The Effect of Butternut Squash (*Cucurbita moschata*) on the Incomes of the Small-Holders in Suba District, Kenya

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Abstract: Butternut squash is an emerging economic crop in Kenya with ready market and high nutritional value. It was introduced to promote food security and enhance the incomes of the small-holder farmers in Suba district. However it is not clear whether butternut could address the problem of low income among small-holder farmers. The aim of the study was to investigate the effect of butternut squash on the incomes of the small-holders. The choice of the study area was due to persistence of poverty problem and existence of butternut squash in Suba District. Cross-sectional data was collected from a sample of 120 farmers who obtained using multi-stage sampling. The small-holder farmers were characterized using descriptive statistics. Gross Margin analysis was used to determine the contribution of butternut squash to total crop income. Gross margin analysis results revealed that butternut squash was a profitable enterprise similar to the other horticultural crops. Results showed that on average butternut squash contributes 38.55% with a standard deviation of 12.2% towards the total crop gross margin/ha. This study therefore, recommends that government and other stakeholders should formulate and implement effective policies related to promotion of butternut squash farming and marketing.

Keywords: Butternut squash, gross margin, Kenya

INTRODUCTION

Agriculture remains the key to achieving the poverty reduction targets of the Millennium Development Goals (MDGs) in Africa. Over 80% of the population in sub-Saharan Africa lives in rural areas with 65% of the economically active population depending on the agricultural sector (Sassi, 2009). Small-scale farming provides most of the food produced in Africa, as well as employment for 60% of the work force (Practical and Pelum, 2005). This has necessitated collective effort from various stakeholders including governments, Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs), Self Help Groups (SHG) and Private sector to engage in agricultural diversification especially of fast maturing crops. The horticulture sub-sector has been isolated since most of the horticultural produce takes a shorter period (85 to 120 days) to mature; thus enhancing fast recuperation of investment and boosting farmer incomes.

In Kenya, the production of horticultural crops such as vegetables forms an important source of income for small holder farmers, who produce more than 70% of the crop output (McCulloch and Ota, 2002). As such the horticulture sub-sector has been isolated since most of the horticultural produce takes a shorter period to mature; thus enhancing fast recuperation of investment

and boosting farmer incomes. Horticultural production has higher returns than most other cash crops and is suitable for production both on small and marginal farms in varying climatic conditions (Minot and Ngigi, 2004). The horticultural industry is the fastest growing agricultural sub-sector in Kenya, contributes more than 10% of total agricultural production (World Bank, 2009).

The main vegetable crops grown by small-holder farmers for both subsistence and commercial purposes in Kenya include cabbages, tomatoes, onions and indigenous vegetables such as the African Leafy Vegetables (ALVs) like amaranth and some cucurbits (Omiti *et al*., 2004) such as butternut squash (*Cucurbita moschata/maxima*).

Butternut squash is a vigorous growing plant that takes 85 to 90 days to maturity and it produces good uniform fruits weighing about 650 to 1000 gm. Among other cucurbits like courgettes, pumpkin and cucumbers, butternut squash is gaining preference because of its early maturity, colour that is appealing to the eyes of the consumers, its long shelf life, small size that makes it attractive to producers, traders and consumers. Moreover, it's a hardy crop, which is able to tolerate moderately harsh environmental conditions, resistant to many pests of the cucurbits (Bonjour *et al*., 1990) and it can be grown well in small plots of land and yield relatively good returns with minimal fertilizer

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inputs making it an appropriate crop as land subdivision continues in the rural setting. The crop also has ready local and export markets (African, 2007). As such, some growers in Western region of Kenya are expanding their production to meet increased local and export demand. More than 30 USAID-KHDP-beneficiary groups are currently selling 100-150 metric tons per month, valued at Ksh 1.0-1.5 million. The farmers mostly grow the orange-fleshed hybrid varieties that are not only preferred by exporters but are also acceptable to local market customers (USAID, 2009).

