ISSN 2518–2021 (Print) 2415–4474 (Electronic)

Fundamental and Applied Agriculture

Journal home page: https://www.f2ffoundation.org/faa/index.php/home

Vol. 8(4), pp. 677 – 683: 2023, doi: https://doi.org/10.5455/faa.146804

AGRICULTURAL ECONOMICS | ORIGINAL ARTICLE

Comparative Socioeconomic of Rice Seed and Grain Production in Kanchanpur District of Nepal

Ramesh Prasad Bhatt[1], Anit Poudel[1] ✉, Januka Singkhada[2], Pradip Gyawali[1]

[1] Agriculture and Forestry University, Nepal

[2] Nepal Polytechnic Institute, Purbanchal University, Nepal

ARTICLE INFO

Article history

Received: 18 Mar 2023

Accepted: 01 Aug 2023

Published online: 31 Dec 2023

Keywords

Benefit-cost analysis,
Cereal,
Gross margin,
Input use,
Marketing constraints

Correspondence

Anit Poudel

✉: anitpoudel@gmail.com

ABSTRACT

Rice is the number-one staple crop in Nepal. However, its production economics may differ when it is grown as grain for immediate consumption or as seed for further planting. Therefore, a study was conducted to compare the input use, productivity, and profitability of rice seed and grain production in the Kanchanpur district of Nepal. Altogether, 94 samples were taken: 30 from rice seed growers and 64 from rice grain growers. Selected households were interviewed with a pre-tested, semi-structured interview schedule. Data entry and analysis were done using SPSS and MS Excel, where statistical modules like gross margin, benefit-cost analysis, indexing techniques, and the t-test were employed to derive the inferences needed. The study showed that the productivity of rice as a seed crop (4.73 ± 0 t/ha) was found to be significantly higher than grain production (3.72 ± 0 t/ha), as well as that the benefit/cost ratio (BCR) of seed production (1.71) was much higher than that of rice grain production (1.23). The costs associated with labor, seed, organic manure, chemical fertilizer, herbicide, and machinery were significantly higher ($P<0.05$) for seed producers than for grain producers, indicating that seed producers exhibited notably more efficient input utilization. Moreover, both seed and grain growers found the unavailability of quality inputs ($I = 0.76$) as the major production constraint and the unavailability of processing units ($I = 0.71$) as the major marketing constraint. This research suggests that the input use, productivity, and profitability of seed production are higher than grain production in rice. Nevertheless, future research on input management strategies and production and marketing factors can provide valuable insights to further validate the outcomes of this study

1. Introduction

Rice (*Oryza sativa)* is the most popular cereal crop among all other grains produced in Nepal. It is Nepal's most important crop in terms of both productivity and area cultivated (Gaihre et al. 2018). Cereal crops are grown on the majority (80%) of Nepal's agricultural land (MoALD 2017). Rice is grown across all the ecological areas found in Nepal. Nevertheless, midhills and highhills contribute 23% and 2% of the total rice area, respectively. So, rice is mainly concentrated in the Terai region of Nepal (Gadal et al. 2019). The primary farming system in the Terai region is rice-wheat-maize, while spring rice is also grown in some regions. In Nepal, rice production makes up half of all agricultural land and productivity (MoALD 2017). The per capita rice consumption in Nepal is 137.5 kg per year (Joshi and Upadhaya 2020). It contributes 20% of the agricultural GDP and 7% of the overall GDP of the country. However, due to its significant reliance on unpredictable weather, agriculture's contribution to GDP has been diminishing over the years (Jha and Dhakal 2020). Rice supplies around 39 percent of carbohydrate, 29 percent of protein, and 7 percent of fat in the Nepalese diet (Dhungel and Acharya 2017). It is evident that around 104 kg of milled rice are available per person per year in Nepal (Joshi et al. 2020). However, Nepal imported food grains worth Nepalese Rupees (NPR) 30 billion in the first ten months of the current fiscal year (2019/20), a five-fold rise from the similar figure from the previous year (2018/19) (MoALD 2020).

