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# Assessment of Knowledge, Perception, and Practices Regarding Pesticide Handling Among Small-Scale Farmers in West Shoa Zone, Oromia, Ethiopia

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**Keywords**

Assessment,
Farmers knowledge,
Perception,
Pesticides,
Safety measurement,
Toxicity

## Abstract

Pesticides are often used to control insects, diseases, weeds, and other pests to improve agricultural production and productivity. However, the inappropriate use and application of these chemicals have detrimental consequences on human and animal health, as well as the environment. Therefore, the objective of this study was to assess the Farmers' perception, pesticide knowledge, and practices on handling pesticides among small-scale farmers in West Shoa Zone, Oromia Regional State, Ethiopia. The farmers in the study area exhibited varying levels of experience, with the highest proportion (54.44%) having more than 20 years of experience. In terms of pesticide usage, the majority of respondents (95.19%) reported using pesticides, while a small percentage (4.81%) did not utilize any pesticides. A substantial number of the participants in the current study were identified as having inadequate literacy skills and a lack of formal education. Moreover, the majority of these individuals had not undergone any form of training pertaining to the appropriate utilization of pesticides. Regarding the handling and usage of pesticides, a noteworthy percentage (12.96%) of the respondents depended on their own to determine the correct dosage. Moreover, it was observed that a practice of combining multiple pesticides in a single mixture was prevalent. Approximately 38.15% of the participants reported cleaning their sprayers in the field, whereas 28.52% preferred to do so near a water source. Additionally, 19.93% of the

respondents opted to clean their sprayers outside their residences, while the remaining 6.3% chose to carry out this task indoors. In general, the small scale farmers of the study area possess insufficient knowledge regarding the usage and management of pesticides and often display unsafe practices when handling them. Thus, the current investigation highlights the need for additional pest management training for small-scale farmers of the study areas

# 1. Introduction

Pesticides play a vital role in Agriculture production and productivity. It has numerous beneficial effects. These include crop protection, preservation of food and materials, and prevention of vector-borne diseases (Peshin and Zhang, 2014). However, indiscriminate and incorrect use can be terrible for human health and the environment globally. Poisoning by Pesticides is a global public and occupational health problem and accounts for nearly 300,000 fatalities annually, most of them in developing nations including Ethiopia (Mahmood *et al*., 2016).

The use of pesticides has a negative impact on agricultural land, fauna, flora, and overall agricultural and environmental sustainability (Wilson and Tisdell, 2018). Despite these facts, in Ethiopia, there is a lack of stringent controlling mechanisms on the importation of hazardous chemicals; the absence of well-established institutions to provide farmers with the knowledge of pesticide application and safety issues, and the expansion of non-licensed vendors increase the importance of establishing effective guidelines to minimize the negative impact of pesticides on the health of farmers and environmental sustainability (Karunamoorthi *et al*., 2012). Human exposure to pesticides can occur in different ways through contamination of drinking water, occupational exposures, dietary residues, ambient outdoor and indoor exposures, and unsafe use of pesticides on domestic animals (Greenpeace-International, 2015).

Acute pesticide poisonings have been reported as a major consequence in the farming community and the extent of poisoning in these workers, particularly in less developed countries, has often been based on inadequate information (Litchfield, 2005). Adequate knowledge of pesticide health risks, proper attitude towards pesticide use, and adequate storage, and handling of pesticides with appropriate application of a full set of personal protective equipment, are crucial to prevent morbidity and mortality from pesticide exposure. The first step to mitigate the negative pesticide impact is to assess the Farmers' perception, pesticide knowledge, and practices on handling of pesticides among small-scale farmers in West Shoa Zone, Oromia Regional State, Ethiopia. Such information is highly limited in Ethiopia in general and in the study area in particular.

Despite these facts, in Ethiopia, there is a lack of stringent controlling mechanisms on the importation of hazardous chemicals; the absence of well-established institutions to provide farmers with the knowledge of pesticide application and safety issues, and the expansion of non-licensed vendors increase the importance of establishing effective guidelines to minimize the negative impact of pesticides on the health of farmers and environmental sustainability (Karunamoorthi *et al*., 2012).

