International Journal of Agricultural and Applied Sciences, December 2021, 2(2):69-74
https://www.agetds.com/ijaas
ISSN: 2582-8053
https://doi.org/10.52804/ijaas2021.2211

Research Article

OPEN ACCESS

Assessment of adoption of improved wheat production technology in Nawalparasi (West) district, Nepal

Diwas Poudel[1*], Ritesh Kumar Yadav [2], Bibhor Gauli [1], Apil Chhetri[1] and Sudip Poudel[1]
[1]*Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal*
[2]*Department of Plant Pathology, Agriculture and Forestry University, Rampur, Chitwan, Nepal*
Corresponding author e-mail: diwaspoudel053@gmail.com
(**Received:** 05/07/2021; **Revised:** 19/09/2021; **Accepted:** 02/11/2021)

ABSTRACT
The study was conducted in Sunwal Municipality, Ramgram Municipality, Pahalinandan Rural municipality, and Sarahwal Rural Municipality of Nawalparasi (west) district of Nepal in order to evaluate the adoption rate of improved wheat production technology. A total of 85 households were selected using the simple random sampling method. The collected data were processed, tabulated, and analyzed by using SPSS and Ms-Excel. Mean and standard deviation was to interpret descriptive data. A probit regression model was used to analyze the effect of different independent variables on the decision to adopt improved wheat production technology. Indexing was used to construct an index for ranking the problems faced by the farmers during the production process. From the study, it was found that the adopter of the recommended variety was 82.4%. The adopter of the recommended seed rate was 50.6%. Similarly, the adopter of the recommended method of sowing was 8.2% and the irrigation rate was 44.7%. The adopter of the recommended weeding practices was 43.5%, disease control was 3.5% and insect-pest control was 43.5%. The characteristics of respondents, i.e., education, farm size, farmers group membership, and training had a significant association with the adoption of improved wheat production technology. The empirical results of the probit regression model revealed that education, family size, farm size, farmers' group membership, and training had a significant and positive association with the adoption of improved wheat production technologies. Wheat production was greatly constrained by lack of agricultural machines, lack of proper irrigation, poor availability of fertilizers, disease and insect-pest prevalence, and lack of quality improved seeds.
Keywords: Probit regression model, Indexing, adoption, wheat production.

INTRODUCTION

Agriculture is considered the backbone of the Nepalese economy contributing 28.1% of total GDP in 2017/18 and is estimated to stand at 27.6% of total GDP in 2019/20 (MoF, 2020). It is a source of food security, income generation, and a way of livelihood for the majority of people of Nepal.

Wheat (*Triticum aestivum*) is the most widely grown crop in the world and is the third most important crop after rice and maize in Nepal in terms of area and production but in terms of human consumption, it ranks second. It is cultivated in a variety of climates, from irrigated to dry and high-rainfall places, as well as warm, humid to dry, frigid climates. The intricate composition of the plant's DNA has certainly allowed for such extensive adaptability (Acevedo et al., 2002). It is rich in protein, vitamins, minerals, and nutritive fiber, among other nutrients (Shewry, 2007). The production area of wheat is decreasing year by year but the production is increasing but not to the attainable amount. About 18.77 percentage of contribution have been made by wheat in the the cereal production of Nepal (MoALD, 2020). The production and productivity of Wheat in Terai belt is more than in the Mid Hills and High Hills. The productivity of wheat was 2.55 mt./ha (2073/74), 2.76 mt./ha (2074/75), and 2.85 mt./ha (2075/76) (MoALD, 2020). The productivity of wheat has been noticeably increased after the introduction of Semi-dwarf varieties which has helped in food supply (Pandey et al., 2019). But, when compared to neighboring countries, India and China, wheat productivity is poor, at 3.37 ton/ha and 5.48 ton/ha, respectively (Ramadas et al., 2019). (Timsina et al., 2019) reported that the yield potential and average national productivity are significantly different. The farm-level yield of wheat (2.85 mt/ha) is not satisfactory as compared to the attainable yield (5.0 mt/ha) in Nepal.

