high rate of time preference by respondents, the low level of trust, lack of good enforcement mechanisms and the moral hazard issues.

Producers expressed some preference for contracts sharing the attribute “payment in cash”, while processors expressed some preference for contracts that all shared the attributes “payment in cash” and “quality checking”. Most producers and processors rejected potential contracts that included credit. There was no significant difference in Nigeria between the poor and the non-poor in their contractual preferences, suggesting that there would be no need to design specific contracts to target farmers based at the poverty level.

Figure 2 depicts matching preferences in Niger. More than 70% of producers and 80% of processors selected contracts rather than the local practice. Among producers, the most preferred contracts were those with the attribute “payment in cash”. As for processors, all the preferred contracts shared the attribute “quality checking”. Two contracts out of 10 matched the preferences of both producers and processors. These contracts particularly highlighted “quality checking”, “payment in cash” and “price set after harvest”.

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In both Niger and Nigeria, there were two important characteristics that producers and processors preferred, and around which contractual arrangements
should be designed: “cash payment” and “quality check”. Controlling for grain quality remained a key driver of contract choice for processors and producers. While processors reduce the costs of processing via access to good quality grains, producers earn more revenues by receiving premiums for grain quality, the survey revealed. Both preferred cash transactions.

In the imperfect credit market environment with its lack of enforcement mechanisms, producers and processors will avoid all transactions subject to high moral hazard and will avoid transactions such as credit that mature in the future. There are, however, some country specificities in the willingness of producers and processors to accept contracts. Compared to Niger, producers and processors from Nigeria were less willing to accept contracts because of a lack of legal enforcement mechanisms. While this strengthens the importance of creating an enabling legal and institutional environment for contracts, it also supports the principle of repeated contractual relationships to increase and build trust and reputation among producers and processors.

Further confirmation of the need to design appropriate contracts was gained from research under the Harnessing Opportunities for Productivity Enhancement (HOPE) project in Niger. Grain producers were linked to processors via 17 contracts at project sites with the aim of drawing lessons that could be incorporated into future contractual arrangements.

Contracts were set up between women’s processing groups in Niamey and farmers’ organizations in Bokki, Tera, Dantchandou and Falwel. Five contracts were initiated during the cropping season 2012/13 and 12 contracts during the 2013/14 cropping season. Contracts that matured to the satisfaction of both parties were those that matched the preferences of farmers and processors based on six attributes (timing of contract negotiations; verification of grain quality; place of product delivery; mode of payment; price setting and dispute resolution). Quality checking was systematically accounted for in all 17 contracts. During the 2012/13 round, only one contract was judged successful out of the five. During the second round in 2013/14, eight contracts were successful.

Factors explaining the failure of contracts included (1) the lack of access to working capital for processors; (2) the existence of competing marketing alternatives offering higher prices to farmers or lower prices to processors; and (3) the climatic risks in some producing areas.

Lessons learned from these contracts were:

- **Need for working capital**
  Processors need credit to purchase raw materials and to increase their processing capacity;

- **Better institutional and legal environments**
  Mechanisms for contract enforcement should be devised to reduce opportunism by contracting parties during the course of contracts;

- **Avoidance of contract negotiations in highly climate-risky producing areas**
  Low production risks are necessary to establishing contracts, especially in the Sahel environment;

- **Adoption of pre-harvest contract negotiations to respond to the preferences of poor producers**
  Due to income risk and for resilience reasons, poor producers expect contracting to guarantee revenues before harvest.

From policy and technological perspectives, interventions to reduce the occurrence of contract failure require the following: (1) norms and standards to help clearly specify grain quality on which to build contracts; (2) access to adequate credit for processors; (3) use of innovative mechanisms to enforce contracts; (4) adoption of food aid policies which do not lead to market distortions in high producing areas; and (5) development of drought-tolerant technologies, crop management techniques and crop insurance mechanisms for farmers.

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1The study of the contractual preferences of grain producers and processors in Niger and Nigeria was conducted for the Flagship “Value Chains” within the CGIAR Research Program “Policies, Institutions, and Markets to Strengthen Food Security and Incomes for the Rural Poor” and the activity cluster “Diagnosis of bottlenecks and design of interventions to address value chains”.

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Moving beyond subsistence farming
and has expanded significantly over the last few years because of increasing demand for food and animal feed due to increasing population and pressure on land. However, productivity can be constrained by environmental (temperature), abiotic and cultural factors.

Dry season irrigation is not new to Northern Nigeria where it plays a key role in the economics of farmers but large-scale groundnut production has ballooned in the hottest months thanks to a participatory variety selection program.

Not only are farmers, who have previously concentrated on vegetables, green maize and wheat, able to get worthwhile groundnut yields, they can also supply the market for maximum returns at a time of peak demand.

The practice of dry season irrigation provides an important source of food, income and employment, and has expanded significantly over the last few years because of increasing demand for food and animal feed due to increasing population and pressure on land. However, productivity can be constrained by environmental (temperature), abiotic and cultural factors.
Window of opportunity
The dry season starts in November (after harvest of wet season crops) and ends in May (beginning of rains), but seasonal variability can hit production badly. When wet season crops are harvested late, the wheat yields are significantly reduced as the crop falls into the hot months of March–May. On the other hand, low temperature during the early part of the dry season (November to January) implies most tropical crops will not perform well during this period. However, temperatures start rising by the end of January, creating a window of opportunity from February to May, although extreme daytime temperatures (frequently at 40°C) during April and May means only heat-tolerant crops/varieties can be grown.

ICRISAT conducted a preliminary evaluation of 21 elite groundnut varieties, along with local checks, with two farmer groups (male and female) during the dry 2011 season (February to May). The farmers participated in participatory varietal selection (PVS) of groundnut varieties and provided pairwise ranking of attributes. While the women ranked grain yield and oil content as the most important attributes of groundnut varieties, the men gave the highest rankings to fodder yield and drought resistance.

Further gender differences were noticed in the PVS, with over 90% of men casting their votes for only four of the 22 varieties, while female votes encompassed 50% of the varieties at the trial in Minjibir, Kano State. Harvest results led ICRISAT Nigeria to conclude that groundnut can be profitably cultivated during this dry period. Pod yields ranged from 0.8 to 1.8 t/ha, with five varieties yielding more than 1.5 t/ha. Fodder yield ranged from 0.2 to 3.3 t/ha, with eight varieties yielding above 2 t fodder per ha. The produce was available just as both seed and grain reached their peak prices in the market.

One tested variety (ICIAR19BT) was officially released in Nigeria as SAMNUT24 during 2011. It is well suited to dry season cultivation thanks to being extra-early (70–80 days) with high pod and fodder yields, and resistance to rosette disease as well as drought tolerance.

Large-scale adoption
The need to stimulate seed production encouraged ICRISAT Nigeria to collaborate with the Institute for Agricultural Research (IAR) in Zaria and with farmer groups to fully demonstrate varietal performance for grain, seed and fodder production in the dry season. Farmers and policymakers attended several farmer field days, resulting in large-scale adoption of dry season groundnut cultivation. From an initial six farmers cultivating the improved groundnut variety in the 2012 dry season, more than 1000 farmers grew the variety in 2013.

Dry season groundnut farming to maximize the use of irrigable farmlands and produce quality planting material is now being introduced by ICRISAT Nigeria, in collaboration with IAR and the Federal Ministry of Agriculture and Rural Development (FMARD) through the Groundnut Value Chain (GNVC) that aims to improve the livelihood of smallholder farmers. H.E. Dr Akinwumi Adesina, the Federal Minister of Agriculture, approved the inclusion of dry season groundnut cultivation with dry season crops supported by the Growth Enhancement Scheme (GES). FMARD gave seed and fertilizer to 675 farmers through the GES to cultivate 675 ha of land during the 2013/2014 dry season.

Unlike vegetables and fruits grown in the dry season, the groundnut produced during this period coincides with the period of demand for groundnut seeds so seed growers can enjoy a readily available market. In addition, the fodder from groundnut crop residues in the dry season provides a good source of income to the farmers at a time when fodder is usually at its most expensive. Nor is groundnut affected by post-harvest losses and market congestion as in the case of fruits and vegetables.

This work is being undertaken as part of the CGIAR Research Program on Grain Legumes.
A group of family farmers in Niger are celebrating the International Year of Family Farming (IYFF 2014) by showing how income from millet seed production and marketing can lift them from poverty.

The immediate visible benefits include children going to school for the first time thanks to profits from seed production, and a general rise in living standards in the village in southwestern Niger where male and female farmers have cooperated in growing new varieties and learning Certified Seed production and marketing methods.

These activities are expected to increase during the United Nations (UN) International Year of Family Farming (IYFF 2014), which aims to stimulate policies for the sustainable development of farming families, communal units, indigenous groups, cooperatives and fishing families. The Year focuses on solutions to combat poverty and hunger, and the UN has underlined that it considers family farming and smallholder farming to be important for sustainable food production to achieve food security.

Over the past decade, the ICRISAT Sahelian Center-based pearl millet breeding program has examined several aspects of pearl millet production technologies with members of the Made Bane Farmers’ Union — affiliated to the Mooriben Farm Union Federation — at Falwel, in Niger’s Dosso Region.

This has resulted in the replacement of under-performing local millet varieties and a steady growth in the production of Certified Seed of improved millet varieties, which now far exceeds local needs.

