



Research Article

Resource Use Efficiency of Banana Production and Impact of Insurance Scheme Adoption on Banana Farming in Chitwan, Nepal

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Article Information

Received: 20 May 2020

Revised version received: 11 June 2020

Accepted: 14 June 2020

Published: 25 June 2020

Cite this article as:

S. Dulal and R.R. Kattel (2020) *Int. J. Appl. Sci. Biotechnol.* Vol 8(2): 170-178.

DOI: [10.3126/ijasbt.v8i2.29120](https://doi.org/10.3126/ijasbt.v8i2.29120)

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Peer reviewed under authority of IJASBT

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Keywords: Banana, Resource use efficiency, Insurance, Return to scale, B:C ratio, Nepal

Abstract

Eastern Chitwan of Nepal is the major banana producing hub. Farmers were categorized as small, medium and large banana producers on the basis of their banana cultivated land. Majority of the large famers had purchased banana insurance scheme. Altogether 150 sample households were selected on the basis of purposive simple random sampling to assess the resource use efficiency of banana farming and impact of insurance adoption in eastern Chitwan of Nepal in 2017. The primary data were collected by household survey using pre-tested semi-structured questionnaire, key informant interview and focus group discussion. The field survey showed that 50.58 percent respondents were male with average family size was 6.04. Only 10 percent of the sampled households were headed by female. Around 36 percent farm households had insured their banana. The B:C ratio of banana farming was 2.18. The research revealed that the farmers had an experience decreasing return to scale in banana production. Land preparation, suckers, labor and chemical fertilizer were the main factors that positively determined whereas the manure, irrigation, pesticide, and micronutrient had have negatively affected on banana production. Adoption of insurance scheme on banana farming had have positive effect on production of banana. It was estimated that the gross return will be increased by 0.012 percent in a farmer who had done insurance. The sampled farm failed to show their efficiency in using resources in banana production. There was further opportunity to increase banana production using more land preparation, suckers, chemical fertilizers and labor.

Introduction

In Nepal agriculture is a major source of income and forms the basis of livelihoods for the majority of population. Agriculture was one of the important business in case of Nepal which contributes 31.7 percent to national GDP and present employment to 65.6 percent of population (MoAD, 2016). Banana was one of the critical high value crops which was commonly grown in tropical and subtropical

parts of the world. In Nepal, banana was being grown since time immemorial in domestic yards for the home consumption purpose (Gautam & Dhakal, 1994). Banana was positioned third in production and fifth in territory among fruit crops in Nepal (CBS, 2016). Banana is a commercial crop which has high potential for income generation, enterprise development and activity creation for

the people. In Nepal it was successively growing in Chitwan and Kanchanpur districts. However, in few different districts like Jhapa, Sunsari, Kailali and in Nawalparasi farmers were cultivating the banana. The B/C ratio of banana was 2.35, which was better as examine to different staple crops (MoAD, 2014). Banana is a fleshy pseudo stem plant. If there is more weight on the top portion of the plants then there takes place more problem and chance of lodging and breaking of stem may occurs. At some point of pre-monsoon and post-monsoon there occurs windstorm which causes serious loss to banana farmers. In the context of Nepal farmers use to cultivate more Malbhog and G9 variety of banana. Among these two variety Malbhog variety of banana has got long height because of demand. The major problem for farmer involved banana farming is windstorm and it causes severe losses of banana. Due to the heavy losses farmers are in the mood to change their enterprise and derive non-farm income from sources.

The fourteenth plan of the Government of Nepal has its objective of reducing poverty level of Nepal from 21.6 percent to 17 percent (MoAD, 2015). In spite of noticeable progress achieved over past decade, there still 24.3 percent poverty in rural areas. Similarly, Prime Minister Agriculture Modernization Project (PMAMP) is 10-year project has targets to become independent in banana within 7 years (MoAD, 2017). So, to become independent on banana production and reducing the poverty in the country, farmers should encourage on banana cultivation. It was also one of the high value crops too. Banana cultivation is emerging as one of the major cultivation practices in Nepal. Although there was high risk in banana cultivation, it was becoming popular among the Nepalese farmers

The domestic demand of banana was increasing every year in Nepal because of increasing population, increasing inflow of tourists and increasing awareness about the nutritive value of banana. However, the expected rate of growth in terms of area and production has not yet been achieve because of inconsistent demand coupled with lack of coordination between production and marketing. At present about 58 percent banana market was cover by Indian banana. So, market for commercial production of banana within Nepal may not be a problem. Lack of inputs, disease free saplings, agricultural credit, proper post-harvest handling, price variation, poor bargaining power are the constraints remaining on banana cultivation (Thakur, 2016). The government has formulated several policies and programs for the commercialization of agricultural sector. But most of them seem to have been limited only to policy and not be able to show real impact on the farmer's level. So, most of the farmers have been adopting less profitable, traditional production practices which are characterized by high cost of production, low productivity and low profitability.