Therefore, to fill this gap, we used data from 270 households randomly selected from nine kebeles, three districts in West Shoa Zone, Oromia Regional State to assess farmers' spray practices that might potentially expose them to chemical hazards. This was by examining types of pesticides used, application methods practiced, pesticide drift, pesticide handling, storing and disposal and its effect on the environment, adequate knowledge of pesticide health risks, proper attitude towards pesticide use, and handling of pesticides with appropriate application of a full set of personal protective equipment are crucial to prevent morbidity and mortality from pesticide exposure; and farmers

ability to decode the information displayed on the product labels which might affect risk reduction were also surveyed.

## 2. Materials and Methods

### 2.1 Description of the Study Areas

The study was conducted in three districts of Western Shoa, Ethiopia (Toke kutaye, Ejresa lafo, and Welmera) districts of major crop growing areas. These districts are known for their significant agricultural production. The selection of study locations was based on the potential for crop cultivation. In each district, three kebeles were chosen, and thirty farmers were selected from each kebele.

Toke Kutaye District, situated 126 km west of Addis Ababa and 12 km from the Zonal Town, Ambo, covers a total geographical area of 78,887 km2 (WSHZORS Road Authority, 2019 unpublished). Its coordinates range from 8049'0'' to 905'30'' N latitude and 370 26' 0'' to 370 57' 30'' E longitude, with an elevation ranging from 1600 to 3100 m above sea level (TKWAO annual report 2019). The district's agroecology consists of 23% Dega (highland), 60% Woinadega (mid-highland), and 17% lowland areas. The region experiences unimodal rainfall patterns, with a distinct dry season locally known as bona. The average annual rainfall recorded at the station is 1045 mm, while the average minimum and maximum temperatures are 8.90°C and 27.40°C, respectively. Nitosol is the dominant soil type in the district, characterized by a slightly acidic pH of 5.5-6.0 and a loose and friable consistency. In the selected Kebele of Toke Kutaye District, namely Nega File, Imala Dawe Ajoo, and Birbirsa, a total of 90 respondents were interviewed, with 30 farmers selected from each Kebele.

Ejersa Lafo district is situated 70 km west of Addis Ababa and 47 km away from the Ambo Zonal town. As per the current administrative structure, the district is distinct from the Dendi district and comprises 17 rural and three urban kebeles. Geographically, the district is positioned between 900′0″ to 90 50′0″N latitude and 380 12′30″ to 380 17′30″E longitude. It shares borders with Dawo district in the southwestern Shoa zone to the South, Ejere district to the East, Jeldu to the North, Ilu district to the South East and Dandi district to the West. The selected kebeles from Ejersa Lafo District were Yekela Imbartu, Jemjem Laga Batu, and Cheleleka Bobe. Each kebele had thirty (30) farmers selected, resulting in a total of 90 respondents interviewed across the three kebeles.

Welmera district, situated 29 kilometres west of the capital Addis Ababa along the main road to Ambo, shares borders with Sebeta Hawas District, Ejere District, Mulo District, Sululta, and Addis Ababa to the south, west, north, northeast, and east respectively. This district comprises of 26 peasant associations and spans a total land area of approximately 80,927 hectares. Out of this, 37,411 hectares are dedicated to farmland and cultivation. The altitude within the district varies from 2060 m a.s.l. to 3380 m a.s.l. Geographically, the district lies between 8050' and 90 15'N latitude and 38025' and 390 45' E longitude. The estimated population of the district is 104,143, with 52,403 men and 51,740 women. The selected kebeles from Welmera District for the interviews were Telecho, Burku sami Gaba Robi, and Goro kersa. A total of 90 respondents, consisting of thirty farmers from each kebele, were interviewed.

### 2.2 Data collection procedures

For this study, data was collected using face-to-face questionnaire interviews. Three well-trained data collectors were employed after completing training on how to administer the questionnaires. The principal investigator provided field supervision during data collection day after day.

### 2.3 Data Collection Instrument

To ensure consistency, the survey questionnaire was initially prepared in English and then translated into Afan Oromo, before being

translated back into English. The data collection process involved the use of a structured and pre-tested questionnaire that consisted of 91 closed questions, some of which had open-ended sections. The questionnaire was designed to gather information on five key domains, including demographic and socio-economic aspects, agricultural practices, pesticide handling and management, and health effects.

### 2.4. Data Analysis

The SPSS Version 23 statistical package was utilized to perform data analysis. Various descriptive statistics, including means, frequencies, and proportions, were computed.

