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# Market building for post-harvest technology through large-scale extension efforts

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ABSTRACT

The Purdue Improved Cowpea Storage (PICS) technology has been disseminated in 30,896 villages in 10 different countries in West and Central Africa from 2007 to 2012. Extension and supply chain development efforts were required to make the PICS technology available to millions of farmers and other users. Several research and development organizations assisted in awareness building activities to develop the market and increase access. Thousands of village and market demonstrations were implemented by field technicians and supported by media activities. Supply chain development activities were led by the private sector with some support from the project. Overall, 40–70 adults attended demonstrations in each village, among which 38% were women. Large-scale extension activities substantially increased the demand for the technology and helped establish the supply chain. More than 2.4 million triple bags were sold in the first 5 years of the project. In some countries, up to 50% of bags ordered during the first year were bought by farmers; even though village demonstrations had not yet been completed. Market building activities helped convince the private sector that there were business opportunities in buying and selling PICS bags. Bags ordered by the private sector went from 0% in 2007 to 200% in 2010, proving that it is possible to commercialize a new agricultural technology in developing countries in a relatively short time.



## 1. Introduction

African agriculture is dominated by smallholder farmers who account for about 95 percent of food production. The majority of these farmers lack resources and know-how and do not use improved agricultural technologies. On farm post-harvest losses count as major challenges in developing countries, especially in Sub-Saharan Africa. Cowpea is a high value commodity in West and Central Africa. Demand for the grain is often higher than the supply, which provides farmers an opportunity to earn additional income. However, cowpea bruchids (*Callosobruchus maculatus*) cause substantial losses during post-harvest storage. Near-certainty of loss to insects causes most farmers to sell cowpea at harvest when prices are at the low point of the year even though they know that the market price may increase as much as three-fold four to six months later. Various storage technologies designed to mitigate losses have been developed and promoted but with little success for many reasons including cost, scalability, cultural acceptability, and availability.

Addressing post-harvest losses requires cost-effective technologies with effective strategies to disseminate them. Technology transfer approaches as well as demand-driven approaches have limitations (Akinnagbe and Ajayi, 2010; Axinn, 1988). Up-scaling some extension approaches to increase adoption tends to be difficult (Hakiza et al., 2004; Tripp et al., 2005). Nevertheless, scaling-up extension efforts is a prerequisite for building a sizeable customer-base for developing markets for new agricultural technologies. This requires devising strategies that allow thousands of farmers to be reached in a short period while simultaneously overcoming challenges arising.

Extension services play a major role in building markets for agricultural products. Most extension efforts have focused more on

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output markets and have given little attention to input markets. Efforts to create markets for inputs such as fertilizer in Sub-Saharan Africa have resulted in little success due to numerous challenges, including insufficient supply and demand due lack of information, availability, price, and government interference with the markets thanks to subsidies (Kelly et al., 2003; Seini et al., 2011). In addition, imperfections in the market can arise from the nature of the technology to be provided. Kelly et al. (2003) suggested that constraints affecting both demand and supply can be grouped into knowledge constraints, financial constraints, and risk issues. To build sustainable markets for agricultural inputs one must address most of the above challenges. Otherwise, failure on the demand or the supply side can hinder development of the market for a new technology.

Market development requires awareness building among potential users. The scope and intensity of awareness building are important because they determine the size of the market. Increasing the number of trained farmers will likely increase the adoption of a technology. Large-scale extension efforts can help to create a sizeable demand of the technology and provide incentives to the private sector to tap into a market opportunity. Efforts to increase wide adoption of agricultural innovations have failed on some occasions for several reasons, including lack of adequate resources to stimulate demand, inappropriate technologies or approaches, and lack of incentives for farmers to adopt.