In this context, this paper assessed the resource use efficiency of banana production and effect of insurance on banana production function in eastern Chitwan of Nepal as well as estimated benefit-cost analysis of banana farming.

Review on Resource Use Efficiency In Banana Production

Thakur (2016) analyzed the resource use situation in banana farms of Padampur of Chitwan, Nepal. Primary data were obtained from a sample of total size 120 in which 60 banana farmers used the credit facility and 60 banana farmers have not used the credit facility. The result revealed that the cost incurred in suckers and labor were significant and have not optimally utilized in banana production. He found that the FYM cost, irrigation cost, and pesticide cost were positive but lower which stated that they were also over utilized and has to be utilized more efficient. Umamaheswari and Verlmurugan (2010) studied the resource use efficiency in banana farms and suggests suitable policy measures. Primary data were collected from a sample of 80 farmers (40 each from wetland and garden land categories) in Karur district, Tamil Nadu, India. Production function analysis revealed increasing returns to scale from banana cultivation. Landge *et al.* (2013) studied allocative efficiency and resource use in banana. They observed that the marginal physical product of the family and hired labor input was negative except that of plantain suckers. The efficiency ratio of plantain suckers became more than one. While the efficiency ratio of family and employed labor turn into less than one.

Landge *et al.* (2010) assessed the resource use efficiency and optimum resource use in banana production. About 48 drip irrigated banana growers have been randomly selected for the research. Cobb-Douglas production function was fitted to the data. The results revealed that the regression coefficient of machine labor, irrigation and area under banana was 0.054, 0.203 and 0.213, respectively which were positive and significant. Marginal productivity with appreciate to area, bullock labor and machine labor was 51.29, 2.75 and 2.74 quintals, respectively. It inferred that if area is increased by one hectare, bullock labor increased by one pair and machine labor increased by one hour, it would lead to increase banana production by 51.29, 2.75 and 2.74 quintals, respectively. The sum of the production elasticities ($\Sigma \beta_i$) was 0.57 which indicated decreasing return to scale.

Materials and Methods

Selection of The Study Area

This study was conducted in the Chitwan district of Nepal. This district was purposively selected for the study because it was one of the main banana producing districts in the country. Under One Village One Product (OVOP) program of Government of Nepal, this district was given main priority for banana production.

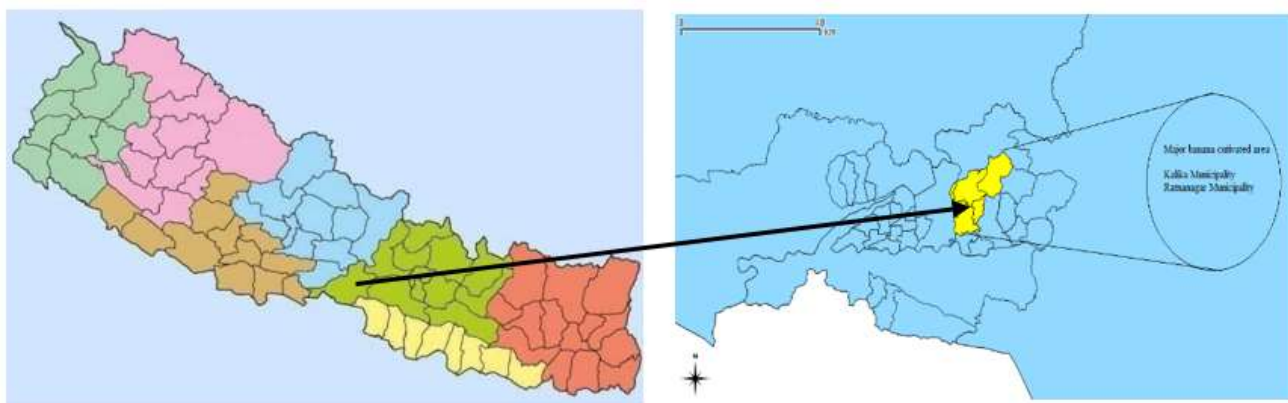


Fig. 1: Map showing the study area of research in Chitwan district of Nepal

Table 1: Details of 3 categories of farm based on size and number of samples

Farmer Category	Farm size (Banana cultivated land)	Number of samples
Small farmer	Less than 1 Bigha ¹	50
Medium Farmer	1 – 4 Bigha	50
Large Farmer	More than 4 Bigha	50

