ICRISAT works in agricultural research for development across the drylands of Africa and Asia, making farming profitable for smallholder farmers while reducing malnutrition and environmental degradation.

We work across the entire value chain from developing new varieties to agribusiness and linking farmers to markets.

About ICRISAT:
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We believe all people have a right to nutritious food and a better livelihood.
Our work contributes towards the following Sustainable Development Goals.
ICRISAT West and Central Africa
Pursuing Food and Nutrition Security in the Sahel

Highlights 2018

Cover photo: Polina Tafawa Samuel participating in a sorghum-based products' processing training, Kano, Nigeria.

Credit: A Diama, ICRISAT

About ICRISAT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, nonpolitical organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners from 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 near Hyderabad, Telangana, India, with two regional hubs and four country offices in sub-Saharan Africa. ICRISAT is a member of the CGIAR System Organization.

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The year 2018 was a rewarding one, and I would like to express our gratitude and appreciation to our partners, and especially the farmers who shared our science and its benefits.

This report presents our progress during the year in the light of emerging challenges of climate change and how our systems approach is adding value towards increasing the productivity and intensification of our mandate crops in West and Central Africa.

Our goal of exploring ways to ensure the long-term sustainability of technologies and exploring innovative and modern ways to extend the benefits of science to a majority of smallholder farmers is articulated in the four major research themes we work on in the region -- Crop improvement, Integrated crop management, Systems analysis and Policy and impacts. This report highlights the main achievements under each theme.

The road to our successes are paved with stories about the beneficiaries of our science. We have stories from the field, of the men and women farmers whose lives have been impacted by ICRISAT and partner interventions under projects such the Africa RISING’s large-scale Diffusion of Technologies for Sorghum and Millet Systems (ARDT_SMS), the groundnut upscaling project and the Nigeria Agricultural Transformation Agenda Support Program in four staple crop processing zones (SCPZs).

We hope you will enjoy reading these.

Dr Ramadjita Tabo
On top of the world: A farmer stacks his harvest of sorghum atop his roof.

Photo: M. Magassa, ICRISAT
Crop improvement

ICRISAT’s crop improvement in West and Central Africa aims to understand crop biodiversity by studying and exploiting phenotypic diversity, intra-varietal diversity and geographic differentiation. The focus is on improving farmer-preferred and market-oriented cultivars of pearl millet, sorghum and groundnut.

Adoption of Chakti, Africa’s first Fe (iron)-biofortified pearl millet variety in West Africa: Chakti with 20% more than the estimated average requirement of iron may improve nutritional status and help achieve physical and cognitive potential of women and children. This is the result of an ICRISAT-HarvestPlus breakthrough. The government of Niger in 2018 officially released Chakti for commercial cultivation. Using the Economic Community of West African States (ECOWAS) seed harmonization laws which facilitate farmer access to high quality seed varieties, this variety will subsequently be recommended for cultivation across the region.

- Developed high Fe (50 mg/kg) and Zn (45 mg/kg) biofortified pearl millet variety ICMV 167001 with white bold grains that look like sorghum grains and high yields of 1.6 tons/hectare (t/ha). It is most preferred by food processors for making different food items.
- 15 t of certified seed were produced in 2018 in Niger and 3 t in Senegal. This will aid its adoption on about 5000 ha in the coming rainy season in both countries.

The ICRISAT-National Agricultural Research System (NARS) partnership led to the release of 20 improved and high yielding groundnut varieties preferred for enhancing productivity and nutrition.

In Mali, 35,000 stakeholders, 46 schools and 127 women were sensitized on the effects of aflatoxin on nutrition through awareness, media campaigns and training.

Pearl millet

- 6 Burkina Faso
- 10 Mali
- 1 Ghana
- 3 Nigeria

Groundnut

- Groundnut producer Mrs Mariam Coulibaly in Wakoro, Mali.
- Identified micronutrients-dense sorghum lines for better health: 38 sorghum B-lines screened for micronutrient content in grains revealed an average of 5 sorghum lines with >65 mg/kg iron (Fe) and 30 mg/kg zinc (Zn) under high and low input conditions. Of these, 3 new R-lines recorded 54-74 mg/kg Fe and 22-34 mg/kg Zn, opening a window for nutrient-dense hybrid development.

- Analyzed prospects of high grain micronutrients (Fe and Zn) in Nigerian sorghum landraces against hidden hunger and malnutrition diseases: 403 generic Kaura and Farafara sorghum landrace collections were analyzed for Fe and Zn content using X-ray fluorescence (XRF). Fe concentration in Kaura types was on average 70.1 mg/kg while Zn concentration was 46.05 mg/kg. Among these, 7 landrace lines are being assessed for farmer-preferred varieties.

- Use of improved varieties, seed dressing and tillage practices in Nigeria increased grain yields of sorghum by 30-64%, 27-38% and 20-55%, respectively.

- The registration and release of two medium-maturing sorghum varieties, Samsorg 47 and Samsorg 48 as Zauna-Inuwa and Samsorg 48 as Kaura Bornu, and an early medium-maturing variety Samsorg 49 as CF35:5 was approved by Nigeria’s National Committee on Variety Naming, Registration and Release on 26 July 2018.

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**Samsorg 47 (Zauna Inuwa)**

- Developed from indigenous sorghum germplasm material through pure-line head-to-row selection
- Medium and uniform height
- Long and semi-compact panicles
- Bold testa-free yellow grain
- Stay green tendencies
- Suitable for the Sudan and Northern Guinea Savanah zones
- Yield potential of 4.8 t/ha.

**Samsorg 48 (Kaura Bornu)**

- Developed from sorghum germplasm material indigenous to Northeastern Nigeria
- Head-to-row selection focused on grain yield, uniformity in height, panicle type and grain quality
- Recommended for cultivation in the Sudan and Northern Guinea Savannah zones.

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**Africa RISING's large-scale Diffusion of Technologies for Sorghum and Millet Systems (ARDT_SMS)**

69,577 farmers (24,350 women) trained by 5,970 Farmer Field School (FFS) facilitators (2,070 women) on best agricultural practices including integrated Striga and soil fertility management, seed treatment and biological control of the millet head miner.

476 extension agents (165 women) trained in best agricultural practices in millet and sorghum

1,082 seed producers (378 women) trained in seed production techniques and post-harvest handling

Grain yields increase by

51% sorghum 72% pearl millet
Integrated crop management

ICRISAT’s research on integrated crop management focuses on developing integrated natural resources and soil-water-crop and nutrient management options to improve agricultural productivity.

Water conservation and utilization

Watershed management practices in the watershed villages in southern Mali reduced runoff and soil erosion. Farm-level practices such as contour bunding and planting fast growing tree species, composting and solar-powered deep wells improved production of sorghum by 72% and of pearl millet by 58% and increased farmers’ incomes by 20% in both crops.

Aflatoxin management

Demonstration and adoption of integrated crop management technologies led to the reduction of aflatoxin contamination in groundnut, increased crop value and improved health and nutritional security. Groundnut samples from plots that adopted improved technologies showed a reduction of 11.20 ppb compared to farmer’s plots using traditional practices.

Farmers and extension agents in Nigeria have a 60% better understanding of good agronomic practices and post-harvest handling following training.