## 3. Results

### 3.1 Results

#### 3.1.1 Demographic and Socio-economic Profile of Respondents

Table 1 shows the demographic and socio-economic profile of the study area. A total of 270 respondents participated (90 from Toke Kutaye, 90 from Ejersa lafo, and 90 from Welmera) districts in this study.

The study findings indicate that a significant proportion of farmers interviewed in this study area were men, constituting more than 226(83.7). This can be attributed to the prevailing trend of men being primarily responsible for farm activities and pesticide spraying in this area. Among the farmers, the largest group (48.49%) was observed to be in the age bracket of 31 to 50 years. Approximately 15 percent of the respondents were above the age of 60.

Among the farmers, a considerable number 116(44.44%) lacked any form of education and were classified as illiterate. In contrast, 113(41.85%) of the farmers had completed elementary school, while a minority (10.74%) had finished secondary school. The remaining farmers (2.96%) had pursued higher education at a college or university.

The socio-demographic survey results (Table 1) revealed that the majority of the farmers surveyed were male, comprising 226 individuals (83.7%). Conversely, there were 44 female farmers (16.3%). In terms of age distribution, the highest number of farmers fell within the 41 to 50 age range, with 69 individuals (25.53%). This was followed by 62 individuals (22.96%) in the 31 to 40 age range and 58 individuals (21.48%) in the 51 to 60 age range. The lowest percentage of respondents' age was observed between 18 and 30, with 42 individuals (15.56%), while individuals above the age of 60 accounted for 39 individuals (14.44%).

The majority of the participants were married, accounting for 90.37% of the respondents. The remaining individuals consisted of singles, widowed individuals, and separated individuals, representing 5.19%, 2.60%, and 1.11% respectively. Among the farmers, a considerable number (44.44%, 120 individuals) lacked any form of education and were classified as illiterate. In contrast, 41.85%, (113 individuals) of the farmers had completed elementary school, while a minority (10.74%, 29 individuals) had finished secondary school. The remaining farmers (2.96%) had pursued higher education at a college or university

**Table 1:** Demographic and Socio-economic Characteristics of Respondents in Three Selected Districts of West Shoa Zone, Oromia Regional State, Ethiopia, during 2022.

| Variables | Categories | Districts | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Ejersa lafo (n=90) | | Toke Kutaye (n=90) | | Welmera (n=90) | | Mean |
| | | n | (%) | n | (%) | n | (%) | N (%) |
| Sex | Male | 79 | 87.8 | 74 | 82.2 | 73 | 81.1 | 226(83.7) |
| | Female | 11 | 12.2 | 16 | 17.8 | 17 | 18.9 | 44(16.3) |
| Age | 18-30 | 21 | 23.3 | 15 | 16.7 | 6 | 6.7 | 42(15.56) |
| | 31-40 | 20 | 22.2 | 25 | 27.8 | 17 | 18.9 | 62(22.96) |
| | 41-50 | 21 | 23.3 | 20 | 22.2 | 28 | 31.1 | 69(25.53) |
| | 51-60 | 15 | 16.7 | 16 | 17.8 | 27 | 30.0 | 58(21.48) |
| | >60 | 13 | 14.4 | 14 | 15.6 | 12 | 13.3 | 39(14.44) |
| Marital status | Married | 74 | 82.2 | 84 | 93.3 | 86 | 95.6 | 244(90.37) |
| | Single | 10 | 11.1 | 3 | 3.3 | 1 | 1.1 | 14(5.19) |
| | Separated | 3 | 3.3 | 0.0 | 0.0 | 0.0 | 0.0 | 3(1.11) |
| | Widowed | 3 | 3.3 | 1 | 1.1 | 3 | 3.3 | 7(2.60) |
| Education | Illiterate | 44 | 48.9 | 41 | 45.6 | 35 | 38.9 | 116(44.44) |
| | Elementary | 34 | 37.8 | 35 | 38.9 | 44 | 48.9 | 113(41.85) |
| | High school | 8 | 8.9 | 13 | 14.4 | 8 | 8.9 | 29(10.74) |
| | College | 3 | 3.3 | 1.0 | 1.1 | 2 | 2.2 | 6(2.22) |
| | University | 1 | 1.1 | 0.0 | 0.0 | 1.0 | 1.1 | 2(0.74) |

### 3.1.2 Farmers Experience and Land Size for Crop Production

The survey revealed that in (Table 2) a significant proportion of farmers, precisely 54.44%, had accumulated more than twenty years of farming experience, while 14.44% had a farming experience of 16-20 years. The majority of respondents were characterized as small-scale farmers, with their farm sizes ranging from one hectare to two hectares. Nearly 65.19% of farmers possessed land sizes between 1 and 2 hectares, and 24.81% had land sizes ranging from 3-4 hectares. The remaining 10.01% of respondents reported having more than 5 hectares of land dedicated to crop production.

