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Research Article

Economics of Maize Seed and Grain Production in Rolpa

Sameer Pokhrel[1]*, Shiva Chandra Dhakal[2] and Swikriti Pandey[1]

[1]*Bachelor Graduate, Agriculture and Forestry University, Nepal*

[2]*Assistant Professor, Department of Agricultural Economics and Agribusiness Management, Agriculture and Forestry University, Nepal*

***Corresponding Author:** Sameer Pokhrel, Bachelor Graduate, Agriculture and Forestry University, Nepal.

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Abstract

Maize ranks topmost among the crops cultivated in hilly areas of Nepal, yet farmers fetch very marginal profit from their practice. Hence, a study was conducted to compare the socio-economic status and identify major problems of maize seed and grain production in Rolpa district. For the purpose, 70 households were interviewed with predesigned questionnaire survey, 35 each of maize seed and grain producers, in September 2017. The data were, then coded and entered in Microsoft excel and analyzed with the help of excel, SPSS and STATA software. Descriptive statistics, benefit cost ratio, Cobb-Douglas production function, mean t test, chi square test, etc. were computed and compared between maize seed and grain production. Social status of both producers was found comparable with exceptions in post-secondary education and involvement in trainings and agriculture co-operatives, where maize seed producers had significant lead. Maize seed production suffered higher cost of production, obtained higher return, had greater market penetration and obtained higher, but statistically non-significant net income, than maize grain production. Both the maize seed and grain production were in loss with the B:C ratio of 0.87 and 0.69, respectively. Nonetheless, seed producers marketed just 36 percent of total output as seed and used rest for consumption purpose; however, marketing the full potential seeds would have achieved significantly higher profit than maize grain production. There were many problems in the study area, where the perceived major problem was lack of transportation and attack of disease pests ranked second position.

Keywords: Maize Seed; Maize Grain; Economics; Problems

Introduction

Nepal is an agrarian country which has more than 60 percent of its citizen dependent upon agriculture as their primary occupation. The sector contributes 31.7 percent of total Gross Domestic Product [1]. Cereal production is the primary activity of Nepalese agriculture, where rice, maize and wheat are dominant crops. Maize ranks the second most important crop of Nepal followed by rice in terms of both area and production. Maize cultivation is inevitable way of livelihood for the people in mid hills and high hills of Nepal [2]. About 78 percent of total maize is cultivated in hills and basic source of food, feed, fodder and fuel, particularly by poor families and disadvantaged groups [3]. In the hills of Nepal, maize is basically cultivated on uplands (Bari land) under rain-fed condition in April-August. In case of terai, inner terai and some low lying regions, with the supply of irrigation, maize is cultivated during spring and winter seasons too.

However, Nepal is an import driven country for maize and the demand of maize for human and animal feed is expected to increase by 4 percent to 6 percent per year in next 20 years. So as the productivity do not increase significantly, we have for sure restore in existing import [4].

Seed stands vital in crop production and timely supply of quality seeds for the specified location is crucial for higher yield of the commodity [5]. High quality improved seeds can improve the crop yield by 20 to 30 percent [6]. Nepal has very less of seed production and is dominated by global seed business, where the seed import is continuously rising [7]. In this sense, Maize seed production holds great potential to flourish in mid hills of Nepal.

Rolpa district, the mid hill of Nepal, relies on maize as the source of food, feed and fodder. It has total cultivable land area of 31496 hectare, which is 26.6 percent of total land area. With the coverage of 12660 hectare land and average production of 29150 metric tons, maize is the leading cereal crop of the district [8]. Basically, most of the uplands are covered with maize from April to October in the district; mostly under rain-fed condition.

The recent years have been showing sign of hope for maize farmers in Rolpa district. Past 5 years of data shows a significant increase in the production level of maize crop in the district [8]. Traditionally, farmers in Rolpa district used to produce maize just for home purpose; however, maize marketing has been a recent trend of farmers of this district. Not only the grain but the farmers are also attracted towards the maize seed production [8]. Still, profit from maize farming is marginal; however, the progressive results of recent years can possibly set up maize cultivation as a profit fetching business in the district. Hence, this study is focused to evaluate and compare the cost, income and profit as well as social status between maize seed and maize grain production of Rolpa district. Similarly, the study will help point out the core constraints in maize cultivation in the district.

