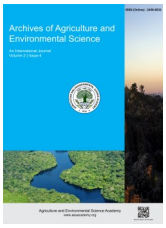
Archives of Agriculture and Environmental Science 11(1): 7-13 (2026)
https://doi.org/10.26832/24566632.2026.110102

e-ISSN: 2456-6632

This content is available online at AESA

Archives of Agriculture and Environmental Science

Journal homepage: journals.aesacademy.org/index.php/aaes



ORIGINAL RESEARCH ARTICLE

Impact of agricultural subsidy on maize farming in Rukum-west of Nepal

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ARTICLE HISTORY

Received: 25 December 2025
Revised received: 27 February 2026
Accepted: 07 March 2026

Keywords

Agricultural technologies
Maize productivity
Marginalized farmers
Subsidy receivers

ABSTRACT

This study was conducted to access the status, impact, and factors affecting access of agricultural subsidies among maize farmers in Rukum-west of Nepal. The data was collected from 92 farmers; 46 subsidy receivers and 46 subsidy non-receivers using purposive multi-stage sampling technique. The major determinants of subsidy access identified through logit regression model were found to be farm registration, training, and co-operative membership. This study revealed positive impact of subsidy in adoption of agricultural technologies like certified seeds and machinery and increase in maize cultivation area. Total cost of cultivation was found to be $163.58 (NRs 23773) for subsidy receivers and $179.27 (NRs 26054) for subsidy receivers significant at 1% with p- value 0.0004. Agricultural subsidy for maize farming was effective in reduction of cost of land preparation, sowing, and shelling was found significant with p- value 0.03, 0.04 and 0.003, respectively. Maize productivity and benefit-cost ration for subsidy receivers was found to be 2.64 t/ha and 1.49, respectively, which was higher compared to non-receivers found to be 2.41 t/ha and 1.21, respectively. Farmers ranked unfair distribution with index 0.74 as the major weakness in current subsidy model. This study suggests input subsidies as an important policy medium to increase maize yield and economic return, thereby contributing towards growing demand for food and feed. However, concerned policy makers should develop strategic transparent framework for subsidy distribution targeting youths and marginalized farmers to ensure long-term food security in the country.

Citation of this article: Dallakoti, A., Dhakal, A., Sapkota, D., & Ghimire, A. (2026). Impact of agricultural subsidy on maize farming in Rukum-west of Nepal. *Archives of Agriculture and Environmental Science*, *11*(1), 7-13, https://dx.doi.org/10.26832/24566632.2026.110102

INTRODUCTION

In Nepal, agriculture forms a significant part of the economy, providing employment opportunity to over two-thirds of the population. Agriculture contributes about 25.16% of national GDP (MOALD, 2022) enhancing food security, and uplifting rural livelihoods. However, agriculture in Nepal faces low productivity and profitability from subsistence farming, traditional methods, lack of modern technology, climate change impact and inadequate agriculture infrastructure, trapping small holder farmers in poverty (Yogi *et al.*, 2025). Due to these reasons Nepal's agriculture sector is not being able to transition towards commercial farming systems (Adhikari *et al.*, 2023). Maize (*Zea mays*) is the second most important staple crop in Nepal in terms of both area and production (MOALD 2023). The demand of maize for food, feed and fodder is increasing annually in Nepal (Timsina *et al.*, 2016; Ghimire *et al.*, 2018; Thapa, 2021). However, Nepal is highly dependent on imports to meet its increasing maize demand showing importance of commercializing domestic maize production to ensure food security (Joshi *et al.*, 2024). Despite having potential of high productivity and commercialization of Maize in Nepal, due to lack of labor, mechanization and infrastructure maize farming is limited to traditional farming practices (Neupane & Devkota, 2025). Agricultural input subsidies lower the price of agricultural inputs for low-income farmers fostering agricultural production, resource utilization, technology adoption and social protection (Ciaian & Swinnen, 2009; Kodmaya, 2011). However, respondents found

