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PROFITABILITY AND RESOURCE USE EFFICIENCY OF RICE SEED PRODUCTION: INSIGHTS FROM NEPAL’S TERAI BELT

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Abstract

Rice is major staple food and accounts for around 50 percent area under cultivation of total cereal crops cultivation in Nepal. The demand of rice seed is high and quality rice seed is crucial for better yield as it has significant role in national food security and income generation of Nepalese people. In this regard, this study attempted to analyse profitability and resource use efficiency of rice seed production in Jhapa, Chitwan and Bardiya districts from Terai belt of Nepal. The total of 100 samples from each district were selected using simple random sampling technique. The productivity of rice productions in Jhapa, Chitwan and Bardiya were 4.21, 3.89 and 4.65 Mt/ha respectively. The study showed that the average cost of rice seed production was NRs. 82,021, and average gross revenue was NRs. 164,000 resulting in an average net profit of NRs. 81,980 on per ha basis. The overall benefit cost ratio of rice seed production was found 2.04 and the BC ratio was higher in Bardiya district (2.15) as compared to Chitwan (1.99) and Jhapa (1.97) reflecting rice seed production as profitable farming. The cost on organic manure, postharvest operation, seed and chemical fertilizer were found underused and could be increased by 387, 76, 75 and 74 percent respectively and In the other hand, the cost related to harvesting and micronutrient were found overused and could be decreased by 104 and 10 percent for optimal allocation of resources used in rice seed production. The optimal use of available resources and providing technical know-how with better delivery of extension services might lead on significant increase on rice production and making rice production as profitable enterprise which ultimately contribute to meet the domestic demand and lowering high rice import.

Keywords: Profitability, Optimum Use, Resource Use Efficiency, Rice, Seed.

1. INTRODUCTION

Agriculture has been a major source of livelihood and employment of Nepalese people, and its growth and development have direct impact on national economy. Rice, which is primary staple food crop in Nepal having high contribution to national food security (Ghale, 2017), is widely grown in area of 1,477,378 Hectare (ha) with 5,130,625 Metric ton (Mt) production in 2021/22 (MoALD, 2023) and this shows the national rice productivity as 3.47 Mt/ha. Nepal is divided into 3 agro-ecological belts as Terai, Hill and Mountain and rice is grown in all three belts of Nepal (Gadal et.al, 2019). Rice and straw combined contributed 15.35 percent to Agricultural Gross Domestic Product (AGDP) in

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2019/20 (MoALD, 2021). The Nepalese farming system is primarily stated as rice-based farming system because of the highest area, production, distribution, adaptability, and contribution of rice to the AGDP.

Seed is one of the crucial inexpensive inputs which has direct relationship with yield (Langyintuo, 2005). The use of quality seed at adequate quantity and at appropriate time helps to increase the yield of any crop. It is reported that improved seeds alone can contribute in increasing the yield by around 20 to 30 percent (SQCC, 2013; Thompson, 1979) and with the adoption of hybrid seed it is expected increase in yield by 45 percent. The supply of improved and hybrid seed is limited in Nepal, thereby increasing the reliance on imports. Rice covers around 50 percent of cultivation area of cereal crop cultivation in Nepal. The domestic rice seed production cannot meet the high demand of rice seed and increase in import of rice seed has increase the cost on seed. The seed replacement ratio of rice production is also less, however the better improved seeds help to increase yield and also reduces the cost of production by lowering the amount of seed required and less likely of infestation of disease and pests. The 20 year overall agriculture guiding strategy of Nepal ‘Agriculture Development Strategy (2015-2035)’ stated that with the increase in participation of private sector and community based organizations, the production of quality seed has increased in recent years (Gauchan et al., 2014). Food security and better human livelihoods are closely related to seed security (Shrestha & Gauchan, 2019). Seed as basic input for agriculture and dominance of rice in Nepalese agriculture, rice seed is of prime importance in our agricultural system. The wise optimal use of available resources helps to increase the yield of rice seed and maximize the profit which also contributes for addressing food security challenges (Ishtiaque et al., 2017). The rice farming in Nepal is more labor based and return based on investment and time is also less. It has great contribution on food security and livelihoods of Nepalese people. Therefore, it is necessary to assess the level of resources used by the farmers and its profitability. This type of study assists farmers for optimum use of allocated resources in a sustainable way (Yang et al., 2021). There are very few study conducted to assess the profitability and level of resources used in rice seed production in Nepal. This study could also support the policymakers for making plans for promotion of rice program to increase the rice production and lowering the heavy import of rice.

