

**SOCIOECONOMIC SURVEY OF TRADITIONAL COMMERCIAL
PRODUCTION OF COCOYAM AND COCOYAM LEAF****Quaye W^{1*}, Adofo K², Agyeman KO³ and F Nimoh³****Wilhemina Quaye**

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ABSTRACT

Cocoyam, *Xanthosoma sagittifolium*, is cultivated for human nutrition, animal feed, and cash income for both farmers and traders. As food for humans, its nutritional value includes carbohydrate, minerals and vitamins. Despite its socioeconomic importance, cocoyam production in Ghana is beset with challenges such as lack of improved varieties for commercial production and post-harvest losses of cocoyam leaves. To address these challenges, a socioeconomic baseline survey was conducted to provide benchmark information on commercial cocoyam and cocoyam leaf production for further research under the Root and Tuber Improvement and Marketing Programme (RTIMP). A total of 110 randomly selected cocoyam farmers were interviewed in Fanteakwa District of the Eastern region of Ghana. Survey findings showed that cocoyam production levels were very low with an average acreage of 0.8 hectares per farmer and yield of 6.2mt per hectare as compared to achievable yields of 8.0mt per hectare. Majority (92%) of the farmers interviewed cultivated cocoyam for both cormels and leaves. However, harvesting of cocoyam leaves was only undertaken when cormels were matured. Cocoyam production in the Fanteakwa District was profitable. For a hectare of cocoyam farm, total cost of production, total revenue and net revenue were \$669, \$1426 and \$757 respectively. Some of the problems besetting the cocoyam industry enumerated by the farmers interviewed include high cost of planting material, lack of knowledge on improved varieties and limited access to credit. Availability of harvestable cocoyam leaves was seasonal. In order to stimulate supply response to high market demand in the dry season, intensive mono cropping management practices under irrigation is recommended. Development of a comprehensive cocoyam/cocoyam leaf production and marketing strategy in Ghana and dissemination of existing improved cocoyam varieties through effective extension activities is also recommended. Farmers interviewed suggested that varietal improvement research should focus on superior qualities such as early maturing, high yielding and resistance to disease and pest.

Key words: cocoyam, production, profitability, constraints, Ghana

LIST OF ABBREVIATIONS

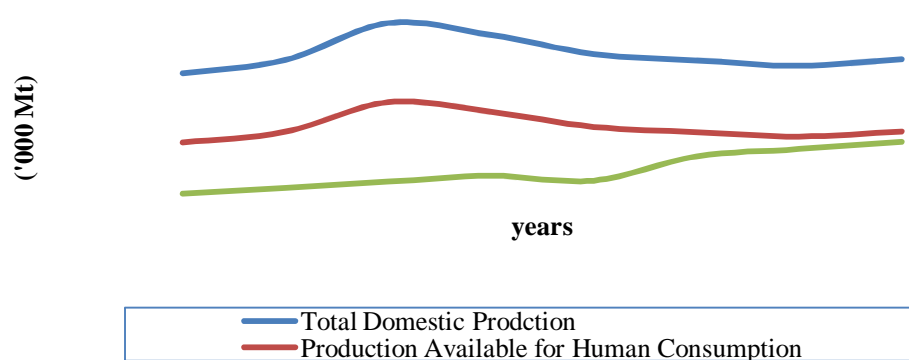
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| MOFA | Ministry of Food and Agriculture |
| MT | Metric Tonnes |
| RTIMP | Root and Tuber Improvement and Marketing Programme |
| SRID | Statistics, Research and Information Directorate |