Butternut is an emerging economic crop with ready market and high nutritional value, despite this, the contribution of butternut squash on the crop incomes of the small-holders is unknown in addition it's not clear whether butternut squash could address the problem of low income. This formed the main objective that examined the contribution of butternut squash to the small-holders' crop income *vis-à-vis* other crop enterprises.

In the following section we describe the materials and methods used in the study. In this we present a description of the study area, sampling procedure and the gross margin analysis. The study concludes with a succinct discussion of the findings, conclusion and recommendations and suggestions for future research.

MATERIALS AND METHODS

Study area and sampling procedures: The study was carried out in Suba district. Suba is one of the districts that make up Nyanza province. It boarders Bondo district to the north across lake Victoria, Homabay district to the east, Migori district to the south and Lake Victoria to the west. Suba is located between longitude 34° E and 34°'' E and latitudes 0°20'' S and 0°52'' S. The district covers an area 641.8 km², has a population of 103,054 people, 21,416 households and it comprises of two divisions; Central Suba and Gwassi. In addition the district receives a bimodal rain pattern, with the peak rainfall generally occurring between March and May, with more rainfall experienced in the hilly areas of Gwassi. The average annual rainfall ranges between 700-1200 mm/annum while temperatures range between 22 and 33°C. These conditions therefore provide a climate that is suitable for the establishment and growth of butternut squash. The map of the study area is shown in Fig. 1.
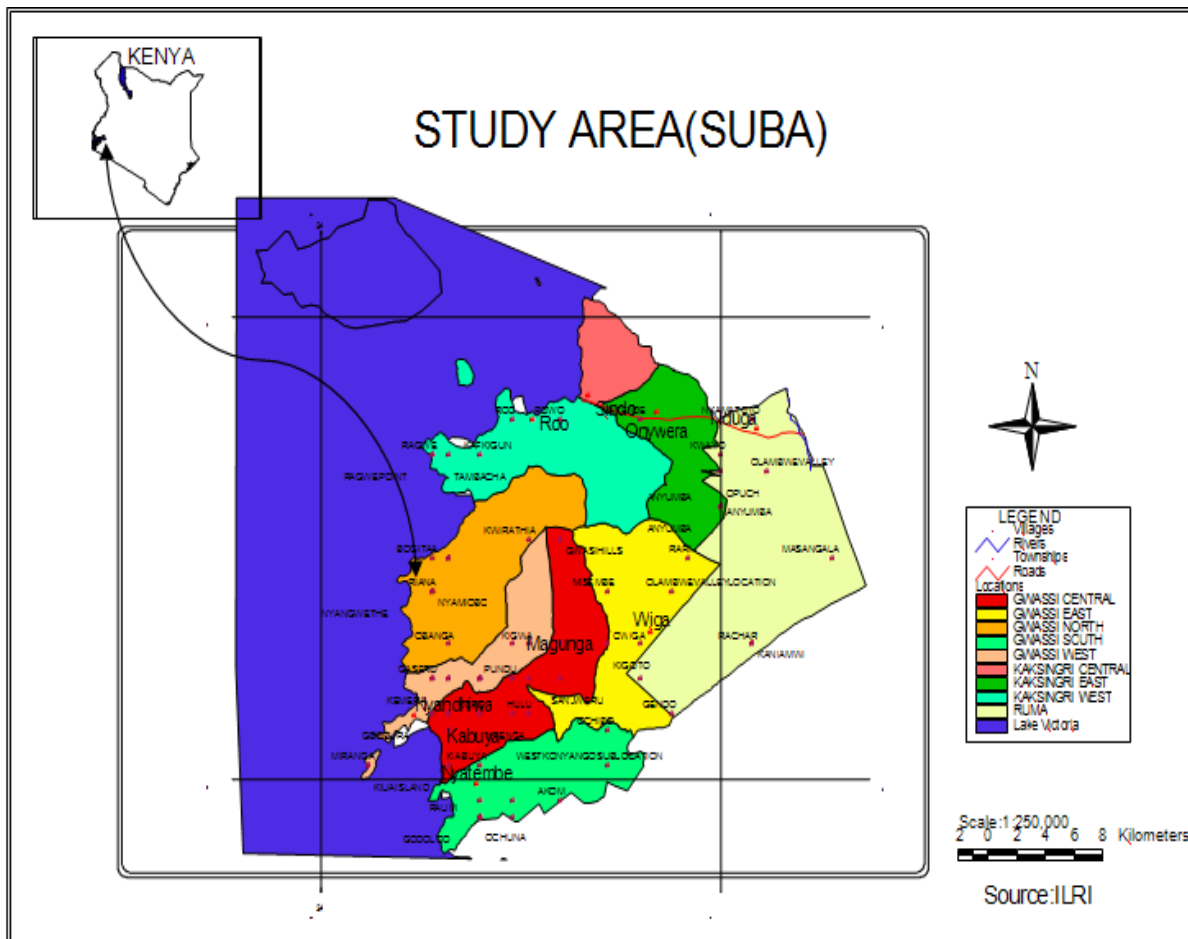

