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Economic Analysis of Paddy Cultivation in Kapilvastu District of Nepal

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ABSTRACT

Rice is the staple food in Nepal being the major source of livelihood and income for around 2/3rd of the farm households. The present study was carried out in wards 5 and 6 of Kapilvastu district of Nepal to estimate the cost and returns from the cultivation of paddy, resource use efficiency and to know the major input constraints perceived by the paddy growers. The primary data were collected through household survey using interview schedule. The cost of cultivation per hectare for paddy was found to be Nepali Rupees (NRs) 140233.91 (INR 87646.19) and the gross and net returns were NRs 158163 (INR 98851.87) and NRs 17929.09 (INR 11205.68), respectively. The benefit-cost ratio was found to be 1.13. This showed that paddy farming was profitable in the study area. The resource use efficiency analysis showed that expenditure on seed, irrigation and fertilizer had significant impact on the total return from the cultivation of paddy. A unit increase in the expenditure on seed, fertilizer and irrigation would result into -6.62, 7.23 and 10.35 unit increase in total returns from paddy cultivation. Analysis of constraints was done using Garret's ranking technique which showed that high seed and fertilizer costs were the major input constraints followed by high labour cost, timely unavailability of fertilizer, timely unavailability of labour, fluctuating market prices of inputs and timely unavailability of seeds. It was suggested that subsidy should be given on seed and fertilizer and it should be made available on time. Similarly, farmers should be encouraged to cultivate crops that give high returns.

Key words: Paddy, benefit-cost ratio, Garrett's ranking technique, resource use efficiency

INTRODUCTION

Agriculture is one of the most important sectors for a country's economic development. Nepal's economy is heavily reliant on agriculture. Agriculture is the second largest contributor, accounting for 23.13% of Nepal's gross domestic product (GDP) in 2020. Rice is the staple food in Nepal being the major source of livelihood for majority of the farm households and national income (Gadal *et al.*, 2019). Rice only accounts for more than 50% of the total calories intake by the Nepalese people (Kharel *et al.*, 2018). Rice import quantity and value have been increasing at the rate of 24.48 and 38.11% per annum, respectively, while production growth was <2% per annum (Gairhe *et al.*, 2021). The Government of Nepal has prioritized increasing domestic rice production to reduce the import bill of USD $ 300 million each year.

Rice (*Oryza sativa*) is a starchy cereal in the Poaceae family. Out of the 23 species, *Oryza sativa* (Asian rice) and *Oryza glaberrima* (African rice) are known for their commercial cultivation (Subedi *et. al.,* 2020). *O. sativa* is the most widely cultivated paddy species in the world. Rice is the third largest crop produced worldwide, the majority of which is flood irrigated and accounts for about one-third of the global irrigated area. Relative to other crops, rice requires a large amount of scarce water input (Champness *et al.*, 2023).

The major production of paddy is done in *terai* belt of Nepal thus it is also called as "Grain basket of Nepal" (Bhusal *et al.*, 2020). The *terai* region accounts for roughly 68% of the country's paddy production, while the hilly region produces 28% and the mountains region produces 4% (MoALD, 2020). In 2019-20, total area under paddy cultivation in Kapilvastu was 66495 ha with total production of 233470 metric tonnes and the average yield was 3.51 metric tonnes per hectare (MoALD, 2021). Modern paddy varieties were introduced in Nepal in late 1960s. Some of the popular paddy varieties cultivated in Kapilvastu district are *Sawa*, *Ramdhan*, *Radh*-4 and *Gorakhnath*. Some other varieties are also grown which include Golden *mansuli*, *loknath*, Hybrid (6444), *kalanamak*, *sabitri*, *hardinath*, *Swarnasawa*-1, *sawa saba*-1, *sindhur*, *mahima* and *motisabha*

(Sapkota and Sapkota, 2019). Land, water, nutrients and energy are critical components for paddy production, but these resources are becoming scarce and increasingly expensive. These elements' temporal and spatial availability are constrained by one or more factors. With increasing population and migration in Nepal, the potential for reclaiming land for agricultural purposes is limited. As a result, there is no room for horizontal growth in agricultural productivity. The only option is to increase production vertically by increasing cropping intensity (Swain, 2016).

Despite of lots of possibilities in paddy cultivation, there are several limitations regarding the production promotion of paddy. In Nepal, investment in paddy research is currently very low, with less than 0.1% of the value of paddy output. Paddy research in NARC also receives a smaller share of the agricultural research budget (only 4% of total research budget), despite the critical role of paddy output (20%) in National Agriculture Gross Domestic Product (AGDP) (Tripathi *et al.*, 2019). To increase the production and productivity of paddy, modernization in agricultural sector is important. Keeping this view, Government of Nepal under Prime Minister Modernization Project (PM-AMP) started paddy zone program in Kapilvastu district in 2017-18. Later in 2019-20, it was upgraded to paddy super zone. The environmental and climatic condition of Kapilvastu district makes it one of the major paddy producing districts of Nepal for the research. Keeping in view the above aspects, the present investigation was carried out with the following objectives: (a) to study the socio-economic profile of the farmers in the study area; (b) to estimate cost and returns from the cultivation of paddy; (c) to study the resource use efficiency in paddy cultivation; and (d) to identify the major input constraints faced/ perceived by paddy growers in the study area.

