



Profitability Gap Analysis of Sweetpotato Production in Ghana: Evidence from Sweetpotato Farmers and Traders

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Authors' contributions

This work was carried out in collaboration between all authors. Authors NEA and KA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors BNF and PPA managed the analyses of the study. Authors RS, JOA and AAA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To assess the profitability gap between farmers and traders in sweetpotato production.
Study Design: Purposive Sampling of Sweetpotato producers and traders.
Place and Duration of Study: Four major sweetpotato growing regions (Volta, Upper East, Central and Eastern) in Ghana for the 2012/2013 planting season.
Methodology: One district was purposively selected from each region (Akatsi, Bawku, Twifo, Kwahu East) based on output levels. 3 communities were randomly selected from a pool of sweetpotato growing districts in each of the districts. 10 farmers were purposively selected from each of the 3 communities hence for every region 30 farmers were selected. For the traders, 5 traders were selected from each community hence 15 traders were selected from every region. In sum, 120 farmers and 60 traders were sampled across the study areas. Gross Margin Analysis was

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employed in the determination of profitability and formed the bases for the profitability gap discussion.

Results: With a total production cost per hectare of 2,452 Ghana cedis (\$580.36), labour accounted for about 39% of the operational cost for farmer's and farmer's net returns on investment stood at 1,647 Ghana cedis (\$389.82). The trader's total cost was 4,429 Ghana cedis (\$1,048.29) and with a net return of 4,841 Ghana cedis (\$1145.80). Farmers had a "net return per cedi" of 1.67 Ghana cedis (\$0.40) whereas the trader had 2.09 Ghana cedis (\$0.49).

Conclusion: Sweetpotato production and trade is profitable. A significant gap exist between traders profit and that of the farmers in favour of the traders. It is recommended farmers form cooperatives and be functional on Innovation Platforms to have bargaining power for better prices and access to inputs at affordable cost; be trained on standardizing produce and processing to add value; extension information access should be modernized using modern telecommunication tools and tailored to the local and unique needs of the smallholder farmer.

Keywords: Sweetpotato; smallholder farmers; profitability gap; gross margin; net income.

1. INTRODUCTION

Sweetpotato (*Ipomoea batatas*) is increasingly becoming a vital crop in the Ghanaian economy for addressing food security issues and a source of income for various actors in the commodity value chain. In Sub Saharan Africa, sweetpotato plays a vital role in the improvement of food security, health and livelihoods of poor smallholder families. It is the third most important root and tuber crop after cassava and yam. It is estimated to be cultivated on about 13.37 million hectares of land in sub Saharan Africa (FAOSTAT, 2012) and Ghana accounts for 9,633ha (MOFA, 2014). According to Food and Agriculture Organisation, Ghana recorded sweetpotato production of 135,000 tons in 2013 and this was the highest output recorded in the last fifteen years.

Even though sweetpotato is easy to cultivate, it does not prove to be cost-effective in the African context. Labour costs are high, yields remain poor, while post-harvest losses and low purchase prices penalize production and deter investment. In Africa, sweetpotato cultivation is primarily destined for family auto consumption. (UNCTAD, 2012).

An investigation conducted by a team of researchers in Luoyang, Henan Province, in May 2004 involving 104 farmers and some grain traders in the city's main grain-producing areas showed a gap between the production cost and the final market price; which was 0.811 yuan (10 US cents) per kilogram for wheat and 0.612 yuan (8 US cents) for corn. The farmer's share was 14.9 per cent of the profit for wheat, and 31.4 percent from each kilogram of corn however that of the grain trader was 85.1 percent (wheat) and

68.6 percent (corn). They realized that the cause of the gap was pertinent to farmers selling soon after harvest due to non-availability of storage facilities and the need to pay creditors. They had no grains to sell when grain prices went up. Traders sold off their products when grain prices were high hence enjoyed huge profits for their produce [1]. Further, Kagolo [2], quoted a farmer saying "Unlike traders who make instant profits, we farmers work on probabilities. Even if you work hard, it's the traders who decide which prices to give us. Apart from saving my family from starvation, I can hardly show a major achievement from farming." An indication that traders tend to gain more profit than farmers who invest so much in the production of the crop and the need to close the profitability gap cannot be overemphasized.

