



An Economic Analysis of Paddy Production in Kanchanrup, Saptari District of Nepal

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Authors' contributions

This work was carried out in collaboration among all authors. The authors declare no irreconcilable circumstances. All authors contributed equally in all phases of the preparation of this manuscript. Likewise, the final version of the manuscript was approved by all authors.

Article Information

DOI: 10.9734/AJRAF/2022/v8i4172

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/92310>

Original Research Article

Received 25 July 2022
Accepted 29 September 2022
Published 10 October 2022

ABSTRACT

Rice falls under the grass family *Graminae*. Paddy cultivation is the principal activity and source of income for millions of people worldwide. The purpose of this research was to better understand the paddy production economics, socioeconomic position, potential, and challenges in Kanchanrup municipality, Saptari District. Using a basic random sampling procedure, 60 rice growers were sampled. A pre-tested interview approach was used to obtain primary data, and a study of relevant literature was used to acquire secondary data. Further, descriptive statistics, SPSS, and MX Excel were used to analyze the data. Among 60 rice-growing farmers, the percentage of the male was 98.3% and females were 1.7% respectively. The average land under paddy cultivation per household was found to be 0.98 hectares. Production costs are estimated by adding variable and fixed costs, however, because rice is a short-lived crop, total fixed costs are not taken into account. Kanchanrup's average variable cost of rice production is NRs. 114758.18. (Per hectare). Similarly, the total profit was NR 20979.32 and the total yield was NR 135737.5 (Per ha). Kanchanrup has a B: C ratio of 1.18, indicating that the paddy is growing economically viable in the Municipality. The business can provide returns of NPR 1.18 for every rupee invested, and the gross margin is positive, indicating that the investment is financially sustainable and the operation may proceed without any problems.

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Keywords: Paddy; production; cost of cultivation; benefit-cost ratio.

1. INTRODUCTION

The cultivation of paddy is the principal activity and source of income for millions of people worldwide. Several African and Asian nations rely significantly on rice as a source of government revenue and foreign exchange income [1]. Rice is one of the most essential basic meals for the world's more than 3.5 billion inhabitants [2]. Rice is the principal staple meal of 17 Asian and Pacific countries, 8 African countries, and 9 American countries. Rice, wheat, and maize supply 20, 19, and 5 percent of the world's dietary energy respectively. Rice provides more energy than other staple food crops [3]. Among cereal crops, paddy is the world's third-largest produced crop, behind maize (corn) and wheat, according to Rice Trade 2021. Like other cereals, it transcends national, cultural, religious, and geographic boundaries. Two of rice cultivars, *Oryza sativa* (Asian rice) and *Oryza glaberrima*, are commercially valuable (African rice). *Oryza glaberrima*, on the other hand, is exclusively cultivated in a restricted area in South Africa. The three subspecies of *Oryza sativa*, the principal commercial rice species, are *Indica*, *Japonica*, and *Javanica*, based on commercial production zones. Tropical and subtropical strains that flourish in South Asia, Southeast Asia, and southern China are referred to as subspecies *indica*. The *Javanica* type is cultivated in Indonesia, but the *Japonica* species is grown in Japan, China, Nepal, and South Korea [4].

The commercial production of rice in Nepal began around 500 years ago. It is known that rice arrived in Nepal from mainland China around the later third millennium BC. Despite being a small nation, Nepal makes a major contribution to the development of national economies despite being a relatively small country [5-7]. Rice is the most important crop in Nepal and provides a significant source of livelihood and income for more than two-thirds of farmers. About 60.4% of the population works in agriculture and is deeply ingrained in the country's culture [8]. Rice had provided more than 20% of AGDP and 7% of GDP in 2021, according to AICT, while agriculture and forestry account for around 27.08% of the country's GDP. More than half of the world's population consumes a lot of rice, and Asia accounts for more than 90% of worldwide rice production and consumption [9].

The Terai region of Nepal is regarded as the nation's "granary," producing around 70% of the nation's rice production, compared to the hills' 26% and the mountains' 4%. To fulfill the predicted world population's food demands in 2025, it has been calculated that global farmers will need to produce around 60% more rice than they do now [5]. Paddy production is expected to grow by 7 percent in the Saptari district. A total of, 81668 ha of land is arable, of which 71558 ha have been planted paddy this year. Production stood at, 248231 metric tons and productivity was 3.47 Mt/Ha (Agriculture Knowledge Center, Saptari 2019/20). However, the area under paddy cultivation in Nepal has shrunk by more than 129,000 ha in 2013. The proportion of households engaged in paddy farming has dropped from 76 percent in 1996 to 72.3 percent in 2011 [10].

