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Research Paper

Knowledge and Practices of Pesticide Use among the Farmers in Kapurkot Rural Municipality, Salyan, Nepal

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ABSTRACT
In Nepal, the use of pesticides was introduced after the Green Revolution in the early 1960s. The use of pesticides in Nepalese fields is increasing with the rise of commercial farming. The national consumption of pesticides in Nepal is 396g a.i./ha. Misuse and overuse of pesticides can cause both immediate and long-term negative effects on human health and environment. The study was conducted in 6 wards of Kapurkot Rural Municipality. Primary data were collected through interviews with semi-structured questionnaires. Secondary data were collected from various publications, various world-wide non-governmental organizations, and journals of universities. The study revealed 34% of the farmers had general knowledge about pesticides. Only 22% of farmers were aware of the toxicity label of pesticide, 32% of them were aware of the waiting period and 82% were aware of wind direction. Out of a total 65% used gloves, 81% used masks, 58% wore boots, 43% wore hats, 73 wore full-sleeve pants, and 72 wore full-sleeve shirts while spraying pesticides. Likewise, 89% of farmers took a bath after spraying pesticides, and 87% washed their clothes. The 43% of farmers burned their pesticide containers, remaining threw them away improperly near water sources and fields. From the survey, it was found most of the farmers (51%) store pesticide in their bari. This could be due to several factors such as their level of awareness about risks, accessibility, and weather conditions. And 86% checked for sprayer leakage before use and 91% of farmers surveyed applied pesticide after disease and pest incidence. It is recommended to implement targeted educational programs that emphasize proper handling, safety measures, and environmental consciousness aiming to enhance farmers knowledge on pesticide, toxicity levels, waiting period, and use and misuse (overuse) of pesticides.
KEYWORDS: *Environment, Farmers, Knowledge, Pesticides, Pests, Practices*

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I. INTRODUCTION

Nepal is an agricultural country and it is a major sector of the Nepalese economy. About 65% of the population is engaged in agriculture and their contribution to Gross Domestic Product is 27% (MOALD, 2023).Vegetable farming plays a significant role in the Agricultural GDP, contributing up to 9.71% according to recent statistics. This trend highlights the importance of vegetable farming, making it a crucial aspect of the agricultural industry (Ghimire, 2018). Recognizing the significance of vegetable production potential and increasing demand, numerous programs have been implemented to boost commercial vegetable farming (Ghimire *et al*., 2018). Chemical pesticides are frequently utilized in Nepal's commercial vegetable farming. However, neither a thorough record of the quantity of pesticides imported and used in agriculture, nor the impact of pesticides on human or environmental health, exists. According to a survey, 211 metric tons of pesticides are imported annually, with fungicides accounting for the majority (51.38%), followed by insecticides (29.19%) and herbicides (7.4%) (Rijal*et al*., 2018)

The national consumption of pesticides in Nepal is 396g a.i./ha according to the latest estimate (PPD, 2016; Sharma, 2015), which is higher than the previous record of 142g a.i /ha (Thapa, 1997; Sharma, 2015). It is estimated that losses of production are 35% due to pest attacks in the field. According to the latest estimate, the annual import of pesticides in Nepal is about 211t a.i. with 29.19% insecticides, 61.38% fungicides, 7.43% herbicides, and 2% others (Sharma, 2012). On an ecological basis, the highest average pesticide used in the Terai region of Nepal i.e. 0.995 a.i. kg/ha followed by valley (0.470 a.i. kg/ha), hill (0.314 a.i. kg/ha), and lowest in the high hill (0.085 a.i. kg/ha) (PPD, 2015). Different forms of pesticides are imported, and their amount is increasing day by day in Nepal (GC & Ghimire, 2018). Exposure to pesticides is becoming a significant public health issue in developing nations. Misuse and overuse of pesticides can cause both immediate and long-term negative effects on human health. The government of Nepal has implemented an Integrated Pest Management program to reduce the use of pesticides in the country. However, farmers continue to misuse and overuse pesticides in the agricultural sector (Aryal*et al*.,2016).

