Factors Influencing on-Farm Common Bean Profitability: The Case of Smallholder Bean Farmers in Babati District, Tanzania

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Abstract

Legumes are important food and cash crops in developing countries. In Tanzania, more than half the farmers grow several species of grain legumes which include common bean, groundnut, pigeonpea, cowpea, chickpea, peas and soybean. However, productivity of all grain legumes is still low and far below potential and this has impacted on profitability. The aim of this study was to contribute to improved bean profitability facts for income and food security in Tanzania. Multistage sampling procedure was used to select respondents from the four divisions in Babati district (Babati, Gorowa, Mbugwe and Bashnet). The first stage involved a purposive selection of two divisions from the four divisions mentioned. The second stage entailed the selection of six wards from the two divisions, using purposive sampling technique; four from Bashnet division and two from Babati division. The fourth stage entailed purposive selection of 9 villages from the six wards basing on bean production dominance. Then the final stage employed systematic sampling technique to select 200 bean farmers from the nine villages. Primary data was collected from the field using a structured interview schedule method. Secondary data were obtained from published literature from Babati District Council, Sokoine National Agricultural Library and Egerton University main library. Smallholder farmers' gross margin as a proxy of profitability was analysed using Gross Margin Analysis procedure. Moreover, Multiple Regression Analysis approach was used to analyse factors affecting on-farm farmers' gross margin. The study results showed that, at farm level, a gross margin of TZS 133,710.20/= (US$63.67) and TZS 307,283.70/= (US$146.33) for local and improved variety respectively was generated per acre per season. Moreover, age of respondents; gender; yield; selling price (farm-gate price); access to credit; and off-farm income affected the gross margin realized by smallholder farmers.

Keywords: Improved variety, Babati, VSLA, common bean, profitability

1. Introduction

Agriculture plays a fundamentally important role in the economic growth and development prospects of a vast majority of developing countries including Tanzania (WTO, 2000). The sector contributes almost a quarter of Gross Domestic Product (24.1%) and employs 75% of the active labour force in Tanzania (Economic Survey, 2011 and URT, 2013). Amongst the important agricultural subsectors in Tanzania are livestock, fishery, agro-forestry and crops (URT, 2013). The major food crops in the country include maize, sorghum, millet, rice, wheat, cassava, potatoes, bananas and legumes (OECD/ADB, 2012). Moreover, the principal export crops include coffee, tea, cotton, cashew nuts, sisal, oil seeds, horticultural crops, pyrethrum, fresh cut flowers, cloves and spices (UNESCO, 2011).

Legumes represent an important component of agricultural food crops in developing countries as they complement cereal crops as a source of protein and minerals especially in Sub-Saharan Africa (Akibode, 2011). Grain legumes also serve as rotation crops with cereals, reducing soil pathogens and supplying nitrogen to the cereal crop (Beebe, undated). Food legume crops are considered vital crops for achieving food and nutritional security for both poor producers and consumers (ICRISAT, 2012). Food legumes as well play an important role as a source of animal feed in smallholder livestock systems (*ibid*). Food legumes moreover have higher prices, compared to cereals, and are increasingly grown to supplement farmers' incomes (Gowda *et al*., 2009 and Giller, 2012). One of the important legume crops grown in Tanzania is common bean. Common bean (*Phaseolus vulgaris L.)* is the most important food legume for direct consumption and as a source of farm income in Tanzania (NBS, 2012). In the country, beans are often cultivated by smallholder farmers for food consumption without the use of fertilizers where quarter to one-third of the households sell their beans (Ndakidemi *et al*., 2006), with around 20% surplus being marketed (FAO, 2005). Common bean is a popular crop among small-scale farmers because beans are a short duration crop (2.5-4 months) which permits production even when rainfall is erratic (CIAT, 2008). This helps in shortening the hunger periods as well as for providing quick cash (*ibid*). The average bean productivity in Tanzania is around 662 kg/ha (Ndakidemi *et al*., 2006). However, the potential productivity under reliable rain-fed conditions, using improved varieties under proper crop and land husbandry is 1,500–3,000 kg/ha (*ibid*).

In Manyara region, beans dominate the production of pulse crops (URT, 2003). The production of beans among other legumes is much higher in Babati than in other districts in the region. The planted area using improved

seeds is more than 41,000 ha, which represent more than 15% of the total planted area with the annual crops and vegetables (URT, 2013). The number of households in Manyara who were reported to be selling common bean in 2010/2011 season was 88,121 (58.6%), of the total number of crop growing households (NPS, 2011). The percentage of crops growing households selling common bean was highest in Babati (81%) followed by Kiteto (55%), Hanang (52%), Mbulu (48%), and Simanjiro at 23% (ibid).

