

RESEARCH ARTICLE

AN ASSESSMENT OF FARM MECHANIZATION STATUS OF RICE CULTIVATION IN RATUWAMAI MUNICIPALITY MORANG, DISTRICT, NEPAL

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ABSTRACT

The study was conducted from February to May, 2019 to assess the status of farm mechanization of Rice cultivation in Ratuwamai municipality Morang, District Nepal. Altogether 80 respondents were selected by using simple random sampling technique from the sampling frame of 400 populations. Pre-tested interview schedule, Focus Group Discussion (FGD) and key informant survey (KIS) were used to collect primary information from the respondents, while secondary information were collected by reviewing different relevant publications to find out the mechanization activities conducted in rice cultivation, perception of farmers regarding farm mechanization and the constraints and factors affecting adoption of agri-mechanical equipment. The data were processed and analyzed using descriptive and inferential statistics through MS-Excel and SPSS. Chi-square test was done to test the significance difference between dependent and independent variables. The result of the study shows majority of the respondent were male, and majority were involved in agriculture as their major occupation. Majority of the respondents were found literate and very few respondents were involved in commercial farming. The study reveals about eighty percent of the respondents were adopter of machineries. During nursery preparation and transplantation no any machineries were employed, during land preparation 86.25 percent respondents have adopted machineries. The harvesting stage was found more mechanized than other stage as 68.75 percent respondents use machines. The use of thresher and combine harvester was found more common during this stage. Chi-square test shows the association between adoption level of machineries with training, subsidies and education level has positive and significant relationship. Regarding perception sixty five percent respondents found mechanical method more beneficial and fifty five percent use unskilled manpower during rice cultivation. Only 22.5 percent respondents had their own machines and majority use machine based on pre-booking. Agriculture knowledge centre (AKS) was found as major source of information on mechanization. Among many constraints during adoption of machinery high land fragmentation was agreed by majority of the respondents. The study revealed that, among the production problems, unavailability of quality seeds and fertilizers in required quantity and time appeared as the most important production problem followed by lack of subsidy on irrigation, disease and pest infestation, lack of technical guidance and labour shortage was appeared as least problem.

KEYWORDS

Agriculture, Mechanization, Adoption, Rice, Farmers

1. INTRODUCTION

1.1 Background of the study

Agriculture is the way of life and mainstream of economic development in Nepal. It is the main source of livelihood, provides employment opportunities to 60 percent of the total population of the country and its contribution to GDP is 26.98 percent (MOF, 2019). Different kinds of cash crops as well as fruits, herbs, flowers, vegetables are grown in different agro-ecological zones of Nepal. Among them the major cereal crops like Rice, wheat, maize, barley, millet are present in dominant amount. Rice (*Oryza sativa*) of family poaceae is one of the most important human food crop in the world, directly feeding more people than any other crop. Rice is the largest crop industry of South Asia including Nepal, playing

significant role in economic and agricultural development as well as in reducing poverty (IBN, 2016). About 90 percent of the global rice is produced and consumed in Asia (CBS, Statistical Year Book Nepal, 2015, 2015).

In Nepal, it ranks first among the cereals in terms of area and production and occupies 58 percent to total cultivated land (ABPSD, Statistical Information on Nepalese Agriculture, 2016/2017). It alone supplies 40 percent of the food calorie intake and contributes nearly 20 percent to the AGDP and 7 percent to GDP of the country (ABPSD, Statistical Information on Nepalese Agriculture, 2015). The crop can be grown from 60m (Kanchanakalan, Jhapa) to as high as 3050masl (Jumla Valley) of Nepal, which is the highest elevation for growing rice in the world. According to statistical information on Nepalese agriculture 2016/17, the area

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,production and productivity of rice in Nepal is 1552469 ha,5230327 mt and 3.37 mt/ha respectively. The growth of rice production is low (grain yield 2.07percent/ yr) as compared to population growth rate (2.29percent/yr).So the growth of rice production with stability has been a matter of concern to achieve food security.

However, the first advance estimate of paddy production was done on 19th November ,2018 using CRAFT, the CCAFS Regional Agricultural Forecasting Toolbox. According to CRAFT, the total paddy production in 2018 is forecasted to be 5,482,634.12 MT, 6.42 percent increase compared to the production level of 5,151,925 MT in 2017. The expected yield of paddy in the country is expected to be 3.8 MT per hectare. Furthermore, the forecasted figure is a 11.81 percent increase compared to the average production level of the last five years. The forecast was made based on the Ministry of Agriculture and Livestock Development (MoALD)'s records of paddy planted area received on 15th November 2018 (1,446,986 hectares) and is based on a prediction uncertainty of ± 7.5 percentage (First advance estimate of paddy production in Nepal,2018). Out of total rice production area Terai occupies 70percent,hills 26percent and mountains 4percent. So the terai region is also called 'granary of Nepal'.