Even though the Terai region of Nepal consists of 70% of cultivable land and is known as the country's "food basket", rising population has caused a severe challenge with food security. The Saptari's rice production is hampered by a lack of timely and appropriate supplies of quality seeds and fertilizers, insufficient drainage and irrigation, labor shortages, disease, and pests such as army worm as well as inefficient marketing and pricing methods [11–13]. The study will focus on calculating the benefit-cost ratio which will be useful for upcoming rice farmers, where who should involve in rice cultivation, and also to the addressable scholars and researchers. Additionally, the significant and frequent problems with paddy production in the Kanchanrup municipality are also disclosed by this study; if these problems are resolved, the zone's ability to produce rice would enhance.

2. METHODS

2.1 Selection of the Study Area

This study was carried out in Nepal's Eastern Terai. Kanchanrup Municipality in Saptari District was chosen for the research. This location was purposefully chosen for research since it was the district's primary hub of rice growing. To meet research aims, this study used primary data. A total of 60 paddy-growing households were chosen randomly for the study because they represented the whole population of the study region, accounting for more than 5% of the overall population since Kanchanrup Municipality

comprehend 12 wards; from each ward 5 families were selected on a random basis. We have used both primary and secondary data for present study.

2.2 Data Collection and Analysis

An interview approach was used to acquire primary data from households. The collected raw

data was coded and input into a computer. Regional measures were translated to standard units, and the final analysis were carried out using Microsoft Excel and social science statistical software (SPSS, 2009). The socioeconomic characteristics of farmers were examined using descriptive statistics such as mean, frequency, percentage, and standard deviation.

Table 1. Total area, production and productivity of paddy in a different district

Districts	In Hectares	Production (Metric tons)	Productivity (Mt/Ha)
Morang	86,634	367070	4.28
Jhapa	84,875	373732	4.40
Kapilvastu	66,495	233470	3.51
Kailali	71,700	306202	4.27
Rupandehi	63,882	264839	4.15
Dhanusha	57,401	228618	3.98
Bara	56,116	232179	4.14
Sunsari	53,350	212735	3.99
Saptari	49,519	176508	3.56
Siraha	47,707	167729	3.52

(Source: Ministry of Agriculture and Livestock Development 2019/2020)