The West African Agricultural Productivity Programme, a World bank sponsored programme in Ghana focused on improving root and tuber crops. Sweetpotato was a key concern of this programme. In order that maximum benefits are attained in the sweetpotato operations of the sweetpotato value chain, a profitability study of producers of the commodity and traders was undertaken.

Agriculture has always been described as a challenging and risky venture especially in sub Saharan Africa where majority of farm activities is dependent on rainfall. In view of this, profitability is an issue that is of great importance to farmers in ensuring welfare and competitiveness. In varied studies at analyzing profitability of agricultural ventures, a number of studies have been conducted. Mishra et al. [3], postulates that profitability of limited resource farms were depended on farmer's age, soil

output, debt asset relation, and variable and fixed costs of production. Dividing cash operating expense to value of farm production, Plumley and Hornbaker [4] calculated Illinois grain farm profitability. In this case Net Farm Income was assumed as proxy of farm profitability and the effect of different farm sizes in three different time periods. Jirgi, Ogundeji [5] investigating the profitability and resources-use efficiency of millet/cowpea mixed farmers production in Niger state Nigeria using farm budgeting technique and exponential production function indicated more profit meant the use of more inputs (seed, family labour, agrochemicals) and less hired labour and land.

This study therefore looks at the profitability of producers and traders in the sweetpotato business. It also focuses on the persistent problem of profitability gap between the producers and traders which literature has been quite silent on in the West African Sub Region.

2. METHODOLOGY

Data was obtained through a formal survey conducted from March to June 2014 across four sweetpotato growing regions in Ghana. The four regions selected were based on total metric tonnes produced in the year 2012 as outlined by the Statistical, Research and Information Division of Ministry of Food and Agriculture (MOFA) Report in 2012 on sweetpotato production in Ghana. Upper East (46,000 mt), Eastern Region (34,910 mt), Volta (15,340 mt) and Central (6,490 mt) were selected. The sum of the output of the regions selected represents 77.83% (102,740 mt) of the total output level (131,990 mt) in 2012 hence the sample size is a significant representation of sweetpotato production in Ghana.

The sampled regions aside Upper East Region which is located at the northern part of Ghana and in the Guinea Savanna agro-ecology, are located at the southern part of Ghana and predominantly in the semi deciduous rainforest agro-ecology. Four main soil types are identified in the study areas namely; loamy soil with poor organic matter (Upper East); clayey loam (Central); heavy clayey, sandy loam (Volta) and forest ochrosol and lithosol (Eastern Region). With the required amount of rainfall, these soil types are suitable for the cultivation of sweetpotato. Annual rainfall patterns were bimodal except for Upper East Region which is unimodal. Annual rainfall ranges were 645-1250

mm (Upper East), 800 mm-1500 mm (Central), 514 mm-1099 mm (Volta) and 900 mm-2000 mm (Eastern) (www.mofa.org). Considering the climatic conditions, soil type and in general the location of these areas, they are naturally better placed as locations suitable for the cultivation of sweetpotato.

In each of the 4 regions, one district was selected purposively based on the output levels. Further 3 communities were randomly selected from a pool of sweetpotato growing districts in each of the regions. 10 farmers were purposively selected from each of the 3 communities hence for every region 30 farmers were selected. For the traders, 5 traders were selected from each community hence 15 traders were selected from every region. In sum, 120 farmers and 60 traders were sampled across the study areas.

