Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.13, No.13, 2022

Perceptions and Knowledge of Smallholder Farmers towards Safe Pesticide Use in Basoliben District, East Gojjam Zone, Ethiopia

*Abebaw Adamu Desalegn[1] and Workneh Abebe Wodajo[2]
1.Ethiopian Institute of Agricultural Research, Debre Markos Agricultural Research Center
P.O. BOX 357, Fax; +251-058 8911909, Debre Markos, Ethiopia
*Corresponding author: e-mail: abebawadamu@gmail.com
2.Food and Agriculture Organization of the United Nations, Riyadh, Saudi Arabia, e-mail: wawj2017@gmail.com

Abstract
The issue of safe pesticide use is great public health concern. Thus, this research was initiated to assess perceptions and knowledge of wheat producer farmers towards safe pesticide use in Basoliben district. To address the objectives of the study, mixed research approach was employed; and 302 respondent farmers were selected using simple random sampling technique. The study revealed that majority of participant farmers had positive perception on the importance of personal protective equipment, the health effect of storing pesticides in home, the health effect of pesticides to human during weighing, mixing and spraying. Even though, participants had positive perception about pesticides storage and importance of protective equipment; they had poor operational and safety practices. The information obtained from pesticide dealers on pesticide dose was also positive. However, participants had negative perception towards the effectiveness of manufacturers recommended dose. The study showed that farmers used lower dose for herbicide and higher dose for insecticides than the recommendation of manufacturers. Among participant farmers; 72.39% claimed symptom of excessive salivation followed by 58.59% nausea, 57.24% headache and 39.06% body weakness after they completed spraying operation. The result revealed that participants noticed a change in reduction of bees 96.03%, pollinator insects 86.42% and bird's population 79.8% during the last five years. Farmers had good knowledge on pesticide can enter to body via eye and nose. Majority of participants didn't have knowledge on pesticide can enter to body through skin. The study also showed that farmers didn't have knowledge on the recommended dose of every pesticide they use. It is recommended that the regional and the local government should focus on introducing affordable protective equipment and mandatory obligation by pesticide dealers on delivery and sale. Furthermore, farmers` self-recommendation dose must be regulated; and demonstration plots should be established for practical training on the effectiveness of manufacturers` recommendation.
Keywords: East Gojjam; Environment; knowledge; perception; pesticide; safe use
DOI: 10.7176/JESD/13-13-01
Publication date: July 31st 2022

INTRODUCTION

Historically, crop yield losses have been caused by damages from birds, other vertebrate animals, insects, weeds and diseases. For many centuries; yield losses from birds, vertebrate animals and some insects were mainly controlled by traditional practices (Ruelle & Bruggers, 1982). Loss of yield due to weed infestations have been mostly controlled by hand weeding. However, crop diseases caused by bacteria, virus and fungus were a difficult task for farmers unlike traditional control of insects and birds before the invention of pesticides.

The human population is continuing to grow (Mattews *et al*., 2014). Without the use of pesticides, the world will not be able to feed the growing population due to higher agricultural pre harvest and postharvest losses by weeds, pests and diseases infestation. Despite strong criticism on pesticide use due to its harmful effect to human, livestock and the environment; farmer's prior preference remains pesticides as effective means of controlling various crop pests.

It is generally accepted that pesticides are playing a vital role by increasing agricultural productivity thus by preventing and controlling pests. Pesticides being applied to control specific weed, insect or crop disease might not be always control only the target pest. When pesticides are applied to the target pest, only a small amount will be useful to protect or control the intended pests. Considerable amount of pesticides pollute off targets; plants, human, animal and the environment through vaporization, absorption by plants, leaching and runoff. According to Yadav and Devi (2017) most pesticides do not distinguish pests and other similar life forms that could be potentially harmful to humans, animals, other living organisms and the environment. Pesticides can contaminate the environment; including soil, water, grazing lands and other vegetation as a result kills insects or weeds that could be toxic to a host of other organisms including birds, fish, beneficial insects and other non-target plants (Gyawali, 2018).

Following the rapid expansion of commercial farms in Ethiopia during 1960s, pesticides are in use for 60 years (Mengstie, 2016). Even though; pesticide use accounted for six decades in the country, it is a recent

phenomenon for Basoliben district farmers to use pesticides as agricultural input. According to Basoliben District Agricultural Office (BDAO, 2019) pesticide use was widely started during the year 2000 following outbreak of Wollo bush cricket on tef (*Eragrostis tef*) crop and other pests on maize and chickpea crops. Until the year 2000 only few farmers were using pesticides to control major chickpea and maize pests. Unsafe use of pesticide has high health risk. Thus, it is high time to assess perceptions and knowledge of smallholder wheat producer farmers towards safe pesticides use which in turn contributes to effective extension intervention.

METHODS

The study was conducted in Basoliben district, East Gojjam zone of Amhara national regional state, Ethiopia. Geographically, Basoliben is located between 10° 09' 60.00"N Latitude and 37° 34' 59.99"E Longitude. The district is among the potential wheat producing districts in East Gojjam zone.

Both probability and non-probability sampling techniques were employed to select the study site and sample respondents.The target population of this study is smallholder wheat producer farmers in Basoliben district. Among 19 *Kebeles*[1], five were selected using simple random sampling technique. Considering the homogeneity of the target population, five *Kebeles* that produced wheat and used pesticides were selected randomly. A total of 302, (297 male headed and 5 female headed) household samples were drawn on the basis of probability proportional sample to size method for the respective *Kebeles*.