fertilizers subsidy had little impact on production of maize mostly because of poor extension services, inadequate distribution mechanism which are critical in achieving optimal utilization of fertilizer and inputs (Isaac *et al.*, 2019). The Nepalese government needs to develop and promote local hybrid maize varieties since the country is highly dependent on imported hybrid maize of Indian origin (Adhikari *et al.*, 2018). Subsidy can be major source to bridge such barriers of production. Maize production barriers can be overcome by using subsidies in conjunction with availability of low-interest loans to true farmers (Thapa, 2021). Existing studies in Nepal provide limited evidence on the impact of subsidies on maize cultivation and the socio-economic factors affecting access, particularly in rural hilly region. This study addresses this research gap by analyzing status, impact, and determinants of subsidy access among maize-farmers in Rukum-west of Nepal.

MATERIALS AND METHODS

Study area

The study was conducted in the Musikot Municipality-Ward no 10 and Triveini municipality- Ward no 11 in the maize block under Prime Minister Agriculture Modernization Project (PMAMP) Implementation Unit in Rukum-West, Nepal.

Sampling design and sample size

The respondents were selected using multi-stage sampling technique. Firstly, Maize block under PMAMP Implementation Unit Office, Rukum-West was taken. Then two municipalities were purposively selected due to their significance in maize farming and access to subsidy program within Rukum-West for maize farming. Subsequently, in the final stage using the same criteria, one ward was purposively chosen from each municipality. In the last stage farming households were selected from each ward using a simple random sampling technique. At first sampling frame of maize farmers was prepared by using various information such as key informants of the study areas and PMAMP. Consequently, due largely to barriers, a definite number of respondents were selected as representative sample of the whole population. The sample size is obtained from the sampling frame of 920 using thumb rule of ten percent.

Data collection

Primary data was collected using pre-tested semi-structured questionnaires, household survey, key informant interviews and focus group discussions, and secondary data from PMAMP, AKC, CBS, MOAD, NARC, journals and other reports. Data included social, economic, farm, institutional info, maize cost, return, marketing, subsidy type and use.

Data analysis

Data was analyzed for mean, median, mode, standard deviation using MS-Excel and SPSS. Independent sample t-test was used to compare the mean difference between subsidy receivers and non-receivers.

The formula used for t-test

$$t-test=\frac{\bar{x}_1-\bar{x}_2}{\sqrt{s^2(1/n_1+1/n_2)}}, s^2=\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}$$

(where pooled variance is used) (Field, 2018).

Chi-square test was conducted to examine association between categorical variables. The formula (McHugh, 2013) used was:

$$\chi^2=\sum(O-E)^2/E$$

For ranking different problems and factors, indexing method was used (Garrett, 1969).

$$I_{imp}=\sum S_i f_i/Na$$

To determine factors of receiving subsidy, binary logistic regression model was applied following (Tranmer & Elliot, 2016):
The logistic regression is:

$$f(x)=1/(1+e^{-(b_1x_1+b_2x_2+\ldots+b_nx_n)})$$

Qualitative data from interviews and FGDs were analyzed to support and check the survey results.

RESULTS AND DISCUSSION

Socio-economic and farm characteristics

The socio-demographic characteristics of farmers in the study area show some important information about subsidy access. Most of the household head were male (around 70%), and there was no big difference between subsidy receiver and non-receiver. This indicates that gender is not main factor for getting subsidy, even though male-headed household is still common in the area. This result is similar with other studies in Nepal, where subsidy program is mostly gender neutral (Thapa *et al.*, 2023). Income source was found significant with subsidy access ($p < 0.10$). Agriculture was main livelihood for most of the farmers (80.43%), but subsidy receiver farmers were more involved in government service as main income source (21.7%) compared to non-receiver (8.7%) (Table 1). This shows that farmers having stable or extra income source may have more chance to access subsidy. This may be because they have more connection with government office or more information about subsidy scheme. Similar result was reported by Panta *et al.* (2023), where farmers with off-farm income were more likely to receive subsidy. Ethnicity did not show significant relation with subsidy access. Most of the farmers, both subsidy receiver and non-receiver, belong to Chettri and Brahmin, which reflects the population of study area. This indicates that subsidy distribution is not biased by ethnicity. Thapa *et al.* (2023) also found that education and institutional factor were more important than ethnicity in subsidy access. Education level was significantly associated with subsidy receipt ($p < 0.05$). Among subsidy receiver, higher number of farmers had secondary level education, while large proportion of non-receiver farmers were illiterate (43.48%). This shows that education helps farmers to understand subsidy process, fill forms, and communicate with extension worker. Illiterate farmers may face difficulty in understanding procedure and infor-