Morang district is one of the most potential district having average productivity of 3.53 mt per hectare which is lower than National productivity (Morang Merchant Association). Several factors s/a low human man power, land fragmentation, insufficient irrigation facility, traditional cultivation practices with low machinery use , high cost of machinery ,lack of awareness on use of machinery use and climate change are responsible for reducing the optimum production and resulted in low production of Rice, which can be minimized by the intervention of mechanization in the very areas. To keep economical consistency over the shifting of manpower from agriculture to service and industry, it requires filling up the labor gap in agricultural operations by mechanical interventions (Islam et al., 2016a). Mechanization can help to increase the cropping intensity by reducing the turnaround time and faster operation of agricultural activities. Agricultural mechanization plays a strategic role in improving agricultural production and productivity in Nepal. Therefore, the major objective of present study is to access the overall mechanization status of Rice cultivation in Ratuwamai municipality of Morang district of Nepal.

1.2 Objectives

1.2.1 General Objective

The general objective of the study was to assess the status of agricultural mechanization in rice cultivation at Ratuwamai municipality , Morang District.

1.2.2 Specific objectives

- To find out the mechanization activities conducted in rice cultivation in the study area.
- To assess the perception of farmers regarding farm mechanization in the study area.
- To determine the constraints and factors affecting adoption of agri- mechanical equipment in the study area.

1.3 Statement of the problem

Rice is the major staple food crop of Nepal. Out of the total Rice produced in a country terai occupies 70percent.Morang district is one of the most potential terai district of Nepal in terms of rice production which contributes to major portion in national production. During the year 2015/16 the productivity of rice in Morang district was 3.53 ton per hectare whereas the productivity of Nepal was 3.15 ton per hectare, which seems higher than National productivity. If proper interventions, mechanization and technical guidance are employed there is no doubt Nepal can be one of the self-sufficient countries in terms of Rice Production. In order to meet the global food demand commercialization and mechanization are two sides of a same coin. Mechanization is one of the important aspect that should be employed in every stages of rice production (Olofinsao, 2015). The major hindering factor in rice production seems the lack of proper implementation and introduction of farm mechanization, small and fragmented land holding, high work load to women , labour shortage, high out migration of youth ,labour migration from agricultural sector to non-agricultural sector is more common and young people are not willing to work on Agriculture. Even the farmers use modern machineries during threshing and harvesting but all the other stages are completely based on manual workers.

The farmers are also not aware about the use of different machineries. Newly adopted machineries at the district are thresher, rotavator, cultivator and combine harvester. Many people store the rice at the traditional storage instruments (bhakari)in which the insect pest can easily attack.. The rice transplanter is also the important machine to be adopted but due to unavailability of skilled manpower and wrong concept of farmers on transplantation they refuse to use it. At Morang district the custom hiring center has not been introduced yet.The only utmost major problem is lack of mechanization facilities at the district. Besides this, farmers are not getting any training regarding the use of machineries. Most of the farmers are unskilled and the agriculture activities are performed by family labor. Apart from this, they are unaware of the organization related to agriculture. The grassroot training was not conducted yet. Some farmers know the importance of farm mechanization but the fact is that they cannot hire it at every stages due the higher cost rate.

2. MATERIALS AND METHODS

2.1 Site selection

The site of the study was Ratuwamai municipality, Morang District Nepal. This municipality was formed merging six village development committee Sijuwa, Ithara, Jhurkiya, Mahadeva, Govindapur and Baradanga. In ratuwamai municipality, rice growing farmers of three farmer's group were selected purposively, which were the target population for the study. Two wards of ratuwamai municipality, 6 and 8 were also purposively selected which was the command area of PMAMP rice zone, Morang. The sampling frame was 400 and the sample size of 80 farmers, 40 from each ward were selected using simple random sampling technique. The respondents were surveyed with semi-structured and pre-tested interview schedule.

2.2 Survey design and data collection procedure

Pre survey field visits was conducted to gather preliminary information regarding the demographic, socio-cultural, and topographical settings of the site. This information was used in preparing interview schedule and designing a sampling framework.

2.2.1 Interview schedule

For the collection of primary data from the farmers regarding present status of farmers under rice cultivation interview schedule was prepared. The major complex variables included in the interview schedule were household's socio economic characteristics, farm characteristics, machineries adopted, cultivated rice varieties, intervention of NGOs and GOs on farm mechanization, farmers' perception regarding the farm mechanization on rice production.