Banana cultivation was widely commercialized and banana cultivated area were increasing in Chitwan district. Banana cultivated area of Chitwan district was 693 hectares with total production of 12256 MT (CBS, 2016). But this area and production has increased significantly in last two years. At present there were about 527 registered commercial banana growers in the district in which 208 had already adopted insurance.

Study Population, Sample Size and Sampling Frame

All the banana farming farmers of the study area were study population. On discussion with Chitwan Banana Production Association members, categorize the banana producing farmers on the basis of their banana cultivated land area as shown in below. Pokhrel (2006) had also similar type categorization was done on tea growers based on suggestion from Nepal Tea and Coffee Development Board (NTCDB) staff. Household Survey was conducted using personal interview schedule with 150 banana producers. Sample were selected using purposive simple random sampling technique. Producers were categorized into three based upon the farm size (Table 1).

Extended Form of Cobb-Douglas Production Function

The Cobb-Douglas production function was estimated to assess the contribution of banana insurance to productivity of banana as the representative of whole agriculture sector. Bhanumurthy (2002) reported that Cobb-Douglas has the greater importance as:

It can handle multiple inputs in its generalized form.

It does not introduce distortions of its own in the presence of imperfections in the market.

Various econometric estimation problems like serial correlation, heteroskedasticity and multicollinearity can be handled adequately and easily, and

It facilitates the computations and has the properties of uniformity, represent-ability and flexibility.

Mathematically, the Cobb-Douglas production function can be written as

$$Y = ax_1^{\beta_1} x_2^{\beta_2} x_3^{\beta_3} x_4^{\beta_4} x_5^{\beta_5} x_6^{\beta_6} x_7^{\beta_7} x_8^{\beta_8} x_9^{\beta_9} e^u$$

Where,

Y= Income of banana (in price per kattha)

X₁ = land preparation cost per kattha

X₂ = Suckers cost per kattha

X₃ = labor cost per kattha

X₄ = fertilizer cost per kattha

X₅ = manure cost per kattha

X₆ = Irrigation cost per kattha

X₇ = Pesticide cost per kattha

X₈ = micronutrient cost per kattha

X₉ = Crop insurance

e = Base of natural logarithm

U = Stochastic random error term

¹ 1 Bigha = 1337.8 m² (20 kattha) = 0.68 hectare

Hence, the production function can be written as below after log transformation:

$$\ln Y = \ln a + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_8 + \beta_9 \ln X_9$$

The β 's are output elasticity with reference to a particular input in consideration that show the marginal increment in the yield banana from the increment in input and are expected to bear a positive sign with them.

The efficiency ratio was computed using the formula

$$r = MVP/MFC$$

Where,

MVP = Marginal Value Product

MFC = Marginal Factor Cost

The MVP was estimated using the formula:

$$MVP_i = b_i * \frac{Y}{x_i}$$

Where,

b_i = Estimated regression coefficients

Y = Geometric mean of total income from banana production

X_i = Geometric mean of i^{th} inputs

Decision Criteria

$r = 1$ indicate the efficient use of the resource

$r > 1$ indicate underused of the resource

$r < 1$ indicate over used of the resource

Results and Discussion

Results from Descriptive Analysis

The population distribution of the sampled household of the banana producers by farm size, gender and average family

size were presented in Table 2. The total population in sample households was found to be 907. In case of large farm, the number of female (50.85%) was slightly higher than the number of male (49.15%). In case of small farm and medium farm the number of male were 51.67 percent and 50.32 percent, respectively and the number of female were 48.33 percent and 49.67 percent respectively. Overall, 50.58 percent of sampled population was male and 49.61 percent was female. The average family size of small, medium and large farm categories were 6.0, 6.24 and 5.94, respectively. Overall, average family size was 6.01, which was higher than the national average (CBS, 2015).