1.1 Objectives

The overall objective of the study was to contribute to common bean improved profitability facts for income and food security in Tanzania.

1.1.1 Study description

The study was carried out in Babati District of Manyara region in Tanzania located at 4°14'08.2"S 35°30'46.0"E. The region was conveniently chosen because of its potential in grain legumes production among other factors which favoured this study. The main economic activities in Manyara Region are agricultural production, livestock keeping and mining. Agricultural production is dominated by peasant farming. The major food crops and cash crops that are cultivated by smallholder farmers include maize, food beans, pigeon peas, sunflower, onions, garlic, coffee, paddy and finger millet (URT, 2003).

The sample size was 200 drawn from a population of common bean smallholder farmers with less than or equal to two hectares under common bean. The sampling units were the households from the sampled villages in the study area. Moreover, because common bean smallholder farmers were evenly distributed among the two selected divisions, 100 farmers from each division were sampled to make a targeted total sample size of 200 farmers. In Bashnet division; out of 11 wards, the sample was drawn from Bashnet, Nar, Dareda and Ayalagaya. Specifically, farmers forming the sample were residing in the villages of Long and Bashnet in Bashnet ward. Respectively, 30 and 10 households from Long and Bashnet villages were systematically selected from a farmers' sampling frame. 10 households were conveniently sampled from Gabadaw village, which is among the only 2 villages in Nar ward. On the other hand, Seloto among 3 villages in Dareda ward was purposively selected. From this village, 25 households were sampled. Hayesam village, among 3 villages in Ayalagaya ward was conveniently selected, where 25 households were sampled to complete a list of 100 households from Bashnet division.

On the other hand, from Babati division, Gallapo and Qashi wards were purposively selected. Gallapo and Endanoga villages among 5 in Gallapo ward were subsequently selected basing on the same approach. 20 households from each village were sampled. Tsamas and Ng'wang'weli villages were purposively selected amongst 6 villages in Qashi ward. 40 and 20 households, respectively, were sampled from these two villages. This is because, according to Ms Manzi, the public extension officer and the sampling frame, there were more common bean farmers in Tsamas as compared to Ng'wang'weli. 40 and 60 households sampled from Gallapo and Qashi wards respectively made another 100 household to complete a total sample size of 200 households. Primary data such as social-economic status of households and institutional characteristics like farmer's age, gender, years of schooling, farming experience, main occupation, household size, the income profiles, distance to the market, extension contacts, group membership, credits, cropping and farming characteristics were collected from the smallholder farmers in the field using structured interview schedules method. In addition, secondary data such as district production estimates and costs including average input prices, yearly quantities of seeds produced along with the supply of fertilizers and agro-chemicals was obtained from published literature and key informants from Selian Agriculture Research Institute (SARI) and Babati District Council in the agriculture department. Published literature such as books, journals and articles were reviewed from Sokoine National Agricultural Library, Egerton University main library and the internet to get a robust of information related to this study.

To achieve the objectives of the study, several statistical techniques and methodologies were employed during data analysis including Descriptive Statistics, Gross Margin analysis and empirical models. The descriptive statistics and analysis of Gross margin were done on MS Excel while the empirical models were run in SPSS (version 22) and STATA computer software.

2. Results

The study sampled 200 households. Among the interviewed farmers, 81.4% were male and 18.6% were female. 52.5% of common bean farmers were aged between 40 to 60 years. Based on Tanzanian education system, 73% of respondents had primary school education. The average farming experience was found to be 18 years. On the other hand, the common bean farming experience of the household head was 17 years while common bean marketing experience was found to be 14 years. The average land owned by sampled smallholder farmers was found to be 2.48 Ha. The findings indicated that 43% of the land was allocated to cereals, 29% and 14% to beans and other legumes respectively. Study results show that, the average working hours for men is 5 while that for women is 7 hours a day. Land preparation, sowing and weeding activities are done by women at 54%. In addition, harvesting, threshing and transportation of threshed bean to home are equally done by male and female at 32%. Furthermore, storage and marketing activities are done by men at 53% compared to 16% by women. 55% of

respondents growing local bean variety and 74% growing improved bean variety, intercropped with maize. Local and improved bean varieties were mono-cropped by 38% and 20% of smallholder bean farmers respectively. The average productivity of local and improved bean variety is 594.45Kg/Ha and 695.44Kg/Ha respectively.