Concerning the division of household decision-making roles, the survey results indicate that 52.96% of the respondents attributed decision-making authority to the husband, while 45.55% acknowledged that decisions are made collectively by both the husband and wife.

**Table 2:** Experience, Land size for crop production, and Decision makers of Respondents in three Selected Districts of West Shoa Zone, Oromia Regional State, Ethiopia, during 2022.

| Variables | Categories | Districts | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Ejersa lafo (n=90) | | Toke Kutaye (n=90) | | Welmera (n=90) | | Mean |
| | | N | (%) | N | (%) | N | (%) | N (%) |
| Experience in Agriculture | 1-5 | 11 | 12.2 | 8 | 8.9 | 6 | 6.7 | 25(9.26) |
| | 6-10 | 13 | 14.4 | 11 | 12.2 | 8 | 8.9 | 32(11.85) |
| | 11-15 | 11 | 12.2 | 11 | 12.2 | 5 | 5.6 | 27(10.0) |
| | 16-20 | 12 | 13.3 | 14 | 15.6 | 13 | 14.4 | 39(14.44) |
| | >20 | 43 | 47.8 | 46 | 51.1 | 58 | 64.4 | 147(54.44) |
| Decision makers | Husband | 61 | 67.8 | 50 | 55.6 | 32 | 35.6 | 143(52.96) |
| | Wife | 1 | 1.1 | 1 | 1.1 | 2 | 2.2 | 4(1.48) |
| | Together | 28 | 31.1 | 39 | 43.3 | 56 | 62.2 | 123(45.56) |
| Land for crop production in hectares | 1-2 | 39 | 43.4 | 63 | 70 | 74 | 82.2 | 176(65.19) |
| | 3-4 | 29 | 32.2 | 25 | 27.8 | 13 | 14.4 | 67(24.81) |
| | 5-6 | 20 | 22.2 | 2 | 2.2 | 1 | 1.1 | 23(8.52) |
| | 7 & above | 2 | 2.2 | 0 | 0.0 | 2 | 2.2 | 4(1.49) |

### 3.1.3 Farmers' knowledge and practical use of pesticides

The survey revealed that 95.19% of the participants had utilized pesticides for crop production. In addition to this, 35.19% of the respondents reported using pesticides to eliminate household insects, followed by 34.07% who employed them for seed preservation. Similarly, 16.30% and 14.81% of the participants resorted to pesticides for treating skin infections and combating livestock pests, respectively.

In terms of pesticide usage experience, 95.19% of the farmers interviewed reported using pesticides. Among those who had previously used pesticides, 14.07% had been using them for over 20 years at the time of this study. Approximately 57% of the respondents had used pesticides for a duration of 6-20 years, while a small percentage (15.18%) had used them for five years or less. Conversely, around 14.07% of the respondents could not recall the length of time they had been using pesticides. Out of the individuals who had previously utilized pesticides, 71.11% opted for family members to carry out the spraying, whereas a mere 8.89% relied on hired labor for this task.