2. METHODOLOGY

Among all the districts of Nepal, Jhapa, Chitwan and Bardiya districts were selected purposively as they represented three districts in eastern, central, and western plain areas with tropical climate. These districts are called grain basket of Nepal. In 2021/22, rice was produced in 141,826 ha with production 587,388 MT and yield 4.14 MT per ha. Similarly in the same year, it covered 63,402 ha and produced 236,145 MT with yield 3.72 MT per ha in Chitwan while productivity was 3.14 MT when produced in 78,416 ha with production of 246,491 MT in Bardiya district. The Government of Nepal has also prioritized for increasing rice production through Prime Minister Agriculture Modernization Project (PMAMP) in Jhapa and Bardiya and there are ‘rice superzone’ in these two districts. For declaring 'rice superzone' under PMAMP, it requires minimum of 1000 hectares of land under rice cultivation. Similarly, there is 'rice zone' under PMAMP in Chitwan district. For declaring 'rice zone' it requires around 500 hectares of land under rice cultivation. PMAMP is a 10-year project identified as a transformative project under the Agricultural Development Strategy which has been in implementation from August 2015 for ten years.

The multistage sampling was conducted including 100 seed producers selected randomly from each district. A total of 300 seed producers were interviewed face to face administrating semi-structured questionnaire. The two rice seed producing clusters in each district were identified in consultation with PMAMP office located at districts and 50 rice seed producing farmers associated with community-based seed producers (CBSP) groups were selected from each cluster. The total of 100 samples were taken from one district and in total 300 rice seed producing farmers were interviewed for primary data collection. The two Key Informant Interview (KII) and two Focus Group Discussion (FGD) in each district were conducted for the triangulation of primary data collected from randomly selected households. The necessary inferences required were analyzed using SPSS and Stata software.

2.1 Profitability analysis

The variable cost incurred for rice seed production such as cost on seed, fertilizer, labor, pesticide, postharvest operations were calculated. The gross revenue from rice seed production was calculated following Mogaji et al. (2013).

Gross revenue = Revenue from rice seed produced + revenue from rice non-seed + revenue from straw

The revenue of each items were calculated by multiplying the price of respective items by amount of respective items produced.

The benefit cost ratio of rice seed production was calculated by following the techniques adopted by Dhakal et al. (2015).

Benefit cost ratio = Gross revenue / variable cost

2.2 Production function analysis

For the estimation of efficiency ratios of inputs used in rice seed production the Cobb-Douglas production function model was used as this model is found mostly used in agricultural sector and ease in computing the elasticity of inputs used (Prajneshu, 2008).

The equation is:

$$Y = aX_1^{b_1}X_2^{b_2}X_3^{b_3}X_4^{b_4}X_5^{b_5}X_6^{b_6}X_7^{b_7}X_8^{b_8}X_9^{b_9}e^{u}$$

Where,

Y= Gross revenue from rice seed production (NRs.)

X_1= Seed cost (NRs.)

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X_2= Tillage cost (NRs.)

X_3= Labor cost (NRs.)

X_4= Organic manure cost (NRs.)

X_5= Chemical fertilizer cost (NRs.)

X_6= Micronutrient and pesticide cost (NRs.)

X_7= Irrigation cost (NRs.)

X_8= Harvesting cost (NRs.)

X_9= Postharvest operation cost (NRs.)

a = constant term

u = Random disturbance term

$b_1 \ldots b_9$ are the regression coefficient.

