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USE AND EFECTS OF PESTICIDES IN BAGNASKALI RURAL MUNICIPALITY-5, DARLAMDANDA, PALPA

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Abstract

This study assessed the pesticide use practice and its health effect among the farmers of Baganaskali Rural Municipality-5 Darlamdanda, Palpa. A total of 64 respondents was selected as a sample population and data was collected through semi- structured interviews and observation. During the study, 26 types of pesticides were documented among them insecticide was the most dominant (15) followed by fungicide (6), herbicide (2), rodenticide (1) and bactericide (1). Nuvan, malathion and bullet were the most commonly used pesticides which were commonly used to control pest and to increase the yield. More than 90% farmers were suffered from pesticide related health signs and symptoms after the application of pesticide. Headache (84.38%), skin irritation (79.69%), eye problem (69.17%), muscular pain (60.94%) and dizziness (50%) were the most common health problems. Majority (95.31%) of farmers used safety measures but among them only (3.13%) farmers used whole body covering PPE. Trousers (92.19%), full sleeved clothes (82.83%) and mask (75%) were the most commonly used PPEs.Only 28.13% of farmers were participated in pesticide related training. The status of pesticide storage, handling and disposal was not found satisfactory.The farmers were in need of special attention in terms of taking safety precautions, pesticide storage, safe handling and disposal. It is recommended that the trainings regarding the use of pesticide, safe handling and use of personal protective equipment's should be conducted with more ecofriendly farming systemto raise the awareness among farmers.

*Keywords***:** Pesticide, Farmers, Hazardous, Symptoms, Precaution, Disposal

Introduction

According to FAO (Food and Agriculture Organization), "A pesticide is any substance or mixture of substance that are intended for preventing, destroying, controlling and mitigating any pest, including vectors of human or animal diseases, unwanted species of plants or animal causing harm or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs or substances which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies."Pesticides are specially designed to prevent, control or destroy the pests of plants and other causal organism of the human, animal and plant diseases (Atreya et. al, 2011). They are used in agriculture, veterinary, public health services and household purposes. Balance use, optimum doses, correct method and right time of application of pesticide increases the crop production (Bhandari, 2014, Sharma, 2015).However, pesticide misuse and overuse cause harmful effects on non-target organisms and adds extra burden to Nepalese society in

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terms of pesticide related health expenses, environment pollution, crop losses due to pest resurgence and spending extra costs both to farmers and country as whole (Sharma et. al,2012; Gauchan,2008). Government of Nepal (GON) has banned 21 pesticides due to their toxicity, persistence, tendencies of accumulation and bio-magnification and long-term serious threats to human and environment (MoALD, 2019, Gyawali, 2018; PRMP,2012).

Generally, pesticides are of following two types which are biopesticide-Biologically derived pesticide, with no adverse impact on ecosystem and environment,such as*Artemisia* (Titepati), *Nicotiana* (Tobacco), *Azadirachta*(Neem), etc and Chemical Pesticide- chemically originated substance with more adverse impact on ecosystem and environment (Sharma, 2019). They include both organic and inorganic types and may be classified into different groups based on chemical composition. These pesticides include Organochlorines (DDT, BHC, Aldrin, Dialdrin, Chlordane, etc.), Organophosphates (Malathion, Parathion, Guthion, etc.), Carbamates (Aldicrab, Carbryl, Sevin, etc.)Formamidines, Thiocyanates,Organotins, Denitrophenols, Synthetic pyrethroids and antibiotics.Chemical pesticides are also called synthetic pesticides(Bohmont, 1990). Most of the pesticides end with the suffix-cide like Fungicide (Fungi),Insecticide(insect),Bactericide(Bacteria), Herbicide (Herbs),Algicide (Algae)etc.