INTRODUCTION

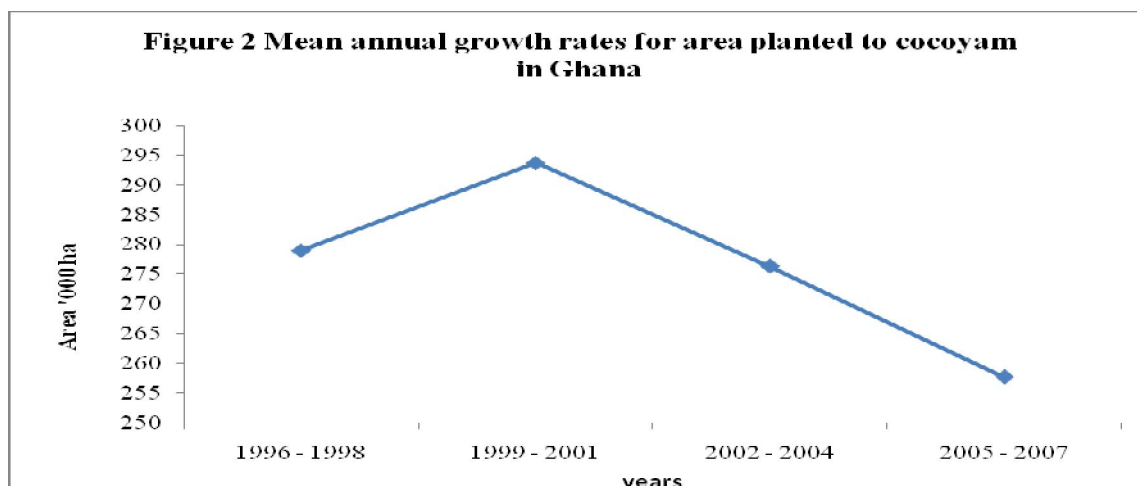
Cocoyam, *Xanthosoma sagittifolium*, is cultivated in tropical regions for human nutrition, animal feed, and cash income for both farmers and traders [1, 2, 3]. Cocoyam is vegetatively propagated using the corms and to a lesser extent the cormels. As food for human consumption, the nutritional value of the various parts of cocoyam is primarily caloric [4]. The underground cormels provide easily digested starch; and the leaves are nutritious spinach-like vegetable, which give a lot of minerals, vitamins and thiamine [5, 6, 7]. In Ghana cocoyam is generally grown by small-scale farmers and cocoyam farms under intensive management are highly limited. Since cocoyam tolerates shade, the crop is frequently grown in intercropping systems together with permanent crops such as banana, coffee, coconut, rubber, oil palm and cocoa [8, 9]. Cocoyam leaf is produced on subsistence basis and pickers who are not farmers dominate its harvesting and marketing [10]. In most countries of West Africa root and tuber crops play a major role in national food security and contribute significantly to the economy [11]. Cassava, yam, cocoyam and plantain constitute over 50% of the Agricultural Gross Domestic Product in Ghana [12]. In 2007, the Ministry of Food and Agriculture in Ghana estimated total domestic cocoyam production of 1,690,000mt with production available for human consumption and per capita consumption of 1,352,000mt and 57.1kg/annum respectively. Although cocoyam production started increasing in 2006 as shown in figure 1, the annual growth rate for area planted has been decreasing as shown in figure 2. The average area of cocoyam cultivated in 2002 to 2004 is compared with 2005 to 2007 average while 1996 to 1998 is compared with 1999 to 2001 average.



Figure 1 Trends in domestic production and consumption of cocoyam in Ghana



Data Source : SRID/MOFA 2008



Source of Data: SRID/MOFA 2008

Despite the usefulness of cocoyam and cocoyam leaves, the cocoyam industry in Ghana is beset with challenges. Some of these challenges are the alarming rate of forest degradation in Ghana (as the bulk of cocoyam grows in forest areas) and lack of improved varieties for commercial cocoyam and cocoyam leaf production. Decreasing rainfall and poor soils have also been identified as some of the causes besetting the cocoyam industry in Ghana [13]. This survey was one of the activities under the Root and Tuber Improvement and Marketing Programme (RTIMP) in Ghana aimed at enhancing food security and rural livelihoods.

Survey Objectives

The main objective of this survey was to provide a thorough description of commercial cocoyam/cocoyam leaf production in the Fanteakwa District of Eastern region of Ghana. Specific objectives were as follows:

- i. To identify the socio-economic characteristics of cocoyam/cocoyam leaf producers;
- ii. To investigate the agronomic practices and scale of production;
- iii. To assess profitability of cocoyam production; and
- iv. To investigate production constraints

METHODOLOGY

Survey Areas

Fanteakwa District (figure 3) is located exactly in the middle of the Eastern Region of Ghana. The total land area of the district is 1,150 sq kilometers and cultivable area of 76,133ha. Fanteakwa District occupies 7.68% of the total land area within the Eastern Region (18310 sq.km) and constitutes 0.48% of the total land area in Ghana. The district lies within the wet-semi equatorial region with mean annual rainfall between 150.0mm and 2000mm. It has a total of 291.42 sq.km forest reserves which is a potential source for timber, game and wildlife. The major underlying rock is the Birrimian formation and is economically the most important geological formation in Ghana containing most of the valuable exportable minerals such as gold, bauxite, diamonds (<http://www.ghana.com> accessed on 2nd December 2009).



