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Full Length Research Paper

A study of factors that determine decision to participate in grain amaranth marketing and factors which influence the level of participation

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Grain amaranth plays an important role in improving household nutritional and economic status. Grain amaranth is still a new crop in Uganda's farming system, after being introduced by Volunteer Efforts for Development Concerns in 2005 to curb malnutrition in Kamuli district. Production and consumption of the crop is still limited mainly due to lack of market; this has limited the purpose of production to domestic consumption with no incentive of producing a marketable surplus. A cross sectional study was conducted in Kamuli district to assess the determinants of small holder participation in grain amaranth marketing. A total of 150 grain amaranth farmers obtained through a multistage sampling technique, constituted the study sample. The decision to participate in grain amaranth marketing was positively influenced by gender of household head, education levels of the household head, grain amaranth yield, selling price, and membership in a farmer group. The results further reveal that the education status of the household head and the quantity of grain yield positively influenced households to sell more grain amaranth. Yield improvements are critical if increased market participation is to be realized. Therefore, research efforts should be directed towards generation and dissemination of grain amaranth varieties that will determine participation of smallholder farmers in Uganda.

Key words: Grain amaranth, small holder farmers, market participation.

INTRODUCTION

Uganda is one of the world's poorest and low income countries with a GNP per capita of US $ 460 (World Bank, 2011). Market participation is one of the drivers of economic growth and poverty reduction (Reardon and Timmer, 2005). Reardon and Timmer (2005) further explains that as households' disposable income increases, so does demand for variety of goods and services, thereby inducing increased demand-side market participation, which further increases the demand for cash and thus supply-side market participation. The current Ugandan population stands at 33 million people and is growing at a rate of 3.2% annually (UNDP, 2010). Given the fact that it is hard to strike a balance between population, food production and economic growth, the government seeks to ensure the country's continued ability to sustain food self-sufficiency, increases in agro-industrial production and productivity, improvement in employment opportunities and increasing access to markets as one of the key elements in its strategy to increase incomes of rural households, enhance food security and to facilitate further expansion of the economy (MOFPED, 2011). This necessitates well-functioning markets and increased market participation.

As a pseudo cereal grain, amaranth has an important role in improving household nutritional and economic status (Muyonga et al., 2008) of vulnerable populations. Nutritionally, the crop has a protein content of about 16% which is higher than other conventional cereals (National Research Council, 1984). It is important to note too that the protein contained in amaranth seeds is well balanced

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in amino acids to meet the optimum balance requirement in human diet when compared to other plant proteins (National Research Council, 1984). Grain amaranth can also be used as a substitute for milk, particularly during child-weaning (Nabakabya and Nakimbugwe, 2007) making it a relatively cheaper source of protein. The grain has a high medicinal value and has proved to be successful in the treatment, management and prevention of various diseases including increasing the body mass index of formerly wasted HIV/AIDS patients, has potential anticancer effects because of its anti-tumor and anti-oxidative effects (Kim et al., 2006).

In Uganda, production and consumption has been limited to the leafy amaranth types and not the grain amaranth types which can be processed and utilized into a number of marketable products. Production and consumption of the crop is still constrained by limited marketing (Muyonga et al., 2008). Consistent with the conceptual framework of the household farm (Singh et al., 1986; de Janvry and Sadoulet, 2006) due to thin markets or market imperfections that give rise to high transaction costs, households may be better off addressing their consumption objectives through on-farm production rather than depending on market sales. This situation has limited the purpose of grain amaranth production to food security and hence there is no incentive to produce a marketable surplus. By unlocking market opportunities for grain amaranth farmers, farmers will be able to enjoy the economic benefits associated with marketing. It is also worth noting that unlocking market opportunities have dual benefits of facilitating commercialization among smallholders and supplying a nutritional product to consumers who are unable to produce it. Hence an understanding of factors that influence market participation will help in identifying interventions to unlock and release benefits associated with marketing agricultural produce such as grain amaranth. Therefore, this study aimed at establishing factors that determine decision to participate in grain amaranth marketing and further more to determine factors which influence the level of participation. The information generated from this study will be used by institutions currently supporting its production and marketing to come up with promotion strategies for encouraging both production and consumption resulting into improved farmers' livelihood. Further still, this study can give a better insight into the role of market participation in enhancing welfare situation and reducing poverty of small holder farmers who have taken up grain amaranth as a commercial crop.

