MARKETING UNDERUTILIZED CROPS:

THE CASE OF THE AFRICAN GARDEN EGG (SOLANUM AETHIOPICUM) IN GHANA

by

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# Marketing Underutilized Crops: The Case of the African Garden Egg (*Solanum aethiopicum*) in Ghana

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1. Introduction

Global food security depends on diversity in phytogenetic resources (FAO, 1999; Wood and Lenne, 1999). Modern agricultural production, however, is based mostly on just a few species that are grown intensively (Prescott-Allen and Prescott-Allen, 1990; Bazile, 2006). Plant breeding has brought incredible benefits to the developed and developing economies around the world by focusing on a number of crops and varieties. However, this simplification of agriculture has reduced the inter-specific and intra-specific diversity in fields, indirectly increasing farmers’ vulnerability. As a consequence, ex-situ conservation of genetic resources of main staple crops has received vast support.

In recent years there has been a shift in focus towards crops that were left aside by research, technology, marketing systems and/or conservation efforts. These latter crops fall into the underutilized category which refers to species with underexploited potential for contributing to food security, health, income generation and/or environmental services (Jaenicke and Hoeschle-Zeledon, 2006). Some of these species have the following characteristics: a) they are locally abundant in developing countries but globally rare; b) scientific information and knowledge about them is scant; and c) their current use is limited, relative to their economic potential (Gruère et al., 2006).

An additional common feature is that most of these crops are still selected, adapted and multiplied by farmers in marginal environments of developing economies. Thus, underutilized crops have the potential to contribute not merely to agricultural biodiversity but, most importantly, to the livelihoods of the poor. Marketing development of underutilized plant species is one way to increase social welfare by generating income for the local producers and chain actors and by promoting the sustained use and conservation of agricultural biodiversity.

1.1 Objectives

The overall objective of this study is to analyze constraints affecting the African garden egg market chain in Ghana. Furthermore, to identify the factors that help determine the success of market chain development of garden egg in Ghana; and to analyze the effect of market development on biodiversity.

Garden egg, also known as African eggplant (*Solanum aethiopicum*), is one of the most important vegetable crops in this country and in West Africa (Norman, 1992; Owusu-Ansah et al., 2001; Grubben and Denton, 2004). Not only is this crop consumed on an almost daily basis by rural and urban families but it also represents the main source of income for many rural households in the forest zone of the country (Danquah-Jones, 2000; Owusu-Ansah et al., 2001). Despite its local importance, there is limited knowledge as to the plant and research efforts involving garden egg. This vegetable crop is traded internationally on a limited scale in the West African sub-region, and only a very small share of the total production in Ghana is
exported to Europe. The crop has interesting nutritional characteristics, and potentially useful agronomic traits. Moreover, there is an noticeable diversity in the type of varieties cultivated in Ghana.

1.2 Scope and definitions

The study was commissioned by the Global Facilitation Unit for Underutilized Species (GFU). The information used in this study comes from primary and secondary sources. Farm level and some of the market level information was collected between February and April 2006, in collaboration with the Program for Biosafety Systems (PBS) and with the assistance of researchers from the University of Ghana, the Biotechnology and Nuclear Agricultural Research Institute (BNARI) of the Ghana Atomic Energy Commission, and the Crop Research Institute (CRI) of the Council for Scientific and Industrial Research (CSIR). Additional market level information for the Greater Accra Region was gathered in October 2006, with support from the GFU.

For the farm level information, production areas were selected based on prior information, by agroecological zone, region, and district (market town). The regions selected were: Greater Accra, Central, Ashanti, Brong-Ahafo and Volta Region. With the help of the district Agricultural Extension Agents, specific towns or major producing areas were identified and considered according to the number of producers in each location. A random sample of farmers was taken after visiting the town and contacting the producers. A total of 156 garden egg producers were interviewed. The main markets linked to these producing areas were identified with the assistance of the extension agents. Traders were interviewed in each of the regions, to compare the market chain organization across regions and identify the major actors.

Additionally, with regard to market level and trading, semi-structured interviews were carried out in the Accra Metropolitan Area (AMA), with a higher degree of detail. The interviews were conducted with key informants at specific points in the chain and relevant actors involved in the garden egg market chain: farmer-traders, wholesaler, retailers and exporters. The interviews included: a) trader profiles, b) product quality considerations, c) procurement quantities, frequency and costs, d) operating costs, and e) sales quantities, sales frequency and prices. A total of 30 traders were interviewed in 5 main markets in AMA: Agbogbloshie, Mallam Atta, Kaneshie, Makola and CMB, to complement the information gathered across regions.

To our knowledge, there has not been a proper evaluation of the genetic diversity of the garden egg, so it is difficult to say whether what we find in farmers’ fields or in the markets are land races, local varieties or a type of garden egg that has different phenotypical expressions. Usually, variants, varieties or populations of crops, with plants that are often highly variable in appearance, are referred to in the literature as landraces (Smale, 2006). Landraces present a genetic structure that has been shaped by farmers’ seed selection practices and management, as well as natural selection processes, over generations of cultivation. Given the limited literature available on the crop, we prefer to use the terminology types when the differences are based solely on the appearance of the fruit: round or elongated, as we will discuss later on. We believe that the number of landraces or varieties per type is large, but there is need for research and appropriate botanic differentiation to substantiate our observations. Other terminologies, such as
cultivars or lines involved some breeding work and are used in the text when necessary.

1.2 Plan of study

In section 2 we present background details regarding garden egg, the origin of the crop and the significance of this vegetable for Ghana, while section 3 covers the description and analysis of the garden egg market chain. This latter section is divided into three parts. First, there is a description of the market channel, actors, linkages and constraints for the domestic and regional market. The second part covers the international market, and the third part presents assessments of market shares and margins. In section 4 of this report, we provide an evaluation of garden egg diversity, and the effect of market development on biodiversity. Based on this information, section 5 discusses the major challenges for the garden egg market chain. Section 6 summarizes the main findings, conclusions and recommendations.

2. Garden egg: current situation

2.1 Origin and importance

The garden egg (Solanum aethiopicum Gilo group) originated in tropical Africa (Norman, 1992; Grubben and Denton, 2004). Grubben and Denton (2004) explain that garden egg is the result of the domestication of one wild and one semi-domesticated Solanum species that grow in tropical Africa (S. anguivi and S. distichum). The crop is widely cultivated across most of the African continent, and more intensively in West and East Africa. Garden egg is also produced in Brazil (known as ‘jilo’) and occasionally in southern Italy and France (Grubben and Denton, 2004). Unlike in these latter countries, in Ghana garden egg is locally abundant, lacks significant knowledge and research investment, and has significant public and private value that has not been fully realized (Horna and Gruère, 2006).