The utilization of pesticides in several districts within the Terai region of Nepal, including Sarlahi, Kavre, Tistung, Palung, and Dhading, has notably risen to an average of 1600g/ha. This figure stands in stark contrast to the national average of pesticide use, which is currently reported at 396 g/ha. There are 3,034 trade names and 169 pesticides registered in Nepal. It has been found that 90% of the pesticides used in Nepal are bought from India. People are also unaware of the negative impacts of pesticides on human health. According to a study it was found that a large majority of farmers, specifically over 50%, tend to mix pesticides with their bare hands, without adhering to proper handling practices. This behavior can pose significant health risks for farmers and may lead to various health issues (Neupane & GC, 2019). In some highly commercialized agricultural industries, synthetic pesticides are also used inefficiently and extensively, often for productivity goals rather for health reasons. In rice (40–50%), pulses (14–20%), cotton (13–15%), and vegetables and fruits (10–15%), pesticide use is primarily seen. The majority of farmers are ignorant of the many types of pesticides, the degree of poisoning, safety measures, and potential risks to human health and the environment (Thapa*et al*., 2021).The pesticides used daily on farm crops negatively impact human health. Infants and children are especially vulnerable to the harmful effects of pesticides due to their non-specific nature and inadequate application Pesticides can harm human health by causing infertility, cancer, developmental, neuro, and immunotoxicity. This is due to the ability of organochlorine to affect hormones, enzymes, neurotransmitters, and growth factors. Pesticide exposure causes short and long-term effects. Exposure to pesticides can cause short-term effects such as diarrhea, abdominal pain, vomiting, and nausea, as well as long-term effects like skin diseases, cancer, asthma, depression, diabetes, genetic disorders, and death. The health effects of pesticides on humans can be either acute or delayed, depending on the level of exposure. This can lead to health problems such as allergies, skin irritation, dizziness, lethargy, and swelling (Neupane & GC, 2019).

II. MATERIALS AND METHOD

A. Selection of Study Site

This survey was conducted in Salyan district of Karnali Province, especially inKapurkot rural municipality. This survey was done following various structured questionnaire based on dependent and independent variables. The dependent variableswere Farmers perception of pesticides used in vegetables such as knowledge, awareness, attitude, preference, beliefs towards pesticide use whereas the independent variables will include socio-demographic characteristics of farmers, farm size and landholding patterns and various farming practices used etc. Kapurkot Rural Municipality was selected for this study as it has wide potentiality of vegetables production and more farmers are engaged in productivity. The survey and its analysis would be feasible in that area which would guide to know about the main objectives of the study.Primary data were collected through household surveys,focusing on farmers' views, challenges, awareness. Secondary data were gathered through a comprehensive literature review, including sources from reputable institutions and online searches.