Figure 3 Map of Ghana showing Fanteakwa District

Agriculture is the predominant economic activity and it employs over 81.8% of the economically active labour force in the Fanteakwa District. Crops produced are maize, cassava, plantain, cocoyam, yam and vegetables. Average farm size is about 1 hectare. Cocoyam production in 2006 was 9430 ha and total production of 76,383Mt [14]. Major areas of cocoyam production in the district include Apaah, Feyiase, Ehiamankyne and Begoro.

Selection and Sampling

Fanteakwa District was selected in the Eastern Region of Ghana based on its environmental suitability for cocoyam production and consumption trends. In order to ensure a reasonable representation of cocoyam farming population in the entire district, a two-stage stratified random sampling technique was used. A random sampling technique was used to select the required number of communities/villages from the sampling frame provided by the Statistics, Research and Information Directorate of the Ministry of Food and Agriculture. From this list, a simple random sample technique without replacement was applied to select a total of 110 cocoyam/cocoyam leaf producers for interviews.

Data collection and Analysis

Both qualitative and quantitative data on socio-economic characteristics, agronomic practices, cost and income as well as constraints involved in cocoyam production were collected. The survey was essentially participatory using key informant interviews, focus group discussions and one-on-one structured interviews as well as participant observation. Key informants interviewed include District Coordinating Directors, District Planning Officers and the District Directors of Agriculture as well

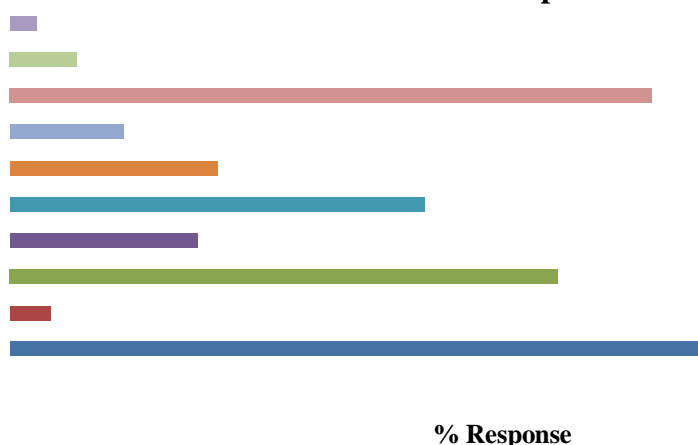
as Community Leaders. Focus group meetings were held with selected relevant groups such as producers, traders and consumers of cocoyam/cocoyam leaf [15]. The discussions were useful for triangulation and consensus building on key issues raised in the objectives. Data on socio-economic characteristics, varietal differences, scale of production, and costing were analyzed with SPSS version 16. Both descriptive and inferential methods of analysis of data were employed. The descriptive tools included frequency tables, cross tables, percentages and descriptive summaries of the quantitative variables.