The above equation is transformed to linear natural logarithm (ln) as:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_{5+} b_6 \ln X_{6+} b_7 \ln X_{7+} b_8 \ln X_{8+} b_9 \ln X_9 + u$$

The efficiency ratio of each input used in rice seed production was computed as:

$$r = MVP/MFC$$

where, Marginal Value Product (MVP) = b_i * Y/X_i

Y and X are the geometric mean values

Marginal Factor Cost (MFC) = 1

The percentage change in each resource was calculated as:

Absolute value D = (1 – 1/r)*100

The return to scale (R_s) was calculated by summing the value of regression coefficient of each resource used in rice seed production.

$R_s > 1$: indicate increasing return to scale

$R_s < 1$: indicate decreasing return to scale

$R_s = 1$: indicate constant return to scale

3. RESULTS AND DISCUSSION

3.1 Socio-economic and demographic characteristics

In context of Nepal, the household head engages in major household and economic decisions. Information regarding age, schooling years of household head are important criteria that may influence decision making in rice seed production.

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The average age, year of schooling of the household head were found 48.44 years and 7.28 years and were statistically significant at 1 and 5 percent respectively. The dependency ratio was calculated as the ratio of total number of dependent members to the total number of active members in the household (CBS, 2014).

Dependent members belong to the members under 15 years of age group and above 60 years of age group whereas active members belong to the age group of between 15 to 60 years. This ratio is used to determine the economic structure of the household. The study revealed that the dependency ratio was 1.49 whereas the average household size was found 6.35 in the study site and the mean differences among the districts was statistically significant at 1 percent level. The average landholding size was found 0.87 ha, however this land holding size was more than the national average of 0.55 ha (NSO, 2023) in Nepal. The area under rice seed production was found 0.82 hectare. The area under rice seed production in Jhapa (1 ha) was higher than Bardiya (0.85 ha) and Chitwan (0.62 ha) and the mean differences was found statistically significant at 1 percent level of significance. The livestock holding was found 1.89 LSU in the study site.

Table 1: Socio-economic and demographic characteristics of rice seed producing farmers

Variables	Overall (n=300)	District			F-value	p-value
		Jhapa (n=100)	Chitwan (n=100)	Bardiya (n=100)		
Age of household head (year)	48.44 (10.77)	53.50 (11.95)	49.86 (8.24)	41.97 (8.34)	37.179***	0.001
Schooling of household head (year)	7.28 (4.16)	6.50 (4.42)	8.24 (3.71)	7.10 (4.17)	4.620**	0.011
Household size	6.35 (1.85)	5.73 (1.58)	7.15 (1.92)	6.16 (1.76)	17.156***	0.001
Dependency ratio	1.49 (1.62)	0.47 (0.44)	3.43 (1.38)	0.58 (0.42)	372.752***	0.001
Active members	3.30 (1.48)	4.06 (1.02)	1.78 (0.73)	4.06 (1.23)	167.942***	0.001
Owned land (ha)	0.87 (0.50)	1.00 (0.71)	0.72 (0.24)	0.89 (0.40)	8.404***	0.001
Lowland (ha)	0.80 (0.48)	0.93 (0.68)	0.66 (0.24)	0.81 (0.38)	8.03***	0.001
Upland (ha)	0.07 (0.04)	0.08 (0.06)	0.06 (0.02)	0.07 (0.03)	4.592**	0.011
Irrigated land (ha)	0.57 (0.37)	0.67 (0.53)	0.45 (0.14)	0.58 (0.30)	9.299***	0.001
Area under rice seed (ha)	0.82 (0.43)	1.00 (0.53)	0.62 (0.21)	0.85 (0.39)	22.725***	0.001
Livestock holding (LSU)	1.89 (1.42)	2.15 (1.61)	1.72 (1.42)	1.79 (1.18)	2.68*	0.070

Note: Figures in parentheses indicate standard deviation. ***, ** and * represent significant at 1, 5 and 10 percent level. Data source: Field survey.