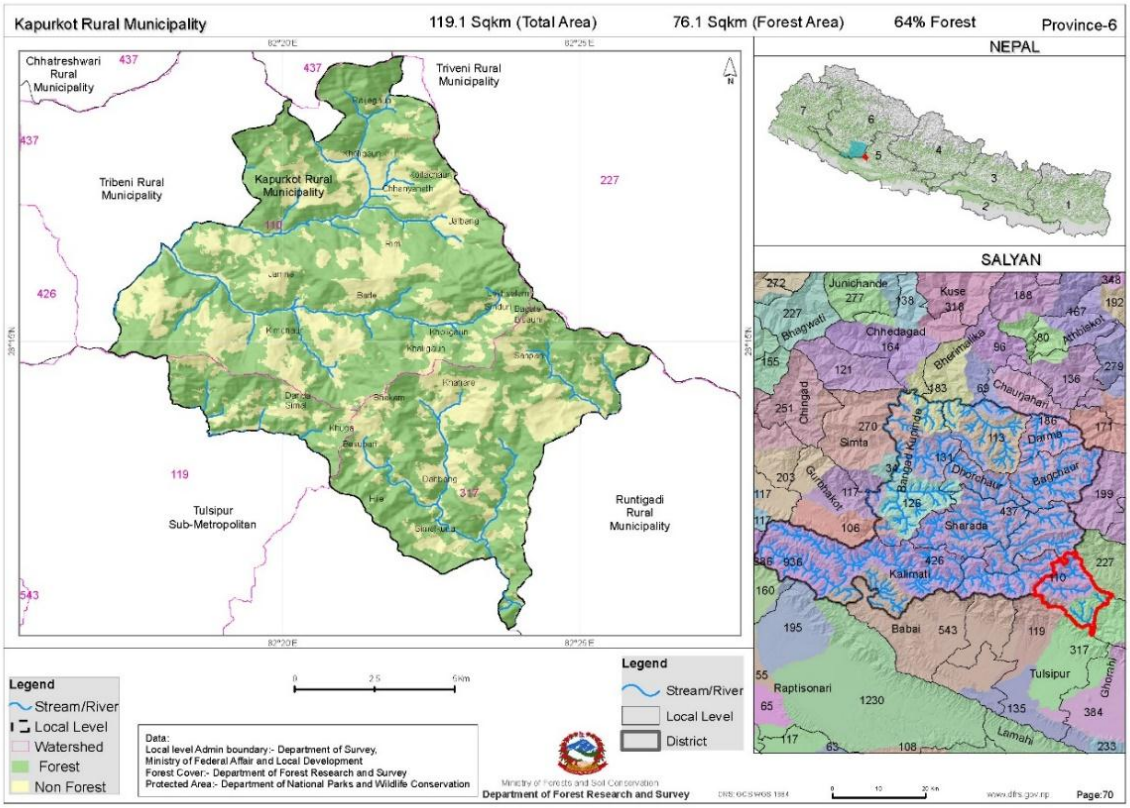

Fig.1 Map of the study area

B. Source of Data

1. Both primary and secondary data were collected with the help of various sources. Primary data was collected from vegetable growers in Kapurkot rural municipality using various research instruments like surveys, prepared questionnaires, and interviews with farmers. Primary data collection allowed for more detailed responses and allowed farmers to discuss their experiences and opinions. Secondary data was collected from various sources, including:
2. Data analysis: The collected data was thoroughly checked and again verified and analyzed using Microsoft Excel for analysis, pie charts, percentages, and graphs to describe the socio-economic aspects of the farmers and farmers' characteristics.

III. RESULTS AND DISCUSSION

1. Socio-demographic Characteristics

I. Gender of respondents

In the study area, 43% of farmers are female, and 66% are male, revealing greater participation by males in or farming.

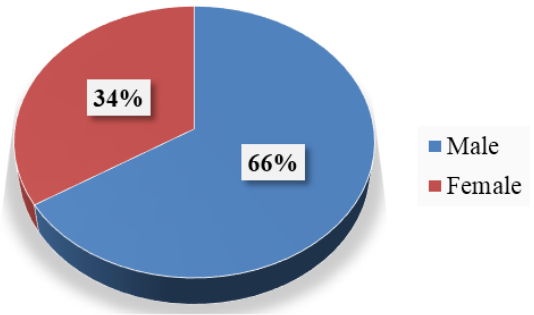

Figure 2: Gender of respondents

II. Age of respondents

Among the interviewed farmers, age group of 31-40 was found maximum (34) while the age group 51-60 was found minimum (13). It was found that the age group 31-40 (34) years are more actively involved in vegetable cultivation.

