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Research Article

Socio-economics of wheat production in Kailali and Sunsari districts of Nepal

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ABSTRACT

For socio-economic assessment on wheat production, research was conducted from March to June, 2019 in two major wheat growing districts of Nepal, Kailai and sunsari. The primary information was collected by face to face interview using the pre-tested semi-structured interview schedule, two Key Informant Surveys were also done.In addition, the secondary information were collected from the review of related literatures. The survey areas were selected by consultating with Agriculture Knowledge Centre and agricultural officials of the local government; sample were selected by using simple random sampling. All total, 194 samples were selected for this study; the outliers and incomplete responses were omitted. The descriptive statistics revealed that Nepal 297 (66.16 %) has the highest area coverage in Sunsari while Gautam (36.50%) has the highest coverage in Kailali. Multiple regression model revealed that wheat cultivated area (p= 0.000), adoption of NARC released varieties (p= 0.000), gender of the household head (p= 0.017), age of the household head (p= 0.040), membership of organization (p= 0.094) and number of family members between age group 15 to 59 years (p= 0.085) have significant effect on wheat production. Furthermore, the unpaired t-test showed that the mean productivity of wheat in Kailali (2.99 t/ha) is significantly higher than that of Sunsari (2.81 t/ha) at 5% level of significance. To increase the wheat productivity, the concerned government agricultural institutions should: assure access to NARC released improved varieties, make policy to consolidate the fragmented land, encourage the economically active population and the household heads towards wheat production by providing the efficient technical and financial support.

Keywords: face to face interview, multiple regression, unpaired t-test , wheat productivity,

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INTRODUCTION

Wheat, which is the important staple crop of Nepal, stands third after rice and maize in terms of area. This crop, wheat, which is grown in the area of 735850 hectare in Nepal, is the world's most preferred staple crop. It is a good source of protein, minerals, dietary fiber and B group vitamins (Shewry, 2007; Kandel et al., 2018). The production of wheat in Nepal in the year 2016/17 was reported 1879191 metric ton (t) while the productivity 2554 kg/ha (MOAD, 2018). It has been reported that more than 80% of wheat is grown in rice-wheat cropping pattern; moreover, in the Nepalese agricultural context, it is a major winter cereal crop (Kandel et al., 2018). In Nepal, the agriculture sector, which contributes 27.6%. to the Gross Domestic Product (GDP) of the country is closely affected by the change in national wheat production.

After the semi-dwarf varieties were introduced from Mexico to Nepal, the wheat cultivated area and production as well has been increased in Nepal; it has a great contribution to national food supply indeed (Poudel et al., 2012; Pandey et al., 2019). Among the three ecological regions of Nepal, more than 60% of wheat is produced in the Terai region. Sunsari and Kailali are the major wheat growing terai districts in the eastern and far-western regions of Nepal. The total wheat growing area in Sunsari is 14500 hectare and that in Kailali is 34530 hectare. In addition, the production and productivity are reported 43800 t and 3021 kg/ha in Sunsari and 101863 t and 2950 kg/ha in Kailali respectively (MOAD, 2018). It has been reported that there is a huge gap between yield potential and average national productivity (Timsina et.al., 2019). The 'yield gap' which has been defined as the difference between the actual yields in a region and agro-climatically achievable yields in the same region (Shrestha and Subedi, 2019).

More than 40 improved varieties of wheat have been recommended by Nepal Agricultural Research Council (NARC) for different ecological zones; of them, 26 are for Terai and 17 for hills. (Timsina et. al., 2018). The wheat varieties, Nepal 297, UP262 and RR21 were developed before NARC establishment which are disease susceptible and have been less prioritized for seed production by the government; however, these varieties are yet common among the wheat growers of Nepal. The adoption of high yielding improved wheat varieties which are climate suitable and resistant to disease and drought could increase the national production and prodcutivity. Thakur et al. (2007) revealed that the adoption of improved technologies by the farmers have significant effect in rate of change in wheat productivity.

National Wheat Research Program (NWRP), NARC which is located in Bhairahawa, Rupandehi has released and recommended high yielding and disease resistant improved wheat varieties such as Gautam, Nepal 971, Vijay, Bhrikuti, Tilottama, Dhaulagiri, Aditya, WK1204, BL 1473, Danphe etc. As Terai is very important region for wheat production, it is very necessary to document the coverage of improved varieties in the major wheat growing districts of this region. Moreover, the estimation of production and productivity of wheat in terai region of Nepal, identifying the major factors affecting the production is needed to be done. Also, the comparision of productivity between two major wheat growing terai districts of Nepal need to be documented. In this respect, limited socio-economic assessment has been done. This research aims to address these research gaps.

