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Comparative Economic Analysis for Early Maturing and Traditional Maize Varieties in Nzega District, Tabora Region

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Abstract: Nzega is among the districts located in semi-arid areas of Tanzania where drought is a limiting factor for agriculture. The Tanzanian government has started advising farmers to use early maturing maize varieties (EMMV) as a response to frequent droughts. The use of EMMV is one of the factors which can increase maize production. Efforts to promote use of EMMV have not been successful. Most farmers are still using traditional varieties which succumb easily to droughts. Farmers will adopt a certain technology if it is likely to have a significant contribution in improving welfare. The present paper examines the relative profitability of the two maize varieties. The paper uses data collected from 150 maize farmers consisting of adopters and non-adopters of EMMV. Multistage random sampling technique was used to select maize farmers. Data were collected through structured questionnaire. Gross margin was computed and t-test was used to compare the profitability maize varieties. The results show that the gross margin for EMMV is higher than the traditional maize varieties. The gross margin for EMMV is 306396.30Tshs/acre while for Traditional maize varieties the gross margin is 177230.3Tshs/acre. The difference is statistically significant at 0.05 levels. Farmers should be emphasized in using EMMV.

Keywords: Improved Maize Varieties, Cost of Production, Marginal Analysis, Adoption

1. Introduction

1.1. Background

Maize is a staple food in SSA where 95% of the maize produced constitutes a significant part of the daily diet [4] Likewise, maize is the major cereal consumed and marketed in Tanzania [10]. It is estimated that the annual per capita consumption of maize in Tanzania is around 73kg and because of its greater caloric density compared to other crops, maize is an important source of calories, contributing 33% of the total household consumption [12]. About 85% of maize in Tanzania is produced by resource-poor, small-scale farmers, while the remaining 15% is produced by public and private large scale farmers [11].

Realizing the importance of the maize crop to the lives of Tanzanians, the government committed human and financial resources to develop the maize sector. This was done through the National Maize Research Program (NMRP) which was launched with the broad objective of developing cultivars suitable for the major maize producing zones [1].

The National Maize Research Programme (NMRP) divided the country into three major agro-ecological zones for varietal recommendations: the highlands, the mid-altitudes, and the lowlands. The highlands have elevations of 1,500 meters above sea level (masl) with a growing period of six to eight months. The mid-altitudes are situated between 900 and 1500 masl and can be subdivided into wet mid-altitude, areas with more than 1,100mm annual rainfall and a growing period of four to five months, and dry mid-altitudes, areas with less than 1,100mm rainfall and with a three to four month growing period. The lowlands have an altitude of 0 to 900 masl with a growing period of three to four months [2] According to the National Maize Research Program, varieties which are suitable in low altitude zone are those which are resistant to drought and mature early. These varieties were distributed in all areas found in low altitude.

One of the districts in Tanzania which is found in low

altitude zone is Nzega district in Tabora region. Early maturing maize varieties were introduced in the area as a mechanism of drought escape. Despite the efforts to promote the adoption of early maturing maize variesties, many farmers have not adopted them. Therefore, this study was done inorder to find whether the low adoption is due to insignificant difference in profitability for the newly introduced maize varieties and the traditional maize varieties.

1.2. Literature Review

1.2.1. Determinants of Maize Profitability Showing How Varieties Can Influence Profit and Adoption

Farmers are rational decision maker's aims at maximizing profit. Because farmers can be plausibly assumed to aims at maximizing profit then varieties which can contribute towards the effort to maximize profit are more likely to be adopted by farmers. A study done on Selection of Peach Varieties and the Role of Quality Attributes found that the expected economic returns affect the decision to grow peaches and the adoption of new varieties are positively correlated [3]. Growers evaluated the profitability of peaches relative to alternative crops before adopting them. Technology profitability affect maize technology adoption in Kenya [13]. Also other studies found that farmers adopt various agro forestry technologies because those technologies are profitable relative to conventional production practices [14, 15].

Other studies found that generally farmers adopt IMV because they perceive that IMV has higher yielding, profitable and market oriented than the local maize varieties [16].