Similarly, the socioeconomic and demographic characteristics of study site related to categorical variables are described below in table 2. The household head in the study site was found male dominated (85%), there were more male headed household in Chitwan district (88%) as compared to Jhapa (87%) and Bardiya (81%), however the differences was statistically non-significant. A study conducted in Vietnam, it was also found male dominated rice agricultural farming (Dey, et al., 2022). The ethnicity of majority of the household were found Brahmin/Chhetri (49%) in the study site and there were more Brahmin/Chhetri I74%) in Chitwan as compared to other two districts Jhapa (57%) and Bardiya (15%) and the differences was found statistically significant at 1 percent level. Similarly, the major occupation of majority of the household was Agriculture (89%) and the majority of the household had joint family type (54%). There were migrated member from the household from around 15 percent household.

Table 2: Socio-economic and demographic characteristics of rice producing farmers (categorical variable)

Variables	Overall	District			χ^2-value	p-value
		Jhapa	Chitwan	Bardiya		
Gender HHH (Male =1)	256 (85.3)	87 (87.0)	88 (88.0)	81 (81.0)	2.290	0.318
Ethnicity (Brahmin/Chhetri=1)	146 (48.7)	57 (57.0)	74 (74.0)	15 (15.0)	90.897***	0.001
Occupation (Agriculture=1)	266 (88.7)	94 (94.0)	83 (83.0)	89 (890.0)	16.584**	0.011
Family type (Joint=1)	163 (54.3)	67 (67.0)	61 (61.0)	35 (35.0)	23.322***	0.001
Migrated to abroad (Yes=1)	**46 (15.3)**	**12 (12.0)**	**23 (23.0)**	**11 (11.0)**	**6.830****	**0.033**

Note: Figures in parentheses indicate percent. *** and ** represent significant at 1 and 5 percent level. Data source: Field survey.

3.2 Resources used for rice seed production

The resources/inputs used for rice seed production is presented in Table 3. Both use of bullock and tractor in the studied area showed the continuing mode of mechanization with increasing scope.

The per hectare average bullock use was found 4.38 days and use of tractor for the preparation of land for seed sowing was found 5.48 hours in the study area. The use of bullock was found higher (5.25 days) in Bardiya whereas the use of tractor for land plowing was found higher (6.51 hours) in Jhapa district and the differences within the districts were found statistically significant at 1 and 5 percent respectively.

The per hectare seed rate was found around 48 kg and organic manure used was found 2485 kg whereas the use of chemical fertilizer which consists urea, DAP and potash was found 248 kg. The per hectare micronutrient and pesticide applied was found as 3 kg in the study area. The per hectare labor used for harvesting of rice seed was found 28 person days and the labor used for rest of the other activities for rice seed production was 39 person days.

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All the resources used for rice seed production when compared within the districts were found statistically significant except seed. Urbanization is an increasing trend which in return decreasing labor supply causing the labor-intensive farming system more troublesome (Joshi, 2018).

Table 3: Inputs used in rice seed production (in hectare)

Variables	Overall	District			F-value	p-value
		Jhapa	Chitwan	Bardiya		
Tillage						
Use of bullock (day)	4.38 (4.58)	3.11 (4.34)	4.79 (4.46)	5.25 (4.71)	6.223***	0.002
Use of tractor (hr)	5.48 (4.52)	6.51 (4.24)	5.08 (4.50)	4.86 (4.68)	4.023**	0.019
Seed (kg)	47.68 (4.04)	47.52 (2.93)	47.66 (5.53)	47.86 (3.17)	0.178	0.837
Organic manure (kg)	2485.14 (1833.76)	3067.83 (2021.97)	2593.22 (1433.70)	1794.36 (1781.97)	13.333***	0.001
Chemical fertilizer (kg)	247.91 (22.71)	229.27 (10.14)	268.45 (15.66)	246.02 (20.70)	149.347***	0.001
Urea (kg)	118.07 (10.74)	121.13 (6.81)	119.03 (10.86)	114.05 (12.54)	12.335***	0.001
DAP (kg)	66.37 (11.46)	55.12 (3.67)	76.89 (9.72)	67.08 (6.95)	227.943***	0.001
Potash (kg)	63.48 (10.81)	53.01 (5.83)	72.53 (6.50)	64.88 (9.03)	183.898***	0.001
Micronutrient (kg)	3.11 (2.95)	2.35 (2.12)	3.97 (3.84)	3.01 (2.39)	7.998***	0.001
Harvesting (person days)	28.35 (12.54)	24.85 (13.24)	32.65 (9.00)	27.55 (13.66)	10.648***	0.001
Labor (person days)	39.36 (12.94)	36.42 (13.49)	44.41 (9.32)	37.24 (14.08)	12.404***	0.001

Note: Figures in parentheses indicate standard deviation. *** and ** represent significant at 1 and 5 percent level. Data source: Field survey.

