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## RESEARCH ARTICLE

## ECONOMIC ANALYSIS OF MAIZE SEED PRODUCTION IN BAGNASHKALI RURAL MUNICIPALITY, PALPA, NEPAL

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## ARTICLE DETAILS

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## ABSTRACT

Maize is the second most important staple crop in terms of area and production in Nepal. A field survey was carried out to assess the economic analysis of Maize seed production in Bagnashkali Rural Municipality (Palpa district) during month of Oct/Sept for cropping year 2022. Palpa district was selected for the study because of its high contribution to Maize seed production. Semi structured questionnaire was designed to collect data in 182 Maize seed cultivating farmer's household in form of interview using Simple Random Sampling. Descriptive statistics, benefit cost ratio (B/C ratio), Stochastic frontier model, Cobb-Douglas production function were used to analyze the data. The result showed that the average family size of household is 5 and involvement of both male and female in maize seed production and post-harvest management was 48% and 52% respectively. The average rate of quality seed Manakamana-3 was Rs. 57.3/Kg. The average total cost was NRs. 50316.37 and average net return was NRs.62522.5, it showed that average B/C ratio was found to be 1.24/ha. The highest cost was incurred on avg. labor cost during production 61.94 % of average total cost followed by machineries (25.97%), fertilizers cum pesticides (8.05%), seed cost (2.24%) and post-harvest labor cost (1.46%). It was found that 99% of farmers were involved in production of certified maize seed certified at regional laboratory, Bhairahawa. Estimated coefficient of inputs like production labor, postharvest labor, DAP, total area, machine, are positive and show significant result to productivity. The major input for seed production was labor, hence more laborers were required for seed production followed by machinery, fertilizers and seed. The study identified that Maize seed production was profitable and has wide market available. However, low productivity was due to lack of irrigation facilities followed by lack of proper training and extension services.

## KEYWORDS

Maize, Economic analysis, productivity, B/C ratio.

## 1. INTRODUCTION

Agriculture alone contributes 21.32 % in national GDP and about 60.4% of the total population engaged in agriculture sector (AICC, 2021). The share of cereal crops to agriculture is about 60%. Maize is one of the most potential cereal crops grown globally and maize (*Zea mays L.*) is the main crop in the mid-hills region of Nepal. It is used as food, fodder, feed and other industrial raw materials. Maize demand has been constantly growing by 5% annually in last decades. At present, the total area and production of maize in Nepal is 957650 ha and 2835674 t in the year 2019/2020 (MoAD, 2021). Maize production and yield are growing at the annual rate of 4.4% and 3.3%, respectively, between 2009/10 and 2018/19 (MoALD, 2020). In Nepal the present yield level is quite low to fulfill the country's demand, there is a big yield gap of maize as affected by various technological and socio-economic factors (KC et al., 2015).

In Nepal, maize is grown in sub-tropical to cool temperate climates. It is cultivated as food, feed and fodder on rainfed upland in the hills. Maize is grown under rainfed conditions during the summer (April-August) as a single crop or relayed with millet later in the season. In the terai, inner-terai, valleys, and river basin areas, maize is also grown in the winter and spring with irrigation (Thapa, 2021). Maize is used as multipurpose grain and typical food products like chayakhla, roti, Dhido are made from it. Maize flour is used in bakery and fermentation industries. It is an important source of starch and contains 70% of starch by weight. It is source of carotenoids such as beta-carotene, cytochrome, zeaxanthin and leucine. Maize is also a source of oil which can also be used for human

consumption. Efforts have been made to make fortified maize rich in iron, zinc and provitamin A (Sangwan et al., 2014). Quantity of maize required for food per year is around 2.9 million metric tons and there is need of about 6.46 million metric ton feed to run the existing poultry industries in our country (Dahal and Rijal, 2019).