Table 1: Age of respondent

Age	Percentage
≤30	19
31-40	34
41-50	20
51-60	13
Above 60	14
Total	100

III. Education of respondents

Figure 3 provides the information about education levels among the farmers. Among them, 25% are illiterate, 28% have completed primary level education, 26% have completed lower secondary level education and 21% have competed secondary level education. It also showed that none of the farmers had formal education on agriculture science.

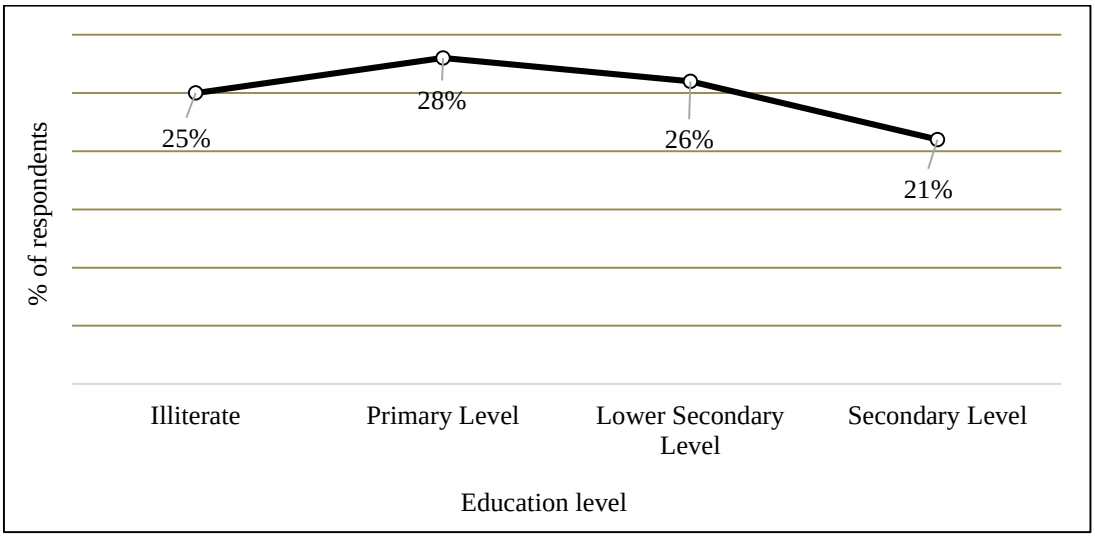

Figure 3: Education of respondent

2. Knowledge of farmers regarding pesticide use

The figure provides insights into the awareness levels among farmers regarding pesticides. Notably, 34% of farmers demonstrate knowledge about pesticides, while a majority of 66% lack awareness on the subject. A significant observation is that 78% of farmers seek external assistance for pesticide-related information, highlighting a prevalent reliance on others for guidance. In contrast, 22% of farmers independently handle pesticides, often consulting with neighbors or agro-vet professionals.

The study further reveals disparities in awareness regarding pesticide tags, toxicity levels, and waiting periods. Only 22% of farmers are informed about these aspects, emphasizing a substantial gap in knowledge. This knowledge deficit is attributed to factors such as low literacy levels among farmers. And only 32% are aware about waiting period while 68% didn't follow waiting period. Those farmers harvested and sold their produces, in some cases, even the same day pesticide was sprayed on vegetables. According to Thapa (2015) and Bhandari (2020) farmers did not understand about waiting period. They believed that pesticides use can improve their produce and market value like the use of carbendazim and mancozeb has been reported before harvesting tomatoes.

Practices during pesticide application also vary. Approximately 86% of farmers consider wind direction during spraying, indicating a conscious effort towards responsible application practices. Meanwhile, 14% of farmers overlook this crucial factor. The timing of pesticide application shows diversity, with 36% choosing the morning, 51% opting for the evening, and the remaining 13% selecting the afternoon.

When it comes to understanding the route of pesticide entry into the human body, 61% of farmers are informed, while 39% lack awareness. Awareness of pesticide effects on the environment is limited, with only 29% having knowledge in this area. This emphasizes the need for increased education on these critical aspects.

