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Research paper

Accounting Costs: The Case of Mid-Altitude Smallholder Maize (*Zea mays L.*) Production as a source of income in Arsi Negele District

Guta Bukero

Ethiopian Institute of Agricultural Research, Wondo Genet Agricultural Research Center, P.O.Box, 198, Shashamene, Ethiopia. Correspondent Author's email: ggutabukero@gmail.com

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In Ethiopia, efforts for achieving broad-based, accelerated and sustained economic growth particularly in agriculture are geared to sustainably increase the productivity of the sector by improving the role of farmers and attain better food security and incomes, while meeting overall goals of the Ethiopian Growth Transformation Plan. For this study, 50 smallholder producers were contacted through a structured questionnaire to collect detail information on the cost of input used and its grain yield value and an estimated value of maize crop residue. Descriptive statistics and cost-benefit analysis technique was used to identify farmers' net return and cost benefit ratio. The results showed that the smallholder cultivation of maize was profitable in the study district. The smallholder maize production has generated a net benefit of 9231.9 ETB per hectare with the variable production costs of 13610.2 ETB per hectare with the BCR of 1.7. Although smallholders' maize production is profitable, the yield is by far lower than the national average and implying that there is a room to increase yield. So efforts should be made to facilitate the availability of improved seed and fertilizers at a good price for the smallholder farmers, and capacity building for the implementation of existing technologies in the fields.

Key words: Maize, Gross return, Net return, Cost benefit ratio (BCR)

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INTRODUCTION

Background

In industrialized countries, maize is largely used as livestock feed and as a raw material for industrial products, while in developing countries, it is mainly used for human consumption. In sub-Saharan Africa, maize is a staple food for an estimated 50 percent of the population. It is an important source of carbohydrate, protein, iron, Vitamin B, and minerals. For instance, *injera* in Ethiopia, *tuwon-masara* and *akamu* in northern Nigeria, *koga* in Cameroon and *ugali* in Kenya. It is also used as animal feed and as raw material for brewing beer and for producing starch (Anonymous, 2008).

In Ethiopia, efforts for achieving broad-based, accelerated and sustained economic growth particularly in agriculture are geared to sustainably increase the productivity of the sector by improving the role of farmers and attain better food security and incomes, while meeting overall goals of the Ethiopian Growth Transformation Plan (MoFED, 2010). The total annual production area and productivity of maize exceed all other cereal crops except *teff* (Mosisa *et al.*, 2012; CSA, 2014). Considering its importance, wide adaptation, total production, and productivity, maize is regarded as one of the high priority food security crops in Ethiopia, the second-most populous country in sub-Saharan Africa (CSA, 2011)

However, agriculture in Ethiopia is confronted with

many challenges like slow rates of adoption of yield-enhancing technologies and practices; limited availability and use of good quality inputs; poor post-harvest management practices and storage facilities; poor infrastructure; increased prevalence of pests and diseases; and limited access to markets and market information.

The Ethiopian agricultural sector is best characterized by a low input-low output system. At present, the use of herbicide, pesticide, and fertilizer is minimal. Multiple factors may contribute to this minimal input usage. For instance, farmers lack trust in the quality of the inputs they purchase and the financial resources to pay for the agricultural inputs like seed as they are mainly obtained from informal sources (Guta *et al*, 2018). Irregular and low demand, high transaction costs creating low profitability have discouraged input suppliers to cater to smallholder farmers. Because of this, the study looked at the profitability of maize production among the small scale farmers and examined the socioeconomic characteristics of maize growers of this crop.

The questions to be answered by this study are: 1) is the production of maize at household level profitable? And 2) what is the benefit-cost ratio for maize production at the household level for the study area? The Objective was to study and document input-output relationships (the cost and profitability) of mid-Altitude maize production.

The rationale of the study is that, maize production may not be to only fulfill the household food need or subsistence. The farmers may be interested in selling their output to raise income. Farmers like any other entrepreneurs would be interested in the profitability of the farm enterprise. Therefore, this study aims at contributing to fulfillment of the national growth and transformation plan objectives of poverty eradication through availing up-to-date informed decision making tools that are necessary for agricultural output expansion.

METHODOLOGY

Study Area and Sampling Technique

The study was conducted in Arsi-Negele district, which is located in West Arsi zone of the Oromia Regional State, Ethiopia. The district is located between 7.15°N to 7.75°N latitudes and 38.35°E to 38.95° E longitudes (Zenebe Mekonnen *et al*., 2017).