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METHODOLOGY

Study area, sample size, and data collection technique

Sunsari and Kailali districts from eastern and far-western terai respectively were purposively selected for this study. The semi-structure pre-tested interview schedule was used to collect the primary information. Moreover, two Key Informant Surveys were also done. Furthermore, relevant books, reports, bulletins along with the scientific papers were reviewed for secondary information. The samples were selected using the simple random method; sampling was done within the selected representative areas that were identified in consultation with Agriculture Knowledge Centre (AKC) and agricultural officials of the local government. All total 194 samples, omitting the outliers and incomplete responses were taken for the statistical analysis.

Assessment of the factors affecting the wheat production

A multiple regression model was used to analyze the factors affecting wheat production. For this, different independent explanatory variables including adoption of NARC released varieties dummy were regressed on dependent variable, total wheat production. Adhikari et al. (2018) also used the multiple regression model to measure the impact of rainwater harvest technology on farm income. The multiple regression model specified in this study is,
Y (total wheat production) = f (adoption of NARC released varieties, wheat cultivated area, membership of the organization, consultation with agricultural technician, subsidy in inputs from the government, gender of the household head, total number of family members, number of family members between the age group 15 to 59, number of schooling years of the household head, age of the household head).
Also,

$LnY = \alpha 0 + \beta iXi + ei$
Where;
LnY = Total wheat production (in natural log form)
$\alpha 0$ = Constant
βi = Coefficient
Xi = Explanatory variables
ei = Error term

We assumed that the regressand, the dependent variable, total wheat production is affected by the regressors, the explanatory variables included in the model. The detailed explanation of variables, types of measures and their expected sign are presented in Table 1.

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Table 1. The statistical description of the dependent and explanatory variables used in the multiple regression model.

Variables	Description of variables	Value	Expected sign
	Dependent variable		
T_wheatprod	Total wheat production	Kilogram (kg)	
	Independent/Explanatory variables		
Adop_narcvar	Adoption of NARC released wheat varieties	If yes = 1,otherwise = 0 (Dummy)	+
Wheat_area	Wheat cultivated area	Kattha	+
Inv_org	Membership of any organization	If had membership = 1, otherwise = 0 (Dummy)	+
F_size	Total number of family members	Persons (in number)	+/-
Fsize_15-59	Number of family members of age group in between 15 to 59 years.	Persons (in number)	+
Edu	Number of schooling years of the household head	Years (in number)	+ /-
Gender	Gender of the household head	Male=1, otherwise = 0	+/-
Age	Age of the household head	Years (in number)	+/-
Consult_tech	Consultation with agricultural technician	If yes = 1, otherwise = 0 (Dummy)	+
Subsidy	Subsidy from the government in inputs	Yes=1, otherwise = 0	+

Mean comparison of wheat productivity in Kailali and Sunsari

Firstly, the variance ratio test was done to compare the variance of two samples. Timsina et al. (2016) also used two independent samples t- test to compare the yield of maize in Kavre and Lamjung districts of Nepal. In addition, Subedi et al. (2017) also used the unpaired t- test to compare the mean productivity of open-pollinated and hybrid maize varieties in Dang district of Nepal. After assurance of equal variance, the unpaired t test was used to compare the productivity of wheat in Kailali and Sunsari districts. The statistical software STATA IC 15 was used for data analysis.

RESULTS AND DISCUSSION

Varietal distribution

This study revealed that, in Sunsari district, cent percent farmers (100%) were cultivating the improved wheat varieties while in Kailali, more than ninenty percent (95.4%) were cultivating the improved varieties, 2.1% the local and 2.5% the Indian. The improved varieties found to be cultivated in the study area are Gautam, Vijay, Nepal 297 (NL 297), UP 262, BL 1022, NL 971, Aditya, Dhaulagiri etc. In Sunsari, NL 297 (66%) was found to have the highest area coverage followed by Vijay (26%); while in Kailali, the highest area coverage was of Gautam (37%) followed by Aditya (22%) and Vijay (18%). The coverage of major wheat varieties in Sunsari and Kailali is better illustrated in figure 1.