The first step was the provision of varietal test kits to allow large numbers of farmers to evaluate many new varieties in competition with their local pearl millet varieties. After a year of testing, farmers selected several of the previously released improved varieties for multiplication and further evaluation. Following further testing, the union members decided to multiply and market seeds of three improved varieties:

- ICMV-IS 89305
- ICMV-IS 94206
- SOSAT-C88

The early variety SOSAT-C88 has since been replaced by ICMV-IS 99001, which has the longer panicles preferred by farmers across much of western Niger, as well as the grain quality preferred by the emerging small-scale food processing enterprises there.

Farm union members were trained in the requirements for formal seed certification (crop rotation, monoculture and maintenance of adequate isolation distance, as well as regular and thorough roguing to remove off-type plants — preferably before flowering), and for basic business record keeping. Area and production of Certified Seed have grown year-on-year, to 2013 production of 85 tons of Certified Seed (see Table 2). The surplus is being sold to members of other unions, as well as to government programs and private seed companies.

Thanks to the additional income from this pearl millet seed production and marketing, producers at Falwel have
seen their living conditions improve substantially. In particular, farmers have been able to pay school fees for their children.

Because of the profitability of seed production and marketing, there has been an increase in seed producers and seed production. The training received helped these farmers to learn all of the standards and requirements of becoming a seed producer, as well as the record keeping necessary to ensure that their efforts improve income. Some producers in Falwel have now become the trainers on seed production for other member unions of the Mooriben Federation of Farmer Unions.

Falwel’s millet seed-producing farmers have managed to sell all of their produce from their increased seed production, thanks to the activities of both a newly created small agricultural firm, ALFARO, and of the Alheri Seed Company in Dogondoutchi (a recipient of support from the Program for African Seed Systems of the Alliance for a Green Revolution in Africa).

The die has been cast
The Made Bane Farmers’ Union organized its own Seed Fairs prior to the 2012 and 2013 rainy seasons. During these fairs, large quantities of pearl millet, sorghum and cowpea seeds were sold, initially much of it in mini-packs of 100 g to 500 g. As time passed and their clients gained greater confidence in the varieties offered, more of this seed is sold in packets of 1 kg to 5 kg, but minipackets continue to be an excellent low-risk way for new customers (especially women) to assess samples of the available varieties under their own farm conditions.

This should be just the beginning as 2013 pearl millet seed production at Falwel was sufficient to meet only slightly less than 1% of the total pearl millet seed necessary to achieve the national target of 20% annual replacement rate for improved pearl millet open-pollinated varieties. In Niger’s expanding market for improved pearl millet seed, there is room at present for more than 100 similar seed villages. The die has been cast and the time has come to extend this success story across Niger where, in future, there may be even more opportunities for pearl millet seed producers if appropriate hybrids — requiring considerably higher seed replacement rates — are identified.

Table 2: Pearl millet seed production by the Made Bane Farmers’ Union of Falwel, in the Dosso Region of southwestern Niger

<table>
<thead>
<tr>
<th>Year</th>
<th>ICMV-IS 89305 (Area grown)</th>
<th>ICMV-IS 94206 (Area grown)</th>
<th>SOSAT-C88 (Area grown)</th>
<th>ICMV-IS 99001 (Area grown)</th>
<th>Total (Area grown)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>3 t (5 ha)</td>
<td>2 t (5 ha)</td>
<td>1 t (1 ha)</td>
<td>–</td>
<td>6 t (11 ha)</td>
</tr>
<tr>
<td>2008</td>
<td>5 t (5 ha)</td>
<td>3.5 t (5 ha)</td>
<td>1 t (1 ha)</td>
<td>–</td>
<td>9.5 t (11 ha)</td>
</tr>
<tr>
<td>2009</td>
<td>4 t (5 ha)</td>
<td>3 t (5 ha)</td>
<td>1 t (1 ha)</td>
<td>–</td>
<td>8 t (11 ha)</td>
</tr>
<tr>
<td>2010</td>
<td>6 t (7 ha)</td>
<td>3.6 t (5 ha)</td>
<td>–</td>
<td>4.2 t (6 ha)</td>
<td>13.8 t (18 ha)</td>
</tr>
<tr>
<td>2011</td>
<td>7 t (7 ha)</td>
<td>6 t (10 ha)</td>
<td>1 t (1 ha)</td>
<td>5 t (6 ha)</td>
<td>19 t (19 ha)</td>
</tr>
<tr>
<td>2012</td>
<td>27 t (25 ha)</td>
<td>20 t (15 ha)</td>
<td>–</td>
<td>8.5 t (10 ha)</td>
<td>55.5 t (60 ha)</td>
</tr>
<tr>
<td>2013</td>
<td>40.5 t (45 ha)</td>
<td>24 t (30 ha)</td>
<td>–</td>
<td>20.5 t (25 ha)</td>
<td>85 t (100 ha)</td>
</tr>
</tbody>
</table>
Voices from the fields

Made Bane Farmers’ Union of Falwel: moving beyond subsistence farming

Seed production plot and Made Bane Farmers’ Union members, including the late Union President Siddo Noma (center) and Yacouba Tanda (second from right), a young producer of the union (following page), with Issa Seydou and other members of the Made Bane Farmers union of Falwel
Farmers who once grew only late maturing and low yielding local pearl millet landraces are now growing and providing other regions with seed of improved varieties.

Poor soils, low rainfall and limited access to agricultural inputs have long made farming very difficult, inefficient and less attractive in Falwel, which lies 197 kilometers from Niger’s capital city Niamey and is heavily dependent on agriculture. Crop production here has been severely tested by several decades of climate change and severe drought. Access to improved seeds was a major problem and farmers grew a single and poorly-adapted local variety, which they called ‘mil tardif’ or ‘late maturing millet’, given its long cycle unsuitable for their region’s diminishing rainfall.

“The yield was very low, only 350 kg of grain per hectare,” according to the late Mr Siddo Noma, President of the Made Bane Farmers’ Union. “So, the initial objective of the union was to drive the region towards food sufficiency by growing and producing as much food as needed to feed the population.”

The farmers’ union first comprised 34 groups from 25 villages. Thanks to ICRISAT and partners providing training and capacity building on crop production and integrated soil fertility management, new members were encouraged to join so that today it has about 3,167 members, including 1,692 women. Improved pearl millet varieties were tested and are currently produced. Input shops were created to facilitate direct access to improved millet seed. The union also created grain banks to prevent food crises in villages most vulnerable to food insecurity.

According to the late Union President, the support from ICRISAT and partners created much needed change by organizing more efficient production, marketing and selling of products. Union members were selected and trained to participate in demonstration trials of improved varieties of millet well adapted to Falwel conditions. After successful tests, some members of the union received accreditation as Certified Seed producers so that seeds of improved varieties are now produced locally and certified. Surplus seeds of improved millets are supplied to other farm unions in Niger.
Thirty-five-year-old Yacouba Tanda was trained in improved seed production techniques and soil fertility management options that have helped him to cultivate seven hectares of seed of an improved millet variety. “I’ve learnt the techniques of quality seed production and marketing,” he says. “I also learned to operate a farming account, which I could not do before. I can plan my seasonal activities properly, take stock of the situation and calculate in advance the return on investment per hectare.”

As a young producer, Yacouba Tanda can see his future in seed production for as long as the climatic conditions allow. “When I count my yearly revenues, I am paying myself a salary of about 200 US dollars per month. Seed production is a very profitable business and I expect to expand my farm to 20 hectares,” says Mr Tanda, who has simple advice for youths. “With a seed business, one can become rich!”

Damou Kaocen also feels multiplying and using improved seeds has brought a huge change in the Falwel region’s farming system: “We have now become specialists and experts in seed production, managers of inputs shops and owners of businesses producing quality seed of improved varieties. Our production has increased and we can sell larger quantities,” he says.

Improved millet varieties were introduced, produced and sold by seed producers. In the words of the late Noma Siddo, the Made Bane Farmers’ Union President, it is a giant step for a region that once cultivated unsuitable low yielding millets to become one of the greatest producers of quality millet seed in Niger. “This has helped us reach a crucial food security goal” he concluded.

Thanks to seed production, Issa Seydou feels fulfilled in the retirement chapter of his life. “I used to live in a hut, but thanks to the seed business I built a new house roofed with metal in which I live comfortably with my family. I paid tuition fees for five children; one of them became a nurse while another is now serving in the National Guard. I also bought a horse and a motorcycle for transport, and some decent clothes.”

Furthermore, as the returns increased, Issa Seydou says he was able to diversify household food consumption: “I am not obliged to consume millet every day. Part of my production is sold and with the return I buy other foods to diversify my family’s food consumption to maintain a balanced diet.”

There is no doubt that Issa is enjoying life in his later years: “Previously, I was heavily indebted. Now, I lend to others. I will continue seed production because it is a profitable business thanks to training on field isolation standards, packaging and controls, and the effective
application of fertilizer. The organized study tours also helped me better understand the production standards for quality seeds, which make me a better seed producer and entrepreneur.”

Ms Mariama Harouna has also made the most of improved seed production and sales to become one of the local leaders in the sector.

Following the capacity building and technical support provided under projects run by ICRISAT and partners in Falwel region, she became a Certified Seed producer and seller. “Now, I can pay taxes,” she says. “I do not need to run away from the village to hide from the tax collectors. With my profits I can pay my taxes and comply with the legislation. Seed production has restored my dignity.”