3.3 Cost incurred, profitability and revenue from rice seed production

Table 4 shows the cost associated with the rice seed production in the study site. The cost incurred in rice seed production were categorized under the headings tillage, seed, labor, organic manure, chemical fertilizer, micronutrient and pesticide, irrigation, harvesting and post-harvest operation costs.

The per hecare cost of inputs such as seed, labor, organic manure, chemical fertilizer, micronutrient & pesticide and irrigation for rice seed production were found as NRs. 2484, 21415, 7643, 8018, 5741, 3567 respectively. All the cost associated with rice seed production when compared among the districts were found statistically significant either at 1 or 5 percent level of significance.

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Table 4: Cost associated with rice seed production (in NPR, ha)

Variables	Overall	District			F-value	p-value
		Jhapa	Chitwan	Bardiya		
Tillage cost	9842.37 (1017.94)	9641.91 (952.80)	9866.88 (845.20)	10018.31 (1197.87)	3.52**	0.031
Seed cost	2483.87 (474.19)	2253.51 (451.50)	2668.38 (430.56)	2529.72 (446.94)	22.721***	0.001
Labor cost	21414.55 (7316.46)	19720.88 (7574.49)	24661.30 (5136.82)	19861.48 (7869.65)	16.29***	0.001
Organic manure cost	7643.17 (6055.76)	7620.77 (5514.38)	10292.46 (6209.61)	5016.30 (5265.90)	21.593***	0.001
Chemical fertilizer cost	8016.64 (824.95)	7250.01 (407.17)	8595.57 (517.00)	8204.34 (809.01)	132.146***	0.001
Micronutrient and pesticide cost	5741.29 (1840.23)	4920.88 (1169.82)	6568.59 (2101.81)	5734.40 (1752.27)	22.992***	0.001
Irrigation cost	3567.02 (1744.39)	3373.59 (2815.95)	4383.91 (314.37)	2943.54 (239.31)	20.285***	0.001
Harvesting cost	14658.02 (6593.51)	12423.09 (6618.07)	16327.02 (4501.89)	15223.94 (7684.58)	9.869***	0.001
Postharvest cost	8653.95 (1240.45)	7783.00 (884.61)	9669.68 (863.53)	8509.17 (1135.58)	96.418***	0.001

Note: Figures in parentheses indicate standard deviation. *** and ** represent significant at 1, 5 and 10 percent level. Data source: Field survey.

Similarly, the total cost, production of rice seed and by-products and gross revenue, profit and undiscounted benefit cost ratio was estimated and shown in below table 5. The per hectare overall total cost of rice seed production was found NRs. 82,021. The total cost of rice seed production was found highest in Chitwan (NRs. 93,034), significantly more than that of Bardiya (NRs. 78,041) and Jhapa (NRs. 74,988) at 1 percent level of significance. The per hectare productivity of rice seed production was found 4.93 MT which was higher than that of national average of rice production of 3.4 MT (MoAlD, 2023). The highest rice seed production was found at Chitwan (5.0 MT) as compared to Bardiya (4.97 MT) and Jhapa (4.82 MT) and the mean difference was found statistically significant at 1 percent level. The highest yield in Chitwan district is due to better access with irrigation and availability of quality rice seed. The per hectare gross revenue from rice seed production was found NRs. 164,001. The gross revenue was found highest in Chitwan (NRs. 184,177) as compared to Bardiya (NRs. 163,070) and Jhapa (NRs. 164,001) and the mean differences was found statistically different at 1 percent level of significance. In line to the gross revenue, the district having higher revenue has more profit from rice seed production and was statistically significant at 1 percent level of significance. The per hectare overall profit after deducting the cost associated with rice seed production was found NRs. 81,980. The overall B:C ratio of rice seed production was found 2.04 which indicates that rice seed production is profitable business in the study site. The B:C ratio was found to be significantly higher in Bardiya (2.15) as compared to Chitwan (1.99) and Jhapa (1.97). The recent study conducted by Bhatt et

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al. (2023) to calculate benefit cost ratio of rice seed production in Kanchanpur district (a far-west Terai district) also found rice seed farming as profitable business which was implied by 1.71 Bc ratio.