Primary data were collected through household interview schedule, focus group discussions, key informant interviews and personal observation. For the reliability and increasing the precision level of the research, the interview schedule tool was prepared and pretested before conducting the data collection processes.

The descriptive statistics analysis (frequency, percentage; mean and standard deviation) were employed. Data were presented through cross-tabulation, graphs and charts. To identify perceptions of households towards safe pesticide use, a five point Likert type scales were used. According to farmers response to each statement, their answers were ranked based on farmers level of agreement from 1to5, (1= strongly disagree, 2= disagree, 3= undecided, 4= agree and 5= strongly agree). As stated by Harry and Deborah (2012) questions that measure perceptions were summed up and mean scores > 3 was categorized as positive perceptions, 3 neutral and < 3 as negative perceptions. To understand the knowledge of farmers towards safe pesticide use, a set of questions which can measure farmer's knowledge were prepared and included in the interview schedule. Each question had either yes or no responses. For each correct answer one point and for the wrong answer zero point was given.

RESULTS AND DISCUSSION

Socio demographic characteristics of the respondents

Mean family size of respondents were 5.73 with the standard deviation of 2.02. Mean age, pesticide use experience and farming experience of the sample respondent was 44.53, 10.84 and 24.63 years, respectively. Regarding educational status of the respondents 55.63% were not able to read and write; 24.5% of the respondent able to read and write through informal ways (basic and religious education). About 12.25% and 7.62% of the sample respondents received elementary and secondary schooling, respectively.

Mean land allocation for major crops in the study area were 0.95 ha for wheat, 0.34 ha for maize and 0.32 ha for *tef*. This indicates that wheat is the major crop which is grown in the study area followed by maize and *tef*. As summarized in Table 1, the data revealed that participants mean score for the perception statement "manufacturers recommendation of pesticide dose is effective" was negative ($\overline{X}$ = 1.65). Perceptions of participants on "storing pesticides in home had negative effect on human health" ($\overline{X}$ =4.45), "information obtained from pesticide dealers on pesticide dose is more important than other channels" ($\overline{X}$=3.71), "pesticide can harm human being" ($\overline{X}$= 4.60), "pesticide can harm livestock" ($\overline{X}$=4.55); "mixing, weighing and spraying pesticides without Personal Protective Equipment (PPE) had negative health effect on human" ($\overline{X}$=4.50) and "pesticide can harm the environment" ($\overline{X}$=4.16) were positive.

[1] The smallest administrative unit in Ethiopia

Table 1. Perception result of respondents

Perception Statements	n	Mean	Result
Information obtained from pesticide dealer on pesticide dose is more important than other channels	302	3.71	Positive
Storing pesticides in home had negative effect on human health	302	4.45	Positive
Manufacturers recommendation of pesticide dose is effective	302	1.65	Negative
Mixing, weighing and spraying pesticides without Personal Protective Equipment (PPE) had negative health effect on human	302	4.50	Positive
Pesticides can harm human being	302	4.60	Positive
Pesticides can harm livestock	302	4.55	Positive
Pesticides can harm the environment (soil, water, air)	302	4.16	Positive

Information Sources on Pesticide Recommendation and Dosage

Availability of proper information on pesticide recommendation and dosage will reduce unnecessary production costs. There are a number of channels which provides information on pesticides including pesticide dealers, extension agents, pesticide labels, colleague farmers and the mass media. However, information obtained from different channels has its own limitation. Households in the study area are highly dependent on pesticide dealers in getting information on pesticide type, efficiency and dose.

Participants had positive perception on source of information about application, efficiency, dose and other management recommendation from pesticide dealers than other information channels. The result of this study is in line with Dey *et al*. (2013); Tandi *et al*. (2014), and Tyagi *et al*. (2015); in developing countries, most of the farmers; pesticide utilizations, application, and dose recommendation and advice were obtained from pesticide dealers and peer farmers. Similarly, a study done by Mahantesh and Singh (2009) and Shetty *et al*. (2010) reported that the main source of information for the smallholder farmers were pesticide dealers and agricultural extensions.

Majority of the respondents (92.7%) purchased pesticides from licensed venders and only 7.3% purchase from a vender they know but not sure about their license. The sample respondents perceived that licensed venders could deliver quality pesticides at reasonable price and provide appropriate information.

Farmers had different criteria to decide and purchase pesticides. Majority of the participants (89.7%) pesticide efficacy was their purchasing criterion whereas, 9.3% argue that pesticide availability was their purchasing criteria in the study area. Farmers were motivated by pesticide dealers, colleague farmers who used previously and, extension agents to purchase efficient pesticide. Tyagi *et al*. (2015) reported that efficiency of the pesticide for pest control was identified as the most important factor that influences the choice of pesticide by farmers.

Perception on Pesticide Storage

In the study area, farmers had positive perceptions towards storing pesticides in home which could have adverse human health effect. They also reported that they usually purchase limited amount of pesticides to be used them in next few days. Majority of the respondents stored pesticides for a limited period of time that they believed secured from the impacts of pesticides on their family members and livestock. Even though, participants had positive perception regarding to storing pesticides anywhere has health problem on human, they had poor operational and safety practices of pesticide storage. According to participants about 45% of respondents stored purchased pesticides in the house that children cannot be reached; 32.8% anywhere in the house; 20.2% in the kitchen and 2% by hanging on a tree for a short period of time (Figure 1).

