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ORIGINAL RESEARCH ARTICLE

Impact of agricultural subsidy on three cereal crops cultivated in Dailekh district, Nepal

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ABSTRACT

This study aimed to investigate the impact of agricultural subsidies on the three primary cereal crops—rice, maize, and wheat in Dailekh district of Karnali province, Nepal and to evaluate the current status of subsidies, their impact on agricultural cultivation, and the variables affecting their allocation. The data was collected through a scheduled of semi-structured surveys and interviews from Narayan municipality of Dailekh district. Data was collected from 100 respondents, among them 60 were subsidy recipients and 40 were non-recipient, using a random sampling technique. A logistic regression model was used to determine the main factors affecting access to subsidies, such as gender, cooperative membership, farm size, and educational attainment. The results showed that the cost NPR 12,283 (90.94$) and NPR 17,625 (130.49$) on land preparation for rice cultivation; NPR 2,737 (20.26$) NPR 9,973 (73.84$) on land preparation for maize cultivation, while NPR 7,010 (51.90$) and NPR 9,417 (69.72$) on land preparation for wheat cultivation was found to be significantly ($p<0.01$) different among the subsidy recipients and subsidy non-recipient's farmers, respectively. Similarly, cost of seeds of rice, maize and wheat was also found to be significantly ($p<0.05$) different between the subsidy recipients and subsidy non-recipient's farmers. The findings emphasize that targeted and effective subsidy programs should be required to increase the cereal production in Dailekh district of Nepal. Thus, policymakers should concentrate on enhancing marginalized farmer's access to subsidies, guaranteeing distribution transparency, and launching training programs in order to optimize the advantages of agricultural support programs.

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INTRODUCTION

Nepal is a small landlocked nation with a total size of 147,516 square kilometres, located between latitudes 26°22'N and 30° 27'N and longitudes 80°4'E and 88°12'E. Nepal had a diverse range of crop varieties and temperatures within a 200-kilometer radius from north to south. This presents Nepal's agricultural growth with both opportunities and challenges (MoALD, 2024). The majority of Nepalese agriculture is composed of paddy, maize, and wheat in terms of area and output and are crucial to the country's food and nutrition security. Due to government efforts in grain agriculture since the 1960s, yield, production, and area have all gradually increased. There aren't many studies that provide a broad picture of the growth and instability of cereal crops in this scenario, and figuring out why production has increased is equally crucial. Fertilizer, seed, and irrigation are necessary for efficient agricultural output. Beginning levels of subsidies in credit, fertilizer, and irrigation helped smallholders to adopt new technologies (Fan *et al.*, 2007). According to APP, approximately 50% of the increase in

output can be attributed to the increased use of fertilizer, while the National Seed Vision (2013-2025) claims that improved seed can contribute to a 20-30% increase in crop yield (GoP, 2013). In fiscal year 2022, Nepal had allocated the amount of NRS 55.97 billion while it increased to 58.98 billion for fiscal year 2023 (MoF, 2024). To ensure food security and boost agricultural productivity, government aims to provide farmers with high-quality inputs including seed, fertilizer and irrigation (MoALD, 2021). Nepal priorities subsidies in agriculture to boost production, ensure food security and reduce poverty (Timilsena, 2019). Dailekh is one of the 77 districts, which lies in hilly area of the Karnali Province. It is situated at coordinates of 28° 35' 00" N to 29° 08' 00" N Latitudes and 81° 25' 00" E to 81° 53' 00" E of Longitudes. The lowest elevation is 544m and the highest elevation is 4,168m. The headquarter is situated at an elevation of 1448m. The district has covered 80% of mid-hill land and 21% of high-hill land. The total area of the district is 1,505 sq. km. Major cereal crop production in this area is paddy, maize and wheat. Apart from this fruits like Mandarin, citrus and walnut and vegetables like potato, tomato are highly grown. In Dailekh, the yield of Rice, maize and wheat are 3.34, 2.21,1.16 Mt/ha, respectively (MoALD, 2024). Cereals are a crucial crop for reducing poverty and import dependency, and thus receive high priority in development interventions in Nepal.