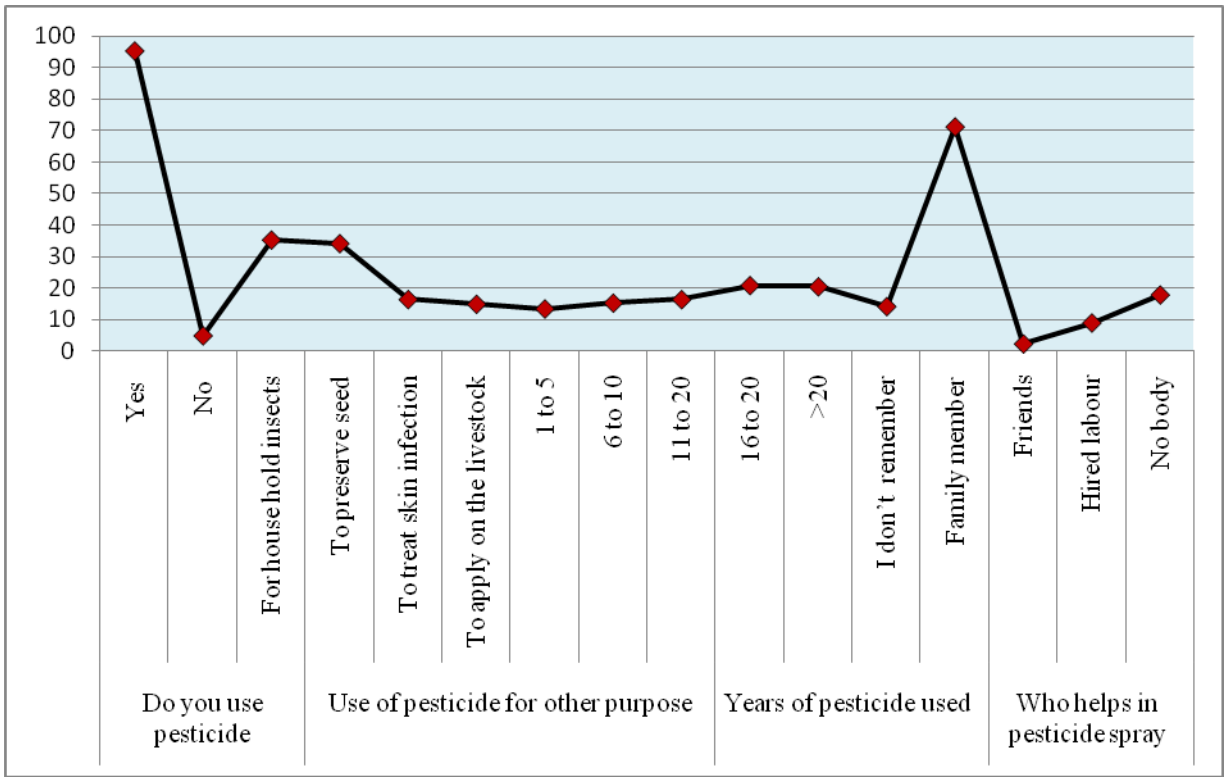


**Figure 1:** The assessment of farmers' knowledge and practical use of pesticide in three selected districts of West Shoa Zone, Oromia, Ethiopia

### 3.1.4 Farmers' knowledge and practices on pesticide application and mixing

In relation to safety measures following the application of pesticides, a majority of the participants (62.6%) reported cleaning their sprayer after use. A significant portion (20.37%) mentioned occasionally washing or cleaning their sprayer, while a small percentage (10.37%) admitted to not cleaning their sprayer before and after use. Additionally, the participants conducted sprayer cleaning activities in various locations. Specifically, 38.15% of the respondents cleaned their sprayer in the field, while 28.52% did so beside the water source. Furthermore, 19.93% opted to clean their sprayer outside the house. Interestingly, the remaining 6.3% chose to clean their sprayer inside the house (Figure 2).

The survey findings reveal that the majority of respondents (85.56%) preferred using a spoon/cup to measure pesticide dosage. Additionally, a significant percentage (12.96%) relied on their own experience for determining the appropriate dosage. Furthermore, this study aimed to evaluate whether there exists a tendency to combine various pesticides into a single mixture for pesticide control. The majority of participants (68.52%) reported not engaging in the practice of mixing different pesticides. Conversely, a smaller percentage (17.41%) indicated occasionally mixing pesticides, while the remaining respondents (13.70%) reported mixing multiple pesticides in a single mixture. The survey participants were also inquired about their motivation for mixing. A majority of the participants were unaware of the reason, while the remaining respondents indicated that they mixed to enhance the pesticide's effectiveness and to save time, accounting for 22.22% and (21.11%) of the responses, respectively.