MATERIALS AND METHODS

Study area and sampling procedure

This study was purposively conducted in Kamuli district because it is one of the pioneer districts for growing grain amaranth following the introduction of the crop by Volunteer Efforts for Development Concerns VEDCO. VEDCO is a non-governmental organization which implements a food and nutrition security in the area with their focus for the introduction of the crop being to curb malnutrition in the area and boost immune systems of expectant mothers and HIV/AIDS patients. A multi-stage sampling procedure involving purposive and simple random sampling methods were used. Only 3 out of the 13 sub counties were covered in the survey since these were the major areas that were producing grain amaranth as a result of massive promotion campaigns mainly by two non-governmental organizations and hence it was ascertained that there was a high concentration of farmers who were at different stages of production and marketing. In the first stage, a purposive sampling procedure was employed to identify the district of interest which is Kamuli district since it is one of the pioneer districts for producing grain amaranth and hence it was ascertained that there is a high concentration of farmers who market grain amaranth and those who do not. In the second stage, the district was purposively stratified into 2 stratas, that is, VEDCO and PLAN-UGANDA since these are the two organizations which are promoting production of the crop. However, though Kamuli district has about 13 sub counties, 2 sub counties (that is, Butansi and Namasagali) were purposively selected from VEDCO stratum since from the time the NGO started promoting production of grain amaranth in 2005 it was operating in only two sub counties. Similarly from the PLAN-UGANDA stratum, only one sub county Mbulamuti was selected since the NGO was only operating in one sub county since the inception of its grain amaranth promotion activities in 2010. In the third stage using a sampling frame provided by community development agents for both grain amaranth marketing farmers and non- market participants, 64 respondents were randomly selected from Mbulamuti sub county, 45 from Butansi and 41 from Namasagali sub county making a total of 150 respondents. The target of the study was to have equal number of farmers in each stratum but this however differed from what was earlier proposed due to the concentration of grain amaranth farmers in some sub-counties resulting from the time difference when the promoting organizations started promoting the crop and hence it was ascertained that in some sub counties where grain amaranth was promoted earlier, there were more market participants than non-market participants.

Data collection procedure

Data were collected during October to November 2011 using a structured pretested questionnaire which was administered directly through interviews to the respondents. Data collected included: characteristics of farmers involved in marketing of grain amaranth, resources that are used in grain amaranth production, information on participation in promotional activities and market, information on asset ownership and access to

services. Data collected were entered using SPSS (statistical package for social scientist) for management of the data after which STATA was used to analyze the data.

Econometric strategy

The Heckman two stage model (Heckman, 1979) was used to establish factors that influence the decision to participate in marketing of grain amaranth and further to establish factors that influence the level of market participation. This model was used because of its advantage over the Tobit model in eliminating sample selection bias (Gebremedhin et al., 2009; Makhura et al., 2001; Siziba et al., 2011; Ouma et al., 2010). In the Heckman two stage models, the first stage identifies factors that influence market participation using probit where the inverse mills ratio was generated. The second stage of heckman model was estimated using ordinary least squares regression to establish factors that influence the level of market participation for farmers that sold grain amaranth. During the second stage, the inverse mills ration generated from the probit regression is added as an explanatory variable to check whether or not selection bias was reduced by using the two stage heckman regression models.

