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S&T REVIEW

STATUS AND CONSTRAINTS OF SPRING RICE PRODUCTION IN KANCHANPUR, NEPAL

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ABSTRACT

This study analyzes the status and constraints of spring rice production in Kanchanpur, Nepal. Three municipalities and one rural municipality of the district were selected for the analysis. Data were collected from 140 farm-holders, including spring rice growing and non-growing rice farmers. Primary data were collected from household surveys using semi-structured, pre-tested questionnaires supplemented with focused group discussions, key informants' interviews, and field visits. Required secondary data were collected through the review of relevant literatures. The obtained data were analyzed using statistical software like Statistical Package for Social Science (SPSS) and Microsoft Excel. Lack of agricultural training, lack of subsidy, and insufficient irrigation facilities were the major constraints of spring rice production in the study area. The household head's education level, economically active family members, irrigated land, agricultural training, and subsidies were major influencing factors affecting the adoption of spring rice. The major obstacles for the spring-fallowing farmers to initiate spring rice farming were lack of irrigation water as well as lack of information and training. The majority of farmers perceived spring rice as a potential commodity to ensure food safety with the intention to expand its cultivation in the future.

KEYWORDS

Production; training; subsidy; irrigation; adoption

1. INTRODUCTION

Agriculture, the most significant economic sectors of Nepal, accounted for 24.12% of nation's GDP in the year 2022/23. However, the productivity and the competitiveness of the sector is very low. Food trade deficit and the malnutrition are still the major problems despite the cereals being the most cultivated crops. Approximately, 50% of districts of Nepal are food deficient and 4.6 millions of people are food insecure, representing 15% of the total population (FAO, 2019). Rice is the staple food in Nepal, and as the dominant crop, largely determines the development of the agriculture sector. The production of rice, the most important crop in Asia both economically and culturally, is considered the top-priority economic activity in the world (IRRI, 2023). In Nepal, during the fiscal year 2020/21, rice was cultivated on 1.47 million hectares of land with a productivity of 3.82 tons per hectare while the productivity of rice dropped to 3.47 tons per hectare in the following year. In 2023, The rice contributed about 13.6% to the total AGDP. Rice is mostly cultivated under two water regimes (irrigated and un-irrigated) and two topographic (lowland and upland) conditions (CDD, 2015). The Terai region, characterized by a tropical climate, is particularly significant, accounting for 70% of the total national rice output (Gadal et al., 2019). In the Terai and inner Terai, four major rice production systems are practiced, each adapted to specific seasonal and topographical conditions; Boro season rice (October-June), Spring season rice (March-July), Main season rice (June-November) and Deepwater rice (May- December) (CDD, 2015). The spring rice accounted for total of 119 thousand Hectares area with 4.67 ton/ha productivity (MoALD, 2023). In irrigated regions, the practice of double rice cropping, particularly spring rice cultivation, is considered a promising strategy to enhance the country's overall rice yield (Yadav and Chaudhary, 2017). However, spring rice is cultivated on only 8.09% of the total rice-producing areas across 53 districts in Nepal (MoALD, 2023).

Kanchanpur, a district in Far-Western Province, expands from 28^{0}38" to 29^{0}28" Northern Latitudes and 80^{0}03" to 80^{0}33" Eastern Longitudes with altitude ranging from 160m to 1528 masl covering the area of 1610 square kilometers. Out of 451,268 total population, about 72.63% is directly involved in agriculture (CBS, 2017). In 2022/23, Kanchanpur district cultivated rice in the area of 48,745 hectares with the productivity of 2.72 ton/ha, while spring rice accounted for 230 hectares with a productivity of 4.3 tons per hectare (MoALD, 2023).

Since, spring rice can be successfully grown in the areas having year-round supply of irrigation, about 89.48% of total cultivated area is well supplied with irrigation according to the census of 2068 B.S (Zone Profile, 2018).

Spring season rice exhibits higher yield potential than main season rice, primarily due to greater solar radiation interception, reduced incidence of pests and diseases, and more efficient utilization of production resources (Shrestha et al., 2022). Additionally, spring rice commands a higher market price and demonstrates significantly higher profitability compared to main season rice, as the newly harvested grain are used by the traders to make *chiura* (beaten rice) particularly in Kanchanpur district (Yadav and Chaudhary, 2017; Bhatt et al., 2024). Despite having tremendous scope to ensure food security and import substitution, the spring rice cultivation has not been expanded in the district as expected. Given that most Nepalese people prioritize rice cultivation and earn living from agriculture, it is important to understand the factors that impede agricultural and rice productivity. Recognizing the advantages of spring rice, the Rice Super-Zone Kanchanpur established under Prime Minister Agriculture Modernization Project (PMAMP), is actively working to overcome production constraints and expand spring rice cultivation. Researchers emphasize that the key to enhancing crop production lies in the continuous mitigation of production constraints coupled with increased farm inputs (Schiller et al., 2001).

