

# Awareness of farmers regarding pesticides and their effects on health and environment: A cross-sectional study at Chisapani village

Jyoti S<sup>1</sup>, Yadav M<sup>2</sup>, Yadav A<sup>3</sup>, Karn SL<sup>4</sup>, Pokhrel S<sup>4</sup>, Sah B<sup>5</sup>, Shah GS<sup>1</sup>, Bishwakarma P<sup>6</sup>

<sup>1</sup>Department of Community Medicine, Nepalgunj Medical College Teaching Hospital, Kathmandu University, Banke, Nepal.

<sup>2</sup>Department of Clinical Oncology, Sushil Koirala Prakhara Cancer Hospital, Khajura, Banke, Nepal, <sup>3</sup>Department of Pediatrics, Chitwan Medical College Teaching Hospital, Bharatpur-5, Chitwan, Nepal, <sup>4</sup>Department of Microbiology, Nepalgunj Medical College Teaching Hospital, Nepal, <sup>5</sup>Department of Biochemistry, Nepalgunj Medical College Teaching Hospital, Nepal, <sup>6</sup>MBBS Student, Nepalgunj Medical College Teaching Hospital, Nepal

## ABSTRACT

### Corresponding author:

Dr. Sabita Jyoti,  
Assistant professor, Department of  
Community Medicine, Kathmandu  
University (Nepalgunj Medical  
College Teaching Hospital),  
Chisapani, Banke, Nepal.

E-mail: [sabitajyoti19@gmail.com](mailto:sabitajyoti19@gmail.com)

Tel.: + 9779819528831

ORCID ID: <https://orcid.org/0000-0003-3853-4051>

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**Introduction:** Over 66% of the population in Nepal is engaged in agriculture, where pesticide exposure is a common issue among farmer. The shortage of personal protective equipment (PPE) and inadequate education on proper PPE use and spraying techniques further increase the risk of pesticide exposure. As pesticides are essential for agriculture and public health, this study aims to assess farmers' awareness regarding pesticides and their effects on health and the environment.

**Methods:** A cross-sectional study was conducted from 5th August to 5th November 2025 in Chisapani village of Baijanath Rural Municipality using convenience sampling. Ethical approval was obtained from the Institutional Review Committee. A total of 100 farmers who had been farming for more than 6 months were included in the study.

**Results:** Among the respondents, 74% perceived pesticides as poison; however, more than half (51%) had used them for 5 to 10 years. The highest proportion, 45% used pesticides for growing both vegetables and grains and 95% sprayed two to three times per month. More than half (52%) do not use any personal protective equipment. Only 23% knew the correct use, 30% checked the expiry date and type and 22% followed the proper directions of use. Health effects were reported by 29%, and 20% reported chronic long-term effects. Respondents who agreed that pesticides affect the environment (the pesticides contaminate surface and groundwater and soil, air, and target and non-target vegetables) were 97 %.

**Conclusion:** The study found a gap between awareness and safe pesticide-use practices among farmers. Most respondents recognize pesticides as poisonous but continue to use them for years, two to three times per month. Although farmers have experienced health issues, many continue to ignore them and still lack safe practices.

**Keywords:** Chisapani, environmental effects, farmers, health effects, pesticide use.

## Introduction

Over 66% of Nepal's population is engaged in agriculture, among whom pesticide exposure is a common issue.<sup>1</sup> Annually, pesticide use increases by 10–20%, with an average application of 396

grams per hectare, and commonly used pesticides are organochlorines (such as Benzene Hexachloride and Dieldrin), organophosphates (including ethyl parathion and methyl parathion),

carbamates, and synthetic pyrethroids in Nepal.<sup>2</sup> However, farmers often lack awareness about types of pesticides, levels of their toxicity, safety precautions, as well as risks they pose to human health and the environment.<sup>1,3</sup> Shortage of personal protective equipment (PPE) and inadequate education on proper PPE use and spraying techniques further make farmers prone to risk of pesticide exposure, as pesticides, these days, are vital for agriculture and public health.<sup>4</sup> A study reports that the majority of participants were well aware of the symptoms of poisoning, such as nausea, vomiting, dyspnea, throat itching, skin irritation, dermatitis, dizziness, headache, eye irritation, burning, and tachycardia affecting the cardiovascular system. They were also aware of chronic effects such as cancer, fetal death, infertility, birth defects and miscarriage because of long-term use of pesticides. Despite this, pesticides are still widely used.<sup>5</sup>

The increasing trend in pesticide use by 10%–20% each year in Nepal, with more than 90% in vegetable products.<sup>6</sup> Although the knowledge of farmers on the use of pesticides is moderate, they have high knowledge of the risks of pesticide use to the environment and health.<sup>7,8</sup> A study from Nepal reports that 66.2% of the participants had a negative attitude toward the use of pesticides, still driven by the aim of increasing vegetable production and income.<sup>9,10</sup> Therefore, the study aims to assess the awareness of farmers regarding pesticides and their effect on health and the environment to fill the gap.