Table 1: Babati District Local and improved Bean variety productivity

Crop grown	Total Area(Ha)	Total yield (Kg)	Productivity (Kg/Ha)
Local bean variety	123.45	73,385	594.45
Improved bean variety	21.20	14,740	695.44

Among the sampled farmers, 47% of common bean farmers had off-farm income generating activities. The average distance to the nearest market was 2.88 Km, 6.20 Km to the most visited market and 10.51 Km to the most preferred market. The transport cost was TZS 24/= /Kg to the nearest and most visited markets while TZS 26/=/Kg was the cost of transporting common bean to the most preferred market. The most common modes of transport to the markets are vehicles (34%) and animal carts (31%). Other modes are head loading (16%), pack animals (10%) and motorbikes (8%). 26% of smallholder farmers sell their beans on-farm, 58% to local market, 14% to main road, and 2% to district market. In all the buying points, 23% of buyers are local assemblers, 25% wholesalers, 29% retailers, 12% urban collectors, and 11% direct consumers.

At farm-gate, improved bean variety fetched an average price of TZS 1,023.68/= (US$0.49) per Kg while at the market level, 1 Kg of improved bean variety was sold at an average price of TZS 1,208.33/= (US$0.58). Local bean variety fetched an average price of TZS 770.87/= (US$0.36) and 914.38/= (US$0.44) per Kg at farm-gate and market level respectively.

Table 2: Babati District Local and improved Bean variety prices

Category	Farm gate (TZS/Kg)	Farm gate (US$/Kg)	Market (TZS/Kg)	Market (US$/Kg)
Improved variety average price	1,023.68	0.49	1,208.33	0.58
Local variety average Price	770.87	0.36	914.38	0.44
Difference (TZS/Kg)	252.82	0.12	293.95	0.14

The 7% of interviewed farmers had access to credit. 60% of the smallholder farmers obtained their credit from VSLA; 20% from banks; 13% from SACCO; 7% from other sources. 47% of the sampled smallholder farmers in the study area have access to extension services. 31% of them received advisory services during the outbreak of disease and or pests; 28% harvesting; 24% got the service during sowing time. Farmers get information on improved bean varieties through field days/visits from other NGOs at 48%, researchers (25%), SARI/CIAT (18%) and government (9%). Farmers get information on improved varieties through direct trainings from the government (35%), other NGOs (31%), SARI/CIAT (27%) and researchers (6%). 17% of the interviewed smallholder famers had group membership.

An average produce of 358.70Kg and 72.095Kg per season, per smallholder farmer, for local and improved variety respectively. Moreover, the average farm-gate prices were TZS 962.18/= (US$0.45) and TZS 1,161.67/= (US$0.55) per Kg for local and improved variety correspondingly. The average total revenue of common bean per smallholder farmer at farm level was TZS 428,884.57/= (US$204.23) / acre per season. TZS 345,133.97/= (US$164.34) from local bean variety and TZS 83,750.60/= (US$39.88) from improved bean variety. The total costs incurred during production was TZS 117,401/= (US$55.90) per season. The Gross Margin (net profit margin) was TZS 311, 483.56/= (US$148.33) per season.

Table 3: The results of the profit margin of common bean at farm level

VARIABLES	LOCAL VARIETY	IMPROVED VARIETY
REVENUE		
Average produce (Kg/season/Farmer)	358.70	72.10
Total Land/Area under Beans(Acres)	305.06	52.38
Total Yield (Kgs)	73,385.00	14,740.00
Productivity (Kgs/Acre)	240.56	281.43
Average farmgate (TZS/Kg)	962.18	1,161.67
TOTAL GROSS MARGIN/ACRE/SEASON	**231,464**	**326,931**
PRODUCTION COSTS		
Labour	40,298.46	8,099.54
Seed	43,410.06	8,724.94
Fertilizer	2,831.00	569.00
Pesticides	7,225.71	1,452.29
Others	3,988.38	801.62
TOTAL COSTS/ACRE/SEASON	**97,753.61**	**19,647.39**
PROFIT MARGIN/ACRE/SEASON	**133,710.20**	**307,283.70**
Total Gross Margin/Total Variable costs per season	**1.37**	**15.64**
Net profit/Gross Margin*100	**57.77**	**93.99**
Profit Margin/Average produce	**372.76**	**4,262.21**

US$ 1~TZS 2, 100

3. Discussion

Common bean business has preponderantly attracted male farmers and generates significant income. Men are attracted to agricultural activities which generate sizeable income. Often for a crop cultivated by a large number of women, the produce is consumed at home or sold to generate family income. This indicates that common bean is a traditional crop cultivated by older farmers. This means that farmers have basic education and can be considered literate. Education can be considered to be important as it makes a farmer innovative and also easily understand concepts that are taught in the trainings and consequently adopt new technologies with ease. This implies that, smallholder farmers in Babati district consider common bean as second most important crop after cereals (mainly maize) when allocating land. The higher proportion of labour force in common bean production is offered by women. Moreover, most of common bean produced by women are grown on smaller plots of land and only consumed at home. Smallholder farmers in the study area prefer intercropping to other systems because, common bean, as other legumes fix soil nitrogen which caters as fertilizer for cereals like maize.