Nepal's agricultural policies prioritize agricultural subsidies to improve agricultural production and productivity, improve food security, and reduce income poverty among smallholder farmer (Paudel & Crago, 2017). Such small farm-holders have a low purchasing power of inputs (Bista *et al.*, 2018) and cannot intensify the use of agricultural inputs on their own (Takeshima *et al.*, 2017). Shrestha (2021) reported that there has not been a proper utilization of Nepalese agricultural subsidies and small farmers are not being benefitted from such policies owing to lack of proper information and higher political influence. Therefore, this investigation was conducted to study the impact of agricultural subsidy on three cereal crops cultivation in Dailekh district, Nepal.

MATERIALS AND METHODS

The present study was conducted in Dailekh district of Karnali province, in wards 3, 6, and 10 of Narayan municipality which were chosen by using simple random technique. The data was collected through a scheduled of semi-structured surveys and interviews from Narayan municipality of Dailekh district of Karnali province of Nepal. Also, both the primary and secondary sources were used to acquire the data. During the study, 100 farmers out of 2,000 were selected as sample size among them, 40 were non-recipients of subsidies and 60 received subsidies. Semi- structured interviews, key informant interviews (KIIs) with agricultural officers, and focus group discussions (FGDs) with regional stakeholders were used to collect primary data. Secondary data was gathered from relevant publications, municipal records, reports from the Agricultural Development Office (ADO), and the Ministry of Agriculture and Livestock Development (MoALD). For statistical analysis, STATA 19 and Microsoft Excel 21 tools were used to process and analyze the data. The sociodemographic data were summarized using descriptive statistical tools, and the recipients and non-recipients of subsidies were compared using inferential statistical techniques such as t-tests and chi-square tests was performed to determine the significant difference between the different variables.

Logistic regression

In order to identify the main socioeconomic determinants affecting access to subsidies, logistic regression analysis was performed for data analysis and to determine the main factors affecting access to subsidies, such as gender, cooperative membership, farm size, and educational attainment. A binary logistic regression analysis (Tranmer & Elliot, 2016) was used to find out the odds of determinants of receiving subsidies. The following model was used to find the variables:

$$P(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ,..., + \beta_n X_n$$

Where; X 1, X 2,..., Xn are explanatory variables; β0, β1, β2, βη are unknown factors; and P (Y) represents the chance that Y will occur.

RESULTS AND DISCUSSION

Socio-demographic characteristics of sampled households

Table 1 illustrates the socio-demographic details of the respondents which contrasts those who received subsidies with non-receiver. During the study, data was gathered from 100 respondents, 60 of whom were subsidy recipients and 40 of whom were not. Although 51% of respondents were female and 49% of respondents were male, the gender distribution did not significantly affect the determination of subsidy status ($p = 0.14$). Analysis of the ethnic composition showed that 72.5% of non-recipients were from the Brahmin/Chhetri community, whereas 91.67% of subsidy recipients were. At the 5% level of significance, the chi-square test showed a significant correlation between ethnicity and subsidy status ($p = 0.03$). Though religion was not substantially correlated with subsidy status ($p = 0.44$), the bulk of respondents (78%), followed by Christians (21%), and Muslim (1%), were Hindu. Analysis of the age distribution classified into three groups: 16-24 years (10%), 25-40 years (44%) and above 40 years (46%), with no significant difference in age distribution between subsidy recipients and non-recipients ($p= 0.11$). Another important component that was examined was family size, which was divided into four groups: 2–4 members (18%), 5–8 members (48%), 9–12 members (17%), and more than 12 members (17%). At a 10% level of significance, the chi-square test showed a significant relationship between family size and subsidy status ($p = 0.06$). Four categories were created based on the respondents' farming experience: less than five years (13%), five to ten years (29%), ten to twenty years (28%), and more than twenty years (30%). Subsidy status was not

Table 1. Socio-demographic characteristics of study area.