Fig. 1: Map of Suba district

The target population of the study was small-holder farmers who comprise of butternut farmers and non butternut squash farmers. The study used a multi-stage sampling technique where the first stage involved purposive selection of the District. In stage two, six locations were randomly sampled from the two divisions that make Suba District; Central Suba and Gwassi. Finally, in stage three, the small holders were randomly sampled to make a sample of 120 small-holder farmers. According to Kothari (2004) when the purpose of sampling is to compare the differences among the strata, then equal sample selection from each stratum is more efficient even if strata differ in size. Consequently, the formula by Kothari (2004) was employed to come up with an appropriate sample for the study being that the population of small-holder farmers doing butternut squash was not known. Farmers were interviewed using a survey questionnaire which captured questions pertaining to the farm characteristics, social-economic, institutional factors and technology characteristics. The map of the study area is shown in Fig. 1.

The emperical model:

Gross margin analysis: The Gross Margin Analysis was used to determine the contribution of different farm and household activities to the household total crop income. The Gross margin was calculated from the net incomes of the agricultural crops. The contribution of each production activity towards the household crop income was established via gross margin calculation Eq. (1) for each production activity:

$$GM_i = R_i - VC_i \qquad (1)$$

where,

R_i = Revenue (cash and in-kind from the sale and use of products) from the ith activity

VC_i = Variable cost (cash and in-kind) from the ith activity

The contribution of butternut squash to the total crop income of the small-holder farmers was determined as a percentage of the total crop income. An F-test was carried out to compare it there were any statistical differences among the crop enterprises. In addition a t-test was also carried out to establish the statistical difference between the total gross margins per hectare of the adopters and non adopters of butternut squash.

LITERATURE REVIEW

Farming households act as consumers and producers of a variety of the products. In this case the gross margin analysis can be used to determine the contribution of different farm and household activities to the household income. In estimating the values of the different income generating activities, the direct and indirect approaches to valuation are used. The direct approach entails estimation of the price of the products which are sold in the market. The indirect market price approach is often used for products that are not directly traded in the market. Their values can be derived from their contribution to other production processes or their impact on the prices of other commodities. For this study, the direct approach was used where the butternut squash is valued at its market price. Willingness to pay can be used but it is difficult to capture and may also be biased (Tietenberg, 1996).

Mithofer and Waibel (2003) used the Gross margin analysis to assess the contribution of indigenous fruits to the household incomes in Zimbabwe where the study found that the contribution of the indigenous fruits to household income was not significant but the returns to labor from indigenous fruits collection was significant. In addition Nedunchezhian and Thirunavukkarasu (2009) carried out a study to explore the contribution of livestock income in different farming systems using gross margin analysis and further determined the percentage contribution to the total income. Ngeno *et al*. (2009) determined the contribution of income from extensive poultry production as a percentage of total farm income in Kericho municipality Kenya and found that it had a range of 1-32%. The findings also showed a negative correlation between farm income and the percentage of contribution.