There are four main cultivar groups: Gilo, Kumba, Shum and Aculeatum. The first three are the most important in Africa. Gilo and Kumba groups are produced for their fruit, while Shum is cultivated for its leaves. The most common group in Ghana is the Gilo group, which is thought to be more genetically heterogeneous due to higher crosspollination than Kumba. However, fruits with the characteristics of the Kumba group have also been observed in the Ghanaian markets.

Domesticated and wild relatives of garden egg have important breeding traits that remain to be explored. In the field, garden egg itself shows a higher drought and heat tolerance than tomato or conventional eggplant. Grubben and Denton (2004) also state the lower susceptibility of garden egg to pests and diseases than that of the exotic eggplant. In Japan, cultivars of the Aculeatum group are used as rootstock for tomato. These important traits could be used for the breeding of garden egg but also for related crops, such as eggplant or tomato.

Some medicinal properties are attributed to the roots and fruits. They are described as carminative and sedative, and used to treat colic and blood pressure (Grubben and Denton, 2004). The nutritional content of garden egg is comparable to that of tomato, but it has a lower content of vitamin C (Table 1). This vegetable is also valued locally for its high iron content (E. Blay personal communication).
### Table 1. Nutritional value (100 g of edible portion)

<table>
<thead>
<tr>
<th>Content</th>
<th>Garden Egg</th>
<th>Tomato (USDA, 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>90.6 g</td>
<td>93 g</td>
</tr>
<tr>
<td>Energy</td>
<td>32 Kcal</td>
<td>20 Kcal</td>
</tr>
<tr>
<td>Protein</td>
<td>1.5 g</td>
<td>1.1 g</td>
</tr>
<tr>
<td>Fat</td>
<td>0.1 g</td>
<td>0.1 g</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>7.2 g</td>
<td>4 g</td>
</tr>
<tr>
<td>Fiber</td>
<td>2.0 g</td>
<td>1 g</td>
</tr>
<tr>
<td>Calcium</td>
<td>28 mg</td>
<td>7 mg</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>47 mg</td>
<td>25 mg</td>
</tr>
<tr>
<td>Iron</td>
<td>1.5 mg</td>
<td>0.4 mg</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>-</td>
<td>70 IU*</td>
</tr>
<tr>
<td>B carotene</td>
<td>0.35 mg</td>
<td>-</td>
</tr>
<tr>
<td>Thiamin</td>
<td>0.07 mg</td>
<td>0.09 mg</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>0.06 mg</td>
<td>0.2 mg</td>
</tr>
<tr>
<td>Niacin</td>
<td>0.8 mg</td>
<td>0.6 mg</td>
</tr>
<tr>
<td>Ascorbic Acid</td>
<td>8 mg</td>
<td>15 mg</td>
</tr>
</tbody>
</table>

* IU: International Units

### 3. Market chain and support services

The performance or efficiency of a market chain is a result of how well the actors in the chain are organized and also how well the chain is supported by a range of services that are also described as ‘business development services’ (Ferris et al., 2006). Services could include research, input supply, communication, transportation, local administration, market information, and financial services (Figure 1). It is recognized that market performance can often be increased more effectively by improving or gaining access to these services, rather than assisting a particular group of actors in a market chain.

Garden egg has a relatively well-developed marketing channel that links actors at different spatial locations from rural communities to national, regional and international destinations. This market or value chain has developed over the years to cover domestic demand. Occasionally, garden egg is traded across borders with neighboring countries or countries in the West Africa sub-region, but it is only the international trade with Europe that has forced further development and specialization in the marketing chain.
The garden egg market chain is presented in Figure 2, overleaf. Breeding and seed multiplication services provide basic support to the chain. Breeding research and formal seed multiplication of underutilized crops are often public tasks unless the crop’s economic potential is already recognized by the private sector. The public sector in Ghana has invested very little resources in garden egg research. No official variety of garden egg has been formally released for commercial cultivation. A number of local varieties are cultivated by farmers to meet the internal demand (Owusu-Ansah et al. 2001). The University of Ghana, Legon and the Crop Research Institute (CRI) have been working on improved lines but there has not been any official varietal release to the market. Some specialized farmers multiply seeds from advanced lines or from selected local cultivars in a sort of semi-formal arrangement. The rest of the garden egg seed is recycled or bought from market women. It is true that garden egg exporters produce one specific type of garden egg, but the seeds come from farmers’ fields and are not certified.

Support services, such as post harvest handling, transportation, financial services, communication, and market information, among others, are also central to garden egg market development. In general, the constraints imposed by the inappropriateness or non-existence of the support services have a significant impact on the performance of the garden egg market chain.
Figure 2. Garden egg market chain
3.1 Domestic / regional market

Together with tomato and pepper (chili), garden egg is among the three most consumed vegetables in Ghana. The use of garden egg fruits in Ghanaian cookery is similar to that of tomato, but tomato and garden egg are used as complements rather than substitutes in Ghanaian cuisine. Both vegetables are the main ingredients in the stews that accompany almost every local dish or are used as soup thickeners. Garden egg fruits can also be consumed raw. Leaves and stems, which are in high demand in East Africa, are very rarely consumed in Ghana.

From time to time, when there is a shortage of garden eggs in the neighboring countries (Côte d’Ivoire, Burkina Faso, or Togo), traders exploit the opportunity to sell in those countries, especially if they can attract higher prices.

3.1.1 Farmers and production constraints

National production is estimated to be at around 30,000 tons but exact numbers are not available for the whole country. Statistics are available for the Greater Accra Region, where a decreasing tendency is observed in total output, areas cultivated and yield, most likely due to urbanization (Table 2).