Bioreclamation of degraded lands

Innovative and participative testing and scaling of integrated land management options and bioreclamation of degraded lands to improve soil health among local communities across 5 regions in Burkina Faso and Niger involved 1200 men and 300 women.
The Research Program on Innovation systems for the drylands aims to improve farm productivity by recognizing the importance of conditions needed to create demand for technologies, and how knowledge produced through systems thinking may be used to bring about such changes. To support its research, ICRISAT focuses on the systemic analysis of conditions that trigger agricultural intensification, and how to support inclusive market-oriented development through digital agriculture and associated technologies. Specifically, automated, remote sensing-based methods to scale up attainable yield gap quantification for locally dominant crops are used and IT platforms developed to include smallholders into networks through enhanced access to credit and financial services, insurance, quality inputs at affordable prices and next generation agricultural advisory services. The research also focuses on improvement of field-scale seasonal yield prediction with satellite data assimilation in smallholder production systems.

An ICRISAT research technician (in blue) with a group of farmers on a field visit in Niger.

A Harnessing Opportunities for Productivity Enhancement (HOPE) II project study in Mali revealed that more households sought better ways of increasing the management and utilization of improved millet grain that leads to improved food and nutrition security.

In Northern Nigeria, a seed needs assessment showed low seed availability (<10%). Majority of farmers (71%) rely on informal seed sources for most crops. Only 6% relied on seed companies as a source of seed while the majority (84%) obtained them within their Local Government Areas (LGA).
A comparative analysis of microdosing techniques under integrated Striga and soil fertility management (ISSFM) strategy and farmer practices in sorghum and pearl millet production systems in Sikasso and Mopti regions of Mali revealed that:

▪ Intercropping cereal and cowpea together with microdosing techniques, particularly the mixed application of mineral fertilizer and seeds, gave high yields of 1,635 kg/ha in sorghum and 1,580 kg/ha in pearl millet-cowpea. Average grain yields varied from 1,285 kg/ha to 1,580 kg/ha in pearl millet.

▪ Smallholder sorghum and pearl millet farmers using microdosing techniques generated high net benefits compared to those using farmer practices. Net benefits from ISSFM averaged 60% higher than those from farmer practices.

▪ About 92% of the smallholder farmers were satisfied with microdosing techniques, mainly due to the consequent increase in grain yields, marketable surpluses, more market opportunities and high impact on well being in terms of increased food availability for the family.

▪ Education had a positive impact leading to significant probability of adoption of ISSFM. Findings confirmed the significance of social networks in technology adoption.

▪ Farm households that adopted ISSFM benefited: An increase of 664 kg/ha for household consumption compared to 451 kg/ha for non-adopters, underlining the potential of new agricultural technology in attaining food security through increased farm productivity and production.
In West Africa, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) contributed to farmers’ access to financial services, e.g. through the agCelerant digital smallholder value chain orchestration platform which provided more than 50,000 farmers with bundled services, and secured commitments to support scaling up to 17 million farmers in Nigeria and across a 10-country Regional Rice Value Chain Program.

In Mali’s cotton belt, unmanned aerial vehicle-derived vegetation indices explained up to 78% of the variation in crop yield and 74% of the variation in fertilizer use within individual smallholder fields. However, lumping together fields growing a given crop saw yields drop to 45% and fertilizer use to 48%, indicating that remote sensing imagery doesn’t fully capture the influence of crop stress and management (http://oar.icrisat.org/10504/).

A soil-plant phosphorus module developed for the CERES-Sorghum model (DSSAT) successfully reproduced vegetative and grain yield penalties associated with P-deficient soils, opening prospects for custom fertilizer recommendations in a low-input system (http://oar.icrisat.org/10619/).

The first ever national 10-meter crop mapping coverage for Mali was generated using parcel-level, near real-time agricultural monitoring from the sen2-agri multi-sensor Earth Observation system, paving the way for improved agricultural statistics (http://oar.icrisat.org/11059/).

In Mali’s cotton belt, Sentinel-2 satellite time series assessed smallholder field crop types with 80% accuracy and village-level crop production with a maximum model uncertainty of 0.33%, which helps improve community-level food security and will help target agricultural development interventions (http://oar.icrisat.org/10845/).
We also work on economics of diversification and its sustainability. socio-economic studies enable an evaluation of the true impact of research and to identify technologies suitable for large-scale adoption in the region. Specifically, the theme conducts research on the onset situation analysis and baseline data collection for impact studies; socio-economic studies and analysis to support farmer transition from subsistence to market-oriented production with productive and nutritious sorghum, millet and groundnut production packages for multiple uses and regional impact assessments of the performance of different improved production technologies and approaches.

- **Ghana**: A national science-policy dialogue platform developed an investment framework and financial plan to support the operationalization of the national climate-smart agriculture and food security action plan.

- **Mali and Senegal**: Two projects totalling US$ 11 M were developed and submitted to Green Climate Funds (GCF) by the national science-policy dialogue platforms, which benefited from capacity strengthening from CCAFS.

- **Climate-smart agriculture country profiles** were developed by CCAFS for Benin, Cote d’Ivoire, The Gambia and SIDS (Seychelles, Cape Verde and Guinea Bissau).
Participants of the AfDB-funded TAAT Sorghum and Millet Compact Project during a field visit in Sudan.

- **Policies, Adoption, Gender and Impacts**: Using a double difference method\(^1\), data collected from 220 households spread across two States in Northwestern Nigeria showed that both gross profit margin and returns on investment were positive. Results of the survey suggest that smallholder farmers could sustain and make additional cash incomes by adopting improved groundnut technologies.

- **Communities make healthier consumption choices**: A HOPE II study in Mali reveals that more households sought better ways of increasing the management and utilization of improved millet grain that leads to improved food and nutrition security. Women are reserving higher quantities of harvested millet grain for family consumption and millet cake and doughnut production for income generation.

\(^1\) Double difference method involves comparing the before and after difference for the group that received the intervention (where they have not been randomly assigned) with the before and after difference for those who did not.
Success stories from the field

Farmers from Burkina Faso and Mali during the cropping season

Photo: ICRISAT

ICRISAT West and Central Africa Highlights 2018
While recovery is a process used in the banking sector to collect money lent out to clients, with its recovery schedules and clear terms and conditions between clients and financial institutions, the process has served as an inspiration to recover seed in the USAID-funded Groundnut Upscaling Project in Nigeria as an option to enhance the production and availability of different classes of seeds of improved groundnut varieties.
ICRISAT assumed the role of facilitator and participant-observer. Both the Centre for Dryland Agriculture of the Bayero University of Kano (CDA/BUK) and Institute for Agricultural Research of the Ahmadu Bello University (IAR/ABU) supplied breeder seeds (BS) and foundation seeds (FS). Community-based seed producers (CBSP) produced certified seeds (CS) under the supervision of Agricultural and Rural Development Authorities/Projects (ADPs). Five seed companies and Jigawa Research Institute (JRI) produced foundation seed (as authorized by the 2014 Nigerian Seed Policy) and guided their out-growers to produce certified seed under the scheme.

