Traditional Maize Storage Systems and Staple-Food Security in Ghana

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Ghana is self-sufficient in the production of maize, the major staple food for many low-income Ghanaians, yet staple maize-availability projections in Ghana do not include insecurity problems in the post-harvest season caused by poor storage, distribution difficulties, and high prices. This study uses the concept of food "security-storage" relationships or an "availability-gap" to refer to the ability of poor Ghanaians to access stored maize in the post-harvest season. This estimated "availability gap" measures available maize needed to raise food consumption of the poorest Ghanaians to the minimum nutritional requirement during the post-harvest season. However, maize price is usually highest in the post-harvest season when maize is not easily available. As a result, Ghanaians with increased poverty levels have insufficient purchasing power to access a minimally healthy maize diet in the post-harvest season. Therefore, ensuring easy availability of maize to the poor can scarcely be accomplished without sufficient maize stored in the post-harvest season to stabilize prices.

This study evaluates how traditional maize storage efficiencies contribute to food security in Ghana by examining the economics of maize-storage systems. There is no standard method for appraising the efficiencies of the traditional maize-storage systems. As a result, this collaborative study between ASU and ISSER uses both direct and indirect analyses to allow cross-checking with each other. The systematic data-collection phase involves interviewing and observing traditional maize farmers and traders as they handle maize in Ghana. Images of traditional maize storage and distribution systems and policy recommendations are presented using visual media and digital technologies.

Ghana is about 99% self-sufficient in the production of maize (Nyanteng and Asuming-Bempong 2003), the major staple for many low-income Ghanaians, yet the aggregate staple maize-availability projections in Ghana do not take into account insecurity problems in the post-harvest season caused by poor storage, distribution difficulties, high prices, and low incomes. This study uses the concept of food "security-storage" relationships or an "availability-gap" to refer to the ability of poor Ghanaians to access maize available in the post-harvest season from storage. This estimated "availability gap" measures available maize needed to raise food consumption of the poorest Ghanaians to the minimum nutritional requirement during the post-harvest season. Unfortunately, the price of maize is usually highest in the post-harvest season when maize is not easily available. As a result, Ghanaians with increased poverty levels have insufficient purchasing power to access a minimally healthy maize diet in the post-harvest season. Therefore, ensuring easy availability of maize to the poor can scarcely be accomplished without sufficient maize stored in the post-harvest season to stabilize prices.

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Data Set

The data set used for this study is based on the survey of maize farmers and traders as well as secondary data collected from public institutions in July and August 2004. Data was collected from the maize production and marketing system using participant-observation techniques; semi-structured interviews; questionnaire surveys of traders, transporters, and farmers; and price monitoring in various major producing and consuming markets. About 243 randomly selected maize traders were interviewed in major maize consuming markets from the Western, Central, and Greater Accra regions. Three hundred seventy-five farmers were randomly selected for interview in the Techiman, Nkoranza, and Kintampo agricultural districts, which were stratified into 13 zones with 48 operational areas. The data used included seasonal wholesale maize prices for major maize producing and consuming regions as well as estimated storage costs for traditional storage cribs.

Results

Maize Availability and Price Variability in the Post-Harvest Season

Analysis of maize prices showed wide variations between the producing and consuming regions as well as between the harvest and post-harvest seasons. Monthly maize prices are generally very low during the major season's harvesting period and increase steadily to a peak just before the minor season's harvesting period (Figure 1). It is estimated that Ghana is about 99% self-sufficient in domestic maize production; therefore, inadequate storage may be considered the major cause of maize-price variability in Ghana. Indeed, over 78% of the "long-distance" traders interviewed indicated that they did not have a crib or secured warehouse in the marketplace for storage purposes. This greatly limits their ability to store maize even for short periods. Most "long-distance" traders generally do not see long-term maize storage in anticipation of high future price as part of their business or as a means of earning profit. Furthermore, given the general situation of capital shortage in Ghana, long-term maize storage is not sufficiently profitable to attract the interest of small-scale "long-distance" traders who mostly buy on cash but have to sell to prepared food sellers and retailers on credit. "Long-distance" traders therefore engage almost exclusively in short-term storage in the normal course of their business and their operations rarely influence the maize "security-storage" relationship or "availability-gap."