Table 2. Production performance of garden egg in the Greater Accra Region

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (t)</th>
<th>Area (ha)</th>
<th>Yield (t / ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>10,100.00</td>
<td>3,100.00</td>
<td>3.26</td>
</tr>
<tr>
<td>1994</td>
<td>12,250.00</td>
<td>3,140.00</td>
<td>3.90</td>
</tr>
<tr>
<td>1995</td>
<td>1,296.40</td>
<td>280.00</td>
<td>4.63</td>
</tr>
<tr>
<td>1996</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
</tr>
<tr>
<td>1997</td>
<td>6,390.00</td>
<td>809.00</td>
<td>7.89</td>
</tr>
<tr>
<td>1998</td>
<td>1,613.00</td>
<td>461.00</td>
<td>2.62</td>
</tr>
<tr>
<td>1999</td>
<td>1,527.00</td>
<td>509.00</td>
<td>2.25</td>
</tr>
<tr>
<td>2000</td>
<td>1,470.00</td>
<td>491.00</td>
<td>2.19</td>
</tr>
<tr>
<td>2001</td>
<td>916.00</td>
<td>322.00</td>
<td>1.80</td>
</tr>
<tr>
<td>2002</td>
<td>962.00</td>
<td>322.00</td>
<td>1.80</td>
</tr>
<tr>
<td>2003</td>
<td>531.00</td>
<td>178.00</td>
<td>1.79</td>
</tr>
<tr>
<td>2004</td>
<td>570.00</td>
<td>190.00</td>
<td>1.97</td>
</tr>
</tbody>
</table>

Source: PPMED – MoFA, 2005

Garden egg is an income-generating activity for smallholder farmers. Asenso-Okyere et al. (2000) report that about 4,305 households from coastal forest and savannah ecological zones in Ghana are actively involved in the production of vegetable crops such as garden egg, leafy vegetables, tomato, okra, pepper and onion. The analysis of our farm survey shows that producers manage plots of less than 1 ha (Table 3). Despite their limited size, these plots represent around 60% of their total cultivated area. More than 97% of the total production goes to the market.
Table 3. Area cultivated and market participation in garden egg

<table>
<thead>
<tr>
<th>Region</th>
<th>Greater Accra</th>
<th>Central</th>
<th>Ashanti</th>
<th>Brong Ahafo</th>
<th>Volta</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garden egg area (ha)</td>
<td>0.62</td>
<td>0.54</td>
<td>0.69</td>
<td>0.58</td>
<td>1.15</td>
<td>0.69</td>
</tr>
<tr>
<td>Shared area (%)</td>
<td>47.5</td>
<td>62.2</td>
<td>84.5</td>
<td>40.8</td>
<td>81.3</td>
<td>58.9</td>
</tr>
<tr>
<td>Portion sold (%)</td>
<td>98.5</td>
<td>97.9</td>
<td>97.8</td>
<td>96.9</td>
<td>97.5</td>
<td>97.6</td>
</tr>
</tbody>
</table>

Gross margins from garden egg activity are presented in Table 4. These figures have been derived from the information collected from small farmer fields and converted to per hectare levels. The net benefit therefore might have an upward bias since: i) input use is not necessarily linearly related to plot size; ii) it is difficult for farmers to account for equipment use when they produce more than one crop, and iii) farmers tend to under-estimate their labor costs. The Ministry of Agriculture reports a national average of 8 mt/ha under rainfed conditions with a potential to increase up to 18 mt/ha (PPMED, 2005) a value that is in the range of our estimations.

Garden egg is a labour-intensive crop, and labour costs are more than 60% of the total costs. Labour is especially needed during the harvesting period. On average, both family and hired labor are used in similar proportions. Ploughing is the main service provided to garden egg farmers who cultivate large areas of land and are able to afford it. Together, equipment and service costs represent 9% of the total production costs incurred by garden egg producers.

According to our estimations, garden egg is a very profitable activity in the Greater Accra Region, where yields and prices are both comparatively higher, despite the fact that prices fluctuate a great deal during the year. Volta Region producers are also earning high returns on their investment in garden egg. Some producers in the Volta region are closer to the Volta River Dam and can produce garden egg during the dry season. In Greater Accra, Volta, and Brong-Ahafo regions there seems to be a higher level of specialization in garden egg production. It is only in the Central Region that producers make almost no profit by engaging in this activity. The main reason is the high labour cost, most of it family labour that is usually unaccounted for by farmers.

Garden egg production can be a profitable activity but it also involves risks. On average, farmers interviewed faced 30% chances of having negative returns. The percentage of farmers with a negative return is a measure of downside risk. Producers’ activities with a positive return have a large enough net income to cover all cash costs plus an opportunity charge for unpaid producer labour and management. A production glut occurs in the rainy season, when market prices are the lowest during the year. Farmers with access to irrigation facilities can produce during the dry season and obtain higher total returns.

Production constraints faced by farmers are multiple. A number of pests and diseases attack this vegetable crop in the field. Mites, stem borers, fruit borers and flower borers are the main pests that attack garden egg. The damage caused can reduce yields and affect the quality and quantity of the produce. For the local market, these damages affect the price significantly but the produce can still be sold. Other factors that influence quality are water and nutrition.
management. Some farmers use very limited amounts of fertilizer and pesticides in garden egg production, and pay much less attention to quality considerations. These farmers, although commercially oriented, are unable to find incentives in the market for further specialization and intensification of the crop. In general, it seems that farmers who get higher yields tend to be younger and have access to credit. Farmers with credit access can invest in fertilizers and damage abatement inputs to get higher yield. Insecticide, pesticide and bio pesticide use however represents only 5.3% of total production costs.

Another constraint to garden egg production is that it is labour intensive, especially during the harvesting period. Garden egg has to be harvested twice a week, otherwise the fruit matures on the plant, develops seeds, and changes color - thus resulting in a severe penalty on market value. Under optimal conditions, the crop should be harvested in the early morning hours when the heat and the sun are not so strong.
Table 4. Garden Egg Budget, expected yields and prices