A farmer who grows improved bean variety harvests 100.99Kg more on land of the same size as compared to the counterpart growing local bean variety. Smallholder farmers distribute risk through investing in off-farm activities which are more liquid such as retail trading thus a reliable insurance during hunger periods. Improved bean variety fetched TZS 252.82/= (US$0.12) and TZS 293.95/= (US$0.14) per Kg more at farm-gate and market level respectively. This is because; improved bean variety has customer desirable characteristics such as shorter cooking time, single seed colour, and pleasant taste. The stringent rules to obtaining and repaying credit determined the amount of credit to be invested in farming. Most of credit beneficiaries preferred investing their credit in crops which they may harvest in as short time as possible, crops like common bean were most preferred. The main constraints to accessing credit were mainly due to failure in meeting the criteria of loans such as an evidence of reasonable commitments in cash or in kind. The other obstacle to farmers towards accessing credit was absence or poor business records which track their historical business information.

Extension service is still a constraint to majority of smallholder farmers in Babati district. This is due to the fact that farmers depend heavily on government extension officers who are very few and each has too large coverage area to manage, and therefore do not reach as many farmers as possible. Smallholder farmers have enough channels for receiving information. However, farmers are pessimistic about some sources of, and information conveyed to them especially on prices and seed quality from buyers and seed dealers respectively. Information received by common bean farmers affects decisions made, and the transaction costs. The role of collective action in mitigating the challenges facing farmers is still underutilized. Group membership would significantly influence the output of bean producers. This implies that producers still get profit from their produce though they are always exploited by traders. The implication of low profit margins earned by smallholder farmers could be attributed by relatively small quantities of output, growing of local bean varieties which fetch relatively low prices as compared to prices paid to improved varieties, and poor access to market information especially on demand and supply to urban areas. Poor access to market information allows the smallholder farmers to sell their produce at low farm gate prices.

Socio-economic factors influencing the profit margin were; age of respondents; gender; yield; selling price (farm-gate price); access to credit; and off-farm income affected the gross margin realized by smallholder farmers.

Table 4: Regression results of factors affecting common bean's gross margin

Variables	Coefficient	Standard Error	P>t
Age	-0.1107	0.03695	0.003
Gender	0.21237	0.10856	0.052
Farming experience	-0.48441	0.38595	0.211
Household size	-0.2303	0.16015	0.152
Bean yield	0.29613	0.01532	0.000
Land size	-0.19234	0.27054	0.478
Most visited market	-0.12461	0.19418	0.522
Farm-gate price	0.14054	0.01415	0.000
Access to market information	-0.06972	0.05043	0.488
Access to credit	0.32619	0.17604	0.066
Access to extension	-0.07379	0.09223	0.425
Off-farm income	-0.15378	0.0895	0.087

Number of obs = 204; F (12, 191) = 109.93; Prob > F = 0.0000; R-squared = 0.8811; Adj R-squared = 0.8731; Root MSE = 1.2e+05

The study results indicate that, age of respondents had a negative effect on profit margin. A unit increase in age led to a decrease in profit margin by 0.1107 units at 1% level of significance. This is because the innovativeness and optimism of the entrepreneur as well as his mental capacity to cope with the challenges of his business activities and his mental and physical abilities to do manual work decrease with age. The study results concur with those by Nwaru and Iwuji (2005) who reported that entrepreneurship gradually becomes less as the age of the entrepreneur increases.

In addition, study results indicate that gender of respondents had a positive effect on profit margin. Being male would lead to an increase in profit margin by 0.21237 units at 10% level of significance. The positive effect of gender on profit margin of the producers is explained by aspects of labour provision and adoption of technologies in agricultural production. Female farmers on one hand, perform most of farm activities and work longer hours as compared to male farmers on the other hand. However, most female farmers produced common bean in small quantities for home consumption only. In addition, male farmers who mainly produced common bean in larger quantities for selling, quickly adopted new technologies as compared to female farmers because they were the ones who were mostly attending trainings, which eventually enabled men to fetch relatively more profit compared to women. Combined efforts in common bean production could reflect high produce for sale, and in return, the more the profit can be generated. This observation compares to the studies by Tesfaye *et al*. (2001) and Mesfin (2005) who reported that, gender influences adoption of technology like common bean variety in Ethiopia, which affects the total earning from the farm. They further informed that, male farmers are more likely to adopt new technology which positively influences their gross margins.