For Producers, productivity is at mean levels per district with the main indicators being output per hectare and cost of production per hectare. It is worth noting that family labour was also accounted for in the cost of production as the opportunity cost of their labour. However practically, sweetpotato traders do not purchase commodities based on hectares grown but in bags as the unit of measure. Profit calculation is therefore extended to cost per 50kg bag harvested and sold in the case of the farmer and 50kg bag bought and re-sold in the case of the trader. Horticulture Australia in 2011 stated that, agriculture remains a risky business hence Gross Margin helps in the decision of what crops to grow and how to allocate resources for profit maximization in the face of the uncertainty and risk. Zulu [6] analyzed the profitability of cowpea farmers in Zambia. He used Gross Margin as the measure of farm profitability (dependent variable) and concluded that yields, land tenure and farm gate price had a positive influence on profitability whereas production costs and area had a negative influence on profitability.

In applying a modified and adapted approach which is based on the methodology employed by Zulu [6], Onyia et al. [7] and Olujenyo [8], "profitability" in this regard is represented as follows;

Gross margin relates Gross Revenue (GR) and the total variable cost of production.

Gross Margin is detailed as:

$$\text{Gross margin (GM)} = \sum (Q_{yi}P_{yi}) - \sum (X_{xi}P_{xi})$$

Where,

GM = Gross margin (cedis/ha)
Qyi = Output of sweetpotato by ith farmer (kg)
Pyi = Unit price of sweetpotato by ith farmer (cedis)
Xxi = Input used by ith farmer (kg/ha)
Pxi = Unit price of input used by ith farmer (cedis)
 Σ = summation sign

Net Farm Income (NFY) = Gross Margin (GM) – Total Fixed cost (TFC)

Comparing the profits for Farmers and Traders leads to establishing the existence and extent of the profitability gap. Exchange rate for cedi to US dollar conversions was \$1 trading for 4.22 Ghana cedis as at May, 2017 (www.xe.com).

3. RESULTS AND DISCUSSION

3.1 Socio Demographic Status

The respondents sampled were made up of 69.1% males and 30.9% females as shown in Table 1. This confirms the old African perception that describes farming as a male dominated venture. It is worth noting however that a 31% female representation is an indication that gradually females are taking interest in sweetpotato farming. This can also be attributed to the fact that the primitive societies of old that saw the duty of farming and fending for the family as that of the man only and that the woman's duty was to keep the home and cater for the children is also changing into the case where both sexes are contributing to the up keep and wellbeing of the Ghanaian and for that matter the African home. Most males are involved in sweetpotato production than females because of the initial land preparation which is quite labour intensive. It is worth noting that, in agriculture, especially in rural areas, an improvement in the quantity and quality of jobs for both women and men has the potential of positively enhancing economic growth hence poverty reduction [9]. In the case of sweetpotato trading it was exclusively the preserve of the women as indicated in Table 1.

Basic education (44.6%) dominated the level of education of farmers. Summing up Basic, Secondary and Tertiary Education holders gave a total of 68% of educated farmers in sweetpotato farming in Ghana. This is a good prospect for adoption of improved varieties and technologies hence a high potential for

increasing farmers' productivity. The educational level showed that 32% of farmers had no formal education at all. This falls below the Ghanaian adult illiteracy rate of 46.3% as quoted by the Ministry of Education in 2012. The implication of education on farm productivity is duly outlined by Adesina and Baidu-Forson [10], where they emphasized that agricultural technological practices and its adoption are positively related to education. In trading, however 65% of traders had education from basic level to secondary level. None had tertiary education but as much as 35% had no formal education. By implication most of the traders at least had the required skill to keep record of activities and to tap into modern trends and existing market prices to make reasonable profit.

Marriage plays a vital role in Africa's agriculture and that of Ghana is no exception. It is therefore significant to record 83% of respondent farmers as married. Spouses served as major sources of labour in Ghana as they lend helping hand on farms and are mostly in charge of harvesting and packaging of sweetpotato roots. According to Harun [11], singlehood, divorced and widowhood status had negative impact on agricultural production as well as the economic growth of farm household. By implication married farmers, contribute positively to productivity by providing additional farm hands. Married traders (82%) constituted the majority of the respondents. This goes to buttress the earlier assertion that women have assumed the role of engaging in economic activities to help support the family and the efforts of their husbands.

