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Research Article

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Economics of rice production under rice zone in Gorkha District, Nepal

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ABSTRACT
A research was conducted at the Gorkha district to access the economics of rice production. The Stratified Random Sampling technique was used in the research. Both primary and secondary data were used in this study. Altogether 120 respondents were surveyed. Data were analyzed using software like SPSS and MS-excel. The average rice cultivation area (spring and summer) was 0.47 hectare. Based on the average rice cultivation area, farmers were categorized into a smallholding (67 in number) and medium and large holding farmers (53 in number). The majority of the respondents were janajati and the majority of the household head had a primary level of education. The major cost of rice production was incurred in labor cost i.e., 75% compared to other inputs. The return from the rice was obtained from rice grains and straw with an overall contribution of 79.5% and 20.5% respectively. The BC ratio on average was found 1.28 while the BC ratio of the medium and large farmers was found higher than the small farmers, indicating rice production was profitable in the study area. Insect pests and diseases were found to be the most serious production problem among the several problems, with index value (I = 0.867). In short, rice cultivation is the primary priority among the farmers as it helps in food security. Hence it is recommended that the timely application of agricultural inputs, optimum utilization of input resources helps to foster rice production in those areas, consequently making it a more profitable occupation.
Keywords: BC ratio, Inputs, Problems.

INTRODUCTION

Rice has fed a greater number of people from the very long period of time than any other crop since it was domesticated between 8,000 to 10,000 years ago (Greenland, 1997). It is the most important food crop of the developing world and the staple food of more than half of the world's population. The cultivation of rice is said to have immense significance to food security of Asia, where more than 90% of global rice is produced and consumed (FAO, 2010). By the year 2025, it is estimated that, the world's farmers should produce about 60% more rice than at present to meet the food demands of the expected growing world population at that time (Fageria, 2007). It feeds 100 million Asian households that plant a total of 60 million ha land with rice (Pandey, Gauchan, Malabayabas, & Hardy, 2012). It accounts for more than 40 percent of caloric intake in tropical Asia, reaching more than 65 percent in many countries and for many poor people (Fairhurst & Dobermann, 2002).

Agriculture is the backbone of Nepalese economy contributing about 27.10% in national GDP (MOALD, 2017). Rice is the dominant crop of South Asia including Nepal, playing a significant role in economic and agricultural development, also in reducing poverty (Gumma, Gauchan, Nelson, Pandey, & Rala, 2011). More than 1,700 rice landraces are reported in Nepal growing from altitude of 60 to 3, 050 m (Mallick, 1981). Rice ranks the first among cereal crops in terms of area, production and livelihood of the people. As the most important staple food of Nepalese people, rice supplies about 40% of the food calorie intake and contributes nearly 20% to the agricultural gross domestic product (AGDP) (MoAD, 2015). Most of the rice is produced in Terai region of Nepal.

On an average, Nepalese consume about 120 kg milled (or 200 kg paddy) rice per year and one-third of the total calorie intake in Nepal is supplied through rice. Rice alone contributes about 53% to the total cereal food production (Tripathi, Bhandari, & Ladha, 2018). In the year 2017/18 the import of cereals from different countries is in NRs. 45 billion, while the export is only in NRs. 16 Million (Depatment of Customs, 2017/18). The rice import has increased by 21% and has reached more than NRs. 24.5 billion (Kafle, 2019).

Gorkha is one of the Hilly districts of Nepal according to the administration but it is also considered as Himalayan region from the geographical point of view. It lies between 27°15″ to 28°15″ N latitude and 83°27″ to 84°58″ E longitudes. The total area of this district is 3610 km^2. The district has the altitude of 228 m - 8136 m above sea level. It is characterized by the maximum annual average temperature of 32℃ and minimum

annual average temperature of 6.6℃ with a maximum annual rainfall of 554.4 mm.