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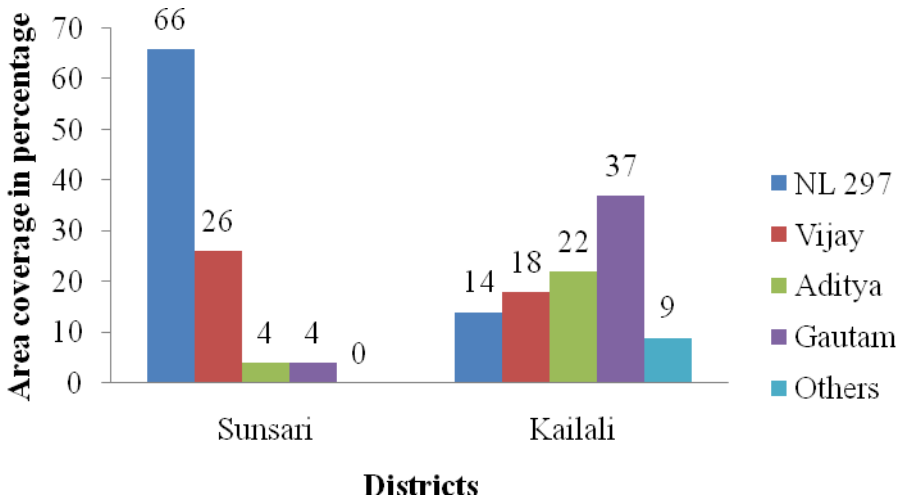

Figure 1. Area coverage of major wheat varieties in Sunsari and Kailali districts

Assessing the effect of socio-economic and farm characteristics on wheat production

A multiple regression model was used to analyze the effect of different explantory variables on total wheat production. Moreover, different socio-economic and household characteristics were regressed on total wheat production. The regression showed the value of the coefficient of multiple determination, R square (R^2) 0.96, which shows that 96% of the variation in the dependent variable, wheat production is explained by the explanatory or independent variables included in the multiple regression model. The F-statistics, F (10,183) = 436.28, Prob>F = 0.0000 shows the stability of the overall regression equation and joint significant at 1% level. The mean Variance Inflation Factor (VIF) is 1.40, and none of the variables had VIF higher than 2.4. It indicates that there is no such multicollinearity between the independent variables which could affect the interpretations that the model has revealed. The Breusch-Pagan test for heteroscedasticity showed a constant variance of errors, that shows the model has no heteroscedasticity. Also, the regression coefficient error test (RESET) confirms the model had no omitted variables The interpretation is shown in Table 2.

The regression model revealed that the adoption of NARC released wheat varieties positively and significantly affects the wheat production at 1% level of significance. The wheat production was 5% more for the farmers who had cultivated NARC released varieties as compared to the farmers who had cultivated otherwise. It is obvious that the adoption of the improved, disease resistant and high yielding improved varieties increases the total production and vice versa is also equally true. Subedi et al. (2017) revealed lack of availability of quality seeds and fertilizers as the first major problem associated with the maize production.

Similary, the wheat cultivated area was found to have significant and positive effect on total wheat production at 1% level of significance. With the increase in wheat cultivated area by unit percent, the wheat production also increases by the same percentage. Adhikari et al. (2018) also reported that the regression coefficient of the maize area was positive and statistically significant related to total maize production.

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Also, the age of the household head has positive and significant effect to wheat production at 5% level of significance. With the increase in age of the household head by one year, the wheat production increases by 1%. Subedi and Dhakal (2015) revealed that the age of the household head is positively related to the adoption of new agricultural technology; thus, adoption of the disease resistant, high yielding NARC released varieties could increase the total wheat production.

Unlike this, the wheat production in the male-headed households was 5% less than the female-headed households. This is found to be significant at 5% level. In the female headed their household, her participation in the agricultural trainings and discussions could contribute in agricultural production. Aregu et al. (2011) also reported, in the trainings related to the nursery management, fertilizer treatments and seed production, the government has encouraged women participation and gender inclusion.

In a like manner, the membership of the organization has negative and significant effect on wheat production at 10% level of significance. The wheat production is 2% less for the households who are the member of any organization as compared to those who aren't. This

household head or family members might be the member of non-agricultural orgazination where they might have been motivated to invest in non-agricultural business giving less time to agricultural activities. Moreover, Mignouna et al. (2011) also reported that the people learn and interact with each other if they belong to a social group which enhances idea and information exchange, making them learn about the benefits of usage of a new technology.