MATERIALS AND METHODS

Kapilvastu was the third major paddy producing district of Nepal during 2019-20 (MoALD, 2021). Therefore, Kapilvastu district was selected purposively for the present study. Out of nine municipalities of the district, Banganga municipality was purposively selected for the present study because it is a major paddy producing zone and it was recognized as paddy super zone by PM-AMP, MoALD in 2018-19. Within this municipality, wards-5 and 6 were selected for primary data collection. Total 46 samples were selected using simple random sampling. The primary data related to paddy cultivation were collected using pre-tested schedule.

Cost of cultivation of paddy was estimated using following methods suggested by the Commission for Agricultural Costs and Prices (CACP) (Singh *et al.*, 2017; Singh and Singh, 2020a).

Cost A_1: included value of hired human labour + value of hired bullock labour + value of owned/hired bullock labour + value of owned/ hired machinery labour + value of seed + value of insecticides and pesticides + value of manure and fertilizer + depreciation on implements and farm buildings + irrigation charges + land revenue + interest on working capital + miscellaneous expenses.

Cost A_2: Cost A_1 + rent paid for leased-in land.

Cost B_1: Cost A_1 + interest on value of owned fixed capital assets excluding land.

Cost B_2: Cost B_1 + rental value of owned land and rent paid for leased-in land.

Cost C_1: Cost B_1 + imputed value of family labour.

Cost C_2: Cost B_2 + imputed value of family labour.

Cost C_3: Cost C_2 + 10% of cost C_2 as an account of managerial function performed by farmers.

To estimate economic viability of paddy cultivation in the study area, benefit-cost ratio (B-C ratio) was estimated (Singh *et al.*, 2020).

$$B-C\ Ratio = \frac{\sum_{t=0}^{n} \frac{B^t}{(1+r)^n}}{\sum_{t=0}^{n} \frac{C^t}{(1+r)^n}}$$

Cobb Douglas production function was used to estimate the resource use efficiency (Singh *et al.*, 2023). The algebraic form of the function is given:

$$Y = aX_1^{b1} \cdot X_2^{b2} \cdot X_3^{b3} \ldots\ldots\ldots\ldots X_5^{b5}$$

Where, Y the total return (gross income); X_1 the expenditure on seed; X_2 the expenditure on fertilizers; X_3 the expenditure on irrigation; and X_4 the expenditure on irrigation.

Statistical significance of estimates was tested by using following formula:

$$t_{(n-k)} = \frac{b_i}{S.E.(b_i)}$$

The Garret ranking technique was used to rank the major constraints and opportunities (Singh and Singh, 2020b).

$$\text{Per cent posisiton} = \frac{100\,(R_{ij} - 0.5)}{N_j}$$

Where, Rij the rank given for the i^{th} item by the j^{th}, respondent and Nj s the number of items ranked by the j^{th}, respondent.

RESULTS AND DISCUSSION

The average age of majority of the respondents was 45% which varied between 45-54 years. Nearly 57% of the respondents were female. Out of total respondents, nearly 68% respondents were formally educated and 45% of them had education up to secondary level (Class 6^{th} to 10^{th}). About 32% of the total respondents had farming experience of less than 10 years. The average size of land holding was 0.46 ha and average size of leased-in land was 0.58 ha.

The cost of paddy cultivation per hectare in Kapilvastu district of Nepal was calculated using the cost concept suggested by the Commission of Agricultural Cost and Price (CACP). The cost of cultivation (cost - C_3) for paddy was found to be NRs (Nepali Rupees) 140233.91 per hectare (Table 1). Out of total cost of cultivation, the highest expenditure was incurred by the imputed value of family labour (19.61%), followed by the rental value of own land (17.30%), the rental value of leased-in land (16.88%), hired and owned machinery charges (11.99%), hired human labour (7.06%), chemical fertilizer (3.18%), value of owned and purchased seed (2.98%), irrigation charges (2.84%), interest on working capital (1.90%), farm yard manure (2.84%) and land revenue and taxes (0.42%).