Maize has minor and major harvesting seasons in the major producing regions. Maize prices continue to be lowest during the major harvesting season, as farmers generally sell their output immediately after harvest (August to October) to meet cash needs. However, most farmers also reported storing much of their minor season's crop harvested in January and February for sale between May and July when prices are high. Therefore, the amount of the minor season's crop and length of time stored largely influence the maize availability-gap. However, the amount of maize from the minor season that farmers store is insufficient to eliminate the availability-gap or to stabilize prices in the post-harvest season. As a result, inadequate maize storage in the post-harvest

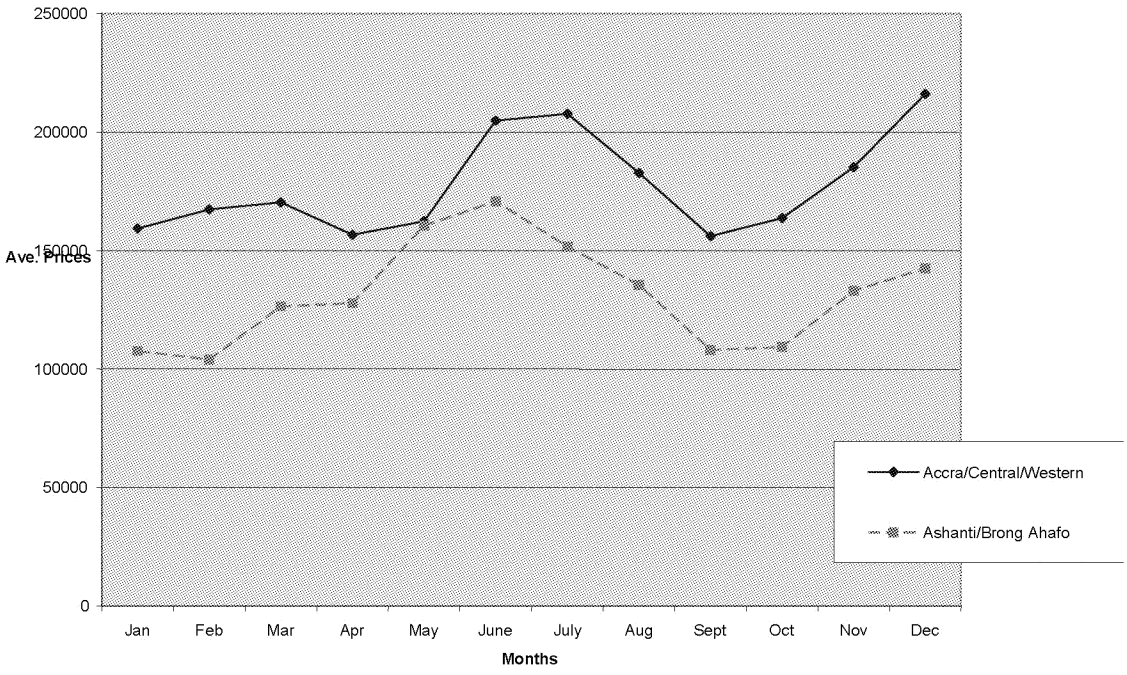

Figure 1. Graph of Average Maize Prices for Major Consuming and Producing Regions: 1998–2003.

Source: Wholesale prices from Ministry of Agriculture.

season continues to be the major underlying cause of high prices or insecurity in staple maize.

Storage-Cost Analysis

To overcome the poor maize "security-storage" relationship in the post-harvest season in order to enhance security in staple maize, the government initiated a buffer-stock policy in 2001 with a goal of 15,000 metric tons of locally produced maize and rice. The main goals of the 2001 buffer-stock policy for maize include putting to use some modern storage facilities located in strategic places in the country belonging to the defunct GFDC, reducing the high post-harvest maize losses, reducing the extent that producer prices collapse in the immediate post-harvest periods, and reducing the high maize prices in the post-harvest season (Nyanteng and Asuming-Bempong 2003).

A survey of storage facilities available in Ghana revealed that none of the defunct GFDC's warehouses or silos was functioning or had buffer stocks of maize. Indeed, all were idle or have become rusting monuments to inappropriate technology transfer. None of the other public storage facilities owned by MofA, FASCOM, CMB, Action Aid, or others was being used to implement the government maize "buffer-stock" strategy. Despite the government's maize buffer-stock strategy, national maize storage-capacity problems continue to be ignored or overlooked. The absence of public storage facilities—including those of the GFDC—from the national maize "buffer-stock" storage program has adversely affected Ghana's maize-security reserves in the post-harvest season. Therefore, the private sector, including farmers and traders, now have the responsibility of storing maize to overcome the "availability-gap" and prevent high prices in the post-harvest season.