Ensuring Seed Purity through a Seed Recovery Scheme

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Farm operations for all classes of seed were certified and later endorsed by the National Agricultural Seeds Council (NASC). Agreed funds were provided for certification. It was mandatory for all clients to participate in pre-season and related trainings facilitated by ICRISAT and NASC. Seed recovery was done in lower classes of seeds i.e., breeder seed was recovered as foundation seed and foundation seed was recovered as certified seed.

Thick arrows represent recoveries while dotted arrows represent seeds given out.
IAR/ABU and CDA/BUK produced and supplied breeder and foundation seed to ICRISAT using funds provided for this operation (core stock for revolving seed fund) and also to seed companies to enhance their seed business operations. They provided improved seeds to individuals and farmer groups in and out of sites not targeted by the project. They also enhanced institutional capacities in groundnut seed production, distribution and marketing.

The ADPs (facilitators of farmer groups) used their recoveries to distribute to farmers in villages/communities not targeted for project scaling interventions during subsequent cropping seasons; pay back recoveries as certified seed to ICRISAT (to be used for other purposes); contribute to setting up varietal demonstrations in villages/communities targeted for scaling interventions during subsequent cropping seasons; demonstrate the performance of the improved groundnut thresher and enhance institutional capacities to support groundnut seed production, distribution and marketing.

The role of the seed companies and JRI was to use the foundation seed produced and certified seed recovered from out-growers to sell certified seed to farmers and foundation seed to other seed companies in and out of the project states during subsequent cropping seasons; pay back recoveries of foundation seed to ICRISAT (received as breeder seed); store and give foundation seed to their out-growers as loans during subsequent cropping seasons; use certified seed in demonstrating the performance of the improved groundnut thresher; and enhance their capacities to produce, distribute and market groundnut.

Outcomes of the scheme: The seed recovery scheme was an opportunity to confirm trueness to quality of groundnut seeds at the point of recovery by the actors concerned. Beginning with an initial stock of 2 metric (M) t of breeder seed and 9 M t of foundation seed during the 2016 cropping season, 28 M t of breeder seed, 133 M t of foundation seed and 1,178 M t of certified seed were in stock at ICRISAT for the 2019 cropping season. A rapid survey of the spread of improved groundnut varieties revealed at least two improved varieties in 145 LGAs (out of 149) where the project had been implemented. Also, the ADPs extension team was reported to have been responsible for 65% of seed scaling initiatives.

An assessment of the recovery rates at the ADPs showed a variation between 80% and 100%. Seed companies and ADPs found the scheme useful in fostering linkages among seed sector actors and in building capacity in seed identification. The Chief Executive Officer (CEO) of the IAR/ABU Seed Company emphasized that despite its official regional mandate, breeder seed must be paid for in advance before being produced. By providing funds in advance to IAR/ABU, the project permitted the company to produce and make the seed available to other seed sector actors.

Both ADPs and seed companies were appreciative of ICRISAT’s engagement in groundnut seed production and distribution. Mrs Mary Turba Senchi, leader of a farmer group in the Danko-Wasago LGA of Kebbi State affirms that many farmers were able to access improved groundnut seeds through the seed recovery scheme even while accessing the desired variety of certified seed remains a challenge. Mrs Hajia Garu Maryam of Ningi, the LGA of Bauchi State, believes the scheme has been an effective tool to engage more women in groundnut production.

Mr Sanusi Dankawu, Project Desk Officer of the Kano State ADP remarked that the ADP will continue with the scheme even after project completion for two simple reasons: “Firstly, recovered seeds will continue to be borrowed by many more farmers, and secondly, the farmer groups involved see themselves as champions of a community course”. Mr Mohammed Usman, Project Desk Officer of the Jigawa State ADP sees the scheme “as a way of telling small farmers that inputs, notably seeds, don’t come free”.

Farmer groups engaged in the scheme during the 2018 cropping season. All members of the groups engaged had enough seeds to plant and nearly 85% of the groups recorded cash sales from certified seeds. Direct cash sales were estimated at ₦ 168,000 (US$ 471) in Jigawa State; ₦ 939,000 (US$ 2,638) in Sokoto State; ₦ 4,678,550 (US$ 13,142) in Kebbi...
State; ₦ 5,524,000 (US$ 15,517) in Bauchi State and ₦ 5,682,900 (US$ 15,963) in Kano State. Cash sales from groundnut haulms, usually about twice the value of seeds/pods, were not captured.

The major challenges faced in the scheme were that farmer groups are still compiling files to register with NASC to be formally recognized as CBSP (stipulated by the Nigerian Seed Policy of 2014); links between the CBSP (via the ADPs) and the IAR/ABU Seed Unit (now a seed company) remain fragile for securing breeder and foundation seed; the seed policy of 2014 confers rights of production, distribution and marketing of breeder seed on IAR/ABU and designated seed certification officers (7) are often too busy with other crops; hence including groundnut in the scheme of things is challenging. Among the operational challenges encountered were what Mr Abubakar Bandado, Project Desk Officer of the Sokoto State ADP, describes as the reluctance of farmer groups to part with seed they consider a scarce commodity; occasional reluctance and at times refusal by some actors (including Project Desk Officers) to return recoveries and the temptation to mix seeds with grains or with those that have similar features (Samnut 14 and Samnut 24).

By the end of the project, actors in the seed recovery scheme had all classes of seed to pursue the scheme during the 2019 cropping season. Physical examination of seed at recovery enhances purity, traceability and availability at different points of recovery. Basic knowledge on seed classes and varieties, including local varieties, is invaluable to ensure seed purity and traceability. Despite seed actors’ enthusiasm to pursue the scheme, its continuity hinges on averting possible downstream adulteration of seed when demand surpasses supply and the need for careful seed reconditioning.

Certified seed collected from out-growers.
Dry-season sorghum production spurs more income for a better livelihood in Nigeria

Alhaji Sule (left) displaying sorghum variety ICSV 400 he produced in the 2018 dry season.

Photo: H Ajeigbe, ICRISAT
The key to enhancing agricultural productivity and production is the easy access to farmers of quality and/or improved seeds at the right time and in the right quantity. This is crucial for food security and poverty alleviation. Improved sorghum varieties and new agricultural technologies developed to enhance productivity have the potential to create wealth for farmers and raw material for industrial use.

In the 2018 cropping season, ICRISAT through the Agricultural Transformation Agenda Support Program – Phase 1 (ATASP-1) project, distributed 22.29 metrics tons of quality seed of high yielding sorghum varieties adapted to the needs and preferences of different farmers/stakeholders in the value chain.

High-yielding Open Pollinated Varieties (OPVs) and hybrids of sorghum with resistance to major biotic and abiotic stresses and with farmer and market preferred traits were deployed and cultivated by farmers across the 4 Staple Crop Processing Zones (SCPZs) of Adani-Omor, Bida-Badeggi, Kano-Jigawa and Kebbi-Sokoto. The seeds were distributed to ATASP-1 farmers either as a seed drop or for demonstrations in communities. Of the 22.29 metrics tons of seed distributed, 21.6 metrics tons were seed drop interventions where 40 farmers were selected per community and given 4 Kg of improved seeds on recovery basis. The area cultivated was 2700 ha that provided grain yields of about 5400 metrics tons. In Kware LGA of Sokoto state, Kebbi-Sokoto SCPZ, where the agro-ecology is Sahel Savannah, the varieties introduced were Samsorg 40 (ICSV 400), Samsorg 41 (ICSV 111), Samsorg 45 (Improved Deko) and Samsorg 46 (Improved Zabuwa).

