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Pesticide Purchase Behavior and Its Determinants Among Vegetable Farmers in Ghorahi, Dang

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Abstract

Pesticides are essential for safeguarding crops both in the field and during storage purpose in Nepal. This study investigated vegetable growers' purchasing habits and the factors that influence their purchasing behavior among vegetable farmers in Ghorahi, Dang. A semi-structured interview schedule was used to interview 92 farmers who were chosen by simple random sampling. The results indicated majority of the vegetable growers i.e. 90.2% purchased pesticide from Agro-vet stores or pesticide retailers. Among the pesticides, the most often used pesticide was insecticide, which was followed by herbicides, fungicides, rodenticides, and nematicides. The most significant issue of farmers regarding pesticide purchase was lack of knowledge of farmers in choosing the right pesticides for their target pests, followed by the high cost of insecticides and the absence of sustainable substitutes like bio-pesticides. Retailer recommendations, prior experience, cost, simplicity of use, and brand trust were important factors affecting purchase decisions. Improving farmers' purchasing decisions requires targeted training and awareness initiatives, cooperation between farmers, retailers, cooperatives, and governmental organizations, as well as suitable guidance.

Keywords: Agro-vet, Bio- pesticide, Brand trust, Retailer recommendation, Target pests

Introduction

Agriculture remains to be an important component of Nepal's economy and it contributes 23.9% to the nation's GDP (MoALD, 2022). However, the agriculture sector is still dominated by subsistence farming, which has a negative effect on agricultural output and productivity (MoF, 2022). Out of total land area, 3,091 ha are under cultivation while, 1,060 ha are cultivable but currently uncultivated and 60.4% of the population are involved in agriculture (MoALD, 2022). Even though significant portion of the population are engaged in agriculture, Nepal imports a significant number of agricultural products and inputs from other nations for daily use such as food grains, potatoes, edible oils, spices, fruits and vegetables, and pesticides (Regmi & Naharki, 2020;

Ghimire & GC, 2018). Pesticides are crucial in vegetable farming as they help in controlling weeds, fungus, insect pests, and other harmful organisms and thereby increasing the yield (Vasoya et al., 2023). The different types of pesticides include herbicides, insecticides, fungicides, rodenticides, and nematicides. Among these, insecticides are mostly used in agriculture purposes (Humagain et al., 2024). Several studies conducted in Nepal clearly demonstrate that pests are accountable for over 50%, or perhaps even more, of crop damage (Joshi et al., 2022). Although, the need for agricultural products has increased due to population growth, but food security is seriously threatened by losses imposed due to pest infestations (Baral & Gyawali, 2025). Moreover, their indiscriminate use has led to environmental contamination and serious health risks (Paudel et al., 2020). Approximately 500,000 to 1 million individuals are poisoned by pesticides annually, and between 5,000 to 20,000 people are probably dying because of the poisoning (Khanal et al., 2025). Agricultural chemicals are used by farmers in underdeveloped nations with minimal protection and few opportunities to improve their safety (Karki et al., 2025).

Application of pesticides in vegetable cultivation in Nepal is extremely high and in increasing trend (Kalauni and Joshi, 2019). The usage of pesticides has been increasing at an annual rate of 10% to 20% due to the introduction of high-yielding crop types and the growing emphasis on vegetable farming (Vaidya et al., 2017). Concerns about the overuse of pesticides in vegetable cultivation and their possible health hazards and threat to the environment are becoming more prevalent in Nepal (Atreya et al., 2011; Sai et al., 2019). Low educational attainment, lack of information about safe handling procedures, and a lack of awareness of pesticide consequences are the factors contributing to this situation (Benaboud et al., 2021). Government policies are crucial in controlling the use of pesticides but Nepal's regulatory structure is still inadequate in terms of execution and inspection (Sharma et al., 2021).

The activities that farmers conduct while purchasing agrochemicals are referred to as purchasing behavior. It is assessed by investigating where farmers get the information needed to buy agrochemicals, fertilizers, pesticides, and other chemicals, and what factors influenced their decision to buy agrochemicals (Sharma et al., 2020). Farmers must have proper knowledge of the product and its usages, like right pesticide, right time of usage and the right method of spraying etc. to achieve high yields without crop losses. Therefore, farmers' buying decision of pesticides is very important for better crop production (Sreekanth, 2018). Marketers need to understand who actually makes the purchasing decisions and what factors affect their decision. They should also continuously monitor the kinds of purchases made and the processes that customers take in a social unit's decision-making process (Thangasamy and Patrikar, 2014). Product knowledge is significant influencer; customers frequently require vital product-related information before making a purchase (Kaldeen, 2019). Generally, local dealers, peer group, extension officials, sales personnel of different pesticide firms, scientists, mass media etc, are the source of information for the usage of pesticides and their application (Muduli et al., 2024).