Variables	Subsidy receivers	Subsidy non- receivers	Chi-square	P-value
Gender				
Male	33(55)	16(40)	2.1609	0.14
Female	27(45)	24(60)		
Ethnicity				
Brahmin	55(91.67)	29(72.50)		
Janajati	2(3.33)	2(5)	7.3413**	0.03
Other	3(5)	9(22.50)		
Religion				
Hindu	48(80)	30(75)		
Muslim	0(0)	1(2.50)	1.64	0.44
Christian	12(20)	9(22.50)		
Age group				
16-24	9(15)	1(2.50)		
25-40	26(43.33)	18(45)	4.37	0.11
>40 year	25(41.67)	21(52.50)		
Family-size				
2-4	7(11.67)	11(27.50)		
5-8	32(53.33)	16(40)	7.34*	0.06
9-12	8(13.33)	9(22.50)		
>12	13(21.67)	4(10)		
Experience				
<5 year	5(8.33)	8(20)		
5-10 year	19(31.67)	10(25)	3.0255	0.39
10-20 year	17(28.33)	11(27.50)		
>20	19(31.67)	11(27.50)		
Major source of income				
Remittance	6(10)	14(35)		
Agriculture	18(30)	17(42.50)		
Government job	19(31.67)	7(17.50)	17.3012***	0.00
Private job	17(28.33)	2(5)		

Note: ** and * indicate 5%, 10% level of significance.

Table 2. Comparative cost of cultivation of rice with subsidy status.

Parameters	Overall		Subsidy recipient		Subsidy non- recipient		Mean difference	t-value	p-value
	Mean	SD	Mean	SD	Mean	SD			
Land Preparation	14420	3687	12283	2643	17625	2528	5342	10.07***	0.00
Seed cost	3789	719	3660	258	3982	1072	322	2.23**	0.03
Labor cost	58444	5634	57500	3986	59860	7288	2360	2.08**	0.03
Fertilizer cost	21449	2344	21496	2353	21379	2359	-117	0.24	0.80
Irrigation cost	10606	51	10605	51	10608	51	3	0.32	0.74
Harvesting cost	26887	3255	26028	3568	28715	2191	2687	3.39***	0.00

Note: Sign ** and *** indicate 5% and 1% levels of significance.

significantly impacted by farming experience (p = 0.39). Agriculture was the primary source of income for 35% of respondents, followed by government jobs (26%), teaching (20%), and private jobs (19%). Nevertheless, there was a significant association between income sources and access to subsidies. Farmers who were reliant on agriculture were more likely to get subsidies, according to the chi-square test, which revealed a highly significant (p < 0.05) association between income source and subsidy status.

Comparative cost of rice cultivation

Table 2 shows the cost comparison of rice cultivation between recipients and non-recipients. According to the data, more than 80% of the overall cost in both categories is made up of labor, fertilizer, and land preparation costs. Recipients of subsidies paid substantially less for important input categories, especially seed and land preparation. Subsidy recipients spent an average of NPR 12,283 (90.94$) on land preparation for rice cultivation, while non-recipients spent NPR 17,625 (130.49$) for land preparation for rice cultivation, resulting in a mean difference of NPR 5,342 (t = 10.07, p < 0.01). With a significant mean difference of NPR 322 (t = 2.23, p = 0.027), the seed cost for subsidy recipients was NPR 3,660 (27.10$), while the cost for non-recipients was NPR 3,982 (29.48$). Additionally, subsidy recipients had lower labor costs (NPR 57,500) than non-recipients (NPR 59,860: 443.19$), with a mean difference of NPR 2,360 (t = 2.08, p = 0.03). There was no significant difference in fertilizer costs (t = 0.24, p = 0.80). While harvesting costs were significantly lower for subsidy beneficiaries (NPR 26,028 vs. NPR 28,715), with a mean difference of NPR 2,146 (t = 3.39, p = 0.001), the irrigation cost difference was statistically negligible (t = 0.32, p = 0.74). The findings of our study are in line with Bista *et al.* (2018) who recommended that fertilizer and seed subsidy can increase the productivity of rice in Nepal. Similarly, Shrestha (2021) suggested the agricultural subsidy policy for the sustainable production of rice crop in Nepal.

Table 3. Comparative cost of cultivation of maize with subsidy status.