Heckman two stage model is written in terms of probability of participation in grain amaranth marketing and proportions of grain amaranth marketed. The participation equation can then be written as:

$$y_1^* = \beta_{1\,I}\, X_{1i} + \varepsilon_{1i} \quad \text{.....(1)}$$

where y_1^* is a latent variable, which is the utility the farmer gets from participating in the market.
The binary model is then stated as:

$$y = \begin{cases} 1, \text{ if farmer sells any grain amaranth} \\ 0, \text{ other wise} \end{cases}$$

In specific terms, the probit model in stage one of estimation is stated as:

$$\Pr(y_1) = f(x_1, x_2, ..., x_n, e) \quad \text{..... (2)}$$

where, Pr (y_1) is the probability of a farmer making a decision to sell grain amaranth into a market or not; where marketing decision = 1 if a farmer participates in marketing and 0 otherwise; $X_1 \ldots X_n$ are the variables that influence the probability of participating and ε the normally distributed error term.

In the second stage of the Heckman model, OLS are estimated to test the effect of hypothesized factors on the level of participation measured by the proportions of grain amaranth marketed. The model is stated as:

$$Z_n = f(y_1, y_2, ..., y_n, e) \quad \text{..... (3)}$$

where,
Z_n is the proportions of grain amaranth sales supplied to the market;
$y_1 \ldots y_n$ are the variables that were *apriori* hypothesized to affect the level of participation in the market.

RESULTS AND DISCUSSION

Descriptive statistics of sampled households

The descriptive statistics of the variables used in the heckman two stage models are presented in Table 1. The results reveal that farmers had on average been growing grain amaranth for 2.5 years; in addition the t-test indicates that there was a 1% significant difference in the mean years spent growing grain amaranth with farmers participating in the market having relatively more years spent in production (3.2) years as compared to the 1.9 years of non-market participants. This is probably because grain amaranth production is a new venture in the study area with the crop being produced for about 7 years since its introduction in the study area in 2005 by VEDCO (Muyonga et al., 2008).

Grain amaranth selling price averaged 707 Uganda shillings with the two tailed test indicating a significant difference in the mean price received by the two farmer categories with market participants receiving a higher price as compared to non-market participants.

From the results, over 70% of the women as compared to less than 30% of the men participated in the production and marketing of the grain amaranth. Increased participation of women in grain amaranth marketing is attributed to the fact that grain amaranth is not a high value crop and so there is fewer tendencies for men to be actively engaged in its production and hence marketing. Similar results have been reported by Ohajianya and Ugochukwu (2010) who found female farmers to be more involved in selling of sweet potatoes compared to their male counter parts.

More results indicate that the average level of education for the household head was 8 years with market participating farmers having higher education levels averaging 9 years as compared to non-market participants averaging 8 years. This finding is verified by the two tailed test indicating a significant difference in the levels of education attained by the two farmer categories. Households that have had formal education can readily accept new ideas and innovations, and also they are in a better position to access and interpret market information. This enhances their willingness to produce more and

Table 1. Characteristics of grain amaranth farmers.

Characteristics	Non-market participants (n=82)	Market participants (n=68)	Total (n=150)	Chi-square test (χ^2)	t-value
			Mean		
Grain amaranth farming experience (years)	1.85	3.21	2.47		2.464***
Grain amaranth selling price (UGX/kg)	39.02	1513.53	707.47		18.022***
Education level of household head (school years)	8.24	9.62	8.87		2.127**
Total land owned (hectares)	1.39	1.41	1.39		0.105
Grain amaranth yield (kg)	6.69	52.63	27.52		3.349***
			Percentages		
Gender of respondent (1=female)	79.27	76.47	78.00	0.1698	
Farmer group membership (1=member)	56.09	83.82	78.70	13.2817***	
Ownership of bicycle	78.05	79.41	78.67	0.0411	

Source: Survey data (2011). Significant level: **=5%, ***=1%.

increase volume of sales. Previous studies (Makhura et al, 2011) have found farmers with higher levels of education to participate more in output markets due to their ability to understand market dynamics.