2.2.2 Pre-testing of interview schedule

The interview schedule was administered on 15 farmers for checking the reliability and validity of the interview schedule near to the study area. Then, necessary modifications were done as per the requirements in the schedule. In order to elicit a comprehensive understanding of the perspectives on present status of farm mechanization in rice production the combination of the farm level cross sectional data was collected through surveys involving semi-structured interview schedule, focus group discussion, KII and others are described below.

2.3 Data and data types

Primary data were obtained through household survey, focus group discussion and key informant interview for documentation of several machineries adopted during the each and every stages of production practices, perception of farmers regarding farm mechanization, intervention of GOs and NGOs on farm mechanization and the socio-economic characters of rice growing farmers at Ratuwamai Municipality. Information and data were collected by participatory methods encouraging the commercial rice grower to share their knowledge. Secondary information were obtained through reviewing different publication mainly by the Ministry of Agriculture development (MOAD), Crop Development Directorate (CDD), Central Bureau of statistics (CBS), Nepal Agriculture Research Council (NARC), District Agriculture Development Office (DADO) of respective district, Agriculture and Forestry University (AFU), Prime Minister Agriculture Modernization Project (PMAMP). Different journals, thesis and network surfing were reviewed for the secondary data.

2.4 Data analysis techniques

Data entry was done by using software package, statistical package for social science (SPSS), strata and Microsoft Excel. For descriptive analysis, descriptive statistics such as frequency and percentage were calculated to determine distribution of the study variables. Chi square test and Independent sample t-test was used to test the significance difference between categorical and continuous variables under investigation and indexing was done for problem ranking.

2.4.1 Chi-square test or test of independence

In order to study whether two variables were independent or associated with each other, chi-square was applied.

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Where, χ^2 = Chi-square

O_{ij} = observed frequency of each ijth term

E_{ij} = indicates expected frequency of ijth term

i = 1, 2, 3 r

j = 1, 2, 3 k

This was tested at 0.01, 0.05 and 0.1 level of probability for different degree of freedom.

2.4.2 Problem ranking

Qualitative data were taken into account to prepare the index. On the basis of responded frequencies, weighted indexes were calculated for the analysis of farmer's perception on the degree of problems during rice production. Farmer's perception to the different production and marketing problems were ranked by using five-point scales. Then the priority index was calculated by weight age average mean in order to draw valid conclusion. The index of importance was computed by using the formula:

$$I_{imp} = \frac{\sum S_i F_i}{N}$$

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

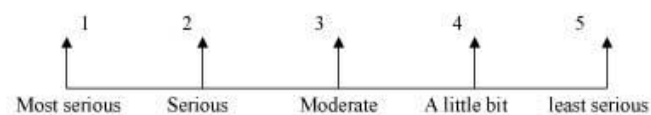


Figure 1: Scale of rating

3. RESULT AND DISCUSSION

3.1 Socio-demographic information

3.1.1 Age

Majority of the respondent i.e 63 percent belong to age group between 38-66, about 17 percent were above 66 year and 16 percent were below 38 age. The average age of respondent involved in framing was found 53.16 nearly 54 whereas minimum age was 21 year and maximum age was 76 year.

Table 1: Age of the respondent	
Age category	Frequency
<38	13(16)
38-66	50(63)
>66	17(21)
Mean	53.16
Standard deviation	14.18
Minimum	21
Maximum	76

Figures in the parenthesis indicate percentage

Source: Field survey ,2019

3.1.2 Sex

The sex of the respondent was enumerated and categorized into two categories i.e male and female. Out of total 80 respondent of the study area 67.5 percent were male and 32.5 percent were female.

Even though the female population was higher, majority of the respondent were male as compared to female. Female respondent were found less because they refuse to perform interview due to low knowledge in technical know-how.

Table 2. Sex of respondent	
Sex	Frequency
Male	54(67.5)
Female	26(32.5)
Total	80(100)

Figures in the parenthesis indicate percentage

Source: Field survey ,2019

3.1.3 Marital status

All the respondents were found married. This shows that most of the farmers were able to utilize the presence and support of family members to cover the labor costs. In addition to this, people at rural area get married at an early age.

3.1.4 Family type

The family type of respondent was categorized into 3 categories Nuclear, joint and Separated. Among them 55(68 percent) were of Nuclear types, 24(30 percent) were joint and remaining 1(1.2 percent) were separated.