Numerous studies have investigated pesticide use in Nepal; however, limited focus on understanding the pesticide purchase behavior of farmers is observed, which directly affects how pesticides are purchased and used (Giri et al., 2014). Purchasing decisions are influenced by factors such as farmer's education, perception of risk, market access, advice from agro-vets or dealers and brand reputation (Sharma et al., 2020; Ntow, 2006; Ali et al., 2018; Police et al., 2024). Ghorahi,

Dang was chosen for this study because it is one of the main vegetable-producing hubs of inner terai regions, where substantial vegetable farming frequently results in the massive use of pesticides. Vegetable growers in this region have a wide range of socioeconomic characteristics including income, farm size, and educational attainment, as well as strong interactions with organizations including extension agencies, cooperatives, and agro-vets. These situations assure significant compatibility with the study's main concern by offering an appropriate environment for examining the behavioral, socioeconomic, and institutional factors impacting pesticide purchase decisions. Findings will help to generate evidence for designing effective policies and interventions that promote safe and sustainable pesticide use.

Materials and Methods

Description of study area

Dang is one of the districts of Lumbini province, located in the inner terai region of Nepal. It lies on a latitude of 28.0° N and a longitude of 82.15° E. It covers an area of 2,955 km² and has a population of 6,74,993 (Central Bureau of Statistics [CBS], 2021). It consists of two sub-metropolitan cities and eight municipalities.

Sample size and sampling techniques

The study targeted vegetable-growing farmers within Ghorahi Sub-Metropolitan City, Dang, which comprises 19 wards. Wards 2, 3, and 18 were purposively selected based on their significant vegetable production areas and the substantial number of vegetable farmers. These wards collectively have an estimated 1,740 vegetable farmers according to data provided by the Agriculture Knowledge Center (AKC), Ghorahi. Using Rao soft at a 95% confidence level with a 10% margin of error, the sample size was calculated to be 92 by using simple random sampling method. A 10% margin of error was found adequate due to the exploratory nature of the study, a limited sampling frame, and practical limitations including time, resources, and respondent accessibility.

Data collection methods

The primary data for this study were collected directly from farmers through a semi-structured interview schedule. Pre-testing was done to evaluate the validity and efficacy of the interview schedule prior to the primary data collection. Secondary information was collected by reviewing different publications, reports, and related research papers from the government, non-government organizations, including MoALD, and AKC, Ghorahi.

Data analysis techniques

The collected data were entered, coded, and analyzed using Microsoft Excel and the Statistical Package for Social Science (SPSS) version 27. Descriptive statistical tools such as frequency, percentage, mean, and scaling technique were employed. Similarly, forced ranking analysis was done to investigate the types of pesticides used and purchasing-related problems. Respondents were asked to rank their preferences and constraints on a five-point scale, and an importance index (I_{imp}) was calculated using the formula, as applied by (Subedi et al., 2019).

I_{imp}= ∑ Si*Fi / N
I_{imp} = Index value of importance
∑= Summation
S i = Scale value of i th intensity
F i = Frequency of i th response
N = Total number of respondents

Results and Discussion

Socio-demographic characteristics of respondents

Majority of the respondents (60.9%) were male and 39.1% were female and average age of respondents was found to be 45.32 years. While average family size of the households was found to be 5.23, which was higher than the national average family size of 3.53 (CBS, 2021). Majority of the respondents were found to be Janajati (41.3%), followed by Brahmin (28.3%), Chhetri (25%), and Dalit (5.4%). Hinduism (79.3%) and Christianity (20.7%) were the major religions followed by the respondents of the study area. Regarding the educational status of the respondents, about 14.13% of the respondents were illiterate, and 29.34% were literate. The majority of them (36.95%) had attained education up to primary level, and only a smaller proportion (10.86%) had attained secondary level education, and 8.72% have attained higher level education. 82.6% of respondents were engaged in agriculture, followed by service (9.8%), foreign employment (4.3%), and business (3.3%). 51.1% of respondents had more than 10 years of experience of pesticide application. 32.6% of respondents have 5-10 years of experience of pesticide application. Only a few proportion (16.3%) of respondents had less than 5 years of experience of pesticide application as shown in Table 1.