Her success in the extent and quality of SOSAT millet seed production was such that it brought her an award in 2011 from the federation of producers. “I got the award because of the quality of my seeds production and because I complied with the rules of improved seeds production as taught by the scientists,” says Mariama, “On one hectare, I used to harvest only two bags, but with improved seeds and application of improved soil fertility management options, I can harvest up to 15 bags per hectare. After harvest, these bags are stored at input shops and sold to customers by the farmers’ union.”

Seed production has had a positive impact on her household. “Previously, with the local millet variety I could not harvest enough to feed my children”

“The training and improved varieties have helped me increase production and income; as well as paying my taxes in full, I can dress my children well and pay for their school tuition; on top of which I have created a small business to sell cereals and condiments and earn more money. But, above all, the whole family has enough to eat.”

ICRISAT capacity building has reached many producers like Mariama Harouna in Niger’s Falwel region, creating new opportunities to move towards food sufficiency and extra income. “Prior to getting into the seed production business, I could hardly raise 200 US dollars. Now, with my yearly seed production, I can sell and earn up to 1000 dollars. I was able to purchase two carts, a solar panel, a TV and a satellite dish. I also paid the tuition fees for one of my daughters to become a nurse.”
Kouli Djibo, also from Falwel village, has a life-changing tale. “Previously, I could barely get 50 head-bundles of millet,” says this millet, cowpea and sesame producer. “But thanks to the knowledge I acquired during farmers’ field schools and testing trials, I am now able to harvest 100–120 millet head-bundles per hectare.”

Capacity building benefits not only women, but also their families and the entire community. “Training has changed my life,” adds Kouli. “I am able to produce enough to feed my family and I am selling a part of the production to pay school fees for my two children in the capital city.”

The experiences of Mariama Harouna (previous page) and Kouli Djibo send a strong message as to why development efforts must focus on the smallholder farming sector. In a speech delivered at the 6th Africa Agriculture Science Week, hosted by the Forum for Agricultural Research in Africa (FARA) in Accra, Ghana, the President of the International Fund for Agricultural Development (IFAD) Dr Kanayo Nwanze said, “Small farms account for 80 percent of all farms in sub-Saharan Africa. They have the potential to be key suppliers to Africa’s burgeoning urban markets, as well as to rural markets.”

According to Dr Nwanze, “To farm successfully, women need agricultural resources and inputs, as well as access to rural finance, education, and knowledge. They also need rights to the land they farm and a voice in the decisions that affect their lives.”

In the context of smallholder farms, empowerment often means providing women with practical training that helps to improve their capacity to cultivate the land and cope with climate change and variability on their land.

This is in tune with the Inclusive Market-Oriented Development strategy (IMOD) towards 2020 developed by ICRISAT and its partners, wherein research for development focuses on smallholders in Asia and Africa, and investment is encouraged in women and in youth.
Local radio is an interactive way of spreading advanced knowledge of improved farming methods.

By synchronizing with the farming calendar, local radio stations such as Radio Ibero Guinda in Falwel, Niger, have been used by the Made Bane Farmers’ Union to broadcast programs to reach the maximum number of farmers. Simply by following these radio programs, many farmers have gained knowledge on integrated soil fertility management options and the use of improved varieties and best farming practices.

“Radio has become a central point of information for many producers,” says Halidou Hamani, Director and producer at Radio Ibero Guinda. “Radio presenters collect information on best farming practices from members of the farmers’ unions in the villages and from extension agents, scientists and trainers. Also ICRISAT’s technicians regularly come to the villages to provide training on production techniques that we attend and broadcast on air. We then invite them on air to provide practical information to farmers in local languages,” he adds.

The radio station has created listening groups to get better program feedback on the likes of the weekly program hosted by Halidou Hamani on improved seed production techniques.

“I used to listen to Radio Ibero Guinda only for good music, but now I can also learn about improved seeds and fertilizer use,” confirms Damou Kaocen, a radio listening group member. “Through the radio I’ve learned how to apply fertilizer and organic manure, composting and microdosing. Although I attend farmers’ field schools I get a better understanding of the teaching each time they’re aired on radio. I always get clarification on what I did not understand well during the field training.”

Radio Ibero Guinda has 10 listeners’ clubs, which are part of an initiative by the NGO Vie Kande Bayra with the involvement of the United Nations Population Fund. The project provides each club with a solar-powered radio and cell phone so that twice a week they can both listen to radio programs and interact on air with radio presenters, guests and even listening farmers in other villages. Another seed producer emphasizes the major role played by the Ibero radio in disseminating improved seeds: “I use radio to advertise my production. Each season, I talk about the seed lifecycle, its length and resistance to drought and various pathologies and this helps to attract buyers.”
Halidou Hamani, says the radio programs increased farmers’ interest in inputs. “Many farmers used to spread organic manure indiscriminately. Now they have mastered how to use the same organic manure in a more effective way.”

Radio has also been instrumental in reaching women farmers and getting their voices heard on many farming issues, according to Adjo Alfari, the facilitator responsible for gender within the Made Bane Farmers’ Union at Falwel. “Within listening groups, women gain greater self-confidence and they now participate in debates on important community issues,” says Alfari. “Listening groups have become a true platform of expression on all subjects, including agricultural, economic and reproductive health matters.”

Binta Tanda, a listening group member, agrees: “Through this program, I know how to make good compost and apply fertilizer in micro doses. The information on new varieties encouraged me to change from old, later maturing and non-adapted varieties to improved varieties that mature earlier. Through the radio I got explanations on how to plant and weed correctly. We have become true producers.”

A solar telephone allows the listening group women to interact with radio hosts and extension agents on air. They benefit from training sessions via radio and now they can have their say and their voices are heard!

The work reported above is continuing under the CGIAR Research Program on Dryland Cereals.
Low phosphorus (P) soils are a major constraint to crop production in West and Central Africa (WCA). Although P-deficiency is known to reduce growth and delay maturity, sorghum is commonly cultivated in this zone with little or no fertilization due to farmers’ limited access to credit and fertilizers.

The levels of plant-available P in Malian farmers’ sorghum fields were found to be well below the 10 ppm (mg P kg⁻¹ soil) threshold considered to be sufficient for sorghum production. For example, soil analyses of 207 sorghum fields, predominantly those of women farmers, in 2011 indicated a median of only 5.5 ppm (mg P kg⁻¹ soil) and the vast majority of men’s fields had less than 10 ppm P values.

Women, who are typically allocated fields at the end of the rotation when soil fertility is at its lowest, often had even lower plant-available P levels. Analysis of 35 women’s fields indicated a mean of 5.2 versus 7.4 for 36 men’s fields sampled in 2009. In fact, several women and a few men had fields with plant-available P levels below 3 ppm.

Sorghum is a staple crop in WCA, in part due to its ability to produce more dependable yields under low-input production conditions than other cereals such as maize. The adaptation of sorghum to low-P soil conditions is therefore vital for food security and, increasingly, for income generation. It may also contribute to climate resilience, since a crop with more rapid growth and development is likely better able to resist both waterlogging stress at the peak of the rains and water scarcity at the end of the rainy season.

Enhancing sorghum adaptation to low-phosphorous soils meets the needs of resource-poor women and men sorghum growers

Figure 3: Means of landrace and research-bred sorghum varieties from WCA for grain yield (GY), stover yield (SY), Biomass yield (BMY) in t/ha, P concentration in the grain (PCG) and stover (PCS) in mg/g, total P-uptake in the grain (PG), stover (PS), and biomass (PBM) in kg/ha, P harvest index(PHI) in %, and P use-efficiency for production of grain (PUTIL_G), stover (PUTIL-S) and total biomass (PUTIL_BM) in kg/g P under Low-P conditions. (*, **, *** denote significant differences among groups at p<0.05, <0.01.)
Sorghum’s ability to take up P from soils with low P-availability and to use this P efficiently to produce dry matter contributes to its adaptation to low P soils. However, no assessment of sorghum varieties from WCA for these traits had been done until experimentation and analyses begun in 2010 by ICRISAT-Mali and the University of Hohenheim, Germany.

Experiments were conducted at ICRISAT-Mali using both WCA farmers’ traditional Guinea-race sorghums and newly bred varieties, developed by introgressing exotic germplasm into local Guinea-race materials. Trials were planted in adjacent fields, one a Low-P field with no P fertilization over the previous five years, and the other a High-P field where 100 kg/ha di-ammonium phosphate had been applied annually.

Highly significant differences among varieties occurred for both amount of P taken up by the plants and the amount of plant dry matter produced per unit of P taken up (P use-efficiency) in the Low-P field. Varieties exhibited more than two-fold ranges for both P-uptake and P use-efficiency. In addition, the repeatability estimates for these traits were very high (0.76 to 0.90), with similar or even higher repeatability values obtained under Low-P versus High-P conditions. WCA sorghums therefore possess great genetic variation for P-uptake and P use-efficiency, which can be exploited effectively through selection, particularly under low-P field conditions.

The landrace varieties, as a group, showed greater capacity for taking up P from P-impoverished soils, whereas the researcher-bred varieties showed higher average P use-efficiency (Figure 3). These different varietal groups thus represent complementary parental pools for sorghum improvement. Furthermore, the significant variation within varietal groups indicates the feasibility of selecting superior genotypes from within both groups. Additionally, photoperiod-sensitive varieties showed significantly higher P-uptake and marginally higher whole-plant P use-efficiency as compared to photoperiod insensitive varieties, pointing to the possible contributions of photoperiod sensitivity to adaptation to low-P conditions as well as matching cycle length to available growing periods.