Seed is a principal factor that governs return from almost all agriculture based technological innovations and transfer genetic potentiality to regenerate new crops. The availability of quality seeds in time and suitable to specific location contribute to high production to farmers (Bajracharya et al., 2016). There is very little supply of breeders and foundation seed for its multiplication due to lack of research and production in seed sector. The supply of maize improved seeds is very limited in Nepal which has hindered the better production and yield of maize (Pullabhotla and GaneshKumar, 2012). Because of increased demand of maize in hilly district, various donor agencies in collaboration with I/NGOs are distributing and contributing maize seeds. This has put an effort into being self-reliant. Seed, labor, animal power, chemical fertilizers and FYM are resources used in maize production. Resources used in production process are regarded as an input that runs production activity. Resources are said to be efficiently utilized when they are used in best possible way by minimizing cost of production (Dhakal et al., 2015). Males are involved in outside job and female spent most of their time in field. Gender inclusion and women participation are much encouraged in the workshops and training conducted regarding nursery development, seed producing, fertilizer treatments, etc. The available data on maize production shows the increase in production was due to the increase in crop area rather than

an increase in yield.

There is very limited availability of hybrid seed in Nepal which is unable to meet the growing demand of maize seed. This provides an opportunity for Nepali farmer to produce hybrid maize seed, which usually has higher return than the non-seed production. While the net return from hybrid maize seed production in Bangladesh was 50 percent higher compared to the non-seed producers (Haque et al., 2012). Seed production requires high management skills and more labor as compared to grain production. There is limited scope to increase the land size, so we need to focus on efficiency of inputs used.

In maize production, the demand for maize is shifting from food to feed for livestock and poultry. For foods, new types of maize-based products such as soups, vegetables, and edible oils are in demand. Under such conditions, the import substitution can only be done by increasing the productivity of maize within the available land. As a new intervention, winter maize under rice-wheat system has been emerging and it can be an option to increase the maize production in Nepal. The area under winter maize in eastern and central Terai is increasing year after year due to the increasing demand of maize for poultry feed. Similarly, winter maize yields are higher due to lower risk of pests and diseases and higher production of CHO/day/unit land among the cereals. Moreover, farmers are solely dependent on multinational hybrid seeds. If the international suppliers fail to supply the hybrid seeds, farmers will be prone to leave growing maize during winter (KC et al., 2015). The Seed Act 1998 (1st amendment 2008), Seed Policy 1999, Seed Regulation 2013 and National Seed Vision 2013–2025 are the seed legislation and policy framework that guide and regulate seed production and marketing in Nepal. These policy frameworks are responsible for ensuring production, processing, availability and supply of quality seeds in Nepal. An apex body of agricultural research in Nepal is Nepal Agricultural Research Council (NARC). It has the mandate to produce breeder and foundation seed of maize. These foundation seeds are multiplied by maize seed producer farmer groups and seed companies as improved seed, which ultimately reach maize growers. Until now the Government of Nepal has released more than 27 maize varieties and registered 58 hybrids, while 14 are denotified (Gairhe et al., 2021).

Therefore, Seed is one of the most important inputs for increasing production and yield. Hence, it should be made easily available and used efficiently for the improvement of the livelihood and income of rural people. The haphazard and inefficient use of inputs or resources leads to wastage of time, money and effort which ultimately declines the yield and profitability of farm which leads to the weak agriculture economic growth (Sapkota et al., 2018). The most important variables included in Socioeconomic characteristics of farmers are age, education, household size, farm size, membership, training and extension contact (Adhikari et al., 2019).