## Methods

A descriptive cross-sectional study was conducted from 5th Aug 2025 to 5th Nov 2025 in a rural Chisapani village of Bajjanath Rural Municipality,

## Results

The highest proportion of respondents, 45 (45%), had attended primary school, followed by 35 (35%) who were illiterate, while only 20 (20%) had completed secondary or higher education. The majority, 86 (86%) were Hindu, by religion, while 7 (7%) were Christian and 7 (7%) were Muslim. More than half, 53 (53%) were female,

Ward Number One, in Banke District of Lumbini Province of Nepal. Farmers who had been involved in farming for more than six months were included, while those with less than six months of experience were excluded. Convenience sampling was used after obtaining ethical approval from the Institutional Review Committee (Reference number: 07/082-083). Formal permission was obtained from the Chairperson of the ward office. Sample size was calculated using the formula:

$$n = z^2 pq / e^2$$

$$\text{Sample size } (n) = [1.96^2 \times 0.61 \times 0.39] / [0.1]^2 = 91.39$$

$$z = 1.96 \text{ (within 95\% Confidence Interval)}$$

$$p = \text{Expected proportion of previous studies where farmers knew the harmful effects of pesticides} = 61\% = 0.61^4$$

$$q = 1 - p \text{ (1-0.61=0.39)}$$

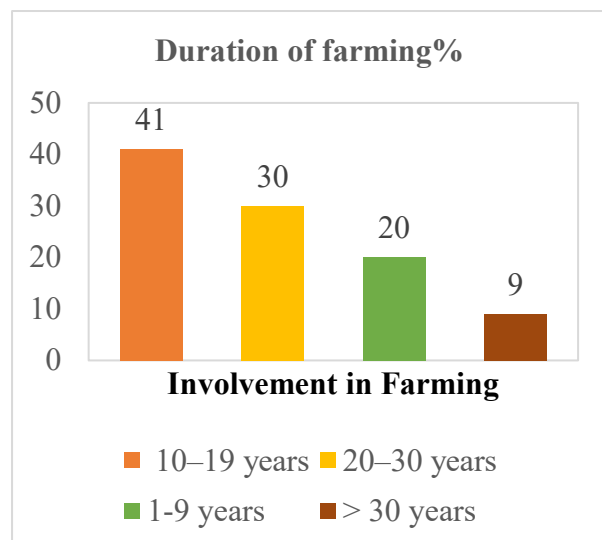
$$d = \text{Allowable error or precision. Usually, it is taken as 10\% (0.1).}$$

Therefore, the final sample size was 100.

An interview was conducted among 100 farmers through a face-to-face interview and all those farmers who had been involved in farming for more than six months were included in the study. And those who have just started farming and have not completed six months were excluded. The data were collected and entered into Microsoft Excel 2016 and analyzed using the Statistical Package for the Social Sciences (SPSS) Version 24. Descriptive statistics (mean, standard deviation, frequency, percentage) were calculated.

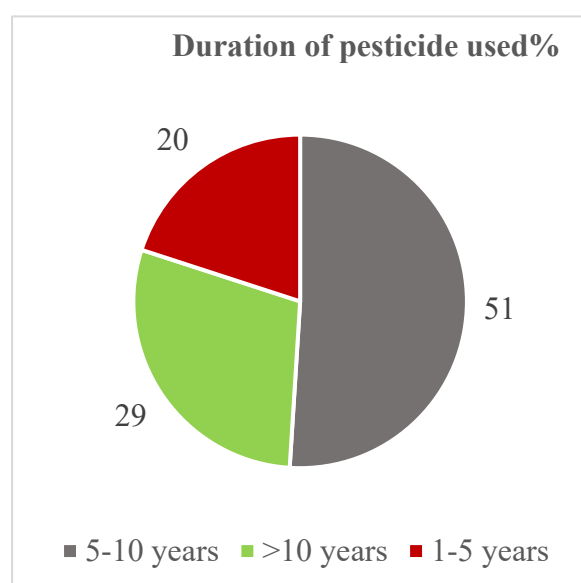
and 47 (47%) were male. All respondents (100%) were adults aged 19 years or older and married. Most of them were from rural areas 71 (71%) and 24 (24%) were from semi-urban areas, and only a few were from urban areas 5 (5%).