Minimum farmer age recorded was 23 and the maximum was 67 years. They fell within the legal working age. The mean age of farmers however was 44 years. Categorizing youths from the age of 15 to 35 and matured farmers 36 to 60, about 59% of farmers were youths. This leaves sweetpotato farming a bright future because the youths have taken interest and are involved in its cultivation. The minimum age recorded was 22 years and the maximum 60 years for traders. Age has become an integral part of farm level data analysis. Among other studies, Ajah and Ajah [12], postulated that age was not a significant factor in productivity analysis but concluded by considering the fact that the influence of age in other sectors of farm data analysis could not be under-estimated.

Sweetpotato varieties grown were categorized into improved and local varieties. Improved

varieties grown were Santom Pona, Sauti, Faara, Okumkom and Apomuden. All these varieties were developed by the CSIR- Crops Research Institute. Local varieties that were grown are outlined in Table 1.

3.2 Sweetpotato Farming and Trading Profitability

For farming, as indicated in Table 2, the overall production cost per hectare of sweetpotato was **GH¢2,452.00 (\$580.36)**. The major component of total cost was human labour which accounted for 38.83% of total cost hence once the cost of labour was catered for most of the work in effect could be done to increase productivity. This was followed by herbicides (13.87%), fertilizer (12.23%), tractor services (10.81%) and Land Rent (10.19%). In the face of these costs, net returns per hectare stood at **GH¢1,647.00 (\$389.82)** from a total revenue of **GH¢4,099.00**

(\$970.18). By implication for every **GH¢1 (\$0.24)** invested, farmers gained **GH¢1.67 (\$0.40)** in sweetpotato production.

It is observed from Fig. 1 that, female farmers were obtaining higher profits than the male farmers. The outcome is inconsistent with the findings of Onyia, Adebayo [13] and Olorunsanya [14] where the reverse was the case. This may be due to the fact that women were good at bargaining for better prices than the men considering the fact that, the men had higher yields than the women. It is also evident that women were not mostly under pressure to sell of their produce right after harvest as compared to the men. The women therefore were able to keep their produce a little longer to meet better market prices. The men on the other hand were under pressure to provide for other social needs including school fees, utility bills and donations at social functions among other.

Table 1. Socio-demographic characteristics of respondents

	Farmers		Traders	
	Frequency	Percentages	Frequency	Percentages
Sex distribution				
Males	74	69.1	-	-
Females	46	30.9	60	100
Total	120	100	60	100
Educational level of respondents				
No formal education	38	32	21	35
Basic Education	54	44.6	15	25
Secondary Education	25	21.7	24	40
Tertiary Education	3	1.7	-	-
Total	120	100	60	100
Marital status				
Single	12	10	8	13
Married	100	83	49	82
Widowed	8	7	3	5
Total	120	100	60	100
Age				
Minimum age	23		22	
Maximum age	67		60	
Mean age	44		44	
Youthful farmers	70	59		
Matured farmers	17	41		
Total		100		
Improved sweetpotato varieties cultivated and sold				
Type of Variety	Improved	Local		
	Santom Pona	Agbeyeyie		
	Sauti	Eworleworme		
	Faara	Akete		
	Okumkom	Disco		
	Apomuden	Obaari		
		Kuffour		
		Abontem		

Table 2. Profitability analysis for sweetpotato producers

Variables	Quantity/HA	Unit cost (GHS)	Value (GHS)	Percentage
Gross returns (GR)				
Yield (50 Kg bags)	103	40.00 (\$9.47)	4,099.00	
Variable cost				
Fertilizer (in 50 kg)	3 bags	100.00	300.00	12.23
Herbicides (in litres)	20 litres	17.00	340.00	13.87
Pesticides (in litres)	3 litres	25.00	75.00	3.06
Human Labour (Land preparation, planting, weeding, harvesting)			952.00	38.83
Farm tools (Hoe and Cutlass)			123.00	5.02
Bags and Basket			147.00	5.99
Tractor Services (Ploughing)			265.00	10.81
Fixed cost				
Land Rent	1	250.00	250.00	10.19
Total Cost (TC)			2,452.00	100
Net Returns (NR)			1,647.00	
Returns Per Cedi (R/C) %			167	