<table>
<thead>
<tr>
<th>Units</th>
<th>Units</th>
<th>Greater Accra</th>
<th>Central</th>
<th>Ashanti</th>
<th>Brong-Ahafo</th>
<th>Volta</th>
<th>All Sample (N = 156)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Income</strong></td>
<td>$ / ha</td>
<td>4,150.2</td>
<td>947.7</td>
<td>1,726.0</td>
<td>2,093.0</td>
<td>2,910.8</td>
<td>2,336.2</td>
</tr>
<tr>
<td>Yield Kg / ha</td>
<td></td>
<td>10,377.3</td>
<td>1,599.9</td>
<td>3,453.6</td>
<td>7,768.1</td>
<td>17,450.3</td>
<td>8,342.5</td>
</tr>
<tr>
<td>Price $ / Kg</td>
<td></td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td>$ / ha</td>
<td>1,012.9</td>
<td>1,197.7</td>
<td>944.8</td>
<td>781.3</td>
<td>1,225.5</td>
<td>985.2</td>
</tr>
<tr>
<td>a) Inputs</td>
<td></td>
<td>236.6</td>
<td>179.6</td>
<td>260.6</td>
<td>280.2</td>
<td>334.4</td>
<td>262.0</td>
</tr>
<tr>
<td>- Water $ / ha</td>
<td></td>
<td>-</td>
<td>18.7</td>
<td>18.5</td>
<td>11.8</td>
<td>-</td>
<td>10.2</td>
</tr>
<tr>
<td>- Land $ / ha</td>
<td></td>
<td>54.7</td>
<td>54.6</td>
<td>32.1</td>
<td>36.0</td>
<td>39.1</td>
<td>42.0</td>
</tr>
<tr>
<td>- Planting material $ / ha</td>
<td></td>
<td>25.8</td>
<td>39.1</td>
<td>13.8</td>
<td>21.5</td>
<td>32.6</td>
<td>25.7</td>
</tr>
<tr>
<td>- Fertilizer $ / ha</td>
<td></td>
<td>101.7</td>
<td>48.7</td>
<td>141.9</td>
<td>142.3</td>
<td>216.2</td>
<td>132.0</td>
</tr>
<tr>
<td>- Insecticides $ / ha</td>
<td></td>
<td>40.4</td>
<td>11.6</td>
<td>17.2</td>
<td>36.6</td>
<td>38.8</td>
<td>30.3</td>
</tr>
<tr>
<td>- Biopesticides (neem, Biovit or Dipel) $ / ha</td>
<td></td>
<td>-</td>
<td>-</td>
<td>0.6</td>
<td>-</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>- Fungicides $ / ha</td>
<td></td>
<td>13.5</td>
<td>6.8</td>
<td>36.2</td>
<td>32.1</td>
<td>7.6</td>
<td>21.6</td>
</tr>
<tr>
<td>- Manure $ / ha</td>
<td></td>
<td>-</td>
<td>-</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>- Other inputs (nematicides, herbicides) $ / ha</td>
<td></td>
<td>0.5</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.1</td>
</tr>
<tr>
<td>b) Labor</td>
<td></td>
<td>598.6</td>
<td>941.9</td>
<td>622.3</td>
<td>421.1</td>
<td>801.8</td>
<td>629.6</td>
</tr>
<tr>
<td>- Hired Labor $ / ha</td>
<td></td>
<td>350.6</td>
<td>244.8</td>
<td>237.6</td>
<td>297.3</td>
<td>491.0</td>
<td>318.6</td>
</tr>
<tr>
<td>- Family Labor $ / ha</td>
<td></td>
<td>248.0</td>
<td>697.1</td>
<td>384.7</td>
<td>123.9</td>
<td>310.8</td>
<td>311.1</td>
</tr>
<tr>
<td>c) Services (Plowing) $ / ha</td>
<td></td>
<td>52.4</td>
<td>29.0</td>
<td>28.6</td>
<td>39.1</td>
<td>62.7</td>
<td>41.6</td>
</tr>
<tr>
<td>d) Equipment $ / ha</td>
<td></td>
<td>125.3</td>
<td>47.1</td>
<td>33.4</td>
<td>40.8</td>
<td>28.2</td>
<td>52.2</td>
</tr>
<tr>
<td>Expected Net Income $ / ha</td>
<td></td>
<td>3,137.3</td>
<td>(304.8)</td>
<td>774.8</td>
<td>1,309.5</td>
<td>1,685.2</td>
<td>1,343.4</td>
</tr>
<tr>
<td>Expected Return on Investment</td>
<td></td>
<td>3.10</td>
<td>0.25</td>
<td>0.82</td>
<td>1.68</td>
<td>1.38</td>
<td>1.36</td>
</tr>
</tbody>
</table>
3.1.2 Farmer-traders, wholesalers, retailers and marketing constraints

Garden egg marketing in the domestic market is in the hands of farmer-traders, wholesalers and retailers (Figure 2). Often these actors perform more than one function. It is common to find farmers taking the initiative to go to the market to sell their produce and sometimes that of other farmers. We have categorized this group of farmers as farmer-traders. In general, farmer-traders can obtain higher prices for their produce. There are a number of factors affecting this decision: harvest size, availability of transportation, and financial need. Thus, when garden egg is abundant during the rainy season, farmers tend to go to the bigger markets close to their village while during the dry season it is the wholesalers from close or distant markets who come to farmers’ fields. Also, since in the case of garden egg, the fruit over-ripen quickly if not harvested on time, farmers are forced to either sell at a very low price at farm gate or go to the nearest market with their produce.

There are two kinds of farmer-traders, those who only bring their own harvest to the market and those who, in addition, deal with their relatives or neighbours’ harvest. Farmer-traders tend to sell basically to mobile or sedentary wholesalers. Wholesalers normally pay for the produce outright but sometimes pay after they have been able to sell or distribute it. The price the farmer-trader gets in such circumstances depends on the price at which the wholesaler was able to sell the garden egg. These arrangements are usually based on trust. While retailers and wholesalers are almost exclusively women who are generally called ‘market women’; independently of the function they perform, farmer-traders can be either men or women.

Wholesalers are market women that manage and/or control the trade in garden egg in a specific market. They are also known as ‘market queens’ and they often deal with just one product. The control of market queens in garden egg volumes traded and in pricing is limited. Garden egg demand during the major and minor rainy seasons is influenced by internal production. During the dry season, prices increase considerably due to reduced supply. There are two different types of wholesalers: i) Mobile wholesalers who travel around the different producing areas (farm gate); usually they come from regional or neighboring markets and act as collectors but often keep smaller quantities for retailing; and ii) permanent wholesalers who are permanently linked to one particular market and either send other people to gather produce for them or buy from farmers who come to the market. They sell to other smaller-scale market women (retailers) or directly to consumers. Transportation costs can be a consideration, especially during the dry season since traders have to move further to get the produce. However, garden egg is widely produced mainly in the rural areas of the central and southern part of the country. In general, the main cities and markets are relatively close to the production areas.