Sudurpaschim Province is one of the major contributors to cereal crops, especially paddy. However, the production of rice is not satisfactory due to various constraints. One of them is the lower area coverage for spring rice (Subedi et al. 2020). The overall productivity of spring rice is 24% higher than that of the main season in Sudurpaschim Province, while it is just 21.6% higher on a national average (MoALD 2019). Chaite 2, Chaite 4, Bindeswari,

Cite This Article

Bhatt RP, Poudel A, Singkhada J, Gyawali P. 2020. Comparative Socioeconomic of Rice Seed and Grain Production in Kanchanpur District of Nepal. *Fundamental and Applied Agriculture*, 8(4): 677–683. https://doi.org/10.5455/faa.146804

Haridinath 1, Sabitri, Ram Dhan, Janaki, Masuli, Ghaiya 2, Radha 7, and SukkhaDhan 4 and 5 are some of the principal rice varieties planted there during the main growing season. About 45,796 hectares of land in Nepal's Kanchanpur district are planted with rice, producing 179,314 metric tons and 3.88 metric tons per hectare (MoALD 2020). This region is known for its productive land and high rice output. Bhimdatta, Bedkot, Krishnapur, Suklaphanta, and Laljhadi are the pocket areas where rice farming is more common. Chaitedhan, or summer rice, is grown on 300 hectares of land in this area, yielding 1500 metric tons of grain and a productivity of 5 metric tons per ha (DADO 2017).

Since rice accounts for more than 50% of Nepal's dietary grain requirements and more than 30% of its caloric consumption, food insecurity is frequently associated with declining rice output (Bishwajit et al. 2013). Hence, the safety of the crop is a good indicator of overall food security. In Nepal, only 33 out of 75 districts were found to be food secure (Paudel et al. 2017). When population expansion outpaces cereal crop growth, as it does in the South Asian region, Nepal has the lowest productivity in several crops, including rice, and as a result ranks among the nations with the highest levels of food insecurity (Joshi and Pandey 2006). In the past few decades, the increase in rice production has not been satisfactory, and the pressure of population growth is ever increasing (Choudhary et al. 2022). The increase in the yield of rice in Terai, which is the breadbasket of Nepal, was 1.77 during 1991–2017 compared to 1.78 during 1974–1990, and the increase in area under rice cultivation was 0.07 in 1991–2017 compared to 0.15 in 1974–1990 (Gaihre et al. 2021). It is evident that the rise in yield is static and the expansion of the rice-growing area is on the downside. The stakeholders must be concerned about this terrible issue.

Since the 1980s, Nepal has started importing rice, and its yield has been decreasing over the years. Nepal is becoming a net importer of rice because the current yield cannot support the country's population (Kaini 2016). During the first ten months of the current fiscal year, Nepal imported rice worth Rs. 24.50 billion (20.68% more than the previous year) (MoALD 2020). Additionally, the limited purchasing power of those in Himalayan districts as a result of the price increase has made them vulnerable to food insecurity (Dhakal et al. 2019). Therefore, it is crucial to boost rice output and productivity to meet the current demand and improve the income and standard of living of Nepalese farmers.

Most of the paddy farmers in Kanchanpur district are small landholders who adopt a traditional method of farming. Furthermore, farmers' use of low-yielding indigenous cultivars makes it impossible to imagine a breakthrough in these conditions. Inadequate seed storage structures, quality seeds, insurance, technical support, credit, and smart subsidies have hindered the production of rice (Gauchan et al. 2014). In Nepal, more than 65% of farmers were using seeds from informal sources with poor germination and productivity (Sapkota et al. 2018). High-yielding and improved varieties coupled with modern-day farming practices may have positive impacts on rice productivity as well as food security in the country. However, we assume that the farming practices as well as the production economics greatly vary depending on the nature of farming. This research is focused on a comparative study of the socioeconomic of rice grain and seed production in Kanchanpur, Nepal, to understand the factors of production, constraints, and economic viability and stability of the farmers who chose rice as a seed or grain business