The first synthetic pesticide introduced in Nepal is DDT for malaria eradication (Bhandari, 2014).But nowa number of 306 commercial products grouped under 71 common names of pesticides have been registered in Nepal: insecticides (40); fungicides (18); herbicides (5); rodenticides (3); Ascaricides (1) and others (4) (NARC, 2005). Among different pesticides, fungicide is the dominant form of pesticide used in Nepal(Thapa, 2017). In the year 2016/17 more than 43% of pesticides were used in the form of fungicide followed by insecticide (31.58%) and herbicide (23.38) (PRMP, 2012). The share of rodenticide, bactericide and biopesticide is very low as compared to above mentioned pesticide and it shares 1.91%, 0.01% and 0.001% respectively (PRMP, 2015). The number of households using pesticides varies considerably across the country. Terai have the highest number of households (25%) using chemical pesticide whichfollowed by mid-hill households (9%) and mountain households (7%) (Sharma et al., 2012,Karmacharya,2012).Most pesticides are used in rice (40-50%), Pulses (14-20%), cotton (13-15%) and vegetables and fruits (10-15%) (Manandhar, 2005).

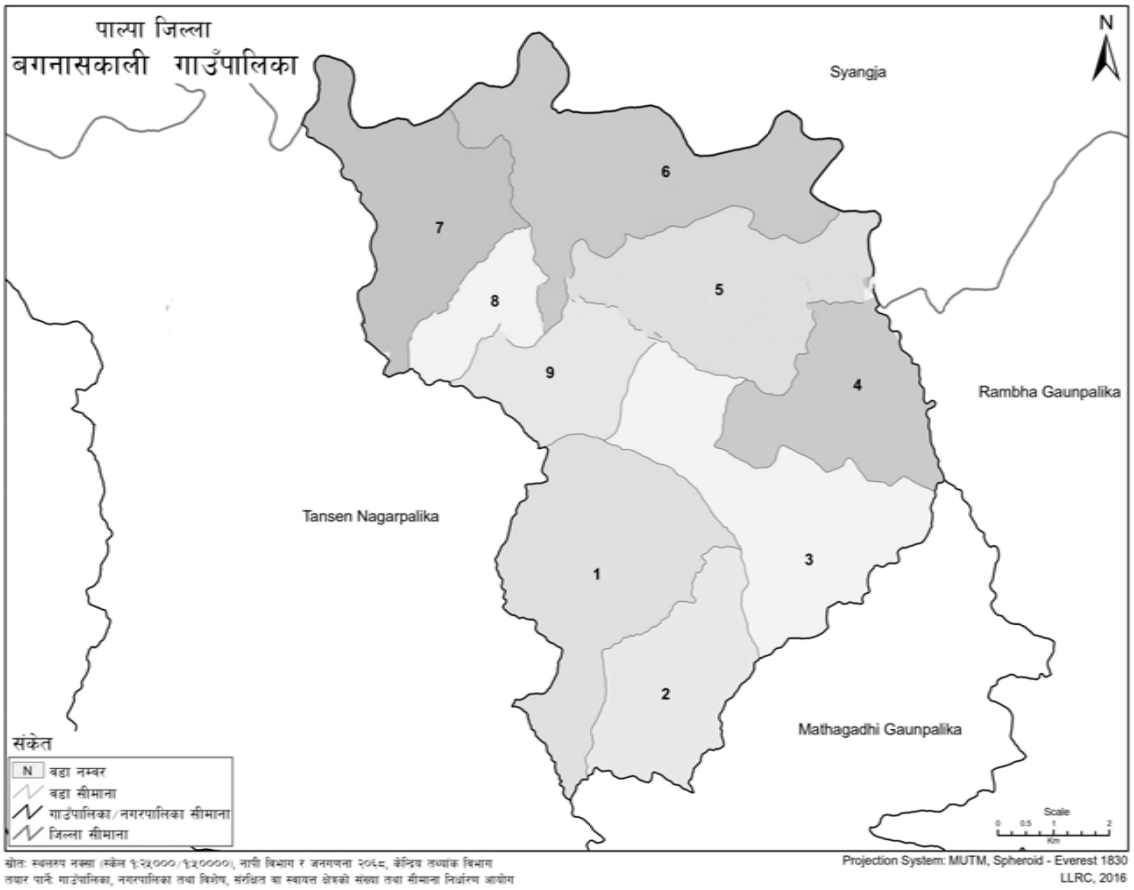
The Objectives of this research isto identify the type of chemical pesticides used in agriculture field, to assess the knowledge about pesticide use practice and its handling, to assess safety precautions taken in pesticide application, to address the pesticide related health problems felt by farmers.

