Farmers' knowledge and perception of walnut insect pest and disease management in Rukum East, Nepal

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Abstract

A survey research study on farmers' knowledge and perception of walnut insect pest and disease management was undertaken in Rukum East, Nepal. The study aimed to evaluate the farmers' knowledge and perception level regarding the identification and management of insect pests and diseases of walnuts. A total of 125 respondents were randomly selected for the interview with a semi-structured questionnaire and evaluated based on direct field observation. According to the survey, the Jumlish variety was more cultivated than the Turkish variety. Out of the total respondents, 79.2% were aware of the presence of insects and diseases in their field, while 20.8% were not. The study identified the walnut weevil as the most occurring insect, followed by the shoot borer, whereas dieback was the most prevalent disease in the walnut saplings. The presence of insects and diseases primarily damaged the leaves, then the stems and fruits. Many respondents followed the cultural method of management, a few followed the physical method, and very few used bio-pesticides. Farmers believed that susceptibility varies with variety, and the Turkish variety was found to be more susceptible according to their response.

Keywords: Knowledge, Perception, Insects, Diseases, Walnut

INTRODUCTION

Walnut is the oldest cultivated fruit in the world and one of the important nut fruits (Sharma et al., 2012; Yadav & Azad, 2022). It is a deciduous fruit tree native to temperate climates, belonging to the family Juglandaceae (Khattak et al., 2022; Dhakal et al., 2003; Verma, 2014). The genus *Juglans* consists of approximately 21 species, with *Juglans regia* being the predominant species found in the Himalayan region, including Nepal (Ji et al., 2021; Weltz & Raizada, 2014). The walnut tree is generally referred to as Okhar in Nepal (Kattel, 2024). Commercially, walnuts are highly valued as dried fruits due to their economic significance and rich nutritional content (Hassan & Ahmad, 2017; Mercan, 2025). Walnuts serve as an excellent dietary source of essential nutrition as they offer numerous nutritional and health benefits due to their polyunsaturated fatty acids, which the human body cannot synthesize (Kumar et al., 2024). The United Nations Food and Agriculture Organization reports that walnuts are produced in 54 nations worldwide, with China leading the globe in both the area used for walnut cultivation and overall production. Similarly, several nations, including Iran, Kazakhstan, Afghanistan, and Pakistan, are part of its primary distribution (Xue et al., 2025; Ye et al., 2024). Exotic thin-shelled varieties like Payne, Hartley, and Ashley are preferred for commercial cultivation in Nepal (Chalise et al., 2021). Walnut trees thrive in deep, nutrient-rich loamy soils up to 1 meter deep, requiring 700-800mm of evenly distributed rainfall. They can tolerate certain periods of drought conditions, but the rainfall should be at least 100-150mm (Sharma et al., 2025). The total area under walnut cultivation in Nepal is 5,207 ha, the walnut production area is 2,182 ha, the production of walnut is 9,960 mt, and the yield is 4.57 mt/ha(MoALD, 2023).

Rukum East, being a temperate region, has a suitable climate for walnut cultivation. The total area for walnut cultivation is 250 hectares, the production area is 55 hectares, the production is 287 metric tons, and the yield is 5.22 metric tons per hectare (MoALD, 2023). Despite this, walnut imports continue to rise, indicating that domestic production is insufficient to

meet growing demand (Anonymous, 2023). Walnut cultivation faces significant challenges from various insects, diseases, and weed species, many of which pose serious threats to plant survival alone or together (Kaplan & Demir, 2022). Different insects like trunk, shoot borer, walnut weevil, aphids, coddling moth, and husk fly are responsible for damaging walnut trees and fruits (Khan et al., 2019). Apart from insects, different diseases, including walnut anthracnose, root and crown rot, branch wilt, ringspot, downy leaf spot, heart rot, powdery mildew, stem canker, and die-back diseases, are also responsible for hindering the proper establishment of walnut saplings and walnut production (Hassan & Ahmad, 2017). Assessment of farmers' perception and knowledge of insect pests is known to be an important tool for communicating messages and setting research priorities (Karar et al., 2021). Enhancing the understanding and attitudes of farmers and their pest management techniques could help them overcome the constraints associated with farm management approaches (Moinina et al., 2018).