RESULTS

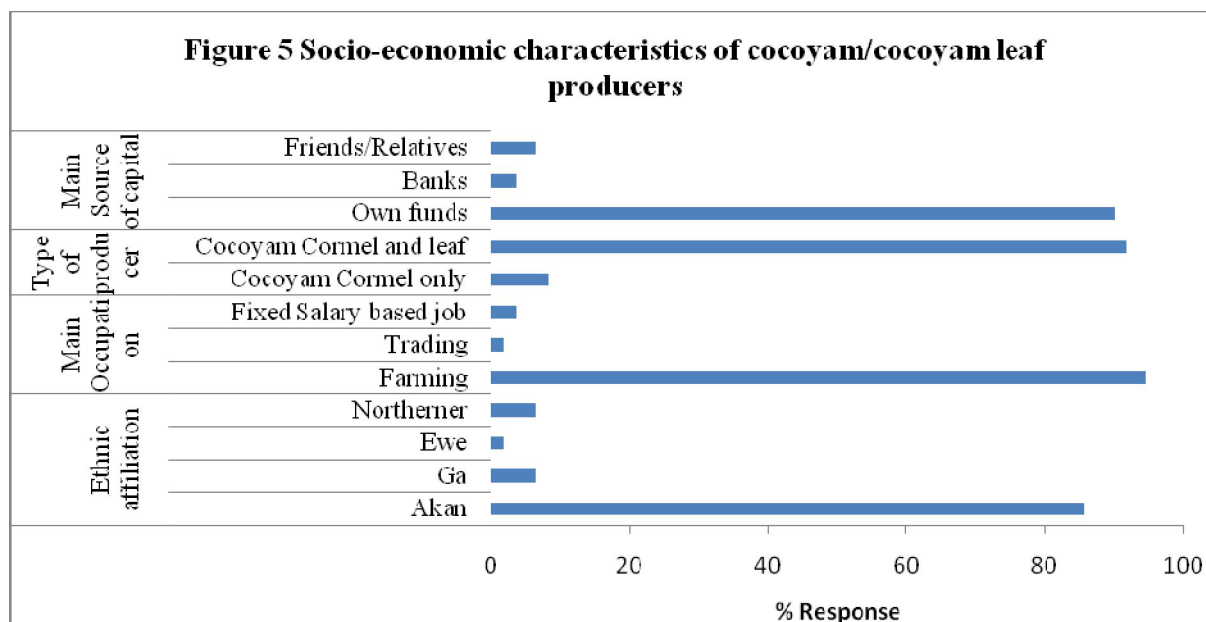
Characteristics of Farmers and Scale of Production

Majority (74%) of the farmers interviewed were males and heads of their households (94%). An opposite observation was found in Nigeria where cocoyam was mostly grown by women [16]. This suggests that the subsistent farmer in Ghana may be dependent upon cocoyam while this product could be additional source of food and income in Nigeria. Approximately 87% of sample interviewed were married, 9% singled and 4% widowed. In terms of educational background of respondents, approximately 56% had had no Formal Education, 28% Primary/JSS/Middle and 16% had Secondary School education. Figures 4 and 5 provide information on the socioeconomic characteristics of farmers interviewed in the Fantekwa district.

Figure 4 Socio-economic characteristics of cocoyam and cocoyam leaf producers



Data Source: Authors' compilation 2008



Data Source: Authors' compilation 2008

Mean age of respondents was 43 years with an average family size of 6. Farming was the main income generating activity for approximately 95% of the respondents. Ninety percent (90%) of the respondents used their own capital to finance farming activities, 4% sourced funding from banks while 6% obtained financial assistance from relatives/friends. Majority (92%) of the farmers interviewed cultivate cocoyam for both the cormel and leaf. Only eight percent (8%) cultivated cocoyam purposely for cormels only. Scale of production was small. Average acreage cultivated per farmer for both cormel and leaf was 2 acres; a maximum of 4 acres was recorded. The average yield per acre of cocoyam farm was 2566kg which is approximately 6.2mt/ha. This compared favourably with national average yield of 6.4mt/ha. Cocoyam was cultivated once in 18 months in the surveyed district.