Gorkha is one of the potential areas for rice production. Different varieties of rice like, Sabitri, Ramdhan, Basmati, Anadi, Gorakhnath, US 312 etc., are grown in these areas. In these areas, rice is grown in two seasons- both spring and summer. It is also a suitable site for the seed production as well.

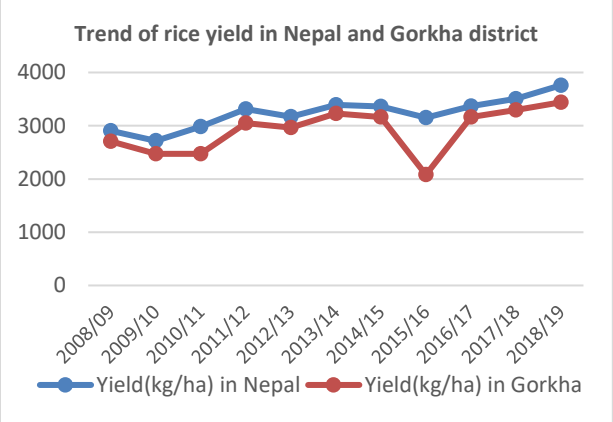

Figure 1. Trend of rice yield in Nepal and Gorkha district

MATERIALS AND METHODS

The survey research was carried out in Gorkha district. Gorkha is one of the Hilly districts of Nepal according to the administration but it is also considered as Himalayan region from the geographical point of view, located in Gandaki province, northern side of Prithivi highway. It is geographically linked to China in the North, Lamjung and Manang in the West, Dhading in the west and Chitwan and Tanahun in the south. In the context of the federal system, it consists of 2 Municipality and 9 Rural Municipality.

Sample and sampling techniques

The study site Gorkha Municipality, Palungtar Municipality, Siranchowk RM and Sahid-lakhan RM were selected for the sampling because of high potential of production than other area. Altogether 120 household samples were taken using stratified random sampling procedure. Simple interview schedule was developed including the information on socioeconomic characteristics of the target group, existing production practices, agricultural land holdings, farm characteristics, income from rice production, and farmer access to extension services. The interview scheduled was pretested prior to administering to the actual respondents for checking the reliability and validity of interview schedule. The pre-testing was done on 10% respondents near to study area. The corrections were made in the final interview schedule.

A focus group discussion was conducted in order to verify and validate the data collected through household survey. For this a checklist was used to gather the information from FGD. The participants were targeted farmers, local leaders and other concerned stakeholders. It was completely inclusive and participatory. To develop further idea of the study site, informal discussion and interview with key informant was done. Key information interview was done to the progressive farmers, AKC officer, Zone officer and other beneficiaries to obtain key information. For this a separate checklist was used.

Both the primary and secondary data were used. Primary data were obtained through household survey, focus group discussion and key informant interview. Primary data were collected through face-to-face interview. The information on existing production system and use of resource in the study site was collected from farmers. The secondary information was obtained through reviewing different publication mainly produced Department of Agriculture, Ministry of Agriculture and Livestock Development (MOALD), Central Bureau of Statistics (CBS), Nepal Agricultural Research Council (NARC), Agriculture Knowledge Centre (AKC), Gorkha.

Data analysis techniques

The information collected from the field was first coded and entered into the computer. Data entry and analysis was done by using computer software packages like the Statistical Package for Social Science (SPSS) and Microsoft Excel. The following analyses was performed.

Total variable cost

It is the summation of cost incurred in all the variable items during the production of rice.

Gross return

It is the total return from the quantity of rice marketed.