Most of the farmers visited belonged to a farmer group with more market participants (83.8%) par taking more than the non-market participants (56.1%) with the chi square test revealing an association between belonging to a farmer group and being a market participant or not at 1% level of significance. Membership in a farmer group increases access to information and also ensures efficient flow of information among members. Group membership also ensures collective purchase of inputs and collective marketing of produce thereby reducing transaction costs associated with individual marketing. Adeoti et al. (2014) found membership in farmer organisations to be positively associated with increased market participation due to the ability of farmers in a group to network and have access to up to date information.

Results for land ownership indicate that on average all total sampled households owned about 1.39 ha with the two tailed test indicating no significant difference in the mean land owned among the two farmer proportions. Yield results indicated that market participating farmers realised more yields (52.63 kg) when compared to non-market participants and this finding is verified by the significant two tailed test indicating a significant difference between the mean yields and the two farmer categories. Higher yields have a positive effect on market participation and marketable surplus sizes. Similar results were reported by Komarek (2010) found out that yield had a positive effect in influencing volumes of banana.

From the results in the tables, approximately equal proportion of respondents across the two farmer categories owned a bicycle as a means of transport (79.4% and 78.0% for the market and non-market participants respectively). This is an indicator that possession of a bicycle as a means of transport does not portray market participation behavior.

Determinants of grain amaranth market participation

In this study, factors that influenced farmers' decision to participate in grain amaranth marketing as well as those which influence increased level of participation through sales volume were determined using the Heckman two stage models. The Heckman two stage procedure is used since the volume to be supplied to the market will be preceded by a farmer making a decision of whether to participate or not in the markets. In the first stage, the probit model was estimated to identify factors affecting the decision to participate in grain amaranth marketing. In the second stage significant factors that determine the level of participation in grain amaranth marketing using ordinary least squares were identified, where the inverse mills ratio variable generated from stage one of heckman model is added as one of the explanatory variables to check whether or not selection bias was reduced by using the two stage heckman regression models.

Factors influencing the decision to participate in grain amaranth marketing

The decision to participate in marketing of grain amaranth (Table 2) was significantly influenced by several factors

Table 2. Factors that determine decision of small holder farmers to sell grain amaranth.

Variable	Marginal coefficient	Standard Error	P-value
Household head gender (1=Male)	0.2544	0.0580	0.000
Education level of house hold head (Years)	0.0286	0.0085	0.001
Frequency of participation in extension activities in the year 2010	-0.0092	0.0714	0.897
Experience in grain amaranth production	0.0098	0.0132	0.458
Bicycle ownership	0.0651	0.0684	0.341
Land owned (ha)	-0.0174	0.0091	0.056
Mean Yield	0.0001	0.0002	0.680
Grain amaranth selling price (Ush)	0.0001	0.0003	0.000
Farmer group membership = 1; 0 = other wise	0.2323	0.0696	0.001
Log likelihood	-21.642249		
Wald chi^2	38.00		
Prob>Chi^2	0.0001		
Pseudo R2	0.4911		
Number of observations	150		

Source: Survey data (2011).

including gender of household head, education level of the household head, grain amaranth selling price, membership in farmer group and farm size.

Gender of the household head positively and significantly (P≤0.01) influenced the decision to participate in grain amaranth marketing. The probability of participating in grain amaranth marketing increases by 25.44% with male headed households. The possible explanation for this is the tendency for male headed households to be more market oriented when compared to female headed households. This suggests that male headed households are more market oriented when compared to female headed households and so are likely to engage in crops that can be sold to generate income. These findings concur with those Sigekei et al. (2013) who found out that male headed households were more likely to participate in marketing of pineapples in Kericho County in Kenya.

Farmers' education level was found to have a positive and significant effect (P≤0.01) on the decision to participate in the market with a one year increase in the level of formal education increasing the probability of marketing grain amaranth by 2.86%. This is because by being educated, farmers become more knowledgeable about the prevailing market situations and so are able to make informed marketing decisions such as where to market and prices. Similar results were reported by Gani and Adeoti (2011) who found highly educated farmers to be more likely to participate in marketing of their produce in Nigeria. Similarly, these findings are in agreement with those of Adeoti et al. (2014) who found out that farmers who had attained formal education were more likely to participate in maize markets in Nigeria compared to those who are illiterate.

