Analysis of the Profitability of Potato Production: The Case of Ejere District, West Shewa Zone of Oromia, Ethiopia

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Abstract: The study was done in Ejere District of West Shewa Zone of Oromia, Ethiopia. The study aimed at analyzing the profitability of potato production. The study was conducted based on the primary data collected from 120 sample respondents those randomly selected from four potato producing kebele administrations. Descriptive statistics and enterprise budgeting techniques were employed in the analysis. The results descriptive analysis has shown that average size of land allocated for potato was about 0.65 ha whereas average potato yield was about 195 q/ha. From inputs used labor and seed demand the largest share of variable input cost, the cost of labor and seed comprised 29.31% and 26.83%, respectively. The analysis of cost and return shows that potato production profitable. As revealed from the enterprise budgeting result potato production was a profitable were farmers earned a net profit of 29,792.45 ETB at suitable environmental condition. Potato output fetch highest price at off-season time, this an indicator for the necessity of processing and modern storage mechanism. To achieve increment in productivity the use of improved varieties and practices induce the return from the potato output. The result shows there is an opportunity to increase profitability of potato production by making efficient use of resources and technologies. Thus, effort of different stakeholders should focus on generation of improved potato seed, technology transfer and capacitating farmers skills to increase potato productivity and profitability of farmers.

Keywords: Enterprise, Cost, Return, Profitability, Potato, Ejere.

1. INTRODUCTION

Agricultural sector accounted 38.8% of real GDP in 2014/15 fiscal year and leading sector in terms of contribution to the country's overall economy. It is a major source of food for domestic consumption, raw materials for the domestic manufacturing industries and primary commodities for export. The agricultural sector contributes 73% of employment, and supplies 70% of the raw-material requirements of local industries [1]. About 83% of the Ethiopian population is living in rural areas, creating their income from agriculture and relying on a limited resource-land [2]. About 70% of foreign exchange was derived from agricultural exports [3].

As part of the struggle for food self-sufficiency, the country has been made efforts to promote the use of improved agricultural technologies and inputs to make land and labor more productive and thereby improve the livelihood of smallholder farmers. The extension services provided by the Ministry of Agriculture and Rural Development and research institutions have been provided farmers with technologies that are developed on stations and on farmers' fields. Potato is one of the economically most important crops in Ethiopia play key roles as source of food and cash income for small-holder farmers.

In view of this, a widespread use of appropriate technologies is essential to increase crop, livestock and land productivity. Profitability and the degree of risk and uncertainty associated with improved technology are important economic considerations in technology adoption. In addition, adoption of a new technology is highly influenced by the capital requirement, agricultural policies, and socio-economic characteristics of farmers. Development of useful and compatible improved agricultural practices for small farmers in developing countries requires assessment of the practice with respect to multitude socio-economic, natural and technical factors [4].

Potato (Solanum tuberosum L.) is an important food security crop in Ethiopia that is grown in widely differing agroecological zones of Ethiopia [5]. Potato is economically one of the most important crops in Ethiopia that play key roles as source of food and cash income for smallholder producers. Empirical evidence shows that different kinds of root crops are cultivated on about 466,984 hectares of land. There were 2.90 million farmers cultivated root crops. Potatoes, sweet potatoes and onion constituted 60.4, 17.2 and 7.3 percent of the country's land under root crops respectively. These crops contribute 50.2, 20.8 and 13.6 percent of the volume of root crops production [6]. There is a potential for potato to contribute for the national economy of the country especially via its value-added products. Recently, there is increasing in area coverage across almost all agro ecologies such as the southern, central, eastern and northern regions. Ejere district is one of the potential areas' potato production and its endowments with conducive environmental and edaphic factors.

However, Productivity, resource use efficiency, marketing and utilization in the country is not well developed. Natural, economic, technical, varietal and institutional factors are responsible for the low performance of potato producers. Above all, the varieties in cultivation were not able to meet the requirements of growers in terms of yield, disease (late blight) resistance, and quality, among others [7]. The development and dissemination of improved varieties, coupled with other technological options, contributed greatly to the improvement and rapid expansion of potato production.