Materials and Methods

Study Area

Bagnaskali Rural Municipality is surrounded by Syangja district from north, Rambha Rural Municipality from east, Tansen Municipality from west and Mathagadi Rural Municipality from south direction. The altitude of the study area ranges from 400m – 1500m. It lies between 27.9^{O}N 83.6^{O}E and covers an area of 84.2 Km^2. The major ethnic groups are Brahman, Magar,

Chhetri, Damai, Kami, Newar, etc. There are 519 households with total population of 2,097 among which 878 (41.87%) are male and 1,219 (58.13%) are female (CBS, 2011). Agriculture is the main source of income and is rich in agricultural production. Different types of vegetables, fruits, cereals, food grains etc are produced in large amount. Paddy is grown in huge amount similarly maize, wheat, barley; potato, mustard etc are also grown in their season. The vegetables like cauliflower, cabbage, brinjal, greenleaves, peas, beans, tomato, chilies, garlic are cultivated. Likewise, the fruits such as guava, pineapple, litchi, mango, orange are also produced.



Field Visit and Observation

The study area was visited for the 3 times from Sep 2019 to June 2020. A total of 21 days were spent in the study area including 7 days for each field visit. The standard questionnaire was prepared for the collection of local people knowledge on use of pesticide. Eight respondents from each of eighttoles were taken as sample by simple random sampling method and thus altogether 64 respondents were interviewed including farmers, pesticide retailers, JTAs, community leaders, school teachers, youths and especially elder people from the study area to obtain the extended information.

Data Collection

Two types of data were collected using Rapid Rural Appraisal (RRA) tools and techniques. Primary data were collected by field observation, direct personal interview, indirect oral interview, questionnaire survey, household survey etc. Mainly primary data was collected by semi-structured interview, focus group discussion and key-informants interview.Standard questionnaires were prepared and then interview was conducted with the vegetable growers/ farmers and local people that comprises from youth to elderly people. Each respondent was asked questions about the type; storage, handling and disposal of pesticide; safety precautions used during application of pesticide; health effects of pesticide; participation in training and waiting period after pesticide used.Focus group interview with 10-12 respondents was conducted during the research period that includes farmers, elder people, community leaders, school teachers and knowledgeable people of the community.This method was used to obtain detail information about the pesticides used in vegetables and their technique of utilization pattern by local people of the study area. So, the interview was taken with the following key informants like vegetable growers/ farmers, knowledgeable old people, pesticide retailers, JTA etc.Secondary data was taken from several published journals, research reports, document, articles, dissertations related to use of pesticides. Furthermore, essential information was also downloaded from related websites. The data used for this study were both qualitative and quantitativetype.

Data Analysis

The data collected were tabulated into separate format systematically in order to achieve desired objectives. The data was analyzed quantitatively and qualitatively by descriptive method. Then these data were interpreted using simple mathematical tools like percentage and mean and were represented by using simple tables, charts and graphs.