“The local materials at our disposal were no longer viable to grow sorghum given the low rainfall in recent years. The project intervention has drawn our farmers back to active sorghum production,” said Mr Alhaji Mu’azu Yakubu, District Head of Durbawa, Kware LGA (Sokoto state) during a community sensitization and mobilization program.

Having known that the varieties introduced are photoperiod insensitive, Mr Alhaji Sule of Bulama community says many farmers have ventured into dry season sorghum production in order to generate more income. He has been active in farmer-to-farmer seed diffusion within his neighboring communities.

| Women processors trained in the production and processing of sorghum to increase its shelf life. |
|---------------------------------|--------|--------|--------|
| Kano-Jigawa                    | 38     | 18     | 56     |
| Kebbi-Sokoto                   | 49     | 7      | 56     |
| Bida-Badeggi                   | 38     | 15     | 53     |
| Adani-Omor                     | 16     | 37     | 53     |

Photo: ICRISAT
Participants from Kebbi, Enugu, Bida and Kano during the training in sorghum products processing.
In addition to the varieties introduced, sorghum farmers received regular training on Good Agronomic Practices (GAPs) such as fertilizer microdosing, integrated *Striga* and soil fertility management and proper sowing time to gain maximum benefits (increase in yield and income).

The sorghum outreach program in Nigeria had a positive impact on youngsters and women as well. About 88 kg of seed were distributed to 11 secondary schools under the “Catch them Young” program to enable boys and girls to benefit from the demonstration of agricultural technologies and capacity enhancement in agribusinesses. At the same time, about 390 kg of improved varieties were distributed to women’s groups across the 4 SCPZs, covering 48.8 ha.

Due to the industrial demand for sorghum because of its health benefits, a series of trainings strategically focused on sorghum processing for household nutrition and income generation across the 4 SCPZs. Participants went through practical demonstrations on the use of Hammer mill with cyclone to produce high quality plain and composite sorghum flour, processing of pop sorghum, bread, biscuits, cake, peanut butter, spaghetti and improved traditional dishes such as *tuwo* and *kunun tsamiya*.

Women processors were trained in increasing the shelf life of sorghum products (flour, cakes, bread, modified local dishes). The main objectives were to facilitate the achievement of food and nutrition security, employment generation and wealth creation among the youth and women in Nigeria. Demonstration-lectures were delivered on Sorghum production and processing into composite flour, sorghum-based products such as Kunu, sorghum noodles, pop sorghum, cookies, cake, bread, doughnuts and crisps. The training was attended by 218 participants (77 men and 141 women).

*A hands-on demonstration by students on how to make pop sorghum using a locally fabricated machine.*
Preparation of sorghum-based noodles.

Photo: A Diama, ICRISAT
Private seed companies boost farmer access to improved groundnut seed in Mali

Groundnut is a very important source of human nutrition, livestock feed (haulms) and income generation in Mali. Yet, productivity is low, with yields of around 1 t/ha compared to the global average of 1.5 t/ha in the USA and over 3 t/ha in China. The main constraint to improving production in Mali is the inadequate availability of and access to seed of improved varieties. In order to enhance seed production, a Community-based Seed System (CBSS) approach was used through participatory varietal evaluation.
This involved seed production and distribution involving farmers’ groups. Seed producer farmer associations were formed to multiply seed of farmer-preferred varieties. Four improved groundnut varieties (ICGV 86024, ICGV 86124, ICGV 86015 and Fleur 11) were introduced in 22 districts in the regions of Mopti, Kayes, Koulikoro and Sikasso.

The project on ‘Increasing groundnut productivity of smallholder farmers in Ghana, Mali and Nigeria’ has been working to enhance the availability of quality seed and popularize improved groundnut varieties for increased adoption thereby increasing production and productivity. Various complementary approaches comprising of inclusive business models were adopted to build farmers’ capacity in seed and grain production and marketing skills. These included participatory varietal selection, on-farm demonstrations, farmer field days, trainings, media communications, seed fairs, seed production and seed quality monitoring.

ICRISAT and IER are the two institutions responsible for producing breeder and foundation seeds while private companies produce foundation and certified seeds. When the project began, only one registered seed company (Faso Kaba) was involved, but to ensure that the project responded to felt needs and sustainability, three more registered seed companies were chosen and trained in foundation and certified seed production [Société de Production de Semences Améliorées (SOPROSA), Comptoir 2000 and Sahel Seed Production], after ensuring they have adequate infrastructure and irrigation facilities. The four seed companies are located in Mopti, Kayes, Koulikoro and Sikasso.

According to SOPROSA Director Dr Kokozié Traoré, “the training imparted by ICRISAT got me interested in groundnut seed production and has given me the opportunity to make more profit than from maize production”.

Dr Traoré’s production used to be limited to cereal crops, but now he is much sought after by groundnut producers in the surrounding region for the sale of improved groundnut varieties. His profits have soared by 30%, enabling him to fulfill his social obligations as well as to buy more agricultural inputs and produce more groundnut seeds.

Results have confirmed that the use of competent and registered private seed companies successfully improved availability of and accessibility to quality groundnut seed in Mali. More than 277 tons of quality seed of four improved groundnut varieties were produced during the 2018 cropping season and injected into the seed system to improve farmer access to quality seed and to increase the availability of seed at the community level. This infusion has stimulated the interest of other seed companies, farmers and CBOs to grow groundnut for both consumption and commercial purposes.
Climate-proofing groundnut production in Mali

Dr Keïta Djeneba Konaté during a groundnut seed fair in Sikasso region, Mali.

Photos: A Diama, ICRISAT
In recent years, climate change has had a significant impact on yields of both groundnut and maize, two key crops for West African food security. It is estimated that droughts have depressed maize yields by about 15% and groundnut yields by 38%. This has frequently led to the exhaustion of local seed stocks, as poor farming families have used the seeds as food. It has also encouraged many farmers to abandon the production of groundnut in favour of crops like cotton and rice.

In June 2016, farmer Affou Berthé from Sirimana village in Mali attended a seed fair in Sikasso conducted by ICRISAT and supported by the Technical Centre for Agricultural and Rural Cooperation (CTA). He had stopped producing groundnut for the same reasons. The visit to the fair marked a turning point in his life.

“We were given four ICRISAT-developed improved groundnut varieties [Fleur 11, ICGV 86015, ICGV 86024 and ICGV 86124] which we planted and obtained higher yields from than compared to traditional varieties we used to grow,” he recalls. “The new varieties are much more resistant to drought.” Many other farmers in his village who had switched from groundnut to cotton, maize and rice are, like Affou, growing groundnut again. “We can all see that there’s more profit in groundnut than in rice,” he affirms.

Affou was one of the over 500 farmers who participated in one of the two seed fairs held in Sikasso and Kayes in Mali in 2016. While the fairs had plenary sessions, group discussions and exhibits by seed companies, they also provided an excellent opportunity for networking, enabling farmers to meet representatives of government agencies, research institutes, NGOs, private-sector companies and district planners.