Furthermore, common bean yield had a positive effect on profit margin. A unit increase in common bean yield led to an increase in profit margin by 0.29613 units at 1% level of significance. Ideally, when smallholder farmers get more units of common bean which sells at a per unit profit, more profit is fetched from the quantity being sold. Smallholder farmers who realised higher output supplied larger proportion of their beans to the market. The results showed that farmers who increased their output increased the quantity of marketable supply. This study corresponds to Birachi *et al*. (2011) who reported that, the quantity of beans produced greatly influence the quantity marketed. Moreover, Katungi *et al*. (2010) observed that, farmers with higher bean output have the potential for commercialisation that could increase their incomes thereby enabling them purchase more inputs to increase output.

Selling price (farm-gate) had a positive effect on profit margin. A unit increase in farm-gate price led to an increase in the profit margin by 0.14054 units at 1% level of significance. A positive coefficient of selling price implies that a unit increase in selling price led to increased profit margin of smallholder farmers. Ideally, when smallholder farmers sell at high prices, more profit is fetched from the products being sold. This is in line with the study by Nekesa *et al*. (1998) who reported that, prices offered to smallholder farmers positively impacted their incomes from bean. The report further asserts that, the attained incomes from common bean as a result of good prices offered to these farmers help in commercialization of the enterprises.

Study results show that, access to credit had a positive effect on profit margin. A unit increase in the credit accessed by common bean farmers led to an increase in the profit margin by 0.32619 units at 10% level of significance. Perfectly, credit facilitates the introduction of innovative technologies and ensures input and output marketing arrangements. The results concur with that of Reddy, 1998 who reported that, having access to credit services enable farmers to purchase improved varieties and hence increase productivity and profitability at farm level.

Off-farm income generating activities had a negative effect on profit margin. A unit increase in off-farm activities led to a decrease in profit margin by 0.15378 units at 10% level of significance. This implies that, when a smallholder farmer owns a more rewarding off-farm income generating activity, the more she/he concentrates to that business and light-touches the common bean business which leads to low and low gross margins. Preferably, when smallholder farmers have a non-farming, and most rewarding business, they tend to opt and concentrate on that business and give less priority to common bean business which leads to low gross margins realized from farming. This is contrary to the result reported by Techane (2006) who found that participation in off farm activities increases the smallholder farmers' financial capacity and profitability after investing on new technologies.

4. Conclusion and recommendation

The Gross Margin (Net Profit Margin) per acre was TZS 133,710.20/= and TZS 307,283.70/= per season for local and improved variety respectively. This indicates that, common bean farming in Babati district is profitable and plays an important role in rural poverty reduction, through creation of employment and wealth for women, men and youth. Moreover, common bean farming in Babati enhanced household nutrition and general food security. The socio-economic factors determining common bean on-farm level gross margin were age of respondents; gender; yield; selling price (farm-gate price); access to credit; and off-farm income. Furthermore, factors influencing the household common bean supply to the market were age of respondents; gender; family size; education level (years of schooling); farm-gate price; distance to the market; and off-farm income. Therefore, this study positively contributes to improved bean profitability for income and food security as articulated in the United Nations Sustainable Development Goals I and II.

This study recommends that; smallholder farmers should allocate more land to production of improved bean variety; and improve on use of recommended fertilizers, at the right calibrations to enhance bean productivity to the potential level. Moreover, in the context of bean production, there is need for the Ministry of Agriculture, Food Security and Cooperatives (MAFSC) to take lead in interventions towards improvement of farmers' extension service and training which will be attributed as approaches for fighting killer diseases such as early-blight, and pests like aphids. Trainings suggested are on correct pesticides use; good agricultural practices including growing improved seed varieties; and record keeping. Improved varieties were relatively more productive, pests and disease resistant, and incurred less cost of production as compared to local varieties. Furthermore, the National Beans Programmes carrying out research in the country are advised to have proper mechanisms of disseminating and monitoring new seed varieties in the industry. This is because, most of farmers either have not heard about the improved variety, which are relatively highly producing, or fail to differentiate between QDS normally improved and counterfeit.

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