Retailers are market women who may or may not have a fixed place in the market. They either buy from sedentary or mobile wholesalers. Sometimes they also buy from farmer-traders or even go to farmers’ fields to stock themselves. They can sell to other retailers but their main customers are restaurants, fast food operations and household consumers. Retailers often sell more than one type but price differentials, if any, are normally due to the relative freshness of the vegetable. One of the income strategies adopted by retailers is diversification with regard to sale of products. Other crops sold alongside garden egg are tomato, pepper (chillies), okro, onion, corn dough, condiments, kpakpo shitor (local pepper variety), maize, and cassava.
The main constraints for traders in general are the poor shelf life of garden egg, poor post harvest handling, lack of storage, cooling and appropriate transportation services. Garden egg is very sensitive to handling and its quality deteriorates quickly. Many farmer-traders do not own a means of transport and have to take public transportation. The average shelf-life of garden egg is 3 to 7 days, depending on harvesting frequency and conditions. This limited shelf life affects the internal price, not to mention losses due to spoilage. According to the market women we interviewed, spoilage losses could be as high as 25%. Several days after harvesting, garden eggs change color from white or cream to yellow and/or intense orange. At the same time, the water content of the vegetable declines dramatically, thus affecting the appearance and texture of the produce.

3.1.3 Attributes, consumer preferences, and pricing

Garden egg’s perceivable quality attributes - such as color, shape, size and taste - vary widely. Garden egg can be deep green, green, white, cream, or yellow. Color is an indicator of freshness. There are many different sizes of garden egg. There seems to be a preference for medium-to-large sizes, but again that depends on the final use of the fruit of the garden egg. Taste is also an important quality attribute sought after by consumers and quite often related to the shape. Garden egg can have a blunt, sweet or bitter taste. Round types tend to be more bitter than elongated types, but this is not always the case. This is a genotype-specific characteristic but it is also suspected that certain agricultural practices could have an influence on the bitterness of the fruits. Also, cultivars\(^4\) that are green when immature tend to be more bitter at harvest (E. Blay, personal communication).

However, local consumers adjust to what the market offers during the different seasons. Based solely on taste, consumers prefer the non-round types, but freshness, color and size are also taken into account by consumers. In general, the consumer looks for larger, fresher and whiter garden egg, but there is also a market for garden eggs that have aged, changed color and lost water.

There are more or less four grades of garden egg to be found in the market: unripe (white), ripe (yellow/orange), aged (dehydrated) and small sizes. Ripe garden eggs are preferred for soup while unripe garden eggs and very small ones are preferred for stew or as a sauce for yam or plantain. There is no clear evidence of price differentials. Normally, ripe garden eggs are sold at half the price of the unripe (white). The aged and small-sized garden eggs could also be sold at half the price of the ripened ones. A few traders sell both the ripe and the unripe at the same price, arguing that a difference in price could create a perception of inferiority.

Garden egg prices fluctuate significantly during the year (GIDA et al., 2004), increasing from November and reaching a peak during April–May. This is the harvesting period for farmers who were able to produce during the dry season (at least in the southern parts of the country). Farmers who have irrigation facilities and produce during the dry season obtain higher market prices. Often, however, they prefer to use irrigated lands for other cash crops, such as tomato in the north or other exotic vegetables in the rest of the country that might represent a higher

\(^4\) Dr. Blay refers to material selected for breeding, thus the use of the term cultivars.
income. Figure 3 indicates the sources of garden egg to be found in the markets of the Accra Metropolitan area, as well as the price fluctuations during the year.

Garden egg price fluctuation is not only seasonal but varies considerably in the market and across markets in one location. The reasons for this wide variation are multiple. First, there is a lack of uniformity of product (color and shape). It is very common to see mixed types in the market. This is because they come from fields where one of the two main types, round or elongated, predominates but the other one is always present. Second, there is no unique weighing standard. The common wholesale unit is the bag, which is assumed to be equivalent to 27 kg, but the bag can vary considerably in size. At retail level, the variation is even higher: garden egg can be sold in trays, buckets, or bunches of 4 or 5. Third, quality standards are not well defined. Consumers are used to buying what they find in the market. Fourth, there is a lack of market information about prices. Traders are usually better informed at the market of price fluctuations than farmers. In any case, the prices can be quite different among traders according to their supplier. Fifth, due to farmer decisions, or to unpredictable weather conditions, the supply is unstable during the season. Finally, the market is dependent on unpredictable demand by neighbouring countries. The occasional demand from neighbouring countries often results in a fall in supply of garden egg on the domestic market.

**Figure 3. Garden egg sources and price fluctuations in Greater Accra markets**
3.2 International Market

Non-traditional export crops such as vegetables are gaining importance in Ghana. Vegetable exports have shown a steady increase in the past decade (GEPC, 2003). There are 414 organized vegetable exporters in Ghana (GEPC, 2002). Data is not available on all the associations and companies involved in vegetable production and export. A wide diversity of vegetable crops are grown, including tomato, pepper, onion, okra, the African garden egg, and leafy vegetables. The major vegetable crops exported are chilies, okra, eggplant, garden egg, tomato and an assortment of Asian vegetables including tinda, bottle gourd, and bitter melon, Asian-type eggplant and long bean. Garden egg as an export crop is traded internationally on a limited scale, and only a very small share is exported to Europe, representing less than 5% of total production in Ghana. The main market is the European Union, largely the United Kingdom. Users of garden egg in these countries tend to be consumers of African origin, African restaurants and expatriates. Unfortunately, there are no available statistics on volumes traded exclusively for garden egg. Usually this crop is either recorded under the broad vegetable category or lumped together with eggplants, another Ghanaian vegetable export. Exporters refer to the garden egg and pink ravaya as ‘baby aubergines’.

3.2.1 Exporter associations and export companies

There are two main types of actors involved in garden egg export: export companies and export associations. A number of private companies are also involved in garden egg trade. The actual number is unknown, but there are probably not more than 120 (GEPC, 2003). Generally, companies are privately owned by sole proprietors who work on a diversity of vegetables. Garden egg export companies are usually small in size. From a sample of 5 companies interviewed, the total number of employees varied from 7 to 35. In addition, these companies employ casual labour as and when necessary, particularly during harvesting. Three of the companies acknowledged increases in volume, price, local consumption and foreign demand for garden eggs over the last three years. The other two indicated that they had opted out of production because they felt that other vegetables, such as eggplant, chilies and okra, offered them a competitive advantage. These companies were not sure of the market trend with respect to volume, price, local consumption and foreign demand since they had been out of the market for two and three years, respectively.