Table 5: Cost, production, revenue, and profitability of rice seed production (per hectare basis)

Variables	Overall	District			F-value	p-value
		Jhapa	Chitwan	Bardiya		
Total cost (NPR)	82020.87 (13897.76)	74987.62 (12481.75)	93033.80 (7395.03)	78041.21 (13579.08)	70.879***	0.001
Rice seed production (MT)	4.93 (0.35)	4.82 (0.40)	5.00 (0.34)	4.97 (0.30)	7.454***	0.001
Paddy straw production (kg)	2144.27 (419.03)	1620.14 (120.26)	2388.28 (245.68)	2424.40 (196.44)	545.865***	0.001
Rice not suitable for seed (kg)	828.91 (151.35)	993.96 (104.42)	809.14 (59.47)	683.62 (74.23)	366.445***	0.001
Gross revenue (NPR)	164000.76 (21501.36)	144755.41 (12740.47)	184176.45 (15166.16)	163070.41 (14756.83)	191.357***	0.001
Profit (NPR)	81979.88 (19920.00)	69767.79 (15535.10)	91142.65 (15490.28)	85029.20 (21732.68)	38.128***	0.001
BC ratio	2.04 (0.31)	1.97 (0.30)	1.99 (0.20)	2.15 (0.39)	10.145***	0.001

Note: Figures in parentheses indicate standard deviation. *** represent significant at 1 percent level. Data source: Field survey.

3.4 Estimates of the production function analysis

The elasticity of resources/inputs used for rice production was estimated by using Cobb-Douglas production function model which is shown in Table 6 below. Among the eleven independent variables which were considered for production function analysis, four of them were found statistically significant. According to Devkota et al. (2019), Nepalese farmers rely more on chemical fertilizers applying not too small number of organic manures during rice production. But still, the nutrient demand of rice had not been fulfilled by chemical fertilizers too.

There is sufficient scope of increasing profit in crop production by intensifying use of chemical fertilizer in Terai (Takeshima, 2019) belt of Nepal. The costs on seed, organic manure, chemical fertilizer, irrigation and post-harvest operation were found underused in the study site whereas the Costs related to tillage, labor, micronutrient, and insect pesticide as well as cost on harvesting of rice seed production were found overused in the study area. The study conducted by Subedi et al. (2020) in rice production also found the cost on chemical fertilizers and irrigation were underused while cost on labor and tillage were overused. In case of research related with resource use efficiency of maize seed production by Sapkota and et al. (2018), labor cost was reported as overused. Mula et al. (2019) also found that cost on seeds, irrigation, organic fertilizers, and chemical fertilizers as underused resources and cost on labor was found overused.

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As Terai has landscape privilege, large machinery such as tractors and cultivators can be used in the Terai for decreasing labor cost. Mechanization is transforming action for improving agricultural practices (NPC, 2021). Tractors adoptions were assumed to increase per capita agricultural income by 20-30% (Hiroyuki & Bhattarai, 2019).

Table 6: Estimation of efficiency ratios using Cobb-Douglas production function model

Variables	Coefficient	Std. error	t-value	MVP	MFC	R	D	Status
Log seed cost	0.062*	0.032	1.920	4.151	1	4.151	75.91	UU
Log tillage cost	0.056	0.041	1.360	0.928	1	0.928	7.80	OU
Log labor cost	-0.048	0.051	-0.940	-0.380	1	-0.380	362.84	OU
Log organic manure cost	0.000	0.001	-0.100	-0.348	1	-0.348	386.99	UU
Log chemical fertilizer cost	0.189***	0.064	2.930	3.845	1	3.845	74.00	UU
Log micronutrient and pesticide cost	0.030	0.019	1.580	0.908	1	0.908	10.15	OU
Log irrigation cost	0.084***	0.028	3.010	3.988	1	3.988	74.93	UU
Log harvesting cost	0.040	0.040	1.000	0.490	1	0.490	104.09	OU
Log post-harvest cost	0.482***	0.044	10.830	9.140	1	9.140	89.06	UU
Constant	4.086***	0.655	6.230					
Observations	300							
F-value (9, 290)	38.32***							
Prob>F	0.001							
R-squared	0.543							
Adj. R-squared	0.529							
Return to scale	0.896							