Wheat is grown in many farming communities. Due to diminishing farm sizes in Terai, crop productivity and the efficiency of farming systems are of great concern. Although wheat farming has been practiced for many years in Nawalparasi west, the production and the productivity have not been to the attainable amount. Farmers are inclined to traditional cultivation practices

despite the development of improved production technology in recent years and hence, not relishing higher productivity and profitability. The adoption rate of improved production practices of wheat among wheat growers is questionable which is often attributed to lack of technical knowhow, awareness, and knowledge regarding the resources factor, lack of access to a reliable package of information, and several socio-economic factors.

Despite the intensive and continuous involvement of research and extension workers, a large gap exists between the expected yield (5.0 mt/ha) and mean farm yield (2.75 mt/ha) due to lack of knowledge and non-adoption of improved wheat production technology by the farming community. It is imperative to know the extent of adoption, gap, and constraints in another option decision process and to examine and analyze socio-economic factors that influence the adoption decision process of IWPTs. However, there is a paucity of data in this regard and no such study had been conducted so far to generate baseline data and empirical information for the policymakers for bridging the gap in the adoption of IWPTs for enhanced wheat production.

MATERIALS AND METHODS

Description of the study site

The survey was conducted on Sunwal Municipality, Pahalinandan Gaupalika, Sarahwal Gaupalika, and Ramgram Municipality of Nawalparasi west district which was the commanding area of the wheat zone. Nawalparasi (west) is one of the districts of Province -5. The headquarter of this district is Parasi. It is located in between 27.32˚ north longitude and 83.40˚ east latitude.

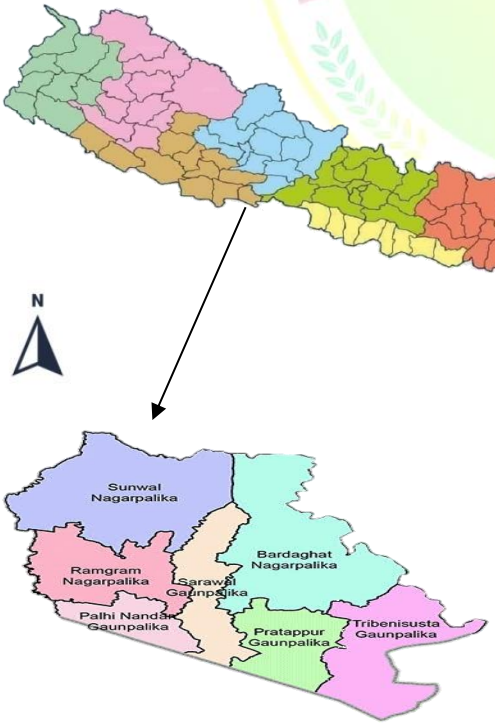

Figure 1: Map of Nepal showing study site

Sample and sampling technique

A list of wheat cultivating farmers from the zone area was prepared which was provided by Wheat zone, PMAMP Nawalparasi. This was used as a sampling frame to select the respondent farmers. The sample size from the wheat zone was selected by a simple random sampling method. The total sample size was 85.

Research design

The different households were selected according to the simple random sampling method. Both primary and secondary sources of data were used. Primary data were obtained from field surveys while secondary data was obtained through different organizations like PMAMP, AKC, and published and unpublished literature.

Techniques of data collection

To obtain the necessary information for this study, different techniques of data collection such as Preliminary survey, FGD, Key Informant Interview (KII) and a questionnaire survey was used.

Data analysis

Both primary and secondary information collected from field surveys and other methods were processed, tabulated, and analyzed by using Microsoft Excel and SPSS.

Variables

Dependent variables

The dependent variable in this study is the adoption of improved wheat production practices. Variety, seed rate, method of sowing, irrigation, weed control, disease, and insect-pest control are the selected improved wheat production practices taken into consideration for the study.

Independent variables

The independent variables in this study are age, sex, education, family size, family income, farm size, farmers group membership, and training.