Parameters	Overall		Subsidy receipt		Subsidy non recipient		Mean difference	t-value	p-value
	Mean	SD	Mean	SD	Mean	SD			
Land preparation	11068	2847	9973	2462	12710	2607	2737	5.31***	0.00
Seed	3970	504	3540	56.56	4400	141.42	860	7.98**	0.02
Labor cost	16846	3107	16926	3096	16727	3158	-199	-0.31	0.75
Fertilizer cost	15879	3340	15809	3416	15985	3265	176	0.25	0.79
Harvesting cost	6271	9175	4980	1442	8210	14288	3230	1.74*	0.08

Note: Sign *, ** and *** indicate 10%, 5% and 1% levels of significance.

Table 4. Comparative cost of wheat with subsidy status.

Parameters	Overall		Subsidy recipient		Subsidy non- recipient		Mean difference	t-value	p-value
	Mean	SD	Mean	SD	Mean	SD			
Land preparation	7973	2143	7010	1265	9417	2382	2407	6.56***	0.00
Seed cost	3938	1223	3571	1090	4487	1217	916	3.92***	0.00
Fertilizer cost	7671	450	7660	349	7688	575	28	0.302	0.76
Harvesting cost	7232	845	7225	814	7244	901	19	0.10	0.91

Note: Sign *** indicate 1% level of significance.

Comparative cost of maize cultivation

Table 3 illustrates the comparative cost of cultivation of maize. Land preparation, labor cost, and fertilizers were major cost components. Here, cost of cultivation subsidy recipient was lower than non-recipient. The mean difference between the amount spent by recipients and non-recipients on land preparation was NPR 2,737 ($t = 5.31$, $p < 0.01$), with recipients spending an average of NPR 9,973 (73.84$) and non-recipients NPR 12,710 (94.10$). Additionally, the mean difference in seed costs between subsidy recipients (NPR 3,540 or 2621$) and non-recipients (NPR 4,400 or 32.58$) was NPR 860 ($t = 7.98$, $p = 0.015$). There was only subtle difference in fertilizer costs across groups ($t = 0.25$, $p = 0.79$). Additionally, labor costs were comparable between groups ($t = -0.31$, $p = 0.75$). But for subsidy users, harvesting expenses were far lower, averaging NPR 4,979 as opposed to NPR 8,210 for non-recipients, with a mean difference of NPR 3,230 ($t = 1.74$, $p= 0.08$). The findings of our study are in agreement with Bista *et al.* (2018) who suggested that fertilizer and seed subsidy can enhance productivity of maize in Nepal. Similarly, Shrestha (2021) suggested the agricultural subsidy policy for the sustainable production of maize crop in Nepal.

Comparative cost of wheat cultivation

The cost comparison for cultivation of wheat is shown in Table 4. Subsidy recipients had much lower expenditures for land preparation, seeding, and harvesting, as was the case with other crops. Land preparation costs of wheat were NPR 7,010 (51.90$) on average for grantees and NPR 9,417 (69.72$) for non-recipients, with a significant mean difference of NPR 2,407 ($t = 6.56$, $p < 0.01$). The average difference between the cost of seeds for subsidy recipients and non-recipients was NPR 3,571 versus NPR 4,487 ($t = 3.92$, $p < 0.01$). Both group's fertilizer expenses were comparable ($t = 0.302$, $p = 0.76$). Similarly, there was no discernible difference in harvesting expenses ($t = 0.10$, $p = 0.91$). The findings of our study are in accordance with Bista *et al.* (2018) who reported the status of fertilizer and seed subsidy in Nepal. Similarly, Shrestha (2021) suggested the agricultural subsidy policy for the sustainable production of wheat crop in Nepal.