mation related to subsidy, which reduce their chance to receive support. This finding is similar with earlier studies highlighting role of education in accessing agricultural program (Panta *et al.*, 2023; Thapa *et al.*, 2023). Religion was not significant factor for subsidy access, as almost all respondents were Hindu. This shows that religion does not influence subsidy distribution in the study area.

Socio-economic and farm characteristics

The mean and standard deviation of farmers Age was 48.23 and 13.19, respectively with mean difference 3.739 and t-value 1.365, which was not significant different with subsidy receivers and non- receivers. Table 2 shows the independent sample t-test conducted to compare the total land holding and subsidy receivers and non-receivers. The mean and standard deviation of land holding was 10.04 and 11.72, respectively with mean difference -4.56 and t-value -1.894, which was significant difference in receiving subsidy at 10% level of confidence. Table 2 also shows independent sample t-test conducted to compare maize land holding of farmers. The mean and standard deviation of maize land holding was 7.11 and 3.11, respectively, which was significant difference at 10% level of confidence. The mean and standard deviation of total members was 7.20 and 1.81, which was not significant with subsidy receivers and non-receivers. Whereas the mean and standard deviation of experience in farming was 32.43 and 12.39, respectively, which have no significant relation to receiving subsidy. Farmers with higher land holding were facilitated with subsidy for procurement of subsidy indicating necessity of providing targeted subsidies through proper institution formation to ensure subsidy to marginalized farmers (Dhakal *et al.*, 2022).

Determinants of farm subsidies access of maize-growers

Logit regression was used to analyze different socioeconomic and farm related factors affecting subsidy receiving by farmers. Explanatory variables such as gender, ethnicity, education, farm registration, training, etc. were selected based on previous studies related to assessment of government policies, farm subsidies and agricultural growth (Bhandari, 2023). The result shows that co-operative membership, training and farm registration were significant in this model. The study revealed that if respondents had membership in co-operatives, the probability of getting subsidy increased by 8.4% and it was significant at 1% level. Similarly, if respondents had received training, the probability of receiving subsidy increased by 17% and this was significant at 5% level of confidence (Table 3). Farm registration showed strong positive effect, where farmers who registered their farms increased the probability of receiving subsidy by 48% and were

Table 1. Socio-economic and farm characteristics.

Variable	Overall	Subsidy received Yes	Subsidy received No	Chi-square	p-value
Gender					
Male	64(69.7)	34(73.9)	30(65.2)	0.821	0.365
Female	28(30.4)	12(26.0)	16(34.7)		
Major source of income					
Agriculture	74(80.4)	33(71.7)	41(89.1)	7.436*	0.059
Government Service	14(15.2)	10(21.7)	04(8.70)		
Private Sector	01(01.0)	00 (00.0)	01(1.09)		
Others	03(03.2)	03 (6.52)	00(0)		
Ethnicity					
Brahmin	22(23.9)	10(21.7)	12(26.09)	0.539	0.910
Chettri	56(60.8)	29(63.0)	27(58.70)		
Dalit	07(07.6)	03(6.5)	04(8.70)		
Janjati	07(07.6)	04(8.7)	03(6.52)		
Religion					
Christian	01(1.09)	00(0.00)	01(2.17)	1.011	0.315
Hindu	91(98.9)	46(100)	45(97.83)		
Education					
Illiterate	30(32.6)	10(21.74)	20(43.48)	11.258**	0.024
Primary	29(31.5)	12(26.04)	17(36.96)		
Secondary	19(20.6)	14(30.43)	5(10.87)		
Plus-two	9(9.78)	6(13.04)	3(6.52)		
Bachelors	5(5.43)	4(8.70)	1(2.17)		

Table 2. Socio economic and farm characteristics.