P-uptake and P use-efficiency showed highly significant positive correlations with grain yields (0.90 and 0.51, respectively), suggesting that there are multiple routes to achieving higher grain yield under P-impoverished soil conditions. The diversity exhibited among WCA sorghum varieties for P-uptake, P use-efficiency, and grain yields under Low-P conditions confirms the opportunity to exploit natural variation among these genotypes, and encourages continued effort and investment to use this diversity for enhancing grain yields for resource-poor farmers in WCA.

In fact, one variety derived from the dwarf Guinea-race random-mating population, NafalenP6, was found to combine superior P-uptake, P use-efficiency and high grain yields under low-P conditions, being among the top 10% varieties for all traits.

These results show that a more prosperous and sustainable future for WCA women and men sorghum producers can be envisaged by combining varieties with high grain yield and high P use-efficiency with enhanced farmers’ knowledge and options for fertility management.

The work reported above is continuing under the CGIAR Research Program on Dryland Cereals.
Evaluation of local and new varieties of crop plants for resistance to insect attack is the often-unsung stock-in-trade of entomologists and plant breeders. It is a vital activity for CGIAR centers such as ICRISAT with specific mandate crops of world importance to food and farming.

Among major pests threatening food security in West and Central Africa, ICRISAT-Mali is working against sorghum midge. Promising new varieties are being developed rapidly thanks to an easy-to-use molecular breeding platform in cooperation with the University of Hohenheim (Germany) and other partners, for example through building on available backcross nested association mapping (BCNAM) populations, of which there are about 2000 sorghum lines adapted to West Africa.

Other aims include incorporating well-characterized traits such as drought adaptation into local germplasm. This involves collaboration between IER, ICRISAT Mali and Agropolis–CIRAD. BCNAM is a new concept aiming to accumulate – in a single adapted background – useful genomic regions identified in a range of diverse varieties potentially contributing new useful traits, beneficial to the sorghum grown in Mali. Groundnut varieties are also being phenotyped for resistance to aphid damage.

**Phenotyping of sorghum breeding lines for midge resistance**

Eighty-five (85) lines of the BCNAM population of sorghum were phenotyped at Fada N’Gourma in eastern Burkina Faso for resistance to the sorghum midge *Stenodiplosis sorghicola* Coq. The population was derived from crosses of Grinkan (a high yielding variety) with Ribdahu and IS154001 (sorghum-midge-resistant varieties).
Genotypic difference for maturing cycle was highly significant and on average the 50% heading (50% panicle emergence from the boot) stage was reached about 76 days after planting (DAP). Midge natural infestation was very high in 2013 with up to 100% losses on the more sensitive material. Genotypic difference for midge infestation (measured as chaffy spikelets) was highly significant. There was no effect of maturing cycle on midge infestation ($R^2=-0.06$). Out of the 85 lines, 11 were highly resistant with almost no midge damage and a yield superiority of two- to three-fold over Grinkan.

Phenotyping sorghum hybrids for midge resistance

Ten hybrids (10) of sorghum developed at ICRISAT-Samanko were evaluated in 2013 at Fada in eastern Burkina Faso for resistance to the sorghum midge. A resistant variety (Soumalemba) and the local landrace (Kapelga) were included as controls. Sorghum midge damage causes up to 77% grain losses, with highly significant differences between varieties. Out of the 10 hybrids, Caufa was the least damaged, followed by Sewa and Pablo, but Caufa was also the only one suffering less damage than the midge-resistant check Soumalemba. Caufa and Pablo were the most productive hybrids, yielding 19% over the local landrace.

Phenotyping millet germplasm for resistance to millet head miner

This activity aimed at identifying material with good resistance to the millet head miner (MHM) for use in breeding programs. A trial was set up at ICRISAT's campus in Sadoré (Niger) with 40 entries (early and medium maturing varieties) from CIRAD’s 1976 West and Central Africa collection. Nine panicles of each variety were randomly selected, caged and artificially infested with MHM eggs (40 eggs/panicle). Out of the 40 varieties, three were almost free of MHM damage (PE00077; PE01490; PE02783) and 11 (KBH; local Maradi; local Sadoré; local Tera; Mil de Siaka; Moro; PE00025; PE05927; PE08043; PE08045; Syn-03-11) were moderately damaged.

Phenotyping groundnut varieties for resistance to aphids

A set of 114 groundnut varieties tolerant to rosette was phenotyped for resistance to the groundnut aphid *Aphis craccivora*. The background of some varieties included ICG 12991, JL24, ICGV-SM 95603, 55-437 and KH241-D. Plants were grown in the greenhouse and artificially infested with aphids. Up to 100% plant mortality was recorded on the most sensitive material. Out of the 114 varieties, six interesting examples were identified (ICGV-IS08806; ICGV-IS08835; ICGV-IS08836; ICGV-IS07981; ICGV-IS07986; and ICGV-IS07860). These varieties, along with three sensitive varieties, were further screened in the greenhouse to understand the mechanisms of resistance. The findings indicated that ICGV-IS08835 and ICGV-IS08836 are the most resistant material, both having the antibiosis and non-preference mechanisms.

When wingless aphids were forced to feed (clip-caged on leaves) on ICGV-IS08835 and ICGV-IS08836 they produced very few progenies (antibiosis mechanism) as compared to sensitive varieties, and adult wingless aphids have a shorter lifespan on the resistant varieties. When given a choice, alate (winged) forms of aphids do not develop on ICGV-IS08835 and ICGV-IS08836 (non-preference mechanism). Both ICGV-IS08835 and ICGV-IS08836 have the ICG 12991 x ICGV-SM 95741 pedigree.

The work reported above is continuing under the CGIAR Research Programs on Dryland Cereals and on Grain Legumes.
Exploring intensification options for mixed crop-livestock farms in southern Mali

Farmers are increasingly guiding scientists in the development of adaptive mixed crop farming systems through early local participation in trials.

Cotton and livestock are primary sources of income for farmers in southern Mali while maize, sorghum and millet are the staple food crops. The farmers face diverse risks and need to adapt to a changing production context. ICRISAT is a prime mover in helping them do that by designing a framework (Figure 4) that ensures farmers have a voice in evaluating potential new farming systems.

A framework to enhance farmers’ participation

The framework has two steps (Figure 4), which were applied in three villages in the Koutiala district. After defining global and specific constraints with farmers, an interactive learning cycle of testing and refining options was started.

In 2012, 12 farmers from three villages tested maize-cowpea intercropping. This was extended in 2013 to 110 farmers from nine villages, who tested a wide range of options in a total of 192 trials, involving fertilizer and improved varieties of sorghum and maize, soybean with inoculum and fertilizer, and several options for increasing fodder production. Thirty-seven farmers scored the different options at a field day. Measured grain and biomass yields allowed calculation of partial Land Equivalent Ratios (LER). An ex-ante assessment for maize-cowpea intercropping was carried out for four farm types, considering the average number of cattle, cropland size and cereal yields.

These activities were carried out through the CGIAR Research Program on Dryland Systems and the project Pathways to agroecological intensification in Southern Mali, funded by the McKnight Foundation and led by Wageningen University, operating in Koutiala Region.

The NUANCES-DEED (Describe, Explain, Explore and Design) cycle is a robust approach developed by the Plant Production Systems group at Wageningen University, The Netherlands, to design new adaptive farming systems. However, this approach needs strong involvement by farmers in the conceptualization and the evaluation of new farming systems. With this in mind, ICRISAT–WCA helped improve the approach with a framework that enhances farmers’ participation in, for example, intercropping trials.
Promising options to improve crop-livestock integration

During the Participatory Rural Appraisal (PRA), farmers indicated that crop-livestock interactions were crucial to their livelihood strategies. The intercropping trials with cowpea and maize showed promising results for fodder production without large grain yield penalties for the cereals, which constitute the staple for human consumption and assure food self-sufficiency. Half of the farmers chose to test this option in their fields and all farmers gave the highest score to a substitutive intercrop pattern (SP, 2 rows of maize and 1 row of cowpea) during the field day. Land Equivalent Ratios were higher than 1 for the two intercropping patterns tested (1.27 and 1.40 for the additive pattern (AP) and SP, respectively). For AP, partial LER was 0.79 and 0.46 for maize grain and cowpea fodder respectively, while for SP partial LER was 0.67 and 0.71 for maize grain and cowpea fodder respectively. Thus AP results in a smaller maize grain yield penalty, but also gives less fodder than the SP.

Ex-ante trade-off analysis indicated that: (i) large farms would be able to feed only half of their herd (45 cattle) in the compound during the hot dry season when intercropping cowpea on 100% of their maize area, while running the risk of not achieving food self-sufficiency, regardless of the intercropping pattern; (ii) intercropping cowpea (SP) in only 50% of the maize area of medium farms would provide the fodder for compound feeding the whole herd (5 cattle); (iii) the decrease in food self-sufficiency for medium farms would be minor (Figure 5). For Medium Resource Endowed Farms (MRE) farms, this strategy would have positive feedbacks on milk production and reduced calving interval, providing a solution to the constraints voiced by farmers.

Figure 5: Ex-ante assessment of the effect of maize-cowpea intercropping adoption on fodder production and household (HH) food self-sufficiency for high-resource-endowed (HRE) farms with a large herd (a) and (b) for medium-resource-endowed farms (MRE)
Over two years of working with this framework, the research team designed and tested innovative options for different farm types. Cowpea-maize intercropping provides opportunities for integration with livestock-stable feeding options. Future work will focus on participatory testing of this and other options with a wide diversity of farmers in southern Mali, and evaluating both scenarios and outcomes at farm scale.