Gross return = (price of rice * total quantity of rice) + (price of by-product * total quantity of by-product) (Dhakal, et al., 2019)

Gross margin

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

Gross margin = Gross return - total variable cost (Dhakal, et al., 2019)

Benefit cost analysis

Cost benefit analysis was done after calculating the total cost and gross return from the rice cultivation. Cost of production was calculated by summing the variable as well as fixed cost items in the production process. For calculating gross return, income from product sale was accounted. So, the benefit cost analysis will be carried out by using formula:

$$B/C \quad ratio \quad = \quad \frac{Gross \quad return}{Total \quad cost}$$

(Dhakal, et al., 2019)

Problems on production

The index was prepared mainly considering the qualitative data. Based on responded frequencies, weighted indexes were calculated for the analysis of farmer's perception on the extent of production problems of rice producers. Farmer's perception to the different production problems was ranked by using five points scale of problems compromising most severe, severe, medium severe, less severe and least severe by giving

weight age on the basis of priority i.e., 1 for first priority, 2 for second, 3 for third, 4 for fourth and 5 for fifth priority. Then the priority index for each variable was calculated by weight age average mean in order to draw valid conclusion and making reasonable decision. The index of importance was computed by using the formula:

$$I_{imp} = \sum \frac{Sifi}{N}$$

Where,

I_{imp} = index of importance

$\sum$ = summation

S_i = I^{th} scale value

F_i = frequency of i^{th} importance given by the respondents

N = total number of respondents

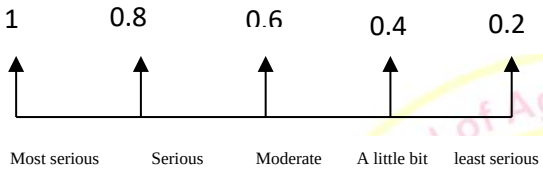

Figure 2. Ranking of scale

RESULTS AND DISCUSSION

Demographic and socio-economic information of the respondents

The assessment of a number of demographic and socio-economic variables of the respondents such as age, gender, family number and type, dependency ratio, ethnicity, religion and educational status was done. The total respondents (n = 120) were categorized into two groups based on mean rice cultivation area (0.47 ha). Small holding farmers (area less than 0.47 ha) was found to be 67 and medium and large holding farmers (area more than 0.47 ha) was found to be 53 in number.

Distribution of sample household on the basis of age and family members

In the study area, the mean age of household age among the 120 respondents was found to be 49.82 years, the average age of small holding farmers was found to be 49.39 years which is smaller than among the medium and large holding farmers i.e., 50.38 years. Likewise, the average family size among the 120 respondents was found to be 2.92, economically active population was found to be 65.06%. The average male number was found to be 3.09 and average female was 2.92. The t-value of female number was found to be statistically significant at 10% level which means the average female numbers among the small holding farmers was found to be significantly lower than the average female numbers among the medium and large holding farmers. The dependency ratio was found 0.232.

Socio-demographic characteristics of the respondents

Within the small farmers, 47.8 % were male while 52.2% were female. Likewise, within the medium and large farmers, 66% were male while 34% were female. Thus, small farmers household were dominated by female while, medium and large farmers household were dominated by male. Overall, the percentage of female household is 44.2%, which was greater than the national census data of female household head i.e., 25.73% (CBS, 2012). Among the small farmers, 73.1% farmers had nuclear family type, while 26.9% farmers had joint family type; whereas, among the medium and large farmers 66% had nuclear family type, while 34% farmers had joint family type. And in overall, 70% were nuclear family and 30% were joint family.

Different ethnic groups of people were recorded from the research sites. Janajati were dominated over other ethnic groups. In the study area, Janajati were in the highest number 55.8%, followed by Brahmin/Chettri 41.7% and finally Dalit 2.5%. Education status was categorized into four categories; namely illiterate, primary education, secondary education and higher education and accordingly information was collected from the respondents. Majority of the household head had primary level of education i.e., 62.5%, followed by secondary level of education 19.2% and illiterate and higher education had the same percentage i.e., 9.2%. Overall, the literacy percentage is higher than national census data i.e., 65.9% (CBS, 2012).