Variable	Overall	Subsidy received YES	Subsidy received NO	mean diff	t-value	p-value
Age	48.23(13.19)	46.36(11.81)	50.10(14.32)	3.739	1.365	0.175
Total Land	10.04(11.72)	12.32(7.55)	7.76(3.05)	-4.56	-1.894*	0.0614
Maize Land	7.11(3.133)	7.71(3.45)	6.52(2.68)	-1.19	-1.850*	0.067
Total Members	7.20(1.81)	7.28(1.83)	7.13(1.808)	-0.15	-0.400	0.6896
Experience	32.43(12.39)	31.76(10.50)	33.10(14.10)	1.34	0.519	0.604

Table 3. Factors affecting access to subsidy.

Variables		Coefficient	Standard Error	P(z)	(dy /dx)
Gender		-0.62	0.82	0.450	-0.528
Ethnicity		0.354	0.52	0.503	0.03
Co-operative membership		0.99***	0.36	0.006	0.084***
Training		0.201**	0.99	0.043	0.171**
Farm-Registration		5.66***	1.25	0.000	0.48***
Loan for farming		0.41	0.83	0.615	00.07
_con		-5.8	1.94	0.003	
No of observation	92				
LR chi-square (6)	75.71				
Prob>chi-square	0				
Pseudo R square	0.59				

Table 4. Impact of subsidy in adoption of new technology.

Variable	Overall	Subsidy received Yes	Subsidy received No	Chi-square	p-value
Use of certified seed					
Yes	67(72.83)	46(100)	21(45.65)	34.328***	0
No	25(27.17)	00(00)	25(54.35)		
Use of machinery					
yes	43(46.74)	33(71.74)	10(21.74)	23.098***	0
no	49(53.26)	13(28.26)	36(78.26)		
Area expansion					
Yes	07(7.61)	06(13.04)	01(02.17)	3.8655**	0.049
No	85(92.39)	40(86.96)	45(97.83)		

positively associated with subsidy receiving. However, variables like gender, ethnicity and loan for farming were not statistically significant in this model. Farmers having registered farms have higher likelihood to obtain higher level of input subsidies (Bharati *et al.*, 2025). Identification of farmers through farm registration can even help to deliver subsides to targeted farmers (Zafar *et al.*, 2023). Training helps farmers to overcome barriers such as low awareness, due to which trained farmers have better information about available subsidy programs and this increases their chance of receiving subsidy. Trained farmers show higher adoption of introduced fertilization technologies (Karki *et al.*, 2025). Likewise, cooperative membership has positive impact on receiving subsidy, inputs and technical information, which highlights the advantage of being in organized groups for better resource distribution (Neupane *et al.*, 2022; Thapa *et al.*, 2023).