**Intercropping**

In substitutive intercropping, one crop replaces a proportion of another crop (in this research, one line of maize is replaced by cowpea). In additive intercropping, one crop is added to the other, so that the final plant population is usually more than had either crop been sown in isolation (here, cowpea is sown every other row within the maize rows).

The work reported above is continuing under the CGIAR Research Program on Dryland Systems.

**A:** The maize-cowpea substitutive pattern in a farmer’s field at M’Peresso village (Koutiala district);
**B:** Farmers’ scoring of the different options during a field day;
**C:** Stable feeding experiment at Nampossela with a lactating cow
Better diets for women and children begin at home

Smallholder farmers are learning homegrown solutions to the threat of malnutrition and inadequate childhood diets thanks to targeted intervention with highly nutritious recipes based on locally available food products.

Education and training underpin the success of the initiatives undertaken by the Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program and its various partners to stave off rural malnutrition, particularly in women and children under 5 years of age. Methods of fortifying and enriching porridges and sauces with familiar local crops and foodstuffs have been introduced to rural women and their communities in Mali.

Understanding the current diet of women and children so that food and nutritional security can be improved is one of the priorities of Africa RISING, which has three research-for-development projects supported by the United States Agency for International Development as part of the US government’s Feed the Future initiative.

Thanks to action research and development partnerships, Africa RISING creates opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition and income security, particularly for women and children, and conserve or enhance the natural resource base.

In West Africa, nutrition-related activities were conducted at Koutiala in the Sikasso region of Mali where a total of 36 villages were selected and grouped into six clusters – mainly by commune. Médecins Sans Frontières (MSF) was already active in the chosen communes on nutrition rehabilitation of severely malnourished children. Capacity building of the mothers, and other rural actors, was initiated by Africa RISING nutrition activities and conducted with ICRISAT, The World Vegetable Center and the Association Malienne d’Eveil au Développement Durable (AMEDD). This built on lessons learned from previous nutrition research projects: INSTAPA (EU financed) and Anbijigi (McKnight Foundation).

Training modules were developed based on the seven essential nutrition actions (ENA) framework and focusing on the 1000 days concept of the first 1000 days of child development, from the moment of conception through pregnancy to 2 years of age, being the most critical period for human development from a nutrition perspective. Four modules were developed, each addressing a specific nutrition issue. Each module also discussed one specific food group, and the participants cooked one new recipe together, focusing on elements of the lessons learnt on: exclusive breastfeeding; nutrition of children from 6 months to 2 years old; nutrition and health of pregnant and lactating women; feeding of a sick child; and the prevention of vitamin A, iron and iodine deficiencies. Several cross-cutting topics were included such as: dietary diversification (food groups); post-harvest processing of cereals and legumes; preparation

Enriched porridge being stirred in
of leafy vegetables for optimal nutrient retention; hygiene; and key messages on the use of ante-natal and post-natal services and the prevention of malaria.

The training sessions included demonstration of recipes such as fortified/enriched porridges, sauces with leafy vegetables (with and without groundnut paste), and vegetable soup. Two recipes for fortified porridges were demonstrated, the first one being a mix of whole millet flour, cowpea flour and groundnut flour, sources of vitamin C, sugar and salt. The second porridge comprised: whole millet flour, soyabean flour (roasted and decorticated) and groundnut flour (roasted), sources of vitamin C, sugar, salt and oil.

Five representatives – 4 women and a man – from each village were selected and trained, and they in turn trained at least 25 women in each of their various villages. Cluster-based training of trainers took place at six health centers, involving the nutrition representatives of each center. Cooking methods and ingredients were displayed in posters at each center. Test packets of seed of the different crops and new varieties of traditional crops were put on sale at the health center.

Beneficiaries included representatives of participating health centers, the trainers, the trainees – most of them mothers – and some of their spouses.

“The training sessions considerably reduced the number of malnourished children in our village once we started to apply the new recipes to our families’ daily food consumption. For me personally, my child Aboubacar, was being treated for severe malnutrition, but I have taken charge of feeding of him since I learned the preparation techniques for enriched porridges,” said Hawa Coulibaly, a trainer at Bana (M’Pessoba commune). “Today he is doing very well.”

Adjaratou Mallé, a trainee and mother at the same locality, told a similar story: “My child Kassim has greatly suffered from my lack of breast milk. When I participated in the training session, I started preparing the enriched porridge for him and he has improved a lot now.”

There were signs that incidence of childhood diseases was reduced. “A woman came to see me with her child who had kwashiorkor and was being treated. I showed how to prepare enriched porridge. Another woman with twins had problems with breast milk, but they are doing better since she started to give enriched porridge to the children,” commented Djeneba Coulibaly, a trainer at N’Tonasso Bougoufi (Medinacoura commune).

The promising results from the quick-win phase spurred a pilot scheme in two villages in Mali (M’pessoba and Sirakelen) to improve the nutritional status of children and women in which 48 women trainers and 12 male trainers were trained on nutrition-related themes.

In the second year the number of modules was increased to six, and included women’s participation in field schools for testing cropping techniques for crops of particular interest to women. AMEDD and AccessAgriculture have developed a training video showing how to make enriched porridge that can be viewed online at: http://www.accessagriculture.org/node/1167/en. A total of 600 women were trained in 2013 in 12 neighborhoods of the two villages.

The work reported above is continuing under the CGIAR Research Program on Agriculture for Nutrition and Health.

Moving beyond subsistence farming...
Malnutrition in Malian children is being tackled by a combination of improving a familiar traditional food recipe and eliminating toxin contamination from its main ingredient.

This increases the chances of the bio-fortified food – Equinut – being acceptable and achieving its aim of reducing the high mortality rate in children under five years, while greater awareness of the contamination risks associated with aflatoxins (toxic and carcinogenic substances) could boost the use of toxin-resistant varieties. The improved recipe also offers women the potential to improve family livelihoods by selling Equinut.

Malnutrition is one of the main causes for 241 of every 1,000 children born in Mali failing to reach the age of five years. Food availability and lack of access to food underlie malnutrition in rural areas where the majority of households do not consume vegetables regularly and do not eat more than one meal a day during the lean season (May, June and July).

A survey on quality of life conducted by the Aga Khan Foundation (AKF) in 2008 revealed the following problems in rural households in Mopti region: a quantitative deficiency of the diet; low dietary diversification; ignorance of the nutritional value of food prepared; low use of food hygiene measures for disease prevention; and little knowledge of the process of weaning and ignorance of the practice of exclusive breastfeeding.

In response, through the Aga Khan Development Network, the AKF is running a research project – Action on Di-dégué – a food recipe based on existing local products in the food habits of people in rural areas of Mali. The project partnership includes ICRISAT, the University of Bamako’s Faculty of Science and Technology and Faculty of Medicine Pharmacy and Dentistry, with the Institute of Rural Economy/Laboratory of Food Technology (LTA) of Mali.

Di-dégué is a combination of peanut groundnut paste, honey and millet, sorghum or rice flour and already in the food habits of people in rural areas of Mali.

The basic concept of the Equinut project is the bio-fortification of di-dégué and its extension as a nutritional and therapeutic food against malnutrition among children from 6 to 59 months in disadvantaged rural communities in Mali and, later, in sub-Saharan Africa. The target is to reduce the rate of acute malnutrition from 39% to 19%.

A strong research component underpins the Equinut project, including the production and dissemination of groundnut free of aflatoxin; development, characterization, and production of Equinut; and a clinical trial to test the effectiveness of Equinut in the management and prevention of malnutrition in comparison with a reference product.

Significant progress has been made in the first two years of the project in two components: production and popularization of groundnut resistant to aflatoxin, and the development, characterization and production of Equinut, as well as capacity building of health centers’ staff. With ICRISAT at the helm, the main breakthrough in the first component is that five varieties of groundnut resistant to contamination by aflatoxin fungi have been developed and the integrated management practices introduced in groundnut–growing areas in rural districts of Kita (Kayes region) and those of Mopti and Djenné (Mopti region). This is a major breakthrough because all the varieties hitherto grown in these zones were sensitive to aflatoxin and carried varying levels of contamination.
Extension techniques for producing groundnut resistant to aflatoxin contamination

Groundnut is an essential component of Equinut because the biofortification of the local dish di-dégué and extension of Equinut requires groundnut varieties resistant to aflatoxin.

ICRISAT contributes to the Equinut project by introducing integrated crop management practices, improved agronomic practices, biological control and biotechnological interventions to reduce risks of groundnut contamination.

The production of groundnut resistant to aflatoxin and its extension phase mainly comprised: (i) training women in the production methods and techniques of groundnut resistant to aflatoxin and the construction of granaries for crop storage in proper conditions after harvest, (ii) training women in Equinut production, and (iii) a study on the value chain for marketing the product in local markets. Twelve women’s groups were selected to produce groundnuts resistant to aflatoxin contamination.
The training course covered theoretical training, which focused on seven priority themes: farming practices, pest control, harvesting, seed packaging, shelling, bagging, storage and conservation of seeds. These courses in the local language were followed by practical work, including participants jointly monitoring a collective testing plot for aflatoxin-resistant groundnut, and exchange of experiences.