Table 3: Family type of the respondent	
Family types	Frequency
Nuclear	55(68)
Joint	24(30)
Separated	1(1.2)
Total	80(100)

Figures in the parenthesis indicate percentage

Source: Field survey ,2019

3.1.5 Education level

Education is one of the preconditions for development. Education grows the mind and makes it receptive to technological innovation. The education level of the respondent was categorized in two categories Illiterate and literate. The literate population was found higher i.e 58(72.5 percent) as compared to illiterate 22(27.5percent). Furthermore, the literate is again categorized into primary level, secondary level and certificate level. Majority of the respondent were educated upto secondary level 29(36.25 percent), followed by certificate level 18(22.5 percent) and primary level 11 (13.8percent). This shows majority of the respondent were literate and can complexity and benefit from adoption of new technology in farming.

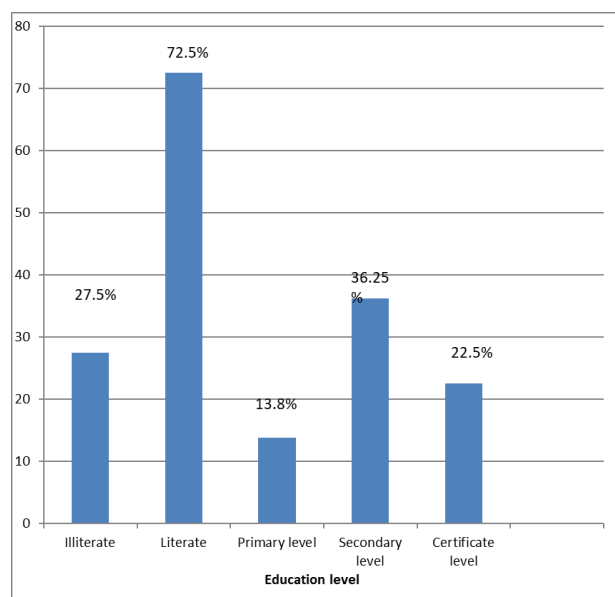


Figure 2: Distribution of respondents by Education level easily understand technologic (Field survey, 2019)

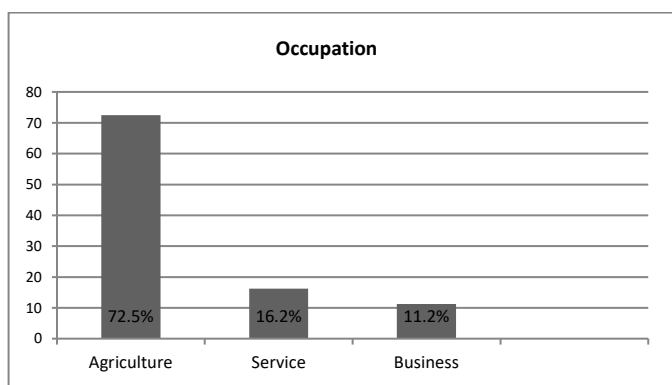


Figure 3: Occupation of the respondent

3.1.6 Family member abroad

Among the households about 85 percent do not have family members abroad whereas 15 percent family have members abroad and the trend of migration was in gulf country like Malaysia, Saudi-Arab, Baharain quatar etc. Mostly the economically active group was found migrated more.

Member abroad	Yes	No	Total
Frequency	12(15)	68(85)	80(100)

3.1.7 Agriculture type

About 58 percent of the respondent perform subsistence agriculture practice, about 25 percent respondents perform semi-commercial agriculture practice whereas very few respondent's 16.2 percent were involved in commercial agriculture farming. This shows there is huge need of agriculture mechanization to promote commercial farming.

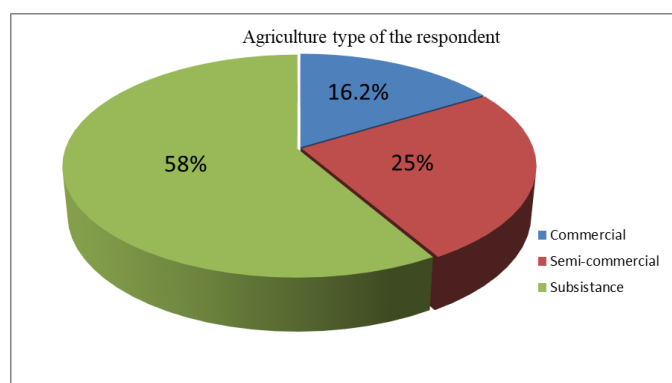


Figure 4: Agriculture type of the respondent (Source: Field survey ,2019)

3.1.8 Family size

The average family size was 5.2 followed by minimum 2 and maximum 12. The average of male and female was found 2.5 and 2.7 respectively which indicate the number of females was slightly larger as compared to male in the study area.