Impact of subsidy in adoption of new technology

A chi-square test was conducted to assess whether the use of certified seeds and machinery is significantly associated with receiving subsidies. In the overall sample, 72.83% of farmers reported using certified seeds, while 27.17% did not. Among subsidy receivers, 65% of farmers used certified seeds, while 54.35% did not. Among recipients, 100% of farmers reported using certified seed. The chi-square value for certified seed use is 34.328 with a p-value of 0.000, indicating that the association between certified seed use and subsidy receipt is statistically significant at the 1% level of confidence (Table 4). Subsidies like quality seeds, machineries, fertilizer have direct positive impact on adoption of technology (Chaulagain *et al.*, 2025). Supply of inputs such as fertilizer and improved seeds through subsidy programs have positive impact on adoption, production, and productivity of crops (Bista *et al.*, 2016; Kumar *et al.*, 2020). A study conducted by Plute Institute to evaluate Nepal's Seed Subsidy Program (SSP) had found that the seed subsidies resulted in higher rate of adoption of improved subsidy among rice farmers, that contributed in increasing production and thus ensuring food security (Dame, 2024). Famers with access to subsidy had higher rate of adoption of machinery such as tractors, cultivators, mills and sprayers (Dhakal *et al.*, 2024). In the overall sample, only 7.61% of farmers reported expanding their farm area, while 92.39% did not expand. Among farmers who received subsidies, only 13.04% reported expanding their farm area, while the vast majority (86.96%) did not expand. Among subsidy non-recipients 2.17% of farmers who did not receive subsidies reported expanding their farm area, while 97.83% did not expand. The chi-square value for this comparison is 3.8655, with a p-value of 0.049, indicating that the association between farm expansion and receiving subsidies is statistically significant at the 5% level of confidence. Insurance subsidy increased farm crop acreage among farmers in the US indicating a positive relation between farming area expansion area and subsidy. 10% percentage increase in subsidy increased crop area by 0.43% (Si *et al.*, 2023)

Impact of subsidy on cost of production

Table 5 shows that the cost of land preparation, labor wage and fertilizer together cover more than 80% of the total cost for both subsidy receivers and non-receivers. Likewise, seed cost was found to be lower for subsidy receiving farmers compared to non-receivers. The cost of land preparation was significantly lower for subsidy receivers at 1% level of significance, sowing

Table 5. Impact of subsidy on cost of production.

Variable	Overall		Subsidy-received Yes		Subsidy-received No		Mean Diff	% share (Overall)	t-value	p-value
	Mean	SD	Mean	SD	Mean	SD				
Seed	1363	598	1262	426	1462	721	199.34	5.46	1.61	0.11
FYM	4376	686	4359	686	4329	614	33.49	17.56	0.246	0.80
Chemical	429	366	476	446	381	384	-94.34	1.72	0.219	0.29
Land Preparation	3789	2668	2828	3202	4751	1499	1922	15.21	3.68***	0.04
Sowing	1414	603	1283	446	1545	707	262	5.67	2.12**	0.03
Labor	11634	609	11788	732	11481	406	-307	46.7	-2.48**	0.01
Shelling	1907	440	1774	468	2040	369	265	7.65	3.02***	0.003
TVC	24913	3159	23773	3602	26054	2133	2280	100	3.69	0.004

Table 6. Impact of subsidy on productivity and BC ratio.

Variable	Overall		Subsidy received Yes		Subsidy received No		Mean Diff	t-value	p-value
	Mean	SD	Mean	SD	Mean	SD			
Productivity	2.52	0.53	2.64	0.31	2.41	0.655	-0.22	-2.1**	0.0385
BC	1.35	0.41	1.49	0.42	1.21	0.32	-0.281	-3.64***	0.0004

Table 7. Ranking of weakness in current subsidy model.

Score	1	0.8	0.6	0.4	0.2	Index	Rank
Weakness in current Subsidy Model							
Lengthy Process	4	2	21	36	28	0.41	V
Poor Monitoring	9	15	20	38	10	0.54	IV
Lack of Demand	24	27	15	15	22	0.7	II
Unfair Distribution	38	13	26	8	7	0.74	I
Communication Gap	16	36	10	7	23	0.63	III

cost at 5% level, and shelling cost at 1% level was also significantly lower for subsidy receivers. However, labor cost was significantly higher for subsidy receiving farmers. In both subsidy receiving and non-subsidy receiving categories, labor cost remained one of the most important components while analyzing total variable cost. The average labor cost per hectare for farmers who received subsidy was higher at 11,788 compared to those who did not receive subsidy at 11,481. In contrast, subsidy reduced the cost of land preparation by 1,922 units less (p = 0.0004) and shelling by 265 units less (p = 0.0033), but it did not reduce labor cost. Labor still remained the largest single cost component, sharing 46.7% of total variable cost. Similarly, Khatri *et al.* (2025) found in Dailekh that subsidy helped to reduce cost of cultivation of maize. Other costs can be reduced by subsidy, but labor cost itself is not reduced and therefore remains high overall and relatively more for farmers receiving subsidy. Due to provision of machinery subsidy such as power tiller, jaff planter and corn Sheller, subsidy programs were effective in reducing cost of land preparation, sowing and shelling for subsidy receivers compared to non-receivers. This finding is in agreement with Dlamini *et al.* (2019), who reported that subsidies had positive impact on maize productivity by increasing use of subsidized inputs, which directly reduced cost and risk of cultivation.