Research on characterization and laboratory testing of Equinut conducted by IER/LTA and FST/LaboREM-biotech registered significant progress, showing an increase in the protein content of di-dégué from 11.91% to 19.50%, and a similar increase of the energy content of simple di-dégué from between 406.62 Kcal and 432 Kcal/100g to 480 Kcal for bio-fortified di-dégué (Equinut) recipes.
What makes Equinut special?

There are seven principles underpinning the fortification of di-dégué to ensure Equinut respond to the needs of the communities. These are:

**Quality**
Equinut provides important energy and meets international standards for vitamin and micronutrient content;

**Volume**
daily consumption of 100 g is effective;

**Administration**
children of 6 to 59 months may eat it at any time of the day;

**Location**
local ingredients are used in product preparation;

**Interaction**
the product is sold in local markets and available to all families in the project area;

**Time**
Equinut can be kept throughout the year at room temperature in a closed container;

**Economy**
all the necessary ingredients are available at harvest, thereby avoiding any additional burden on households.

Researchers from the institutions involved ensure implementation, while the overall project management functions (monitoring of activities, resource mobilization, management of partner relationships) are carried out by the Aga Khan Foundation (Mali). A national steering committee is also involved in project implementation and monitoring.

Integrated management of aflatoxin in groundnuts

Many people in the developing world are exposed to aflatoxins, poisonous toxins produced by fungi infecting crops such as groundnuts that are unknowingly ingested by consuming contaminated foods.

Therefore, the importance of ensuring that farmers produce safe crops and food provides focus for ICRISAT involvement in the Equinut project in Mali.

ICRISAT, together with the Institut d’Economie Rurale (IER), is helping farmers produce quality groundnut, free of aflatoxin, to enhance household consumption as part of a project with the Aga Khan Foundation in Mali. ICRISAT’s role involves supporting groups of women to produce improved aflatoxin-free groundnut varieties that will be used to make a biofortified version of the local dish di-dégué, which will be developed into a product known as Equinut.

As part of the project, 10 staff of the Health Referral Centers and Community Health Centers in Mopti, Djenne and Kita districts attended refresher courses for the diagnosis, recognition and management of malnutrition, along with communication for behavioral change. Similarly, 1000 women from various women’s groups, some of which have already been introduced to growing aflatoxin-resistant groundnut in the said districts, were trained in the recognition of malnutrition and behavior change practices.

Nearly 14,420 children under five years in 20 villages benefit directly from this project, which indirectly affects nearly 16,583 Malian women of childbearing age.

The work reported above is continuing under the CGIAR Research Program on Agriculture for Nutrition and Health.
Life’s less of a grind for West African women

When considering how to improve the situation for women farmers, the focus often settles on farming issues such as land rights, training and access to better seeds and markets. But for many women, post-harvest chores entail a heavy work burden that needs to be relieved to improve their lives. Doing so could also improve their communities’ resilience to drier climates.

An example is the pestle and mortar that are still the main tools used to grind staple cereals such as millet and sorghum in most sub-Saharan countries. Grinding grains manually is painful and time-consuming for rural women with relentless daily workloads in West Africa.

Zénabou Halilou from Niger gained a massive eight hours a day when a powered grinding machine was installed in her village. She used that saved time to expand her farming activities as well as devoting more hours to her children.

ICRISAT and its partners have been working with women such as Zénabou Halilou to try progressive technologies to ease their work burden. “Before a mill was installed in our village, we manually processed all our grain,” she says. “Threshing, husking, and milling used to take about 16 hours of my daily time. Thanks to the mill I save nearly eight hours a day. This has made a big difference.”

“I can now spend more time on food processing and have just started a poultry farm. I also have more time for my children. Instead of meals served very late or not at all, they now eat every night before going to bed,” she explains.

Technologies that free women from manual threshing are also appreciated for other reasons. Halilou proudly shows off her hands. “Threshing and husking used to make my hands very rough,” she says. “Now that I use the mill, they are much smoother, and I am not ashamed to greet people with my hands.”
ICRISAT-Kano in Nigeria, in collaboration with the Federal Ministry of Agriculture and Rural Development (FMARD) supported a group of 25 women processors and seven male artisans on the use and maintenance of one such technology – the small-scale, groundnut-oil-extraction and milling machine fabricated by Eng. Wada Dandago. After demonstrating the machine’s use and giving maintenance and troubleshooting tips, Eng. Dandago said that it would take about 10–15 minutes to extract the oil with the machine compared to two hours by manual extraction of the same amount of groundnuts. The machine costs about N70,000 ($443) and local fabrication means spare parts are easily available.

Two women’s groups paid a deposit towards the purchase of the machine while others promised to source funds for the same. The local government said arrangements were being made to purchase 20 machines for distribution to women’s groups in the area and asked ICRISAT to assist with training.
"My wish is to make improved seeds available throughout Mali, and distribute them to farmers."

In 2005, Mrs Mouna Sidibé Coulibaly, a secretary by training, had just returned from working for a seed company in the United States where she had dreamed of creating a label for her country’s seeds. More than that, she dreamed of creating a company that would produce, package and distribute high quality seeds in Mali.

In her vision, Mali’s farmers would no longer depend on imported seeds, but also use seeds produced locally and distributed at affordable prices. The name of the new company was “Faso Kaba”, or ‘maize from the country’ in the Bamanakan language. "We chose this name to show that the seeds we sell are improved seed varieties from Malian research, and therefore produced locally," confirms Mrs Coulibaly.

In those early days, few people believed in her project; the banks and lending institutions were reticent; they had no confidence in the marketing of seeds because they did not consider seed distribution to be a profitable and viable business, so had no interest in investing in the activity. Mrs Coulibaly points out: “The few financing opportunities in the sector were granted to cooperatives and organizations with guarantee funds. The bank made me understand that giving money for this purpose to a private operator like me was not one of its responsibilities.”

Perseverance
Rather than be discouraged, she put her experience at the service of a farmer organization in the Upper Niger River Valley (OHVN) area known in Mali for its intense agricultural activity. “Our mission was to assist in preparing bank financing and guarantee files. The organizations subsequently had access to bank financing to buy agricultural inputs.”

Despite this access by organizations to credit to buy inputs, Mrs Coulibaly still noted a gap to be filled with respect to farmers’ needs: “They still did not have access to quality seeds. At the end of each cropping season, they complained of having invested their money in herbicides, but without gaining a good harvest.”

Meanwhile, her agronomist husband carried out research and was able to distribute resulting tiny quantities of improved seeds, which were deemed satisfactory by farmers.

The dream becomes reality
The trigger that moved the dream into reality came when Mrs Maimouma Sidibé Coulibaly heard the testimony of a farmer, who showed interest in buying the improved seeds from research, but could not get them in quantity while they were free of charge.

“Firstly, I started with a small seed shop at home as a retailer selling maize to which I had easy access, with the support of my agronomist husband and also because of my experience in the United States as an employee of a maize seed company.”

The start was not easy but despite a few setbacks, she was able to obtain a loan which was eventually repaid, and the Faso Kaba Seed Company increased volumes of inventory.

With the first home shop doing very well, a second shop was opened in Bougouni (Sikasso region), one of the largest agricultural zones in Mali. “We tried to get closer to the countryside; and by word of mouth and support from the Rural Economy Institute (IER), which directed farmers to me for seeds, the company started operating.”
Mrs Maïmouna Sidibe Coulibaly, Founder and CEO of Faso Kaba Seed Company, in a seed cleaning and packaging line with an employee of the company.
“I worked with cooperatives to produce and distribute seeds. They accepted the partnership, and that is how things got started.”

West Africa Seed Alliance inspiration
The environment that has allowed Faso Kaba and other seed producers and traders to thrive is in part due to the existence of the West Africa Seed Alliance-Seed Project (WASA-SP), a five-year, multilateral public-private sector alliance executed in partnership with ICRISAT, the African Seed Trade Association (AFSTA) and the Seed Science Centre of Iowa State University (SSC-ISU), with the cooperation of other regional and local partners. WASA-SP supports an African-led agenda by improving trade-related capacities for market access, enhancing the food supply, and developing agricultural research to sustain long-term productivity growth.

Faso Kaba also benefited from a two-year grant and multiple training courses sponsored by the Alliance for a Green Revolution in Africa (AGRA).

Faso Kaba has become a benchmark in Mali for the production and marketing of seeds by the private sector.

The company has expanded its network beyond the borders of Mali into new import partnerships with the likes of United Genetics and its tomato seeds, in particular Maxipeel. The company is a member of the Association Semencière du Mali (ASSEMA), which is itself a member of the African Seed Trade Association (ASFTA).

“I am convinced that change is coming into the production and distribution of seeds in Mali, which is also a source of income for farmers because the price of seeds is higher than that of grains.”

Currently Faso Kaba Seed Company works mainly with four Malian cooperatives with which it has concluded seed purchase contracts, but the distribution network operates at several levels so that improved seeds are available even deep in the villages. Mrs Coulibaly has ambitious plans: “My wish is to make improved seeds available throughout Mali and distribute them to farmers.”

Now one of the main agro-dealers in Mali, and certainly the only woman who has so far succeeded in producing and distributing seeds on a large scale, she takes great pride in what she has done. “My mom was a producer (nearly 500 kg of sorghum per cropping season); that’s how she fed us. She had no access to improved seeds at that time. Producing and marketing tons of improved seeds is therefore a source of satisfaction and great pride for me; and above all this, I feel that through the activities of the company I am rendering service to farmers, and this means that I am somehow useful to farmers.”