Technology alone as a solution to alleviate basic agricultural problems is unrealistic. The technology has to be accessible at a price that farmers can afford and make them profitable. Therefore, the adoption of improved technology like improved varieties, fertilizers, does not indicate the benefit that farmers accrue from potato production because the total cost incurred in potato production should have to be reduced through effective and efficient input use. Many literatures showed that the rate of adoption and the involvement of smallholder farmers in improved potato production have increased from year to year in Ethiopia [8]. It was believed that potato growers have been benefited from it. However, frequent field evaluations or observations showed that a successful potato production requires very skillful and careful application of human, material and financial resources [9]. It is, therefore essential that all potato growers fully understand all aspects of potato production including technical operations, business requirement and marketing which are considered to be a guarantee for the success or failure.

Moreover, cost of improved seed (tuber), fertilizers and chemicals (fungicides) and output prices are important constraints in potato production [10]. There is an information on the adoption and production of potato, but regarding the profitability of potato production in the selected area specifically there is no information. Therefore, this study addresses the gap in information on profitability of potato production in Ejere district.

1.1 Objectives of the study

The general objective of the study is to analyse the profitability of potato production in the study areas and the specific objectives were:

1. To identify the costs incurred and returns on potato production in the district.

2. To analyse the profitability of potato production and to give possible recommendations.

2. RESEARCH METHODOLOGY

2.1 Description of the study area

The study was conducted in Ejere district, West Shoa of Oromia regional state and located at 40 km west of Addis Ababa. Ejere district is one of the districts in which potential potato producers found and benefited from potato outputs and its endowments with conducive environmental and edaphic factors and the availability. The district is located in west of Addis Ababa to Ambo main road. Geographically, the altitude of the district ranges from 2060-3185 meters above sea

level and the highest average annual temperature is 26.5°C in the month of April and the lowest is 5.8 °C in the month of September and the annual rain fall of the district is 1200 mm/year. It comprises 27 peasant associations (PAs) and 3 town PAs or kebele Administrations. The district is surrounded by Welmera from the East, by Ginchi district from the West, from the north by Ada Berga district and to the south by Alem Gena district [11].