This study was conducted to identify the major insects and diseases affecting the establishment, growth, and development of walnut saplings and trees. The study determined the farmers' knowledge level regarding the insects and diseases of walnuts and their perception of the issues related to the hindrance of walnut cultivation. Moreover, the study assessed the various management practices adopted by farmers to prevent and control the damage caused by insects and diseases.

MATERIALS AND METHODS
Study site
Rukum East is a mountain district of Lumbini province of Nepal and is popularly known for having 52 ponds and 53 hills. It lies at a latitude of 28.6270° N and a longitude of 82.4697° E. The total area of Rukum East is 1,161.13 sq km, and the total population is 56,768 according to the 2021 census. Rukumkot serves as the interim headquarters of this district. The district is divided into three rural municipalities: Bhume, Putha Uttarganga, and Sisne, where the study was conducted.
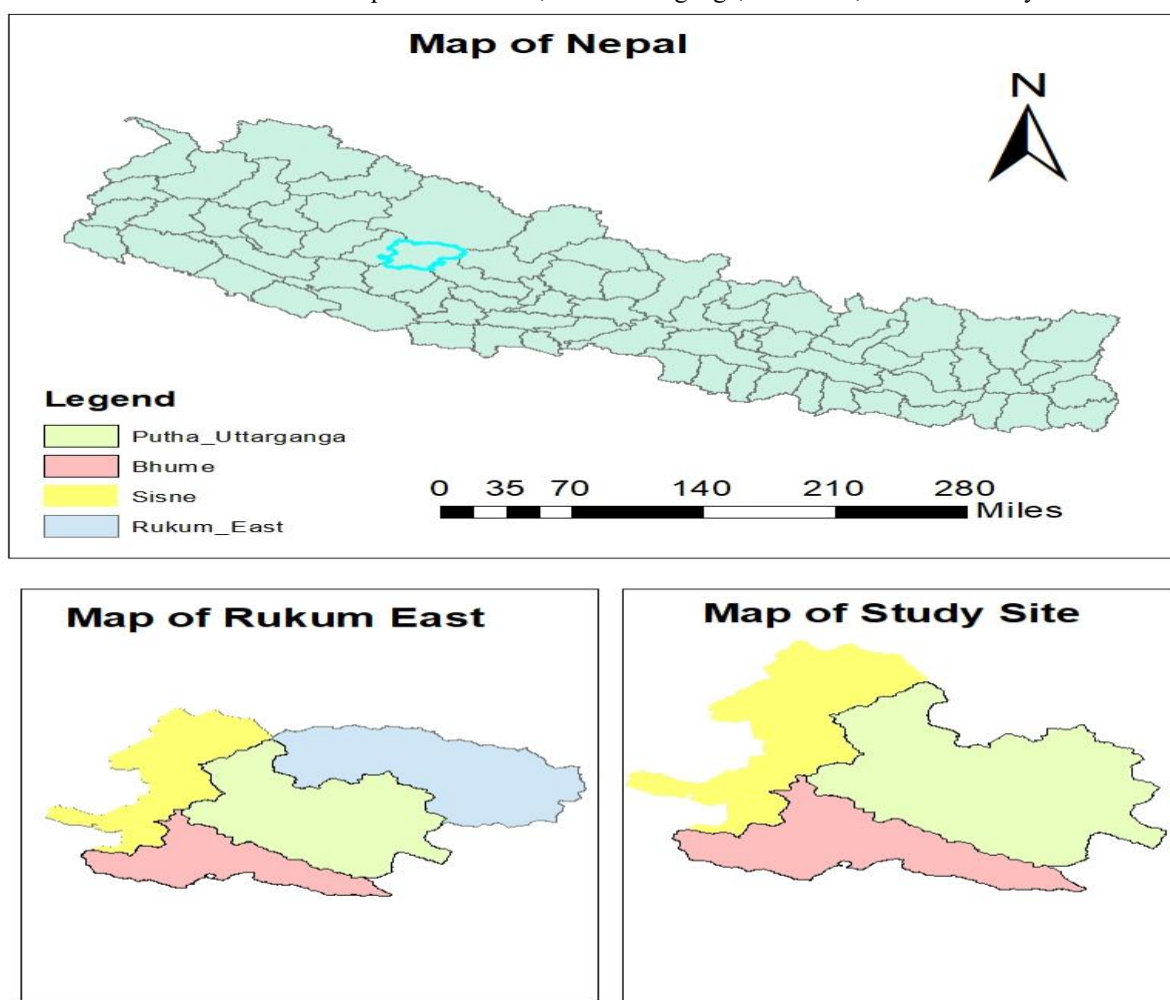