### 1.2 Statement Of Problem

The low productivity of maize is attributed to various factors including abiotic and biotic stresses; and their interactions and socio-economic constraints. Abiotic factors include poor soil fertility, drought and heat stresses and biotic factors include fall army worm, use of low yielding germplasm, diseases, stalk borers and storage pests (Lobulu et al., 2019). Insufficient amount of quality seed at planting time has been considered one of the major production constraints for maize in the country (Paudel and Matsuoka, 2009). When maize is grown under prolonged droughts, water deficit conditions, yields will be significantly affected. It has been shown that relative soil moisture below 60% will have negative impacts on maize growth. During heavy rains and/or strong winds, maize is prone to lodging (breaking of the stalk), resulting in un-harvestable yield and crop failure (Song et al., 2020). Despite the large area coverage, the productivity of maize is limited to 2.678t ha<sup>-1</sup>. The reason behind this is that 80% of the maize grown land is rain-fed, unavailability of improved seed and lower seed replacement rate (11.30%). Consequently, Nepalese agriculture failed to meet the increasing maize demand (11% per annum) and Nepal has turned into an import driven country importing 45% of maize from India (Maize, 2017). Remoteness, poor infrastructures, labor shortages, small quantities of seed at the producer level, and few private seed traders are inherent problems in maize seed production and marketing in the hills of Nepal (Dilli Bahadur et al., 2018). In Palpa district farmers are facing same difficulty as it is hilly area like remoteness, high labor cost, low availability of fertilizer, lack of training and extension services. Poor bargaining power of producers, low volume of production, inefficient intermediaries, poor marketing infrastructure, and price variation are the marketing problems in maize seed. that the unavailability of quality improved seed, fertilizer and lack of an assured seed market impacts negatively on seed production and productivity (KC et al., 2011). The major problem in maize seed production in Bagnashkali Rural

municipality, Palpa was identified as lack of irrigation facilities and high labor cost followed by monkey attack on maize cobb, lack of training on seed production, low seed quality and lack of subsidy.

Availability of technical assistance and adequate irrigation facilities in areas assist to adopt maize seed production to increase maize production and income (Hintze et al., 2003). Training Plays important role for the Change in behavior by improvement of knowledge, skill and ability of the farmers. To follow up and enhance more technically about the local methods, techniques, learning and experiences with current climatic requirement and technical needs are our major responsibility. Good Agricultural practices like management of the problems which arise during the farming like; disease pest occurrence, soil, Agro-materials, traditional knowledge, skill and experience as well as research output techniques will be very helpful for successful Agriculture work. Proper road access, availability of labor, adequate training and subsidy to farmers, proper postharvest technique and proper market system can solve problem address by seed producing farmers in Palpa. seed multiplication of improved maize varieties through the Community-Based Seed Production (CBSP) program was initiated in the Hill Maize Research Project (HMRP) in 2000. This has been a very successful model, which significantly contributed to increasing the production of improved seeds and has increased the seed replacement rate in hilly region like Palpa (Dilli Bahadur et al., 2018).

### 1.3 Rationale of the study

The agriculture of Nepalese plains and hills is cereal based under which rice, wheat and maize are predominantly cultivated. The contribution of cereal crops to Agriculture Gross Domestic Product (AGDP) is about 49.41%. Maize (*Zea mays* L.) is the main crop after rice in Nepal in term of area and production. Out of the total maize area, maize is cultivated 17.34% of Terai region, 72.85% of mid hills and 9.81% of high hills of Nepal (B.K et al., 2015). Two third of the maize produced in hills of Nepal is consumed directly by the farmers (Dulal et al., 2020).

Despite the large area coverage, the productivity of maize is limited to 2.678t/ha. The reason behind this is that 80% of the maize grown land is rain-fed, unavailability of improved seed and lower seed replacement rate (11.30%). Consequently, Nepalese agriculture failed to meet the increasing maize demand (11% per annum) and Nepal has turned into an import driven country importing 45% of maize from India (NMRP, 2019).

Traditionally, farmers used to produce maize for home consumption and for the feed to their livestock but now they have realized the economic value of commercial maize production. Due to higher prices and more income from the seed enterprise, farmers are attracted more towards it. But the proper documentation of the economics of maize seed and grain production is still not accessible. The difference in the social and financial status of the farmers might also have influenced their involvement in seed and grain production. Hence, this study was done to assess and compare the cost of cultivation, income and profit as well as making comparative remarks on the social status of the maize grain and seed producers of the Palpa district. In addition to this, the study was also focused on pointing out the major problems regarding the production and marketing of maize in the district.