RESULTS AND DISCUSSION

The first part of the results provides a description of the social economic characteristics of the adopters (butternut squash farmers) and non adopters (farmers not doing butternut squash) followed by the gross margin results (Table 1).

There were no marked differences in terms of gender between the adopters and non adopters of butternut squash. However, the male gender accounted for 73.33% of the respondents among the adopters while the female were 26.67%. In addition 90% of the adopter were married indicating married farmers were more likely to adopt butternut squash with there being a statistical difference between the adopters and non adopters at 5% level. These results suggest that the contribution of both men and women was important in adoption of butternut squash among the households. In the marriage set up it is possible that the men were in a better position of accessing the information while the women supported in actual farming of butternut squash hence contributing to higher adoption. In addition, given the nature of traditional woman's role at home it is possible that married women participated in butternut

Table 1: Descriptive statistics of selected variables

Variable	Adopters (N = 60)	%	Non-adopters (N = 60)	%
Male headed household (1 = male)	44.00	73.33	46.00	69.67
Age of household head (mean age)	41.52		37.73	
Marital status (married)	54.00	90.00	46.00	76.67
Household size (number of persons)	6.95		4.77	
Farm size (ha)	1.84		0.94	
Credit access (access = 1)	54.00	90.00	10.00	16.67
Group membership (membership = 1)	54.00	90.00	12.00	20.00
Distance to market (km)	10.06		10.83	
Income from livestock (shillings)	18919.00		9578.00	
Own livestock	59.00	98.33	55.00	91.67
Man hours on butternut (average h)	273.87			
Access to extension (number of contacts)	46.00	76.00	36.00	60.00
Years of experience in butternut (mean years)	2.94			
Occupation of the household head				
Formal and informal employment and trade activities	43.00	71.67	39.00	65.00
Fishing activities	17.00	28.33	21.00	35.00

Own calculation from survey data

Table 2: Average total crop gross margin per hectare

	Type of farmer					
	Sample mean	Adopters	Non-adopters	Mean diff	t	Sig.
Gross margin (KES)	107,368.5	121,684	93,053	28,631	-2.54**	0.012

**: Significant at 5% level

squash farming as a way of enhance the food basket and cushion themselves against moments of total lack of food for their families.

The butternut squash households were larger (6.95) than non butternut farmers (4.77). It was observed that butternut farmers had larger land holding (1.84 ha) than non butternut farmers (1.26 ha). Furthermore a larger proportion accessed to credit and extension while at the same time participated in group or association activities (90%) compared to non adopter (20%). Statistics also showed that there is a significant difference between the butternut farmers (41.52) and non butternut squash farmers (37.73) ages. Fishing is a major activity and 28.3% of the butternut squash and 35% of non butternut squash farmers engage in the same while others participate in formal and informal employment and trade livelihood activities.

Gross margin analysis: This study used gross margin analysis to evaluate the contribution of butternut squash to the total crop gross incomes for the third objective. The major crop enterprises considered in the study were maize, beans, butternut squash, millet, sorghum, watermelon, kales, sunflower, green grams and ground nuts. The analysis involved the subtraction of variable costs such as cost of seeds, cost of preparing land, labour, fertilizer and chemicals from total value of yields of each crop enterprise. Results showed that on average butternut squash contributes 38.55% with a standard deviation of 12.2% towards the total crop gross margin per hectare. A further comparison between the average total gross margins between the adopters of butternut squash and non adopters of butternut squash farming was done and the results are shown on Table 2.