Notes: The dependent variable is natural log transformation of gross revenue from paddy production. Log indicates natural log transformation. ***, * indicate significant at 1 and 10 percent level of significance, respectively. OU indicate over-used of the resources when r<1 and UU indicate under-used of the resources when r>1.

The underused resources such as costs on organic manures, post-harvest operations, seeds, chemical fertilizers and irrigation could be increase by 387, 89, 76, 74%, and 75. percent respectively for optimum allocation of resources. However, for optimum allocation of resources, costs associated with harvesting and use of micronutrients and pesticides could be decreased by 104 and 10 percent respectively. The optimum allocation or use of resources used in rice seed production helps in lowering down the cost of production and profit maximization. The return to scale of rice seed production was found as 0.896 which indicate decreasing return to scale in rice seed production. This implies that the proportion of increase in rice seed income was less in comparison to the increase in costs of inputs for rice seed production.

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4. CONCLUSION

This study concluded that rice seed production is profitable farming enterprise as depicted by benefit-cost ratio more than one. The Cobb-Douglas production function revealed that cost on organic manures, irrigation, chemical fertilizers, post-harvest operations and seed were found underused resources whereas tillage and labor were found overused. Hence, increase in cost on chemical fertilizers, organic manures, irrigation, post-harvest operations for value addition and quality seeds can increase profit margin from rice seed production in the study area. Similarly, costs on activities such as tillage and labor should be reduced with proper mechanization. Therefore, this study can be helpful for optimal utilization of resources for better profitability of rice seed production.

References

1) AICC., (2023). Annual report of Agriculture information and communication centre 2023.

2) CBS (2014) Population Monograph of Nepal, Volume I (Population Dynamics). Government of Nepal, National Planning Commission Secretariat, Central Bureau of Statistics, Ramshah Path, Kathmandu Nepal.

3) Gauchan, D., & Shrestha, S. (2016). Agricultural and rural mechanization in Nepal: status, issues and options for future. Institute for Inclusive Finance and Development (In M).

4) Gauchan, D., Magar, D. T., Gautam, S., Singh, S., & Singh, U. S. (2014). Strengthening seed system for rice seed production and supply in Nepal. IRRI-NARC collaborative EC-IFAD funded project on Seed Net Development. Socioeconomics and Agricultural Research Policy Division, Nepal Agricultural Research Council, Nepal. 40p.

5) MoAD. (2023). Statistical Information on Nepalese Agriculture, 2023. Government of Nepal Ministry of Agriculture and Livestock Development Kathmandu, Nepal.

6) Mogaji,TS., Olufemi, AD., Fapetu,OP,. (2013). African Journal of Agricultural marketing performance and efficiency of evaporative preservation cooling system for fresh tomato marketing in Ondo state, Nigeria.

7) Prajneshu, (2008). Fitting of Cobb-Douglas Production Functions: Revisited. Agric. Econ. Res. Rev. 21:289-292

8) SQCC, (2014). Seed balance sheet for FY 2013/2014. Seed Quality Control Centre (SQCC), Ministry of Agriculture Development (MoAD), Pulchowk, Lalitpur, Nepal. 26p.

9) Thomson, J.R., (1979). An introduction to seed technology. London, United Kingdom. 150p.

10) Bhatt, R. P., Poudel, A., Simkhada, J., & Gyawali, P. (2023). Comparative Socioeconomic of Rice Seed and Grain Production in Kanchanpur District of Nepal. Fundamental and Applied Agriculture.