2. Materials and Methods

2.1. Site selection and Sampling technique

The study was carried out in Bhimdatta municipality, Bedkot municipality, Shuklaphanta municipality, Krishnapur municipality, and Laljhadi rural municipality of Kanchanpur district, Sudurpaschim Province, Nepal. These regions were selected as they represent the primary rice-producing blocks of the district. For the sampling technique, a total of 94 samples were collected from various locations within these blocks. Among these, 30 samples were obtained from rice seed producers, while 64 samples were collected from rice grain producers. The sampling methods employed a combination of cluster random sampling and purposive random sampling.

2.2. Research design and Data collection

First of all, the study area of interest was selected. Then, relevant literature about the study area was gathered to gain insights into the subject. Problem identification was done with the help of Focus group discussions, a Key informant survey, informal talks with the farmers, and field observation. To ensure the effectiveness of the interview schedule, a pre-testing phase was carried out with 10 respondents near the study site. Based on the pre-test results, the interview schedule was modified before its actual implementation with real respondents. Data collection encompassed both primary and secondary sources. Primary data were gathered through field surveys, while secondary data were obtained from published and unpublished literature, the Agriculture Knowledge Center (AKC) profile, and the agriculture statistical profile published by the Ministry of Agriculture and Livestock Development (MoALD).

2.3. Data analysis techniques

After the completion of the household survey, the next step was data entry and analysis. The information collected from the field was coded, tabulated, and analyzed using MS Excel and SPSS. Other descriptive statistics like graphs, charts, and other such tools were also used to present the data. Statistical modules like gross margin, benefit-cost ratio, Indexing technique, and the t-test were employed to derive the inferences needed.

2.4. Gross margin

Gross margin is the value of output by the producer, which is computed at the farm gate price minus total variable costs.

Gross margin = Gross return - Total variable cost

Where, Gross return = Price × total quantity marketed, and total variable cost = Summation of cost incurred in all the variable items

2.5. Benefit-cost analysis

A benefit cost analysis was done after calculating the total cost and gross return from the rice cultivation. The cost of production was calculated by summing the variable cost items in the production process. For calculating gross return, income from product sales was included. Therefore, the benefit-cost analysis was carried using the formula:

B/C ratio = Gross return / Total Cost

2.6. Indexing

The production and marketing constraints in rice cultivation were ranked using index scale values. The scaling technique (Miah, 1993), which provides the direction and extremity attitude of the respondent towards any proposition, was used to construct the index. The formula given below was used to find the index.

$$I_{prob} = \Sigma S_i F_i / N$$

Where, I_{prob} = Index value for intensity; Σ = Summation; S_i = Scale value of i^{th} intensity; F_i = Frequency of i^{th} response; N = Total number of respondents

2.7. T-test

A two tailed independent sample t-test was used to compare the means between seed and grain producers. They were tested at a 5% level of significance. The t-test is computed as

$$t = \frac{(\bar{X}_1 - \bar{X}_2)}{\sqrt{(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2})}}$$

Where, $\bar{X}_1$, s_1, n_1 are mean, variance and number of observations for first sample and $\bar{X}_2$, s_2, n_2 are mean, variance, and number of observations for second sample

3. Results and Discussion

3.1. Socio-demographic characteristics

3.1.1. Gender of the respondents

Of the total farmers who grew rice for grain purposes, 70.3% were male and 29.7% were female. Similarly, 60% of farmers growing rice as a seed were men, while 40% were women. However, 49.94 percent males and 50.06 percent females reside in this district (AKC 2020) (Figure 1).