“The main objective of the fairs was to create awareness about the advantage of using improved varieties of groundnut and maize which are drought and disease tolerant. Groundnut and maize yields could be greatly increased in the region if farmers had better access to improved varieties,” says Dr Ayoni Ogunbayo, who manages the ICRISAT project on ‘Increasing groundnut productivity of smallholder farmers in Ghana, Nigeria and Mali’. The seed fairs helped create awareness about the importance of using improved varieties, and groundnut’s potential as a cash crop and source of nutrition. Approximately 400 farmers were provided with mini packs (200 gm) per variety of improved groundnut seeds. Two thousand flyers and 250 brochures designed to be both a learning aid and a convenient reference source for those involved in the production and consumption of groundnut were distributed. Farmers attending the fairs also benefited from advice on good agricultural practices, including post-harvest technologies and efficient marketing.

Seeds for the future

While all the four varieties distributed are high yielding, early maturing and resistant to drought, Fleur 11 is the one that local farmers call ‘Alason’, which means ‘gift of God’ in the local language Bambara. It can yield up to 2 tons per hectare and gives higher yields than traditional varieties. ICGV 86024 shows particularly good resistance to foliar diseases.

Farmers planting improved varieties of groundnut have seen a significant increase in their incomes and also improved nutrition and health. “The profits I’ve...
made from groundnuts have helped me meet all my needs, pay for medical care and help my children and grandchildren,” says Affou Berthé. The bicycle he bought from the profit made producing groundnut has reduced travel time to reach neighbouring villages and his fields.

As Yaya Bengaly, in charge of local cooperative Agno Gnétaso and a farmer from the same village says, “we learned a lot of things that we used to ignore about the importance and usefulness of groundnut, and the advantages of using improved varieties. The results are visible in our fields.” Furthermore, the revival of groundnut production has proved very beneficial to the many women who attended the fairs and who are now planting improved varieties. They have increased their incomes and become less dependent on their husbands. “The women are now in a better position to buy clothes and utensils and help their husbands with family expenses,” says Yaya.

Though Fatogoma Bengaly did not attend the seed fair in Sikasso, it still had a significant impact on his life. “Several members of our cooperative went to the fair,” he recalls. “When they returned, they shared information about what they had heard, as well as the seeds they received at the fair.” Fatogoma estimates that yields with the improved varieties are almost double those from traditional varieties, even when the rains are sparse. In August 2016, the village received 286 mm of rain; a year later, during the same month, it received just 95 mm. Yet such are the drought-resistant improved varieties that farmers still achieved excellent yields. In Tamala near Bamako, improved varieties of seed supplied by Faso Kaba benefitted Drissa Coulibaly. “Though we haven’t had enough rain in our village this year,” he says, “we saw that this barely had any impact on the new improved groundnut varieties we planted. Our fields haven’t been much affected. We are expecting a good harvest.”

Measuring success

An evaluation of the impact of the seed fairs was carried out in two phases – in September 2016 on 14 fields in Sikasso region and 34 fields in Kayes region and in March 2017, wherein 260 farmers, including 139 women, were interviewed about their use of improved groundnut varieties, adoption of good agricultural practices and the performance of the seeds.

“Everybody we interviewed said they were very satisfied with the improved varieties received at the seed fairs,” says Dr Ogunbayo. “Despite a drought at the flowering stage of the crop at Kayes, farmers could reap a good harvest with 50% increase in yield compared with local varieties.” The ICRISAT team noted that the farmers had managed their crops well and were very enthusiastic about the new varieties.

Some clear preferences emerged. Most of the farmers in Sikasso region favored ICGV 86024 and ICGV 86015, while those in Kayes preferred Fleur 11 and ICGV 86124. During recent years, Faso Kaba has collaborated with ICRISAT on the distribution and popularization of new varieties of seed developed by the plant breeders. This has been undertaken with support from the United States Agency for International Development’s Feed the Future initiative, which focuses on three countries, one of these being Mali. Faso Kaba was able to promote drought-tolerant varieties of groundnut at the two seed fairs and distribute flyers describing their passport data, production techniques and harvesting requirements. After the fairs, Faso Kaba sold more than 50 tons of improved groundnut seeds to farmers. The largest orders were for Fleur 11, with many farmers telling the company that they particularly liked it for its short growing cycle and resistance to drought. According to Mrs Maimouna Sidibé Coulibaly of Faso Kaba, the fairs’ success owed much to the fact that they were highly educative.

The fairs featured presentations on how to improve farmers’ understanding of the importance of improved varieties and relevant production techniques, discussions by scientists, technicians and farmers on the constraints, challenges and opportunities in seed production systems in West Africa, and the problems caused by aflatoxins. Among the NGOs to attend the fair in Sikasso was GRADECOM, involved in agricultural programs in the region since 2001. These include a partnership with ICRISAT to promote improved varieties of groundnut under the Feed the Future project. According to its executive director, Fousseyni Dembele, local communities now have a much
better understanding about how climate change is affecting their lives. “In the past, the communities didn’t really believe in climate change, but now their own observations have made them realise that it is a reality,” he says. Farmers have begun to notice significant changes in the pattern of rainfall, with excessive precipitation at times, and none at all when rain is expected. “The seeds that farmers used in the past were traditional varieties which were not resistant to climate change,” continues Fousseyni. “The introduction of new drought-resistant varieties is undoubtedly helping to break the cycle of vulnerability”.

He says that farmers have been unanimous in their praise for the new varieties of seeds. Some have come into GRADECOM’s office in Sikasso with samples of the seeds they have produced as evidence of the quality seed picked up at the fair.

“That’s one way for them to show their satisfaction,” says Fousseyni, adding they would like to see more fairs.

This project is evidence of CTA’s commitment to finding workable climate-smart solutions for farmers. “We collaborated with different partners in the field to ensure that smallholder farmers get the necessary support to access various technological options that are available, as well as information about new seed varieties,” says Oluyede Ajayi, Senior Programme Coordinator for Climate Change and Agriculture. “This is helping farmers make informed decisions as they cope with the challenges of climate change.”

(Edited version of article by Charlie Pye-Smith, United Kingdom, based on reportage by Dieudonné Diama, Mali).
Project participants in Mopti and Sikasso regions
Building on decades of experience in agricultural research for development, ICRISAT and partners have implemented an innovative project on the large-scale diffusion of new technologies for scaling up sorghum and millet production systems in Mali (ARDT_SMS).

The project is based on the premise that both production and productivity of sorghum and millet can be significantly increased in Mali through capacity building of producers in the use of agricultural technologies. Its goal is to increase the incomes of sorghum and pearl millet producers in Mopti, Sikasso and Timbuktu regions through strengthened research-development partnerships for large-scale utilization of priority proven technologies.

The project technologies involved were open-pollinated varieties and hybrids of sorghum and millet, seed treatment, integrated soil fertility and Striga management, and biological control of the millet head miner. Farmers who adopted these improved technologies experienced a yield increase by 51% in sorghum and 72% in pearl millet.

Between 2014 and 2018, ARDT_SMS brought together several partners to propel the diffusion of new technologies through innovative approaches that meet the needs of smallholder households who mainly depend on sorghum, millet and associated crops for their subsistence. What did this exercise mean to them? How beneficial were the interventions?