There are basically two main identifiable export associations, VEPEAG (Vegetables Producers and Exporters Association) and GAVES (Ghana Association of Vegetable Exporters). However, GAVES is not visible on the ground. VEPEAG is the larger of the two and has a total of 148 members of which 16 regularly export to the United Kingdom, France and Germany. A number of benefits are derived from being a member of an export association, among them input supply including seed, fertilizer, agrochemicals and tractor; access to training and other technical services; joint marketing of produce and sourcing credit.

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5 According to some traders this percentage can be as high as 10%, but this is probably including eggplant.
6 Small black eggplant.
Exporters are in charge of the processes from harvest or post harvest to final delivery in the foreign market. Post-harvest handling, packaging and selection of garden egg according to export quality demand are key activities (Figure 2).

### 3.2.2 Product quality and relationship with farmers

Preferred product characteristics for the export market are taste and aesthetic value. The aesthetic value is measured by the damage-free condition, uniformity in size, clearly defined shapes, glossy appearance, white color, and good preservation qualities. In order to ensure quality, exporters have adopted several strategies including a) inspection of produce before purchasing at farm gate or the market; b) buying from the farmer but harvesting produce themselves; or c) arranging an out-grower scheme with reliable growers and supplying inputs to farmers. Under the third strategy, the contract with farmers who supply the produce is verbal and based on trust. Inputs in the form of seed, fertilizer, pesticides and money for hired labour are supplied to farmers and the cost deducted at harvest. The exporter must monitor the farmer and has an option of first-buy. This is a spot market, thus the exporters do not guarantee a special price to out-growers and prices compare with what prevails on the market. Furthermore, several exporters who are members of the associations are also producers.

### 3.3 Market shares and margins, producer and consumer prices

Figure 4 presents the main market channels observed across regions and the shares at each level. It is important to recognize that this representation is a simplification of a more complex system where volumes of trade, actors, functions, sources of provision and customers vary broadly in amplitude and with time (Horna and Gruère, 2006).

Garden egg can be traded in the market where the farmer lives (village markets). The volumes traded in this market are relatively small (4%). Approximately 35% of the volume produced is traded directly by the farmer, who assumes the transportation costs and goes to the next big market (district markets) to get a higher price. This decision is determined by the volume traded and distance to the market (Fafchamps and Hill, 2004). The highest share is traded by wholesalers. These wholesalers travel around different producing areas, gathering enough volume to trade in neighbouring or other larger markets (regional markets). Approximately 40% of the total volume produced is traded by wholesalers from regional markets and 15% by wholesalers in neighboring markets. On average, 3% of the production of the farmers surveyed was destined for export. Farmers can export directly or function as out-growers for registered exporter associations like the Vegetable Producers and Exporters Association of Ghana (VEPEAG). These associations are concentrated mainly in the Greater Accra and Volta regions.

Once at the neighboring market, farmers have the option to sell to mobile wholesalers from regional markets (40%) who often offer higher prices or to wholesaler and market women from this market (60%). Wholesalers in the neighbouring markets can either sell to consumers (50%) or to retailers from their own market and other neighbouring markets (45%), and

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7 Since harvesting is done twice a week, there are instances where the exporter and farmer rotate who should harvest and this is for the exporter to recoup his investment.
eventually to wholesalers and smaller traders from regional markets. This part of the chain is similar in the regional markets where mobile wholesalers sell directly to consumers (35%) or to permanent market women and retailers (65%). Quite often, a number of market women act as intermediaries between wholesalers and retailers, thus multiplying the steps to finally reach the consumer.
Figure 4. Garden Egg Market Channels and Shares

Source: Horna and Gruère, 2006
In the Accra Metropolitan Area, more detailed information was collected with respect to prices and trading costs incurred by each actor. Market margins have been estimated for farmer-traders, wholesalers and retailers in the domestic market chain in the Greater Accra Region (Table 5). These margins have been estimated by interviewing actors, and complementing and cross-checking with additional key informants. These estimations should be taken as approximations. Market margins for garden egg are particularly difficult to obtain as the lack of produce uniformity makes price comparisons difficult. It is hard to find a unique type of garden egg across markets in one location.

The market margin estimation, however, allows us to have an idea of the margin distribution across actors. These margins are estimated with prices from the peak sales season. Trades refer to peak and low sales seasons; however, these seasons are not linked to demand performance but to supply. A peak sales season thus means greater supply of garden egg and consequently lower prices. Most important, trading costs include transportation costs to and from the market, loading and offloading, market fees, and packing or trading materials (bags, bowls) and storage costs. It should be noted that, depending on the source of garden egg, the margins are different for the traders. In general, traders tend to have higher margins than producers and or even farmer-traders. Mobile wholesalers are those profiting most from this activity.

**Table 5.** Garden egg market margins in the Greater Accra Region

<table>
<thead>
<tr>
<th>Level</th>
<th>Buys from</th>
<th>Selling Price</th>
<th>Trading costs</th>
<th>Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Original Units</td>
<td>€ / kg</td>
<td>US$ / kg</td>
</tr>
<tr>
<td>Production costs</td>
<td>-</td>
<td>913</td>
<td>0.099</td>
<td></td>
</tr>
<tr>
<td>Producer</td>
<td>-</td>
<td>€ 40,000/bag</td>
<td>1,481</td>
<td>0.169</td>
</tr>
<tr>
<td>Farmer-trader</td>
<td>Producer</td>
<td>€ 60,000/bag</td>
<td>2,593</td>
<td>0.242</td>
</tr>
<tr>
<td>W. mobile</td>
<td>Producer</td>
<td>€ 110,000/bag</td>
<td>3,704</td>
<td>0.443</td>
</tr>
<tr>
<td>W. sedentary</td>
<td>Farmer-trader</td>
<td>€ 130,000/bag</td>
<td>4,815</td>
<td>0.523</td>
</tr>
<tr>
<td>Retailer</td>
<td>W. mobile</td>
<td>€ 45,000/bowl</td>
<td>6,429*</td>
<td>0.706</td>
</tr>
<tr>
<td>Retailer</td>
<td>W. sedentary</td>
<td>€ 45,000/bowl</td>
<td>6,429*</td>
<td>0.706</td>
</tr>
</tbody>
</table>

*1 bowl of garden egg is approximately equivalent to 7 kg and 1 bag is approximately 27 kg

4. Market and biodiversity

While contributing to inter-species biodiversity, the local cultivation of garden egg also helps preserve large intra-species biodiversity. The genetic diversity of garden egg is maintained by the small-scale producers. However, there is a negative relationship between market development or market specialization and genetic diversity. This has been observed in other African countries, such as the Ivory Coast and Senegal, where there is large-scale cultivation of a few cultivars (Grubben and Denton 2004). In Ghana, as already mentioned, there is no formal seed officially released and farmers often have a mix of cultivars in their fields.