Table 1
Socio-demographic and farming characteristics of surveyed vegetable farmers

Variable	Frequency	Percentage
Gender		
Male	56	60.9
Female	36	39.1
Ethnicity		
Brahmin	26	28.3
Chhetri	23	25
Dalit	5	5.4
Janajati	38	41.3
Religion		
Hindu	73	79.3
Christian	19	20.7
Educational Status		
Illiterate	13	14.13
Literate	27	29.34

Primary Level	34	36.95
Secondary Level	10	10.86
Higher Level	8	8.72
Occupational Status		
Agriculture	76	82.6
Foreign Employment	4	4.3
Service	9	9.8
Business	3	3.3
Pesticide Application Experience		
<5 Years	15	16.3
5-10 Years	30	32.6
>10 Years	47	51.1

Figure1

Major vegetables highly exposed to pesticides

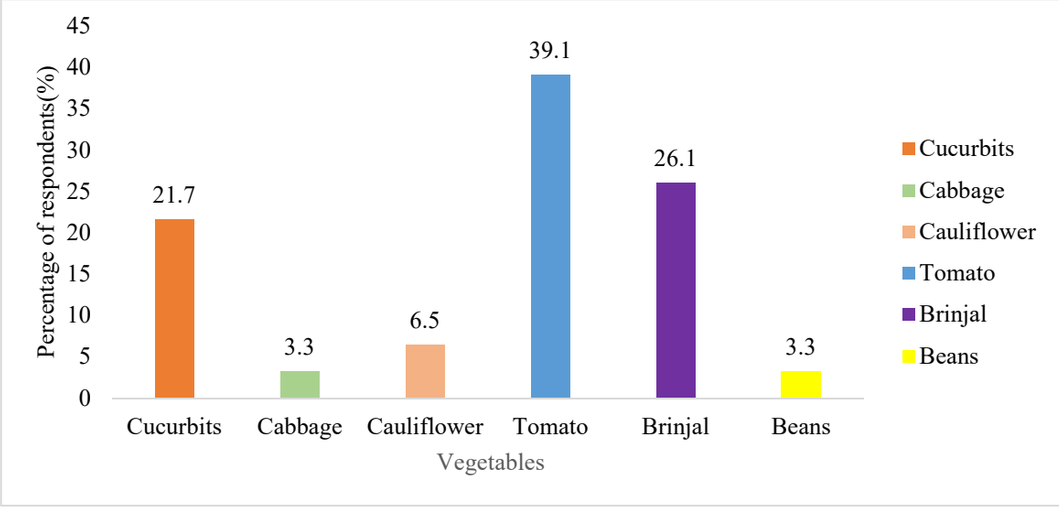

Figure 1 indicates that 39.1% of respondents experienced tomato as the most pesticide-exposed vegetable. This finding aligns with Bhandari et al. (2020), who reported higher residues of pesticides in tomatoes than other vegetable crops. Similarly, 26.1 % of respondents identified brinjal, 21.7% cucurbits, and 6.5 % cauliflower as highly exposed vegetables to pesticides. A small proportion of respondents (3.3%) reported low pesticide exposure in beans and cabbage.

Figure 2
Pest occurrence frequency in the study area

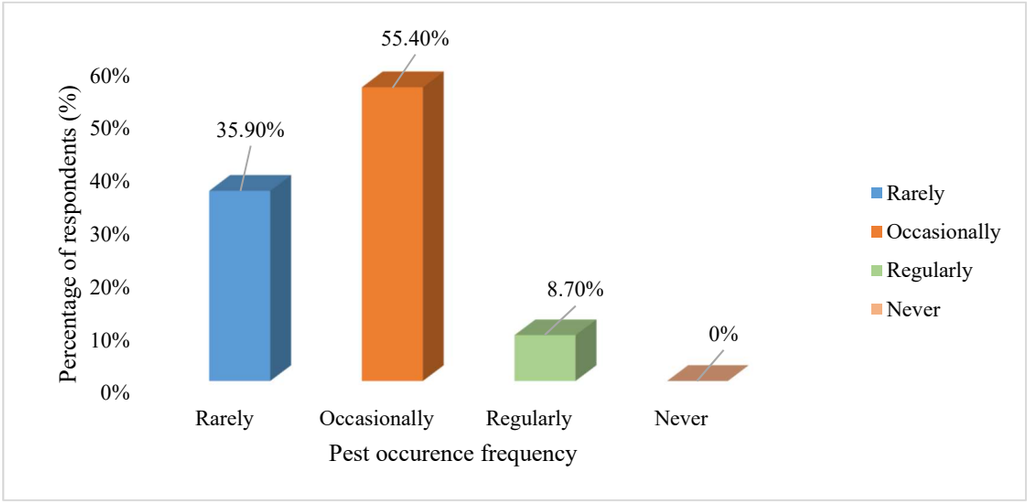

Figure 2, illustrates that the majority of respondents (55.4%) encountered the problem of pest occurrence occasionally. Likewise, 35.9% of respondents experienced pest problems rarely, and only a few of them (8.7%) faced the problem regularly. These findings are consistent with previous studies done by Parajuli et al. (2023) and Thapa et al. (2020) which documented that pest occurrence is a serious challenge for vegetable farmers in Nepal.