Some of the beneficiaries share their stories.
Spreading quality seed and the word about best bet agronomic practices
Eight months of the year was the most farmer Seydou Yolo’s harvest would last to feed his family of two wives and fifteen children. From then on, the cattle would have to be sold to feed the family for the following four months. No amount of hard work could raise the yield from the farm of this farmer from Doundé village in Mopti region beyond 4 tons, i.e., 3 tons from millet, 300 kg from sorghum, and 700 kg from groundnut, cowpea and fonio millet.

“I joined the ARDT_SMS project in 2014 through Catholic Relief Services (CRS). First, I joined a Farmer Field School which conducted several trainings on best agricultural practices in millet and sorghum. The trainings focused on composting, seed treatment with Apron star 42 WS, intercropping (millet and cowpea), conservation of cowpea grains against pest attacks, microdosing, and improved seed production and conservation techniques,” explains Seydou.

What turned the tide in his production fortunes was the training on biological control of the millet head miner. “The module was taught at a workshop in 2016 in Bankass. Following many other trainings, my skills and knowledge of the right practices for millet and sorghum production technologies improved,” says Seydou. Today, he is a Farmer Field School facilitator, seed producer and resource person, all rolled into one, spreading the knowledge he has gained and teaching other farmers how to ward off deadly pest attacks that can decimate their millet and sorghum crops. He has supported many NGOs and the district agricultural extension services during the trainings.

Though Seydou has reduced the extent of sowing on his farm given the physical effort it required, his yields have risen. The use of quality seeds and improved agronomic practices gave him a harvest of 7 tons (6 tons of millet and 1 ton of sorghum).

“I could sell 480 kg out of the 680 kg of cowpea produced, earning about CFA 170,000 (about US$ 400) for household expenses. In addition, the fodder from cowpea as a result of intercropping, is being use for livestock fattening.

“Farmers in the community are open to testing new technologies. Once the benefits of greater yields became visible, they were more receptive to applying compost, adopting microdosing, using improved seed and treating them with Apron star 42 WS, intercropping (millet and cowpea) and the biological control of the millet head miner,” says Seydou. “Thanks to USAID, ICRISAT and the project partners who exposed us to new technologies, I have become a useful member of the community and strongly believe that together we can make food insecurity a thing of the past with such interventions.”

Mining the benefits of good practices

- Earned CFA 41,500 in 2017 and CFA 18,000 from the sale of ‘dodoli’, the local name of butterflies used in the biological control of the millet head miner
- Earned CFA 240,000 on training beneficiaries in 2018
- Bagged CFA 75,000 as 1st prize at a farmers’ competition organized by CRS in Mopti Region
- By the end of the 2018 cropping season, an estimated 83 ha grown to millet and sorghum in Doundé and 822 ha in other villages had been protected against the millet head miner.

Training on best farming practices, 2015

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Training on biological pest control, 2018

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<td>Koro</td>
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Knowledge + passion: Women’s recipe for millet and sorghum production in Mali

Two women’s associations in Sikasso in Mali are changing the status of millet and sorghum, using these crops to diversify and improve food and nutrition security. Sikasso is one of the most prosperous agricultural regions in southern Mali, where farming is dominated by maize, potatoes, peas and other crops while the nutritious millet and sorghum are less popular.
In 2014, the ARDT_SMS project was initiated in Sikasso. Both associations, Jigui Fa (based in Bougouni) and Benkadi (based in Sikasso district) showed interest in undergoing training conducted by the project partners. The women farmers were provided with hybrid seeds of sorghum and improved millet which they tested on their fields.

Members of both Jigui Fa and Benkadi had better access to sorghum and millet production technologies. Since four years, Mrs Habi Marico and others from Jigui Fa have became sorghum hybrid seed producers.

The housewives are also involved in its marketing. When both associations joined the project in 2014, their members participated in trainings in integrated Striga management and soil fertility and pest management. “Those were the major challenges in our farming systems,” says Mrs Marico. Then women groups were trained in seed production techniques by the national agricultural system, the Institut d’Economie Rurale (IER) and ICRISAT. The project also gave them Apron star for seed care.

The next stage involved linking members of the women’s cooperative to seed companies. They signed production contracts and it was agreed that CFA 500 (about US$ 1) would be paid to the cooperative for every kilo produced. “Farming is my main activity. However, before the project, I used to produce local varieties of sorghum for household consumption, though not quite sufficient for domestic consumption. Over the years, yields from local varieties have dipped and information on sound agricultural practices and technologies to enhance productivity eluded us,” recalls Mrs Marico, adding “now we write our own destinies. We have better access to seeds, to technology packages, and we are marketing our own seeds.”

The project interventions have benefited 261,197 farmers (among them 91,419 women) through 29,852 Farmer Field School facilitators (including 10,448 women). Training included modules on integrated Striga and soil fertility management, seed treatment and biological control of the millet head miner. About 1,082 seed producers (including 378 women), have been trained in seed production techniques and post-harvest handling. These technologies were covered on 68,299 ha. According to Dr John Nzungize, Coordinator of the ARDT_SMS project, “grain yields have increased by 51% in sorghum and by 72% in pearl millet”. What is remarkable is that together, both women associations produced 12 tons of sorghum and millet during a single cropping season. While part of the produce was used for domestic consumption, up to 10 tons were sold to locally authorized seed dealers at CFA 500 (about US$ 1) per kilo.

“The seeds we produce are deemed one of the best, which accounts for the enthusiastic buyers we get,” says a beaming Mrs Rokia Koné. With this new knowledge, members of the cooperative are now producing surplus seed for local markets, with earnings being used to pay for the children’s schooling and savings. Proving the old proverb money begets money right, some women farmers have already invested their earnings in small businesses. Mrs Habi Marico now plans to launch a second poultry business and is saving up to buy residential plots for her children.
Pilot farmer Afou Ouattara’s success with sorghum

Sorghum producer Mrs Afou Ouattara.
“Fruitful and empowering years” is how Mrs Afou Ouattara of N’Tabougu Commune, Sikasso region describes her three-year association with the ARDT_SMS project. This 45-year-old mother of four has witnessed and personally experienced changes in production practices brought about by the project in her village, be they in the form of microdosing, composting or improved varieties of sorghum.

Sorghum cultivation had almost been totally abandoned before the project, with maize and potatoes ruling the roost, says Afou, “We never would have imagined it would be possible to achieve yield of 3,500 kg/ha from a hectare sown to sorghum. The demonstration fields confirmed this for us in our village in 2015-2016. Willing to see how it works, in 2016-2017 I convinced my husband to place one hectare at my disposal. I brought organic manure and seeds of sorghum variety Pablo that the project had introduced. I followed all the instructions the extension agent gave on production practices.” Sorghum is an indispensable alternative that ensures food selfsufficiency. Stalks of variety Pablo are preferred by livestock.

Elaborating on the benefits accrued from this move, Afou says, “I can harvest around 1800 kg of sorghum, a huge contrast to the previous years when my family could barely extract 100 kg from a quarter hectare! My husband and I decided to set aside 800 kg to consume at home and sell the rest when we obtain a higher price. This meant I would have to store them till then. I was able to get 10 PICS (Purdue Improved Crop Storage) bags from a vendor to store the 1000 kg to be sold. Incidentally, the vendor promised to buy my sorghum since the grains were clean and good.”

