



Adoption of cowpea hermetic storage by women in Nigeria, Niger and Burkina Faso



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ABSTRACT

In this study, 2741 randomly selected rural women were interviewed about their cowpea storage practices in 101 villages in Burkina Faso, Niger and Nigeria in late 2010 and early 2011. The overall objective was to determine their cowpea storage practices and identify the most important factors in choosing Purdue Improved Crop Storage (PICS) triple bag storage. About two thirds of women said they used some type of hermetic storage. The hermetic containers included metal drums, plastic jugs, double bags and triple bags. The weighted percentage of women using PICS triple layer bags is 46%. Quantity of cowpea stored by technology showed similar patterns. Overall the percentage of cowpea in hermetic storage was 64%. The study estimated that women stored 50% of their cowpea in PICS bags. The percentage of cowpea in hermetic storage overall and in PICS bags specifically is higher for women than for men in a parallel 2012 ten-country study of mostly male household heads. In PICS villages, the women cite PICS technicians as the most important source of information. In Non-PICS villages, radio was the most important. Most women say that higher income is the major benefit of PICS. The 2009–2010 three country weighted average of the net cash flow from cowpea storage in PICS bags is \$10.81/100 kg bag and \$39.27 per respondent. Overall, the women indicated that local unavailability was the primary constraint to use of PICS bags. The LOGIT regression analysis shows that the most important factor influencing use of PICS technology is living in a village where PICS demonstrations occurred. The regression shows that radio and the PICS technicians have key roles as information sources. Being able to attend mixed gender meetings was statistically significant only in Burkina Faso where PICS did not organize many women-only PICS activities.

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1. Introduction

In West and Central Africa, cowpea grain is stored on farms in a variety of ways including: in pods on roof tops, in granaries, in woven sacks with or without insecticides, and in a variety of airtight hermetic storage containers. Hermetic storage of cowpea has been widely adopted in West and Central Africa. [Moussa et al.](#)

(2011) estimated that in 2003–2004 about 30% of farm stored cowpea was hermetically stored. As a result of the Purdue Improved Cowpea Storage (PICS) project, Catholic Relief Services (CRS) promotion of the use of plastic jugs and other technology transfer efforts, updated estimates in 2012 indicate that use of hermetic storage has increased substantially. Based on surveys done in Niger and Burkina Faso in 2010, on-farm cowpea hermetic storage of cowpea was estimated at over 70%, with storage in the PICS triple layer bags ranging from 7% to 38% of the quantity stored ([Moussa et al., 2010](#)). The studies by Moussa and colleagues focused exclusively on household heads, which in West and Central Africa are mostly male, but in many areas storage of cowpea is considered a woman's responsibility. The overall objective of this study was to

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determine cowpea storage practices of rural women in Burkina Faso, Niger, and Nigeria and identify the most important factors in choosing PICS triple bag storage. The focus on PICS is motivated by the fact that it is a new technology recently introduced into these countries. A stratified random sample of rural women was interviewed in Nigeria, Niger, and Burkina Faso. The data were statistically analyzed with Logit analysis. This study is of interest to researchers and development specialists concerned with technology transfer to women, and to gender specialists who are focused on the mechanisms for women's access to technology.

Cowpea can be hermetically stored in any container that can be sealed airtight including metal or plastic drums, plastic jugs, and plastic bags. In West and Central Africa, drums are in high demand for transport and storage of water, and often are too expensive for use in cowpea storage. Plastic jugs are good for small amounts, but are cumbersome as the quantities increase beyond 100 kg. The PICS triple layer bags are often the most cost effective storage option in Africa. PICS bags are composed of an outer layer of ordinary woven polypropylene and two inner liners of 80 microns thick, high density polyethylene (HDPE). Cowpea coming from the field usually has a low level of infestation. When the grain is sealed in an airtight container, the insects quickly consume the oxygen and the insects die or go into dormancy. [Murdock et al. \(2012\)](#) show that lack of water is key to the hermetic storage effect on insects. From 2007 to 2010, the PICS project implemented cowpea hermetic storage demonstrations in almost 31,000 villages in West and Central Africa. PICS started with pilot activities in 2007 in 100 villages each in Niger and Burkina Faso, and 100 villages in Nigeria in 2008. By the end of the 2009/2010 storage season, PICS had conducted demonstrations in 5730 villages in Niger, 3315 villages in Burkina Faso and 11,634 villages in Nigeria. In areas where women do not usually attend public meetings for cultural reasons (e.g., Islamic seclusion), the PICS project implemented all female demonstrations by cooperating with women's associations and neighborhood women's groups. During this period, six plastic manufacturers in five West African countries produced and sold over 1.8 million 100 kg PICS bags. Initially the project helped distributors finance PICS bag orders, but by 2010 the distribution system was entirely in the hands of African entrepreneurs.