Figure 1. Study site showing Sisne, Bhume, and Putha Uttargana rural municipalities

Sampling Methodology and Sample Size
A total of 125 respondents were selected randomly from a list of commercial walnut growers in the Prime Minister Agricultural Modernization Project (PMAMP), Rukum East. Data was collected using a semi-structured questionnaire. Primary data was collected through face-to-face interviews with respondents and field observations. The secondary data were obtained from newspaper articles, journals, the Prime Minister Agriculture Modernization Project, the Integrated Agriculture and Livestock Development Office, and Nepal Agriculture Research Council reports for the year 2023.

Data analysis

The data obtained from the survey were then entered, coded in MS Excel (2010), and analyzed using the Statistical Package for Social Science (version 25). A chi-square test was done to test the association between the variables. The association of the knowledge level of farmers with the confidence in identifying insects and diseases of walnuts was tested. The bar diagram and pie chart were made using MS Excel.

RESULTS AND DISCUSSION
Socio-Economic Traits of Walnut Producers

The socio-economic traits of the respondents were studied. The age group of respondents was categorized into three groups: 36.8% of the respondents were in the 20-40 age range, 49.6% were in the 41-60 age range, and 13.6% were in the 61 and above age range. Among the surveyed respondents, 78.40% were male, while 21.60% were female. In terms of education, 8% of the respondents are illiterate, 29.6% are literate, 22.4% have primary-level education, 33.6% have secondary-level education, and 6.4% have university-level education. The majority of respondents were Janajati, accounting for 47.2% of the total. Additionally, 41.6% were Chhetri, 7.2% were Dalit, and 4% were Brahmin. The primary sources of income of the respondents in the study area were agriculture, services, business, and others (Table 1). In line with the study, Khadka & Øivind Solberg (2020) reported that the male respondents outnumbered the female respondents in Jumla and Mustang districts of Nepal. Similarly, Kattel (2024) reported 85.7% male and 14.3% female respondents in Jumla district of Nepal. In contrast, it has been stated that the ethnicity is composed of 90.5% Chhetri members and 9.5% Dalit members.

Table 1. Socio-economic traits of the respondents

Traits	FD*	Percentage (%)
Age group		
20-40	46	36.8
41-60	62	49.6
61 and above	17	13.6
Gender		
Male	98	78.4
Female	27	21.6
Education level		
Illiterate	10	8
Literate	37	29.6
Primary school	28	22.4
Secondary school	42	33.6
University	8	6.4
Ethnicity		
Brahmin	5	4
Chhetri	52	41.6
Janajati	59	47.2
Dalit	9	7.2
Occupation		
Agriculture	114	91.2
Business	2	1.6
Services	5	4
Others	4	3.2

*FD: Frequency Distribution

Farmers' knowledge of walnut insect pests and management methods
Walnut variety grown by the respondents

The respondents mostly cultivated the Turkish and Jumlish varieties, while some also grew other kinds (locally grafted varieties). 82.4% of the respondents have grown the Jumlish variety, 54.4% have grown Turkish, and 6.4% have grown the other varieties (Table 2).