Table 1. Distribution of sample household on the basis of age and family size

Description	Small holding Farmers (n=67)	Medium and large holding Farmers (n=53)	Overall (N=120)	Mean Difference	t-value
Age of Household Head (years)	49.39 (11.27)	50.38 (10.45)	49.82 (10.88)	-0.989	-0.493
Family size	5.72 (1.99)	6.38 (2.76)	6.01 (2.36)	-0.661	-1.522
Male	3.0 (1.22)	3.21 (1.63)	3.09 (1.41)	-0.208	-0.797
Female	2.71 (1.21)	3.19 (1.58)	2.92 (1.40)	-0.477	-1.861*
Dependency ratio	0.324 (0.216)	0.331 (0.213)	0.323 (0.214)	-0.066	-1.58

Note: Figures in the parentheses indicate standard deviation.
Source: Field survey (2020),
* indicates significant at 10% level of significant

Rice production, inputs used and marketing in the study area

Rice sells

Rice sells among the small and medium and large farmers were analyzed in the study area. Rice sells was higher among medium and large landholding farmers (64.2%) as compared to the small landholding farmers (32.8%). On overall, the majority of respondent do not sell rice 53.3% and 46.7% sell rice. Majority of farmers sold rice from home (79.7%) followed by from field (18.7%) and very few farmers sold rice from market (1.6%). Rice sells was found to be statistically significant at 1%.

Table 2. Socio-demographic characteristics of the respondents

Variables	Small holding farmers (n = 67)	Medium and large holding farmers (n=53)	Overall (N = 120)	Chi-square test
Gender of household head				
Male	32(47.8)	35(66)	67(55.8)	4.008**
Female	35(52.2)	18(34)	53(44.2)	
Family type				
Nuclear	49(73.1)	35(66)	84(70)	0.710
Joint	18(26.9)	18(34)	36(30)	
Ethnicity				
Brahimns/Chhetri	31(46.3)	19(35.8)	50(41.7)	1.738
Janajati	35(52.2)	32(60.4)	67(55.8)	
Dalit	1(1.5)	2(3.8)	3(2.5)	
Education of household head				
Illiterate	6(9)	5(9.4)	11(9.2)	0.405
Primary Education	42(62.7)	33(62.3)	75(62.5)	
Secondary Education	12(17.9)	11(20.8)	23(19.2)	
Higher Education	7(10.4)	4(7.5)	11(9.2)	
Source of income				
Agriculture	29(43.3)	25(47.2)	54(45)	0.286
Remittance	15(22.4)	12(22.6)	27(22.5)	
Service	15(22.4)	10(18.9)	25(20.8)	
Business	8(11.9)	6(11.3)	14(11.7)	

Note: Figures in the parentheses indicate standard deviation.
** indicates significant at 5% level of significant.
Source: Field survey (2020)

Table 3. Rice sells status in the study area

Rice sells	Small Farmers (n=67)	Medium and large Farmers (n=53)	Overall (N=120)	Chi-square	p-value
Yes	22(32.8)	34(64.2)	56(46.7)	11.659***	0.001
No	45(67.2)	19(35.8)	64(53.3)		
Total	67(100)	53(100)	120(100)		

Note: Figures in parentheses indicate the percentage in respective column. *** indicates significant at 1% level of significant.
Source: Field survey (2020)

Source of seed

Farmers in the study area were asked about the source of their seed. Majority of households used seed saved by them (55%) while 37% purchased seed from agrovets. About 6% household brought seed from agriculture cooperatives and only 2% from neighbor. More than 90% of cereal seeds in Nepal is obtained from traditional or informal system (Paudel, et al., 2013). The majority of respondents (89.16%) used traditional canal as the source of irrigation whereas, 7.5% household used concrete canal and at last 3.33% household used rainfall as the source of irrigation. The major source of traditional canal irrigation was Daraudi river.

Profitability from rice cultivation

Respondents were asked whether rice cultivation is profitable or not. Majority of respondents (73.3%) responded that rice cultivation is profitable while, 26.7% respondents responded that rice cultivation is not profitable. Profitable was due to the cover of cost of rice cultivation.