Gender analysis of agricultural technology transfer in Africa has shown that there is not "one size fits all." Gender roles vary widely and the impact of technology on women depends on the details ([Doss, 2001](#)). The literature on cowpea technology supports that general observation. For example, [Tipilda et al. \(2005\)](#) showed that introduction of dual purpose cowpea varieties in northern Nigeria increased farm household resources and consequently reinforced the seclusion of women because it helped the household survive without the women's work outside the home. [Langyintuo et al. \(2004\)](#) analyzed consumer preferences for cowpea in Cameroon and Ghana. They found that women vendors in Cameroon often were able to charge a small premium for the cowpea grain that they sold, probably because they provided extra services (e.g., packaging in small quantities of a few hundred grams to appeal to low income consumers).

Research indicates that the role of women is particularly important in cowpea processing and that certain types of processing technology can benefit them. [Lowenberg-DeBoer and Ibro \(2008\)](#) examined gender roles in the cowpea subsector of Kano State, Nigeria. They found that because of Islamic seclusion of women, few Kano State women were directly engaged in field activities associated with cowpea production, but many women were involved in the cowpea small scale processing. Muslim women in Islamic seclusion often operated successful small businesses making and selling kosai (cowpea fritters), moin–moin (steamed cowpea paste), dan wake (cowpea dumplings) and other cowpea

products from their home compounds. These women entrepreneurs could benefit directly from processing technologies that reduced the cost and/or the labor required to make these products, but the women were threatened by industrial technology that moved cowpea processing to factory settings where few Muslim women would be involved. In a related study, [Ibro et al. \(2009\)](#) document the benefits of a dry milled cowpea meal for making kosai in Niamey, Niger. In addition to reducing the cost of kosai production, the dry milling process allowed women to avoid the risky, early morning travel to neighborhood mills for traditional wet milling of cowpea. [Otoo et al. \(2012\)](#) interviewed women kosai vendors in three cities in Niger and showed that formal education is negatively related to business success in kosai vending. This is probably because women with formal education have opportunities in the formal sector that are more remunerative than street food vending. Otoo et al. conclude that a dry milled cowpea meal for kosai preparation could alleviate an important constraint in batter preparation.

No study has considered the impact of cowpea storage technology transfer specifically on women and this gap has important potential implications. In many African cultures, women are responsible for grain storage. This is true even in cultures where men decide how much grain to store. If women are not informed about new storage technology and do not have access to the storage materials, then the technology may be underused even if men are well informed. To begin to fill that gap the overall objective of this study was to determine cowpea storage practices of rural women in Burkina Faso, Niger, and Nigeria and identify the most important factors in choosing PICS triple bag storage. This survey focused only on women because previous studies have collected data from heads of households who are mainly male. The sample design was developed to elicit the experience of women with the technology. A substantially different survey design would have been needed to compare experience of men and women. The specific objectives of this study are to:

- 1) Determine the percentage of rural women using hermetic storage for cowpea,
- 2) Estimate the percentage of their stored cowpea in PICS bags,
- 3) Identify their sources of information about PICS bags,
- 4) Quantify which factors are most important in their decision to adoption PICS technology, and
- 5) Estimate the economic benefit that they derive from use of PICS bags.

Hypotheses are:

- I) Over 50% of rural women in each of the three countries are storing cowpea in hermetic containers,
- II) Over 20% of the quantity of cowpea stored by women is in PICS bags,
- III) PICS technicians are the most important source of information for women in PICS villages and radio is the most important source in non-PICS villages,
- IV) Commercial availability of PICS bags close to home is the most important factor in explaining the PICS adoption decision, and
- V) Monetary benefit of using PICS technology is estimated at \$100 per woman.

The quantitative thresholds are essential for hypothesis testing. The quantitative thresholds in the hypotheses above were established as follows: Hypothesis I – the 50% threshold was set because overall the goal of PICS was 50% of on-farm cowpea in hermetic storage; Hypothesis II – the 2012 ten-country survey of household

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