Methodology

The district under study was Rolpa which lies in the hills of mid-western development region. It was located in between the elevation of 701m to 3639m with average temperature variation of 3.6^0c to 31.2^0c, which suits for maize cultivation. Under PMAMP (Prime Minister Agriculture Modernization Project), Rolpa had been selected as block for the production of maize and Libang municipality was one of the regions considered for the purpose. Hence, Libang was purposively selected for the study and total of 70 samples, 35 each of maize seed and maize grain producers were randomly taken for the purpose.

Semi structured questionnaire survey was basis for the research among maize seed and maize grain producing famers. The questionnaire included socio-demographic, economics of production, major problems in maize cultivation and marketing aspect of the harvest.

Focus group discussion was conducted to the officer of DADO, Rolpa, president of a cooperative and few progressive farmers to bridge the information lag and triangulate the validity of data obtained from the respondents of household survey.

Similarly, secondary data were obtained from DADO annual reports and booklets, Ministry of Agriculture Development (MoAD), various NGOs and INGOs in the district and so on.

Data collected from household survey were rechecked, complied and entered in Microsoft excel. Those data were analyzed with the help of Microsoft excel, SPSS and stata software. According to necessity in the data various diagrams, charts and graphs were drawn and frequencies, mean, standard deviation, mean comparison test, chi square test, correlation, regression and so on were analyzed and compared between maize grain and seed producers on various topics.

Cost benefit analysis

Cost benefit analysis was done after calculating the total cost and gross return from the maize cultivation. Cost of production was calculated by adding all the variables cost items (FYM, bullocks cost, seed cost and labor used during sowing, weeding, manure application, harvesting and marketing as well as the seed input for mixed crop grown along with maize crop) in the production process separately for maize seed and maize grain producers. Similarly, the income for maize seed producers was obtained from maize seed in addition with maize grain and income from mix crops cultivated along the field. For the maize grain production, the same parameters were considered except maize seed.

Finally, benefit cost analysis was carried out by using formula:

$$\text{Benefit cost ratio} = \frac{(\text{Gross return})}{(\text{Total variable cost})}$$

Gross return = Total quantity of seed produced (Kg)* Price per unit of maize seed (Rs.) + total quantity of grain produced (Kg) *Price per unit of maize grain (Rs.) + total quantity of mixed crops (bean, soyabean, etc.) (Kg) *price per unit of mixed crops (Rs.)

Total variable cost = seed cost + Bullock cost + Labor cost + seed cost of mixed crop

Problem ranking

The index values were calculated considering the qualitative data. On the basis of ranking of each problem by the individual respondent final index value was obtained which revealed the severity of each of the farmer's problems. The index of the problem was calculated using the following formula

$$I = \sum \left(\frac{SiFi}{N}\right)$$

Where

I = index value; Σ = summation; Si = i^{th} scale value (I = 1, 0.83, 0.66, 0.5, 0.33,0.16)

F = frequency of i^{th} importance given by the respondents

N = total number of respondents

From the field study and FGD six primary problems of the study area were considered and farmers were requested to rank them according to their severity they had experienced. The problems included lack of irrigation, incidence of disease pests, lack of storage, lack of transportation, lack of quality seed, and lack of fertilizers.

Correlation and regression analysis

Dummy regression techniques in Cobb Douglas form was used to compute the efficiency of maize seed and maize grain farming in the study area. Following formula was used for the purpose:

ln Y= ln a + b1ln x1 + b2ln x2 + b3ln x3 + b4ln x4

Where,

Y=return; x1 = bullock cost per ha; X2= FYM cost per ha; X3 = seed cost per ha; X4= labor cost per ha; bi= Regression coefficient of respective inputs.

Result and Discussion

Household characteristics

In the study area most of the oldest members (about 50 years in average) in the household were the heads and household decision are rightfully vested upon them. Similarly, average family size in the study area was 5.33 which is higher than average national family size. The dependency ratio (number of dependents/numbers of economically active population) of maize grain producers was 0.86, while that of maize seed producers was 0.599 and these two values are significantly different at 5 percent level of significance.