Total human population of the district is estimated at 89,168 of whom 45,352 are males and 43,816 females. Of the total households 88.36% are rural agricultural households. The soils types of the district are predominantly red (58%), black (32%) and mixed (10%). The district is characterized by subsistence mixed farming system in which production of both crops and livestock is common economic activity. The total land of the district is estimated to be 56,918 ha, out of which 40,985 ha is cultivated land, 4,446 ha is grazing land, 4,456 ha is forest and 7,031 ha is covered with others [11]. The district is endowed with various natural resources such as medium fertile soil which vary greatly in their texture and good for agricultural productivity, high potential for livestock rearing, and forestry. The economic base of the district is predominantly agriculture which is subsistence type mixed farming. Off-farm activities and small-scale industries are operating and act as alternative sources of income. Many flower farms are under operations around Addis Alem town (which is the town of Ejere district). However, its overall production is being challenged in feeding its ever-growing population's. The farming system of the district is mixed farming system where more than fourteen types of crop grown. The district is known for its high production potential of crops and livestock. Crop production takes the lion share of consumption and income generation of the household. Vegetables and root crops produced in the area include potato, onions, tomato, pepper, cabbage and sweet potato. Annual crops are predominant and rain-fed agriculture is mainly practiced using animal power. Livestock production is also another source of income and the source of traction power and used as a means of transpiration [11]. Adoption and production of potato has increased from time to time.
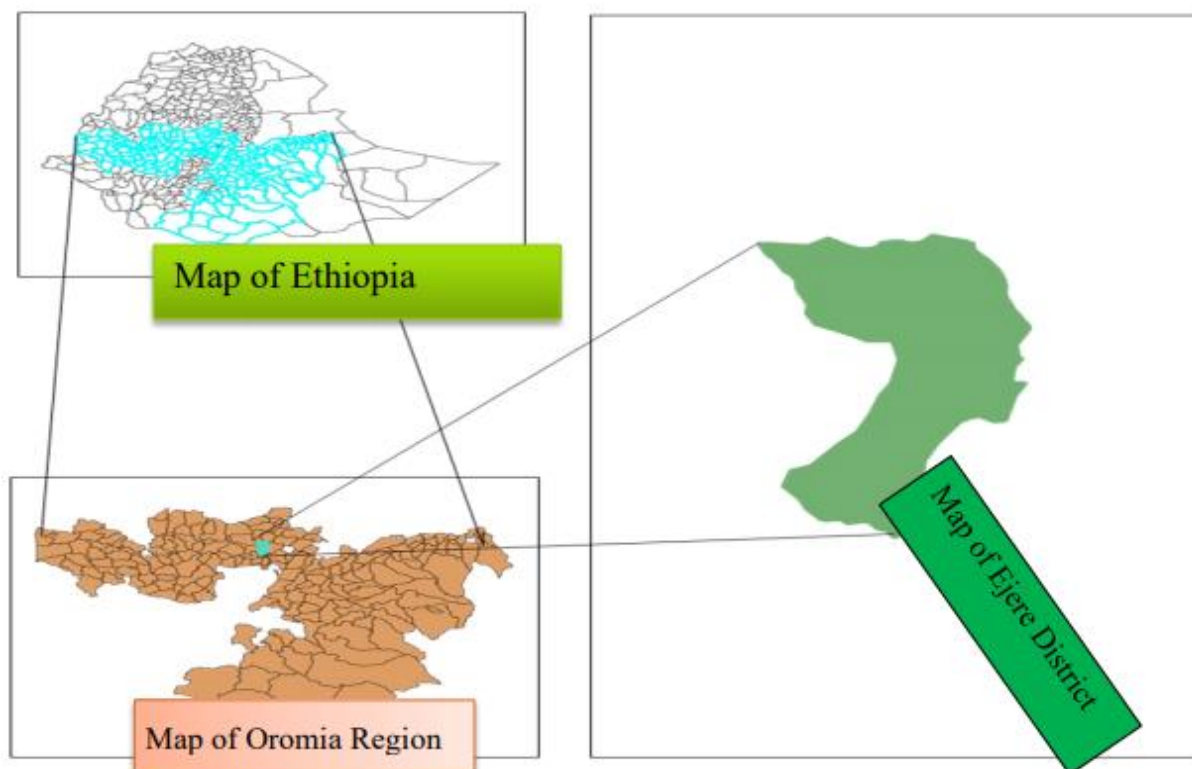

Figure 1: Location of the study area

Source: Adapted from Addisu Hailu (2016)

2.2 Methods of Data Collection

Both primary and secondary data were used for this study. The primary data used in the study were collected from potato producing farmers through personal interview by pre-tested structured and semi-structured questionnaires A checklist will

also be used to guide the informal discussion that is to be conducted to generate data that may not be collected from individual interviews. The primary data includes household demographic characteristics, human capital, resource endowment, access to financial capital, institutional factor and infrastructure focusing on in Ejere District of West Shewa Zone on the 2011 crop production year.

Secondary data on socio-economic information, determinants potato production, trends in agricultural production were collected from published and unpublished documents of Governmental institutions, including the Central Statistical Authority (CSA), the Agricultural and Rural Development Office of District, and from journals and website.

2.3 Sampling Procedure and Sample Size Determination

The target populations for this study were potato producers in Ejere district. Purposive and Multi-stage sampling procedure will be used to select household heads. Ejere district were selected purposively since its major producer and potential area for potato production. In the first stage, four potato producing kebeles were selected randomly from 27 peasant associations of the district.

In the second stage, a total of 120 sample household heads were selected randomly, using probability proportionate to size of potato producer households in the kebeles. The total sample size (n=120) was determined following a simplified formula provided by Yamane (1967). Accordingly, the required sample size at 95% confidence level with degree of variability of 5% and level of precision equal to 9% were used to obtain the sample.

$$n = \frac{N}{1+N(e)^2} \tag{1}$$

Where: n = sample size, N = population size (sampling frame) and e = level of precision.

2.4 Method of Data Analysis

In this study, descriptive statistics and enterprise budgeting techniques were used to analyze the data collected from sample respondents.