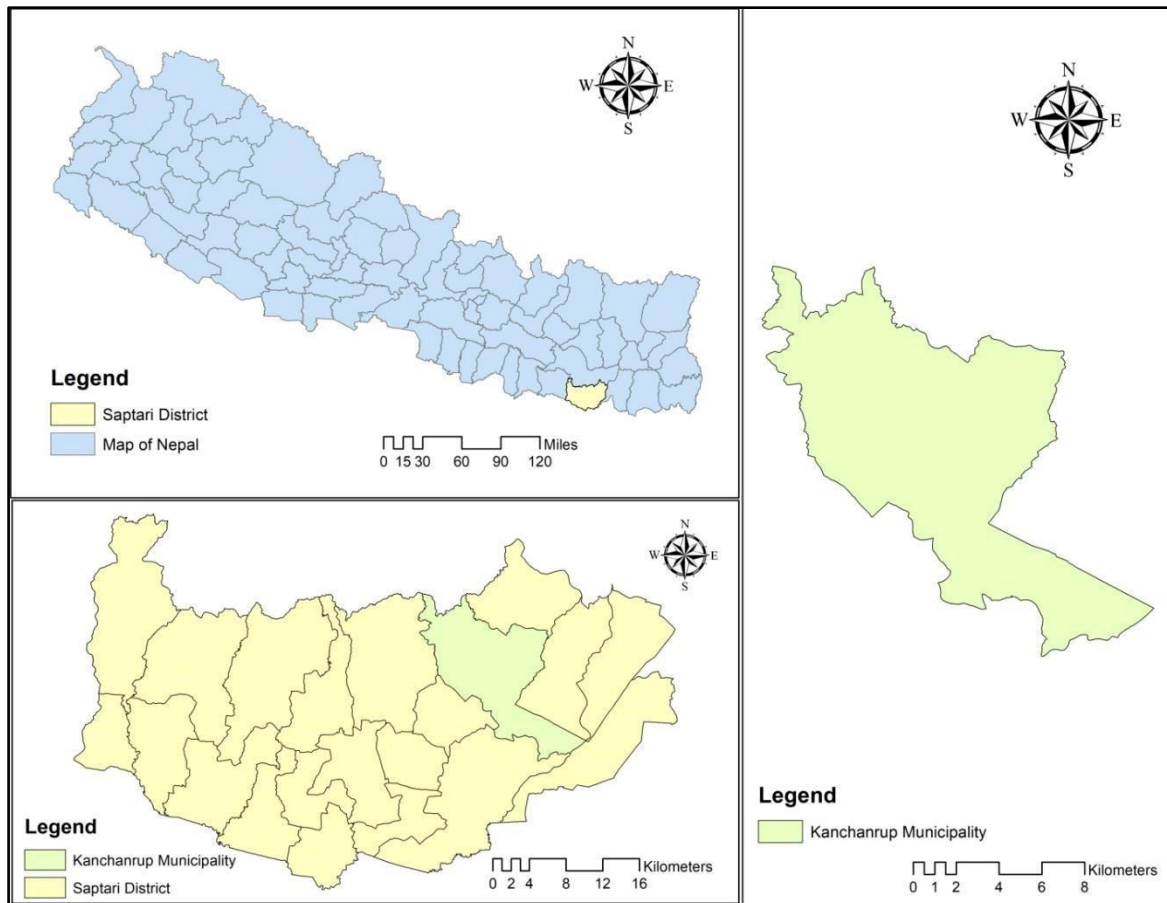


Fig. 1. Map of studying area showing research site

2.2.1 Survey

The survey will be conducted through semi-structured interviews. For this purpose, the questionnaire will be prepared and pre-tested before the actual survey. Data regarding price and quantity of input supplies, production of paddy; collection amount; processing cost; marketing cost; retail price paid by the consumers. Demographic and socio-economic information will be collected.

2.2.2 Focus group discussion

A focus group discussion will be held in a group comprising all the major actors for Strength-Weakness-Opportunity and Threats (SWOT) analysis on paddy production and marketing to know the farmer's knowledge and to collect information regarding the cost of production, price, and quantity.

2.2.3 Key informants interview

The major key informants were farmers, stakeholders, Gyan Kendra, and the Zone officer. They were asked a series of questions about the production, marketing and constraints of paddy in Kanchanrup Municipality, Saptari district of Nepal.

2.2.4 Analytical techniques

2.2.4.1 Quantitative analysis

Analyzed primary data from field observations, focus group talks, key informant interviews, and household surveys quantitatively. For the descriptive study of output, pricing, costs, and margins, simple statistics such as sums, averages, relative frequencies, minimum and maximum values, and standard deviations are utilized.

2.2.4.2 Qualitative analysis

Economic analysis of qualitative paddy data will be done by using various analysis tools of economic analysis approach and relevant economic & marketing research tools.

2.2.4.3 Cost of production

By summing the costs of all variable inputs and the opportunity cost, the total cost of production was computed. Seed, farm manure (FYM), fertilizer, labor, machinery, and irrigation

expenditures are elements of variable costs. Renting land or utilizing your equipment are examples of fixed costs. The cost of production was computed by using the subsequent formula [14]:

$$\text{Total Cost} = \text{Total Variable Cost (TVC)} + \text{Total Fixed Cost (TFC)}$$

2.2.4.4 Gross return

Gross return is derived by combining grain and straw yields. At the time of harvest, rice grains and straw were evaluated at local market values.

$$\text{Gross Return} = \text{Grain Return} + \text{Straw Return}$$

$$\text{Gross Return} = \text{Total Grain Produced (tons)} \times \text{Price per tons}$$

$$\text{Straw Return} = \text{Total Straw Produced (bundles)} \times \text{Price per bundles}$$

2.2.4.5 Gross margin

Gross margin is the output of a firm computed by deducting total variable expenses from revenue.

$$\text{Gross Margin (GM)} = \text{Gross Return (GR)} - \text{Total Variable Cost (TVC)}$$

Where,

$$\begin{aligned} \text{Gross return} &= \text{Price} * \text{total quantity marketed} \\ \text{Total variable cost} &= \text{Summation of the cost incurred on all the variable items} \end{aligned}$$

Similarly,

$$\text{Gross Profit Ratio (GPR)} = \frac{\text{Gross Margin (GM)}}{\text{Total Revenue (TR)}}$$

Retrieved from [15]

2.2.4.6 Benefit-cost analysis

The goal of benefit-cost analysis is to guarantee that a resource investment yields an acceptable return on the resources used. The Benefit to Cost Ratio (BCR) is widely regarded as one of the simplest and quickest methods of evaluating a farm's economic performance. Profit per cost unit is compared using BCR. As a result, the following formula was used to do a benefit-cost analysis [14]:

$$\text{B:C Ratio} = \frac{\text{Gross Return (GR)}}{\text{Total Cost (TC)}}$$

2.2.5 Analysis based on B: C ratio

- If the B: C ratio < 1, the farm business is considered to be at loss.

- If the B: C ratio = 1, the farm business is recovering the cost of production.
- If the B: C ratio > 1, the farm business is considered to be profitable.

2.2.5.1 Problem Confrontation Index (PCI)

The study determined the main issues that farmers experienced while cultivating rice using all available inputs in a methodical manner. By summing the farmers' individual scores for each of the five challenges chosen, an aggregate score of the issues they encountered was calculated. Each farmer was asked to rate the severity of each issue by selecting one of the four options: "frequently," "occasionally," "rarely," or "not at all." These answers were assigned weights of 3, 2, and 0, respectively. The following formula was used to calculate the problem confrontation index (PCI) scores for each of the problems that were chosen [16]:

$$PCI = (P_{frequently} \times 3) + (P_{occasionally} \times 2) + (P_{rarely} \times 1) + (P_{not\ at\ all} \times 0)$$

Where,

- $P_{frequently}$ = Number of responses indicating the problem occurred frequently
- $P_{occasionally}$ = Number of responses indicating the problem occurred occasionally
- P_{rarely} = Number of responses indicating the problem occurred rarely
- $P_{not\ at\ all}$ = Number of responses indicating no problem at all

According to the farmers' PCI score, which represented the intensity of their remarks, the issues were graded.