Nepalese agriculture has a peculiar feature of utilizing family as labor force. In the study area most of the farmers were found to using family as the labor force, only at the peak time of operations few labors were hired. In case of maize grain producers, in an average 3.085 number of family labors were directly involved in agricultural activities, where the figure was 2.74 in case of maize seed producers.

Land fragmentation and low land holding has been one of the major limitations for the economical production in the study area. It has been found that average land area for maize grain production was 0.26 hectare, while for the maize grain production it was 0.172.

Variables	Type of producer		Mean difference	t value	P value
	Maize Grain	Maize Seed			
Age of HH head	53.37	50.25	3.11	0.944	0.174
Family number	5.45	5.22	0.228	0.535	0.2970
No. of dependents	2.2	1.65	0.542	1.77**	0.040
No. of independent	3.31	3.57	-0.257	-0.688	0.248
Dependency ratio	0.864	0.599	0.265	1.864**	0.033
Family labor	3.085	2.742	0.342	0.948	0.173
Maize cultivated area	0.265	0.172	0.093	2.466***	0.0081

Table 1: Household information of the respondents.

Note: ** and *** indicate significance 5 and 1 percent level of significance respectively

Source: field survey, 2017.

Education level of household heads

Most of the household heads (60%) were illiterate in case of maize grain producers and about 43 percent of household heads were illiterate in case of maize seed producers. In both cases, 40 percent of the household heads had attended primary level of education. While, 17 percent of household heads had attended secondary post-secondary level of education, none of the maize grain producers have achieved secondary or higher level of education. Hence, in study area achievement of higher degree was somehow associated with shifting towards the maize seed production.

Gender distribution as labor force for the maize production

In contrast to the fact that most of the households are headed by the male in study area; major source of labor in the agricultural farm is female. In an average female contribute as 60 percent of labor force in the farm whereas male contribute 40 percent of total labor force.

Farmers' involvement in agricultural institution and participation in training

While less than 3 percent of total grain producers were involved in agriculture cooperatives or groups, more than 48 percent of maize seed producers were found to be involved. The difference is significantly high at less than 1 percent level of significance.

Majority of farmers (about 80 percent) of the study area have never attended any sort of trainings regarding maize cultivation. While, most of the grain producers (about 83 percent) haven't participated in trainings, about 38 percent of seed producers have participated.

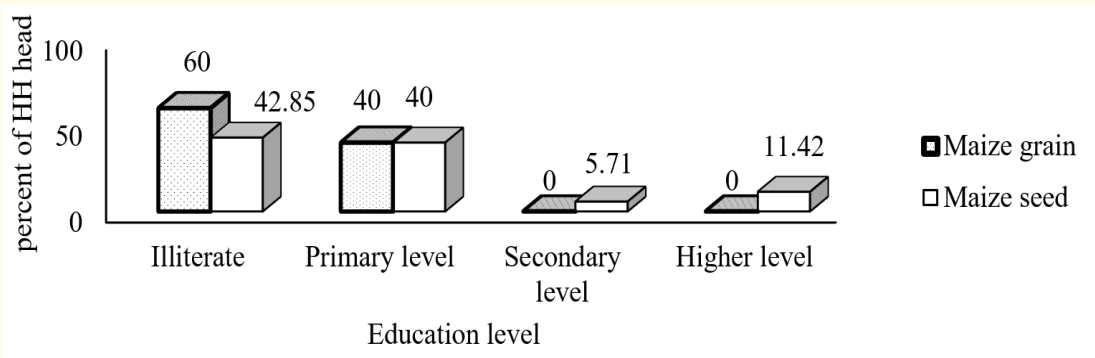

Figure 1: Education level of household head.

Source: Field survey, 2017.