Generally, the adoption of improved maize varieties in developing countries is determined by the profitability of the varieties. In the present study farmers will opt for early maturing maize varieties if the profit of these varieties is higher than the traditional maize varieties.

1.2.2. Cost of Maize Production

A study on Comparative Cost of Maize Production Study in East and Southern Africa found that the cost for producing maize differ within country, for example the cost of maize production in Malawi was found to be 162.85 MK/ha for the cash cost and the opportunity cost was 119.84MK/ha. Revenue in Malawi was 723.75MK/ha. In Kenya maize production is dominated by smallholder farmer and yield per hectare is 4 tonnes [9]. Total cost of maize production in Kenya was found to be 900KES/ha while revenue was 1170KES/ha.

Other study on yields, Cost of Production and Economic Return to Management of Maize/Cassava Intercrop as Influenced by Different Tillage Practices found that net benefit on maize production ranges between 248,387 up to 292,987 Tshs/ha [8].

2. Methodology

2.1. Theoretical Framework

Theoretical framework of this study lies on profit maximization. A profit-maximizing firm chooses both its inputs and its outputs with the sole goal of achieving maximum economic profits It is usually assumed that entrepreneur behave so as to maximize their profit. This assumption will be adopted at this study where by farmers will only adopt the new variety if it contributes to their efforts to maximize profit. If farmers are strictly profit maximizes, they will make decisions in a "marginal" way by examine the marginal profit obtainable from producing one more unit of output.

Total revenue is given by

$$R(q) = p(q)\cdot q \quad (1)$$

Where R(q)= revenue of a given output(q)

p(q)= price of a given output

In the production of output (q), certain economic costs are incurred [C(q)]

Economic profits (π) are the difference between total revenue and total costs

$$\pi(q) = R(q) - C(q) = p(q)\cdot q - C(q) \quad (2)$$

The necessary conditions for choosing output which will maximize profit is by setting the derivatives of profit function with respect to the output obtained equals to zero

$$\frac{\partial \pi}{\partial q} = \frac{\partial R}{\partial q} - \frac{\partial C}{\partial q} = 0 \quad (3)$$

$$\frac{\partial R}{\partial q} = \frac{\partial C}{\partial q} \quad (4)$$

$$\frac{\partial R}{\partial q} = MR \quad (5)$$

$$\frac{\partial C}{\partial q} = MC \quad (6)$$

Where by

MR= Marginal Revenue

MC= Marginal cost

Profit is maximized when Marginal revenue is equal to the marginal cost (MR=MC)

2.2. Location of the Study Area

The present study covers the district of Nzega in Tabora Region. Tabora Region is found between latitude 4^0 and 7^0 south of Equator and longitude 31^0 to 34^0. According to the region socio-economic profile, Nzega district is located within central eastern zone and northeastern zone where rainfall is low at about 750mm to 850mm per year for the central eastern zone, and 650mm to 750mm on the northeastern zone.

2.3. Data Collection Methods

Structured questionnaire was designed for collecting primary data through direct interviewing. A total of 150 maize farmers consisting of adopters and non adopters of EMMV were involved in the study. Multistage random sampling was used to get maize farmers from fifteen villages found in Nzega district. Data were collected on important

inputs and outputs together with their respective prices.

2.4. Data Analysis

In estimating benefit of the use of early maturing maize varieties gross margin were computed and t-test was used to determine if the profit between early maturing maize varieties and the traditional varieties is statistically significant. Gross margin involved computation of average variable cost and average revenue for both early maturing maize varieties and the traditional varieties using the following formula:

$$GM=TR-TVC \quad (7)$$

Where:

TR= Total revenue obtained from using both early maturing maize varieties and traditional varieties.

TVC= Total variable cost for producing early maturing maize varieties and traditional varieties.

$TR=P_y y$

$TVC=\sum P_{xi} x_i$

$P_{y=}$ Price of output

P_x= Price of the i^{th} input (Tshs/Unit)

X_i=Quantity of i^{th} input (Unit/acre) used in producing Y.