3. RESULTS

The data gathered from the research region was purposefully examined with relevant statistical tools such as MS Excel and SPSS, and the results are provided in this part.

3.1 Socioeconomic and Demographic Characterization of the Rice Farmer

Here is a brief discussion of information gathered from the survey about socioeconomic and form factors, such as respondents' ages, sexes, occupations, educational levels, family sizes, and amounts of land owned.

3.1.1 Age of respondent

The age of the respondent was classified into three categories i.e. (i) Young (less than 35), (ii)

Adult (between 35-55), and (iii) Old (above 55). The study has revealed that the majority of the respondents in the study area were between the age group 35-55 years (76.7%) followed by those above 55 years (16.7%) and less than 35 (6.7%).

Table 2. Age of respondent

	Frequency	Percent
Young (less than 35)	4	6.7
Adult (between 35 -55)	46	76.7
Old (above 55)	10	16.7
Total	60	100.0

Source: Field survey 2022

3.1.2 Religion of respondents

The study revealed that the majority of the respondents in the study area were Hindu 91.7% followed by Muslim 8.3%.

3.1.3 Education status of the respondents

Education is one of the most essential variables in societal socioeconomic and cultural transformation. This is one of the variables that contribute to the acceptance of technology. The highest level on the table of education was a SLC which accommodates about 38.3% of respondents followed by literate 26.7%, illiterate 21.7%, and College 13.3%.

Table 3. Education status of the respondent

	Frequency	Percent
Illiterate	13	21.7
Literate	16	26.7
SLC	23	38.3
College	8	13.3
Total	60	100.0

Source: Field survey 2022

3.1.4 Caste or ethnicity of the respondent

We discovered that respondents in the survey region belonged to many castes, including Brahmins, Chhetris, Madhesi, Janjatis, and Dalits. With a frequency of 32, the majority of responders were Madhesi and the percentage is 53.3% followed by janjati having a frequency number 16 and a percentage is 26.7%, Brahmin with 7 frequency percentage is 11.7%, Dalit having a frequency of 4 and percentage is 6.7% and last, is Chhetri having frequency 1 and accommodate 1.17%.

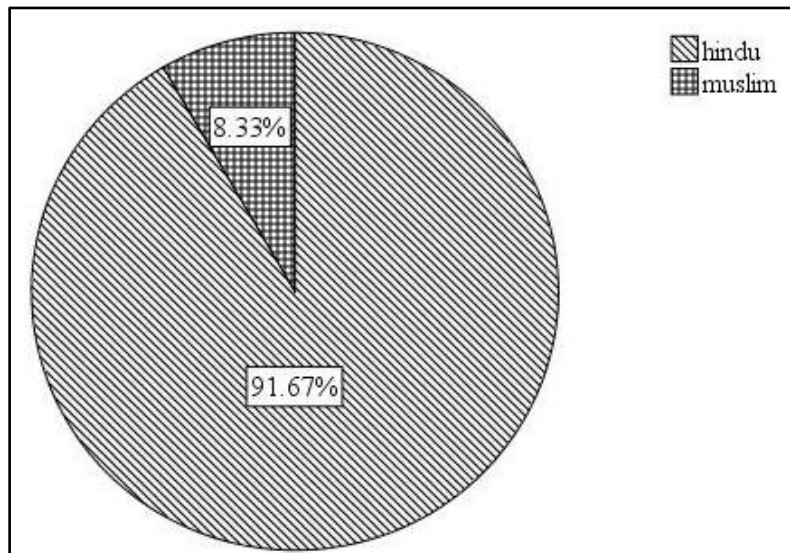


Fig. 2. Religion of respondents

Source: Field survey 2022

Table 4. Cast and ethnicity of respondent

	Frequency	Percentage
Brahmin	7	11.7
Chhetri	1	1.7
Janjati	16	26.7
Madhesi	32	53.3
Dalit	4	6.7
Total	60	100.0

Source: field survey 2022

3.1.5 Occupation of respondent

The majority of respondents (95%), according to the poll, work in agriculture, followed by 3.3% in business, and at least 1.7% in the service industry as their primary occupation. We also discovered that all respondents worked in agriculture.

Table 5. Occupation of respondent

	Frequency	Percent
Agriculture	57	95.0
Service	1	1.7
Private business	2	3.3
Total	60	100.0

Source: field survey 2022

3.1.6 Landholding

It was found that total land holding between 20-40 kattha is 60%, less than 20 kattha is about 26.7% and more than 40 kattha is 13.3%. It was

found that 60% of the respondents had their area under rice in area 20-40 kattha and the remaining 26.7% of the respondents had less than 20 kattha and 13.3% had more than 40 kattha as their area under rice cultivation.