	Minimum	Maximum	Mean	Std. Deviation
Family size of the respondent	2.00	12.00	5.2750	2.00616
Number of male	1.00	6.00	2.5625	1.10056
Number of female	1.00	6.00	2.7125	1.33306

Figures in the parenthesis indicate percentage
Source: Field survey ,2019

3.1.9 Land holding

The average land holding of the respondent was 25.88 kattha (1.29 bigha/ 0.86 ha) whereas minimum land holding was 5 kattha and maximum land holding was 120 kattha.

	Minimum	Maximum	Mean	Std. Deviation
Total land holding of the respondent (kattha)	5.00	120.00	25.8813	23.83053

Figures in the parenthesis indicate percentage
Source: Field survey ,2019

3.1.10 Productivity

The average productivity of Rice was 2.2 metric ton per hectare which is very lower than the National Productivity (3.37 mt/ha)

	Minimum	Maximum	Mean	Std. Deviation
Productivity(mt/ha)	1.86	2.60	2.2844	.23048

Figures in the parenthesis indicate percentage
Source: Field survey ,2019

3.1.11 Cropping pattern

Rice dominant cropping pattern was found common in the study area. Major cropping pattern was Rice-mustard + maize-Rice (32.5 percent) followed by Rice- Potato + mustard-Rice (23.8 percent), Rice-fallow-Rice (21.2 percent), Rice- potato +maize-Rice (10 percent) respectively.

Cropping pattern	Frequency
Rice - fallow-Rice	17(21.2)
Rice-mustard-Rice	5(6.2)
Rice- Potato+ mustard-Rice	19(23.8)
Rice- fallow- fallow	0
Rice-mustard+maize-Rice	26(32.5)
Rice- maize-Rice	5(6.2)
Rice-potato+maize-Rice	8(10)
Total	80(100)

Figures in the parenthesis indicate percentage
Source: Field survey ,2019

3.1.12 Farming experience

The maximum farming experience of the respondent was found 40 years minimum was 3 years with standard deviation of 7.6.

	Minimum	Maximum	Mean	Std. Deviation
Farming experience	3.00	40.00	24.6375	7.62614

Figures in the parenthesis indicate percentage
Source: Field survey ,2019

3.2 Mechanization activities conducted during Rice Cultivation

3.2.1 Machineries used during different stage of Rice cultivation

The given table shows during land preparation about 86.25 percent respondents use machines while 13.57 percentage use traditional method which shows land preparation stage is highly mechanized than other stages. Similarly, during Nursery preparation and transplantation no any machines were employed which shows these two stages were completely based on manual labour. The use of thresh or and combine harvest or was found very common during this stage.

Different stage of Rice cultivation	Manual Method	Mechanical Method
Land preparation	13.575percent	86.25percent
Nursery preparation	100percent	0percent
Transplantation	100percent	0percent
Weeding	18.75percent	81.25percent
Fertilizer application	100percent	0percent
Irrigation	0percent	100percent
Harvesting	31.25percent	68.75percent

Figure in the parenthesis indicate percentage
Source: Field survey,2019

3.2.2 Machineries and tools adopted during Rice cultivation

The different types of tools and machineries used by farmers during different stage of rice cultivation were listed and categorized as adopted and non-adopted machineries and the checklist has been prepared based on frequency and analyzed data was presented in table 16.

Table 11: Machineries' and tools adopted during Rice cultivation		
Machineries and tools	Adopted	Not Adopted
Tractor drawn MB plough	24(30)	56(70)
Local plough	--	80(100)
Spade	62(77.5)	18(22.5)
Hoe	31(38.8)	49(61.2)
Sprayer	60(75)	20(25)
Transplanter	--	80(100)
Rotavator	80(100)	--
Cultivator	73(91.2)	7(8.8)
Power tillar	51(63.8)	29(36.2)
Mini tillar	39(48.8)	41(51.2)
Threshor	74(92.5)	6(7.5)
Combine harvester	63(78.8)	17(21.2)
Electricity operated pump set	80(100)	--
Solar pump set	18(22.5)	62(77.5)

Figures in the parenthesis indicate percentage
Source: Field survey ,2019

3.3 Association of Socio-demographic and extension related factors with the adoption of farm machineries

Chi-square test was conducted to measure the relationship between socio-demographic and extension related factors with the adoption of farm machineries on rice cultivation. The relationship was tested at 0.05 and 0.01 probability level. The socio-demographic factors include age, education level, family size and land holding. Likewise, extension related factors include training and subsidies.