The respondents in the study area reported that total yield of paddy was 40.40 q/ha (Table 2). Similar kinds of findings were found in the study of Sapkota and Sapkota (2019) where the yield of *Gorakhnath* variety of paddy was 42 q/ha in Kapilvastu district of Nepal. But according to the report of Ministry of Agriculture and Livestock Development (2021), the yield of paddy/ha was 35.10 q for the year 2019-20 in the Kapilvastu district. This showed that the production of paddy/ha for sample farmers was significantly higher than what it was reported. The gross and net returns from paddy cultivation/ha were NRs 158163 and 17929.09,

Table 1. Cost of cultivation of paddy crop (NRs/ha)

Particulars	Total cost	Percentage to cost C_3
1. Hired human labour	9900.55	7.06
2. Imputed value of family labour	27500	19.61
3. Hired and owned machinery charges	16818.40	11.99
4. Value of owned and purchased seed	4179.82	2.98
5. FYM	4458	3.18
6. Chemical fertilizer	4459.80	3.18
7. Land revenue and taxes	591.80	0.42
8. Irrigation charges	3978.02	2.84
9. Working capital	44386.39	31.65
10. Interest on working capital	2663.18	1.90
11. Rental value of leased-in land	23672	16.88
12. Rental value of own land	24263.80	17.30
13. Cost-A1	52049.57	37.12
14. Cost-A2	75721.57	54.00
15. Cost-B1	75721.57	54.00
16. Cost-B2	99985.37	71.30
17. Cost-C1	103221.57	73.61
18. Cost-C2	127485.37	90.91
19. Cost-C3	140233.91	100.00

Source: Primary data.

respectively. The results showed that B:C ratio at cost A_1, A_2, B_1, B_2, C_1, C_2 and C_3 was 3.04, 2.09, 2.09, 1.58, 1.53, 1.24 and 1.13, respectively. The B:C ratio was greater than one which indicated that paddy cultivation was profitable in the study area. Similar kind of finding was found in the study conducted by Yadav *et al.* (2021), where B:C ratio was 1.11. In the findings of Sapkota and Sapkota (2019), all four varieties in the study had B:C ratio greater than one. The average B:C ratio was 1.312, 1.202, 1.240 and 1.005 for paddy varieties i.e. *Sawa, Gorakhnath, Ramdhan* and *Radha-4*, respectively, in the Kapilvastu district of Nepal.

Table 2. Income from paddy

Particulars	Amount
1. Main produce (q/ha)	40.40
2. Value of main produce (NRs/ha)	92920
3. By-product (q/ha)	55.49
4. Value of by-product (NRs/ha)	65243
5. Gross returns (NRs/ha)	158163
6. Net returns (NRs/ha)	17929.09
7. B:C ratio over	
(a). Cost A_1	3.04
(b). Cost A_2	2.09
(c). Cost B_1	2.09
(d). Cost B_2	1.58
(e). Cost C_1	1.53
(f). Cost C_2	1.24
(g). Cost C_3	1.13

The primary data collected through survey were analyzed and it was found that 86% variation of the data could be explained by the three variables i.e. cost of seed, cost of fertilizer and irrigation charges, whereas labour cost was found insignificant in this analysis (Table 3). The result showed that a unit increase in the fertilizer and irrigation charges resulted in 7.23 and 10.35 unit increase in total returns from paddy cultivation and one unit increase in seed cost resulted in decline of -6.62 unit in total returns.

Table 3. Resource use efficiency

	Coefficients	Standard error	P-value*
Intercept	112099.89	27282.95	0.00
Seed cost	-6.62	1.77	0.00
Fertilizer cost	7.23	2.34	0.00
Irrigation cost	10.35	5.08	0.04
Labour cost	0.01	0.05	0.84
R square	0.86		

*Significant at P=0.05.

Respondent's perceived high seed and fertilizer costs as the major constraint, with a Garret's mean score of 61.98 (Table 4). Another constraint with high labour costs was ranked second with a Garrets mean score of 60.94. Constraints faced by the sample farmers included timely unavailability of fertilizer, timely unavailability of labour, fluctuation in market prices of inputs and timely unavailability of seeds with Garret's mean scores of 58.78, 44.75, 38.87, and 34.70, ranking third, fourth, fifth and sixth, respectively. Inadequate supply of fertilizer and seeds was also found as major constraint in paddy cultivation in the study by Basyal *et al.* (2019). However, timely delivery of inputs was found as major constraint in study by Tripathi *et al.* (2019).

Table 4. Garret ranking of various constraints in adoption of drip irrigation

Constraints	Mean average score	Rank
1. High seed and fertilizer cost	61.98	I
2. High labour cost	60.94	II
3. Timely unavailability of fertilizer	58.78	III
4. Timely unavailability of labour	44.75	IV
5. Fluctuating market price of inputs	38.87	V
6. Timely unavailability of seeds	34.70	VI

CONCLUSION

The total cost of cultivation of paddy in the study area was Nepali rupees (NRs) 140233.91/ha. The gross and net returns from paddy cultivation/ha were NRs 158163 and 17929.09, respectively. The B-C ratio for paddy cultivators was found to be 1.13. The major constraint in paddy cultivation in the study area was high seed and fertilizer cost. The study showed that high cost and timely unavailability of inputs i.e. seed, fertilizer and labour were major constraints faced by the paddy cultivators. Based on the above conclusions, it was suggested that: (a) priority should be given in subsidising the seeds and fertilizer and additionally, there should be timely availability of these inputs and (b) since benefit-cost ratio is low, therefore, farmers should be encouraged to cultivate crops that give high returns along with the main crop. Expenditure on seed, irrigation and fertilizer was found to have significant impact on the total returns from the cultivation of paddy.

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