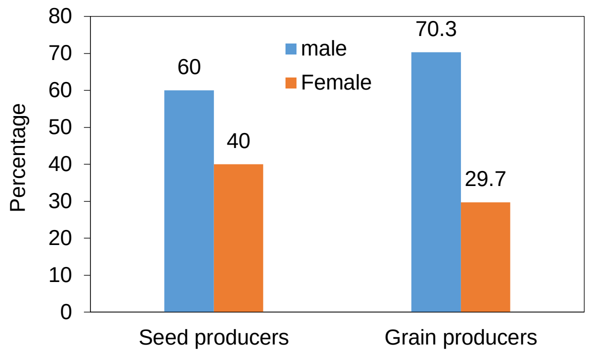

Figure 1. Distribution of respondents by gender in the study area, Kanchanpur (2021)

3.1.2. Age

All respondents were classified into 3 categories according to age, as presented in Table 2. Among the respondents, the majority of the respondents for both seed rice growers (66.7%) and grain rice growers (63.3%) were between 32 and 60 years of age (Table 1).

Table 1. Distribution of respondents by age in the study area, Kanchanpur (2021)

Age of respondents in years	Seed producers	Grain producers
<32	7 (23.3)	13 (20)
32-60	20 (66.7)	40 (63.3)
>60	3 (10)	11 (16.7)
Mean	45	47.43
Standard deviation	13.5	14

Note: Figures in parentheses indicate percentage

3.1.3. Ethnicity

This research studied the relative involvement of different ethnic communities in rice seed or grain productions. Chhetri communities were dominant in both rice seed (53%) and grain (36%). The study revealed that the Janajati populations mostly grow rice for grain purposes (28%), rather than seed purposes (10%), unlike Dalits, who grow rice for seed purposes (7%) rather than grain purposes (0%) (Figure 2).

3.1.4. Education level

The study showed that the farmers with a higher level of education (secondary level and above) mainly chose rice as a seed business (83%) than grain business (61%). The majority of the farmers with no or a low level of education (primary level and below) chose to grow rice for grain purposes (39%), rather than for seed purposes (17%) (Figure 3).

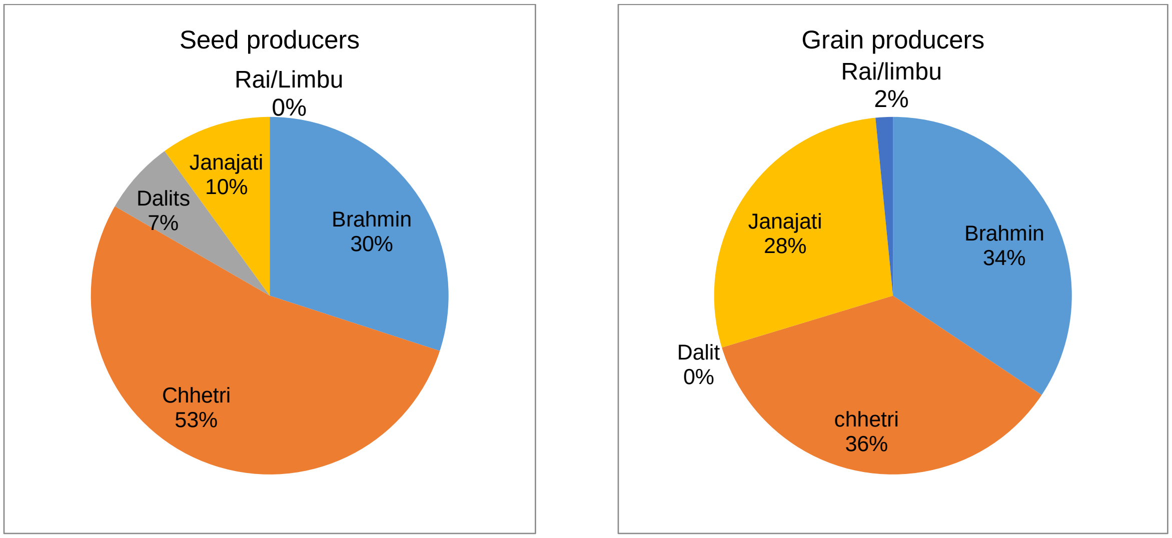

Figure 2. Ethnicity of rice seed growers and rice grain growers in Kanchanpur (2021)