Table 6. Landholding

	Frequency	Percent
Less than 20 kattha	16	26.7
Between 20-40 kattha	36	60.0
More than 40 kattha	8	13.3
Total	60	100.0

Source: Field survey 2022

3.1.7 Variety cultivated

In Kanchanrup Municipality mostly cultivated variety by the respondent was Hardinath which accommodate about 36.67% followed by Mansuli (33.33%), Radha-12 (15%), Sabitri (8.33%), and Radha-11 (6.67%).

3.2 Technical Issues of Producing Paddy

3.2.1 Insect pest problem

From the Table 7, we found that 18.3% of respondents had severe problems with insect pests in their field, whereas 68.3% of respondents had a moderate problem and 13.3% of respondents have no problem with insect pests in their paddy field.

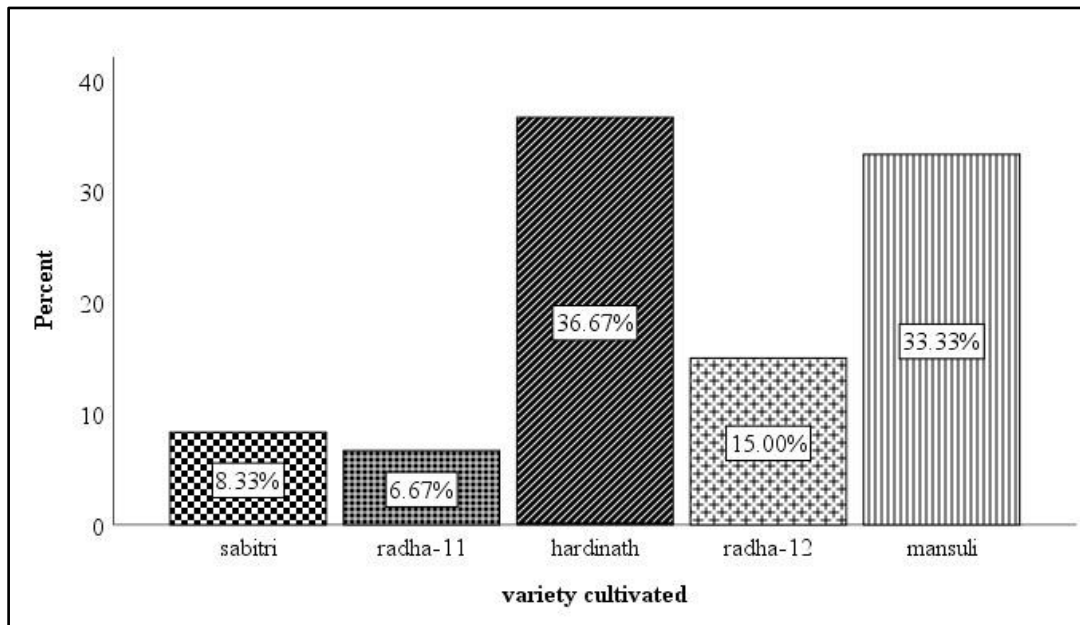


Fig. 3. Variety cultivated by respondent

Source: Field survey 2022

Table 7. Insect pest problem

	Frequency	Percent
No problem	8	13.3
Moderate	41	68.3
Severe	11	18.3
Total	60	100.0

Source: Field survey 2022

3.2.2 Disease problem

From the Fig. 4, we found that 23.33% of respondents had severe problems of disease in their field, whereas 66.67% of respondents had a moderate problem of disease and only 10% of respondents had no problem of disease in their paddy field.