Proving that the adoption of right production practices can lead to substantial benefits, Afou compares the stark losses/gains from her harvest in 2018: “Our household’s entire potato harvest went for a low price of CFA 75/kg (approximately US$ 0.13) in the market since they had not been stored well. Sorghum, on the other hand, sold for CFA 200/kg (approximately US$ 0.34) in the same market. My husband and I will sell our stock (1000 kg) to buy an oxen plough.”
For millions of women and children in Africa, anaemia is a significant public health concern—and diets deficient in iron are often to blame. But consuming a new variety of pearl millet called Chakti—with an additional 20% of the estimated average requirement of iron—may improve their nutritional status and help them reach their physical and cognitive potential. This scientific breakthrough has been possible thanks to plant breeders at ICRISAT under the work of HarvestPlus.
Pearl millet is consumed daily by millions of low-income families in Africa and Asia. This first biofortified pearl millet variety in Africa is naturally high in iron and zinc—two micronutrients essential in diets for good health and productivity. Chakti was officially released by the government of Niger earlier this year for commercial cultivation.

Using the Economic Community of West African States (ECOWAS) seed harmonization laws, which facilitate farmer access to high-quality seed varieties, this variety will subsequently be recommended for cultivation across the region.

Pearl millet is the oldest millet, used largely in Africa, south of the Sahara. As a Smart Food that is good for consumers, the planet and the farmer, its high temperature tolerance and low water requirement make it ideally suited for dryland cultivation and climate smart agriculture. Often, the major dietary energy source in the Sahel, it is also the cheapest source of dietary iron and zinc in the region.

“In partnership with INRAN in Niger, ISRA in Senegal, SARI in Ghana, INERA in Burkina Faso, IER in Mali, and UDUS in Nigeria, we tested the improved pearl millet across six countries,” say Dr M Govindaraj and Dr P Gangashetty, pearl millet breeders at ICRISAT. “In addition to the nutritional benefits for consumers, farmers also appreciate that Chakti matures 40 days earlier and has a 30% greater yield than local varieties, as well as resistance to downy mildew disease.” While Chakti already has over 65 mg/kg iron content compared to popular farmer varieties with about 47mg/kg, breeding efforts continue to make it even more nutritious.

“We are working closely with ICRISAT and national partners to scale up biofortified iron pearl millet in Niger and other ECOWAS countries,” says Dr Wolfgang Pfeiffer, Director of Research and Development at HarvestPlus. “This will help improve nutrition in millions of households in sub-Saharan Africa, and most significantly, can enhance physical and mental performance of children as well as of women of reproductive age.”

“Chakti is a proven, sustainable, food-based solution to reducing the burden of iron deficiency,” says Dr Erick Boy, head of nutrition at HarvestPlus. “It has been proven that it can provide a significant amount of the iron needed daily by young children in India and non-pregnant women in Benin, resulting in profound positive impacts on livelihoods.”

This activity was carried out as part of the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH) and the CGIAR Research Program on Grain Legumes and Dryland Cereals (GLDC).
Burkina Faso

Helping innovative farmers to emerge: François Tarpaga’s life gains momentum

Mr François Tarpaga (atop his tractor) with Dr Amos Miningou and Mr Sy Appolinaire Traore (INERA, Burkina Faso).
Had you asked François Tarpaga in 2014 if he could buy a tractor, he would have shrugged his shoulders and said a wistful “no”. Four year later, it no longer is in the realm of dreams. In 2015, together with other pilot farmers, he was selected for the varietal testing of groundnut by the Tropical Legumes III Project.

The experience included training, farmer field schools and guided tours. In 2017, his demonstration plot of improved groundnut in Tenkodogo province of Burkina Faso hosted a regional farmer’s field visit organized by the state agricultural department and visited by the governor of the region, the High Commissioner in Agriculture and the Regional Director of Agriculture of Tenkodogo.

“I’ve just been able to buy a new tractor at the end of the cropping season. Can you believe it? My dream came true! Being a member of the groundnut multi-stakeholder platform created by the Tropical Legumes III project helped me produce and sell groundnut and save money; now I can expand my farming,” says François.

Although François has been a seed producer for the past 11 years, it was his participation in the project that proved to be a major turning point. He started producing improved varieties on a small plot, just as a trial. The training together with advice on plowing, sowing, application of fertilizer and the use of improved varieties was helpful in initiating him into a profitable business. The government recognized him as the best farmer in Burkina Faso in 2016; so did the President on the National Day of the Peasant.

Of all the improved varieties promoted by the project, SH470P is the one he prefers because of its high popularity, preference in the market and by consumers for its color and grain size, followed by the high yielding Te3 that is difficult to decorticate. The average yield of these improved varieties is 1.5 to 2 t/ha against 600 to 700 kg for local varieties.

In 2017, François produced 5 tons of foundation seed of SH470P and Te3 from 3 hectares, which helped him buy a tractor and other agricultural equipment. “The money I gained from the sale of groundnut seeds along with other savings in the bank facilitated the purchase,” he says.

Now François is building his own groundnut seed store in Koupela (an urban area 20 minutes from his village) to sell more certified seed that he will produce during coming seasons. “The multi-stakeholder platform was a great opportunity to link with microfinance actors to access credit and to meet researchers who facilitated access to improved varieties for the production of foundation and certified seed,” he admits gratefully.

François has also introduced many other villagers to the improved groundnut varieties and helped initiate community seed production through a network of 10 women to whom he distributed certified seed in 2017 for their own business.
Tropical Legumes in Ghana: More groundnut means shelling is a big business

In Nyankpala in northern Ghana, the business of groundnut sheller fabricator Umar Jibril is booming! “In 2006, we barely fabricated one or two shellers a year. Now we fabricate up to four shellers per month! So high is the demand now that clients must place orders well in advance. Our clients are no longer just from the village,” says Umar.
“In the mid-nineties, Ghana’s groundnut breeding program was full of promise. Rosette disease and the lack of a dedicated groundnut breeder in the national system in the last 10 years have led to a decline in production. It was in 2015 with support of the Tropical Legumes Project that the groundnut breeding program was reinitiated,” says Dr Daniel Kenton, Deputy Director General of the Savanah Agricultural Research Institute (SARI).

The lone fabricator and his uncle who used to work out of a small garage are now owners of an enterprise employing ten people. “A sheller can shell up to 4000 kg of groundnuts per day,” says Umar, who also rents out one of his shellers to a women’s group which is in the business of shelling.

“Back then only a few local germplasm were available,” adds Dr Richard Fripompg-Oteng, a young groundnut breeder who helped restart the breeding program.

The existing local varieties had a yield potential of 1.8 t/ha while the new materials have 10 and 30% higher yield advantage. “An increase in breeder seed means that companies can access them to produce foundation seed. It also means that outgrowers can produce certified seed and that there is a better community seed system,” says Mr El Hadj Abdul Razak, Director of Seed Heritage Company.