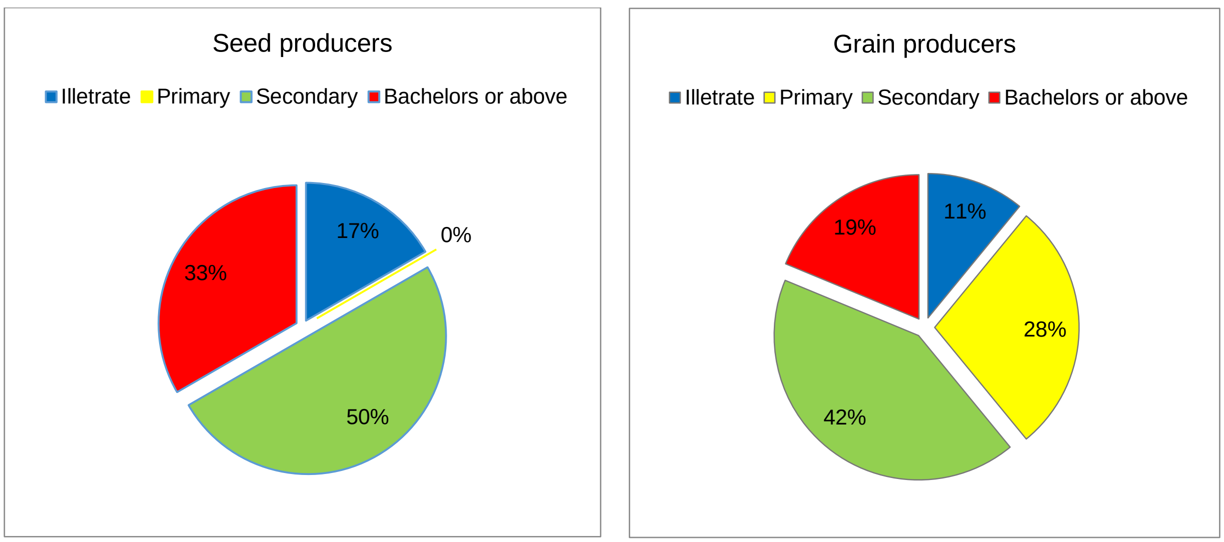

Figure 3. Education level of household head of rice seed growers and rice grain growers, Kanchanpur (2021)

Table 2. Source of seed purchase in Kanchanpur (2021)

Source of seed purchase	Seed producers	Grain producers
Own seed	5 (16.7)	36 (56.3)
Agro-vet	10 (33.3)	21 (32.8)
AKC or PMAMP	10 (33.3)	0 (0.00)
Co-operatives	5 (16.7)	7 (10.9)
Total	30 (100)	64 (100)

Note: Figures in parentheses indicates percentage

Table 3. Type of seed cultivated by farmers in the study area, Kanchanpur (2021)

Type of seed cultivate	Seed producers	Grain producers
Local	0 (0.0)	21 (32.8)
Improved	30 (100.0)	20 (31.3)
Hybrid	0 (0.0)	23 (35.9)
Total	30 (100)	64 (100)

Note: Figures in parentheses indicates percentage

3.1.5. Source of seed purchase

The study revealed that the majority (56.3%) of rice grain growers do not purchase but grow their own seed, while the majority (83.3%) of rice seed growers purchase seeds from other sources like Agro-Vet, AKC, and co-operatives rather than using their own seeds. It can be inferred that the seed replacement rate is higher in rice seeders than in grain growers (Table 2).