Types of pesticides purchased by the farmers

Insecticide was the most used pesticide with an index value of 0.90, as insect was the major cause of crop damage in the study area. Fungicides were the second most used, with an index value of 0.85, followed by rodenticide (0.50) and nematicide (0.48). Similarly, herbicide was the least used with an index value of 0.36. This finding is in line with the findings of Bhandari et al. (2020), who stated that insecticides predominated as pesticides because farmers believed insect pests posed the greatest harms to vegetable crops in study area.

Table 2
Type of pesticides purchased

Descriptive	Index Value	Rank
Insecticides	0.90	I
Fungicides	0.85	II
Rodenticides	0.50	III
Nematicides	0.48	IV
Herbicides	0.36	V

Source of pesticide purchase

Farmers' main source of pesticide purchase was Agro-vet stores or pesticide sellers (90.2%). These stores offered a variety of goods as well as suggestion and guidance on safety, brand, and efficacy. Gyawali et al. (2021) supported the finding, pointing out that because of their accessibility and wide range of services, Agro-vet stores and pesticide dealers are farmers' main sources of knowledge on pesticides. None of the respondents purchased pesticides solely from the agriculture co-operative, mainly due to limited availability and limited product choices during the application period. Only a smaller proportion (9.8%) of respondents obtained pesticides from both sources.

Table 3

Source of pesticide purchase

Source of buying pesticides	Frequency	Percent
Agro-vet/pesticide retailer	83	90.2
Agriculture co-operative	0	0
Both	9	9.8
Total	92	100.0

Timing of pesticide purchase

Among the respondents surveyed, 52.2 % purchased pesticides before the incidence of insect attack. Farmers bear additional costs when they apply pesticides before pests appear which reduces their profit (Hoy et al., 2015). Similarly, 26.1 % of respondents applied pesticides at the time of the incidence of insect attack. While the remaining 21.7 % of respondents applied after experiencing some crop loss. Many farmers tend to apply pesticides on a calendar basis or as a precautionary measure rather than relying on actual pest monitoring (Koirala et al., 2019).

Table 4

Timing of pesticide purchase

Timing of pesticide purchase	Frequency	Percent
Before the incidence of insect attack	48	52.2
Time of incidence of insect attack	24	26.1
After a certain loss	20	21.7
Total	92	100.0

Source of information for pesticide use

Farmers often rely on various sources of information to guide their pest use decisions. Majority of the respondents (34.8%) obtained information from pesticide retailers. This showed there was a great influence of agro-vet and pesticides retailers on pest control decisions in the study area, which is similar to the study of (Rijal et al., 2018). 20.7% of farmers reported relying on their own experience when making decisions about pesticide use which is in line with the findings of Desye et al. (2024), who found that farmers in developing countries frequently depend on their experience in determining pesticide application practices. Similarly, 18.5% information was

obtained from the progressive farmers, while 17.4% obtained advice from the agriculture cooperatives. The remaining 8.7 % of respondents accessed information from the agriculture office.

Table 5
Source of information for pesticide use

Source of information	Frequency	Percent
Self-decision	19	20.7
Progressive Farmer	17	18.5
Agriculture co-operative	16	17.4
Pesticide Retailer	32	34.8
Agriculture Office	8	8.7
Total	92	100.0

Farmers' Awareness and Practices During Pesticide Purchase

43.48% respondents always checked the manufacturer's date and expiry date before purchasing pesticides, while 95.65% respondents always checked whether the bottle was properly sealed or not. Only 21.74% of the respondents always examined the pesticide label. Limited attention to label information is consistent with findings of Jallow et al. (2017) who reported farmers often neglect or fail to understand labels due to language barriers, technical complexity, and lack of training. Furthermore, 32.61% respondents always checked the specified waiting period, and 10.87% respondents always checked the pesticides toxicity level. The majority of respondents (89.13%) never checked the toxicity information, despite the associated health and environmental risks which is similar to the findings of Jyoti et al. (2023).