Adoption index (AI)

It is the degree of adoption of innovation by the farmers. It is used to determine the level of adoption of technology by the farmers by classifying it under different categories. AI is calculated by using the following formula (Dongol, 2004)

$AI = \frac{ASI}{MAS} \times 100\ \%$

AI= Adoption score

ASI= Adoption score obtained by an individual farmer

MAS= Maximum adoption score

Independent t-test

The independent t-test was conducted to find out the association of variables singly i.e. keeping other variables constant. Here, adoption of IWPT was considered as a dependent variable whereas age, sex, education, family number, family income, farm size, farmers group membership and participation in training as independent variables. The formula for the independent t-test is as follw:

Let us consider that A and B represent the two roups to compare.

$$t = \frac{mA - mB}{\sqrt{\frac{s^2}{nA} \frac{s^2}{nB}}}$$

Where,
m_A and m_B represent the means of groups A and B, respectively
n_A and n_B represent the sizes of groups A and B, respectively.

Probit regression model

A probit model is a type of regression tool where the dependent variable can take only two values. It has been used to assess the functional relationship between the likelihood of acceptance and the factors influencing it. (Kafle, 2010) used to investigate the factors influencing the adoption of improved maize varieties in developing countries. The use of binary empirical model allows for a more detailed examination of farmers' adoption of new technologies (Muzari et al., 2012). The probit regression model is chosen to the others because of the assumption of normal distribution (Wooldridge, 2010). We used the probit regression model in this study to determine the factors influencing IWPT in Nawalparasi(west).

Indexing

Indexing/Scaling technique was applied to construct an index for ranking the problems as per farmers' perceptions. The index was computed by using the following formula,

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

Where I_{imp} = Index of importance
Si = scale value at i^{th} priority
Fi =frequency of i^{th} priority
N = total number of observations

RESULTS AND DISCUSSION

Descriptive analysis

The description of the variables with mean and standard deviation are presented in table 1. The average age of the respondents (household head) was 41 years with an average of 4 years of schooling. The average family size of the study area was 11 members and the total income of the family was more than 2 lakhs. The average farm area of the farmers was around 1 hectare. About 86 percent of the farmers had farmers' group membership and only 28 percent of the farmers had participated in training.

Table 1. Socioeconomic characteristics of the wheat-growing farmers

Variables	Description	Value	Mean	SD
Age	Age of household head in years	Years	41.58	7.566
Gender	Gender of the household head	Male=1, otherwise=0	0.66	0.477
Education	Schooling of household head	Years	4.07	3.677
Family size	Number of family members	Persons in number	11.52	4.366
Family income	Amount of total family income per year	Amount in Nepalese rupee	21711 7.65	23603 2.91
Farm size	Area under wheat cultivation in hectare	Area in hectare	1.134 81	0.802 044
Membership	Membership of any organization	Membership =1, otherwise=0	0.86	0.350
Training	Participation in training related to wheat	Training received=1, otherwise=0	0.28	0.453

Level of adoption of improved production technology

The average value of adoption index was found to be 39.50% and none of the farmer's adoption index equals the average adoption index. Therefore, the farmers were categorized into two categories viz. high adopter and low adopter.

High adopter comprises those farmers having an adoption index more than the average value i.e., 39.50%. The farmers with adoption index of less than average value is kept under low adopter. The adoption of improved practices under each dependent variable is as follows:

Variety

Table 2 revealed that 82.4% of the respondents were the adopter of the recommended variety and the remaining 17.6% of the respondents were non-adopter of the recommended variety.

Table 2. Distribution of respondents according to use of variety in the study area

Variety	Frequency	Percent
Adopter	70	82.4
Non-adopter	15	17.6
Total	85	100.0

Seed rate

Table 3 revealed that 50.6% of the respondents were the adopter of the recommended seed rate and the remaining 49.4% of the respondents were non-adopter of the recommended seed rate.