2.4.1 Descriptive Statistical Analysis

Descriptive statistical method of data analysis refers to the use of means, ratios, percentages, variances and standard deviations. The data obtained from 120 farmers were used for analytical purposes. Descriptive statistical were used to describe household characteristics, resource endowment, area allocated to potato, fertilizers applied, cost of labor, traction, seed and fungicide use aspect of the sample households. Fertilizers applied relates to the amounts of DAP and UREA applied on each plot. Cost of labor relates to the opportunity cost of family labor and hired labor. Cost of traction relates to the cost of hiring oxen power (draft power), the opportunity cost of draft power is also considered in this study. Cost of fungicide relates to the cost of fungicide (Redomine) applied on each plot.

Household demographic and socio-economic factors related to family size, land holding, livestock holding, and education level of the household head, and plot specific variables like rotation practices plot were included in the analysis. Livestock was measured in terms of total Tropical Livestock Unit (TLU). Education level of the household head was measured in terms of schooling that is illiterate, can read and write primary school (1-8) and secondary school (9-12). Respondents were subjectively assessed for fertility status of their plots as fertile, medium and infertile (poor). A rotation practice reveals the precursor crops used by farmers. A descriptive statistical tool for all variables was used to represent/describe the minimum, maximum, mean and standard deviation of continuous variables and frequency and percentage of discrete variables.

2.4.2 Enterprise Budgeting

The cost and return of potato production were analysed by using enterprise budgeting techniques. an enterprise budgeting is a listing of all estimated income and expenses associated with a specific enterprise to provide an estimate of its profitability. A budget can be developed for each existing or potential enterprise in a farm or ranch plan. Several budgets could be developed for a single budget to represent alternative combinations of inputs and outputs. Each budget should be developed on the basis of a small common unit such as one acre of potato, wheat, hay, etc. or one head of livestock. This permits comparison of the profit for alternative and competing enterprises. Enterprise budgets can be organized and

presented in several different formats, but they typically contain three sections: income/receipts, variable or operating expenses and fixed expenses.

Here cost benefit analysis was done to determine the relative economic returns of the farmers using the prevailing market prices. Costs of farm services, amount of potato produced and unit price were taken from potato producers. The economic indicators used were: Gross benefit is the product and the sale prices and calculated by multiplying the yield by the market price and also net benefit was calculated by subtracting the total cost of production from the gross benefit. Here all costs incurred and returns earned by farmers are used in the analysis. A study by [12] explained that net return to land, labour and management calculated in birr per hectare by subtracting all costs except land, labor and management from the gross value of output. For this purpose, the data obtained from farmers were averagely converted to per hectare bases.

2.4.2.1 Steps to develop an enterprise budgeting

An enterprise budgeting for potato production were conducted through the following steps: The first step is to record total production (output) and expected output price. The yields and prices are what farmers gain under normal conditions. The second step is to calculate variable costs. Variable costs are the out-of-pocket costs that must be incurred in potato production like for labor, seed, fertilizers and fungicide, etc. The third step is to assess fixed costs. Fixed costs will be estimated for the enterprise on opportunity cost basis. The last step is calculating net profit that left for potato producing farmer.

3. RESULT AND DISCUSSION

3.1 Demographic and Socio-economic Characteristics of Sample Households

The results of descriptive statistics for all the variables are given in the following tables. As shown in the Table 1, out of total sample respondents, 108 (90%) were male-headed and 12(10%) were female-headed households (Table 1). Accordingly, with regards to the educational level of sample household heads, about 19(15.3%) of them attend secondary education, 58(48.7%) of the attend primary, 12(9.8%) of the respondents can read and write through informal education and 31 (26.2 %) of respondents are illiterate. Regarding agronomic practice that farmers use to maintain their farm fertility most of the respondents use cereals 85 (70.8%). Whereas 9 (7%) and 26 (22.2%) use fallow practice and vegetables as rotation respectively. Out of the total respondents 105 (87.5%) of respondents respond as the fertility status of their land is medium. Whereas 11 (9.7%) and 4 (2.8%) respond as infertile (poor) and highly fertile land, respectively (Table 1).