Table 2. Knowledge of respondents on the walnut variety grown by them

Variety	Yes		No	
	FD*	%	FD*	%
Jumlish	103	82.4	22	17.6
Turkish	68	54.4	57	45.6
Others	8	6.4	117	93.6

*FD: Frequency Distribution

Awareness of respondents on the presence of insect pests

During the assessment, the respondents were asked about the presence of insect pests in their walnut plants. Out of 125 respondents, 79.2% were aware of the presence of insects in their field, and 20.8% were not (Table 3).

Table 3. Knowledge of respondents on the presence of the walnut insect pest

Insects present	Frequency	Percent (%)
Yes	99	79.2
No	26	20.8
Total	125	100

Damage caused by insects on a scale

Respondents were asked to rate the damage to their walnut trees on a scale of 0-5, where 0 indicated no damage and 5 indicated the most severe damage. The results in Figure 2 show that 12% rated 0, meaning that the respondents did not think the insects' damage was serious, and 8.80% rated 1, meaning that minor harm was done to their walnut trees. Similarly, 46.40% assessed the harm as somewhat serious and rated 2. Additionally, 29.60% rated 3 thinking the damage was moderately serious, and just 0.80% considered the damage to be very serious and rated it a 5.
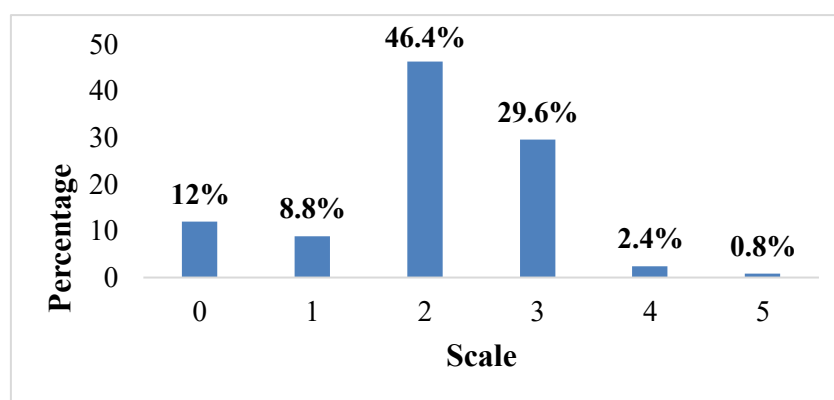

Figure 2. Damage caused by insects on a scale of 0-5, where 0 indicates no damage and 5 indicates severe damage

Presence of insects in walnut plants

Overall, several insect pests were known to attack walnuts, as mentioned by the farmers. These include shoot borer, walnut weevil, husk fly, aphids, and others (Table 4). The walnut weevil is the most common insect, appearing in 66.4% of respondents' fields, while the shoot borer is present in 52% of respondents' fields. The study showed that aphids are rarely found, with the presence of only 2.4%. Similarly, 28% of the respondents observed the presence of husk flies in their field. Overall, the data indicate that walnut weevils and shoot borers are the major threats to walnut saplings or trees. In line with the current results, Sheikh et al. (2022) also reported the walnut grey weevil as the major insect affecting the walnut foliage in Kashmir.