Table 3. Distribution of respondents according to use of seed rate in the study area

Seed rate	Frequency	Percent
Adopter	43	50.6
Non-adopter	42	49.4
Total	85	100.0

Method of sowing

Table 4 revealed that 8.2% of the respondents were the adopter of the recommended method of sowing and the remaining 91.8% of the respondents were non-adopter of the recommended sowing method.

Table 4. Distribution of respondents based on the method of sowing in the study area

Method of sowing	Frequency	Percent
Adopter	7	8.2
Non-adopter	78	91.8
Total	85	100.0

Irrigation

Table 5 revealed that 44.7% of the respondents were the adopter of the recommended irrigation rate and the remaining 55.3% of the respondents were non-adopter of the recommended irrigation rate.

Table 5. Distribution of respondents based on irrigation applied on the field

Irrigation	Frequency	Percent
Adopter	38	44.7
Non-adopter	47	55.3
Total	85	100.0

The farmers with the availability of irrigation facilities were able to irrigate the field in the critical stages of the wheat crop. River, Canal, Pond, and Pump set were the sources of irrigation for a wheat field. The non-adopter of recommended irrigation rate was dependent on rainfall or river to irrigate the field.

Weed control

Table 6 revealed that 43.5% of the respondents were the adopter i.e., perform weeding and the remaining 56.5% of the respondents were non-adopter i.e., not performing weeding practices.

Table 6. Distribution of respondents based on weed control

Weeding	Frequency	Percent
Adopter	37	43.5
Non-adopter	48	56.5
Total	85	100.0

Disease control

Table 7 revealed that 3.5% of the respondents were the adopter of the recommended disease control practices and the remaining 96.5% of the respondents were non-adopter of the recommended disease control practices.

Table 7. Distribution of respondents based on disease control

Disease control	Frequency	Percent
Adopter	3	3.5
Non-adopter	82	96.5
Total	85	100.0

Insect control

Table 8 revealed that 43.5% of the respondents were the adopter of the recommended insect control practices and 56.5% of the respondents were non-adopter of the recommended insect control practices.

Table 8. Distribution of respondents based on insect control

Insect control	Frequency	Percent
Adopter	37	43.5
Non-adopter	48	56.5
Total	85	100.0

Independent t-test analysis

Table 9: Difference in socio-economic characteristics of the high adopter and low adopter of IWPTs

Variables	High adopter	Low adopter	Difference	t-value
Age	40.67	42.60	-1.93	1.179
Gender	0.71	0.60	0.11	-1.070
Education	5.31	2.68	2.63	-3.520**
Family size	12.27	10.68	1.59	-1.700
Family income	231667	200750	30917	-0.600
Farm size	1.37758	0.86170	0.52	-3.110**
Membership	0.93	0.78	0.16	-2.120*
Training	0.40	0.15	0.25	-2.630*

*and ** represent the level of significance at 5% and 1% respectively.

The difference between high adopters and low adopters of IWPTs in the study area in terms of different socio-economic characteristics is presented in Table 9. The results showed that the difference in education was positive and statistically significant at 1% between high adopters and low adopters of IWPTs. Likewise, the difference between the mean of the high adopters and low adopters of IWPTs in farm size was found positive and was significant at a 1% level of significance. Similarly, the results showed that the difference in membership and training was positive and significant at a 5% level of significance. Lastly, no significant difference in age, gender sex, family size, and family income between groups of high adopters and low adopters of IWPTs were found in the study area.

Table 10. Parameter estimates of adoption of IWPTs

Variables	Coefficient	Std. Error	z	P>|z|	95% Confidence Interval	
Age	0.018	0.028	0.419	0.518	-0.037	0.073
Gender	0.219	0.353	0.386	0.535	-0.473	0.911
Education	0.194	0.072	7.296***	0.007	0.053	0.335
Family size	0.072	0.042	2.863*	0.091	-0.011	0.156
Family income	-6.661E-07	8.211E-07	0.658	0.417	-2.275E-06	9.433E-07
Farm size	0.638	0.269	5.600**	0.018	0.110	1.166
Membership	1.184	0.564	4.405**	0.036	0.078	2.290
Training	1.142	0.401	8.084***	0.004	0.355	1.929
Constant	-4.239	1.547	7.499	0.006	-7.272	-1.205
No. of observations	85					
Log-likelihood	-40.96					
LR Chi^2 (8)	35.62***		(Prob.> chi^2 =0.000)			