Promoting the sustainable cultivation of spring rice is a key strategy for enhancing land productivity, as supported by the Agriculture Development Strategy (MoAD, 2016). National agricultural documents, including the ADS and the National Agricultural Policy, prioritize increasing rice production and productivity. Expanding the area dedicated to spring rice cultivation is identified as the most viable approach to boosting annual rice production (CDD, 2015).

This paper aims to present the current status and challenges associated with spring rice production, which have led to its low adoption in Kanchanpur, Nepal. It offers valuable insights for stakeholders involved in spring rice cultivation, providing policy recommendations and interventions designed to enhance rice production. The ultimate goal is to ensure food security and promote sustainable livelihood improvements in Nepal.

2. Materials and Method

2.1 Study Area

The study was conducted in Kanchanpur, which was purposively selected due to its potential and comparative advantage for spring rice production. This research encompasses rice growers from Bhimdutta, Krishnapur, and Belauri municipalities, as well as Beldandi rural municipality, within the command area of the Rice Super-Zone in Kanchanpur.

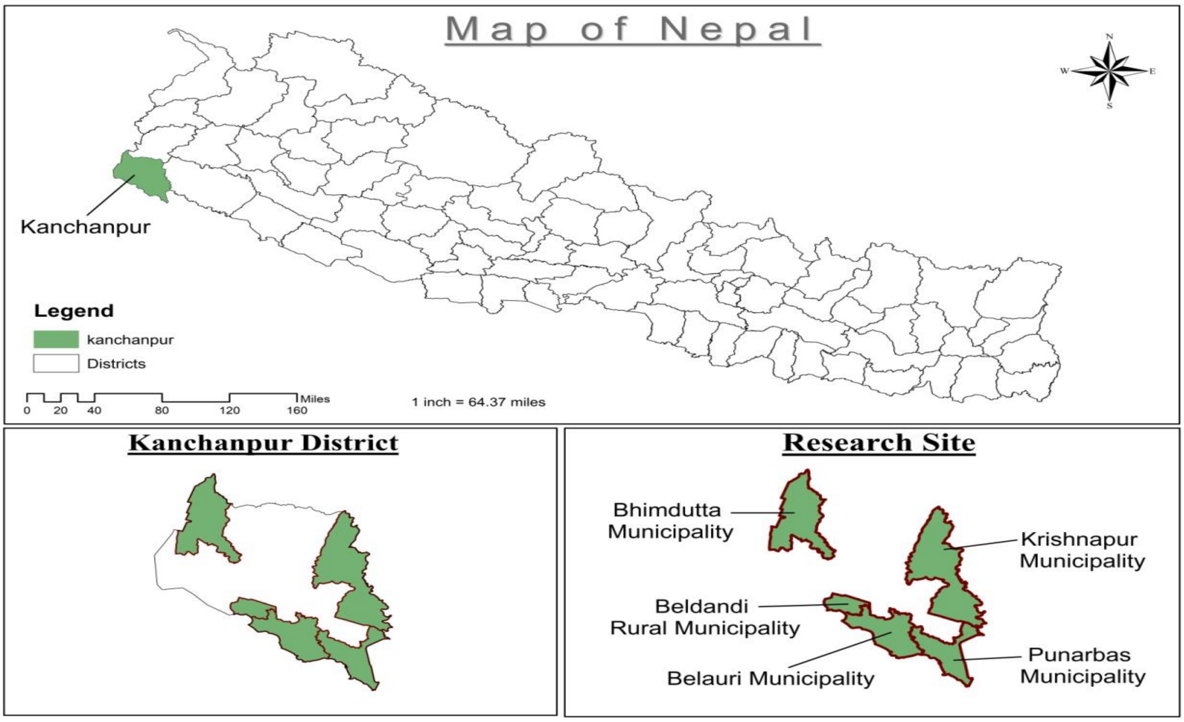

Figure 1: Map of Nepal showing Kanchanpur district and study area

2.2 Sampling Method and Data Collection

The sampling frame for rice growers was meticulously designed to represent the target population for the survey. A total of 140 samples were selected from the registered list of farmers within the Rice Super-Zone, encompassing both spring rice growers and non-growers. Primary data were collected through household interviews using a pre-tested semi-structured questionnaire. Additionally, data collection was supplemented with tools such as Focus Group Discussions (FGD) and Key Informant Interviews (KII). Secondary data sources included published journal articles and publications from various governmental and non-governmental organizations, such as the Ministry of Agriculture and Livestock Development (MoALD), Prime Minister Agriculture Modernization Project (PMAMP), Agriculture Knowledge Center (AKC), Central Bureau of Statistics (CBS), as well as various NGOs, INGOs, and cooperatives.