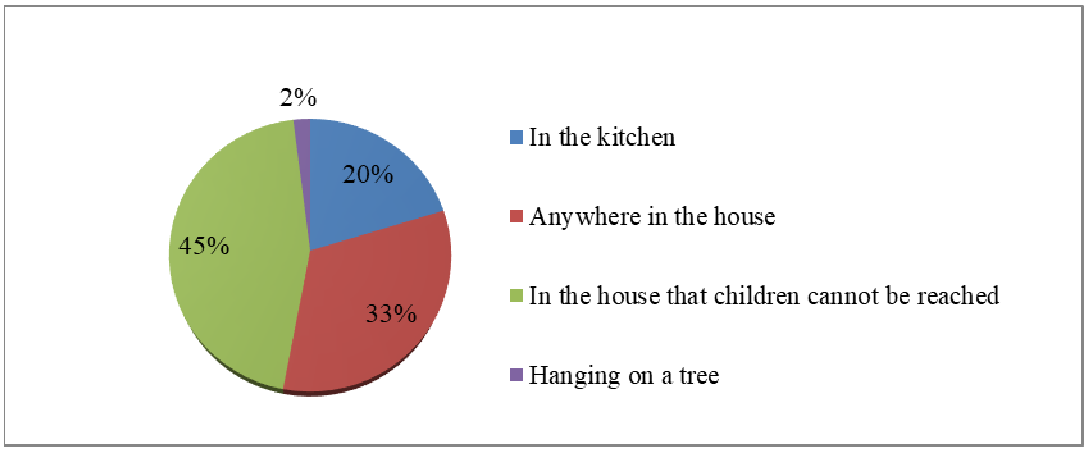

Figure 1. Pesticide storage practices of participants

Regarding pesticide storage, many studies reported that in developing countries majority of farmers' stored pesticides in their house and kitchen. For instance, Kwakye *et al.* (2019) reported that in Ghana 89% farmers' stored pesticides in their home and 76% of them use products immediately. Similarly, Godfrey *et al.* (2018) reported that more than 60% of coffee producer farmers in Uganda storing pesticides in their homes and 25% of respondents store in their bedrooms. In Ethiopia, different studies showed that farmers store pesticides in different locations. For example, in North Shewa of Amhara region; 42.53% of farmers store their pesticides in a separate place specified for pesticide storage but 37.5% store their pesticides anywhere in the house and 19.98% stored their pesticides in the kitchen (Kalayou & Amare, 2015). Another study conducted by Negatu *et al.* (2016) in Central Eastern part of Ethiopia only 16% of farmers stored their pesticide in a locked box, 38% store under the bed and 22% store by hanging on the wall. This implies that most of farmers stored their pesticides in different locations including home, bedroom, hanging on wall, and the kitchen that could significantly affect their family members and livestock.

Participant farmers in the study area didn't have special location to store pesticides. During focus group discussion (FGD) and key informant interview (KII) they stated that maximum care is taken while they store pesticides by limiting the shortest time to use, tightly covering pesticide containers with plastic sheets to avoid aerial contamination and by hiding and forbidding access to children and other household members. During FGD, a farmer from Yedug *Kebele* stated:

> *"Nowadays reckless pesticide storage is becoming source of suicidal commit in our community. We are taking more care by hiding and hanging up pesticides that family members cannot be easily reached of it. Usually we didn't inform and show the location where pesticide is stored to family members"*

In general, majority of respondents purchase and store unlabeled pesticides at home and kitchen. There might be a possibility of contamination with family members and different food items. This indicates that even if respondents understood the health effect of storing pesticides in home, they are not in a situation to protect and reduce the adverse health effects of pesticides on their family members and livestock.

Perceptions on Manufacturers Recommended Pesticide Dose

The result of this study showed that most of the farmers didn't accept manufacturer's recommendation of pesticide dose. Pesticide dose is important information that farmers expected from pesticide dealers and experts. After they bought pesticides, farmers decide the dose on the basis of previous experiences and information obtained from peer farmers.

In the study area, farmers commonly used herbicides and insecticides to control the prevalence of weeds and insect pests that causes yield loss. However, the key informant interview participants were agreed that the prevalence and yield loss by fungal and bacterial disease is too minimal. Farmer's decision on pesticide dose is generally based on their past experience and is different from manufacturer's recommendations. Participants reported that they decide the dosage of pesticides on the basis of the density of weeds and severity of pest infestation on their farm land. Usually, farmers in the study area prefer low dose for herbicide; however, farmers used higher doses of insecticides over the recommendation level provided by pesticide dealers and manufacturers.