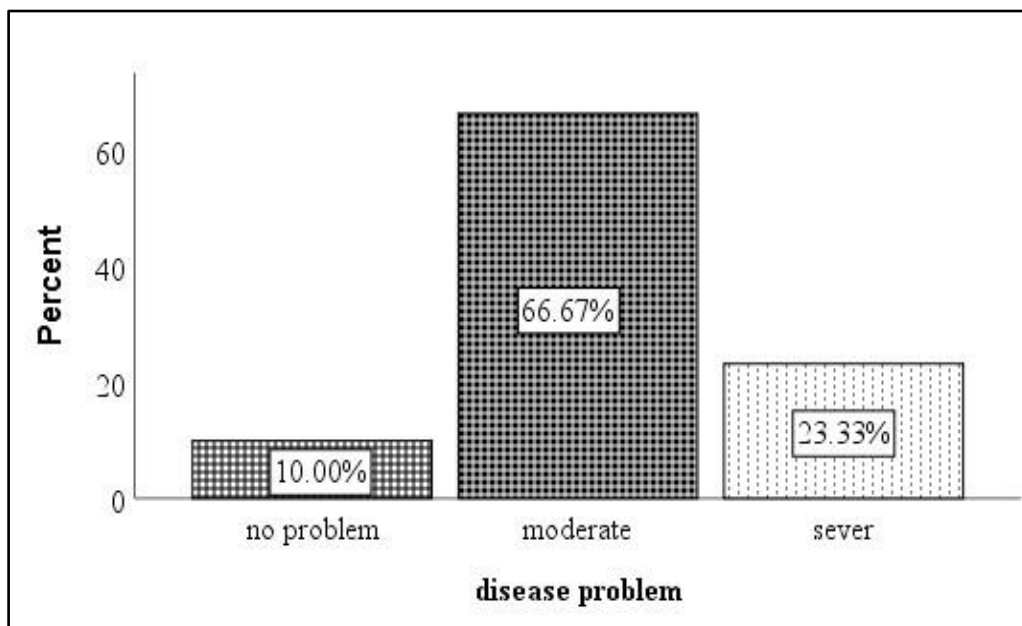


Fig. 4. Disease problem

Source: Field survey 2022

3.2.3 Fertilizer problem

From the study of economic analysis of paddy production in Kanchanrup Municipality, we found that 35% percent of the respondent had severe problems with fertilizer whereas 38.3% of respondents had moderate problems and only 26.67% of respondents had no problem with fertilizer.

3.2.4 Buyer state

In Kanchanrup Municipality mainly wholesaler buys 61.67% of respondent paddy. The local trader buys 20% of respondent paddy and the retailer buys only 18.33% of respondent paddy. Upon observation, these data shows that the

wholesaler governs the majority of respondent paddy. The wholesalers can regulate the price of the paddy produced since they acquire more than 50% of the respondent paddy.

3.2.5 Market state

The market is one of the most important factors for the economic analysis of paddy production. Here in Kanchanrup Municipality, 45% of respondents use Baluwa as a marketing center whereas 30% of respondent use Kanchanpur, 15% Beriyar, and 10% as Barmajhia respectively. Therefore, the majority of individuals prefer Baluwa for the marketing of produced paddy that primarily causes the price alteration in all four markets.