The major storage problems reported by over 85% of the farmers surveyed include uncertain returns from storage as a result of future price unpredictability, lack of working capital to construct cribs and store maize, and physical losses of stored maize. Furthermore, most farmers who have farms near GFDC silos reported lack of access to GFDC drying and storage facilities as other storage concerns. The survey results also show that maize farmers will only store maize if their storage benefits outweigh their costs or if future prices rise enough to cover storage costs. In deciding how long to store in the post-harvest season, the benefits from storage must be balanced by the storage costs involved. This can be represented by

$$(1) \qquad \sum_{t1}^{tn} S = \sum_{t1}^{tn} P_f - P_c,$$

where S represents monthly maize storage cost, P_f is the future monthly prices at which maize is sold, and P_c is the current monthly price at which maize is stored.

Table 1 shows the results of the model applied to farmers' estimated monthly maize storage costs and corresponding monthly price spreads in the major maize-producing districts of Brong-Ahafo. It is expected that farmers will have greater opportunities to increase their earnings by storing maize immediately after harvest in order to sell when prices are high. However, Table 1 indicates that short-term storage does not increase farmers' earnings or that there is no opportunity for farmers who store for less than three months after harvest. While farmers generally benefit from long-term storage of their minor season's crop harvested in February and sold between May and July, further storage-cost analyses indicate that farmers do not benefit from storing their major season's maize from August to December. This implies that there is opportunity in long-term maize storage but not in short-term storage—i.e., only long-term storage of the minor season's maize crop for sale between May and July is beneficial. The policy implication is that access to inventory capital will encourage farmers to engage in long-term storage of their minor season's maize crop.

Notwithstanding the opportunities in long-term maize storage, maize prices and unavailability are at their highest during May and July. Future price unpredictability and losses are cited by most farmers surveyed as some of the factors preventing them for storing maize for the post-harvest season. The moisture content of fresh maize intended for long-term bag storage must be low, to reduce the incidence of discoloration. Reduction in losses due to discoloration in bag storage can be attained through rapid drying before storage. Unfortunately, most farmers who store their maize in bags do not have access to drying facilities. While it is now generally accepted that traditional local storage systems such as cribs are usually well-adapted to local conditions and losses from grain storage are generally low and acceptable to farmers (Compton

Table 1. Monthly Maize Price Spreads and Estimated Storage Costs for Traditional Cribs in Brong Ahafo (Cedis).

2003	Price Change Pf –Pc	Storage Cost S	Margin (Pf –Pc) –S	Action
February	0	4123	-4123	Loss
March	4000	6306	-2306	Loss
April	6000	8514	-2514	Loss
May	54000	13072	40928	Profitable
June	71868	16946	54922	Profitable
July	43379	17791	25588	Profitable
August	10604	17548	-6944	Loss
September	-3720	18331	-22051	Loss
2002				
February	-9463	5253	-14716	Loss
March	-1003	7690	-8693	Loss
April	-2323	9816	-12139	Loss
May	25898	13465	12433	Profitable
June	21648	17470	4178	Profitable
July	34248	18614	15634	Profitable
August	-33620	16905	-50525	Loss
September	-6269	16165	-22434	Loss

Source: 2004 Farmer's Survey and Ministry of Agriculture.

1992), farmers surveyed estimated losing 5% to 20% of maize stored in cribs. Maize storage losses therefore affect the quantity and quality of maize available for sale during the post-harvest season and hence its price. Thus any program that encourages farmers to increase on-farm storage must stress the need for appropriate market information and access to effective drying and storage facilities.

Conclusions

This study shows that maize prices are at their highest in the post-harvest season in both major consuming and producing regions. This suggests that maize storage is inadequate and that there is a poor maize "security-storage" relationship, or an "availability-gap." Given the general situation of capital shortage, long-term maize storage is relatively unprofitable to "long-distance" maize traders who mostly buy maize on cash but have to sell on credit. Long-distance maize traders therefore engage almost exclusively in short-term storage in the normal course of their trading activities and their operations rarely influence the maize "security-storage" relationship or "availability-gap."