Results and Discussion

a. Types of Pesticides Used

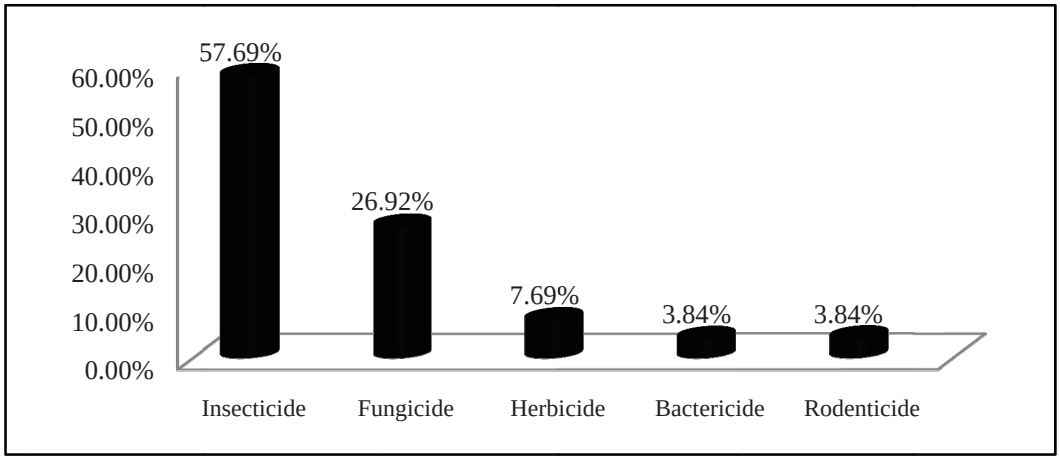


Figure 1: *Type of Pesticides Used*

A total of 26 different types of chemical pesticides were found used by farmers of the study area. Among them, 15 types of insecticide (57.69%), 7 types of fungicide (26.92%), 2 types of herbicide (7.69%), 1 type of bactericide (3.84%) and 1 type of rodenticide (3.84%) (Figure 1). There were 43 different types of chemical pesticides used in Bhaktapur out of which 28 types were of insecticides and 15 types of fungicides(Jha and Regmi,2009). Insecticide was the most dominantly used; probably because crop loss due to insect was the prevalence problem and the application of insecticide may be found more fruitful than other pesticides.

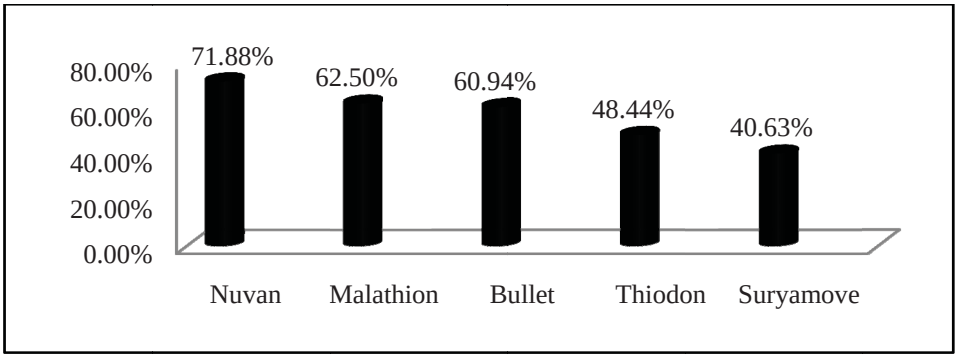


Figure 2: *Most commonly used Insecticides*

Out of the 26 identified chemical pesticides, Nuvan was the most common used pesticide (71.88%) followed by Malathion (62.5%), Bullet (60.94%), Thiodon (48.44%), Suryamove (40.63%) (Figure 2) and most commonly used fungicides were Di-ethane M-45 (56.25%), Himil (53.13%), Bavistin (45.31%), Navistin (35.94%), Blitox 50W (25%) as in Figure 3.