3.1.6. Type of seed cultivate

The majority of rice grain growers (34.9%) cultivated hybrid seed, followed by localseed (32.8%) and improved seed (31.3%). Among rice seed growers, all of the respondents cultivated improved seed (100%) in the study area (Table 3).

3.2. Economic indicators of rice grain and seed production

3.2.1. Input Use

Several input factors like seeds, fertilizers, pesticides, labor, and farm machinery were considered to study the differences in the input use of rice seed and grain production. The study showed that the costs for labor, seed, organic manure, chemical fertilizer, herbicide, and machinery were significantly different (P<0.05) between grain and seed growers. Insecticide and irrigation costs were not significantly different between grain and seed growers (P > 0.056). The cost of labor in grain production (NPR 30658.7 ± 91.3) was significantly higher than seed production (NPR 27920 ± 192.2). The cost of seed (Rs 5484.5 ± 91.7), organic manure (NPR 2960 ± 162.9), chemical fertilizer (NPR 13868.6 ± 134.6), herbicide (NPR 4856 ± 65.4), and machinery (NPR 14199.7 ± 305.1) for rice seed production was found to be significantly higher than the cost of seed (NPR 3809.9 ± 67.3), organic manure (NPR 2231.2 ± 181), chemical fertilizer (NPR 11743.7 ± 145.9), herbicide (NPR 4588.7 ± 74.4), and machinery (NPR 12813.7 ± 278) for grain production (Table 4). It can be inferred that input use in seed producers is higher than in grain producers. Choudhury et al. (2022) found the coefficients of the estimated frontier function of seed and chemical/fertilizer inputs to be positive and significant, implying that farmers are willing to pay more for better-quality seeds and spend more on fertilizer.

Table 4. Average cost of production of different inputs in Kanchanpur (2021)

Parameter	Seed production	Grain production
Seed	5484.5 ± 91.7[a]	3809.9 ± 67.3[b]
Organic manure	2960 ± 162.9[a]	2231.2 ± 181[b]
Chemical fertilizer	13868.6 ± 134.6[a]	11743.7 ± 145.9[b]
Insecticide	492.52 ± 6.2[a]	477.04 ± 7.7[a]
Herbicide	4856 ± 65.4[a]	4588.7 ± 74.4[b]
Irrigation	6264.87 ± 94.9[a]	6318.9 ± 171.5[a]
Labor	27920 ± 192.2[b]	30658.7 ± 91.3[a]
Machinery	14199.7 ± 305.1[a]	12813.7 ± 278[b]

*Mean values with different superscript letters in the same row were significantly different (P<0.05)

3.2.2. Production Economics

Total production cost, gross returns, gross margin, and BCR differed significantly (P<0.05) between seed and grain rice production. Total production cost per hectare (NPR 73069), gross returns per hectare (NPR 89938), gross margin per hectare (NPR 16869), and BCR (1.23) of rice grain production were significantly lower than total production cost per hectare (NPR 97127), gross returns per hectare (NPR 166092), gross margin per hectare (NPR 68995), and BCR (1.71) of seed production of rice. In their research, Bhandari et al. (2015) found that the average cost of production per ha of rice in Nepal was NPR 60000 with gross returns of NPR 80000, i.e., a gross margin of NPR 20000 and a BCR of 1.33 in 2013/14 (Table 5). The result indicates that, though the cost of production for seed production was higher (32%), the gross return was much higher (85%) than grain production for rice. Xie and Hardy (2009) noted that the additional cost of seed production averages 5%, with a range of 1% to 18% across countries. According to present research, rice seed production has a 54.85% higher gross margin than grain production. Also, the BCR of seed production (1.71) is higher than grain production (1.23). Thus, it can be concluded that rice seed production is more profitable than grain production. Xie and Hardy (2009) reported that the marginal returns of seed over grain production average about 27%, ranging from 23% to 119% across countries, and the benefit-cost ratio of rice seed production (1.7) is marginally higher than that of rice grain production (1.3).