Lastly, the study highlights purchasing behaviors, revealing that 28% of farmers check the expiry date before buying or applying pesticides. In contrast, 72% rely on recommendations from Agrovet, indicating trust in expert guidance. And majority (86%) of the farmers checked leakage of the sprayer before application of pesticide. Overall, the findings underscore the varied awareness levels among farmers regarding pesticide-related factors, emphasizing the importance of targeted educational initiatives.

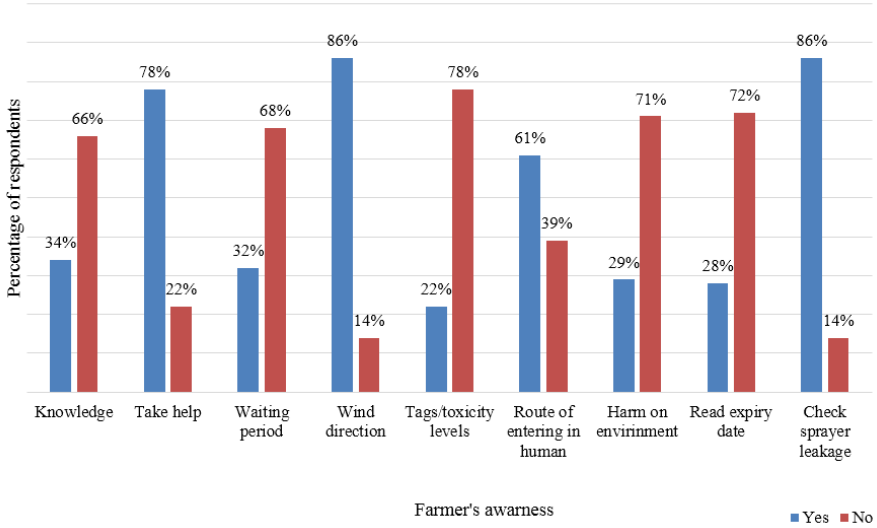

Figure 4: Knowledge of pesticide use

3. Practices of farmers regarding precaution

a. Use of safety measures

Out of 100 farmers, 65% used gloves, 81% farmers used, 58% farmers used boots, 43% farmers used hats and 73% farmers used sleeve pants while spraying pesticide, likewise, 72% of the farmers used full sleeves. Similarly, when farmers were asked about takinga bath after spraying pesticide, 89% of the farmers took a bath. Some of them also said they only wash their hands, face, and legs after pesticide application. 87% of the farmers washed cloth after pesticide application and the remaining didn't.

Farmers may be at higher risk when handling chemical pesticides due to inadequate safety measures, such as low adoption of personal protective equipment and extreme misuse (Lamichhane*et al*.,2018).