Table 1: Descriptive results of discrete variables of sample households

Variables	Frequency	Percent
Sex 1=male	108	90
2=female	12	10
Education level 1=illiterate	31	26.2
2=can read and write	12	9.8
3=primary school	58	48.7
4=secondary school	19	15.3
Fertility 1=fertile	4	2.8
2= medium	105	87.5
3= infertile (poor)	11	9.7
Rotation 1=cereals	85	70.8
2=fallow	9	7
3=vegetables	26	22.2

Source: Own survey data, 2011

3.1.1 Resource ownership and farm inputs used by sample households

Ownership of physical resources is an important factor that determines the productivity of agrarians. Land, labor, capital and other resources are the major resources that farmers used to in potato production.

Land ownership

The analysis of survey data depicts that the average total land size owned by the sample households was 2.02 hectare with standard deviation of 0.64. The minimum and maximum land holding of sample respondents was 0.72 and 3.96 hectares, respectively (Table 2).

Livestock ownership

As illustrated in description of the study areas in the district, mixed crop and livestock farming system is dominantly used by farm households. Livestock resources are useful in the livelihoods of smallholders, oxen are the major contributors to crop production by serving as a draft power. The minimum and maximum livestock holding of sample respondents was 2.16 and 13.15 TLU respectively. The average livestock owned by sample households was 5.25 TLU with a standard deviation of 4.49 (Table 2).

Farm Inputs Used in Potato Production

Farmers in the study area used different types of inputs for potato production. The common farm inputs used in potato production includes: land, labor, fertilizers, improved seed, and fungicide. Out of major agricultural inputs used by sample households improved potato seed is the one the survey result indicates that the minimum and maximum amount seed used by sample respondents on per hectare was 14 and 20qt, respectively. The major source of improved potato seed was Holetta Agricultural Research Center as specified by respondents. Inorganic fertilizers (DAP and Urea) are the most critical input to increase the productivity. The survey result indicates that the minimum and maximum amount fertilizers used by sample respondents on per hectare was 1.2 and 3.5qt, respectively (Table 2).

Table 2: Descriptive results of continuous variables of sample households

Variables	Minimum	Maximum	Mean
Land holding of the hh	0.72	3.96	2.02
Livestock holding of the hh	2.16	15.15	9.39
Seed rate (q/ha)	14.00	20.00	17.12
Fertilizer (DAP + UREA) (q/ha)	1.20	3.50	2.79
Fungicide (kg/ha)	1.00	2.14	1.44

Source: Own survey data, 2011

As revealed on the above Table 2, fungicide was used by the sample households for control of late blight disease, the result shows that the minimum and maximum amount fungicide used by sample respondents on per hectare was 1 and 2.14 kg, respectively.

3.2 Analysis of Cost and Returns of Potato Production

3.2.1 Analysis Cost of Potato Production

The total variable cost of potato production consisting of cost of seeds, cost of fertilizer, cost of fungicide, cost of labor, traction cost, and miscellaneous cost shown in Table 3. The opportunity costs were used to calculate the price of some inputs. Out of total variable costs, cost of labor and seed takes the greater share, they comprised 29.31% and 26.83%, respectively. This was an indicator of the fact that major activities in production of potato has undertaken by more labor force and the price of improved potato seed was high in that production year.

Table 3: Descriptive results variables costs of potato production

Cost category	Average Cost of Production	Share from total variable cost (%)
Cost of potato seed (Birr/ha)	4,301.88	26.83
Cost of fertilizer (birr/ha)	2057.76	12.83
Cost of fungicide (kg/ha)	350	2.18
Cost of labor in Birr/ha	4,699.30	29.31
Cost of traction in Birr/ha	2034.62	12.69
Miscellaneous costs (birr/ha)	2,589.00	16.15
Total variable costs (birr/ha)	16,032.56	100.00

Source: Own survey data, 2011

3.2.2 Analysis Profitability of Potato Production

As shown in the Tables 4, the average size of land allocated for potato was about 0.65 ha. The average potato yield was about 195 q/ha. The results in Table 4, indicates that the net profit that the sample respondents gained from potato production was about ETB 29,792.45 per ha which implies that potato producers were making a profit at an average price.