With more breeder, foundation, and Quality Declared Seed, not only farmers, but outgrowers and companies could increase their production and yield. A range of new businesses appeared in the value chain, including shellers that would speed up processing. Umar has noticed a boom in the demand for groundnut shellers in the past two years. “People are aware of the potential of groundnut production and processing as a business. We have many entrepreneurs buying our shellers for the villages,” says Umar.
Awards 2018

**Outstanding Scientific Article Research Program, WCA**

Dr Birhanu Zemadim Birhanu, Dr Murali Khrisha Gumma, Dr Felix Badolo, Dr Ramadjita Tabo and Dr Anthony Michael Whitbread.

**Outstanding Partnership Award Research Program, WCA**

Dr Birhanu Zemadim Birhanu, Dr John Nzunge, Dr Ayoni Ogumbayo, Dr Affognon Hippolyte, Dr Haile Desmae and Dr Ramadjita Tabo.

First Grant as Principal Investigator Award For the project “Networking4Seed”: Growing Sustainable seed systems by learning from experiences across Mali, Burkina Faso, and Niger”

Dr Baloua Nebie.

ICRISAT’s Young Scientist Award for 2018 recognizing his efforts to improve pearl millet breeding in WCA

Dr Prakash Gangashetty, Lead Scientist, Pearl Millet Breeding.

**Dr Aboubacar Touré** was recognized for his significant contribution to the Alliance for a Green Revolution in Africa (AGRA), as its Program Officer for Crop Improvement and Variety Adoption for West Africa from 2007 to 2016.

**Dr Issoufou Kapran**, ICRISAT's seed systems specialist in West and Central Africa, was recognized for his contribution to the Alliance for a Green Revolution in Africa as a member of its seed team (PASS) and as a private sector development specialist from 2007-2017. The second recognition came from Ghana seed company M&B for his mentorship.
Publications

Crop Improvement


Touré A, Bengaly A, Touré AO, Diallo AG, Cissé F, Diourté M, Yaro N, Touré AW and Dembébé B. 2018. Development and utilisation of improved white-


Integrated Crop Management  


Systems Analysis and Policy & Impact


Extension Guides, Manuals and Policy Briefs


ICRISAT research team in West and Central Africa

Burkina Faso: 1  Ghana: 1  Senegal: 3  Nigeria: 20  Niger: 46  Mali: 83

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Mali

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Research Program Director – West and Central Africa and Country Representative, Principal Investigator - HOPE II, Mali

Robert B Zougmoré  
Regional Program Leader – CCAFS

Aboubacar Touré  
Senior Scientist – Sorghum Breeding

Ayoni Ogundayo  
Country Project Manager, Mali – USAID Project

Birhanu Zemadim Birhanu  
Senior Scientist – Land and Water Management

D Hailemichael Shewayrga  
Senior Scientist – Groundnut Breeding

Issoufou Kapran  
Senior Scientist – Seed System Specialist

Mathieu Ouédraogo  
Scientist – Climate Change, Agriculture and Food Security (CCAFS)

Felix Badolo  
Scientist – Agricultural Economics

Hippolyte Affognon  
Senior Project Manager and Technology Uptake Specialist

Agathe Diama  
Head – Regional Information

Baluoa Nebie  
Scientist – Sorghum Breeding

Amadou Bila Belemgoabga  
Manager – Administration

Hamado Tapsoba  
Regional Coordinator – HOPE II and TL III

Yila Jummai Othniel  
Scientist – Gender Research

Lilian Nkengla  
Visiting Scientist – Gender Research

Nadine Worou  
Program Officer

Amadou Sidibe  
Special Project Scientist

Bouba Traore  
Scientist – Knowledge Broker

Samuel Tetteh Partey  
Scientist – Climate Change, Agriculture and Food Security (CCAFS)

Haile Desmae  
Senior Scientist, Groundnut Breeding

Nigeria

Hakeem Ajeigbe  
Country Representative

IJantiku Ignatius Angarawai  
Senior Scientist – Sorghum Breeding

Michael Boboh Vabi  
Country Project Manager

Shuaibu Abubakar Ummah  
Monitoring and Evaluation (M&E) Specialist

Folorunso Mathew Akinseye  
Post-doctoral fellow

Senegal

Issa Ouedraogo  
Project Coordinator – Climate Services (CCAFS)

Ndèye Seynabou Diouf  
Manager – Monitoring & Evaluation (CCAFS)

Pierre CS Traore  
In – Business Researcher (Secondment)

Ghana

Paul Tanzubil  
Country Project Manager, Ghana – USAID Project

Burkina Faso

Myriam Adam  
Systems Agronomist
Where we work

Senegal
Kaffrine

Mali
Kayes
Kouloukoro
Mopti
Segou
Sikasso

Burkina Faso
Yatenga

Ghana
Northern
Upper East
Upper West

Niger
Diffa
Dosso
Maradi
Tahoua
Tillabery
Zinder

Nigeria
Abuja (FCT)
Adamawa
Anambra
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Borno
Enugu
Gombe
Jigawa
Kaduna
Kano
Katsina
Kebbi
Sokoto
Taraba
Yoba
## New grants in 2018

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<td>Capacitating Stakeholders in Using Climate Information for Enhanced Resilience in the Agricultural Sector in West Africa (CaSCIERA-WA) under West Africa Agricultural Productivity Program (WAAPP)</td>
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<td>Technologies for African Agricultural Transformation (TAAT)-African Development Bank (AfDB)</td>
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<tr>
<td>DFID thru Blumont International</td>
<td>Building Resiliency and Adaptation to Climate Extreme and Disasters-X (BRACED-X)</td>
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<tr>
<td>USAID/University of Florida Feed the Future Innovation Lab for Livestock Systems</td>
<td>Enabling value chains to create sustainable income for vulnerable people in crop-livestock systems of Burkina Faso and Niger</td>
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<tr>
<td>FAO, Nigeria</td>
<td>Seeds fair commodities vouchers payment in the state of Yobe North East Nigeria</td>
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<tr>
<td>McKnight Foundation</td>
<td>Networking4Seed: Growing sustainable seed systems by learning from experiences across Mali, Burkina Faso, and Niger</td>
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<tr>
<td>PASEC, Niger</td>
<td>The development and dissemination of CSA technologies and other innovations to address changing climate issue and other agricultural constraints (World Bank)</td>
</tr>
<tr>
<td>FAO, Nigeria</td>
<td>Increased access to seeds of improved varieties and climate smart agricultural technologies for improved rural livelihoods and food security in Adamawa and Yobe state Nigeria</td>
</tr>
<tr>
<td>Kansas State University</td>
<td>Improving sorghum adaptation in West Africa with genomics enabled breeding</td>
</tr>
<tr>
<td>FAO, Nigeria</td>
<td>Enhanced awareness and knowledge of approaches to Climate Smart Agriculture (CSA) technologies and practices in Borno, Adamawa and Yobe state, Nigeria</td>
</tr>
<tr>
<td>USAID FFP thru CARE International-Mali</td>
<td>Enhancing resource use efficiency through integrated land and water management practices in the watershed villages of Badiangara and Douentza, Mopti region</td>
</tr>
<tr>
<td>McKnight Foundation</td>
<td>West Africa Community of Practice (CoP) Research Methods Workshops in Niger, Burkina Faso and Mali</td>
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</table>
Our work contributes towards the following Sustainable Development Goals.
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