Table 6
Farmers' Awareness and Practices in Pesticide Purchase

Description	Always	Sometimes	Never
Check the manufacture date and expiry date	40 (43.48%)	10 (10.87%)	42 (45.65%)
Check whether the bottle is sealed	88 (95.65%)	0 (0%)	4 (4.35%)
Check the labels of the pesticide	20 (21.74%)	10 (10.87%)	62 (67.39%)
Check the indication about the waiting period	30 (32.61%)	17 (19.57%)	45 (48.91%)
Check the toxicity level of the pesticide	10 (10.87%)	0 (0%0	82 (89.13%)

Determinants of Farmers' Pesticide Purchase Decisions

Table 7 presents the factors influencing pesticide purchasing decisions of farmers. Recommendations from pesticide retailer (28.3%) was the major factor affecting pesticide purchase decision of farmers. This finding aligns with Maharjan et al. (2020) and Schreinemachers et al. (2017) who stated that farmers rely heavily on agro-vets or local retailers for advice, and such recommendations strongly influence pesticide choice. Similarly, second major detereminant of pesticide purchase decision was found to be the previous experience of farmers (25%) which is in

line with the finding of Damalas and Koutroubas (2017) and Atreya et al. (2022) who revealed farmers' preference for products that they have previously used successfully, which reduces perceived risk and increases confidence in efficacy. The cost of pesticides was another important determinant (15.2%), as high prices can limit farmers' ability to purchase preferred products, often leading them to select cheaper or lower-quality alternatives (Wilson & Tisdell, 2001; Atreya et al., 2022). Other factors identified were ease of application (14.1%), trust in the manufacturer's brand (13%), and concern for environmental safety and health (4.3%). Although these factors were not as frequently highlighted, prior research suggests that ease of use, brand familiarity, and safety awareness may still influence farmers' decision-making (Damalas & Koutroubas, 2017; Pretty & Bharucha, 2015; FAO, 2020).

Table 7

Determinants of Farmers' Pesticide Purchase Decisions

Determinants of Farmers' Pesticide Purchase Decisions	**Frequency**	**Percent**
Cost of pesticide	14	15.2
Ease of application	13	14.1
Safety (Health and Environment)	4	4.3
Past Experience	23	25.0
Pesticide retailer's recommendation	26	28.3
Trust in manufacturer's brand	12	13
Total	92	100.0

Problem faced during pesticide purchase

The main issues farmers encounter while purchasing pesticides are highlighted in Table 8. With an index value of 0.65, the main problem was inadequate understanding about the selection of suitable pesticides for target pests followed by higher cost of pesticides (0.60). This result is consistent with Atreya et al. (2022), who revealed that low literacy, poor extension services, and insufficient training hinder farmers' capacity to recognize pests and choose appropriate pesticides, which results in incorrect application. Wilson and Tisdell's (2001) further supported the finding and claimed increased input costs had a major impact on the procurement of pesticides. Lack of sustainable alternatives such as bio-pesticides (0.58) was another important challenge. Despite their ecological benefits, bio-pesticides remain underutilized due to higher perceived costs, uncertain efficacy, and limited market availability (Pretty & Bharucha, 2015). Likewise, recommendations from pesticide retailers based on profit motives (0.57) was another problem affecting pesticide purchase, which is similar to the findings that Agro-vets and dealers often provide biased information for farmers, thereby encouraging overuse or inappropriate pesticide choice (Maharjan et al., 2020). At last, limited availability of effective pesticides (0.55) was the least important problem which is supported by the finding of FAO (2020).

Table 8

Problem related to pesticide purchase

Problem related to pesticide buying	Index Value	Rank
Limited availability of effective pesticides	0.55	V
Profit based recommendation of pesticide retailer	0.57	IV
Lack of sustainable alternatives (Bio-pesticide)	0.58	III
Higher cost of pesticide	0.60	II
Limited knowledge on the choice of pesticides	0.65	I

Conclusion

Vegetable farming in Ghorahi Sub-Metropolitan, Dang, relies heavily on chemical pesticides, among which insecticides are the most commonly used. Farmers mostly depend on Agro-vet or retailers for pesticide purchases, and their decisions are influenced by retailer recommendations, prior experience, cost, and ease of application. There is a significant gap in farmers' awareness regarding pesticide labels, toxicity levels, safety measures, and recommended waiting periods. The main obstacles were the high cost of inputs and the lack of knowledge in choosing suitable insecticides. It is crucial to increase farmers' ability through awareness campaigns, training, and access to trustworthy advice and guidance. Furthermore, to guarantee safe use, lower health and environmental risks, and support the long-term sustainability of vegetable growing, better control of pesticide sales and encouraging the use of sustainable substitutes like bio-pesticides are essential.

Conflict of interest

The authors claimed that they have no conflicts of interest with relation to this paper's publication**.**

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