Photo: CRS-Burkina Faso

Quality seed through storage in Burkina Faso

Introduction

Landlocked in the heart of the Sahel, Burkina Faso is ranked second-to-last on the UNDP's 2007 Human Development Index. Almost 75% of Burkina Faso's 14 million people live on less than US$2 a day. Especially vulnerable are rural households, constituting 80% of the population, who rely on agriculture for their livelihood. Major staple crops include millet, sorghum, maize, cowpea, rice, and groundnut. The agricultural sector faces multiple challenges that affect crop productivity and food availability. Seed selection, handling, and storage can contribute to farm level productivity through improved yields and reduced post-harvest loss (CRS 2011).

Cowpea is an important crop in the Burkina cropping system where it is usually intercropped with pearl millet. Burkina Faso exported over 200,000 metric tons (MT) of cowpea in 2010. Storage losses due to bruchids in cowpea reach 80 to 100% after six months storage if the grain is not properly stored. The challenges in controlling cowpea storage pests are demonstrated by the variety of storage methods used, the estimated 40% of farmers that employ insecticides, and the fact that most farmers are forced to sell cowpea immediately after harvest when prices are lowest and must buy more seed for the next planting season. Seed from the local grain market is frequently of poor quality and not of the preferred variety, yet farmers continue to cultivate traditional varieties sourced from their own stocks, neighbors, or local markets (CRS 2011; Traore and Kone 2013).

Research institutes have developed improved techniques for cowpea storage such as hermetic triple lined sacs and solar heater techniques, but these are not yet widely available. Burkina Faso's national Environment and Agricultural Research Institute, INERA, has developed and released a wide range of new cowpea varieties that are shorter duration, have partial insect resistance, striga resistance and higher grain and fodder yields. The government of Burkina Faso, with donor support, invests in seed production, certification and distribution of the improved cowpea varieties (along with new varieties of other staple crops) to farmers. In spite of this, farmers appear to have low access to the new cowpea varieties and continue to cultivate traditional varieties. Farmers continue to struggle with cowpea grain and seed storage. This case study focuses on the results of project activities with cowpea aimed at addressing these issues.

Materials & Methods

Severe flooding in Burkina Faso in 2007 resulted in significantly lower crop yields and dramatic increases in food prices in 2008. This lowered the availability of smallholder farmers' own saved seed and raised the price for off-farm purchase. CRS responded quickly to this seed security shock by conducting a rapid seed assessment and by organizing a series of Seed Voucher and Fair events with funding from USAID/OFDA. Farmers in Burkina Faso have also been exposed to hermetic storage through the Purdue Improved Cowpea Storage (PICS) project. The PICS technology involves a double layer of plastic – one bag inside another bag to guarantee an oxygen free environment – and an outer bag for protection. Based on this earlier experience, CRS collaborated with two local NGO partners, agro-dealers, and INERA to strengthen both on-farm seed management of cowpea and farmer access to new varieties of cowpea. The project had three core activities: promotion of new varieties in small packs through vouchers; training on seed management (selection, handling, storage); and the promotion of different storage containers based on the principle of hermetic storage technology.

In 2009 and 2010, 19,226 farmers received seed of six new cowpea varieties and 10,991 received hermetic containers for seed storage from local agro-dealers through vouchers provided by the project. Farmers were provided with information both on the new varieties and on the principles of hermetic storage without insecticide. The project implemented varietal demonstration plots to highlight the performance of new cowpea versus traditional varieties. The performance of the new varieties was monitored over two seasons for yield and seed multiplication rate. The percentage of seed stored and planted the following year was recorded. A sample of seed from three consecutive generations was analyzed for germination and varietal purity by INERA (Remington and Barbier 2012).

Results & Discussion

During the two seasons of project implementation, 19,226 direct beneficiary farmers obtained 19,226 seed vouchers and 10,991 storage containers in the northern part of the Namentenga; this represents 107% achievement of the targeted 18,000 farmers. Each farmer received a 1 kg packet of certified seeds for production, multiplication and management.

Program staff distributed the various cowpea storage containers to farmers in the interest of testing hermetic storage techniques. The following containers were distributed: 179 PICS sacs, 22 plastic containers (25L), 446 plastic containers (20L), 11,031 plastic containers (5L) and 1,484 plastic containers (1.5L). FASO Plast, a private company located in Ouagadougou, provided the PICS sacs and some of the new 5L plastic containers; all other storage containers were purchased from local traders. The key project achievements are presented in Table 1.