Determinants of farm subsidies access

The findings of a logistic regression study to determine the socio-oeconomic characteristics impacting access to subsidies are shown in Table 5. Gender, educational attainment, farm size, and cooperative participation are the main variables. The findings revealed that the respondents' age, religion, ethnicity, family size, access to mass media, area used for cereal crops, and experience were not statistically significant. The study revealed that if the respondents had got the higher education the probability of getting subsidy increase by 10.4% and was significant at 5% level of significance. These findings are in consistent with KC *et al.* (2021) who found that at least a few years of schooling completed by the farmers was helpful in implementing new technology in agriculture and if the respondents were female the probability of getting subsidy decreases by 14.4% and was significant at 5% level of significance. This finding is similar with work of Mignouna *et al.* (2011) that men have greater access to and control over essential production resources than women because of sociocultural norms and values, and that the head of the household makes the majority of the decisions. Farmers with large farms have a higher chance of receiving subsidies by 24.8%, while those who were members of farmers' organizations or cooperatives had a 19.1% higher chance and were positively correlated with receiving subsidies. According to KC *et al.* (2021), farmers with larger farms typically produce more marketable surplus, have the financial resources to invest in cutting-edge technologies, and are more willing to take on greater risks than those with smaller farms. According to Mwangi & Kariuki (2015), some agricultural technologies are classified as scale-dependent because of the substantial influence that farm size has on their adoption. Farmers who belonged to cooperatives were 19.1% more likely to get subsidies ($p < 0.01$), highlighting the significance of group involvement in mechanisms for policy-driven assistance. Similarly, Shrestha (2021) suggested the agricultural subsidy policy for the sustainable agricultural growth in Nepal.

Table 5. Determinants of farm subsidies access.

Variable	Coefficient	dy/dx	Standard error	P(z)
Gender	-2.17**	-0.14**	0.97	0.02
Age	1.13	0.07	0.83	0.17
Religion	-0.35	-0.02	0.61	0.56
Ethnicity	-0.11	-0.00	0.62	0.85
Family	0.45	0.03	0.43	0.29
Education	1.57**	0.10**	0.73	0.03
Cereal land	-0.49	-0.03	0.49	0.31
Experience	0.22	0.01	0.4	0.57
Large farm	3.74***	0.24***	1.18	0.00
Cooperatives	2.88***	0.19***	1.11	0.01
Access mass media	1.19	0.07	1.39	0.33

Statistics summary: N: 100; LR chi^2: 91.48; Prob>chi^2: 0.0000; Log likelihood: -21.56; Pesudo R^2: 0.6796; Note: ** and*** indicate significant at 5% and1% level of significance. dy/dx indicates marginal effect after logistic regression.

Conclusion

The study emphasizes how important agricultural subsidies are to improve the cultivation of cereal crops in Dailekh district, Nepal. Subsidies have greatly increased the economic feasibility of producing rice, maize, and wheat by lowering the expenses related to labour, seed purchases, and land preparation. The results showed that those who received subsidies gain from reduced production costs, which increases farming's profitability and sustainability. Additionally, a logistic regression study revealed that gender, farm size, cooperative membership, and educational attainment were important factors affecting the accessibility of subsidies. The probability of receiving subsidies rose with more education and cooperative involvement. This underscores the need for more inclusive and transparent subsidy allocation mechanisms to support to the marginalized groups of farmers. Policymakers should focus on increasing awareness, ensuring equitable distribution, and strengthening training programs to optimize subsidy utilization. In the long run, a balanced approach that fosters self-sufficiency while maintaining government support will be essential for sustainable agricultural development in Nepal. Also, agricultural subsidies are essential for bringing down the cost of producing cereal crops in Dailekh district. These findings highlight the necessity of focused subsidy initiatives that give marginalized farmers priority and increase the openness of subsidy allocation. Overall, while subsidies play a crucial role in supporting cereal crop production, a balanced strategy that fosters resilience and self- sufficiency in the agricultural sector will be vital for long-term success in Nepal.

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DECLARATIONS

Author contribution statement

Conceptualization: N.K. and S.M.D.; Methodology: N.K.; Software and validation: S.M.D., R.D. and P.B.; Formal analysis and investigation: N.K. and S.M.D.; Resources: R.D.; Data curation: N.K. and P.B.; Writing—original draft preparation: N.K.; Writing—review and editing: N.K; Visualization: R.D. and P.B.; Supervision: S.M.D.; Project administration: R.D. and P.B. All authors have read and agreed to the published version of the manuscript.

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