However, among the farmers who have been interviewed, the majority, 85 (85%), practiced commercial farming, and only 15 (15%) practiced non-commercial farming. The majority of them, 41 (41%), had been working for more than 10-19 years, followed by 30 (30%) working for 20-30 years, as depicted below.



**Figure 1: Showing the duration of involvement in farming**

According to the respondents, pesticides were perceived as poison by the majority (74%). However, 26 (26%) thought it was a good fertilizer for growing crops. More than half of the respondents (51%) had been using pesticides for 5 to 10 years, as shown in Figure 2 below.



**Figure 2: Duration of pesticide use by farmer**

The majority of farmers used pesticides for growing both vegetables and grains, 45 (45%), followed by 31 (31%) for all types of crops, as shown in Table 1 below. The farmers usually 95 (95%) sprayed pesticides two to three times per month and 5% sprayed more than three times per month.

**Table 1: Types of crops where pesticides are used/time**

| Types of crops and pesticides use/time | n (%)    |
|----------------------------------------|----------|
| Both vegetables and grains             | 45 (45%) |
| For all types of crops                 | 31 (31%) |
| Only grains                            | 20 (20%) |
| Only vegetables                        | 4 (4%)   |

More than half 52 (52%) do not use any personal protective equipment (PPE) and 48 (48%) do use PPE to protect themselves from pesticide exposure. Among those who used PPE, 17 (17%) used a mask, 19 (19%) used gloves, and the rest, 22 (22%) of respondents, either used two or three of these items, such as a mask, gloves, cap, boots, and spectacles. However, none of them used the proper full PPE. Only 19 (19%) have taken IPM (integrated pest management) training; however, 81 (81%) have not taken it.

Farmers' awareness regarding mode of entry into the human body: 56 (56%) responded that it enters through the skin, 24 (24%) through the mouth, 14 (14%) through the skin, and 6 (6%) through inhalation. According to them, pesticide storage, 74 (74%) agreed that pesticides should not be stored indiscriminately inside the house, and 26 (26%) thought they should not be stored outside the house as rain and air decrease their efficacy. The majority, 77 (77%), of farmers use pesticides incorrectly based on their convenience without reading the label and correct dose and use instructions, and only 23 (23%) knew the correct use of pesticides and also always read the label carefully on the bottle while purchasing pesticides. However, the majority, 70 (70%) do not check for expiry dates and types of pesticides.

When purchasing them, only 30 (30%) check the expiry date and the types of pesticides. In total, 78 (78%) do not follow the proper directions for pesticide use on the label, and only 22 (22%) do.

Health effects were reported by 29% of respondents who fell ill in the last month after they sprayed pesticides. However, the majority have still not noticed 71 (71%). Among those who fell ill, 20 (20%) of them reported more than two symptoms such as headache, skin irritation, burning of the eyes, dizziness and extreme tiredness, and 9(9%) only had skin irritation.

The majority (97%) of farmers agreed that pesticides are harmful to their health; still, they've been widely used, while very few (3%) disagreed. The majority of them, 43 (43%), ignored these signs and symptoms by taking a few days' rest, followed by 26 (26%) who consulted with a healthcare worker nearby, 22 (22%) who consulted with doctors after falling sick, and 9 (9%) who used home remedies/self-medication. Only 20 (20%) agreed that they have experienced chronic health issues due to long-term use of pesticides, and the remaining 80 (80%) have not.

**Table 2: Effects of pesticide use on health**

| Effect on health due to the use of pesticides                                                                                                                   | n (%)    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Fell ill last month after the application of pesticide to crops                                                                                                 | 29 (29%) |
| The respondent noticed these multiple signs and symptoms, such as headache, skin irritation, burning of eye, dizziness, extreme tiredness, skin irritation etc. | 20 (20%) |
| Pesticide use is harmful to health                                                                                                                              | 97 (97%) |
| Ignore the treatment                                                                                                                                            | 43 (43%) |
| Long-term effect                                                                                                                                                | 20 (20%) |

A total of 97% of respondents agreed that pesticides have harmful effects on the environment, including contamination of soil, water, and air. Also, 98 (98%) respondents

agreed that pesticides contaminate the air and target non-target vegetation, and 2 (2%) disagreed.

The majority (97%) responded that pesticides have long-term effects that can undermine the sustainability of farming practices, while three percent responded that they do not. However, all (100%) agreed that pesticide use is harmful to the environment.