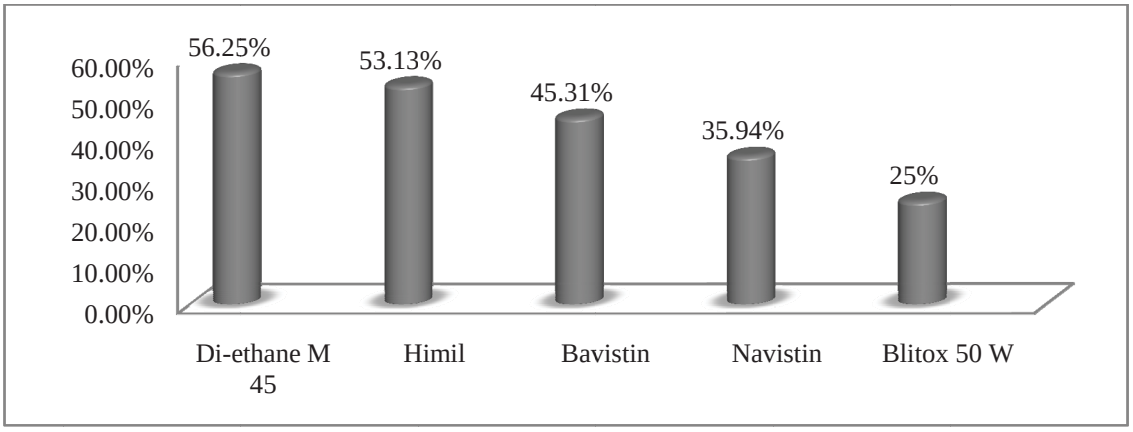


Figure 3: *Most commonly used Fungicides*

b. General information on pesticide use

Regarding chemical pesticide utilization, 31 (48.44%) of participants used pesticide mostly at the fruiting, 26(40.63%) at flowering stage and 7 (10.94%) at vegetative stage of plant (Figure 4,). High use of pesticide at fruiting stage might be due tothe damage caused by pests during this stage was higher than at other stages.

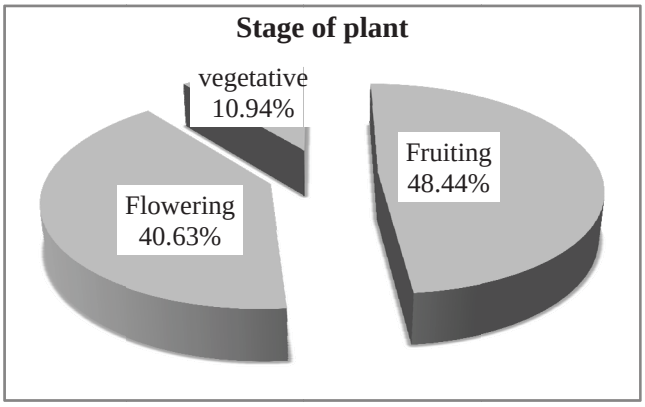


Figure 4: *Pesticide applied stage*

In case with the timing of pesticide application, half (50%) of the farmers stated that they apply pesticides after the presence of pest, 43.75% before appearance of pest and 6.25%after pest started destroying crops (Figure 5). The application of pesticide before appearance of pest might be due to fear of farmers that if once the pests were appeared, it is difficult to prevent the crop from damage caused by it.

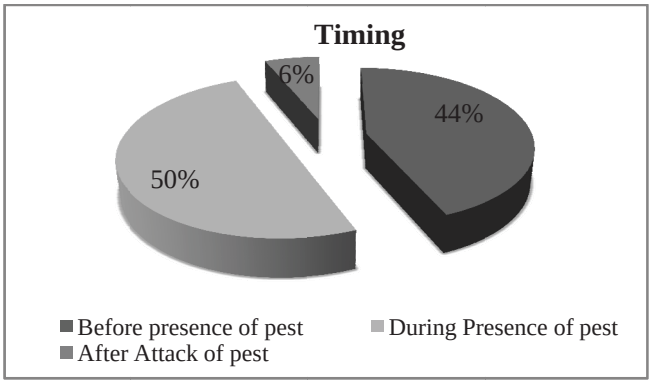


Fig 5-Timing of pesticide use

About the waiting period for harvesting the crop after pesticide use, 37.5% of farmers indicated that they follow the waiting period of 5-10 days whereas 4.69% follow no waiting period. They harvest the product next day after pesticide use which might be due to economic pressure or due to lack of knowledge about its hazardous effect. About 20.31% of farmers followed the waiting period of 1-5 days, 23.44% of farmers followed 10-15 days and 14.06% of farmers followed the waiting period of more than 15 days (Figure 6). More waiting period indicates that there is lesser risk of pesticide residue in crops while the less waiting period indicates that there is higher risk of pesticide residues which poses higher health risk to vegetable growers as well as consumers. The present study showed that the farmers had good knowledge about the waiting period of pesticide for harvesting crop.