Linking Faso Kaba Seed Company to women producer associations
Conscious of the difficulty that women can face in seed production and distribution, Mrs Ma mouna Coulibaly, the CEO of Faso Kaba Seed company, supports others who may one day also become agro-dealers: “Women have strong interest in operating in the seed sector but they mostly lack time because of their many responsibilities during the peak sale periods of seeds when they would need to be 100% available.”

In 2013, Faso Kaba Seed Company entered into a contract for the production of certified groundnut seeds on 43 hectares with the Women Groundnut Seed Producers’ Association of Wakoro in Mali for the 2013 rainy season. Members of the group have benefited from ICRISAT training and capacity building support in producing quality seed and are now trying to commercialize their production. For the 2014 season, Faso Kaba has a further new contract with this group of 50 women groundnut seed producers for expected production estimated at 7 tons.
IFAD President comes “home” to ICRISAT Niger

“We have a future that has potential, and our role is to transform this potential into actionable results. I am proud of the work ICRISAT is doing in helping ensure prosperous, food-secure and resilient drylands. This mandate is not an easy one to achieve but it is feasible,” said Dr Kanayo Nwanze, President of the International Fund for Agricultural Development (IFAD).

During his visit to the ICRISAT Sahelian Center in Sadoré, Niger on 25 July, 2013, Dr Nwanze (left) stressed the importance of investing more in rural development and in smallholder farming systems: “While potential exists, this needs to be translated into real and concrete projects on the ground. Scientific knowledge is to be transformed into action for development. That is why scientists must work together with diverse partners – the public and private sectors.”

Niger Prime Minister pledges support to ICRISAT-Niamey

“This is an environment I will be willing to work in, and the Niger authorities will make every effort to preserve and enhance this ICRISAT Sahelian Center here in Sadoré,” said His Excellency Brigi Rafini, Prime Minister and Head of the Government of Niger, during his visit to ICRISAT-Niamey on 31 January.

“ICRISAT’s mission fits perfectly with the 3N (Nigériens Nourish Nigériens) Initiative launched by the President of the Republic, His Excellency Mahamadou Issoufou,” he added.
ICRISAT at the 6th Africa Agriculture Science Week

Showcasing agricultural science and innovation for food security

ICRISAT took an active part in the proceedings and side events at the 6th Africa Agriculture Science Week (AASW) organized under four sub-themes from 16–20 July in Accra, Ghana. “Let’s talk money”, a film developed by ICRISAT and its partners (Agro Insight and partners) was awarded the third prize in the Film Festival Award category. The award was presented to Mr Bougouna Sogoba, Director of the Malian NGO Association Malienne d’Éveil au Développement Durable (AMEDD).

ICRISAT Nigeria celebrates Annual Day

The Institute’s 41st anniversary was celebrated at the ICRISAT-Nigeria office in Kano on 19 December with a large turnout of dignitaries from Kano, Katsina, Jigawa, Bauchi and Kaduna States of Nigeria and representatives of the Federal and Kano State Ministries of Agriculture and Rural Development.

Delivering the welcome address, ICRISAT Nigeria country representative Dr Hakeem Ajeigbe thanked the partners for their support and enumerated some of the station’s successful projects and activities during 2013. Among those highlighted were the successful implementation of 2198 on-farm trials and demonstrations in six states, reaching over 8000 farmers in Kano State and the official release of groundnut varieties SAMNUT 25 and SAMNUT 26 and the pearl millet variety PE05984.

Dr Farid Waliyar, Director, ICRISAT West and Central Africa, thanked the Federal Ministry of Agriculture and Rural Development for the trust it has placed in ICRISAT and also presented the Outstanding Partnership Award to Katsina State Agricultural and Rural Development Authority (KTARDA) on behalf of ICRISAT Director General Dr William Dar.
ICRISAT Annual Day Celebration in Niger and Mali

It was a day punctuated with team-building exercises and cultural events as staff at ICRISAT Mali celebrated the Institute’s 41st anniversary on 11 December in Mali. Also present were representatives of fellow CGIAR institutions, including the International Livestock Research Institute (ILRI), the International Center for Research in Agroforestry (ICRAF) and The World Vegetable Center (AVRDC).

In Niamey, staff celebrated Annual Day on 13 December at the W National Park on the Niger River, a major regional park that spreads from Niger into Benin and Burkina Faso. Several Sadoré staff members camped in tents by the river, with some taking a canoe ride on the river on the lookout for wildlife.
Commitment to a stronger and more dynamic agricultural research-for-development partnership as the way forward in tackling food security and poverty reduction in West and Central Africa was underlined when ICRISAT’s 68th Governing Board meeting was held strategically in Dakar, Senegal on 6–10 April.

Recognizing that partnership is the key to overcoming the poverty and food insecurity that remain as serious challenges in the WCA region, a Partnership Day was organized by ICRISAT, the Institut Sénégalais de Recherches Agricoles (ISRA), and the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) on 8 April. The Partnership Day succeeded in further strengthening ties and in exploring new opportunities for collaboration and sharing of expertise and resources between ICRISAT and its partners in WCA.

A highlight of the week-long event was a courtesy meeting with Senegal’s then Prime Minister, Mr Abdoul Mbaye and Minister of Agriculture Mr Abdoulaye Baldé on 9 April.

Senegal Prime Minister Mr A. Mbaye (left) with Dr Nigel Poole (Chairman of ICRISAT Governing Board) and Dr William Dar (ICRISAT Director General)
ICRISAT and the West African Centre for Crop Improvement sign a partnership agreement

During the Partnership Day, ICRISAT and the West African Centre for Crop Improvement (WACCI) signed a five-year Memorandum of Understanding targeted at cooperation and collaboration in research for development, training and other activities. It encourages the exchange of scientific material, publications and information as well as staff exchange visits and admission of students. ICRISAT and WACCI will also explore external funding opportunities through joint project proposal development, thus enabling both parties to extend their collaborative activities. WACCI, based at the University of Ghana, trains plant breeders to lead the conversion of genetic and molecular discoveries into innovative solutions that result in improved varieties to benefit agriculture and improve food security in West Africa.

International Day of Rural Women celebrated by ICRISAT and Maisha TV in Mali

Rural Women’s Day on 15 October was celebrated by ICRISAT’s West and Central Africa regional hub in Mali in a first-time partnership with Maisha TV. A magazine broadcast featured women engaged in groundnut production, processing and marketing. The program was aired four times by the TV station, which covers a wide range of countries in West Africa.
On 3 October, 79 groundnut farmers (60 of them women) convened at ICRISAT’s Samanko station in Mali for a farmers’ field day. The group visited experimental and demonstration plots of improved groundnut varieties, showing keen interest to learn about quality seed production and new varieties, especially their resistance to foliar diseases and tolerance to drought and aflatoxin contamination.

Also attending the field day were NGO partners (Plan Mali, CAAD, Faso Kaba, GRAADECOM, Sahel 21, and EUCORD) with whom ICRISAT has been working to empower women individually or in groups to access improved varieties.

Linking women groundnut seed producers to seed markets in Mali

In line with ICRISAT’s Inclusive Market-Oriented Development (IMOD) approach to exploring opportunities to link farmers to markets, 14 women groundnut seed producers from Wakoro and the Faso Kaba Seed Company met at ICRISAT’s Samanko station in Mali on 17 April. Together with ICRISAT scientists, they deliberated production of quality groundnut seeds, certification and marketing as well as contracts.

Left to right, Mrs Maimouna Coulibaly (CEO of Faso Kaba Seed Company) and Mrs Mariam Coulibaly (Groundnut seed producer) with Dr Bonny Ntare (ICRISAT Scientist). In photo (top of page): Field day participants examine groundnut varieties.
Improved groundnut and millet varieties showcased in Bauchi State, Nigeria

On-farm trials and participatory demonstrations of improved varieties of millet (SuperSossat and Sossat-C88) and groundnut (SAMNUT 24), as well as improved agronomic and management practices, were showcased during farmers’ field days held on 16 and 17 September in Bauchi State, Nigeria. The event highlight was a display of produce by the ICRISAT Farmers Association Ningi. The program was covered live by the Ningi community radio station and other media, and welcomed over 300 participants composed of farmers, marketers, processors, and extension agents. Improved groundnut varieties SAMNUT 21 and SAMNUT 22 were showcased during the field day in plantings alongside local variety Mai borgu.

Hybrid sorghum seed: an attractive option for WCA producers

An Open Field Day was organized on 24 September by ICRISAT and Mali’s Institute of Rural Economy (IER) to enable information exchange on maximizing profitability and minimizing production risks with new sorghum hybrid varieties which were demonstrated in plots with various agronomic options applied.

In addition to a tour of the plots, the nature and the potential of the new sorghum hybrids was explained to about 60 producers by ICRISAT sorghum breeder Dr Frederick Rattunde and colleagues in both French and the national language Bamanankan.
Strengthening seed producers’ organizations to become viable enterprises

ICRISAT, together with the Farmer-Managed Seed Enterprises in Mali (FarmSEM), has stepped in to improve the skills and capacity of seed producers’ organizations in the Sikasso and Mopti regions through the USAID Feed the Future project.