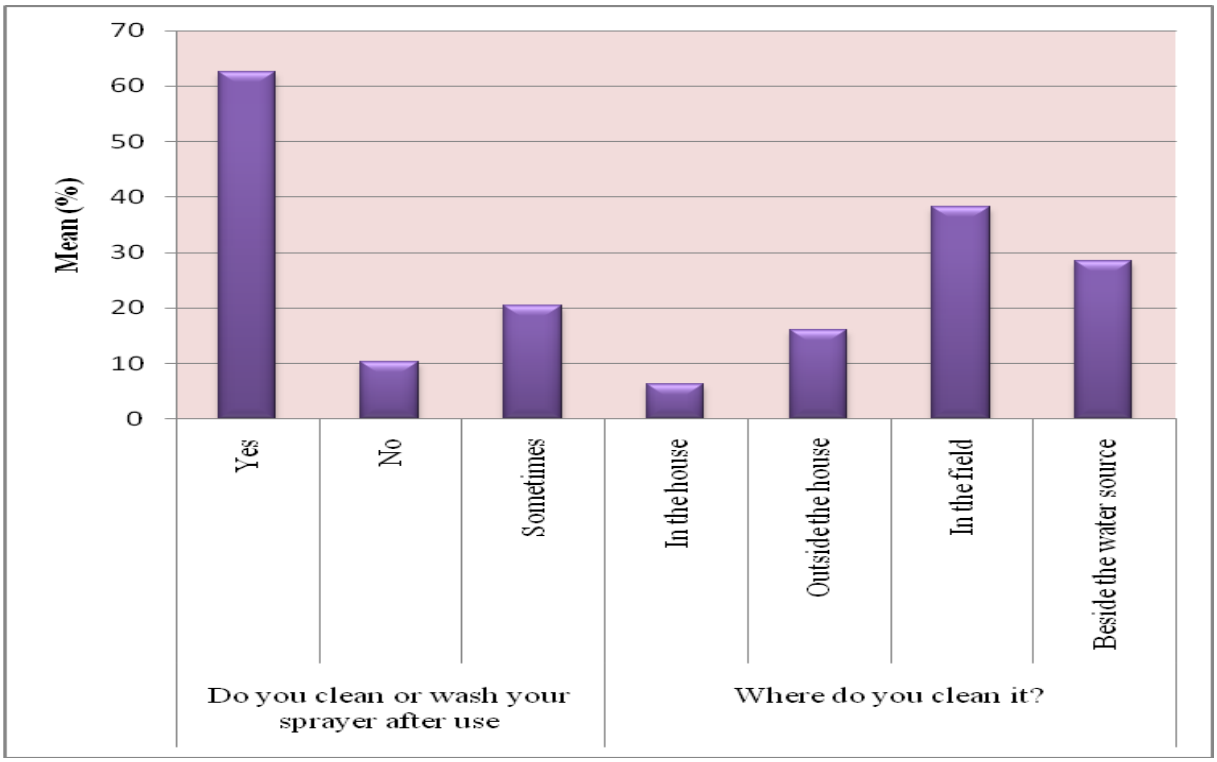


**Figure 2:** Farmers' knowledge and practices on pesticide application

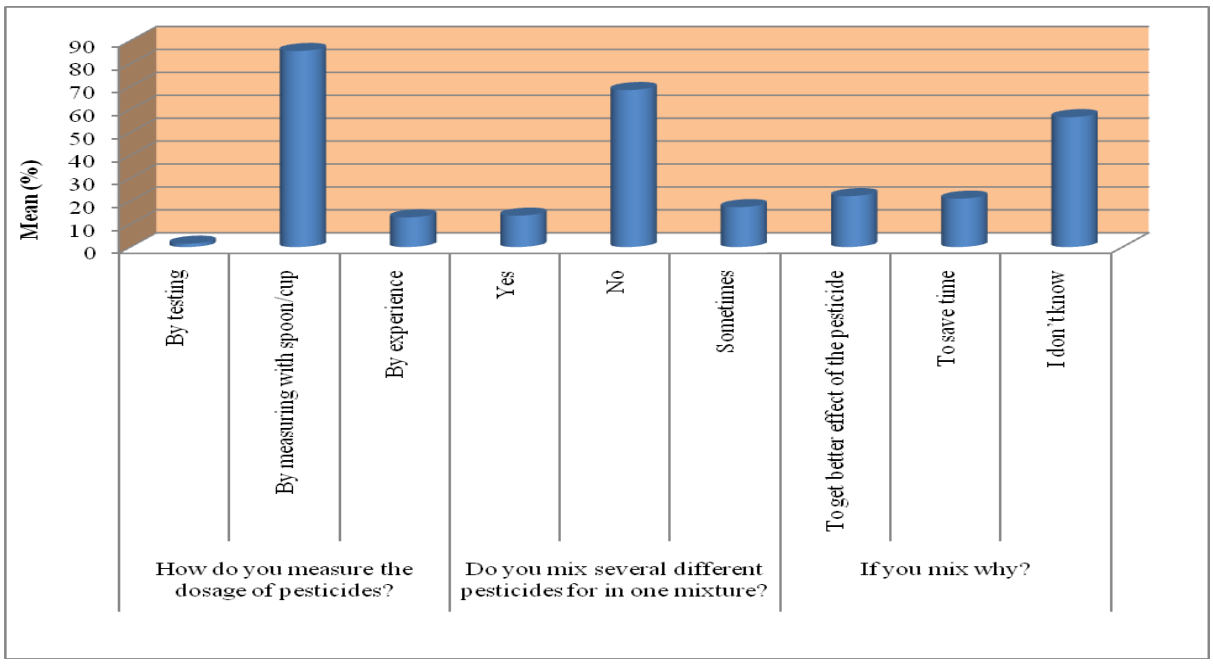


**Figure 3:** Farmers' knowledge and practices on pesticide mixing

### 3.1.5 Training and Knowledge of Pesticide Handling

The survey result in (Figure 4) showed that (20%) have attended training related to pesticide use and its handling practices. Most (81.85%) of the trainings were given by government extension workers whereas, the role of private chemical companies in this regard is very minimum, (11.85%). Regarding the length of time that the training was given, most of the respondent (78.15%) reported that they attended training lasted for hours while very few (8.15%) respondents attended training that took several days.