2.3 Categorization of Variables

Continuous variables such as land holdings were categorized using mean and standard deviation (SD) into three categories:

Small: Having value less than (mean-SD)

Medium: Having values between (mean-SD) and (mean+SD)

Large: Having values more than (mean+SD)

Period of spring rice farming was categorized into two categories; one before implementation of PMAMP and another after its implementation.

2.4 Data Analysis

2.4.1 Factors Affecting the Adoption of Spring Rice

Binary logistic regression model was used to assess the effects of various factors on the adoption of spring rice. The logistic function is given by,

$$\frac{p}{(1-p)} = e^{b0 + b1x1 + b2x2 + b3x3 + \ldots\ldots\ldots\ldots\ldots + bnxn}$$

Here, $\frac{p}{(1-p)}$ is the odd of an event and p is the probability of adoption of spring rice and is the dependent variable

$b_0 \ldots\ldots\ldots b_n$ are the coefficients, and

$x_1 \ldots\ldots\ldots x_n$ are the independent variables

The model was used as logit model by taking natural log on both sides which is given by,

$$\ln\frac{p}{(1-p)} = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + \ldots\ldots\ldots\ldots\ldots + b_nx_n$$

The independent variables used were:

- Land holding (continuous)
- Land under rice cultivation (continuous)
- Irrigated land (continuous)
- Economically active population (continuous)
- Gender (dummy)
- Level of education (continuous)
- Training received (dummy)
- Subsidy received (dummy)

2.4.2 Indexing

Indexing was used to study the relative severity of the constraints of spring rice in Kanchanpur. The intensity of problems and measures were identified by using seven -point scaling technique using scores of 1.00, 0.857, 0.714, 0.571, 0.428, 0.285 and 0.143. 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

3. Results and Discussion

3.1 Status of Spring Rice Production

Table 1 presents the observations made on different variables under study to reflect the status of spring rice production in the study area. Mean land holding size of spring rice growers was found to be 30 katha with standard deviation of 22. Majority of growers had medium size of holding between the value of (Mean±SD). A fraction of land under irrigation was found decreasing with increase in the size of holding; small holders having higher percentage of irrigated land. Similarly, an inverse relationship was observed between rice land allocation and overall landholding size. Larger landholders tended to allocate a smaller proportion of their land to rice cultivation. In contrast, medium-sized landholders integrated spring rice into a larger proportion of their holdings. This trend is likely due to the higher proportion of irrigated land available to medium-sized landholders compared to their larger counterparts.

The majority of spring rice farmers in Kanchanpur district possess less than a decade of experience in cultivating this crop, with an average growing period of 6.22 years. This trend is likely a direct result of the positive impact of the Prime Minister Agriculture Modernization Project (PMAMP) in the Rice Super-Zone, Kanchanpur, which has been consistently promoting the expansion of spring rice production throughout the district. Most farmers prefer utilizing lowland areas characterized by submerged soil types for spring rice cultivation, reflecting the crop's favorable adaptability to such environments. Moreover, about 33% of respondents indicated cultivating spring rice on normal soils equipped with irrigation facilities.

In conclusion, a significant majority of respondents expressed satisfaction with the suitability, performance, and profitability of spring rice farming. This satisfaction has fostered a collective willingness among farmers to further expand their cultivation areas in the near future.

The findings from the provided table highlight the comprehensive status, strengths, and potential opportunities associated with spring rice in the study area. Particularly under lowland conditions and on normal irrigated lands, spring rice demonstrates a high suitability for integration into double rice cropping systems. The responses gathered during the study collectively underscore the superiority of spring rice compared to other spring season crops, especially under irrigated tropical conditions. This positioning emphasizes its potential to enhance agricultural productivity and sustainability in the region.