3.3.1 Age

Table 12: Association between Age and adoption of machineries					
Age	Overall	Adoption level		Chi-square	P-value
		Adopters	Non adopters		
<38	13	13(20.3)	0	11.529***	0.003
38-66	50	42(65.6)	8(50)		
>66	17	9(14.1)	8(50)		

Figure in the parenthesis indicate percentage

Chi-Square (χ^2 Cal)= 11.529 (χ^2 tab)=6.635df= 1,P value= 0.003 ,significant at 0.01 level of probability.

This result signifies that the association between age of the respondent and adoption of machineries are highly significant. It means there is association between age of the respondent and adoption of machineries.

3.3.2 Education level

Table 12: Association between Education level and adoption of machinery					
Adoption	Overall	Education level		Chi-square value	P-value
		Literate	Illiterate		
Adopters	64(80)	51(79.7)	13(20.3)	6.827**	0.016
Non-adopters	16(20)	8(50)	8(50)		
	80(100)	64(80)	16(20)		

Figures in the parenthesis indicate percentage

Chi-Square (χ^2 Cal) = 6.827 (χ^2 tab)=3.841P value 0.016 df=1 , significant at 0.05 level of probability

This result signifies that the association between Education level of farmer and adoption of machineries are statistically significant. It means there is association between education level and adoption of machinery.

3.3.3 Subsidies

Table 13: Association between subsidies and adoption level of machinery					
Subsidy	Overall	Adoption level		Chi-square value	P-value
		Adopter	Non-Adopter		
Yes	58(72.5)	51(79.7)	7(42.75)	8.292***	0.004
No	22(27.5)	13(20.31)	9(56.25)		
	80(100)	64(100)	16(100)		

Figures in the parenthesis indicate expected percentage

Chi-Square (χ^2 Cal)= 8.292 (χ^2 tab)=6.635 P value= 0.004 df=1 significant at 0.01 level of probability.

This result signifies that the association between subsidies and adoption of machineries are statistically significant. It means there is association between subsidy and adoption of machineries.

3.3.4 Training

Table 14. Association between training and adoption of machineries					
Training	Overall	Adoption level		Chi-square	P-value
		Adopter	Non-Adopter		
Yes	53	47(73.4)	6(37.5)	7.393***	0.007
No	27	17(26.56)	10(62.5)		
Total	80(100)	64(100)	16(100)		

Figure in the parenthesis indicate percentage

Chi-Square (χ^2 Cal)= 7.393 (χ^2 tab)=6.635 P value= 0.007 df=1 ,significant at 0.01 level of probability.

This result signifies that the association between training and adoption of machineries are statistically significant. It means there is association between training and adoption of machineries

3.3.5 Association between socio- demographic variables and adoption of machinery (continuous)

Table 15: Association between socio- demographic variables and adoption of machinery (continuous)			
Variables	Mean difference	T-value	P-value
Family size	0.65625	1.300	0.197
Land holding	4.09375	1.116	0.268
No of male	0.4688	0.155	0.877
No of female	0.60938	1.786*	0.078

Note: *, **, *** indicates significance at 10percent,5percent and 1percent level of significance respectively.

This result signifies there is no any significant association between family size, landholding and number of male with adoption of machinery whereas Number of female is statistically significant with adoption of machinery at 0.1 level of significance.

3.4 Perception of farmers on Farm Mechanization

3.4.1 Adoption level of machinery

Out of the 80 respondents, 64 (80 percent) were adopter of machinery and 16(20 percent) were non adopters. Education level of respondents, training, subsidies and extension related factors were found as major factors on adoption.

Table 16: Adoption of Machinery	
Adoption level	Frequency
Adopter	64(80)
Non adopter	16(20)

3.4.2 Perception of farmers on various factors on mechanization

Among 80 respondents 65 percent agreed on labour shortage and 35

percent did not agreed on labour shortage problem. The outstanding feature of farm mechanization was found time saving factor that enables mechanized farmers to spend their spare time on other aspects of life like education, business, other professions and social activities.

Variables	Agreed	Disagreed
Labour shortage	52 (65)	28(35)
Machinery economical than traditional	49(61.2)	31(38.75)
Familiar with PMAMP	42(52.5)	38(47.5)
Availability of machinery	63(78.8)	17(21.2)
Satisfaction from rice production	67(83.8)	13(16.2)
Time saving	79(98.8)	1(1.2)

Figures in the parenthesis indicate percentage
Source: Field survey,2019

3.4.3 Beneficial method

Majority of the respondents i.e., 65 percent found mechanical method more beneficial than traditional method which was only 35 percent.