The data showed that for herbicides; among the respondents 31.8% perceived manufacturers recommended dose is less, 42.7% optimum and 25.6% much. The dose for insecticide; among the respondents 68.5% perceived manufacturers recommended dose is less, 30.50% optimum and only 1% claimed much (Figure 3). The finding is in line with those; May *et al.* (2012) identified that in Myanmar among the respondents 26.15% perceived that manufacturers recommended pesticide dosage is too less, 3.85% too much where as 69.23% perceived adequate;

Wang *et al*. (2018) rice farmers in China 27.18 % uses more than the recommended dose, 31.01% uses based on previous experience and only 38.68% follow the recommended dose; Nguyen *et al*. (2018) in Vietnam 11% of vegetable producer respondents reported they applied higher doses of pesticides to achieve better effectiveness; and Shetty *et al*. (2010) in India farmers who are engaged in different cereal crops, vegetables and fruits production; majority of respondents (71%) did not follow the recommended dose. This implies that there is wider acceptance that farmers in developing nations practice under or over dose of pesticide use depending on the context hopping to achieve better results.

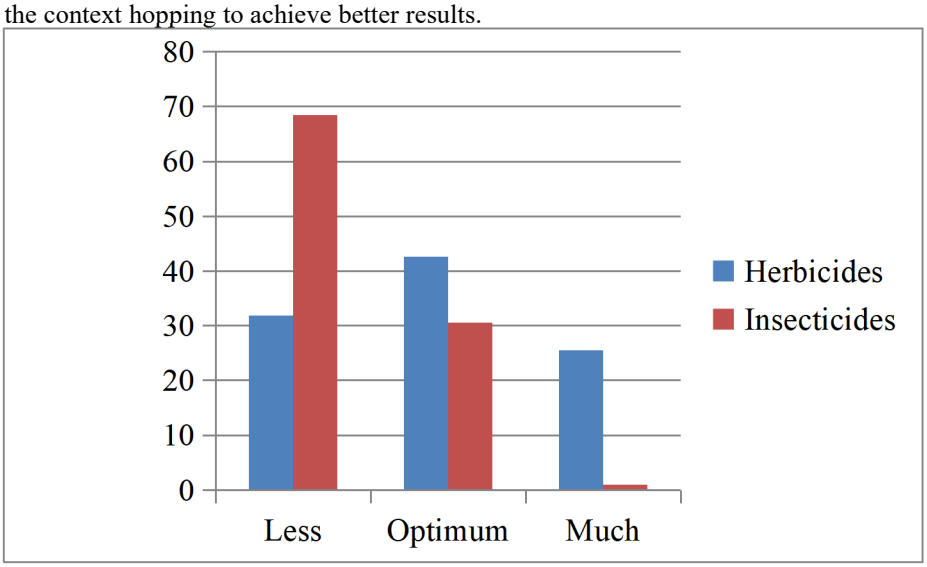

Figure 2. Perception of respondents on manufacturers recommended pesticide dose

Allocation of farm land by farmers for each crop is mostly less than a hectare. Therefore, they will not obtain labeled pesticides for their fragmented plot. Obviously, farmers who have half or quarter of a hectare may need to use pesticides by calculating and measuring exact volume from labeled bottles. Interestingly, majority of the participants (80.8%) didn't use any standard pesticide measuring devices. They usually use coffee cups and other locally available measuring materials. During the personal observation, these measuring cups are not suitable to measure pesticides and the exact volume of each cup is not known. As a result, these inappropriate tools lead farmers to practice pesticide over or under dose. According to the study result of Khanal and Signh (2016), almost all (96%) of Nepalese farmers measured the dosage of pesticide with a spoon, cup, jar or any available materials in their locations.

Perceived Health Effect of Pesticides and Safety Equipment Use

Pesticides have the highest concentration level before mixed with water. Since concentrated pesticides are highly toxic to human and livestock health, a due attention and care must be taken. Farmers ought to know and understand the hazardous routes of pesticides to human and its wider effect. According to ILO (1991) report and Ogg *et al.* (2018) study, pesticides can enter to human body in three ways; through the mouth, the lung and the skin. Mixing and weighing concentrated pesticides without personal protective equipment (PPE) will have serious health hazard on farmers. Therefore, the key solution to reduce the risk of pesticide exposure is always using proper PPE.

Despite participants having positive perception on mixing, weighing and spraying pesticides without PPE had health problem, they are not in a position to access either complete PPE or essential PPE components. During the KII, participants argued that most of spraying operation undertaken mainly with their normal cloths except covering their mouth and nose with towel.

Participants were cognizant that pesticides could have negative effect on human. Participant farmers noticed several health symptoms after using and spraying pesticides such as; nausea, vomiting, headache, itching of eye and skin, excessive sweating, salivation and body weakness.

Female household members in the study area didn't practice spraying operation. It was appreciable practice accepted by residents. All sample respondents who practice spraying operation were asked whether they felt any discomfort or illness symptoms after they sprayed by allowing multiple responses. Among listed symptoms; 72.39% claimed symptom of excessive salivation followed by 58.59% nausea, 57.24% headache, 39.06% body weakness, 36.7% eye irritation and 35.69% skin irritation. Figure 2 shows summary of symptoms after finishing spraying operation.