Based on marital status, as observed in Fig. 1, both the married and single made profits but the singles (single, divorced and widowed) made more profits than the married. The singles had a less responsibility in terms of household commitments hence in most cases they have the full complements of their produce for sale as compared to the married who uses some for feeding the household and as gifts to other families and friends. In addition to this, the singles were not mostly under social pressure hence were able to wait until good times to sell of their produce as compared to the married that had to rise to a lot of responsibilities hence sold produce right after harvest for money to meet the numerous obligations facing them. Simpa [15] showed a negative relationship between marital status and profitability though it was statistically insignificant.

Considering the educated farmers against uneducated farmers, there was not much difference between the two groups as shown in Fig. 1. The uneducated however had a slight edge over the educated. This was contrary to the findings of Masuku and Xaba [16] where education resulted in an increase in profit.

Categorizing age into Young farmers (15-35) and Matured farmers (16-60) as indicated in Fig. 1, matured farmers made higher profits in sweetpotato production than the young farmers. The reverse of the results of Masuku and Xaba [16]. In this study it came to light that, Matured farmers had more experience in locating target

markets and also identifying the right times to sell of produce than the young farmers. In addition to that, the young farmers depended on the matured farmers to sell of their produce due to two factors. Firstly the young farmers were not familiar with the market terrains and did not have enough market information to contact prospective buyers. Secondly, matured farmers had the capital base to buy produce from the young farmers for sale at a later date.

In trading the same quantity of commodities considered in the farmer's profitability case, total cost was **GH¢4,429.00 (\$1048.29)** and total revenue was **GH¢9,270.00 (GHS2194.09)**. This yielded a net profit of **GH¢4,841.00 (\$1145.80)**. By implication, for everyone **GH¢1(\$0.24) invested**, the trader gained **GH¢2.09 (\$0.49)**. It is conclusive therefore that in the face of high cost of production and operation, the trader made positive net gains as was the case with the farmer. Refer to Tables 2 and 3 for details of sweetpotato farming and trading profitability.

3.3 Profitability Gap between Farming and Sweetpotato Trading in Ghana

The profitability analysis conducted showed that, farmers were gaining **GH¢1.67 (\$0.40)** for every cedi invested whereas the trader was gaining **GH¢2.09 (\$0.49)**. A critical look at Figs. 2 and 3 shows the differences in net gains between the producers and the traders. At every location, the trader gains more than the farmer. The trader gains an average of 52.12% above the gains of

the farmer with the highest occurring in Twifo where the trader gains 94.5% more than the farmer and the lowest at 36.2% at Kwahu East.

There is therefore an indication that the trader gains more than the farmer and the difference is significant.