Table 3 represents the gender and family type the household head. Usually, the gender of the household head plays a major role in the household decision-making. Result shows that majority (90%) of the household heads were male while only 10 percent were female. Out of 50 small farmers, 40 were male headed and 10 were female headed. Similar result was found in medium farm where 45 households were male headed and 5 were female headed. But in large farmer all the households head were male headed (100%). From the study it was found that joint family type was dominating family type in small and medium farm where as nuclear family type was dominating family type in large farm. Overall, Nuclear type family was found to be the most dominating family type. In totality 50.70 percent of the household were nuclear where as 49.30 percent were joint type.

Table 2: Population distribution of the households by farm size, gender and average family size

Gender	Farm size			Total (N=150)
	Small farm ² (n = 50)	Medium farm ³ (n = 50)	Large farm ⁴ (n = 50)	
Male	155 (51.67)	157 (50.32)	145 (49.15)	457 (50.58)
Female	145 (48.33)	155 (49.67)	150 (50.85)	450 (49.61)
Total	300 (100.00)	312 (100.00)	295 (100.00)	907 (100.00)
Average family size	6.0	6.24	5.9	6.04

Note: Figures in parentheses indicate percentage

Table 3: Gender, family type, religion and ethnicity of household head by farm size

Variables	Farm size			Total (N = 50)	Chi-Square
	Small farm (n = 50)	Medium farm (n = 50)	Large farm (n = 50)		
Gender					11.11***
Male	40 (80.00)	45 (90.00)	50 (100.00)	135 (90.0)	
Female	10 (20.00)	5 (10.00)	0 (0.00)	15 (10.00)	
Family					2.774
Joint	26 (52.00)	28 (56.00)	20 (40.00)	74 (49.30)	
Nuclear	24 (48.00)	22 (44.00)	30 (60.00)	76 (50.70)	

Notes: Figures in parentheses indicate percentage. *** indicates significant difference at 1% level.

² Less than 1 bigha (1 hectare = 1.48 bigha)

³ 1 bigha to 4 bigha

⁴ More than 4 bigha

Table 4 represents the age, education and experience of households by farm size. The total average age of the households head age was 50.02 years. The small farm households head was older than the medium and large farm household head. The average ages of households' head were 53.24, 50.78 and 46.04 years for the small farm, medium farm and large farm, respectively. Similarly, the total average education level was 8.25 in which large farm households head had higher level of education (10.16) followed by medium farm household's head (9.66) and small farm household's head (4.92). Overall, average total experience on banana cultivation was 6.63 years. Large farm households head had more experience on banana cultivation (10.00) followed by medium farm households head (6.56) and small farmers household head (3.32). The age, education and experience of household head were found significantly different among farm size at 1 percent significance level.

Different Operational Cost Incurred in Banana Farming

There were different inputs used for the production of the banana in the study area and incurred different level of costs production for banana. The different cost incurred during the banana cultivation are land cost, land preparation cost, suckers cost, labor cost, chemical fertilizer cost, manure cost, irrigation cost, pesticide cost and micronutrient cost.

The result revealed that the total average operational cost per kattha incurred in the banana production by the small, medium and large farm was NRs⁵. 9613, NRs. 9773 and NRs. 9919, respectively. The result revealed that among the

cost incurred in the banana production per kattha, land cost share (NRs. 3004) followed by manure cost (NRs.1798), fertilizer cost (NRs. 1705), suckers cost (NRs. 1150), labor cost (NRs. 1108), pesticide cost (NRs. 463), land preparation cost (NRs. 230), micronutrient cost (NRs. 212) and irrigation cost (90).

The above-mentioned average cost pattern was same for the small and medium farm but for large farm it was different. In large farm second highest cost incurred was fertilizer cost (NRs. 1821) followed by manure cost (NRs. 1815). Similarly, the last cost incurred was land preparation (NRs.177) for large farm while it was second last for small (NRs. 276) and medium farm (NRs. 238). Details of cost incurred on different variables by farm size is presented in Table 5.

From the Table 6, it was found that the average net profit, total revenue for all farm was NRs. 11128 and NRs. 20947, respectively. Net profit was highest in medium farm (NRs.11280), followed by small farm (NRs. 1139) and large farm (NRs. 10875). Similarly, total revenue was highest in medium farm (NRs. 21053), followed by small farm (NRs. 21004) and large farm (NRs. 20785). The benefit-cost (B: C) ratio was found highest in small farm (2.23) followed by medium farm (2.19) and large farm (2.12). On an average, the B: C ratio was found to be 2.18. The B: C ratio shows that banana cultivation was profitable enterprise. Similarly, Rane and Bagade (2006) also found that the average benefit cost ratio of banana cultivation was 2.27.