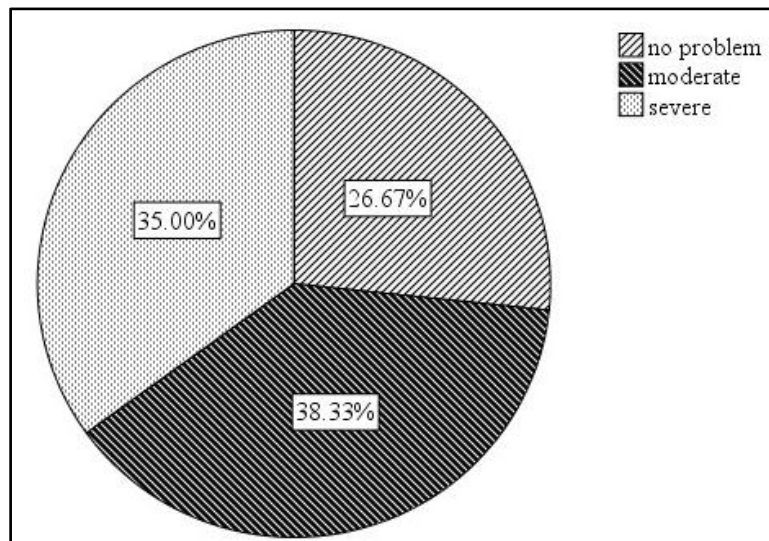


Fig. 5. Fertilizer problem
Source: Field survey 2022

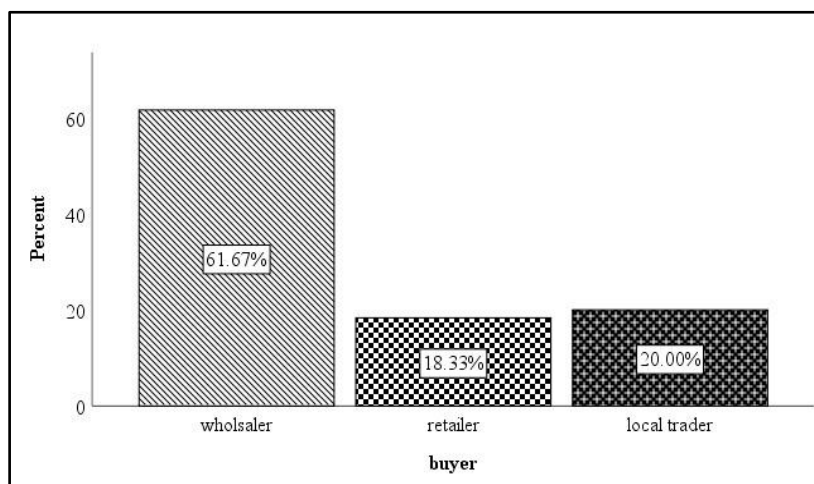


Fig. 6. Buyer
Source: Field survey 2022

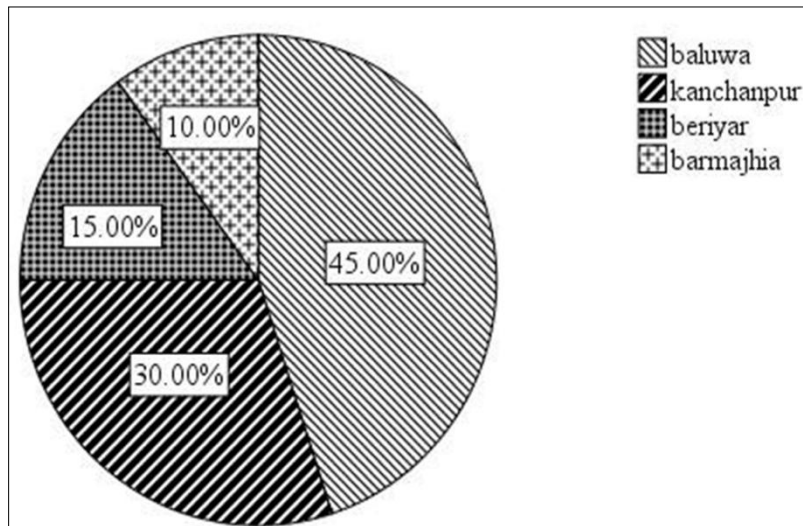


Fig. 7. Market of respondent

Source: Field survey 2022

3.3 Total Average Cost of Paddy Production (NRs)

3.3.1 Costs of production

The sum of all fixed costs and variable costs is the total cost of production. It was calculated in the following way as:

Total cost = Sum of all variable cost + fixed cost

= Cost of land renovation + cost of tractor (land preparation) + cost of nursery preparation (labour cost) + cost of seed sowing (labour cost) + cost of manuring and fertilizer (labour cost) + cost of seedling transplanting (labour cost) + cost of weeding and hoeing (labour cost) + cost of harvesting (labour cost) + cost of threshing + cost of seed + cost of FYM + cost of DAP + cost of urea + cost of potash + cost of pesticides + land cost.

Here in the Table 8, the average cost of production of 60 farmers of Kanchanrup Municipality per hectare per season was found to be NRs 114758.18 in the land renovation cost was NRs 758.44 which is about 0.66%. Similarly, tractor cost for land preparation was NRs 13804.78 (12.02%), nursery preparation cost (labor cost) was NRs 655.60 (0.57%), seed sowing cost (labor cost) was NRs 648.12 (0.56%), manuring and fertilizer cost (labor cost)

was NRs 635.34 (0.55%), seedling transplanting cost (labor cost) was NRs 29865.59 (26.024%), weeding and hoeing cost (labor cost) was NRs 13108.25 (10.45%), harvesting cost was (labor cost) NRs 11284.40 (9.83%), threshing was NRs 3851.03 (3.35%), seed cost was NRs 3196.88 (2.78%), FYM cost was NRs 12346.12 (10.75%), DAP cost was NRs 9028.31 (7.86%), urea cost was NRs 2403.89 (2.09%), potash cost was NRs 3278.99 (2.85%), pesticides cost was NRs 2000.44 (1.74%), the land cost was NRs9000 (7.84%). The highest average cost of production was in seedling transplanting, which accommodates about 26.29% and the lowest average cost was in manuring and fertilizer which contain about 0.55%.

3.3.2 Gross return

The total yield is the sum of the yields gained from grain and byproducts (such as straw). The formula was used to calculate it:

Gross return = (the market price of paddy * total output) + (the price of paddy byproduct * total amount of byproduct)

Gross Return = NRs. 135737.5

3.3.3 Gross margin

The total yield is computed by subtracting total growing expenses from the total yield. Gross profit is not the same as total yield. Gross Margin Analysis allows for quick and easy judgments when analyzing any firm. The formula was used to compute it:

$$\begin{aligned} \text{Gross margin} &= \text{Gross return (per hectare)} - \\ &\quad \text{Total variable cost (per} \\ &\quad \text{hectare)} \\ &= 135737.5 - 114758.18 \\ &\quad \text{(per hectare)} \\ &= 20979.32 \text{ (per hectare)} \end{aligned}$$

3.3.4 Benefit – Cost ratio

The benefit-cost ratio is a quick and straightforward indication of any business's economic success, including the agriculture industry. This is the total revenue to total cost ratio. The following formula was used to compute BCR,

$$\begin{aligned} \text{Benefit-cost ratio} &= \text{Gross return (NRs.)} / \\ &\quad \text{Total cost (NRs.)} \\ &= 135737.5/114758.18 \\ &= 1.18 \end{aligned}$$

Rice farming had a benefit-to-cost ratio that was somewhat higher than one, i.e., 1:18, which

portrays rice production in Kanchanrup Municipality as economically feasible. The business can provide returns of NPR 1.18 for every rupee invested, and the gross margin is positive, indicating that the investment is financially sustainable and the operation may proceed without any problems.