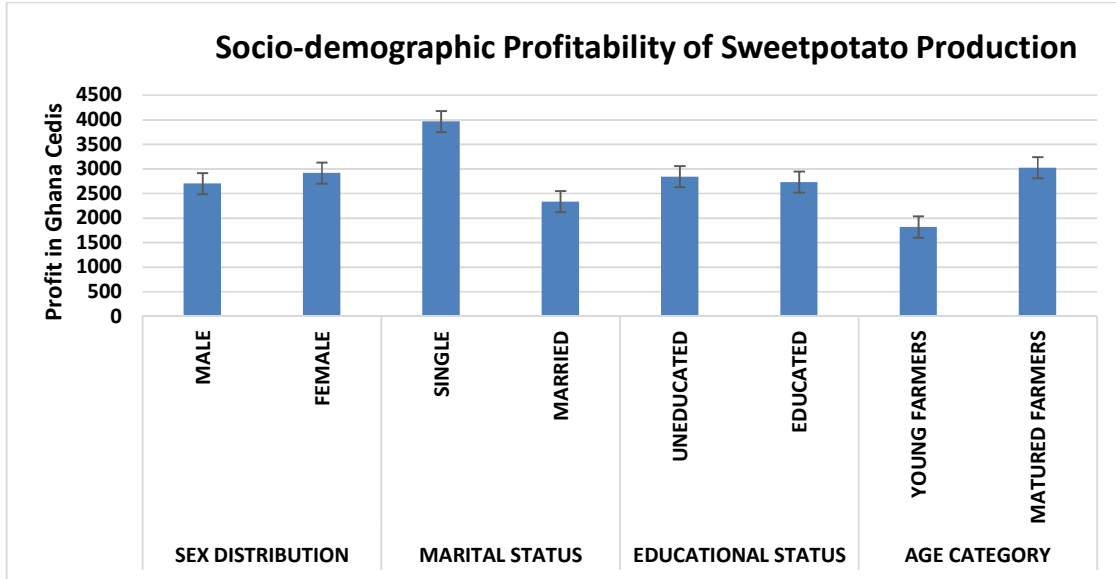


Fig. 1. Socio-demographic distributions of sweetpotato production profitability

Table 3. Profitability analysis for sweetpotato traders

Variables	Cost Per 50 KG	Cost Per 103 (50 KG Bags)
Cost Price (CP)	40	4,120.00
Transport	2	206.00
Market levy	1	103
Total Cost	43	4,429.00
Selling Price (SP)	90	9,270.00
Profit (SP-CP)	47	4,841.00
Returns per Cedi (R/C) %		209