### 1.4 Objectives

#### 1.4.1 Broad Objectives

- To access the production function and benefit cost ratio of maize seed production.

#### 1.4.2 Specific Objectives

- To study about socio-economic characteristics of maize seed producers.
- To assess the profitability of maize seed production.
- To determine the production efficiency of maize seed production.

## 2. MATERIALS AND METHODS

Research methodology consists of the procedures used by the investigator to answer the question with logic. Methodology consists of the procedures involved in preparation of questionnaires, selection of research sites, sampling techniques and data analysis techniques.

### 2.1 Preparation of questionnaire

Interview schedule was prepared after surfing relevant literature. The schedule thus prepared was pre-tested for its relevancy in the study and to find out minor corrections to be made if any.

## 2.2 Selection of research site

Maize is considered as a staple crop in the hills of Nepal. The production of maize seed was found more in Palpa among other districts. Hence, Palpa District was selected for this study. The survey was carried out in Bagnashkali rural municipality of Palpa district. It is located at mid-hills of Nepal. It has a subtropical climate with an altitude ranging from 550 m to 1250 m above sea level. Bagnashkali was selected as study area because production of maize seed was found more here, and it is located near Tansen which makes easy access of marketing facilities and transportation. Geographically, Bagnashkali rural municipality covers an area of 84.3 km<sup>2</sup> and lies on latitude 27.862939° North and longitude 3.596085° East.

## 2.3 Sampling technique

There were 8 farmers' groups and 3 cooperatives registered in Palpa District. These registered farmers' groups and cooperatives are comprised of 260 member farmers growing maize for seed purposes (DADO, Palpa). Among them 182 households were surveyed through mWater surveyor. Survey was carried out in Aug./Sept. of 2022 AD. A semi-structured questionnaire was asked to maize seed producer farmer by using mWater surveyor app and data was collected.

## 2.4 Data collection

The interview schedule was pretested among 10 respondents of Bagnashkali Rural Municipality of Palpa District. The necessary modification and corrections were done in the interview schedule before administering actual respondents for the collection of primary data.

For this study, primary data were collected from 182 maize seed production households of Bagnashkali rural Municipality of Palpa district. These data were collected from five cooperatives of Bagnashkali named as Shree Tilottamma agriculture cooperative Ltd, shiva shakti cooperative, Shree pragati krishak samuha, Shree shikhar tarkari krishak samuha, Pipal danda krishi sahakari samuha etc. The sample farmers of each cooperative were interviewed by administration a prestructure questionnaire designed to collect information on output, input, and some major socioeconomic characteristics of the farmers as well as the prices of input which serve as the basis for computing the costs of materials used during production. The input data includes the costs of tractor, animal power, human labor, fertilizer, pesticides and seed required to calculate the total cost of production. Data was collected also on the socio-economic variables such as family members, the age of the household, the schooling year and the maize area of the sampled farmers to explore their influence on the estimated cost efficiencies of the maize farm. Secondary data were collected from various governmental and non-Governmental organization. The field survey was carried out during September 2022.

## 2.5 Methods and techniques of data analysis

Data obtained from questionnaire filled was arranged systematically, codes were designed, and units were standardized wherever necessary before analyzing data. Then data were entered in the SPSS software, and analysis was done using SPSS and Stata software. Work on cleaning and missing data was done to improve data quality. Descriptive statistics, mean comparison, Benefit cost ratio and Cobb-Douglas production function were used to derive the required result. Software's used during data analysis was MS Excel and STATA 14.