Table 4. Knowledge of respondents on the presence of major insects

Insects	Yes		No	
	FD*	%	FD*	%
Shoot borer	65	52	60	48
Aphids	3	2.4	122	97.6
Walnut weevil	83	66.4	42	33.6
Husk Fly	35	28	90	72
Others	20	16	105	84

*FD: Frequency Distribution

Presence of diseases in walnut plants

Different diseases, such as foot root rot, anthracnose, crown gall, walnut blight, and dieback, are known to attack the walnut saplings or trees during their establishment, growth, and development phases. Among these diseases, 69.6% of the respondents considered dieback to be one of the major diseases contributing to the poor establishment and death of the walnut saplings, while 60% identified anthracnose as the primary disease (Table 5). Likewise, 13.6% of respondents had the presence of foot and root rot, and crown gall was the least observed disease, with a presence of 0.8%. In line with the study, Mehta & Khatiwada, (2025) also reported dieback as the major disease affecting walnut plants, followed by root rot in Rukum East, Nepal, whereas, Khanal et al., (2025) reported walnut blight as the major disease in Darchula district of Nepal. Similar to the study, Khasanov et al. (2019) found that anthracnose was the most frequently seen disease infecting walnut trees in Uzbekistan.

Table 5. Knowledge of respondents on the presence of major diseases

Diseases	Yes		No	
	FD*	%	FD*	%
Walnut blight	6	4.8	119	95.2
Anthracnose	75	60	50	40
Crown gall	1	0.8	124	99.2
Foot and root rot	17	13.6	108	86.4
Dieback	87	69.6	38	30.4

*FD: Frequency Distribution

Influence of knowledge on farmers' confidence in the identification of insects and diseases of walnut

Table 6 presents a chi-square test examining the relationship between farmers' confidence levels in identifying insect pests and their knowledge levels. It categorizes respondents based on their confidence in identifying insect pests as somewhat confident, not very confident, and not confident at all, while also distinguishing between poor knowledge and good knowledge groups. The results show that among those who were somewhat confident, all 6 respondents had poor knowledge, with none having good knowledge. In the "not very confident" category, the distribution was almost even, with 49 respondents having poor knowledge and 51 having good knowledge. In contrast, among those who were not confident at all, 6 of the respondents had poor knowledge, while only 3 had good knowledge. The chi-square value indicates a statistically significant relationship between confidence in pest identification and knowledge levels ($p < 0.05$). This suggests that an individual's confidence in identifying insect pests may be associated with their actual level of knowledge.

Table 6. Confidence of respondents in the identification of insects and diseases

Confidence in Pest identification	Poor knowledge	Good knowledge	$\chi^2(2)$	p-value
Somewhat confident	6	0		
Not very confident	49	51	6.64**	0.03
Not confident at all	6	3		

Note: ** indicates significance at level of 0.05

Farmers' knowledge of insect and disease damage to plant parts

Different parts of the walnut trees or the saplings sustain damage from various insects and diseases. According to the survey report, the leaf suffered the most damage (90.4%), followed by the stem (47.2%). Fruit damage was 10.4%, which was relatively low (Table 7).

Table 7. Damage to different plant parts as recognized by the respondents

Damage	Yes		No	
	FD*	%	FD*	%
Leaf damage	113	90.4	12	9.6
Fruit	13	10.4	112	89.6
Stem	59	47.2	66	52.8

*FD: Frequency Distribution

Farmers' knowledge of management methods

Most respondents (81.6%) follow cultural methods to manage walnut insect pests. Some (47.2%) of the respondents among the total follow the physical method of insect management, and 6.4% of the total use bio-pesticide as the management method (Table 8). Contrary to the findings of this study, Mehta & Khatiwada (2025) reported that 42.5% of respondents in Rukum East, Nepal, participated in bio-pesticide preparation, while 37.5% and 70.8% farmers adopted disease and insect management practices, respectively. Similarly, Kaplan & Demir (2022) reported that 57.2% of the producers of the Bitlis province used chemical methods for insect pest control, 18.3% used cultural methods, 6.7% used mechanical control, 2% used physical control, 12.8% used biotechnical control methods, and 2.62% stated that they did not apply any control methods, which is in contrast with our findings.