11) Devkota, S., Panthi, S., & Shrestha, J. (2019). Response of rice to different organic and inorganic nutrient sources at Parwanipur, Bara district of Nepal. Journal of Agriculture and Natural Resources, 53-59.

12) Dey, B., Visser, B., TIN, H. Q., Laouali, A. M., Mahamadou, N. B., Nkhoma, C., . . . Bragdon, S. (2022). Strengths and weaknesses of organized crop seed production by smallholder farmer: A five country case study. 0utlook of Agriculure, 1-13.

13) Finance, M. o. (2023). Economic Survey 2022/23. Kathmandu, Nepal: Government of Nepal.

14) Gadal, N., Shrestha, J., Poudel, M. N., & Pokhrel, B. (2019). A review on production status and growing environments of rice in Nepal and in the world. Archives of Agriculture and Environmental Science, 4(1), 83-87.

15) Ghale, Y. (2017). Role of Rice in Ensuring Right to Food in Nepal. In P. MN, D. R. Bhandari, M. P. Khanal, P. Acharya, & K. H. Ghimere (Eds.), Rice Science and Technology in Nepal: A historical , Socio-cultural and Technical Compendium (pp. 68-76). Crop Development Directiorate and Agronomy Society of Nepal.

16) Gobinda, M., Layak, N., & Roy, B. (2019). Economics of Rice Seed Production and Marketing – A Study in Terai Zone of West Bengal, India. International Journal of Current Microbiology and Applied Sciences, 8.

17) Hiroyuki, T., & Bhattarai, M. (2019). Agricultural Mehaniation in Nepal- Patterns, Impacts and Enabling Strategies for Promotion. In T. Ganesh, A. Kumar, & P. K. Joshi (Eds.), Agricultural Transformation in Nepal: Trends, Prospects and Policy options (pp. 261-290). Springer Nature Singapore.

18) Joshi, G. R. (2018). Agricultural Economy of Nepal: Development challanges and oppurtunities. Kathmandu: Sustainable Development and Research Center.

19) Kummanee, K., Aungsuratana, A., Rojanaridpiched, C., Chanprame, S., Vijitsrikamol, K., & Sakurai, S. (2018). Input Factor Affecting Rice Seed Production in Thamai Sub-district, Nakhon Sawan Province, Lower Northern, Thailand.

20) NPC. (2021). Nepals' Food Systems Transformation: Contexts, pathways and Actions as a part of the UN food systems Summit 2021. Kathmandu: Nepal Planning Commission.

21) NSO. (2023). National Agriculture Census 2078. Kathmandu: National statistics Office.

22) Sapkota, M., Joshi, N. P., Kattel, R. R., & Bajracharya, M. (2018). Profitability and resource use efficiency of maize seed production in Palpa. SAARC journal of Agriculture.

23) Shrestha, R. B., & Gauchan, D. (2019). Strengthening Seed Systems and Farmers' Rights for Improving Food & Nutrition Security in South Asia. In R. B. Shrestha, E. Penunia, & M. Asim (Eds.), Strengthening Seed Systems: Promoting Community Based Seed Systems for Biodiversity Conservation and Food & Nutrition Security in South Asia (pp. 1-28). SAARC Agriculture Centre (SAC), Dhaka, Bangladesh; the Asian Farmers' Association (AFA), the Philippines; and the Pakistan Agricultural Research Council (PARC), Pakistan.

24) Statistics and Analysis Section, P. a.-o.-o. (2021). Selected Indicators of Nepalese Agriculture. Nepal: Ministry of Agriculture and Livestock Development.

25) Subedi, S., Ghimire, Y. N., Kharel, M., Sharma, B., Shrestha, J., & Sapkota, K. B. (2020). Profitability and Resource Use Efficiency of Rice Production in Jhapa District. International Journal of Social Sciences and Management, 242-247.

26) Takeshima, H. (2019). Use of Chemical Fertilizers in Nepal-Issues and Implications. In G. Thapa, A. Kumar, & P. K. Joshi (Eds.), Agricultural Transformartion in Nepal: Trends, Prospects and Policy options. Springer Nature Singappre Pvt. Ltd.