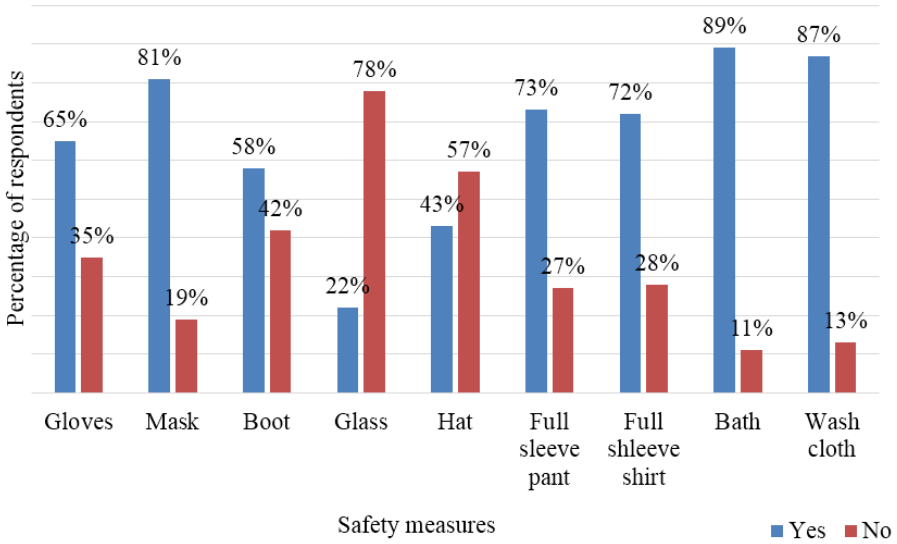

Figure 5: Use of safety measures

b. Dispose of pesticide containers/packages

Out of 100 farmers, 43% of the farmers burnt the pesticide container after the use, likewise, 13% of the farmers buried the pesticide container near the field after the use, and 44%
threw the pesticide container after the use. They throw the empty container anywhere they like near or in water sources, or fields.

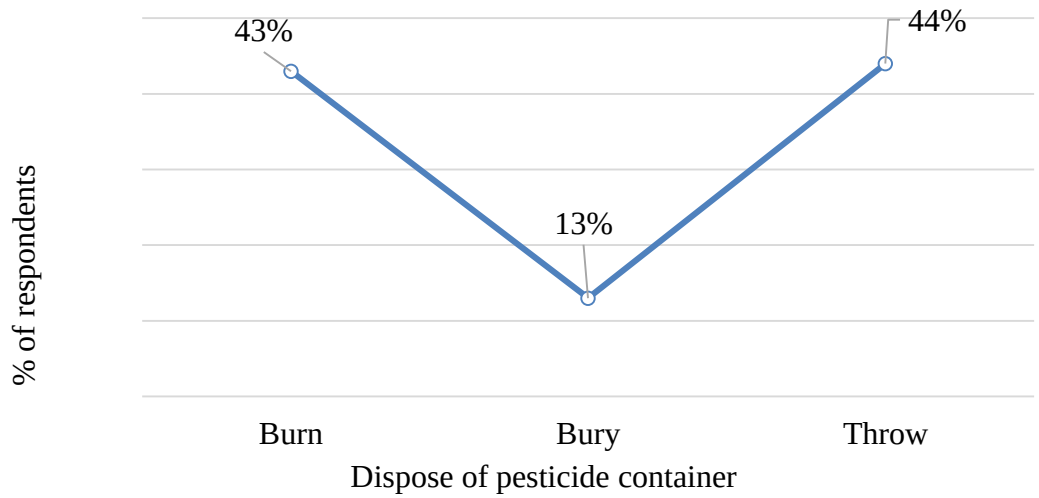

Figure 6: Dispose of pesticide containers/packages

Farmers lack knowledge of proper disposal of pesticide containers/packets/sachets/bottles. Studies show that used bottles and packets of pesticides are thrown haphazardly into the environment (Koirala *et al*., 2013; Lamichhane*et al*., 2018; Sapkota *et al*., 2020; Bhandari *et al*., 2021; Sharma *et al*., 2021).

c. The place to store pesticide

Farmers generally stored pesticides in the house, animal shed, and bari. In total, 22% of the farmers stored pesticides in the house, 27% stored pesticides in animal sheds, and 51% stored pesticides in the bari. Farmers didn't store pesticides in the kitchen as they were aware of the harm of pesticides.

Figure 7: Place to store pesticide

d. Check leakage of sprayer before use

In figure21, the majority (86%) of the farmers checked leakage of sprayer before use and remaining (14%) did not check leakage of the sprayer before use.