To address cowpea storage challenges, researchers at Purdue in collaboration with scientists from the National Agricultural Research System (NARS) in Cameroon developed a cost-effective triple-layer plastic bag- the Purdue Improved Cowpea Storage (PICS) bag (Murdock et al., 2003). The PICS bag is a chemical-free hermetic container composed of one outer polypropylene (PP) woven bag, and two liners of high density polyethylene (HDPE), each 80 microns thick. PICS bags limit oxygen availability leading to insects inactivity, cessation of population growth, desiccation and eventual death (Murdock et al., 2012). Early dissemination initiatives followed later by adoption studies found that some farmers knew of triple bagging but failed to adopt it due to two major issues: (i) they did not know how to properly use the bags, and (ii) bags were not readily available on the market (Moussa, 2006).

To increase use of triple bagging for cowpea storage, there was a need to build awareness, train farmers, and supply the technology. Large-scale extension and supply chain development activities were implemented toward this end. This paper shares the experience of introducing and making the PICS technology commercially available to reduce cowpea storage losses in West and Central Africa. The objectives of this paper are to:

(i) describe the approach used in building markets and supply chains for PICS bags;
(ii) share the results of efforts to foster and sustain the availability of hermetic technology;
(iii) draw lessons to inform future efforts in making other agricultural technologies commercially available in West and Central Africa.

## 2. Methods

To create awareness of the PICS technology among farmers and sustain its availability, the project had two major components: (i) large-scale extension activities to build awareness by training farmers how to use the technology, thereby creating demand for it, and (ii) supply chain development efforts to support local manufacturing and distribution of the PICS bags to make the technology available to farmers in rural areas.

### 2.1. Large-scale extension activities

The specific goal of the extension activities was to reach farmers with improved cowpea storage technology in 28,778 villages in 10 countries in West and Central Africa including Nigeria, Niger, Burkina Faso, Ghana, Mali, Senegal, Cameroon, Chad, Benin and Togo. The targeted countries and the number of villages per country were chosen based on the importance of their cowpea production. Extension efforts encompassed building awareness about the existence of PICS bags and teaching farmers how to properly use them. These included village activities as well as media efforts. In each of the target countries, a partner organization was selected to lead and coordinate the extension activities. Partners included national and international agricultural research institutions, government extension services, farmer-based organizations (FBOs), and local and international non-governmental organizations (NGOs).

#### 2.1.1. Village activities

Village activities were implemented by field technicians. These included awareness building just before or during cowpea harvest; demonstrations right after harvest; follow-up visits during the storage period; and open-the-bag ceremonies at the end of the storage period. Each of these village activities are described below:

i. *Awareness building* – Field technicians in collaboration with village leaders organized a meeting with the community's members. The meeting introduced the triple bagging technology to farmers. During these meetings, with inputs from members of the community or from the chief of the village, five pilot farmers were selected. Criteria for selecting pilot farmers included: (a) his or her voluntary agreement to participate in the storage activity; (b) the condition that he or she produced enough cowpea to store, and; (c) that the individual was in a position to store a minimum of 50 kg of cowpea for 4–6 months. The date, time and location of each village demonstration was determined during this first meeting but was always set at a time when farmers would have cowpea ready for storage.
ii. *Demonstration* – Field technicians gave one PICS bag to each of the 5 volunteer pilot farmers. No guarantee was given to farmers in case problems arose during the trial of the new technology. Field technicians demonstrated the bag-filling procedure, using one of the donated bags and cowpea from one of the pilot farmers. At that time the rest of pilot farmers practiced using the bag with their own grain. The demonstration had four key elements: (a) technology: understanding how the technology works, and recognizing the PICS brand (logo and drawings) to help farmers differentiate between authentic PICS bags and imitation products; (b) grain to be stored: it had to be dry, clean and without debris; (c) use of the technology: how to properly fill and tie the bag, and; (d) storage of the bag on a pallet or elevated platform, away from walls, and in a clean area. After the event, the names of each pilot farmer and date of demonstration were written on their respective bags. Bags were either stored in a community warehouse facility or kept by individual farmers in their houses. Both storage approaches had their own management challenges and benefits. Storing in the farmer's own house had the advantage of enabling him or her to monitor stored grain at any time and minimize attacks by rodents. Its disadvantage was that it tempted the farmer to