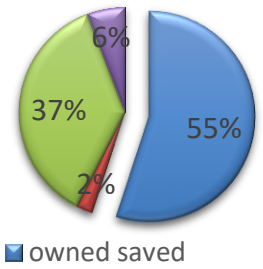

Figure 3. Sources of rice seed

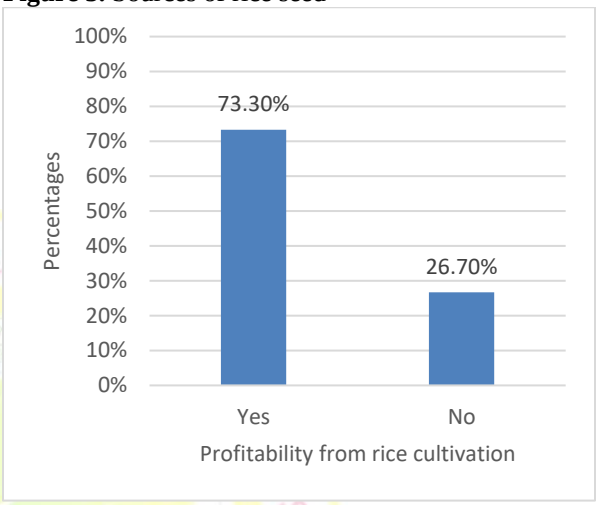

Figure 4. Farmer's opinion about profitability from rice cultivation

Timely availability of seeds and fertilizers

Majority of the respondents i.e., 86 out of 120 (71.7%) recognized that seed was available on time whereas, 34 respondents (28.3%) recognized that seed was not available on time. Unlike seeds, 60.8% respondents recognized that fertilizers were not available on time and 39.2% responded that fertilizer was available on time. The potential demand is higher than supply i.e., potential demand and supply in the year 2016/17 was 7,00,000 MT and 3,24,977 MT respectively and low average subsidy on chemical fertilizers i.e. 43.78%, might be the cause of lower available of fertilizers on time.

Financial analysis of rice production

Financial analysis of rice includes the analysis of current scenario of rice production in Gorkha district, total variable cost of production, gross return, gross margin and benefit-cost ratio.

Cost of rice production

It is the summation of cost incurred in all the variable items during the production of rice. Different costs like labor cost, seed cost, manure cost, fertilizer cost, pesticides cost and machineries cost were summed to calculated the total variable cost of rice production. From the analysis Table 8, it can be clearly seen that the main portion of the production cost (75.1%) was incurred in labor cost. According to the (Sapkota & Sapkota, 2019) labor cost has the greater contribution to the cost of rice production. Labor cost was found significantly lower in medium and large farmers than in small farmers.

Similarly, manure cost was found significantly lower in medium and large farmers than in small farmers.

Analysis on the basis of BC ratio

If B: C ratio < 1 then, enterprise is in **Bankrupt** condition.

If B: C ratio = 1 then, enterprise is in **Just solvent** condition.

If B: C ratio > 1 then, enterprise is in **Solvent** condition. Gross margin is positive and B: C ratio is greater than 1, so this particular enterprise (i.e., Rice Production) can be considered as profitable in the study area.

The overall BC ratio is 1.28 which means if we invest 1 rupee on rice production, we get return of 1.28 from rice.