*, ** and *** represent level of significance at 10%, 5% and 1% respectively

Probit regression model analysis

The empirical results of the probit regression model are presented in Table 10. This study used a dummy dependent variable, which took the value 1 for high adopters and 0 for low adopters of IWPTs. The estimated results of the probit regression model showed that the coefficient of family size was significant at a 10% level of significance and positively associated with the adoption of improved wheat production technology. The result is consistent with the findings of (Gebresilassie & Bekele, 2015).

The coefficient of education was significant at a 1 % level of significance and positively associated with the adoption of improved wheat production technology. This result showed that the educated farmers get information on new technology from extension agents and are more likely to adopt IWPTs, which is in confirmation with the findings of the study conducted by (Chandio & Yuansheng, 2018).

The study further showed that the coefficient of farm size was also significant at 5% and positively associated with the adoption of improved wheat production technology. Large landholding farmers were more likely to have more opportunities to learn about modern technologies by first experimenting with innovations to see their results and adopting them on large scale. This finding is confirmatory with the findings of (Chandio & Yuansheng, 2018).

The coefficient of membership was significant at a 1 % level of significance and positively associated with the adoption of improved wheat production technology. In line with this finding, (Mignouna et al., 2011) reported that farmers associated with a social group increase the interchange of ideas and information, allowing them to learn about the advantages of using new technology.

Similarly, the coefficient of training was significant at a 1% level of significance and positively associated with the adoption of improved wheat production technology. This means that farmers provided training are more likely to adopt improved production practices. This finding is in line with the findings of (Kunwar et al., 2018)

Assessment of problems of wheat production

The indexing technique was used to rank the problems faced by the wheat-growing farmers. (Subedi et al., 2019) used this technique to rank the problems faced by the wheat-growing farmers of eastern and western Terai of Nepal. As per a survey on wheat producers, lack of agricultural machines was found to be the major problem followed by lack of proper irrigation. Similarly, poor availability of fertilizers, disease and insect-pest prevalence, and lack of quality improved seeds were ranked third, fourth and fifth respectively as per farmers perception. The yield is significantly affected by seed quality, disease, and pest infestation, and availability of irrigation as stated by (Paudyal et al., 2001). (Hailu, 1992) stated that the lack of availability of quality improved seeds including fertilizers and agricultural machines are the major limiting factors in increasing maize production and productivity.

Table 11. Problems associated with wheat production

Problems	Index value	Rank
Lack of quality improved seeds	0.31	5
Poor availability of fertilizers	0.56	3
Lack of proper irrigation	0.85	2
Lack of agricultural machines	0.86	1
Disease and insect pest prevalence	0.42	4

CONCLUSION

The study revealed socio-economic characteristics of wheat-growing farmers. From the study, it was found that the majority of the respondents (82.4%) were adopter of recommended variety. The adoption of recommended method of sowing and disease control was low. But, the adoption of remaining improved production practices was medium. Education, farm size, farmers group membership, and training had a significant association with the adoption of improved wheat production technology. The empirical results of the probit regression model revealed that education, family size, farm size, farmers group membership, and training had a significant and positive association with the adoption of improved wheat production technology. The production of wheat was greatly constrained by lack of agricultural machines, lack of proper irrigation, poor availability of fertilizers, disease and insect-pest prevalence, and lack of quality improved seeds.

ACKNOWLEDGEMENT

The authors express the deep sense of indebtedness to Mr. Rakesh Kumar Ojha, Senior Agriculture Development Officer, PMAMP, Project Implementation Unit, Nawalparasi west for his continuous guidance and suggestions throughout the research period.