Impact of subsidy in productivity and BC ratio

The average production the subsidy receivers was 2.64 metric ton/hectare, which was statistically higher than average production the subsidy non-receivers 2.42 metric ton/hectare. Similarly, the average BC ration of subsidy receivers was found to be 1.49, which was statistically higher than the average BC ratio of subsidy non-receivers. The overall production and BC ratio was found to be 2.52 metric ton/ hectare and 1.35, respectively (Table 6). Similar finding was found in Dang district where it was found that government subsidies on improved maize varieties led to significantly higher productivity (2.28 t/ha) compared to local varieties (1.74tha), with 85% of subsidized seed users adopting them and hence increasing overall production (Subedi *et al.*, 2017). In a 2020 study in Rukum-West district found that maize seed production under subsidy-like conditions yielded higher benefit-cost ratios (1.47) than grain production (1.14) (Chhetri *et al.*, 2024). Similarly, Chaulagain *et al.* (2025) found subsidy aids in increasing yield and profitability.

Ranking of weakness in current subsidy model

The table 7 portrays vital gaps in the current subsidy model, which are ranked according to their index value and score across criteria. Unfair Distribution is the first concern which highlights the current subsidy model is an important constraint Index = 0.74, Rank I. Subsidy program in Nepal fails to meet farmers demand due to ineffective distribution system (Gautam *et al.*, 2022). Lack of Demand-Driven Subsidy is in second position: Index = 0.707, Rank II, indicating that the subsidy model is not properly aligned with the requirements of the beneficiaries. Other significant issues are "Communication Gap" at Rank III and Index of 0.633 and "Poor Monitoring" at Rank IV and an Index of 0.546. The least impacting weakness refers to "Lengthy Process," Rank V, Index = 0.415, although this, too, is a weakness. These insights thus help in prioritizing areas of improvement in the subsidy model.

Conclusion

In the study area, subsidy has been effective to increase adoption of agriculture technologies which contributed to increase in maize cultivation area among subsidy-receivers compared to past years. Logit regression results showed that co-operative members, training recipient, farm registered farmers have greater access to agricultural subsidy. Due to availability of subsidized machineries and certified seeds, the cost of production of land preparation, sowing, shelling and thus total cost of production have been reduced and productivity has increased, resulting in increased production and profitability of farmers. However, due to unfair distribution system, marginalized farmers are still not benefited properly through such subsidy programs. Agricultural policy that ensures unbiased and equal distribution of agricultural subsidy to real farmers should be formulated and implemented for poverty alleviation, productivity enhancement, long-term commercial production.

DECLARATIONS

Author contribution statement: Conceptualization: AD^1 AD^2.; Methodology: AD^1; Software and validation: AD^1, DS. and Z.Z.; Formal analysis and investigation: AD^2, AG.; Resources: AD; Data curation: AD^1 DS AG; Writing—original draft preparation: AD^1; Writing—review and editing: AD^2, DS, AG; Visualization: AD^1; Supervision, Project administration: AD^1; Funding acquisition: DS. All authors have read and agreed to the published version of the manuscript.

Conflicts of interest: The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

Ethics approval: This study did not involve any animal or human participant and thus ethical approval was not applicable.

Consent for publication: All co-authors gave their consent to publish this paper in AAES.

Data availability: The data that support the findings of this study are available on request from the corresponding author.

Supplementary data: No supplementary data is available for the paper.

Funding statement: Not applicable.

Additional information: No additional information is available for this paper.

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