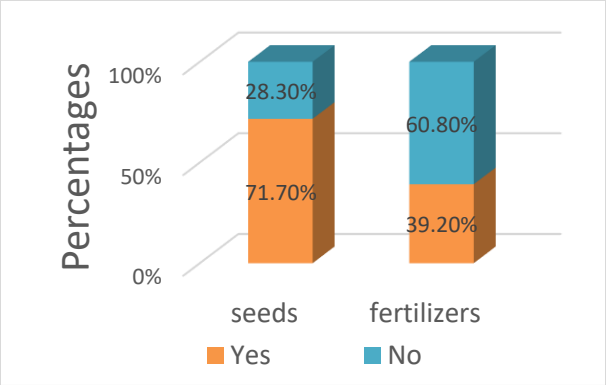

Figure 5. Timely available of seeds and fertilizers

Table 4. Cost of rice production per hectare

Variables	Small Farmers (n=67)	Medium and large Farmers (n=53)	Overall (N=120)	Mean Difference	t-value	p-value
Labor cost[1]	93346 (75.3)	85433.2(74.8)	89851.2(75.1)	7912.8	2.992***	0.003
Seed cost	4647.6(3.7)	4531.4(4.0)	4596.2(3.8)	116.2	0.356	0.722
Manure cost	9217.8(7.4)	8669.2(7.6)	8975.4(7.5)	548.6	2.491**	0.014
Fertilizer cost [2]	4423.6(3.6)	4359.6(3.8)	4395.4(3.7)	64	0.156	0.876
Pesticide cost	1856.8(1.5)	1729.6(1.5)	1800.6(1.5)	127.2	1.820*	0.071
Machineries and bullock	10496.6(8.5)	9519.4(8.3)	10065(8.4)	977.2	1.499	0.136
Total	123988.4(100)	114242.4(100)	119683.8(100)			

Note: Figures in parentheses indicate the percentage to their respective columns. *, ** and *** indicate significant at 10%, 5% & 1% level of significance respectively. Source: Field survey (2020)

Table 5. Return from rice production per hectare

Variables	Small Farmers(n=67)	Medium and large Farmers(n=53)	Overall (N=120)	Mean Difference	t-value	p-value
Rice grain	119906.8 (79.6)	122549 (79.5)	121073.8 (79.5)	-2642.2	-0.842	0.402
Straw	30794.4 (20.4)	31573 (20.5)	31138.2 (20.5)	-778.6	-1.593	0.114
Total	150701.2 (100)	154122 (100)	152212 (100)			

Note: Figures in parentheses indicate the percentage to their respective columns.
Source: Field survey (2020)

Table 6. BC ratio of rice cultivation in study area

B: C Ratio	Small Farmers(n=67)	Medium and large Farmers(n=53)	Overall (N=120)
	1.22	1.35	1.27

Source: Field survey (2020)

Problems in rice production

Different problems regarding the rice production were identified in study area. Those problems were ranked using scaling technique. Five different problems were asked among the respondents and they were ranked on the basis of their weightage.

The study revealed that the major problems in rice production in study area was insect pests and disease problems, followed by lack of quality seeds, lack of fertilizers and pesticides, lack of irrigation and lack of extension services. According to the (Upadhyaya, 1996), technical constraints like Insects, disease and weeds were the major production problems in rice. Due to the insect pests and disease in study area the production of rice was low than its actual potential.

Table 7. Ranking of rice production problems

Production problems	Index	Rank
Insect pests and diseases problem	0.867	I
Lack of quality seeds	0.717	II
Lack of fertilizers and pesticides	0.633	III
Lack of irrigation	0.558	IV
Lack of extension services	0.433	V

Source: Field survey (2020)

[1] Labor cost = Nursery preparation, land preparation, planting, weeding, harvesting, threshing

[2] Fertilizer cost = Urea, DAP, MOP, Zinc sulphate

CONCLUSION

From above results and discussions, we can conclude that the rice farming is profitable farming in the study area. Despite the cost of production of rice is high especially the labor cost, the farming is in solvent condition. If we are able to decrease the cost of production by optimum utilization of the resources, the profit can be increased. Timely control of insect pests and diseases led to increase in the production of rice. Also, effective and optimum use of agricultural inputs like seeds, fertilizers, pesticides, manures help not only in reduction of cost but also increase in gross margin.

Farm mechanization helps to decrease the labor cost of production which contributes the major portion of cost. There should be the provision of timely availability of seeds and especially fertilizers and scientific rice cultivation training program to the farmers, which can ensure the potential production of rice.

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