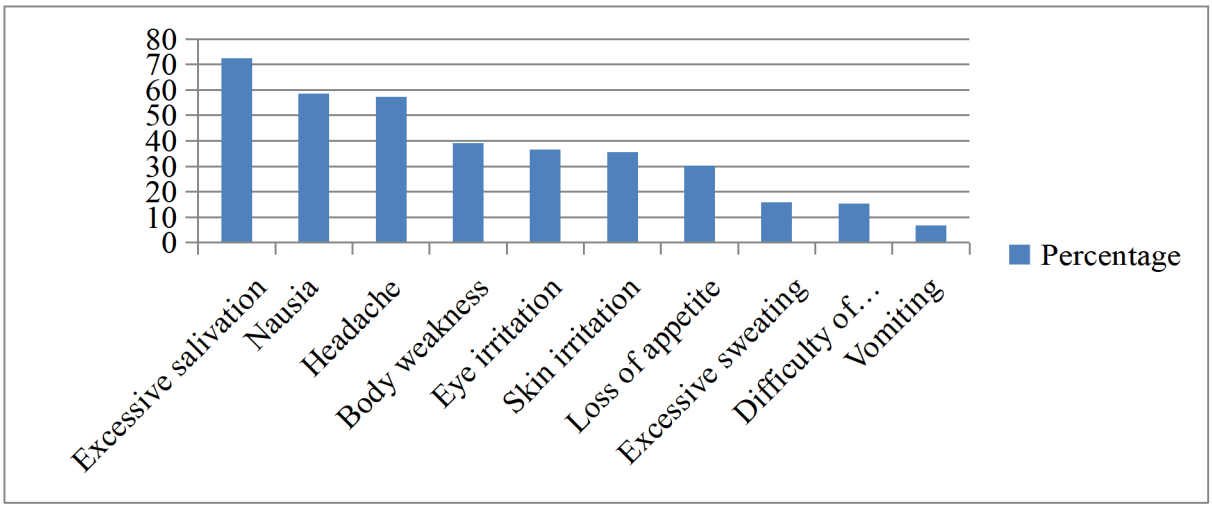

Figure 3. Perceived health effects of pesticides

Symptoms claimed by respondents can be termed as mild poisoning that most of pesticide manufacturers warn on their written precautionary statements except for excessive salivation. The result is in line with Tandi *et al*. (2014); in Cameroon pesticide applicators using no or partial PPE as a result of improper safety equipment use; farmers were reported different health symptoms. A research by Dey *et al*. (2013) in India, farmers reported symptoms of excessive sweating, stinging (itching of eyes), dry throat, skin redness, muscle weakness, burning sensation and excessive salivation.

According to Yadav and Devi (2017) excessive salivation symptom is moderate poisoning category. This symptom implies that sprayers in the study area lack using PPE as required and there was moderate level of pesticide poisoning. The result seems different from Dey *et al*. (2013) reported that in India symptom of excessive salivation was 33.1%. This is because sprayers in India are familiar with and use standard PPE to protect themselves from pesticide hazard and access to training is better.

Perception on the Health Effects of Pesticides on Livestock and Environment

According to respondents, unwise disposal of pesticide sachets was affected the health of their livestock when grazing those empty pesticide sachets. Farmers underlined the health effect of their livestock is at risk when grazing pesticide sprayed fields in case of drift and pesticide runoff. Furthermore, participants claimed that during the last five years there were a dramatic change in the bees, other pollinating insects and bird's population in their locality that they perceived this might be due to unwise application of pesticides (Figure 4).

The result showed that during the last five years participants noticed significant reduction in the bees, pollinator insects and bird's population. The data showed that participants noticed a change in reduction of bees 96.03%, pollinator insects 86.42% and bird's population 79.8% during the last five years. The result of this study is consistent with Shetty *et al*. (2010) in India majority of the respondents have a strong perception on the negative impacts of pesticides on the environment. Similarly, a study done by Oluwole and Cheke (2009) in Nigeria revealed that farmers had noticed decreases of beneficial insects and animals due to pesticide application.

Majority of respondent farmers 62.91%, 61.92% and 63.58% noticed increase in weeds, insect pests and crop diseases, respectively during the last five years. The change was due to inappropriate and unwise use of pesticides. Unwise use of pesticides can damage ecosystem function and reduce biodiversity and contribute to the development of resistance in pests (EPA, 2017). Practice of misusing and mixing different pesticides together can increase pest resistance by reducing its effectiveness (Nguyen *et al*., 2018); can change the chemical properties of pesticides, thereby can affect human health and the environment (Dey *et al*., 2013).