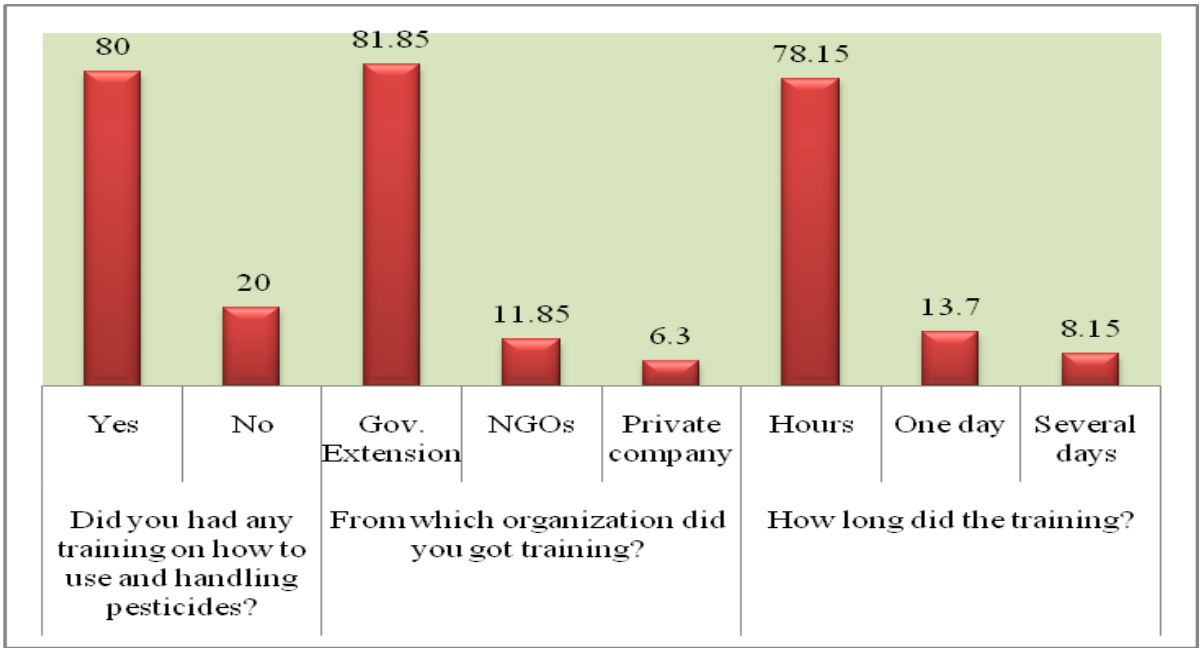


**Figure 4:** Training and Knowledge on pesticide handling the respondents

### 3.2 Discussions

In the current investigation, it was observed that the majority of farming activities were carried out by males, accounting for 83.7%. This finding aligns closely with a study conducted in Nigeria by Adesuyi *et al.* (2018), where 94.8% of farmers were males and 5.2% were females. The male-to-female ratio in our study is consistent with previous reports by Ugwu *et al.* (2015) and Adelani *et al.* (2011). Interestingly, Waichman *et al.* (2007) and Adjrah *et al*. (2013) found that in Brazil (97.4%) and Togo (92%), respectively, males were predominantly engaged in farm practices. Furthermore, an investigation by Nguetti *et al*. (2018) revealed that 90% of farmers in Kenya were male. The reason behind the majority of males participating in farming activities can be linked to the physically demanding nature of the work.

In general, farmers who have received education tend to possess a greater awareness of the detrimental impacts of pesticides on both human health and the environment. Consequently, they are more inclined to utilize safety equipment and employ suitable techniques for the disposal of pesticide containers (Karlsson, 2004; Rı ´os-Gonza´lez *et al*., 2013; Sharifzadeh *et al*., 2019; Recena *et al*., 2006). Conversely, a significant portion of the participants in the current study lacked literacy and formal education, and the majority of them did not undergo any training regarding the appropriate usage of pesticides. Farmers who have received education typically demonstrate a greater understanding of the harmful consequences that pesticides can have on

human health and the environment. As a result, they are more likely to utilize safety equipment and employ appropriate techniques for the disposal of pesticide containers (Karlsson 2004; Rı ´os-Gonza´lez et al. 2013; Sharifzadeh et al., 2019; Recena et al., 2006). However, in the current study, a significant number of farmers lacked formal education and were illiterate, leading to a lack of training regarding the proper usage of pesticides. It is important to highlight that farmers with extensive experience tend to have a deeper understanding of safety precautions. Regarding the farming experience of the surveyed individuals, the majority of farmers (54.44%) stated that they have been involved in farming for over 20 years. As a result, a significant number of participants in the survey continue to follow their traditional practices based on their accumulated experience. Khan and Damalas (2015) suggest that the level of experience in pesticide usage greatly influences the adoption of safety equipment and the willingness to invest in mitigating pesticide-related risks.