The project promoted three new cow pea varieties, as reflected in Table 2. During the 2010 campaign, seed samples were collected from 391 cowpea farmers (223 men and 168 women). The average cowpea yields of new varieties in small plots were 746 kg/ha (with a range from 393 kg to 1,088 kg/ha) in 2010 and an average of 527 kg/ha (ranging from 486 kg to 612 kg/ha) for 2nd generation cowpea seed, compared to 321 kg/ha for local varieties.

A significant majority of male (86%) and female farmers (85%) stated that yields from new varieties exceeded the yields of their current variety. Their preferred variety depended on meteorological conditions, market conditions and the use of grains. For example, women and men who owned livestock preferred KVX745-11P for fodder production.

Germination rates ranged from 32% to 100% after two generations, indicating that farmers are capable of maintaining seed quality. As expected, the varietal purity of farmer-saved seed varied from 78 to 100% but the average increased slightly from 91 to 94% from the first to the second harvest, indicating that varietal purity can be maintained by farmers.

As indicated in Table 1, over the two years a total of 19,226 farmers accessed cowpea seed as a result of this project. However, the use of vouchers to connect farmers with seed enterprises and agro-dealers was not successful as virtually all certified seed is purchased by the government for distribution to farmers.

This project promoted the use of a variety of hermetic storage technologies: PICS sacks, vegetable oil containers of different volumes, 1.5 liter water bottles, and traditional clay pots. Table 3 presents a comparison of the most popular hermetic storage technologies employed. In general, the larger the unit volume of a hermetic storage container, the lower the unit cost. With a storage capacity of 100 kg per unit, PICS come in at roughly US$.02 per kg compared to US$.12 per kg for vegetable oil containers handling 26 kg. However, while the re-cycled vegetable oil containers are readily available in the market and can be used for many seasons, PICS sacks have to be replaced every 2–3 years.

Table 1: Project participants per key activity

Year/season	Seed coupons of cowpea improved varieties (N)	Improved cowpea storage containers (N)	Beneficiaries (N)	
			Direct	Indirect
2009	10,719	2,484	10,719	64,314
2010	8,507	8,507	8,507	51,042
Total	19,226	10,991	19,226	115,356

- As indicated in Table 1, a total of 10,991 cowpea storage units were made accessible to farmers. Multiple hermetic storage containers, all appropriate for seed, were purchased by farmers using vouchers. These hermetic storage containers included 20–25 liter vegetable oil containers, 1.5 liter plastic water bottles, and 5 liter plastic containers.. For storing seed, most farmers suggested that the 5 liter plastic containers were the most appropriate. Hermetic storage techniques for the conservation of cowpea grains produced in 2010 were used by 77% of men and 67% of women; and by 93% of men and 88% of women for the conservation of the cowpea seeds 2nd generation produced in 2010. These results are well above the target of 50%. In general, the containers used by farmers depended on the quantities of the grains/seeds stored. For grain storage, 61.5% of the farmers used 25 liter or 20 liter plastic containers and 28.3% used PICS sacs. On average, farmers stored 23–24 kg of cowpea grains, which correspond to 22–29% of total production. Farmers either consumed or sold the remaining grain. On average, farmers stored 6 kg of improved variety seed and 5 kg of local variety seed. When surveyed, farmers agreed that all containers promoted by the program could provide nearly 100% protection against insects; however the 5 liter plastic containers were more readily used than PICS sacs. Our analysis identified the following reasons:
  - Used plastic containers are widely available in local markets for only US$1.50 to US$3 per unit.
  - Plastic containers can be reused for multiple years.
  - Plastic containers are appropriate for storing small quantities of seed/grain.

  As the cowpea value-chain continues to develop and production continues to increase, we anticipate that adoption rates for PICS sacs will rise as they are more appropriate for storing quantities of 50 kg or more.

The supply chain for PICS sacks and new 5 liter containers was not established during the project but CRS and its partners worked with small agro-dealers to order containers from the factory (FASOPLAST) in conjunction with voucher activities.