The altitude of the district ranges from 1500 to 2300 meters above sea level; Gara Duro is the highest point. Rivers include the Gedamso, Lephis, Huluka, Awede Jitu, Awede Gudo, and Dadaba Gudo. A survey of the land in this district shows that 29.9% is arable or cultivable, 4.3% pasture, 5.2% forest, and the remaining 60.6% are considered swampy, degraded or otherwise unusable (Wikipedia, 2017).

The Arsi-Nege1e farming zone is one of the potential areas for maize and wheat production in Ethiopia. Crop and livestock production is the major source of livelihood for the farmers (Yeshi Chiche, 2001).

With respect to sampling technique, the purposive sampling technique was applied to identify major maize producing districts in West Arsi zone out of which Arsi Negele was selected randomly and then potential maize producer kebeles within the district. Then, a simple random sampling technique was used to identify maize producing farmers among which 50 farm households were contacted through a structured questionnaire to collect detail information on the cost of maize production and its grain yield and residue value (calculated at farm gate price existed during that period).

Data Collection and Analysis method

Cross-sectional data were collected from the Arsi Negele district of the West Arsi zone in Ethiopia, in 2018. Both primary (data through a structured questionnaire) and secondary data were used for the study.

Descriptive and cost and benefit analysis techniques were used to identify farmers' net return and benefit cost ratio. Definitions of some terms and the methods of calculations are described as follows:

Average yield: it is the quantity of output produced per unit area. Yield is expressed in kg/ha.
Output prices: we used farm gate prices to compute returns. The farm gate price of the output is the value (price) farmers receive or can receive for their harvested crops. In other words, it is the price farmers received at the end of the production process.
Gross Return: the gross return is the product of the farm gate price of the output and the adjusted yield. Farm gate prices have been derived from a field survey conducted. Therefore, the profitability of maize production was identified using BCR as follows:

$$\mathrm{BCR} = \frac{\mathrm{GR}}{TVC}$$

Where BCR: is Benefit-Cost Ratio
GR: Gross Return, and TVC: Total Variable Cost

The break-even and sensitivity analysis were also evaluated for smallholder maize producers. Break-even analysis refers to the point in which total cost and total revenue are equal. This estimation is paramount for any business owner because the breakeven point is the minimum profit when determining revenues. The break-even was computed as the total costs / total output.

Similarly, sensitivity analysis was done by different scenarios of uncertainty events. Sensitivity is done to examine how sensitive is the production of the fluctuations in the values of the variables.

RESULT AND DISCUSSION

Socioeconomic characteristics of the farm households

The average family size of households is 5 persons (productive force) while the non-productive average family size was found to be 4, which is an indication that this result is similar to the findings of Truneh A. *et al.,* (2000) in the central parts of Ethiopia. The socio-economic characteristics of the respondents reveal that (65%) of the respondents were within the age range of 15-64 years that is defined as economically productive, while 35% fall within the age group classified as dependents, with a mean age of 41 years. Similarly, the mean class of the educational level of the respondents was 7.7 implying that the respondents on average have completed elementary school (Table 1).

Table 1: Socioeconomic characteristics of respondents in the study area

Characteristics	Mean	Minimum	Maximum
Age (years)	41.2	25	77
Education level (years)	7.7	2	15
Experience in maize production (years)	20.4	3	49
Total land size (ha)	1.2	0.2	3.1
The area under maize (ha)	0.5	0.2	1
Family size			
<= 14	4	0	11
Between 15-64	5	2	10
> 64	0.06	0	1

Source: Survey data, 2018

Land holdings among the respondents ranged from 1.2 ha to 3.1 ha with the mean of 1.2ha while land under maize for farmers ranging from 0.2 to 1 hectare with a mean of 0.5. Some of the respondents hired additional land to grow maize cultivars. The findings of Yohannes Kebede *et al.* (1990) also showed that farm size was significantly related to the use of improved practices in some parts of Ethiopia.

Cost and benefit analysis of maize production

In this section the results obtained from the cost-benefit analysis are explained for the maize production at the farm household level. Labor cost for agronomic management except land preparation and sowing accounted for about 38% of the total cost of production (Table 2). The inputs for which cost is accounted include compost, seeds, labor, UREA, DAP, pesticides, labor force, and harvested yields.