Figures 5 and 6 present some of the most common varieties observed in the market. According to garden egg breeders, the most widely-cultivated variety is ‘legon’, which is actually an advanced line bred in the University of Ghana at Legon (hence its name). However,
this line is an interspecific cross between the common eggplant (*S. melongena*) and the African garden egg (*S. aethiopicum*); and has already been mixed with local material, making it difficult to distinguish it from the rest. In addition to local diversity, some exporters buy or import improved eggplant varieties that looked very similar to garden eggs. This is not an extensive practice but adds to the diversity observed in the market.

When asked about their preferred varieties, farmers and traders used a large diversity of names - the most common being: ‘aworoworo’, ‘obolo’, ‘white beauty’, ‘antropo’\(^8\), or ‘yorgbe’. Quite often however they give more descriptive names, such as ‘long white’, ‘round white’, ‘white local’, ‘black local’, or else adopt the names of the places where it is produced more abundantly, like: ‘kwashie’, ‘kpando’, ‘techiman’ and ‘agogo’. When evaluating Ghana’s vegetable production, Gyiele (1999) identified several types: ‘aworoworo’, ‘obolo’, ‘asurowia’, ‘asusuapin’, and ‘antropo’, coinciding only partly with our findings. Not only are the varieties dispersed across sites but they are also frequently named differently. Furthermore, the varieties could even be the same but with different phenotypic expressions due to different biotic or abiotic factors (poor soils, salinity, drought conditions, etc.).

According to our informants, the ‘round white’ garden egg can also be called ‘obolo’\(^9\), ‘akutuku’, ‘tin toro’\(^10\), ‘kukruwa’, ‘techiman’\(^11\), ‘kpando’\(^12\) – depending on the area. This round type is cropped for export and some farmers call it ‘kwashie’\(^13\); according to our survey, it seems to be more widely cropped in the Greater Accra, Central and Volta regions. ‘Aworoworo’ which is more elongated and shaped like a tear drop, is more common in the Ashanti, Brong-Ahafo and Central regions. In the Volta Region, a ‘long-white’ type and ‘yorgbe’ are the most abundant. ‘Yorgbe’ is similar to ‘aworoworo’ but it is larger and has a more triangular shape. Some traders claim ‘yorgbe’ and ‘aworoworo’ essentially mean the same thing - just one is a Ga\(^14\) word (Yorgbe) and the other an Akan\(^15\) word (Aworoworo).

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\(^8\) Although Antropo belongs to the African garden egg group it is not a *S. aethiopicum* but rather a *S. macrocarphum*.

\(^9\) Obolo means big and is used to refer the big size of the garden egg.

\(^10\) Tin toro is a Volta word suggesting roundness

\(^11\) Techiman is a district in Brong-Ahafo region

\(^12\) Kpando is an important garden egg producing district in the Volta region. The round type is produced under irrigation during the dry season and the elongated type is produced under rainfed conditions during major and minor season.

\(^13\) Kwashie is a town in the Eastern Region where the round type is cultivated.

\(^14\) Ga is a language spoken in the Greater Accra region. This particular term comes from Dangme district.

\(^15\) Akan is a language where Fanti, and Chui originate from and they are spoken in Central, Brong-Ahafo, Western and Ashanti Regions.
This garden egg, with its tear-drop shape, is more common in the Ashanti, Central (Mankessim) and Volta (Kpando rainfed variety) regions. It is know by most people as Aworoworo.

Similar to ‘aworoworo’ but it is larger and has a more triangular shape (broader at the stem insertion and narrower at the other end). This type is not very common.

**Figure 5.** Garden egg diversity: Elongated
a) Fresh (local market)

Depending on the area, this ‘round’ garden egg can also called ‘akutuku’, ‘tin toro’, ‘ kukruwa’, ‘Techiman’, ‘Kwashie’, or Kpando irrigated variety’. It is also called ‘obolo’ which in the local language means ‘big’.

b) Ripe (local market)

c) Export

Figure 6. Garden egg diversity: Round

5. Market Success Factors

The economic potential of garden egg is higher than its current value, if evaluated in terms of export possibilities. The export of garden egg is constrained by a number of quality factors. Some export constraints are genetic traits, such as poor shelf life; others are management practices like the appropriate post harvest handling of the crop. These constraints require appropriate investment and training of producers and could be undertaken by the private sector if the incentives turn out to be high enough. Appropriate irrigation, transport, cooling and storage facilities also constrain the development of the export channel but these interventions require the involvement and/or participation of the public sector.

For the domestic and regional market, the chain works relatively well because supply covers demand throughout the year. On the production side, farmers producing garden egg during the dry season make very good profits from this activity. These farmers tend to have better access to other inputs like fertilizers, pesticides and credit. On the trading side, traders
have successfully organized to move the production from the rural areas to the cities and markets. Every village has market women traveling through the producing areas to obtain and deliver their produce and trade in the next bigger market. On the consumption side, consumers are satisfied with varying attributes and qualities and do not demand higher quality standards. The aesthetic value of garden egg is important but does not limit its consumption, especially when garden egg is consumed mainly in soups or stews. Even though quality suffers considerably from post-harvest handling and transport, consumers are adjusted not only to lack of uniformity in attributes but also to unstable supply and vast price fluctuations.

Unfortunately, there are no statistics available on the per capita consumption. Due to urbanization, the production of garden egg seems to be diminishing in the Greater Accra Region. According to the perception of the local people, garden egg is less popular in Accra and consumption is apparently decreasing. In spite of this observation, locals also point out that garden egg soup is still frequently consumed by the sick and the elderly, probably due to the sedative, carminative or other medicinal properties of the vegetable. Further research into the medicinal properties of garden egg might add to its potential value in the domestic and export market.