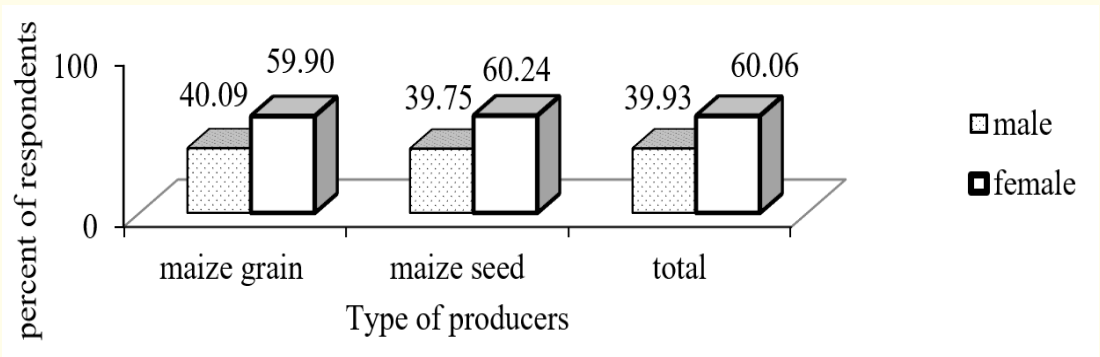

Figure 2: Gender contribution as labor force in maize production.

Source: Field survey, 2017.

Particulars	Response	Grain	Seed	Total	Chi square	P value
Membership	Yes	1(2.90)	17 (48.60)	18 (25.70)	19.145***	0.00
	No	34 (97.10)	18 (51.40)	52 (74.30)		
Involvement in training	Yes	6(17.10)	13 (37.10)	19 (27.10)	3.540*	0.060
	No	29(82.90)	22 (62.90)	51 (72.90)		

Table 2: Distribution of farmers involved in agricultural institution and participation in training.

Figure in parenthesis indicate the percent.

*** indicates significant at 1 percent level

* indicates significant at 10 percent level.

Source: field survey, 2017.

Comparative cost of production in hectare

Out of total cost, FYM and labor cost accounted for majority of production cost, which was more than 75 percent in case of maize grain producer and more than 76 percent in case of maize seed producers. Similarly, cost of seed input was nominal in both cases contributing less than 1 percent in both producers. The fact behind this was huge subsidy from DADO and seed distribution free of cost by cooperatives and other organizations. Comparatively, cost

of production was higher in maize seed producer than in case of maize seed producers. These two costs were found to be statistically significant at 5 percent level of significance.

Similarly, labor cost of maize seed production was found to be significantly higher than maize grain production at less than 1 percent level of significance.

Variables	Maize grain	Percent share	Maize seed	Percent share	Mean difference	t-value	p-value
Bullock cost	18705 (1028)	22.04	21456 (1226)	21.5	-14938.51	-2.319*	0.012
Seed cost	496 (80)	0.58	346 (120)	0.34			
FYM cost	35244 (2935)	41.54	36107 (2826)	36.18			
Labor cost	29317 (1931)	34.55	40012 (2668)	40.1			
Bean cost	457 (60)	0.53	813 (139)	0.81			
Soya bean cost	623 (75)	0.73	1045 (141)	1.04			
Total	84844	100	99782.62	100			

Table 3: Comparative cost of production of maize seed and grain producers.

Note: * indicates significant at 10 percent level

figures in the parentheses indicate SEM

Source: field survey, 2017.

Producer type	Observation	Mean	Std error	Standard deviation	Mean difference	t value	P value
Grain	35	239317	1931.709	11428.14	-10695.57	-3.246	0.00***
Seed	35	40012.85	2668.508	15787.1			

Table 4: Comparison of labor cost of maize seed and grain production.

Note: *** indicates significance at 1 percent level.

Source: field survey, 2017.

Income from maize cultivation

The average income for maize grain producers was Rs. 58,248 and in case of maize seed producer, it wass Rs. 80,134 and hence the difference between them was statistically significant at less than 1 percent. Similarly, mixed crops, soybean and bean shared respectively about 7 percent and 11 percent of total income from the cropping system.

We had considered those farmers who produced any amount of seed as maize seed producers; in fact, just about 32 percent of total income was obtained from seed, whereas grain contributes for 49 percent of total income for the seed producers. In contrast to the fact that about one third of the total seeds of a single maize cob can be used as actual seed for next generation, just 36 percent has been utilized as maize seed in the study area and hence most of the output, which accounted for 64 percent, was used as grain for food or feed to animals. That figure was quite less than the potential up to which seeds could have been marketed.