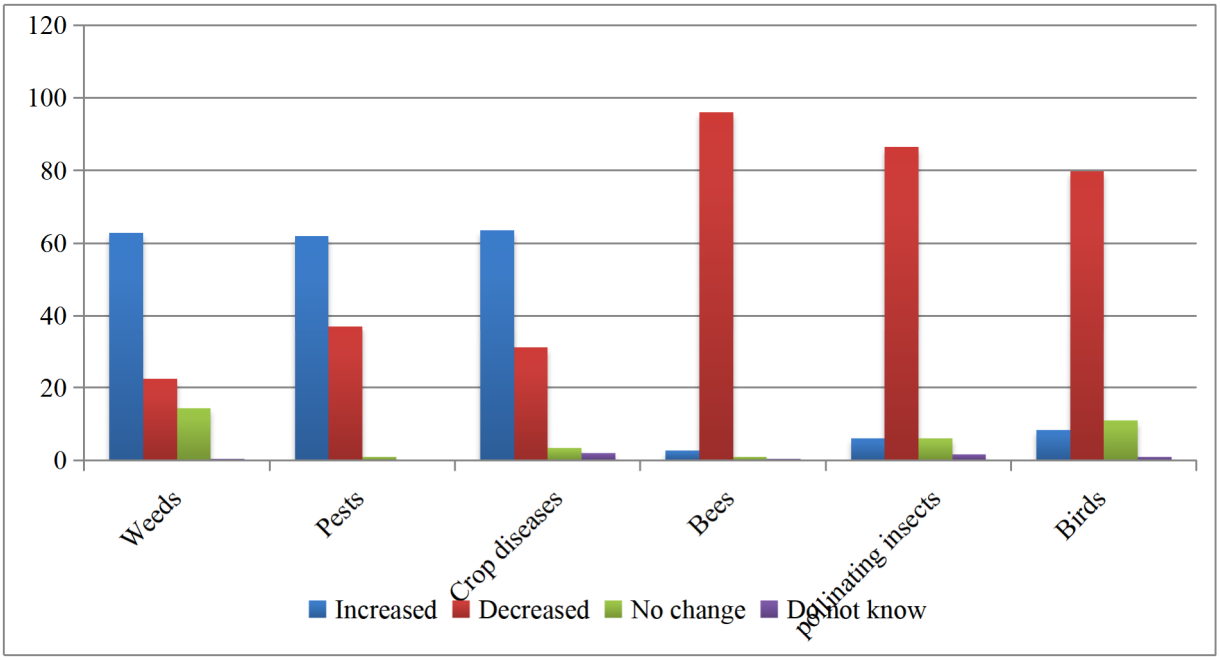

Figure 4. Perception of respondents change in crop pests, bees, birds and other insects

The result showed that participants had good understanding about the potential hazard of pesticides to the environment. Obviously, pesticides being applied to control specific weed, insect or crop disease might not be always control only the target pest. The proposed pesticide can harm off target pests, human beings, livestock and the environment.

The result is in line with Perez *et al*. (2015) in the Philippines most of farmers perceived that pesticide may have negative effect to their health and environment by killing the natural enemies of pests and other off-target organisms. Shetty *et al*. (2010) also reported that in India majority of the literate respondents expressed strong perception on the negative impacts of pesticides on soil, water, air and other beneficial organisms in the environment. A research by Fikre *et al*. (2016) indicated that in South Western part of Ethiopia majority of the respondents perceived pesticides could harm the environment.

Knowledge of Farmers towards Safe Pesticide Use

Majority of respondents (61.9%) didn't know whether pesticides could enter to their body via their exposed skin. However, (66.2%) of participants knew pesticides can enter via their noses and 63.9% claimed they knew pesticide can enter through their eyes during transportation, storage, weighing, mixing, spraying and post spraying management activities (Table 2).

Table 2. Percentage distribution of respondents' knowledge score for routs of pesticides

Questions	Responses	n	Percent
Do you think that pesticides can enter through your skin?	No	187	61.9
	Yes	115	38.1
Do you think that pesticides can enter through your nose?	No	102	33.8
	Yes	200	66.2
Do you think that pesticides can enter through your eye?	No	109	36.1
	Yes	193	63.9

Farmers and their families are exposed to pesticides through their skin, mouth, eyes and nose. Pesticides are harmful to human being unless handled and used safely. In most cases; people who handled and use pesticides can absorb toxic chemicals through their exposed skin and eyes and through ingestion via the mouth and nose. The finding is consistent with López-Dávila *et al.* (2020) Cuban farmers considered that pesticides can enter through their body via the skin, mouth, and nose, but mainly can affect their health if ingested; not when they came in contact with the skin or enter through the nose. Similarly Jean *et al*. (2019) reported that Cameroonian farmers claimed that mouth is the most common route of pesticide; however, only 2% reported skin is to be route of pesticide entry. From the researcher point of view, farmers can realize that eyes and nose to be routs of pesticides from their health symptom during pesticide management i.e., itching of eyes and pesticide smell lead to headache and nausea. However, to understand whether human skin is absorbing toxic chemicals or not farmers require having at least a secondary school level education. Because at this level, they may knew from their biology course. Practically, only 7.62% of participant farmers received secondary school education.

Majority of the participants (69.2%) didn't know the recommended dose of every pesticide they used. Among the respondents who didn't know the recommended dose (73.68%) received information about the right recommended dose of the pesticides from pesticide vendors and 21.53% from extension agents. Due to higher illiteracy level and practice of using unlabeled pesticides, farmers didn't read pesticide labels and leaflets. Farmer's knowledge on safety use of pesticides is influenced by their level of education (Reddy *et al*., 2014). Farmers in the study area heavily relied on pesticide dealers to acquire information about the right recommended dose, or apply over/under dose based on previous experiences. Extension agent's knowledge to assist farmers on safe pesticide use appeared to be weak, because they are not well trained. Participants had best knowledge on some PPE components that can protect from pesticide hazards. Almost all participants knew using PPE items like; gloves, plastic boots, nose and mouth mask, goggles, hats, long-sleeved shirts and overalls can protect from pesticide exposure (Table 3).