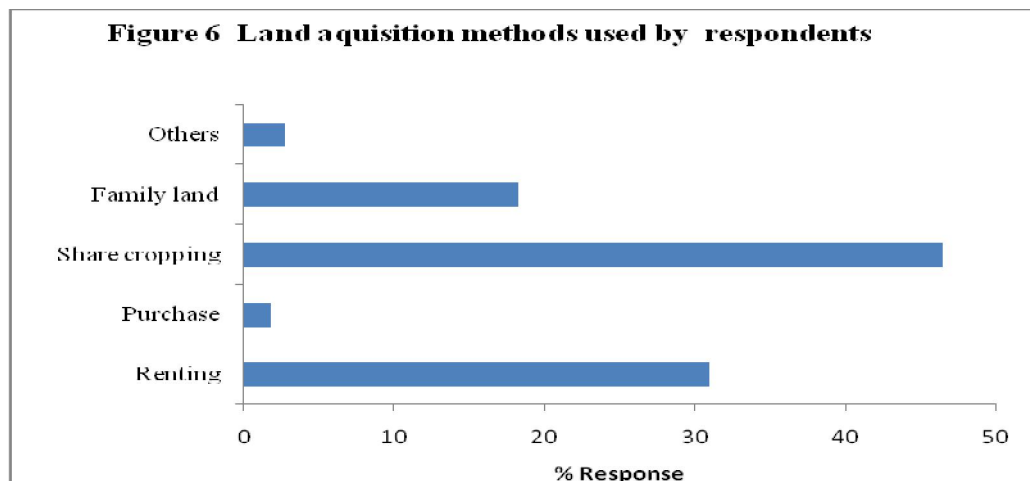
Cultural Practices

Farming system observed in the Fanteakwa District was bush fallow alongside slash and burn. Mixed and inter cropping systems were mainly practiced. Since cocoyam tolerates shade, the crop was grown in intercropping systems with permanent crops such as plantain, oil palm and cocoa. There was no mono-cropping or cocoyam farms under intensive crop management practices. Cocoyam was grown under forest management systems in some of the communities in Fanteakwa District. In such situations, farmers had to practice shifting cultivation when trees were grown or when the canopy closes after 3 years.

Land Acquisition and related problems

Close to 50% of farmers interviewed practiced share cropping where farmers used land belonging to others but had to share outputs of crops cultivated with land owners. About 31% of farm lands were rented while 18% of farmers interviewed used family

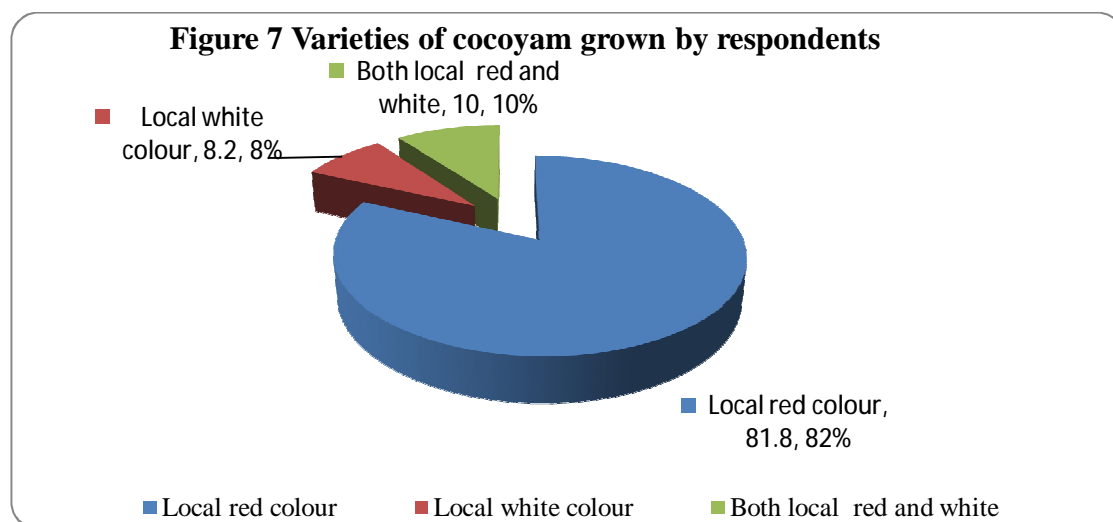
lands for farming. High rent charges on land was the main problem associated with land acquisition in the Fanteakwa District. Other problems were non-availability of land and difficulty in obtaining land. Figure 6 shows the land acquisition methods used by cocoyam farmers interviewed.



Data Source: Authors' compilation 2008

Varieties grown and sources of planting materials

Generally local varieties of cocoyam were grown in the Fanteakwa District. There were two main local varieties; red and white varieties as shown in figure 7. Over 80 percent of sample interviewed cultivated local red variety due to its high market preference. Cocoyam leaves could be dark green or light green but usually difficult to differentiate the leaf colour by variety. However, some farmers indicated that the leaves of the local white variety dehydrate faster, itchy and not very good for consumption.



Data Source: Authors' compilation 2008

Farmers interviewed either used their own planting materials (60%) or obtained planting materials from relatives (40%). None of the farmers obtained planting materials from the Ministry of Food and Agriculture and Research Institutions. Farmers however suggested that any varietal improvement programme should focus on superior qualities such as early maturing, high yielding and resistance to disease/pest. Others are good pounding ability and high shelf life.

Planting methods and Labour use

About 65% of farmers interviewed planted anyhow while 35% planted in rows. The use of fertilizer and agrochemicals among farmers interviewed was limited. Close to 60% of farmers interviewed had no idea of any improved pest/disease control measures for cocoyam. However, there were agro-chemical shops in 40% of the farming communities visited. Land clearing was mostly done with hired labour. Planting, weeding and harvesting were done with both family and hired labour.