Table 5. Economic indicators of rice seed and grain production in Kanchanpur (2021)

Parameter	Seed production	Grain production
Production cost per ha (Rs)	97127±395[a]	73069±482[b]
Gross returns per ha (Rs)	166092±590[a]	89938±790[b]
Gross margin per ha(Rs)	68995±556[a]	16869±943[b]
BCR	1.71±0[a]	1.23±0[b]

*Mean values with different superscript letters in the same row were significantly different (P<0.05)

3.2.3. Production constraints

There are many constraints pertaining to the farmers' paddy production. This study attempted to find some of them as perceived by the farmers. Similarly, the five-point scaling (1, 0.8, 0.6, 0.4, and 0.2) technique was used to find the relative intensity or priority of the constraints (Miya 1993). The value obtained from the ranking scale revealed that the unavailability of farm inputs has the highest index value (0.76) and the lowest index value (0.43) (Table 6). Thus, the major constraints faced by paddy farmers in the study areas were prioritized in the following order: unavailability of farm inputs, lack of technical knowledge, disease-insect management, labor shortage, and market access. Fahad et al. (2022); John and Fielding (2014); and Thanh and Singh (2006) have reported biotic and abiotic stresses, low input use, and resource unavailability as the major constraints in the rice industry.

Table 6. Ranking of rice production constraint in study area, Kanchanpur (2021)

Production constraint	Index	Rank
Unavailability of quality inputs	0.76	I
Disease- Insect Management	0.63	III
Market Access	0.43	V
Lack of technical Knowledge	0.67	II
Labor shortage	0.49	IV

3.2.4. Marketing constraints

Key informants interviewed identified major problems associated with rice marketing in the district and block area based on direct field observation and informal discussions with AKC officers and included them in the interview schedule. The farmers were asked to rank these problems. Forced ranking scales were used for scaling by giving a maximum of 1 and then decreasing as the severity decreased. Similar techniques were used by Poudel et al. (2022) to identify the major biotic constraints in citrus. The index value was obtained, and ranking was done based on the index value. The major problems related to the marketing of the rice were found to be the following: unavailability of processing units (0.71), poor road and transport infrastructure (0.69), lack of an auction market (0.61), absence of a collection center (0.50), and lack of access to credit (0.47) (Table 7). Joshi et al. (202); Basyal et al. (2019); and Sapkota et al. (2011) have identified a lack of production inputs and machinery, as well as a lack of milling technologies, as major technical constraints in Nepalese rice production.

Table 7. Ranking of rice marketing constraints in study area, Kanchanpur (2021)

Marketing constraint	Index	Rank
Unavailability of processing unit	0.71	I
Poor road and transport	0.69	II
Absence of collection centre	0.50	IV
Lack of access to credits	0.47	V
Lack of auction market	0.61	III

4. Conclusion

The study offers valuable insights into rice production in Kanchanpur district, Nepal, providing a comprehensive understanding of the socio-demographic characteristics, input use, production economics, and production constraints faced by rice growers. The study reveals the dominance of male farmers, and chhetri community in both seed and grain production, with middle-aged individuals being actively engaged in rice farming. Similarly, an important finding is the economic advantage of rice seed production over grain production, despite higher initial production costs. The significantly higher gross returns, gross margin, and Benefit-Cost Ratio (BCR) associated with seed production underscore the potential for increased profitability and economic viability in this segment. The study also identifies key production constraints, including the unavailability of quality inputs and disease and insect incidence and also highlights marketing constraints such as the lack of processing units and poor infrastructure. Overall, by addressing the identified challenges and capitalizing on the opportunities revealed by this research, stakeholders can collectively work towards a more prosperous and resilient rice farming sector in Kanchanpur district.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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