Variable	Maize grain	Percent share	Maize seed	Percent share	Mean difference	t- value
Grain income	47199 (3285)	81.03	38853.71 (3683)	48.48	-21886	-3.617***
Seed income	0	0	25922.11 (3104)	32.34		
Bean income	6535 (659)	11.22	9168.58 (741)	11.44		
Soya bean income	4513 (694)	7.74	6189.69 (641)	7.72		
Total	58248	100	80134.9	100		

Table 5: Average income from maize cultivation.

Note: *** indicates significant at 1 percent level.

Figure in parentheses indicate SEM.

Source: field survey, 2017.

Estimation of efficiency of maize grain producers

The table below shows the Cobb Douglas regression model to estimate the efficiency of maize grain producers. The Cobb Douglas production function was considered to determine the effect of various inputs on the total income of maize grain producers. The F value was 2.34 which was significant at 10 percent level and R square value was 0.238 which means 29 percent of variation in maize income was explained by the variables under consideration. Hence, the model fits into the study.

From the analysis, we can interpret that that FYM cost had direct positive and statistically significant impact upon the income. With the one percent increment in the FYM cost, the income would increase by 0.35 percent which is significant at 5 percent level of significance. Similarly, the bullock cost shows a positive relation with the income whereas seed cost and labor costs are negatively related to income. However, none of these figures were statistically significant. It can be interpreted that the farmers were already using excess of labor and seed in their production system and hence, minimizing them would make no less in income from their farming practice.

Variables	Coefficient	Standard Error	T	P > t
Bullocks cost	0.222	0.186	0.12	0.906
FYM cost	0.354**	0.130	0.011	0.011
labor cost	-0.138	0.157	0.387	0.387
seed cost	-0.163	0.113	0.159	0.159
Constant	9.816	1.894	5.94	5.946

Table 6: Estimation of efficiency ratio of maize grain producers.

Note: ** indicates significant at 5 percent level.

Number of observations = 35; F (4,30) = 2.34; prob > F = 0.077; R- squared = 0.238; adj R- squared = 0.136.

Efficiency of maize seed producers

Likewise, the Cobb Douglas production function was estimated to justify the relation between various production functions upon the income level of maize seed production. The F value was found to be 5.30 which was statistically significant at less than 1 percent level of significance. Similarly, the R square value was 0.414 which means the variables under consideration had 41.4 percent impact on the income, other factors remaining the same.

It can be analyzed from the table that increasing one percent in the labor cost would increase the income by 0.68 percent which is highly significant at less than 1 percent level of significance. In other words, maize seed production needed to increase the labor to enhance the income. Similarly, increasing bullock cost and seed cost would increase the income level, whereas increasing the FYM cost would decrease the income level, however, none of those figures was statistically significant.

Variables	Coefficient	Standard Error	t	P > t
Bullock cost	0.272	0.246	1.11	0.276
FYM cost	0.246	0.153	1.61	0.118
Labor cost	0.681***	0.168	4.04	0.00
Seed cost	0.142	0.111	1.28	0.210
Constant	-2.236	3.155	-0.71	0.484

Table 7: Estimation of efficiency ratio of maize seed producers.

Note: *** indicates significance at 1 percent level.

Number of observations = 35; F (4,30) = 5.30; Prob > F = 0.002; R-squared = 0.414; Adjusted R- squared = 0.336.

Comparative profit from maize seed and grain production

Both the maize seed and maize grain producing farmers were suffering economic loss from their farming practice. Maize seed producers had an economic loss of Rs. 19,648 per hectare, whereas the maize grain producers suffered a loss of Rs. 26,595 per hectare in their farming practice. The benefit cost ratio of maize seed and grain production were 0.875 and 0.69 respectively. Profit obtained by maize seed producers exceeded the maize grain producer by Rs. 9,947, which, however was not significantly different. Virtually, farmers perceived their practice to be in profit as they did not consider the monetary value of two major cost of production, FYM cost and labor cost. They obtained FYM free of cost from their sheds and most of the labors in the farms were family labors whose opportunity costs were not considered.