Harvesting method	Frequency
Traditional harvesting	28(35)
Mechanical harvesting	52(65)
Total	80(100)

Figures in the parenthesis indicate percentage
Source: Field survey,2019

3.4.4 Types of labour

Out of total respondents, 55 percent use unskilled labour , 13.75 percent used family labour and 31.25 percent respondents used both types of labour during cultivation of Rice.

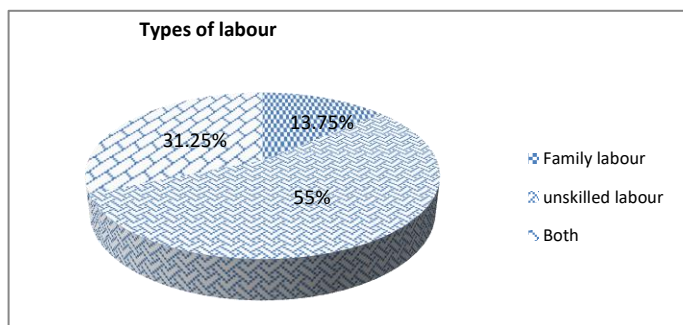


Figure 5: Types of labour

3.4.5 Satisfaction of farmers from Rice production

The table indicates only 5 percent respondents were highly satisfied from rice production. 67.5 percent were moderately satisfied,18.8 percent were considerably satisfied and 8.8 percent were completely unsatisfied from production.

Satisfaction level	Frequency
Highly satisfied	4(5.0)
Moderately satisfied	54(67.5)
Considerable	15(18.8)
Highly unsatisfied	7(8.8)
Total	80(100)

Figures in the parenthesis indicate percentage
Source: Field survey,2019

3.4.6 Basis of using machines

Table shows about 57.5 percent respondents use machinery based on pre-booking, 35 percent use machinery based on harvesting time and only 7.5 percent use based on landholding.

Basis	Frequency
Landholding	6(7.5)
Pre-booking	46(57.5)
Harvesting time	28(35)

Figures in the parenthesis indicate percentage
Source: Field survey,2019

3.4.7 Distribution of respondents on the basis of owing of machinery

Among 80 respondents ,77.5 percent hire the machinery from other private sectors and 22.5 percent respondents has their own machinery.

Owing of Machinery	Frequency
Hire the machinery from other	62(77.5)
Own machinery	18(22.5)
Total	80(100)

Figures in the parenthesis indicate percentage
Source: Field survey,2019

3.4.8 Source of information about mechanization

The result shows most of the farmers got the information regarding mechanization from Agriculture knowledge center (AKS) (42.5 percent) followed by PMAMP (32.5 percent), agriculture service centers, NGOs and INGOs (8.75 percent). Agriculture knowledge center (AKC) was regarded as primary source of information dissemination in the study area.

Informants of mechanization	Frequency
Agriculture service centers	13(16.25)
NGOS AND INGOs	7(8.75)
PMAMP	26(32.5)
Agriculture knowledge center(AKS)	34(42.5)
Total	80(100)

Figures in the parenthesis indicate percentage
Source: Field survey,2019

3.4.9 Satisfaction from activities conducted by PMAMP

Among 80 respondents, about 42.5 percent were undecided about PMAMP, 27.5 percent were highly unsatisfied, 17.5 percent were moderately unsatisfied and 12.5 percent were moderately satisfied from the activities conducted by PMAMP.

Satisfaction level	Frequency
Moderately satisfied	10(12.5)
Undecided	34(42.5)
Moderately unsatisfied	14(17.5)
Highly unsatisfied	22(27.5)
Total	80(100)

Figures in the parenthesis indicate percentage
Source: Field survey,2019

3.4.10 Interest on tools from PMAMP

About 81.2 percent were found interested and 18.8 percent were not interested in using tools from PMAMP.

Interest on tools from PMAMP	Yes	No
Frequency	65(81.2)	15(18.8)

Figures in the parenthesis indicate percentage
Source: Field survey,2019

3.5 Problem faced by farmers regarding the adoption of farm Machineries

The farmers were inquiring their feedback about the degree of problems faced during adoption of machineries. The responses of farmers were recorded on four-degree scale i.e., Highly agreed, moderately agreed, don't know and Highly disagreed and presented in a given table.