Table 3: Comparison of the average gross margin per hectare

Crop enterprise	KES	F	Sig.
Maize	42,929.98	5.202	0.022**
Beans	20,102.96	0.263	1.000
Butternut squash	44,222.08	1.727	0.018**
Sorghum	20,504.28	0.691	0.820
Millet	21,963.38	0.929	0.584
Kales	77,274.60	4.335	0.000***
Watermelon	53,894.52	17.825	0.000***
Tomatoes	136,335.56	3.790	0.001***
Sunflower	50,079.73	0.837	0.362
Green grams	43,390.17	1.753	0.178
Groundnuts	2,965.16	0.012	0.915

: Significant at 5%; *: Significance at 1%

As shown in Table 2 an average of 121,684 shillings was reported for the adopters of butternut squash while that of non adopters of butternut squash was 93,053 shillings thus indicating a mean difference of 28,631 shillings. On further analysis, results of a t-test revealed a statistical significant difference between the total crop gross margins per hectare of the adopters and non adopters of butternut squash farming at 5% level of significance. This difference is explained by the income that is obtained from butternut squash.

Table 3 shows results of a comparison of the mean gross margin per hectare for the key crop enterprises that were considered in this study. The findings indicate that horticultural crops recorded gross margins of KES.136, 333.56, 77,274.60, 53,894.52 and 44,222.08 shillings for tomatoes, kales, watermelon and butternut squash, respectively. It is observed that some of the other horticultural crops considered in this study recorded higher gross margins than butternut squash. However, butternut squash is gaining preference because of its early maturity, long shelf life, small size that makes it attractive to producers, traders and consumers and high nutritional and commercial value.

As highlighted earlier butternut is a hardy crop, which is able to tolerate moderately harsh environmental conditions, resistant to many pests of the cucurbits (Bonjour *et al.*, 1990) and it can be grown well in small plots of land and yield relatively good returns with minimal fertilizer inputs making it an appropriate crop as land subdivision continues in the rural setting. The crop also has ready local and export markets (African, 2007). This therefore, warrants adoption of butternut squash compared to the other horticultural crops. In addition maize, beans, sorghum, millet, sunflower, green grams and ground nuts had an average gross margin of Ksh.42, 929.98, 20,102.96, 20, 504.28, 21, 963.38, 50, 079.73, 43, 390.17, 2, 965.16 shillings/ha. The findings show that butternut squash and other horticultural crops had a relatively higher gross margin per hectare compared to none horticultural crops. These results concur with other finding which reported that horticultural production has higher returns than most other cash crops and is suitable for production both on small and marginal farms in varying climatic conditions (Minot and Ngigi, 2004).

An analysis of comparing each crop enterprise contribution to the total crop gross margin per hectare carried out using the F-test and was significant at 5% probability level for butternut squash and maize crops and at 1% for kales, watermelon and tomatoes (Table 3).

CONCLUSION AND RECOMMENDATIONS

Butternut squash farming contributes to improving the livelihoods of the farming households through increased agricultural productivity, food security or by impacting on the incomes of the households. This study sought to establish the effect of butternut squash farming and its contribution to the crop income of the smallholder farmers in Suba district. The results revealed that butternut squash farming was low and that male farmers participated more in butternut squash farming more than the female farmers. In addition there were more married farmers who practiced actual farming of butternut squash. Further it was established that majority of the farmers produced butternut squash with a motive of generating income much as it was also used as food to cushion themselves against moments of lack of food for their families.

Butternut squash has a potential for being adopted by smallholders in Suba district. Despite the low levels of butternut squash farming contributed significantly to the total crop income and there was a significant statistical difference between the adopters and non adopters of butternut squash with regard to the total gross margin per hectare. Thus it would play an important role in enhancing the incomes of the farmers being that it was found to be a profitable enterprise. In addition other benefits could accrue such as providing

alternative employment in the district. It could also be used to improve the food security situation first, by being used directly as food by the households and secondly through commercialization the income obtained would be used to smooth consumption.

The main aim of the study was to establish the contribution of butternut squash to the income of the smallholder-farmers in the Suba district. Thus to this end the study suggests further studies on value addition to butternut squash which would stimulate demand and enhance the incomes to the butternut squash farmers and an evaluation of the effect of adoption of butternut squash on the poverty levels and food security.

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