**Table 3: Effect of pesticide use on the environment**

| Effect on the Environment due to pesticide use | n (%)      |
|------------------------------------------------|------------|
| Contaminate the surface and ground water       | 97 (97%)   |
| Contaminate soil                               | 97 (97%)   |
| Effect on air and target non-target vegetation | 98 (98%)   |
| Long-term effects on sustainability            | 97 (97%)   |
| Pesticides are bad for the environment         | 100 (100%) |

## Discussion

The study findings highlight important socio-demographic and occupational characteristics influencing pesticide use and safety practices among farmers as most respondents had low educational levels with 45% completing only primary education, and 35% being illiterate. Similar educational patterns were reported among Nepalese farmers in studies conducted in Tokha Municipality and Bhaktapur, where limited literacy was associated with inadequate knowledge of pesticide labeling and safe handling practices, as in the present study. Also, only 23% knew the correct use, 30% check expiry dates and types of pesticide and 22% follow the proper directions of use.<sup>1,8</sup> Low literacy levels may explain why 77% of respondents in our study reported using pesticides based on convenience rather than label instructions, and 70% did not check expiry dates.

The rural residents seem to have predominance, as 71% of residents and are doing commercial

farming, 85%, suggesting a high level of occupational exposure. Also, a long duration of farming involvement for more than 10–19 years among 41% and pesticide use for five to ten years among 51% suggest chronic cumulative exposure. These findings are comparable to those observed in Panchkhal Municipality and Rupandehi District, where prolonged exposure to pesticides was common among experienced farmers.<sup>5,6</sup> The frequent spraying pattern, 95% (applying pesticides two to three times per month), is consistent with increasing pesticide dependency in vegetable farming reported in the Bharatpur Metropolitan City study.<sup>10</sup>

Although 74% of respondents understood pesticides as “poison,” misconceptions still existed, with 26% perceiving them as fertilizers. This gap between perception and practice aligns with findings from Lamatar Village Development Committee, where knowledge did not necessarily translate into safe practice.<sup>9</sup> Furthermore, only 19% had received Integrated Pest Management (IPM) training, similar to studies in Southern India and Malaysia that reported limited formal training.<sup>4,7</sup> The use of personal protective equipment (PPE) was inadequate, with 52% not using any form of protection and none using complete PPE. Similar poor compliance with PPE use has been documented in Nepalese studies, including those in Tokha, Panchkhal, and Lamatar.<sup>1,6,9</sup> The lack of full protective measures increases dermal and inhalational exposure, which corresponds with our finding that 56% correctly identified skin as the major route of entry, yet did not consistently protect themselves.

Health effects reported in the present study include headache, skin irritation, burning eyes, dizziness, and fatigue. These are consistent with the acute pesticide-exposure symptoms described in previous Nepalese and international studies.<sup>2,3,4,9</sup> Although only 29% reported illness in the past month, 20% acknowledged chronic health problems, reflecting potential under-reporting or normalization of symptoms. A concerning observation is that 43% ignored

symptoms, opting only for rest rather than seeking medical care, similar to findings in Rupandehi and Bhaktapur where self-medication and neglect were common practices.<sup>5,8,11</sup>

Environmental awareness was notably high in our study. Nearly all respondents agreed that pesticides contaminate water, soil, and air, and negatively impact non-target vegetation and long-term agricultural sustainability. These findings align with national reviews highlighting environmental contamination and ecological imbalance due to excessive pesticide use in Nepal.<sup>2,3,12-14</sup> However, as observed in other Nepalese contexts, awareness of environmental harm does not necessarily reduce usage patterns.<sup>10</sup> Similarly, all of them agreed that pesticide use is not good for the environment. These findings were consistent with those reported from other studies.<sup>12,15</sup>

## Conclusion

This study's findings suggest there is a gap between awareness and safe practice regarding pesticide use among farmers, as most respondents recognize pesticides as poisonous but still have been using them continuously for years, two to three times per month, increasing the potential for cumulative exposure. Despite this, the use of PPE and safe handling practices remains inadequate. Although farmers have experienced health issues, many continue to ignore them. Environmental awareness appears to be comparatively higher, as almost all agreed that pesticides contaminate surface and groundwater, soil, air, and affect both target and non-target crops. However, this awareness has not translated into safer practices or reduced their use. So, there is an urgent need for structured training programs on a regular basis and community-based awareness initiatives to promote safe pesticide handling, encourage the use of personal protective equipment, and reduce both health and environmental hazards through mass media (TV, radio, or by use of flip chart, pamphlets), etc.



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