Harvesting of Cocoyam Leaf and post harvest handling

Harvesting

Generally cocoyam was cultivated purposely for cormels. Harvesting of leaves therefore, started when cormels were matured after a year. Harvesting was usually scattered so as to get fresh leaves weekly. Most farmers indicated that harvesting was not encouraged during rainy season because of low price. It was also mentioned that some people (who were not farmers) just picked from the forest (wild) and fallow farms. Harvesting of cocoyam in the surveyed district was done either by hand without a knife or by hand with a knife or both. Harvesting was predominantly a female activity. Desirable qualities of harvestable cocoyam leaf include tenderness, freshness, shape, disease free and greenish colour of leaf as well as the maturity of cormels. The key limiting factors to the availability of cocoyam leaf were dry season and inadequate rainfall as reported by 47% and 26% of farmers interviewed respectively. Limited supply usually occurred during the dry season while low patronage was commonly experienced in the rainy season.

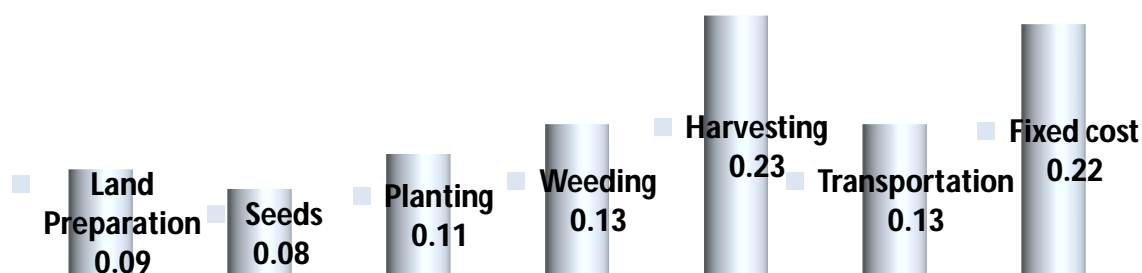
Post harvest handling, preservation and packaging

Generally farmers just select the marketable leaves based on the desirable qualities (such as tender, fresh and disease free leaves) and tie in bundles. There was virtually no processing of cocoyam leaves at the farmer level before marketing except for sorting and cleaning. After selection and tie of cocoyam leaves in bundles farmers either packaged in baskets or jute sacks. Only 5% of farmers interviewed packaged cocoyam leaves in polythene bags. Majority (93%) of farmers sold their cocoyam leaves immediately after harvesting. Majority (76%) of the farmers interviewed sold at the main market in the district. Preservation of cocoyam leaves at the farmer level was done by either keeping in an airy place (30%) or leaving in the open overnight (70%). Cocoyam leaves stayed fresh within 3 days after harvesting at the farmer level. Beyond this period farmers were discouraged to sell. Excessive heat was the main factor causing deterioration of cocoyam leaves at the farmer level.

Costing of cocoyam Production

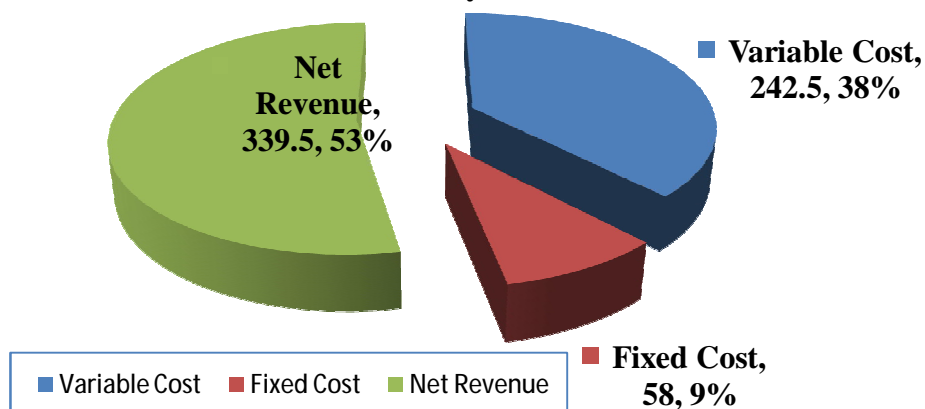
Variable cost, fixed cost and net revenue per acre of cocoyam production are presented in tables 1-3. Cocoyam production (in 2008 production season) was profitable. For a hectare of cocoyam farm, total cost of production, total revenue and net revenue were \$669, \$1426 and of \$757 respectively. Labour cost constituted about 80% of the total variable cost while the rest went into planting materials and transportation. Percentage breakdown of cost structure for cocoyam production in the surveyed area is shown in figure 8. Fixed cost, variable cost and net revenue constituted 9%, 38% and 53% of total revenue generated from a hectare of cocoyam farm in the surveyed area respectively (Figure 9)