Table 1: Observations on variables used to study the status of spring rice production in Kanchanpir, Nepal

S.N.	Variables	Categories	Percentage of Spring Rice Growers
1.	Land holding size	Small (<8)	5
		Medium (8-52)	78.8
		Large (>52)	16.2
2.	Irrigated land	Small (<8)	100
		Medium (8-52)	79.94
		Large (>52)	60.21
3.	Rice area	Small (<8)	100
		Medium (8-52)	85.80
		Large (>52)	68.84
4.	Spring rice area	Small (<8)	0
		Medium (8-52)	19.8
		Large (>52)	16.5
5.	History of spring rice farming	1-8 years	55
		More than 8 years	45
6.	Land type used for spring rice	Normal water regime	33
		Submerged condition	67
7.	Satisfaction from spring rice farming	Highly satisfied	2
		Satisfied	50
		Neutral	43
		Dissatisfied	3
		Highly dissatisfied	2
8.	Future intention on spring rice farming	Extension in production area	73
		Contraction in production area	7
		Continue with same area	16
		Replace spring rice with other crops	4

3.2 Comparison Between Main Season Rice and Spring Rice

Technically, the inputs used for spring rice and main season rice are similar, given their quantitative differences; however, significant differences can be observed in their performances. According to the survey responses, problems of weeds, pests and diseases are seen significantly higher in spring rice as compared to main season rice. Higher weed infestation, insect pest infestation and disease infestation in spring rice as compared to main season rice were claimed by 52.5%, 57.5% and 17.5% respondents respectively. Despite higher attack by weeds, pests and diseases, productivity of spring rice was found superior by 76.2% of total respondents. Only 1.3% respondents claimed the yield of spring rice to be less than main season rice. Regarding selling price, 65% of total respondents claimed it to be more in case of spring rice and none of the respondents found the yield of spring rice to be lower than main season rice. Concurrently, the profitability of spring rice was higher than main season rice as perceived by 74.9% of total respondents. The findings of researchers supports this result where they stated the market price of spring rice is always higher than the main season rice (Yadav and Chaudhary, 2017).

Table 2: Comparative observations between main season rice and spring rice in Kanchanpur, Nepal

S.N.	Variables of Comparison	Categories	Percentage of Respondents
1	Weed Infestation	More in Spring Rice More in Main Season Rice Negligible Difference	52.5 11.3 36.2
2	Insect Pest Infestation	More in Spring Rice More in Main Season Rice Negligible Difference	57.5 12.5 35
3	Disease Infestation	More in Spring Rice More in Main Season Rice Negligible Difference	17.5 2.5 80
4	Yield	More in Spring Rice More in Main Season Rice Negligible Difference	76.2 1.3 22.5
5	Selling Price	More in Spring Rice More in Main Season Rice Negligible Difference	65 0 35
6	Profitability	More in Spring Rice More in Main Season Rice Negligible Difference	74.9 11.3 13.8

3.3 Constraints of Spring Rice Production

In the comprehensive study area, spring rice farmers identified inadequate training and financial support as their most critical production challenge, with a severity index of 0.787. Additionally, significant issues included irrigation deficiencies and pest and disease infestations. Crop damage caused by wild and feral animals was notably more severe compared to other concerns such as marketing difficulties, labor shortages, and input-related issues. Specifically, wild animals originating from the surrounding forests, primarily Suklaphanta National Park, were responsible for substantial destruction of the economic yield of spring rice across the entire study region.

Within the rice super-zone command area, farmers in Beldandi rural municipality faced pronounced deprivation of irrigation facilities, presenting their most significant challenge in spring rice cultivation. Furthermore, both Beldandi and Belauri's greater distance from the main city of Kanchanpur district, Mahendranagar, likely exacerbated marketing difficulties. Conversely, issues pertaining to the availability of quality inputs were relatively minor, likely due to the district's proximity to Indian markets, which facilitated a seamless flow of necessary agricultural inputs. The primary institutional constraint hindering rice production in the western Terai region of Nepal is the lack of training and market infrastructure, as noted by (Basyal et al., 2019).

Table 3: Distribution and relative severity of spring rice production constraints in Kanchanpur, Nepal

Distribution of Production Constraints	Index Value				
	Overall Study Area	Bhimdutta Municipality	Krishnapur Municipality	Beldandi Rural Municipality	Belauri Municipality
Lack of Training and Subsidy	0.787 (I)	0.63 (II)	0.69 (II)	0.775 (I)	0.675 (III)
Insufficient Irrigation Facilities	0.687 (II)	0.746 (I)	0.765 (I)	0.42 (VI)	0.506 (V)
Pests and Diseases	0.632 (III)	0.413 (V)	0.63 (IV)	0.571 (III)	0.72 (II)
Problem of Wild Animals and Ferals	0.587 (IV)	0.619 (III)	0.647 (III)	0.551 (IV)	0.56 (IV)
Marketing Constraints	0.546 (V)	0.381 (VI)	0.29 (VI)	0.591 (II)	0.76 (I)
Limited Availability of Quality Inputs	0.473 (VI)	0.529 (IV)	0.49 (V)	0.54 (V)	0.474 (VI)
Labor Shortage	0.246 (VII)	0.296 (VII)	0.243 (VII)	0.275 (VII)	0.2 (VII)