Table 3. Right answer responses of respondents for personal protective equipment components

Statements	n	Percent
I know that using glove can reduce pesticide exposure	295	97.7
I know that using plastic boot can reduce pesticide exposure	291	96.4
I know that using nose & face mask can reduce pesticide exposure	296	98
I know that using goggles can reduce pesticide exposure	298	98.7
I know that using hats can reduce pesticide exposure	295	97.7
I know that using long sleeved shirts can reduce pesticide exposure	295	97.7
I know that using overall can reduce pesticide exposure	296	98

Due to several health symptoms after spraying operation, farmers understood that using these PPE components will reduce the health impact of pesticides. A farmer during group discussion from Limichim *Kebele* informed:

> *"We are learning and understanding pesticide health effects just by observing health changes of farmers who spray for money. These farmers are very busy and take much of their time on spraying operation without any PPE; as a result, their health is deteriorating from time to time"*

Due to lack of training and awareness to routs and the extent of pesticide hazards in the long run; farmers weigh, mix and spray pesticides without proper PPE. Mostly, spraying operation is undertaken with normal clothes. Even though, farmers knew some routs of pesticides (eyes and noses) they are not in a position to use and access complete PPE or essential PPE components. In the field observation made, few farmers used some locally available protective clothes like; hats, towels (instead of face mask), long sleeved shirts, long pants and plastic boots; but these materials are pesticide absorbent and could not protect them.

Even though, farmers had knowledge on PPE can protect them from pesticide hazard; they didn't use safety equipment. **Similar finding was reported by Abbassy (2017) that Egyptian pesticide sprayers (88.4-96.5%) have knowledge on the importance of PPE components but they didn't use this safety equipment.** According to Gesesew *et al*. (2016) even though, the majority of farmers in Southwest Ethiopia had average knowledge on the problems of pesticide exposures, around 41.8% reported never used PPE.

CONCLUSION

The majority of farmers had positive perception on several aspects of safe pesticide use. Participant farmers had positive perception on the benefit of PPE during weighing, mixing and spraying of pesticides. However, they had poor operational and safety practices. Unavailability of complete PPE and essential PPE components at the nearest market in the study area is critical problem. Thus, the local and the regional government should focus on introducing affordable PPE and mandatory obligation by pesticide dealers to deliver for sale. Farmers know that eyes and noses are hazardous routs of pesticides; but majority of respondents didn't know pesticide can enter to their body through skin. Majority of farmers didn't know the right recommended dose of every pesticide they used. They decided on the basis of previous experiences and information obtained from peer farmers hopping to achieve better results. The practice and perception can damage ecosystem function, reduce biodiversity and develop resistance to pests. In order to convince farmer's perception on manufacturer's recommendation dose is effective, extension agents should establish demonstration plots for practical training at farmers training center. Farmers mostly relied on pesticide dealers to obtain the required information on pesticide dosage and other pesticide related issues. Capacity building efforts to extension agents on pesticide management should be encouraged so as to help farmers to obtain the required information and knowledge on their locality. The health symptom of excessive salivation is evidence on the availability of mild poisoning due to unwise management of pesticides. Continuous research and preventive measures should be taken by the local and regional government before it is public health problem. Declining population of bees, other pollinating insects and birds is alarming. The change is perceived to be due to inappropriate and reckless use of pesticides. Farmers should practice responsible use of pesticides in accordance to the country regulations.

REFERENCES

Abbassy, M. M.S. (2017). Farmer's Knowledge, Attitudes and Practices, and their Exposure to Pesticide Residues after Application on the Vegetable and Fruit Crops. Case Study: North of Delta, Egypt. *J Environ Anal Toxicology 7: 510. doi: 10.4172/2161-0525.1000510*

Basoliben District Agricultural Office. (2019). Basoliben District Agricultural Office Annual Report (Unpublished).

Dey, K. R., Choudhury, P., and Dutta, B. K. (2013). Impact of pesticide use on the health of farmers: A study in Barak valley, Assam (India). *Journal of Environmental Chemistry and Ecotoxicology. Vol. 5(10), pp. 269-277, November, 2013*

EPA (2017). EPA Guidelines for Responsible Pesticide Use. EPA, Adelaide

Fikre, L., Fikadu, M., Gezahegn, B., and Adugna, E. (2016), Smallholder farmers' knowledge, perception and practice in pesticide use in South Western Ethiopia. *Journal of Agriculture and Environment for International Development - JAEID 2016, 110 (2): 307-323*

Gesesew, H.A., Woldemichael, K., Massa, D., Mwanri, L. (2016) Farmers Knowledge, Attitudes, Practices and Health Problems Associated with Pesticide Use in Rural Irrigation Villages, Southwest Ethiopia. *PLoS ONE 11(9): e0162527. doi:10.1371/journal.pone.0162527*

Godfrey, K., Patrick, K., Judith, K., D. Nicholas, O., Lilian, N., Winnie, N., P. Babra, N., Sammy, O., & W. William, W. (2018). Farmers' knowledge and perception of the use of pesticides in Arabica coffee, Coffea arabica agro-ecologies of Uganda. *Journal of Agriculture and Environmental Sciences, 7(2), 173–188.*

Harry, N., Boone, Jr. and Deborah, A. Boone. (2012). Analyzing Likert Data. *Journal of Extension. April 2012 Volume 50 Number 2 Article Number 2TOT2West Virginia University Morgantown, West Virginia*

International labor organization. (1991). Safety and health in the use of agrochemicals: A guide. An ILO contribution to the International Program on Chemical Safety (a collaborative program of the United Nations Environment Program, the International Labor Organization and the World Health Organization), Geneva