The two-year (2013–2015) project’s first planning workshop targeted at Sikasso was held on 8–10 October, when about 60 farmer members of producer associations and cooperatives met in Koutiala. The workshop served as a platform for exchange of experiences, clarifying roles and expectations of partners in the development of a viable and sustainable seed system, and refining strategies with stakeholders for wider use of improved seed and hybrids of sorghum and other associated crops. Significant time was spent identifying priority actions to strengthen the production and dissemination of improved seeds.
Mrs Sanogo Fanta Diamoutênè, President of a producers union, outlines the contribution of her organization to the seed production sector, in the national language Bamanankan.
Training courses conducted in 2013 by ICRISAT West & Central Africa

**ICRISAT-Niamey, Niger**

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<td><strong>275</strong></td>
<td><strong>1326</strong></td>
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# Participants

<table>
<thead>
<tr>
<th>Name of the course</th>
<th>Countries</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
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<tr>
<td>Formation sur les tests culinaires des hybrides, Djiguidala, 15 January</td>
<td>35</td>
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<tr>
<td>Atelier de formation sur les méthodologies de sélection de l’arachide, Samanko, 6–15 May</td>
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<tr>
<td>Formation sur l’approche CEP par grappe et essais participatifs, Koutiala, 13–15 May</td>
<td>28</td>
<td>26</td>
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<tr>
<td>Formation sur la microdose mécanisée et l’utilisation du Gro Plus, Samanko, 28–30 May</td>
<td>57</td>
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<tr>
<td>Formation de jeunes producteurs pour la conduite des champs de démonstration hybrides de sorgo, Dioïla, 1 June</td>
<td>34</td>
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<td>Formation en production de semences hybrides de sorgo, Dioïla, 2 June</td>
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<tr>
<td>Formation sur microdose mécanisée et utilisation de Gro Plus, Koutiala, 4–6 June</td>
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<tr>
<td>Formation des partenaires de l’ICRISAT sur la microdose mécanisée, le processus de trempage et d’enrobage des semences avec le Gro Plus, Koutiala, 4–11 June</td>
<td>34</td>
<td>32</td>
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<tr>
<td>Formation sur l’évaluation participative des nouvelles variétés et la diffusion de technologie, Samanko, 1–2 July</td>
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<td>Formation sur les techniques agricoles et les techniques de vulgarisation, Samanko, 1–2 July</td>
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<td>Formation sur Africa RISING, Samanko, 2–3 November</td>
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<td>Formation en production de semences hybrides de sorgo, Siby, 4 July</td>
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<td>Formation en production de semences hybrides de sorgo, Samanko, 24 September</td>
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<td>Formation sur l’évaluation et la valorisation des champs de démonstration de sorgos hybrides, Koutiala, 1–2 November</td>
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<td>Training on pre- and post-harvest aflatoxin management using varietal and demonstration plots in collaboration with the extension service (Secteur d’Agriculture de 120, Kolokani), 1 November</td>
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<td>Training on peanut transformation and post-harvest aflatoxin management, Kita, 5 November</td>
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<td>Training on pre- and post-harvest aflatoxin management using varietal and demonstration plots in partnership with AMASSA-AFRICA GREEN, Koutiala, 13–14 November</td>
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<td>Training on pre- and post-harvest aflatoxin management, Koutiala, 13–14 November</td>
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<td>Training on integrated aflatoxin management, Sadiola, Kayes, November</td>
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<td>Training on integrated aflatoxin management, Ouéléssébougou, November</td>
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<td>Pre- and post-harvest management of aflatoxin, Kita</td>
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<td>Aflatoxin management, Tiele</td>
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<td>5</td>
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<td>Training of NGO agents, Koutiala</td>
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</table>
| Aflatoxin management, Kita | 2846 | 1470 | 1376 | 2846 | **Sub-total (Mali)**
ICRISAT-Kano, Nigeria

<table>
<thead>
<tr>
<th>Name of the course</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>Dry season groundnut seed production training, Kano, 17 January</td>
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<td>2</td>
<td>58</td>
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<tr>
<td>Extension agents and technicians pre-season training, Ningi, 1 May</td>
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<tr>
<td>Extension agents and technicians pre-season training, Kano, 2 May</td>
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<td>Extension agents and technicians pre-season training, Katsina, 10 May</td>
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<td>Extension agents and technicians pre-season training, Dutse, 11 May</td>
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<td>Training of enumerators on household data collection, Bebeji, 21–22 May</td>
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<tr>
<td>Groundnut value chain stakeholders workshop, 30–31 July</td>
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<td>Groundnut oil extraction machine training, 8 August</td>
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<td>Sorghum survey for the farmers in Kano State, 14 August</td>
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<td>Groundnut farmers and stakeholders workshop, 21 August</td>
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<td>EAs and stakeholders mid-season training, Katsina, 28 August</td>
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<td>EAs and stakeholders pre-season training, Dutse, 3 September</td>
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<td>EAs and stakeholders pre-season training, Bauchi, 4 September</td>
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<td>Large-scale farmers meeting and training, 9 September</td>
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<td>EAs and stakeholders mid-season training, Kano, 10 September</td>
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<td>Hammer mill and groundnut oil extraction machine demonstration and training, September</td>
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<td>Dry season groundnut seed production training, Kano, 19 September</td>
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<td>Dry season groundnut seed production training, Dutse, 19 September</td>
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<td>Dry season groundnut seed production training, Bauchi, 20 Sept</td>
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<td>Dry season groundnut seed production training, Katsina, 20 Sept</td>
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<tr>
<td>Training women on food security, value addition, entrepreneurship and sustainability of women’s cooperatives, Zango, 9–10 December</td>
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<td>Training women on food security, value addition, entrepreneurship and sustainability of women’s cooperatives, Bebeji, 12–13 December</td>
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<td>Training women on food security, value addition, entrepreneurship and sustainability of women’s cooperatives, Tsanyawa, 16–17 Dec</td>
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<td>Training women on food security, value addition, entrepreneurship and sustainability of women’s cooperatives, Gambawa, 19–20 Dec</td>
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<td>Training course in statistics and statistical computing with SAS, 16–20 December</td>
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<td>Scenario Visioning workshop, Kano, 16–18 December</td>
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<td>Annual biomass training, Kano, 15–16 September</td>
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<td>Perennial biomass training, Kano, 19–20 December</td>
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| Sub-total (Nigeria) | 629 | 204 | 833 |
| Grand total | 2280 | 3000 | 5280 |
Moving beyond subsistence farming

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Who we are

Scientific staff list

Bamako, Mali

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Director, West and Central Africa  
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Principal Scientist (Sorghum Breeding and Genetic Resources) – Dryland Cereals  
Germany

Tom Van Mourik  
Special Project Scientist – Dryland Cereals  
Netherlands

Abdoulaye Moussa  
Senior Scientist, CCAFS West Africa, Resilient Dryland Systems  
Niger

Moses Osiru  
Senior Scientist – Legume And Cereal Pathology (Grain Legumes/Dryland Cereals)  
Uganda

Wenda Bauchspies  
Gender Specialist  
USA

Baloua Nebié  
Junior Professional Officer – Geneticist, Sorghum Breeder  
Burkina Faso

Ramadjita Tabo  
Incoming Director, West and Central Africa  
Chad

HFW Rattunde  
Principal Scientist (Sorghum Breeding and Genetic Resources) – Dryland Cereals  
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D Haile Michael Shewayrga  
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Ethiopia

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Regional Administration Manager  
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BR Ntare  
Assistant Regional Director/Principal Scientist (Breeding) – Grain Legumes  
Uganda

Pierre CS Traoré  
Remote Sensing Scientist and Head of Geographic Information Systems – Resilient Dryland Systems  
France

Robert Zougmoré  
Team Leader, CCAFS West Africa Region, Resilient Dryland Systems  
Burkina Faso

George E Okwach  
Manager, HOPE Project for Sorghum and Millet – Dryland Cereals  
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Birhanu Zemedim Birhanu  
Scientist – Land and Water Management (Resilient Dryland Systems)  
Ethiopia

Felix Badolo  
Visiting Scientist – Agro-Economist  
Burkina Faso

Agathe Diama  
Regional Information and Communication Officer  
Mali
Niamey, Niger

Mahamadou Gandah  
Country Representative  
Niger

Hamidou Falalou  
Regional Scientist (Physiology) – Resilient Dryland Systems  
Niger

Malick Ba  
Senior Scientist – Entomology (Grain Legumes/Dryland Cereals)  
Burkina Faso

Ijantiku Ignatius Angarawai  
Scientist – Sorghum Breeding – Dryland Cereals  
Nigeria

Hakeem Ajinde Ajeigbe  
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Nigeria

Fatondji Dougbedji  
Regional Scientist – (Soil and Water Conservation) – Resilient Dryland Systems  
Benin

Tom Hash  
Principal Scientist/Pearl Millet Improvement Program – Dryland Cereals  
USA

Prakash Gangashetty  
Post-Doctoral Fellow (Pearl Millet Breeding) – Dryland Cereals  
India

Jupiter Ndjeunga  
Principal Scientist/Economist – Policies, Institutions and Markets  
Cameroon

Mensah Edouard Romeo  
Associate Professional Officer (Economics) – Policies, Institutions and Markets  
Benin

Babu Nagabhushan Motagi  
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Hassane Amadou  
Regional Finance Manager  
Niger

Gaston Sangaré  
Regional Farm Manager  
Mali

Kano, Nigeria

Hakeem Ajinde Ajeigbe  
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Nigeria

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Scientist – Sorghum Breeding – Dryland Cereals  
Nigeria

Babu Nagabhushan Motagi  
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India

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