Furthermore, the model showed that the number of family members in between the age group 15 to 59 years has negative and significant effect on wheat production at 10% level of significance. The population belonging to the age group 15-59 years is considered as the economically active population by the Government of Nepal (CBS, 2012). The model revealed that if the number of family member of this age group increases by one, the wheat production decreases by 0.9%. However, Subedi et al. (2019) revealed that the number of family members involved in agriculture have significant and positive effect on adoption of improved varieties released after NARC establishment. This showed that the members of this age group are more likely to engage either in service, business or employed elsewhere other than agricultural production.

Table 2. Factors affecting the wheat production

Variables	Coefficients	Standard error	T value
Adop_narcvar	0.055***	0.013	4.10 (0.000)
Wheat_area	1.007***	0.015	65.24 (0.000)
Inv_org	-0.223*	0.013	-1.68 (0.094)
F_size	0.003	0.004	0.82 (0.413)
Fsize_15-59	-0.009*	0.005	-1.73 (0.085)
Edu	-0.0006	0.002	-0.39 (0.698)
Gender	-0.046**	0.019	-2.42 (0.017)
Age	0.001**	0.001	2.07 (0.040)
Consult_tech	0.015	0.016	0.94 (0.348)
Subsidy	-0.035	0.032	-1.08 (0.280)
Constant	1.953	0.040	48.66 (0.000)

**** Significant at 1% level ;** Significant at 5% level ; * Significant at 10% level*
Note: Figure in parentheses indicates P value.

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Summary Statistics	
Number of observation(N)	194
R square	0.9597
Adjusted R square	0.9575
F value	F(10, 183) = 436.28, Prob > F= 0.0000
Variance Inflation Factor (VIF)	1.40 (mean VIF)
Heteroscedasticity	Chi2 (1) = 0.20, prob> chi2 = 0.6559 (constant variance)
Model has no omitted variables (ovtest)	F(3, 180) = 1.20, Prob > F = 0.3099

Source: Field survey, 2019

Comparision of mean wheat productivity in Kailali and Sunsari

The two sample variance comparision test, F test, revealed, f= 0.999, Pr(F > f)= 0.499 and Pr(F < f)= 0.501 which showed that the two samples have equal variances. Now, the unpaired t test with equal variances was applied to compare the productivity means. The mean productivity of wheat in Kailali (2.99 t/ha) was found to be significantly higher than that of Sunsari (2.81 t/ha) at 5% level of significance (Table 3). The higher productivity in Kailali might be due to the highest coverage of recently released improved NARC variety, Gautam. Timsina et al. (2016) also used two independent samples t- test to compare the yield of maize in Kavre and Lamjung districts of Nepal, which revealed that the productivity of maize was significantly higher in kavre (4.63 t/ha) compared to lamjung (3.2 t/ha). In addition, Subedi et al. (2017) also used the unpaired t test to compare the mean productivity of hybrid and open pollinated maize varieties in Dang district of Nepal.

Table 3. Mean comparison of productivity of wheat in Kailali and Sunsari

Variables	Obs	Mean	Std. Err.	Std. Dev.	t value
Productivity of wheat in Kailali	92	2.986	.0626859	.6012625	2.081**
Productivity of wheat in Sunsari	100	2.805	.0601355	.6013547	
Combined	192	2.892	0.0437727	0.6065328	
Diff		.1808007	.0868671		

** Significant at 5% level *Source, Field survey, 2019*

CONCLUSIONS

The area coverage of the improved varieties was cent percent in Sunsari; NL 297 (66%) was found to have the highest area coverage among the improved varieties. However in Kailali, the area coverage of improved varieties was 95%, the highest area coverage was of Gautam (37%) among the improved ones. The mean productivity of wheat in Kailali (2.99 Mt./ha) was found to be significantly higher than that of Sunsari (2.81 Mt./ha) at 5% level of significance. The wheat productivity in Kailali might be higher due to the highest coverage of recently released improved NARC variety, Gautam. The farmers should be encouraged for cultivating by NARC released improved wheat varieties. Moreover, the household heads and the economically active family members should be provided with technical and financial support from the government to increase wheat production and productivity.

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Author contributions

S Subedi was the main investigator and the initiator of this research. D Devkota, M Kharel, S Gautam, B Sharma and BK Sapkota were responsible for literature search, data generation and drafting of the manuscript. S Subedi and YNG were responsible for overall study design and finalization of the manuscript. All authors read and approved the final manuscript.

Conflict of interest

The authors declare no conflicts of interest regarding publication of this manuscript

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