Table 4: Age, education and experience of household head by farm size

Variables	Farm size			Total	F value
	Small farm	Medium farm	Large farm		
Age	53.24	50.78	46.04	50.02	4.94***
Education	4.92	9.66	10.16	8.25	22.27***
Experience	3.32	6.56	10.00	6.63	48.49***

Note: *** indicates significant difference at 1% level.

Table 5: Comparative cost of banana cultivation by farm size (per Kattha)

Inputs	Small farm	Medium farm	Large farm	Total average
Variable Cost (in NRs.)				
Land preparation cost	276.03	238.78	177.24	230.69
Suckers cost	1249.78	1106.02	1096.91	1150.90
Labor cost	1076.23	1101.18	1148.83	1108.75
Chemical fertilizer cost	1553.20	1742.42	1821.36	1705.66
Manure cost	1674.98	1904.52	1815.78	1798.42
Irrigation cost	89.46	92.30	88.90	90.22
Pesticides cost	454.73	458.29	478.68	463.90
Micronutrient/Hormone cost	207.29	203.70	227.68	212.90
Total operational cost (NRs.)	6581.4	6847.32	6855.4	6761.37
Fixed cost (in NRs.)				
Land leased cost (NRs.)	3031.96	2926.18	3054.60	3004.2
Total cost (NRs.)	9613.76	9773.5	9910.02	9765.76

⁵ 1 US Dollar= NRs. (Nepalese Rupees) 103 during field survey 2017.

Table 6: Comparative return of Banana cultivation by farm size

Variables (NRs/Kattha)	Small farm	Medium farm	Large farm	Total average
Net Profit	1139.04	11280.2	10875.28	11128.17
Total Revenue	21004.63	21053.48	20785.27	20947.79
B:C ratio	2.23	2.19	2.12	2.18

Source: Field survey (2017)

Table 7: Descriptive statistics of variables used in the model

Variables	Description of variables	Mean	Std. Dev.	Min	Max
ln_banana_income	Total annual household income from banana farming (in NRs.)- dependent variable	9.93	0.168	9.25	10.45
<i>Independent variables</i>					
ln_land_prpn	Cost of land preparation per kattha	5.29	0.489	3.91	7.48
ln_suckers_cost	Cost of suckers per Kattha	6.97	0.297	5.07	9.39
ln_labor_cost	Cost of labor per Kattha	6.95	0.340	5.85	8.11
ln_fert_cost	Cost of chemical fertilizer per kattha	7.36	0.413	6.09	8.31
ln_manure_cost	Cost of manure per kattha	7.33	0.946		8.38
ln_irrg_cost	Cost of irrigation per kattha	4.49	0.134	4.24	4.82
ln_pesticide_cost	Cost of pesticides per kattha	6.08	0.358	4.09	6.90
ln_micronutrient	Cost of micronutrients per kattha	5.00	1.39	1.00	6.50
Insurance	Crop insurance status (1=Insurer, 0-non insurer)	0.36	0.48	0	1

Source: Field survey (2020)

Results from Cobb-Douglas Production Function

Table 7 presents the descriptive statistics of variables used in the model. About 36 percent banan producers adopted insurance scheme of their banana farming to cop production risk.

The estimation result of Cobb-Douglas production function result showed that the overall regression equation is highly significant as shown by the zero-probability value of F test as shown in Table 8. The model was tested for the multi-collinearity and result revealed that there was no multi-collinearity in the independent variables used in the regression model.

The regression coefficients of Cobb-Douglas production function indicate that the elasticity values of an input in production and the sum of these elasticity value indicates the nature of returns to scale. The returns to scale are decreasing, constant and increasing as the sum of regression coefficients is less than, equal to or greater than unity respectively. It can be observed from the Table 8 that the sum of the elasticities values of banana production was 0.245 which were less than unity, indicating that farmers had experienced decreasing returns to scale in banana production in the study area. The coefficient of multiple determinants R^2 means that the explanatory variables explained 26.4 percent of the variation in banana production.