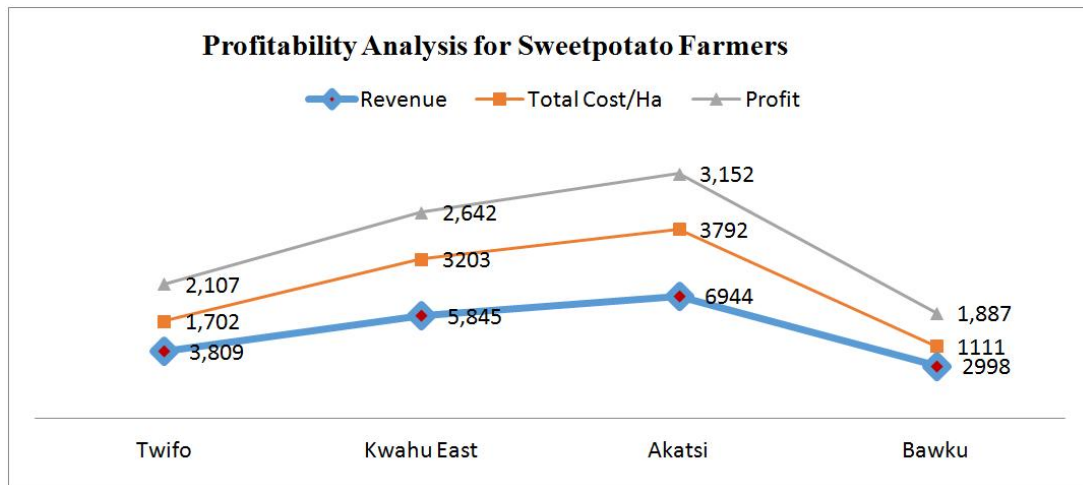


Fig. 2. Gross margin for producers

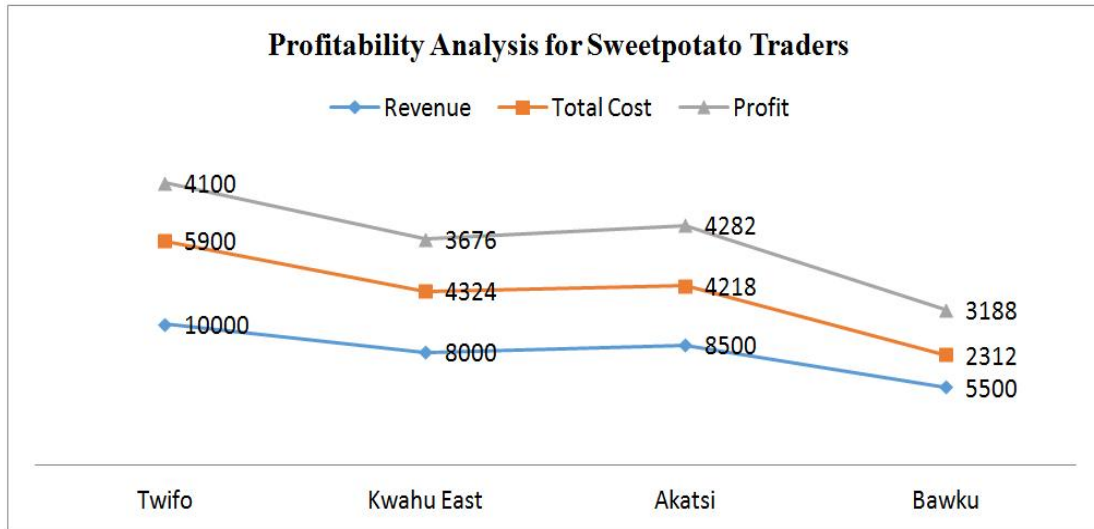


Fig. 3. Gross margin for traders

Farmers attributed the causes of the profitability gap to lack of storage facilities that led them to sell off their produce soon after harvest. In addition to this traders determined the price to pay the farmer hence the farmer had no control over prices at which his commodity was sold. If they do not sell the produce, it would go bad, hence they were forced to accept the low prices offered by the traders. Farmers also touched on the non-availability of any regulatory body to determine the prevailing price of sweetpotato produce in the local and regional markets.

4. CONCLUSION

Sweetpotato farming in Ghana is profitable and a lucrative venture. However the profit margin for traders from sweetpotato outweighs that of farmers obtained from farm gate trade which has become a de-motivating factor for sweetpotato farmers. Market prices were higher than farm gate prices. This trend was due to the fact that farmers had no storage facility to store the produce in wait of higher prices. Secondly the traders had better negotiation skills and were more organized than the farmers. The following recommendations are therefore made in reducing the gap between production and trade;

Farmer Based Organization should be formed by the sweetpotato farmers to give them a unified front and a higher bargaining power. In addition to this, Innovation Platforms (IP) involving all actors in the sweetpotato value chain should be encouraged. This will allow actors to take

advantage of various opportunities in the areas of easy access to inputs at lower cost and guaranteed access to financial support as suggested by Addison, Sarfo-Mensah [17].

Government should ensure a reliable pricing and market policy (government regulates the commodity prices directly depending on world market conditions and welfare of the farmers) as the case is with Cocoa production. This will aid in protecting smallholder farmers against price fluctuations and market exploitation. Market-based mechanisms that provide smallholder farmers with proper incentives to invest in sustainable sweetpotato production should be developed. Removing subsidies on inputs of high cost (fertilizer, herbicides and machinery services) would encourage farmers to produce at competitive cost. Machinery for farm level processing of sweetpotato produce should be provided at subsidized cost to ensure farm households have control over the prices at which they sell their products [18].

Investments in modern and efficient extension services using audio, audio visuals, simulations, mobile telecommunication and virtual and physical farmer based schools should be encouraged and implemented [19,20]. This will aid the development of farm advice tailored to the needs and adapted to the prevailing conditions (environmental, production and marketing) at various unique farm household locations. Proper marketing of agricultural produce should be incorporated into the curricula

for training agricultural extension agents [18]. Hired labour increases the the cost of production and has a negative effect on profitability at the farm gate. The economic implication of hiring labour depends mostly on market wage which also has a positive relationship with road access [21]. A guaranteed market returns coupled with good infrastructure such as good roads and modern processing units among others would encourage more abled bodied persons to render farm services. This will reduce the cost of labour and ensure secured profit in the light of processed high valued outputs and good road networks to access markets.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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