Grain amaranth price was found to have a positive and significant (P≤0.01) effect in influencing the decision to participate in markets. This implies that a one Ugandan shilling increase in the price of grain amaranth increases the likelihood of participating in grain amaranth marketing by 0.1%. Komarek (2010) argues that prices are an important driver of market entry decisions with a rise in price viewed as a fall in marketing costs or a change in economic conditions such as consumer behavior. These findings augment those of Ouma et al. (2010) who found out that the selling price of both beer bananas and cooking bananas increased the volumes sold to the market by market sellers.

Farm size in this study was found to have a negative and significant effect (p≤0.1) in influencing market participation decisions contrary to *apriori* expectations with a one hectare increase in farm size decreasing the likelihood of participating in grain amaranth marketing by 1.74% (Table 2). The possible explanation for this is the tendency for farmers to shift to the production and marketing of widely known cash crops such as maize following an increase in farm sizes with less land being allocated to crops that are considered to be of low value and where farmers are not certain of the markets. Barret (2008) argues that households with least amounts of land tend to be gross purchasers in the market, with the probability of making gross purchases declining steadily as households land holdings increase. Similarly, Komarek (2010) argues that households which are well endowed with agricultural land are more likely to be commercially oriented, however being endowed with agricultural land has no explanatory power in predicting market participation decision. The findings in this study deviates from a number of market participation studies

Table 3. Factors influencing the level of participation in grain amaranth marketing.

Variable	Coefficient	T-value	P-value
Household head gender (1=Male)	-4.4769	1.06	0.290
Education level of household head	0.9471	1.70*	0.090
Experience in grain amaranth production	0.5982	0.66	0.512
Number of extension visits in past year (2010)	-13.9151	2.06**	0.041
Farm size	-0.0247	0.08	0.936
Grain amaranth yield	0.0365	3.29***	0.001
Grain amaranth price	0.0017	0.49	0.623
Farmer group membership (1=Member)	-5.3059	0.97	0.336
Ownership of bicycle	-7.4397	1.47	0.144
Mbulamuti	14.5574	2.81*	0.006
Namasagali	0.7456	0.14	0.887
Inverse mills ratio	-16.0337	7.38***	0.000
Constant	26.04716	2.08	0.040
F-value	30.40		
Prob>F	0.0000		
R-squared	0.66		
Number of observations	150		

*, ** and *** denote significance levels at 10%, 5% and 1%, respectively.

such as those of Makhura et al. (2001) and Adeoti et al. (2014).

More results revealed that membership to a farmer group positively and significantly (p≤0.01) influenced the decision to participate in grain amaranth marketing. Farmers who belong to a farmer group are 23.22% more likely to engage in marketing of grain amaranth than those who do not belong to any group. The possible explanation for this is that working in a group creates synergy among the farmers and enables them to access market information as well as sharing experiences thereby removing fixed transaction costs faced by farmers when entering output markets. These findings concur with those of Adeoti et al. (2014) who found out that belonging to a farmer group increased likelihood of participating in maize markets in Nigeria. Ohajianya and Ugochukwu (2010) also found out that belonging to a farmer group influenced households to be more of sellers than being autarkic in sweet potato markets in Nigeria.

Determinants for increased level of sales in grain amaranth markets

Table 3 presents factors that influence the level of participation in grain amaranth markets. Education level of the household head, frequency of participation in extension activities, grain amaranth yield, ownership of bicycle statistically influence the levels of grain amaranth supplied to the market. The high R^2 value of 66% shows that the explanatory variables jointly explain 66% of the variation in the dependent variable.

The literacy level of a farmer is related to the way he/she makes marketing decisions and reads market signals. Farmers' education level in this study was found to have a positive and significant (P≤0.05) effect in influencing the level of participation in grain amaranth markets. A one year increase in the level of education increases grain amaranth sales by 0.95% (Table 3). This is because by attaining higher education levels, farmers can easily get and accurately interpret market information and read market signals like prices and frequency of buyers before they sell their produce into the market. The findings of this study concur with those of Tesfaw (2013) and Adeoti et al. (2014) who found highly educated farmers to be more involved in marketing in output markets.