- In terms of loss reduction due to hermetic storage, the beneficiaries reported that no losses have been noted during the storage period. In addition, the percentage of farmers that use chemicals for conserving cowpea grain has decreased from the baseline of 40% to 22% for grain and 6% for seed – both of which have surpassed targets. The majority of 2nd generation cowpea seeds produced by farmers meets FAO Quality Declared Seed Standards.[1] An analysis of seed samples revealed the following results:
  - The germination rate of R2 seed ranged from a low of 32% to a high of 100% with an average of 72%; those of R1 certified seeds ranged from 64% to 96% with an average of 79%.
  - The germination rate of KVX396-4-5-2D increased from 72% (R1) to 77% (R2). Farmers were able to maintain a high germination percentage of their own saved seed – often surpassing the R1 germination rate for all varieties tested.
  - The varietal purity of the 2nd generation seeds ranged from 78% to 100% with an average of 91% but improved to 94% in the R3 seeds generation, demonstrating that farmers were able to improve and maintain the purity of their cowpea seed.

[1] FAO Quality Declared Seed Standards stipulate that seed must meet the following key parameters: 98% genetic and analytic purity, 75% germination rate, 13% humidity.

Table 2: Characteristics of the cow pea varieties promoted

Variety	Cycle	Yield	Observations
IT98K-205-8	65 days	926 kg/ha	Extra early called 'Hunger Stopper'
KVX396-4-4	70 days	1012 kg/ha	Drought resistant
KVX745-11P	70 days	637 kg/ha	Dual purpose grain and fodder; Semi-runner
Local	–	321 kg/ha	

Table 3: Comparison of hermetic storage technologies (Remington and Barbier 2012)

Type	Number	Weight	Price	Price/kg	Cowpea price US$/kg	Cowpea price US$/kg	Price difference US$/kg stored	Gain by container US$/kg stored
					Harvest time	After storage		
PICS	179	100	1.70	0.02	0.60	2	1.40	1.38
VegOil	22	25	3.00	0.12	0.60	2	1.40	1.28
VegOil	446	20	2.50	0.13	0.60	2	1.40	1.27
Vegoil	2,115	5	1.24	0.25	0.60	2	1.40	1.15
Mineral water	1,484	1.5	0.25	0.17	0.60	2	1.40	1.23

Conclusions & Recommendations

Over 25 MT of certified seed of new cowpea varieties were injected into the cowpea system via small packet exchange for vouchers. This proved more effective and efficient than the government program for distributing cowpea seed to meet 100% of farmers' sowing requirements. This is because the cost of 1 kg of certified cowpea seed costs only US$1.00 to US$2.00. At an estimated cost of US$37,500, farmers produced over 2,500 MT of good quality first generation, post certified seed. Through the small packet approach, nearly 20,000 farmers increased their awareness of and access to the new cowpea varieties and within one season produced adequate seed to meet the entirety of their cowpea seed requirement.

On-farm hermetic cowpea seed storage proved effective in controlling insects without insecticide. All sizes of hermetic containers from the 1.5 liter mineral water bottle to the 20 liter vegetable oil container to the 100 kg PICS sacks were found to be effective. The use of insecticide in seed storage dropped from 40% to only 6%. An unanticipated impact was that the use of insecticide on grain also dropped from 40% to 22%.

Hermetic storage, with accompanying training on seed management, provided an incentive to farmers to maintain varietal purity. This has resulted in a stronger and more integrated seed system that potentially enables farmers to capture a better sale price for a product that meets market and customer requirements.

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Further reading

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This case study summarizes the findings of the CRS Quality Seed through Storage Project in Burkina Faso. It would not have been possible to compile this case study without the support and assistance of many people. Catholic Relief Services thanks the members of each community served for their willingness to undertake the projects and to revisit the actions taken to achieve success. The editor would also like to thank Tom Remington, Jean Joseph Coulibaly and Amidou Traore who contributed significant time and effort collecting valuable background information for this study. Special thanks to Anselme Yormalan Hervé Kone, Program Coordinator/OCADES Kaya who was an implementing partner for the activities described in the case study.

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This publication was made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of the authors and do not necessarily reflect the views of USAID or the United States Government.

Contact information
Amidou Traore
Agricultural Program Manager
CRS Burkina Faso
Email: Amidou.Traore@crs.org

Suggested citation
Remington, T., A. Traore, J. J. Coulibaly and H. Kone. *Quality Seed through Storage in Burkina Faso*. Edited by Stephen Walsh. Nairobi: Catholic Relief Services, 2014.

Project supported by:

USAID FROM THE AMERICAN PEOPLE | Office of Foreign Disaster Assistance

Project executed by:

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