The value of production coefficient for land preparation was 0.058 for banana. The estimated coefficient 0.059 revealed that 1 percent increase in land preparation would increase gross return by 0.059 percent. The value of production coefficient of suckers was 0.102 for banana. The estimated coefficient revealed that 1 percent increase in suckers would increase gross return by 0.102 percent. Both the land preparation and suckers were positive and significant at 5 percent level of significance.

The value of production coefficient for labor was 0.103 for banana. The estimated coefficient 0.103 revealed that 1 percent increase in labor would increase gross return by 0.103 percent. Shivanand (2002) also found that the labor cost have significantly influenced the production of banana.

The value of production coefficient of fertilizer was 0.109 for banana. The estimated coefficient revealed that 1 percent increase in fertilizer would increase gross return by 0.109 percent. Both the land preparation and suckers were positive and significant at 1 percent level of significance. This indicates that land preparation cost, suckers cost, labor cost and fertilizer cost had significant positive impact on banana production in the cultivated area. However, the production coefficient for manure was negative (-0.035) and statistically significant at 1 percent level which indicate that manure had a significant negative impact on banana production and return from banana can be increased by reducing manure.

Table 8: Estimated value of coefficients and related statistics of Cobb-Douglas production function for annual household income from banana farming (in natural log)

ln_banana_income	Coeff.	Std. Err.	T	P>t
ln_land_prpn	0.059**	0.025	2.31	0.021
ln_suckers_cost	0.102**	0.041	2.44	0.015
ln_labor_cost	0.103***	0.037	2.76	0.004
ln_fert_cost	0.109***	0.031	3.50	0.000
ln_manure_cost	-0.035***	0.013	-2.63	0.009
ln_irrig_cost	-0.048	0.095	-0.51	0.607
ln_pesticide_cost	-0.037	0.044	-0.83	0.376
ln_micronutrient	-0.009	0.012	-0.79	0.478
Insurance	0.012	0.026	0.48	0.063
Constant	8.13***	0.706	11.51	0.000
Sum of elasticities	0.245			
F value	6.310***			
Prob >F	0.000			
R-squared	0.264			
Adjusted R Square	0.217			

Note: ***and ** indicate significance difference at 1% and 5% levels, respectively
Source: Field survey (2017)

The estimated coefficient -0.035 revealed that 1 percent increase in manure would decrease the gross return by 0.035 percent while other factors remaining constant. The value of production coefficient of irrigation (-0.048), pesticide (-0.037) and micronutrient (-0.009) were negative and they were all statistically insignificant in the banana production in the study area. The negative coefficient of manure, irrigation, pesticide and micronutrient revealed that farmer expended excessive amount of money on manure, irrigation, pesticide and micronutrient to grow banana in the study area. This finding was supported with the findings of Mukul and Rahaman (2013) who found the value of coefficient of cost of land preparation, cost of suckers and cost of fertilizer positive was significant at 5 percent level.

The value of production coefficient for crop insurance was 0.058 for banana. The estimated coefficient 0.012 revealed that 1 percent increase in land preparation would increase gross return by 0.012 percent. This shows that there is positive effect of insurance on banana production which is not statistically significant.

The estimated Cobb-Douglas production function for the banana production is

$$\begin{aligned} \ln_income = & 0.059 \ln_land_prepn + 0.102 \ln_sapling \\ & + 0.103 \ln_labor + 0.109 \ln_chemical \\ & - 0.035 \ln_manure \\ & - 0.045 \ln_irrigation \\ & - 0.037 \ln_pesticide \\ & - 0.009 \ln_micronutrient \\ & + 0.012 \text{ insurance} \end{aligned}$$

Resource Use Efficiency of Banana Production

The marginal value products (MVPs) of various capital inputs were worked out at the geometric mean (GM) levels

for the method of application of the banana cultivation and were compared with their respective prices. Marginal factor cost (MFC) of all inputs was expressed in terms of an additional rupees spent for providing individual inputs in Cobb-Douglas production. Therefore, to calculate the ratio of MVP to MFC the denominator would be one and consequently the ratio would be equal to their MVP of an input in the production process. The marginal value product and the ratio of MVP to MFC of banana cultivation were presented in Table 9. The Table 9 shows that none of the marginal value products (MVPs) of inputs was equal to one, indicating that the sampled farmers in the study area failed to show their efficiency in using the resources in wheat cultivation.