The study revealed that a substantial proportion of individuals surveyed in the study areas were unable to read or write, indicating a lack of formal education. Moreover, Only 20% of the farmers attended training related to pesticide use and its handling practices indicating that most small-scale farmers had not been equipped with the necessary knowledge on the appropriate usage of pesticides through training programs. Thus, most of the respondents of the respondents are still devoted to their traditional experience practices. A study by Negatu *et al*. (2016) confirmed that, in the Rift Valley region in Ethiopia reported that local government extension workers and farmer cooperatives did not provide needed training to small-scale farmers on the proper usage of pesticides. Similar studies in Africa countries have pointed to similar poor attendance of pesticide-related trainings; for instance, only 16% of surveyed female farmers in South Africa attained any formal training (Naidoo *et al*., 2010) and almost all (98%) of the respondents of a survey in Egypt indicated they did not receive any training (Ibitayo, 2006). Accordingly, these farmers could not read or understand pesticide labels about the proper and safe use of pesticides (2007). Subsequently, the spray procedures were confused and messy. This has significant effects on the environment and the health of farmers.

## 4. Conclusion and Recommendations

This research examined the levels of awareness regarding pesticide use in small-scale farmers in West Shoa zone, Ethiopia with regards to the use and handling of pesticides. The results demonstrate that farmers have an inadequate understanding of pesticide use and handling, and frequently exhibit unsafe behaviors when dealing with them.

To bridge the knowledge gap, it is crucial to provide farmers with training programs that specifically address pesticides. These sessions should encompass the potential health risks associated with pesticide exposures, the adverse effects of pesticides on the environment, and the appropriate techniques for measuring and mixing various pesticides. Training pesticide retailers is also essential as they serve as the main source of information about pesticides for farmers. Increasing their knowledge about pesticides is crucial in ensuring the dissemination of accurate and up-to-date information to the farming community. To mitigate the health effects of the misuse of pesticides, there is a need for continuous pesticide safety training for farmers on the use of pesticide handling.

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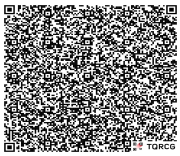
|  | Website: www.ijarm.com |
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