Table 8. Management practices used by respondents

Management methods used	Yes		No	
	FD*	%	FD*	%
Cultural	102	81.6	23	18.47
Physical	59	47.2	66	52.8
Bio-pesticide	8	6.4	117	93.6

*FD: Frequency Distribution

Farmers' perception of walnut insect pests and diseases
Farmers' perception of damage caused by insects

During the assessment, farmers' perceptions of damage caused by a few insects were known. Certain individuals (14.4%) believed that a few insects could not cause any harm to their walnut trees or saplings, whereas the majority believed that even a small number of insects could hinder their developing saplings or trees (Table 9).

Table 9. Perception of respondents on damage caused by a few insects

Few insects can cause damage	Frequency	Percentage
Yes	107	85.6
No	18	14.4
Total	125	100

Farmers' perception of susceptibility of walnut varieties to insects and diseases

Various respondents had differing opinions about the variety of walnuts and their capacity to germinate, grow, and mature into healthy trees, as was known throughout the assessment. Among the respondents, 72.8% thought that susceptibility to insect pests varies with the variety of walnuts grown, while 27.2% disagreed (Figure 3).
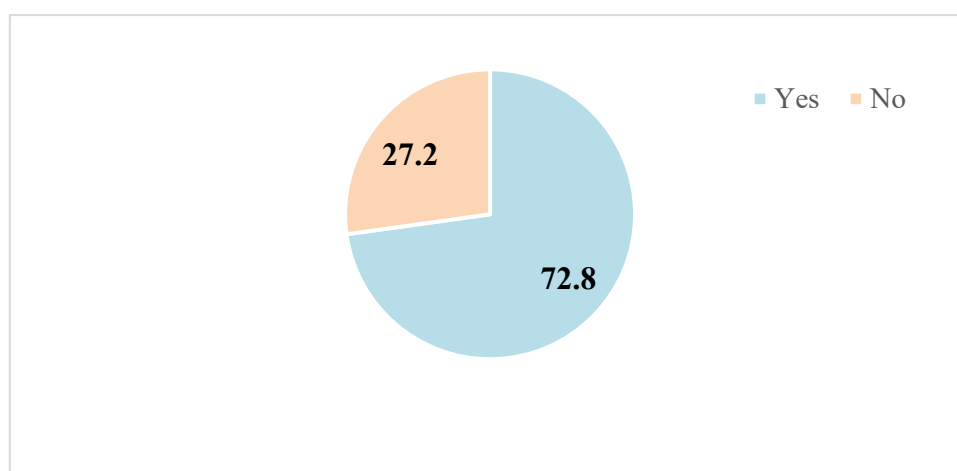

Figure 3. Response to the variation of susceptibility according to cultivars

Farmers' perception of the susceptibility of a specific cultivar

The table below shows that the majority of the respondents (71.2%) perceived that the Turkish variety was more susceptible than the Jumlish variety, and 28.8% denied it. Additionally, 2.4% of respondents believed that the Jumlish variety was more susceptible, while 97.6% disagreed (Table 10).

Table 10. Farmers' perception of susceptibility

Susceptibility	Yes		No	
	FD*	%	FD*	%
Jumlish	3	2.4	122	97.6
Turkish	89	71.2	36	28.8

*FD: Frequency Distribution

CONCLUSION

The study was conducted to determine farmers' knowledge and perceptions of insect pest diseases and the management methods they adopt. Results obtained from the study indicated that the major insects causing threats to the walnut saplings were walnut weevils, shoot borers, and husk flies, and die-back was the major disease affecting the establishment of walnut saplings. Leaf damage was mainly seen due to the insect infestation and disease occurrence. Farmers in the study area had limited knowledge about the management practices. Most of the respondents had a perception that the Turkish variety was more susceptible to insects and diseases. Therefore, the provision of training to the farmers on the identification and management of insect pests and diseases of walnuts would be crucial in the proper establishment and growth of walnut saplings.

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