Table 4: Observations on variables used to study the status of spring rice non-growing rice farmers in Kanchanpur, Nepal

S.N.	Variables	Categories	Percentage of Respondents
1	Idea about spring rice	Well-known Not Known	86.7 13.3
2	Cultivation in past	Past growers Non-growers	30 70
3	Reason for past growers to stop/switch spring rice cultivation	Irrigation problem Wild animals and ferals Better substitute crops	53.57 32.14 32.29
4	Spring grown crops	Maize Vegetables Other crops Fallow	16.7 8.3 6.7 68.3

A significant proportion of spring rice non-growers (86.7%) were aware of spring rice cultivation; however, they opted not to engage in it. Notably, 30% of these respondents were former spring rice cultivators who had ceased its production. The primary challenges leading to this shift included inadequate irrigation, damage from wild animals and feral pests, and the availability of more profitable alternative crops. During the spring season, 68.3% of primary season rice farmers left their fields fallow, primarily due to insufficient irrigation. A minority of respondents cultivated alternative crops such as maize, vegetables, legumes, and green manures during this period.

These findings can be useful to generate insights for the expansion of spring rice area among the fallowed lands through better provision of irrigation. Further, past growers of spring rice can again be brought to the mainstream of spring rice expansion program of PMAMP.

3.4 Factors Affecting the Adoption of Spring Rice

Table 4 presents the results of a binary logistic regression analysis with the adoption of spring rice as the dependent variable. The findings indicate that several factors significantly influence the likelihood of adopting spring rice, including the level of education, the number of economically active family members, access to irrigated land, training, and agricultural subsidies, each at varying levels of significance. Conversely, the gender of the household head, overall landholding size, and the specific area devoted to rice cultivation did not exhibit a statistically significant relationship with the probability of spring rice adoption.

The level of education of the household head exhibited a positive and significant impact ($p<0.05$) on the adoption of spring rice. Specifically, each additional level of education increased the likelihood of adopting spring rice by a factor of 3.19. Moreover, the number of economically active family members also significantly ($p<0.1$) and positively affected adoption rates. For each additional economically active family member, the odds of adopting spring rice rose by 2.617 times across the study area.

Similarly, the extent of irrigated land had a significant impact on spring rice adoption ($p<0.05$). Each additional kathha of irrigated land increased the likelihood of adopting spring rice by a factor of 5.81. Furthermore, receiving training and agricultural subsidies exhibited a highly significant positive effect ($p<0.01$) on adoption rates. The results indicate that respondents who received training were 15.513 times more likely to adopt spring rice compared to those who did not receive training. Additionally, the likelihood of adopting spring rice was 18.764 times higher for respondents who received agricultural subsidies compared to those who did not receive any subsidies.

The overall R^2 value obtained was 77.6% indicating that, 77.6% of total factors affecting spring rice adoption were explained by the variables taken under study.

Table 5: Effects of various explanatory variables on adoption of spring rice in Kanchanpur, Nepal

Variables	Coefficients	p-value	Nagelkerke R^2
Constant	0.288	0.192	0.776
Gender	0.171	0.679	
Education of HH	3.192	0.041**	
Economically Active Family Members	2.617	0.068*	
Land Holding	0.123	0.725	
Irrigated Land	5.811	0.016**	
Rice Area	1.86	0.245	
Training Received	15.513	0.000***	
Subsidy Received	18.764	0.000***	

4. Conclusion

Kanchanpur district has huge potential for spring rice which can be tapped for enhancing the overall rice production of the district thereby enhancing the possibility of attaining food and nutrition security. However, the current production system is entangled with numerous production and marketing constraints of which the major ones include limited irrigation facilities and support activities including training and subsidy. These major two are responsible for limiting the current production status of spring rice, fallowing the land in spring season and switching the production pattern away from spring rice. Having known the impact of irrigation, trainings and agricultural subsidies on adoption pattern of spring rice, efforts should be directed in these sectors in order to improve the existing status and to achieve the periodic targets of sectoral development strategies and national periodic plans.

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