### 2.5.1 Cost benefit analysis

The purpose of performing benefit cost analysis is to find if the investment made in the resources yields a reasonable return to the resources engaged. Benefit cost ratio (BCR) is assumed to be quick and one of the easiest methods for evaluating the economic performance of any farm. For this study, the cost of production of maize seed producers was calculated by adding all the variable cost items such as seed, FYM, fertilizer, tillage, labor, intercultural operations, harvesting and post-harvest management and marketing was calculated. Likewise, the revenue obtained from the sale of maize seeds in addition to maize byproducts was also evaluated on monetary terms. And finally, the benefit cost analysis was conducted using the formula as used by (Dulal et al., 2020).

Total variable cost = C labor on prodn + C tractor + C seed + C fertilizer cum pesticide + C labor on postharvest

Where,

C labor on Prod. = Cost on human labor used during field preparation to be harvesting (NRs. /ha),  
C tractor = Cost on tractor used (NRs. /ha),  
C seed = Cost on seed (NRs. /ha),  
C fertilizer cum pesticide = Cost on inorganic chemical fertilizers and pesticides (NRs. /ha),  
C postharvest labour = Cost on postharvest operations (NRs. /ha)

Gross return was calculated by multiplying the total volume of Seed from maize by the average price of maize. Thus, gross return and productivity were calculated. Gross margin calculation was done to have an estimate of the difference between the gross return and variable costs. Gross margin was calculated by using the method given by Ghimire (2014) using following formula.

Gross Margin (NRs. /ha) = Gross return (NRs. /ha) - Total variable cost (NRs. /ha)

Furthermore, average cost per Kilogram of maize product equivalent was calculated as the ratio of total variable cost (NRs.) to total production (kg). Similarly average gross margin (NRs. /kg) was calculated as the ratio of gross margin (NRs. /ha) to productivity (kg/ha).

### 2.5.2 Benefit-Cost ratio

Benefit cost ratio is the quick and easiest method to determine the economic performance of a business. It is a relative measure, which is used to compare benefit per unit of cost. Undiscounted benefit cost ratio was estimated as a ratio of gross return and total variable cost. Thus, the benefit Cost analysis was carried out by using formula; (Economic Analysis of Ginger Cultivation in Selected, 2017).

$$B/C \text{ Ratio} = \frac{\text{Gross returns (NRs.)}}{\text{Total variable cost (NRs.)}}$$

### 2.5.3 Econometric Models

Cobb-Douglas production function was accessed to calculate economics of maize production. This model is widely used to represent the relationship of an output to inputs, and it gives good approximation to actual production. It is used to determine the efficiency of the resource use of agricultural commodities (Dahal and Rijal, 2019).

$$Y = \alpha X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5}$$

Y is income of maize production in hectare (NRs), X1 is cost of maize seed per hectare, X2 is cost

of machinery per hectare, X3 is cost of labor in production per hectare, X4 is cost of chemical fertilizer cum pesticide per hectare, X5 is cost of labor in postharvest per hectare. e is error term and b1 to b5 is coefficient to be estimated.

The above-mentioned equation is linearized in logarithmic function.

$$\log Y = \log \alpha + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + u$$

Where, ln= natural logarithm,  $\alpha$ = constant and u are random disturbance.

Y= Total cost (Rs/hectare)  
X1= Labor cost (Rs/hectare)  
X2= Machine cost (Rs/hectare)  
X3= Seed cost (Rs/hectare)  
X4= Fertilizer cost (Rs/hectare)  
 $\alpha$ = Coefficient<sup>17</sup>

## 3. RESULTS AND DISCUSSION

### 3.1 Socioeconomic characteristics of the maize farmers in Palpa district

The summary of the descriptive analysis of the farmers' socio-economic characteristics is shown in Table 1, categorical variables and their frequency percentage are shown where the summaries of sex distribution revealed that 69.2% of the gender in household head were male. Around 28.6% of the household had migrated members. Major occupation was agriculture (100%), followed by abroad (17%) and others (15.9%). The result shows that about 86.3% of farmers have access to subsidies and market access for maize seed was found to be 92.2%. About 86.8% of the farmers interviewed used farm mechanization for maize seed production.