6. Challenges

To strengthen the performance of the garden egg market chain, the following challenges must be addressed:

6.1 Breeding, research and seed multiplication

Even though garden egg is highly demanded locally and has export potential, no official variety has been bred and released for commercial cultivation. The availability of formal varieties would set some quality standards, critical for export success. Local consumers could also benefit from better garden egg quality. The Vegetable Producers and Exporter Association of Ghana (VEPEAG) have developed basic standards to meet export demands. There is still a need to improve on these standards and make them uniform across exporters, if the goal is to keep export possibilities open.

Not only do the perceived quality attributes of garden egg vary widely but also agronomic characteristics, such as branching habit, time of flowering time of fruit maturity, and fruit yield vary broadly across cultivars (Blay, 1978). Local breeding efforts will further discussion between breeders, farmers and traders for preferred characteristics to be incorporated in varietal releases. At the farm level, garden egg damage due to pests and diseases affect yields and final quality of the produce. At the market level, the poor shelf life of garden egg affects the sales of local traders and exporters. These should be priorities in a breeding strategy for garden egg. The University of Ghana and CRI have contributed to the research in this vegetable but there are still very few studies on inheritance of quantitative characteristics in this crop. Heritability is important in helping the plant breeder to execute an effective breeding strategy (Danquah-Jones, 2000).
6.2 Post-harvest handling and processing

Post-harvest activities are crucial for maintaining the quality of the fruits. Garden egg fruits are very sensitive to handling and easily develop bruises through inappropriate post-harvest practices. Bruises decrease the value of the fruits and serve as entry points for pests and diseases. Garden egg is traded in sacks that vary greatly in content and that do not protect the produce from the impacts of handling and transportation. Shelf-life of garden egg is further diminished by improper post-harvest practices. Short shelf life and poor resistance to transportation and handling are usual reasons for abandoning the export of garden egg. Exporters argue that they have a very narrow window from harvest to final delivery of the plant in the foreign market. During this time, if the produce has not been properly handled its quality would be dramatically affected.

There have been some initiatives for garden egg processing and canning. According to Danquah-Jones (2000), processing for export purposes is being carried out by Food Processing International and the Nsawam Cannery Company. This is a feasible alternative for dealing with the poor shelf life of garden egg. Private initiatives could find this a positive return to investment and this, in turn, could enhance further research.

6.3 Market infrastructure

Non-availability of adequate storage facilities is a disincentive to increased agricultural production. Harvested garden egg should be pre-cooled before entering the cold chain. Unfortunately, there are no pack houses or cooling facilities available, which is critical for the export market. For the local market, prices are depressed during harvest time as a result of over-supply. Availability of improved storage facilities would enable farmers release their produce onto the market when prices are favourable.

Lack of good feeder roads and irrigation facilities are affecting vegetable production in general. Farmers growing garden eggs in the hinterland have a real challenge getting their produce to the marketing centres or other points of sale. Upgrading of feeder roads, especially in areas that serve as the nation’s food basket, will enhance marketing of produce and reduce transport costs. Additionally, irrigation would allow increased production of garden egg during the dry season. These facilities however are quite expensive and require large, initial capital investment. In addition, there is need for technical assistance for the purchasing of equipment, for those who can afford it. Payment by installment is a good option.

Access to market structures with basic facilities and sanitary conditions, including water and lighting, is also a challenge for improving garden egg marketing. Market site selection must be done in consultation with the people to ensure ownership and sustainability.

6.4 Policy environment

Even though garden egg is a vegetable of great importance in the daily diet of Ghanaians, government interest in this vegetable crop is very limited if measured in terms of policies set up in favor of the crop or research investment allocated to it. The Ghanaian government is currently focusing its attention on non-traditional export crops such as pineapple and cassava (for starch)
through the Presidential Special Initiative (PSI). While garden egg is not a priority crop for the government, some general policies could be put in place to favor the crop - in particular, to provide incentives for private participation. Private companies involved in the production and export of garden egg face risks that could be reduced with appropriate irrigation, transport and storage infrastructure.

The Ghanaian government recognizes the need for major investment in infrastructure to promote agricultural development such as irrigation facilities, a good network of trunk and feeder roads, storage, processing facilities and markets (Ministry of Food and Agriculture, 2002). The government has addressed the issue of access to irrigation for vegetable production but mainly for tomatoes and mostly in the Northern part of the country. Irrigation facilities could stabilize the garden egg supply, avoid the considerable price fluctuation and provide a steady surplus for garden egg export and/or processing during the year.

7. **Summary and conclusions**

In this paper, we have analyzed the marketing chain for the African garden egg in Ghana. We have compiled primary and secondary information and conducted structured and semi-structured interviews with key informants and chain actors in the major production areas and markets. Unlike many other underutilized species, garden egg is supported by some general scientific knowledge on its nutritional content, and some of its medicinal properties. This knowledge appears to be relatively recent and is likely not to have been shared with Ghanaian users. Generally, such information is either incomplete or inconclusive. At the same time, efforts to improve garden egg through plant breeding have been very limited in Ghana. Furthermore, garden egg germplasm in the country shows a considerable amount of diversity but little research has been done to evaluate factors that determine and affect this diversity. The public value of the crop has not encouraged a larger allocation of research resources and there is no strategy in place to conserve the diversity of garden egg.

Our findings suggest that some targeted marketing development strategies might be followed to better exploit the economic potential of the crop and at the same time maintain its contribution to Ghana’s local crop biodiversity. We found, first of all, that the poor shelf life of the fruit affects export possibilities as well as local market potential. Market women complain that they have to throw away large portions of their stocks when they are unable to sell within a week. Secondly, we noted that the market would benefit generally from improved post-harvest handling. This vegetable is sensitive to poor practices at harvest and after harvest that decrease its shelf life even more. And finally, lack of quality standards for the local and external market creates a problem for price transmission and limits export opportunities. The private sector has shown some interest in garden egg but it will find a broader range of possibilities once these constraints are addressed.

Each of these identified constraints can, in turn, trigger a specific policy response that would benefit the market chain actors. Quality improvement of garden egg would benefit both the local and the export market. A quality standard could be developed and disseminated among producer groups. Crop improvement and selection efforts should focus on shelf life while also maintaining the attributes preferred by consumers. Post-harvest handling issues would require a concerted effort on the part of market chain actors and an improvement in storage and
transportation conditions. At the same time, as a crop of African origin, garden egg shows a high level of diversity in Ghana. The development or introduction of garden egg varieties should be carried out in such a way that the crop’s local genetic diversity is not adversely affected. Any public or private intervention in this direction would likely result in multiple effects on rural incomes and on future crop biodiversity.

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