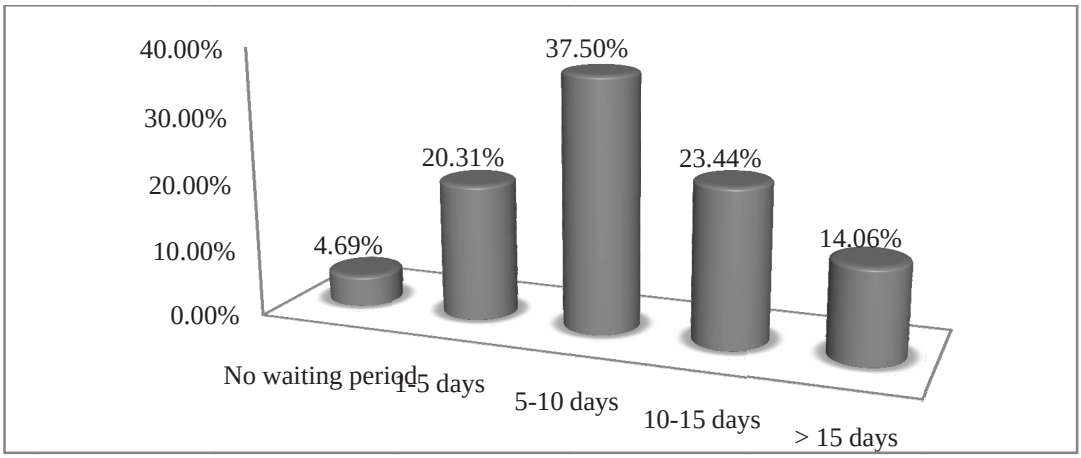


Figure 6: *Waiting period for harvest*

Safety Measures Use

The result showed that the most commonly used PPE was trousers (92.19%) followed by full sleeve cloths (82.83%), mask (75%), gloves (46.88%), hat (37.5%), boot (20.31%), sunglasses (10.94%) and only 3.13% of farmers used the overall cover dress (Figure 7). It was observed that, most of the pesticide users in the study area didn't use the necessary safety measures. Non-use of full covering PPE might be due to unavailability or high cost of PPE and also due to discomfort associated with hot and humid weather. The use of cheap and easily available PPEs like trousers, full sleeved clothessuggest that farmer's choice of PPE was influenced by consideration of minimizing costs.

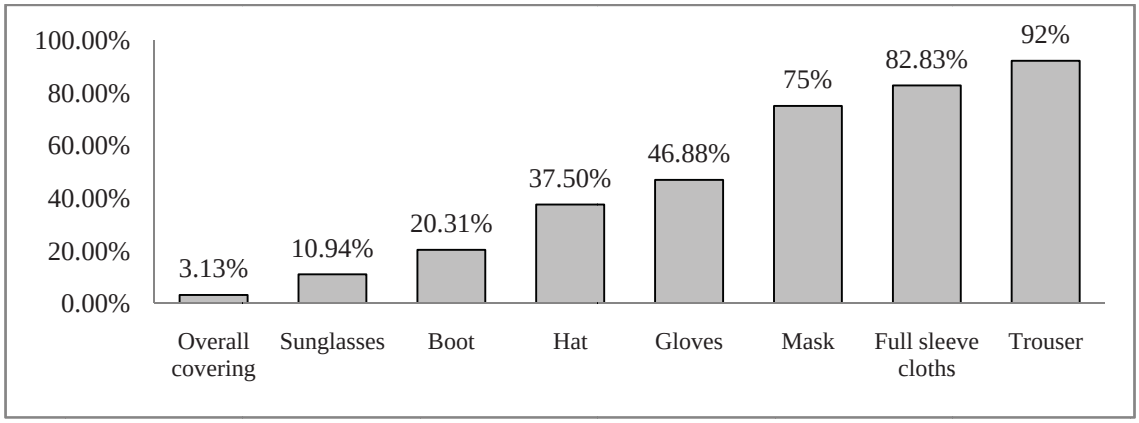


Figure 7: *PPEs used by farmers*

Health impact of pesticide

Regarding impact of pesticide to the respondent's health, the study revealed that most of the farmers (92.19%) felt discomfort/ weakness after application of pesticide and (7.81%) of farmers said that they didn't feel any discomfort yet.