3. Results and Discussion

In the present study the results show that, the profit margin for EMMV and the traditional maize varieties were 306 396.3Tshs/ha and 177 230.3Tshs/ha respectively. The gross margin for EMMV is statistically different from the gross margin obtained from the traditional maize varieties at 0.05 level of significance.

Table 1 presents the gross margins per acre for early maturing maize varieties and for the traditional maize varieties grown in Nzega District. The results show that more fertilizer and pesticides are used for early maturing maize varieties than for the traditional maize varieties. The other difference is on yield, where early maturing maize varieties yield more than the traditional maize varieties. The results from Table 1 show that the average yield for farmers using early maturing maize varieties was 1240kg/acre while for those who use traditional maize varieties the average maize yield was only 944kg/acre. Yield for early maturing maize varieties is only 1240 kg/acre which is equivalent to 3400 kg/ha. The yield is less than the maximum potential yield which is 6300kg/ha. Low yield of early maturing maize varieties under farmer's conditions is because most farmers do not follow the recommended agronomic practices in terms of input usage and the management principles.

The results also show that the profit margin for early maturing maize varieties is higher than the traditional maize varieties. Also a study on Farmers' perceptions, profitability, and factors influencing the adoption of improved maize varieties in the Guinea Savannas of Nigeria, found that improved maize varieties are profitable than old maize varieties [5].

In this study the total variable cost (TVC) incurred by IMV adopters and non-adopters were N36,740/ha and N19,922/ha respectively. Fertilizer accounted for 55% of the TVC for adopters and 38% of the TVC for non-adopters. The total revenue per hectare for adopters and non-adopters was N102,029 and N54,613, respectively, and their gross margins were N68,656/ha and N34,115/ha, respectively. Higher revenue derived from IMV is attributed to two factors. First, IMVs have higher yields per hectare compared with local varieties. Secondly, IMVs fetch a higher market price. Thus, IMV production is profitable.

Other study which was done in order to compare yield between improved maize varieties and the local varieties found that, the mean yields from improved maize varieties was (2941.5kg/ha per season) which is significantly higher than the yields from local varieties (1694. kg/ha per season) [6]. Also other study show that the average yield from the improved varieties is significantly higher than the local maize varieties [7]. As a result of higher yields and lower costs per unit of output, the adopters of improved maize have higher overall net income compared to the non-adopters. found that the net income for improved maize varieties and local varieties were 841.89Tsh/ha and 550Tshs/ha respectively.

Table 1. *Gross margin result for early maturing maize varieties and traditional varieties for the year 2012/13.*

Type of seed	Traditional varieties	Early maturing varieties
Seed quantity/Acre	3.2	4.1
Seed price	4 650	13 791.7
Fertilizer cost	50 321.43	78 500.00
Pesticide cost	7 333.33	11 089.24
Land preparation cost	20 000	20 000
Cultivation cost	33 285.7	30 042.75
Sowing cost	11 166.67	11200.84
Weeding cost	20 333.33	40 333.33
Fertilizer application cost	20 854	25 646
Pesticides application cost	30 000	35 000
Harvesting &storage cost	20 000	27 500
Transport cost	18 000	22 000
Storage cost	11 625	15 000
Total cost	247 569.7	251603.7
Yield/Acre(kg)	944	1240
Price/kg	450	450
Revenue	424 800	558 000
Gm/acre (Tshs/acre)	177 230.3	306 396.3

4. Conclusions and Recommendations

The present study found that the gross margin for EMMV was higher than the traditional maize varieties this is because EMMV yields more than the traditional maize varieties.

Because EMMV yield more than the traditional maize varieties, this enable farmer to have surplus for selling, therefore the government should increase farmers' ability to reach to the market through constructing rural roads and market.

Since EMMV needs more inputs than the traditional maize

varieties, Policy-makers should address the possibility of providing appropriate credit for pesticides and fertilizer to small-scale maize producers. The importance of credit is to increasing maize production through relaxing income constrants for buying inputs. Also input subsidy issue needs to be addressed by policy-makers inorder to increase adoption rates of EMMV and hence increase maize production, which is very important for Tanzania's food security.

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