Figure 8 Percentage breakdown of cost structure for cocoyam production



Data Source: Authors' compilation 2008

Figure 9 Percentage breakdown of total revenue from hectare of cocoyam farm



Data Source: Authors' compilation 2008

DISCUSSIONS

Majority of cocoyam/cocoyam leaf farmers were not aware of any improved cocoyam varieties although from the literature some germplasm collections have been done for cleaning and further work on varietal improvement in Ghana [17]. Cocoyam farmers interviewed used local varieties and planting materials from their own farms. Thus survey findings support the observation that share of total seed supply by the formal sector in West Africa rarely exceeds 10% [18]; all other seeds and planting materials are produced by the farmers themselves. Often, seeds and planting materials are just saved from the current harvest for the next planting season and informal diffusion takes place among farmers within the communities. Although average yield of 6.2mt/ha recorded in the surveyed area compares favourably with national average yield of 6.4mt/ha there is more room for varietal improvement. Achievable yields of 8.0mt/ha of cocoyam have been reported [14] in cases where more effective extension and recommended technologies have been used. It has been reported that leaf harvesting results in significant reduction in cormel yield [19]. Reductions of 31.4% and 58.6% for alternate and complete defoliation respectively have been reported. From survey findings fertilizer was rarely applied on cocoyam farms. However research has shown that plastic mulched plots provide a better soil environment for cocoyam than unmulched plots and that tilled mulched plots especially tilled black plastic mulched plots provide superior edaphic environment for cocoyam [20]. This suggests that the use of organic fertilizer could increase cocoyam yields. Research has also shown that type of cropping system practiced affect yields. For example, cocoyam yields were reduced by 70 to 75 per cent when mixed with maize [21].

Cost analysis of cocoyam production in the surveyed areas showed that labour cost for land preparation, planting, weeding and harvesting constituted about 80% of the total variable cost. Other research findings revealed that farmers generally make

significant savings on labour cost by using free family labour which is a common feature in small scale farming in Sub-Sahara Africa [22]. This could also explain why most farm households have large family sizes; providing safety nets in situations of enduring poverty and inability to pay high labour cost [22, 23]. Current results also compare favourably with agricultural labour costs estimated for smallholder cocoyam farming in Southern Nigeria [24], which was between 70 and 90% of the total costs. Labour cost has been a critical constraint to manual agricultural production systems [25]. Other constraints faced by cocoyam/cocoyam leaf farmers interviewed include problems with land acquisition, high cost of transportation, lack of knowledge on improved varieties, soil born diseases and limited access to credit. Similar results have been observed in Kenya, Uganda and Tanzania [26, 27, 28].

Policy Implications

The socio-economic baseline information on traditional commercial production of cocoyam and cocoyam leaf production described above have some policy direction challenges especially for rural economies. The issue is whether to keep farming practices at the small scale level with equally low level of improved technology usage which turn out to be more expensive or opt for large scale farming practices as done in developed countries. Small -scale farming cannot be ignored since it provides sources of livelihoods for the poor majority who have limited off-farm income generating options. However, the survey results have policy implications for sustainable small-scale cocoyam farming in rural economies. Small-scale farmers need to be well organized into groups for efficient access to production credits and markets. Policy directions should be focused on conscious reorientation and mobilization of cocoyam farmers into well organized groups. This will also facilitate effective dissemination of improved technologies in order to optimize the economic and utilization potential of cocoyam [29]. Currently, small-scale farmers are generating modest profits on cocoyam cultivation. To increase profit levels from cocoyam cultivation, promotion of labour efficient farming technologies is recommended. Use of labour efficient farming practices will significantly reduce production cost and increase profits from cocoyam farming. High cost of transportation of raw agricultural produce and cocoyam in particular from the farm gate to consumption centers could also be significantly reduced through post harvest processing and value addition at the farm gate. Problems identified with land acquisition in the surveyed district imply that farm expansion cannot be a solution to increase production in that area but rather improvement in yields through improved varieties and efficient use of fertilizer. Crop improvement research needs to use agro-ecological approaches that develop new varieties to fit into local niches, placing a premium on farmer, trader and consumer participation in varietal breeding [30].