Further still, higher levels of grain amaranth output positively and significantly (p≤0.1) influenced the level of participation by grain amaranth farmers in the market. The results show that one kilogram increase in grain amaranth produced increases in the proportions of grain amaranth marketed by 3.65% (Table 3). The possible explanation for this is due to the ability of these households to produce a marketable surplus after surpassing their consumption needs. These findings concur with those of Komarek (2010) who in a study on the commercialization of bananas, found that its yield positively influenced the quantities of bananas traded; the author further goes ahead to argue that yields realized help to explain market participation decision. Similarly, Tesfaw (2013) also found amount of pepper produced to be a major factor in determining the extent of market participation in Ethiopia. Rios et al. (2008) in a study on linkages between market participation and productivity reported that households with higher productivity tended

to participate more in agricultural markets regardless of market access factors.

Possession of bicycle as a means of transport negatively and significantly (P≤0.1) influenced the level of participation in grain amaranth markets contrary to *apriori* expectations. The possible explanation for this is that most of the marketing is done using farm gate market outlet and where the volumes supplied are few; so this does not necessitate the use of bicycle as a means of transport to access distant markets. Though these findings concur with those of Ouma et al. (2010) who found ownership of bicycles and vehicles to negatively influence participation in banana markets, they contradict the findings by Siziba et al. (2011) and Sigekei et al. (2013) who found ownership of transport means to positively influence the volumes supplied in cereal and pineapple markets respectively.

Furthermore, the number of extension visits in the past year negatively and significantly influenced the level of participation in grain amaranth markets. The possible explanation for this could be as a result of the information disseminated during these visits to be inclined more on the utilization and nutrition aspects of the crop and less on the marketing hence this reduces the volumes supplied to the market in favour of utilizing the crop for nutritional purposes. These findings contradict those of Gebremedhin et al. (2009) who found a positive and significant effect of extension access on the volume of teff sold.

The results also show that farmers who are located in Mbulamuti sub-county significantly (P≤0.05) supplied more grain amaranth to the market compared to those from other sub counties such as Namasagali and Butansi. This could be an indicator of increased commercialization behavior of these famers. The coefficient on the inverse mills ratio was negatively significant implying that there are unobserved factors that affect market participation decision and level of participation in grain amaranth markets and that selectivity bias would have resulted had the grain amaranth sales been estimated without consideration of the decision to sell grain amaranth.

Conclusion

The study has highlighted important factors that influence participation in marketing of grain amaranth. Study findings revealed that output price is a major incentive for initiating entry into output markets due to its direct effect with volumes traded. Similarly, by encouraging collective action efforts through forming groups, farmers are more likely to enjoy benefits associated with collective marketing such as accessing information on where to get better markets and prices and how to reduce transaction costs that usually rise with individual sales transactions. Once market participation decisions are made, yield surpluses become critical for inducing the extent of participation in the markets. Extension agents have a critical role to play by availing the necessary information in terms of crop management and marketing. However, the extent of acceptance of this information is correlated with the education levels of the farmers with highly educated farmers more ready to take up new ideas and innovations and this enhances their willingness to produce more and hence participate in marketing after generating a marketable surplus.

In view of the above, it is therefore recommended that farmers should be encouraged to form groups; this will ensure that they improve on their economies of scale in input and output markets due to their ability to attract favorable price incentives. Governments have a critical role to play in this by facilitating extension agents to initiate group formation and it is important to note that the role of extension agents should be more focused towards promoting growing of grain amaranth as a way of stimulating marketing rather than focusing on promotion of marketing since increased production will derive consumption. Since higher yields are critical in influencing the extent of market participation, it is therefore recommended that research efforts should be more focused on generation and dissemination of grain amaranth varieties that are superior in production, consumption and nutrition attributes.

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