Table 1: Categorical Variable with their frequencies	
Variables	Frequency (Total sample=182)
Gender of HH (Male=1)	126(69.2)
Migration for eco purposes (Yes=1)	52(28.6)
Major occupation	
Agriculture (Yes=1)	182(100)
Business (Yes=1)	10(5.5)
Govn job (Yes=1)	8(4.4)
Abroad (Yes=1)	31(17)
Others (Yes=1)	29(15.9)
Agricultural loan (Yes=1)	5(2.7)
Subsidy (Yes=1)	157(86.3)
Market access (Yes=1)	169(92.9)
Farm mechanization (Yes=1)	158(86.8)

\*Footnote: Data present inside the parentheses are expressed as percentage

In Table 2, continuous variables and their meaning are shown where the mean age for the sampled farmers was 52.90 years this implies that most of the maize farmers are in their active and productive age when they can put in their best for optimum productivity. The average household size was (4.97) found greater as compared with national household size (4.88) and Palpa district's average (4.41). Distribution of sampled farmers according to years of experience in maize production revealed the mean value as 25.46 years. This suggests that most of the respondents were experienced maize farmers. The distance of nearest highway and nearest market was found 1.96 and 6.41 km respectively.

Table 2: Continuous Variable of socio-economic characteristics			
Variables	Mean	S.E.	S.D.
Age of HH	52.90	.879	11.858
Size of HH	4.97	.174	2.344
Farming exp. (years)	25.46	.760	10.249
Eco. active male	1.43	.057	.767
Eco. active female	1.09	.057	.763
Distance from nearest highway (km)	1.964	.0677	.9134
Distance from nearest market (km)	6.41	.265	3.579

### 3.2 Benefit-cost ratio (B/C ratio)

The price of maize seed, labor cost in production, machine cost, fertilizer cum pesticide price, postharvest cost was calculated and found to be NRs. 1297.87, 31165.35, 13065.41, 4051.20, 736.54 respectively and total cost for maize seed producers was NRs. 50316.37 whereas the final return of maize seed to the farmers was also calculated and return for maize seed producers was NRs. 62522.5 on hectare basis. The benefit cost ratio (B:C) was computed as the ratio of gross returns to the total cost involved in maize production. The B:C of seed producers was found to be 1.24. The B:C ratio indicates that the seed producers benefited and maize seed production in Bagnashkali, Palpa was profitable.

Table 3: Cost and benefit of maize seed production		
Avg. total cost/ha (NRs.)	Avg. total revenue/ha (NRs.)	B/C ratio
50316.37	62522.59	1.24258943

### 3.3 Cost Structure of Maize Seed Production

Figure 1 shows the share of different cost components to total cost of maize seed production of the study area. The highest cost was incurred in labor during maize seed production (62%) from field preparation to harvesting and threshing. About 26% of total cost was governed by machinery cost followed by fertilizer cum pesticides cost (8%), seed cost (3%) and postharvest labor cost i.e. only 1% of total seed production cost. The results show that labor costs should be minimized, and use of farm mechanization should be emphasized along with use of good fertilizer and

quality seed to achieve more profitability.

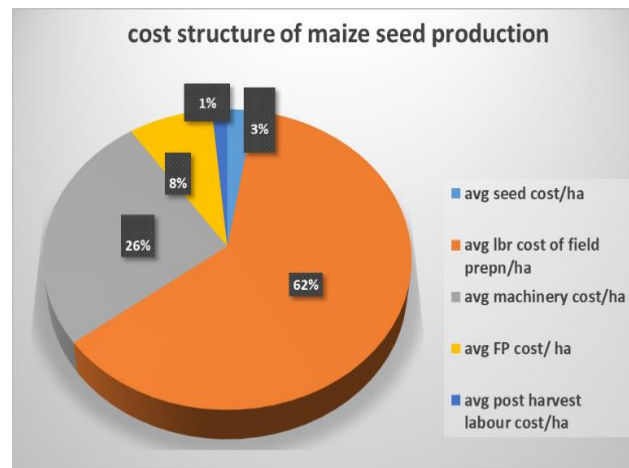


Figure 1: Share of different cost components to total cost of maize seed production