From Table 9, it was observed that, for the banana cultivation the ratios of MVP to MFC for the cost of land preparation (0.109) and suckers cost (0.145) were both statistically significant at 5 percent level. MVP to MFC for labor cost (0.151) and fertilizer cost (0.148) were both statistically significant at 1 percent level. MVP to MFC for land preparation, suckers' cost, labor cost and fertilizer cost were positive but values were less than one, which indicate that there was further opportunity to increase banana production using more land preparation, sucker, labor and fertilizer. This finding was supported with the findings of Alagumani (2005) who found the MVP/MFC value of fertilizer cost, planting material cost, female labor cost, plant protection in banana farming less than one. Similarly, the r values for the irrigation was negative for the irrigation and lower than one which was supported by the findings of Mukul and Rahaman (2013).

Table 9: Cobb-Douglas production function showing resource use condition

Variables	Coeff.	Geometric mean	MVP	MFC	r (MVP/MFC)
ln_land_prpn	0.058**	5.297	0.1095	1	0.109
ln_sucker_cost	0.102**	6.979	0.1455	1	0.145
ln_labor_cost	0.106***	6.957	0.1519	1	0.151
ln_fert_cost	0.109***	7.363	0.1482	1	0.148
ln_manure_cost	-0.035***	7.334	-0.0480	1	-0.048
ln_irrig_cost	-0.048	4.493	-0.1079	1	-0.107
ln_pesticide_cost	-0.039	6.086	-0.0643	1	-0.064
ln_micronutrient	-0.008	5.001	-0.0166	1	-0.016
Constant	8.125				
Geometric mean of yield (in price)		9.936			

Note: ***and ** indicate significance difference at 1% and 5% levels, respectively.

Source: Field survey (2017)

In case of manure cost, the ratio of MVP to MFC was (-0.035) which was statistically significant at 1 percent level and ratio of irrigation cost (-0.107) and pesticide cost (-0.064) were also negative, however they were not statistically significant. These negative values indicated that there was no further scope to increase banana production by using manure, irrigation, pesticide and micronutrient. Similarly, the r value for the micronutrient cost (-0.008) was found negative which means excessive use of manures and it was not profitable to expense on manure more so lessening of manure for cultivation of banana but this finding was contrast with the findings of Thakur (2016) who found that FYM had r value less than one but positive and they were over utilized and has to be utilized more efficiently.

Conclusion and Policy Implication

The study was carried out to explore the economic analysis banana production of farms and their purchase of crop insurance scheme as risk aversion tools in Chitwan district. There were large number of banana growers in Eastern part of Chitwan. Kalika and Ratnanagar municipalities were the major area for banana growers and there were 525 registered banana growers in Chitwan Banana Production Association. Due to the frequent windstorm these days, the annual loss from banana was in increasing trend and expected to rise in future. To compensate the loss of banana purchasing of crop insurance scheme was getting popular among the banana growers. Cobb-Douglas production function was used to estimate the contribution of specified factors for production of banana. The findings showed that land preparation cost, suckers cost, labor cost, fertilizer cost and adoption of banana insurance scheme were the main factors that positively influence income from banana whereas manure cost, irrigation cost, pesticide cost, and micronutrient costs have negative effect on banana production. The farmer spent excessive amount of money on irrigation, fertilizer, pesticides and micronutrient to grow banana. None of the MVPs of inputs was equal to one. Indicating that all the sampled farm in the study area failed

to show their efficiency in using the resources in banana cultivation. The result indicates that there was no further opportunity to increase banana production using land preparation, suckers, labor and fertilizer. This study recommends that adoption of insurance scheme helps to enhance banana production and income making farmers toward risk seeker and commercialization. So, concerned stakeholders and policy makers need to focus on promotion of insurance scheme on banana farming through awareness raising and benefits from adoption of insurance e among banana producers.

Authors' Contribution

S. Dulal designed the research plan and performed households' level required data collection from field and analyzed the data. R. R. Kattel reviewed and edited the manuscript and both authors prepared and finalized the manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest with present publication.

Acknowledgement

It is our pleasure to express our deepest acknowledgement, profound gratitude and sincere appreciation to all my concerned people, farmers and different government and non-governmental institution for their contribution and support to go success for this research. Furthermore, our special gratitude also goes to Mr. Bishnu Hari Panta, Mr. Kadam Shrestha and the entire staff and members of Chitwan Banana Production Association (CBPA).

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