Variables	Profit	B:C ratio	Mean difference	t-value	p-value
Maize seed	-19648.52	0.875	-6947.219	-0.94	0.173
Maize grain	-26595.74	0.69			

Table 8: Profit obtained from maize grain and seed production.

Amount of maize used as seed by seed producers

Maize seed producers did not actually utilize seeds up to full potential. Only 35 percent of total maize output was used as seed and rest 65 percent of the products was used as grain for household consumption as well as feed for animals. However, it is estimated

that about 70 percent of total grains in the ear can be used as maize seed. Hence, if the farmers can fully utilize the potential maize seeds, the profit obtained would have been significantly higher for maize seed producers compared to maize grain producers.

If the maize was used for the full potential, then the total income from maize cultivation would have been about Rs. 88,000 from existing Rs. 40,000 per hectare. In such case, the BC ratio would be 0.95 and hence, the loss would be Rs. 11,343. The profit obtained from full production of maize seed would have been significantly higher than the profit obtained from maize grain production at 5 percent level of significance.

Type of producer	Mean	Standard error	t value	P value
Seed producer	-11343.63	6135.429	2.098	0.0198**
Grain producer	-26595.74	3894.681		
Mean difference	-6947,219			

Table 9: Comparison of profit obtained from maize grain and maize seed producers when full potential maize seeds are marketed.

** indicates significant at 5 percent level.

Marketed maize seed and grains

All of the respondents of maize seed producers were found to sell their product, at least a fraction of it. While in case of maize grain producer's majority (71.43 percent) had not sold any part of their maize grain and the consumption was entirely household, either for human consumption or as feed for domesticated animals. The difference between maize grain and seed producers were significantly different in the sense of marketing of products at less than 1 percent level of significance.

Variables	Maize seed	Maize grain	Chi square value	P value
Yes	35 (100)	10 (28.57)	38.889***	0.00
No	0 (0)	25 (71.43)		

Table 10: Marketing of the maize harvested.

Note: *** indicates significant at 1 percent level.

Figures in parentheses indicate percent.

Problem ranking

Both maize seed and maize grain producing farmers were asked to rank the predesigned six of the most severe problems in the study area. Based on the rank they gave to each of the problem, final weight of each problem was calculated and finally the index of each problem was obtained. Based on the index the problems were ranked.

Both the maize seed and grain producers ranked lack of transportation as the most severe problems in the study area which was followed by the incidence of disease and pests. Since, the maize was cultivated only during rainy season; they ranked lack of irrigation at 3rd and 4th position. However, if there were the availability of irrigation in spring or winter season, a new trend of growing maize at other than rainy season would have been established.

	Maize grain producer			Maize seed producer		
Problems	Weight	Index	Rank	Weight	Index	Rank
Disease and pests	25.22	0.72	II	24.4	0.69	II
Transportation	33.13	0.94	I	31.59	0.90	I
Irrigation	19.77	0.56	IV	23.24	0.66	III
Storage facility	23.35	0.66	III	21.51	0.61	IV
Seed quality	12.86	0.36	V	12.66	0.36	V
Fertilizer	7.46	0.21	VI	8.04	0.22	VI

Table 11: Ranking of problems based on the perception of farmers.

Field survey, 2016.

Conclusion

In contrast to household heads dominated by male, female contributed more as farm labor force. Farmers ranked transport as major problem and lack of transportation had been a barrier to market the outputs and hindered the mechanization for efficient maize production. Both the maize seed and grain producers were bearing loss from their farming, yet, they adopted the practice, as the major determinant of production cost, labor and FYM, were available from within the household and left unconsidered in the economics of production, at the same time, there was no better opportunity costs for these inputs.

Seed producers had a better market penetration and market information. Besides, they were involved more in training and associated more with agricultural institution. Upgrading from maize grain production to maize seed production was economically profitable. Farmers in the study area underutilized maize seed and used most of the potential maize seed as grain. While, marketing all of the potential seed could achieve significantly higher profit as compared to grain producers.

Nonetheless, availability of irrigation holds a potential to bring a new practice of producing maize even at seasons other than the rainy season.

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Sameer Pokhrel

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