CONCLUSIONS

Cocoyam production in the Fanteakwa District of Eastern Region of Ghana was profitable. For a hectare of cocoyam farm, total cost of production, total revenue and net revenue were \$669, \$1426 and of \$757 respectively. From the survey findings majority (92%) of the farmers interviewed cultivated cocoyam for both the cormel

and leaf. Only eight percent (8%) cultivated cocoyam purposely for cormels only. Production levels of cocoyam were very low. Average acreage cultivated per farmer (for both cormel and leaf) was 0.8 hectares. The average yield per acre was 2566kg or 6.2mt/hectare. Generally local varieties of cocoyam were grown; Local red and local white varieties. Problems besetting the cocoyam/cocoyam leaf industry include difficulty in land acquisition, high cost of planting, lack of knowledge on improved varieties and limited access to credit as well as soil born disease.

Development of a comprehensive cocoyam/cocoyam leaf production and marketing strategy in Ghana and dissemination of existing improved cocoyam/cocoyam leaf varieties through effective extension activities is recommended. Further research on varietal improvement should focus on superior qualities of cocoyam such as early maturing, high yielding, and resistance to disease/pest. Irrigation facilities should also be provided for intensive crop management practices and commercial cocoyam production in the dry season when demand is extremely high. Further research into semi-processing and preservation techniques is needed to enhance commercial production and marketing of cocoyam leaf in the dry season.

ACKNOWLEDGEMENT

Funding for this work was provided by The Root and Tuber Improvement and Marketing Programme (RTIMP), Ministry of Food and Agriculture in Ghana

Table 1: Variable Cost per acre of cocoyam production

| VARIABLE COST PER ACRE OF COCOYAM | | | |
|--|-----------------------|-------------------------------|---------------------|
| Item | No of Man days | Cost per Man day (GHC) | Amount (GHC) |
| Land preparation | 7 | 3.5 | 24.5 |
| Seed/Suckers | - | - | 20 |
| Planting | 8 | 3.5 | 28 |
| Weeding (3x) | 10 | 3.5 | 35 |
| Fertilizer/Agrochemicals | - | - | - |
| Fertilizer Application | - | - | - |
| Harvesting | 15 | 4 | 60 |
| Haulage/Transportation | 10 | 3.5 | 35 |
| Total | 50 | - | 242.5 |

Exchange rate \$1: GH¢1.1 as of August 2008

Table 2: Fixed Cost per acre of cocoyam production

| <i>FIXED COSTS</i> | Quantity | Unit Cost(GH¢) | AMOUNT (GH¢) | Useful Life(years) | Amount per year(GH¢) |
|-------------------------|----------|----------------|--------------|--------------------|----------------------|
| i. Land | - | - | - | - | 30 |
| ii. Cutlass | 2 | 4 | 8 | 1 | 8 |
| iii. Hoes | 2 | 4 | 8 | 1 | 8 |
| iv. Baskets | 3 | 3 | 9 | 1 | 9 |
| v. Other materials | - | - | - | - | 3 |
| Total Fixed Cost | | | | | 58 |

Exchange rate \$1: GH¢1.1 as of August 2008

Table 3: Net Revenue per acre/hectare of cocoyam production

| Item | Cocoyam Cormels (Per Acre) | Cocoyam Cormels (Per Hectare) |
|----------------------|-------------------------------|----------------------------------|
| Yield per acre (kg) | 2566 | 6287 |
| Yield per acre (Mt) | 2.57 | 6 |
| Selling price per Mt | 249 | 610 |
| Total revenue (GH¢) | 640 | 1568 |
| Total Cost (GH¢) | 300.5 | 736 |
| Net Revenue (GH¢) | 339.5 | 832 |
| Total revenue (\$) | 582 | 1426 |
| Total Cost (\$) | 273 | 669 |
| Net Revenue (\$) | 309 | 757 |

Exchange rate \$1: GH¢1.1 as of August 2008

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