### 3.4 Average Labor Cost in Maize Seed Production

Figure 2 shows the share of different labor costs to total labor cost during maize seed production of the study area. The highest labor cost (44%) of total labor cost was seen during intercultural operations i.e. weeding and earthing up. Average labor cost in field preparation was found to be 25% of total labor cost followed by labor cost in harvesting (23%) and labor cost during postharvest (8%). The result implies that a greater number of labors were used in intercultural operations that gave good result in yield and productivity of maize seed production of Palpa.

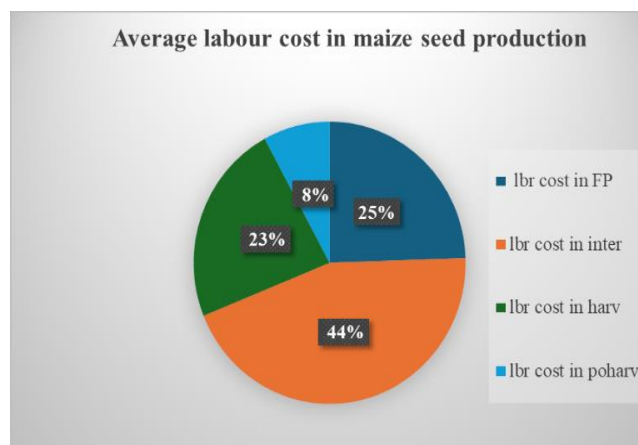


Figure 2: Share of different labor costs to total labor cost during maize seed production

### 3.5 Cobb-Douglas Production Functions

#### 3.5.1 Production Efficiency

Estimated results for Stochastic Frontier Model-1 are given in Table 4 that shows the input usage relation with productivity. Productivity was kept as dependent variable and inputs such as labour, urea, dap, machine, area as independent variables. Estimated coefficient of inputs like production labor, postharvest labor, DAP, machine, total area are positive and show significant result to productivity. The result implies that the coefficient for machinery hours utilized in maize production is 0.41, indicating that a one percent increase in machinery utilization in maize production could increase productivity of maize seed by 0.41 percent. Same as for other positive coefficient input variables, increase use of labor, Area, DAP fertilizers, machine at proper times would increase in maize yield. Here, coefficient of urea is negative, implies that it has insignificant result to productivity that might be because most of the farmers didn't use the urea in time or they didn't use appropriate dose.

Table 4: Inputs variables in Production efficiency				
Logproductivity	Coef.	Std. Err.	z	P> z
Loglbrinproduction	.1481624	.0848382	1.75	0.081
loglbrpostharvest	.2706397	.1041094	2.60	0.009

Table 4 (Cont): Inputs variables in Production efficiency				
Logproductivity	Coef.	Std. Err.	z	P> z
logurea	-.1911815	.1062144	-1.80	0.072
logdap	.1309728	.2262127	0.58	0.563
logmachine	.4137579	.1353983	3.06	0.002
logtotalarea	.3640347	.1217526	2.99	0.003
_cons	6.299145	.5715317	11.02	0.000
sigma_v	.1429136	.1131048		
sigma_u	.5830693	.1409614		
sigma2	.3603941	.1374036		
lambda	4.079872	.2454044		

3.5.2 Technical Efficiency

Table 5 shows the predicted mean technical efficiency of maize growers in the study area ranged between the minimum value of 6.24 percent and the maximum of 7.65 percent with a mean level of 7.00 (inefficiency level is 0.65). It means that maize growers are about 65 percent below the production frontier.

In other words, on average the maize growers could increase their efficiency by 65 percent to reach the maximum level of efficiency. It was observed in the literature review that the average technical efficiency for maize growers' in developing countries ranged from 63% to 91%, in the United States' Corn Belt (Iowa, Illinois and Indiana States), technical efficiency in maize production was 63% (Cience and Aper, 2013).