As indicated in a Table below a profit to variable cost was about ETB 1.86 per ha which indicates that for each Birr invested in variable input used in potato production the profit gained would be ETB 1.86 per ha (Table 4)

Table 4: Descriptive results of profitability of potato production

Variables	Mean
Potato area operated in ha	0.65
Average Potato output in quintal (100kg)	195
Average selling price of potato (ETB/q)	235
Gross Margin (birr/ha)	45,825.00
Total variable cost	16,032.56
Net profit (ETB)	29,792.45
Profit to total variable cost	1.86

Source: Own survey data, 2011

Fluctuation of Potato Price

The mean price of potato was ETB 235/quintal in 2011 production season. This price become low at potato-harvesting period and it became high on the off-season. Price assessment revealed a wide seasonal variation in potato prices between harvest and off-season periods. The assessment indicate, prices were highest during the off-season and become low at harvesting periods, prices was ETB 350/quintals and ETB 175/quintal, respectively. As shown in Table 5 below, there was also a difference in average gross income and net profit earned by sample households in the district. The results indicated below shows that the gross incomes and net profit were high at off-seasons and low at harvesting time.

Table 5: Average gross income analysis at different season

Incomes earned at different Season	Average gross income	Net profit
At harvesting time	34,125.00	18,092.45
At Average time	45,825.00	29,792.45
At off-season	68,250.00	52,217.45

Source: Own survey data, 2011

The above results revealed that the importance industries to take potato product for processing like as Chips and Crips and modern storage facilities to avoid post-harvest loss. Thus, farmer have to marketing cooperative to have a bargaining power on market price of potato and to easily access improved potato seed from research centers.

5. CONCLUSIONS AND RECOMMENDATIONS

In Ethiopia agriculture is the leading sector in terms of contribution to the country's overall economy. It is a major source of food for domestic consumption, raw materials for the domestic manufacturing industries and primary commodities for export. Out crop production subsector Potato serves as both cash income and food crops. Potato production is becoming the most important profitable for farming community as a source of on-farm income. The study reveals that there exists an efficiency differential among the farmers. The study was conducted with the specific objectives of identifying the costs incurred and returns on potato production and on analysing the profitability of potato production in Ejere district.

Primary data were collected through structured and semi structured questionnaire by trained enumerators from randomly selected 120 potato producer households in four kebele. Descriptive statistics and enterprise budgeting techniques were used to analyze the collected data. Potato production cost components were identified in the study, these include seed, fertilizer, labor costs, cost of land, cost of traction and fungicide cost. Out of total variable costs, cost of labor and seed takes the greater share they comprised 29.31% and 26.83%, respectively.

The analysis of cost and return shows that potato is highly profitable. Average size of land allocated for potato was about 0.65 ha. The average potato yield was about 195 q/ha. The results indicate that the net profit that the sample respondents gained from potato production was about ETB 29,792.45 per ha which implies that potato producers were making a profit at an average price. Price assessment revealed a wide seasonal variation in potato prices between harvest and off-season periods. The assessment indicate, prices were highest during the off-season and become low at harvesting periods.

The profitability in potato production come from the use of improved varieties and improved cultural practices and this enable farmers them to fetch higher prices. Improved varieties are highly marketable for both local consumption and for the purpose of seed. Therefore, it is important for the extension and research institutions to support potato production by supplying improved varieties and agronomic management practices. It is important to increase the productivity and resource use efficiency farmers, because in the area farmers have a little crop land (on average 2.02 ha) and economically using this scarce resource essential.

There to enhance the over all profitability of potato production efforts of different stockholders such as research institutes, ministry of agriculture and rural development office, cooperative office and local NGOs were critical in availing disease-free improved potato varsities and attitudinal change of farmers to improve the technical skills of potato production. The potato producing farmers should organizing themselves in cooperative to have a better bargaining power and for alleviating the above-mentioned production problem as well as to reduce marketing failure during pick production period.

CONFLICT OF INTERESTS

The authors declared that there is no conflict of interest.

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