REFERENCES

Acevedo, E., Silva, P., & Silva, H. 2002. Wheat growth and physiology. *FAO*.

Chandio, A., & Yuansheng, J. 2018. Factors influencing the adoption of improved wheat varieties by rural households in Sindh, Pakistan. *AIMS Agriculture and Food*, 216–228.

Dongol, B. S. 2004. *Extension education* (1st ed.). Dongol printers.

Gebresilassie, L., & Bekele, A. 2015. Factors determining the allocation of land for improved wheat variety by smallholder farmers of Northern Ethiopia. *Journal of Development and Agricultural Economics*, 105–112.

Hailu, G. 1992. *Availability and use of seeds in Ethiopia*.

Kafle, B. 2010. Determinants of Adoption of Improved Maize Varieties in Developing Countries: a Review. *International Research Journal of Applied and Basic Sciences*, **I**(1), 1–7.

Kunwar, B., Dhakal, D., & Panta, H. K. 2018. Determinants of smallholders' adoption of off-

season vegetable production technology in Okhaldhunga District of Nepal. *Journal of the Institute of Agriculture and Animal Science*, *228*, 221–228. https://doi.org/10.3126/jiaas.v33i0.20708

Mignouna, B., D., Manyong, V. M., Rusike, J., Mutabazi, K. D. S., & Senkondo, E. M. 2011. Determinants of Adopting Imazapyr-Resistant Maize Technology and its Impact on Household Income in Western Kenya. *AgBioforum*, **14**(3), 158–163.

MoALD. 2020. *Statistical information on Nepalese agriculture*.

MoF. 2020. *Economic Survey 2019/20*.

Muzari, W., Gatsi, W., & Muvhunzi, S. 2012. The Impacts of Technology Adoption on Smallholder Agricultural Productivity in Sub-Saharan Africa: A Review. *Journal of Sustainable Development*, *5*.

Pandey, D., Chaudhari, H. K., Upadhyay, S. R., Gautam, N. R., Ghimire, B. R., Shrestha, J., & Thapa, D. B. 2019. Participatory on-farm evaluation of wheat varieties. *Journal of Agriculture and Natural Resources*, **2**(1): 312–321.

Paudyal, K. R., Ransom, J. K., Rajbhandari, N. P., Adhikari, K., Gerpacio, R. P., & Pingali, P. L. 2001. *Maize in Nepal: Production Systems, Constraints, and Priorities for Research*.

Ramadas, S., Kumar, T. M. ., & Singh, G. P. 2019. Wheat Production in India: Trends and Prospects. *Intech Open*. https://doi.org/10.5772/intechopen.86341

Shewry, P. R. 2007. Improving the protein content and composition of cereal grain. *Journal of Cereal Science*, **46**(3): 239–250.

Subedi, S., Ghimire, Y. N., Adhikari, S. P., Devkota, D., Poudel, H. K., & Sapkota, B. K. 2019. Adoption of improved wheat varieties in eastern and western Terai of Nepal. *Journal of Agriculture and Natural Resources*, **2**(1): 85–94. https://doi.org/https://doi.org/10.3126/janr.v2i1.26047

Timsina, K. P., Gairhe, S., Koirala, P., & Shrestha, J. 2019. Investment on wheat research and its effect: A case of Nepal. *Agricultural Science and Technology*, **11:** 138–143.

Wooldridge, J. 2010. Econometric analysis of cross section and panel data. In MIT Press.

Citation: Poudel, D.; Yadav, R.K.; Gauli, B.; Chhetri, A. and Poudel, S. 2021. Assessment of adoption of improved wheat production technology in Nawalparasi (West) district, Nepal. *International Journal of Agricultural and Applied Sciences*, 2(2):69-74. https://doi.org/10.52804/ijaas2021.2211

Copyright: © *Poudel, D. et. al* 2021. Creative Commons Attribution 4.0 International License. IJAAS allows unrestricted use, reproduction, and distribution of this article in any medium by providing adequate credit to the author(s) and the source of publication.