3.4 Production Problems of Rice Grower

Farmers in the study region encountered a variety of production-related issues. Farmers' perceptions of production concerns were used to rate the issues. According to the data, the main problems of rice production in Kanchanrup Municipality are crop damage caused by pests, diseases, and wildlife (0.84), a lack of access to improved seeds, fertilizers, and pesticides (0.74), a lack of technical knowledge and support (0.62), a labor shortage and the high cost of mechanized tools (0.56), and land fragmentation (0.42).

Table 8. Cost of cultivation

Particulars	Average cost per hectare per season (NRs.)	Percentage Share
Land renovation cost (Labour)	758.44	0.66
Tractor cost (Land preparation)	13804.78	12.029
Nursery preparation cost (Labour)	655.60	0.57
Seed sowing cost (Labour)	648.12	0.56
Manuring and fertilizer cost (Labour)	635.34	0.55
Seedling transplanting cost (Labour)	29865.59	26.02
Weeding and hoeing cost (Labour)	12000.25	10.45
Harvesting cost (Labour)	11284.40	9.83
Threshing cost	3851.03	3.35
Seed cost	3196.88	2.78
FYM cost	12346.12	10.75
DAP cost	9028.31	7.86
Urea cost	2403.89	2.09
Potash cost	3278.99	2.85
Pesticides and insecticides cost	2000.44	1.74
Land cost	9000	7.84
Average cost of paddy production (per hectare)	Rs. 114758.18	100

Table 9. Problem with the rice production in the study area

	Index	Rank
Damage to crops by pests, disease, and wild animals	0.84	I
Poor access to improved seed, fertilizer, and agrochemical	0.74	II
Lack of technical knowledge and support	0.62	III
Labour shortage and high cost of mechanization tools	0.56	IV
Land fragmentation	0.42	V

Source: Field survey 2022

4. DISCUSSION

The majority of the respondents of paddy growers were male, middle-aged group i.e., Adult (between 35-55 years), belonged to Madhesi ethnic group, had medium-sized family, had medium farm size, most of the respondent had education status up to SLC level and agriculture was the primary source of income. A similar result was reported in the study made by Sapkota et al. [5]. The average land holding size of the overall sampled household was 0.98 hectares (29.4 kattha). This is greater than the national average land holding (Central Bureau of Statistics (CBS), 2019). The average operating cost of paddy cultivation per hectare was estimated to be NRs. 114758.18 which is greater than the finding of Sapkota et al. [5]. The gross margin is positive, with a cost-benefit ratio (BCR) of 1.18 anticipated. This is more than one, which means that if you invest 1 rupee, you will receive a return of 1.18 rupees from trading. This demonstrates that the investment is financially viable and that the firm can operate smoothly and a similar result was reported in the study made by Sapkota et al. [5]. Lack of good cultivation skills, diseases, and pests, untimely availability of fertilizer, rapid price increases for inputs including labor, and seeds, as well as labor migration had severe inflame on rice output, and lack of timely and adequate supplies of high-quality seeds are the major constraints in paddy production and a similar result was found in Sapkota et al. [5]. The result showed that the paddy growing farmers need training about the scientific way of paddy cultivation, provision for credit, market facility and timely availability of inputs to solve the production and marketing problems.

5. CONCLUSION

The predominant source of income for the majority of farmers, i.e., agriculture is the primary profession. Most of the respondents have their major occupation of agriculture (95%). The benefit-cost ratio was calculated as greater than 1 i.e., 1.18 which indicates the economic feasibility of paddy farming in the study area. The calculated gross margin indicated that paddy cultivation is one of the profitable options for the farmers of the Kanchanrup Municipality. Due to the high cost of labor and the lack of farm machinery, vast amounts of manpower are needed for agronomic operations, which drives up the cost of cultivation. As a result, strategies and regulations must emphasize farm

mechanization while taking geographic constraints into account. According to the study, training and extension initiatives centered on scientific production technology are required. This aids in advancing farming practices away from the conventional model. Based on the study conducted as an economic analysis of paddy production in Kanchanrup Municipality Saptari Nepal some conclusion was made. The climatic condition of Kanchanrup Municipality is favorable for paddy cultivation and it is also the pocket area under PMAMP. The production and productivity are high in this study area and all farmers are highly motivated to cultivate the paddy. Besides this there is also some problem, farmers are found to face problem with marketing and production. The major problem is a disease, insect pests, lack of technical knowledge high prices of the input, and low prices offered by a wholesaler, and retailers.

ACKNOWLEDGEMENT

We want to express our thanks to site supervisor Mr. Rajendra Prasad Yadav, Chief Agriculture Officer, AKC, Saptari, and the entire team of AKC for their kind support throughout my research survey period and Member supervisor Mr. Madhav Bhatta, Ministry of Agriculture and Livestock Development. Additionally, we would like to expand our sincere gratitude to Mr. Krishna Dahal campus director, and all faculty members of G.P. Koirala College of Agriculture and Research Center for providing the congenial environment and continuous encouragement.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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