Table 5: Mean technical efficiency of maize farmer					
Variable	Obs	Mean	Std. Dev.	Min	Max
u_e	58	7.001199	.2793524	6.249096	7.650598

3.5.3 Inefficiency in Maize Seed Production

Estimated results for Stochastic Frontier Model-2 are given in Table 6. The results reveal maize seed farmers gender of household head i.e. male and number of farming experience as important determinants have negative

significant effects on inefficiency in maize production. other variables like Age, size of household, economically active male and female and year of schooling of household head have positive significant effects on inefficiency in maize production.

Table 6: Inefficiency of socio demographic characteristics in maize seed production				
u_e	Coef.	Std. Err.	t	P>t
AgeofHouseholdhead	.004685	.0043353	1.08	0.285
GenderofFarmHouseholdhead	-.1358904	.1066432	-1.27	0.208
SizeofHousehold	.0078037	.0233191	0.33	0.739
Economicallyactivemale	.025246	.0688506	0.37	0.715
Economicallyactivefemale	.0572183	.0580766	0.99	0.329
YearofschoolingofHH	.0155652	.0113443	1.37	0.176
Numberoffarmingexperienceinyear	-.0022134	.0057865	-0.38	0.704
_cons	6.735979	.3094342	21.77	0.000
Number of obs	= 58			
F (7, 50)	= 1.33			
Prob> F	= 0.2580			
R-squared	= 0.1565			
Adj R-squared	= 0.0385			
Adj R-squared	= 0.0385			

5. SUMMARY AND CONCLUSION

The study under topic "Economic Analysis of Maize Seed Production in Bagnashkali Rural Municipality, Palpa, Nepal" was carried out in Bagnashkali RM, Palpa district. After conducting the primary survey, the sample of the survey was collected from the field and house of our respondents. A total of 182 households were surveyed through the Random sampling technique. The survey was carried out in oct/sept 2022 AD. A household field survey conducted through the in-person interview was done to collect data. For this research, both quantitative and qualitative data were collected. Primary data were taken by household field survey through in-person interview with the help of semi-structured questionnaire through "mWater surveyor" and focal group discussions (FGD). Secondary data were taken through the Annual agricultural statistical book, data from CBS, MOALD etc. Data obtained from the questionnaire filled were arranged systematically, codes were designed, and units were standardized wherever necessary before data was analyzed. Descriptive statistics are shown through pie charts and descriptive tables. For analytical data Stochastic Frontier model is used. It is used because the dependent variables are in countable form. Software used during data analysis was STATA 14 and MS Excel.

DAP, machine, total area are positive and show significant result to productivity. On average maize growers could increase their efficiency by 65 percent to reach the maximum level of efficiency. The major input for seed production was labor, hence more labor was required for seed production followed by machinery, fertilizers and seed.

Findings of the study revealed that the benefit cost ratio in the research area is 1.24 which indicates that maize production was profitable and farmers of Bagnashkali Rural Municipality, Palpa got additional 24 paisa with investment of one rupee in maize farming. The results show that labor costs should be minimized, and use of farm mechanization should be emphasized along with use of good fertilizer and quality seed to achieve more profitability. The Estimated Stochastic Frontier Production Model-1 showed that coefficient inputs like production labor, postharvest labor, DAP, total area, machine, are positive and show significant result to productivity. On average the maize growers could increase their efficiency by 65 percent to reach the maximum level of efficiency. Results from Stochastic Frontier Model-2 reveal that maize seed farmers gender of household head i.e. male and number of farming experience as important determinants have negative significant effects on inefficiency in maize production.

AUTHORS' CONTRIBUTION

All authors equally contributed to the research and manuscript preparation.

CONFLICTS OF INTEREST

There are not any conflicts of interest between the authors regarding the

data collection, analysis, preparation of manuscript, and publishing this research work.

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