Table 2: Cost of smallholder maize production per hectare

Items	Cost of production (in ETB)	% of the total cost
Maize Seed cost	554.5	4
Fertilizer cost	2381.3	17
Agrochemical cost	98.6	1
Cultivation cost	4126.8	30
Labor cost	5174.8	38
Transportation cost	1274.1	9
Total	**13610.1**	**100**

Source: Survey data, 2018

The gross return from maize production was found to be 22,842.1 ETB (including both grain and Stover) with the yield of maize being 3070 kg/ha (Table 3).

Table 3: Summary grain yield and value of maize production per hectare

Items	Amount
Yield in (kg)	3070
Income from grain(in ETB)	20874.2
Gain from Stover (in ETB)	1967.9
Gross return from maize (in ETB)	22842.1

Source: Survey data, 2018

The results in (Table 4) show that the cultivation of maize was profitable for the smallholder maize producers in the study area. Maize production generated a net benefit of 9231.9 ETB per hectare with the variable production costs of 13610.2 ETB. The benefit-cost ratio of producing maize was found 1.7 indicating that i.e. for every rupee investment, farmers were getting Birr 0.7 returns on investment (70% returns for a birr investment).

Table 4: Profitability analysis of maize production

particulars per hectare	Value (in ETB)
Overall Cost of production	13610.2
Gross Return /ha	22842.1
Net Return/ha	9231.9
Benefit-Cost Ratio (BCR)	1.7

Source: Survey data, 2018

The Break Even Yield and Price

A breakeven point analysis, in this case, was used to determine the number of units or revenue needed to cover variable costs of maize production at the smallholder level. In this case, the cost variable should reflect total economic costs and the output should reflect only the marketable output, i.e. excluding waste, losses and own consumption. This ratio represents the “breakeven” price or the price to cover the production cost for a unit of product. If unit farm-gate prices are higher than the breakeven price, the farm operation makes an economic profit. The breakeven price and production for maize was found to be 4.4birr/kg and 2000kg/ha respectively.

Sensitivity Analysis

The sensitivity of maize production was tested in the following scenarios, assuming other variables are constant. Based on the listed scenarios, the effect of the variables to net return and benefit-cost ratio (BCR) of maize production were examined as presented in the table below.

Table 5: Sensitivity Analysis of maize production at household level

S/N	Changes in Scenarios	Gross Return	Total Cost	Net Return	Benefit-Cost Ratio (BCR)
1	When the yield of maize decreased by 10%	20557.9	13610.2	6947.7	1.5
2	When the price of maize decreased by 10%	20756.3	13610.2	7146.1	1.5
3	When the variable cost of maize production is increased by 10%	22842.1	14971.2	7870.9	1.5
4	When the variable cost of maize production is increased by 10% and yield of maize is decreased by 10%	20557.9	14971.2	5586.7	1.4
5	When the variable cost of production increased by 10% and the price of maize decreased by 10%.	20756.3	14971.2	5785.1	1.4
6	When both yield and price of maize decreased by 10%	16909.6	13610.2	3299.4	1.2
7	When the yield and price of maize decreased by 10%, and variable cost increased by 10%.	16909.6	14971.2	1938.3	1.1

Source: Survey data, 2018

Keeping other things constant, When Price is decreased by 10%, the production of Maize provides a net return of 7,146.1birr/ha. Similarly, it is shown that when both yield and price is decreased by 10%, investing in maize production is still profitable resulting in the same benefit cost ratio (BCR) of 1.5. This indicates that the production of maize is financially feasible as BCR was greater than one. It shows that if 1 birr is invested in the production of Maize it yields a net benefit of birr 1.5 in this scenario. The result showed that even though the selected scenarios changed together the production is still financially feasible.

SUMMARY, CONCLUSION, AND RECOMMENDATION

Summary and Conclusion

This report performs a cost-benefit analysis of maize production in the Oromia region of Ethiopia particularly in the Arsi Negele district using the survey data and the simple cost accounting method. The survey was conducted in 2018 and covered the selected maize producer households.

The results showed that the maize production has a potential of 3070 kg grain yields (lower average yield than the national average) and generated a net benefit estimated to 68% of the per hectare maize production cost (TVC). Generally, this study proved that maize production at small holder farmer is financially feasible in the study area. The results showed that the maize production has a benefit cost ratio of 1.7 (implying that it is financially feasible).

Recommendation

Although smallholders' maize production is profitable, the yield is by far lower than the national average and implying that there is a room to increase yield. So efforts should be made to facilitate the availability of improved seed and fertilizers at a good price for the smallholder farmers, and capacity building for the implementation of existing technologies in the fields. Similarly, increasing the utilization of commercial inputs in maize production should be the focus of government intervention to overcome the low maize yield situation in the study area.

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