Table 25: Degree of Problem faced while using machineries

Problems	Highly agreed	Moderately agreed	Don't know	Highly disagreed	Total
High rent rate	32(40)	36(45)	8(10)	4(5)	80(100)
Low affordability	31(38.8)	39(48.8)	6(2.2)	4(5)	80(100)
Access to loan	0	18(22.5)	12(15)	50(62.5)	80(100)
Low availability of operator	40(50)	32(40)	5(6.2)	3(3.8)	80(100)
Difficulty in Maintenance	46(57.5)	24(30)	10(12.5)	0	80(100)
High labor requirement	0	12(15)	8(10)	60(75)	80(100)
High land fragmentation	34(42.5)	39(48.8)	7(8.8)	0	80(100)
Poor subsidies	56(70)	16(20)	8(10)	0	80(100)
High work load to women	6(7.5)	20(25)	4(5)	50(62.5)	80(100)

Figures in the parenthesis indicates percentage
Source: Field survey,2019

3.6 Problems faced by farmers regarding Rice Production

In the study area, farmers were facing several problems related to the production. Based on the farmers' perception towards production problems, the ranking of the problem was carried out. The study revealed that, among the production problems, unavailability of quality seeds and fertilizers in required quantity and time appeared as the most important production problem and labour shortage was appeared as least problem. Due to the unavailability of fertilizers and quality seeds farmers were compelled to brought fertilizers from India. This shows Nepalese Rice growing condition is completely dependent upon Indian market.

Table 26: Problem of rice production

Production problems	Weightage	Index	Rank
Unavailability of quality seeds and fertilizers	66.4	0.83	I
Lack of subsidy on Irrigation	63.4	0.7925	II
Disease and pest infestation	46.6	0.5825	III
Lack of technical guidance on production	40.4	0.505	IV
Labour shortage	33.6	0.42	V

Source: Field survey,2019

4. DISCUSSIONS

The study was conducted at Prime Minister Agriculture Modernization Project, (PMAMP) Rice Zone Morang at Ratuwamai Municipality Morang District. This zone area was purposively selected for study. The major reason behind this area selection was, this region represents the major rice growing area of Morang District. The result of the findings revealed about 50 percent respondents belongs to 38-66 age group, 67.5 percent were male and 32.5 percent were female. About 72.5 percent of the respondent were literate and 27.5 percent were illiterate. Almost all were involved in agriculture as their major occupation. About 58 percent were involved in subsistence farming, 25 percent were involved in semi-commercial farming and only 16.2 percent were involved in commercial farming which shows there is strong urge to promote mechanization in rice cultivation.

The average family size was 5.2 followed by minimum 2 and maximum 12. The average of male and female was found 2.5 and 2.7 respectively which indicate the number of females was slightly larger as compared to male in the study area. The study shows during land preparation about 86.25 percent respondents use machines while 13.57 percent use traditional method which shows land preparation stage is highly mechanized.

Similarly, during Nursery preparation and transplantation no any machines were employed which shows these two stages were completely based on manual labor. During weeding 81.25 percent were found using mechanical instruments like sprayer and 18.75 percent perform weeding manually. The use of knapsack sprayer was found most common. Fertilizer application was done completely manual through broadcasting. During harvesting stage, 68.75 percent respondents use machines and 31.25 percent does harvesting manually. The use of thresh or and combine harvest or is was found very common during this stage.

The study about perception of farmers shows about 65 percent respondents found mechanical method beneficial whereas 35 percent found traditional method beneficial 55 percent used unskilled labour during rice production. Only 22.5 percent respondents had their own machines and majority use machine based on pre-booking . About 80 percent were found adopters of machinery and 20 percent were found non-adopters . Among many constraints difficulty in maintenance (57.5 percent), high land fragmentation(42.5 percent), poor subsidies(70 percent), high work load to women (62.5 percent), high-rent rate (40 percent) were highly agreed constraints. The study revealed that, among the production problems, unavailability of quality seeds and fertilizers in required quantity and time appeared as the most important production problem followed by labor shortage as least problem.

5. CONCLUSION

From the study following conclusions were drawn:

- Irrigation was found completely mechanized which was solely provided by electricity operated boring pump followed by land preparation ,weeding and harvesting stage.
- Rotavator, Tractor drawn MB plough, Cultivator, sprayer, thresher, combine harvester and electricity operated boring machines were most commonly used machineries during rice cultivation .
- The factors like age , education level ,training and subsidies have significant relation with adoption of machineries .
- Similarly, unavailability of quality seeds and fertilizers in required quantity and time appeared as the most important production problem followed by lack of subsidy on irrigation ,disease and pest infestation, lack of technical guidance and labor shortage was appeared as least problem.

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