The absence of public storage facilities for the national maize "buffer-stock" storage program implies that the public sector is not directly involved in overcoming the maize "availability-gap" in the post-harvest season. Therefore, storing maize in the post-harvest season to overcome the "availability-gap" and prevent high prices in order to ensure food security to the poor has largely become the responsibility of traditional small-scale maize farmers, and also of long-distance traders. While there is opportunity in long-term maize storage, farmers and traders continue to face many constraints, including uncertain returns from storage as a result of future price unpredictability, lack of working capital to construct cribs and store maize, and physical losses of stored maize. Programs designed to eliminate these constraints can encourage farmers and trad-

ers to increase maize storage in the post-harvest season.

Policy Recommendations

In spite of the buffer-stock policy initiated in 2001 by the government to enhance staple maize security, the most relevant ingredient to ensuring increased maize storage, or overcoming the "availability gap," is public incentive programs that can encourage maize farmers and traders to engage in long-term maize storage. It is clear from this study that the private sector will store more maize in the post-harvest season only in response to positive incentives or opportunities in storage. The successful implementation of government buffer-stock strategies or programs will therefore require helping farmers and traders overcome the constraints they face as well as creating incentives that will encourage them to change their current storage practices in order to eliminate the maize availability-gap in the post-harvest season. While most of the interventional activities may be provided by local farmers and traders themselves, there will be a need for a complementary role by the government. Access to drying and storage facilities at strategic maize producing and consuming areas, easy access to inventory capital, and improvements in communication infrastructure to assist in effective dissemination of market information and prediction of future prices are areas where national policies can play a key role in encouraging maize storage among farmers and traders.

Market Information Constraints

Uncertainty of storage costs, future prices, and benefits from storage appear to be major constraints affecting farmers' maize storage. Inability to predict post-harvest maize prices has meant a reduction in maize storage or made farmers and traders engaged in maize storage vulnerable. Furthermore, as GFDC's influence on maize prices in the post-harvest season has ended, the value of future maize prices has become an important factor in increasing maize storage. Therefore, improvements in the government's collection and dissemination of maize prices to both consuming markets and producing regions will be a potentially valuable service to farmers and traders engaged in maize storage but who lack access to future price information. The improved communication or dissemination of future maize prices may therefore offer significant potential benefits to the private sector's maize-storage decisions.

Storage Constraints

This study shows that traders' and farmers' access to drying and storage facilities is critical to increasing maize storage as well as to overcoming maize losses and an "availability-gap" in the post-harvest season. Until now, large-scale maize storage in Ghana has been carried out by GFDC, with financial assistance from the government and private banks. This resulted in the building of large numbers of silos and warehouses located in both the major maize consuming and producing regions. However, GFDC is now defunct because of poor management, and inappropriately designed and located storage and drying facilities. Greater emphasis is now needed in designing a positive complementary role for the government in assisting farmers' and traders' access to storage and drying facilities in order to increase maize storage. One possible such role for the government is the evaluation of available or idle public silos and drying and warehouse facilities, and making them available to the traders and farmers (at a fee) for maize storage; this may improve access to storage facilities and provide the possibilities for reducing storage costs. Another possible area of proactive intervention to encourage traders to engage in long-term maize storage is the involvement or collaboration of traders and central and municipal governments in the design, construction, and management of secured warehouses or storage spaces in marketplaces for use by long-distance traders. Indeed, improved government and private-sector arrangements involving the management and use of the public drying and storage facilities (e.g., easy access by farmers and traders to GFDC's idle drying and storage facilities) may allow some reductions in storage cost and encourage more farmers and traders to store maize.

Capital Constraints

Easy access to inventory capital by both farmers and traders appears to be a critical component of increasing maize storage over long periods. Public policies and programs that encourage easy credit access from financial institutions to maize traders

and farmers to finance stored maize or to hold maize stocks until the post-harvest season may be an appropriate means of promoting or encouraging maize storage among traders and farmers.

While Ghana is self-sufficient in maize production, however, the management of staple maize security in the post-harvest season requires effective policies on storage practices and information dissemination to deal with the shortages and surpluses, and the corresponding price variability. Furthermore, it is the poor Ghanaians who are prone to maize insecurity in the post-harvest season as a result of unavailability and inaccessibility. Addressing the maize "availability gap" is therefore the central policy issue of maize insecurity problems in the post-harvest season. The strategic focus on increasing maize storage and ensuring maize security to the poor in the post-harvest season will only be attained through complementary public policies and programs that can assist the private sector's access to market information, capital, and storage facilities. Therefore, the creation of an enabling environment to encourage farmers and traders to store maize in the post-harvest season is considered a major complementary role for the government in ensuring staple maize security for the poor.

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