Jean, S., Emmanuel, F., Edouard, A.N., and Brownlinda, S. (2019). Farmers' Knowledge, Attitude and Practices on Pesticide Safety: A Case Study of Vegetable Farmers in Mount-Bamboutos Agricultural Area, Cameroon. *Agricultural Sciences , 10, 1039-1055.*

Kalayou Hiluf, G. and Amare Ayalew, A. (2015). Assessment of Pesticide use, practice and environmental effects on the smallholder farmers in the North Shoa zone of Amhara National Regional State of Ethiopia. *Research Journal of Agricultural and Environmental Sciences.*Volume-2, Issue-2,

Khanal, G., and Singh, A. (2016). Patterns of Pesticide Use and Associated Factors Among the Commercial Farmers of Chitwan, Nepal. *Environmental HealthInsights 2016:10(S1)*

Kwakye ,O. M., Mengistie, B., Ofosu-Anim, J., Nuer,A. T., Brink, P. J. V. (2019). Pesticide registration, distribution and use practices in Ghana. *Environmental Development Sustainability. (2019) 21:2667–2691*

López-Dávila, E., Ramos Torres, L., Houbraken, M., Du Laing, G., Romero Romero, O., &Spanoghe, P. (2020). Knowledge and practical use of pesticides in Cuba.*CiencTecnolAgropecuaria, Mosquera (Colombia), 21(1): e1282*

Mahantesh, N., & Singh, A. (2009). A study on farmers' knowledge, perception and intensity of pesticide use in vegetable cultivation in western Uttar Pradesh.*Pusa Agricultural Science* Vol. 32,

Mattews, G, Bateman and Miller, P. (2014). Pesticide Application Methods.Fourth Edition. John Wiley & Sons, Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

May Lwin, O. O., Mitsuyasu, Y. A. B. E., & Huynh Viet, K. H. A. I. (2012). Farmers Perception, Knowledge and Pesticide Usage Practices: A Case Study of Tomato Production in Inlay Lake, Myanmar. *J. Fac. Agric. Kyushu Univ*, *57*(1), 327-331.

Mengistie, B. (2016) Environmental governance of pesticides in Ethiopian vegetable and cut flower production (Doctoral dissertation, Wageningen University).

Negatu Beyene, Kromhout Hans, Yalemtshay Mekonnen and Vermeulen Roel, (2016). Use of Chemical Pesticides in Ethiopia: A Cross-Sectional Comparative Study on Knowledge Attitude and Practice of Farmers and Farm Workers in Three Farming Systems. *The chattered society for worker health protection.Ann. Occup. Hyg., 2016, 1–16*

Nguyen, T. M., Le, N. T. T., Havukainen, J., & Hannaway, D. B. (2018). Pesticide use in vegetable production: A survey of Vietnamese farmers' knowledge. *Plant Protection Science*, *54*(4), 203-214.

Ogg, C., Bauer, E., Hygnstorm, J., Bright, F., Puckett, G., and Alberts, C. (2018) Protective Clothing and Equipment for Pesticide Applicators. Nebraska Extension

Oluwole, O., and Cheke, R. (2009). Health and environmental impacts of pesticide use practices: a case study of farmers in Ekiti State, Nigeria. *International Journal of Agricultural Sustainability 7(3) 2009, PAGES 153–163*

Perez Ian, Gooc, C., Cabili, J., Rico, M., Ebasan, M., Zaragoza, M., Redondo, A., Orbita, R. and Lacuna, M. (2015). Pesticide use among farmers in Mindanao, Southern Philippines.*Advances in Environmental Sciences, International Journal of the Bioflux Society, Volume 7, Issue 1.*

Reddy, P. N., Lakshmi, T., and Prasad, S.V, (2014). Standard Test to Measure Knowledge of Cotton Farmers on Health Hazards of Pesticides Usage in Kurnool District of Andhra Pradesh.*IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) Volume 7, Issue 5 Ver. IV. PP (24-29)*

Ruelle, P., and Bruggers, R. L. (1982) Traditional approaches for protecting cereal crops from birds in Africa. Proceedings of the Tenth Vertebrate Pest Conference.University of Nebraska - Lincoln

Shetty, P. K., Murugan, M., Hiremath, M. B., & Sreeja, K. G. (2010). Farmers education and perception on pesticide use and crop economies in Indian agriculture. *Journal of Experimental Sciences*.

Tandi, T. E., Wook, C. J., Shendeh, T. T., Eko, E. A., & Afoh, C. O. (2014). Small-scale tomato cultivators' perception on pesticides usage and practices in Buea Cameroon.*Health*, *6(21), 2945.*

Tyagi, H., Gautam, T., & Prashar, P. (2015). Survey of pesticide use patterns and farmers' perceptions: a case study from cauliflower and tomato cultivating areas of district Faridabad, Haryana, India. *International Journal of MediPharm Research*, *1*(03), 139-146.

Wang Jianhua, Chu May & Ma Yuting. (2018). Measuring Rice Farmer's Pesticide Overuse Practice and the Determinants: A Statistical Analysis Based on Data Collected in Jiangsu and Anhui Provinces of China. *Sustainability 2018, 10, 677*

Yadav, I. C. and Devi, N. L. (2017). Pesticides Classification and Its Impact on Human and Environment.*Environ. Sci. & Engg. Vol. 6: Toxicology*