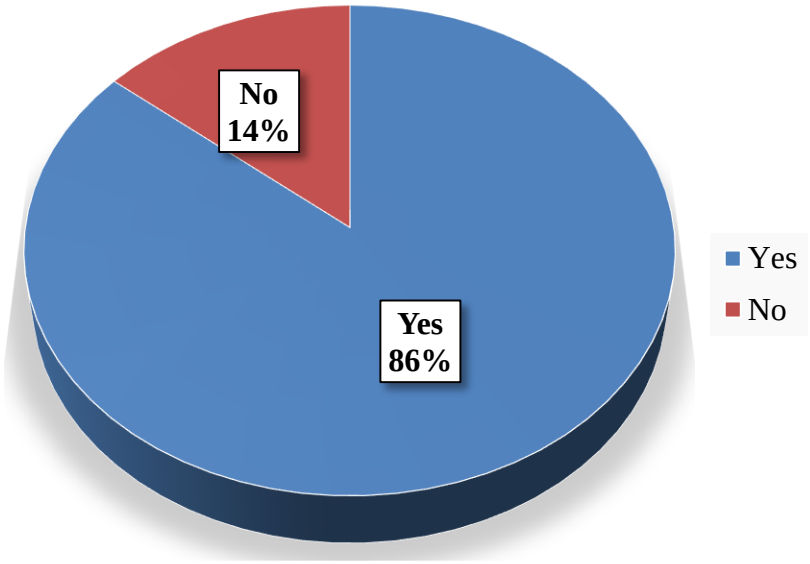

Figure 8: Check leakage of sprayer before use

e. Time for pesticide application

Farmer's practice of spraying pesticides varied fromfarmer to farmer, at different field conditions where, 91% applied pesticide after disease and pest incidence, and the remaining 9% before disease and pest incidence.

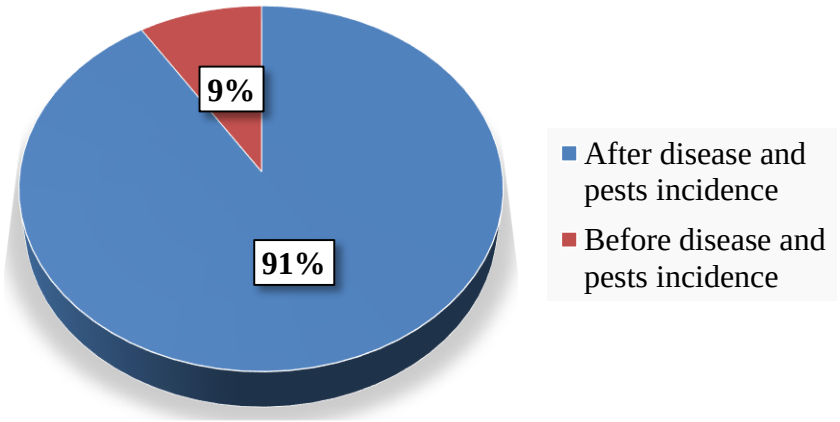

Figure *9*: Time for pesticide application in field

IV. CONCLUSION AND SUGGESTIONS

Most of the farmers were not aware of the knowledge of chemical pesticides and most of them used chemical pesticides for pest management. The majority of the farmers were unaware of the toxicity labels of pesticides. Two-thirds of the farmers seek help from others. One-third of the respondents followed the waiting period and spray pesticides in the evening and consider wind direction. Almost of farmers were aware of pesticides entering the human body and the majority of farmers were unaware of pesticide harm and its effect on the environment. The majority of farmers didn't read the expiry date before application/buy.

The study revealed that most of the farmers used gloves, masks, full-sleeve shirts, and pants, took baths, and washed clothes after pesticide application. And very few wore glasses and hats while spraying

pesticides. The study reveals that most of the farmers throw empty pesticide containers anywhere in the field and near the water sources and store pesticides in the Bari. Almost all of the farmers check the leakage of the sprayer before application and spray pesticides after disease and pest incidence.

Suggestions

Based on the findings, the following suggestions are made:

- The findings suggest the need for targeted farmers training, extension services, technical support, and access to credit facilities to farmers for vegetables productions.
- The finding highlights the provision for proper IPM training and knowledge about pesticides use among the farmers.

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