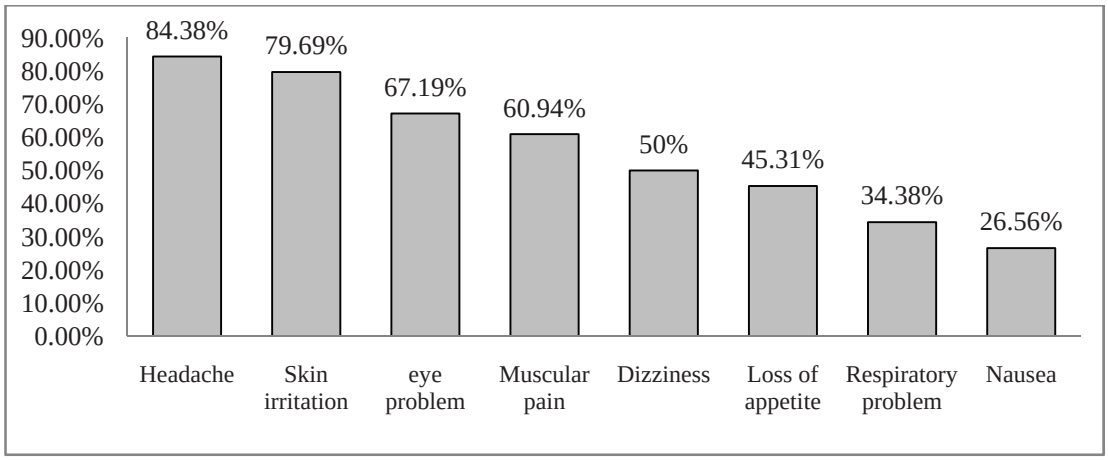


Figure 8: *Health impact of pesticide*

Throughout the study, farmers indicated several types of symptoms and health problems. Among them headache (84.38%) was recorded as the major health problem followed by skin irritation (79.69%), eye problem (67.19%), muscular pain (60.94%), dizziness (50%), loss of appetite (45.31%), respiratory problem (34.38%) and nausea (26.56%) (Figure 8).More discomfort might be due to little or no use of necessary safety measure and improperapplication or handling of the hazardous pesticide. Due to unsafe practices, vegetable growers are more vulnerable to expose with toxic pesticides and are in higher health risk as there has been use of pesticide with too little or no protection.

c. Storage of Pesticide

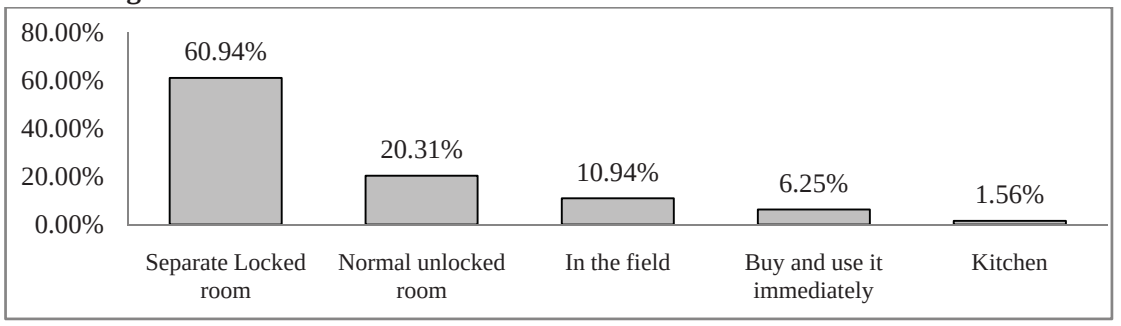


Figure 9: *Pesticide Storage Place*

Pesticide storage place of all participants was observed to access the pesticide storage practice in study area. About (60.94%) of participants had stored the pesticides in separate/ locked store room where children can't reach easily; (20.31%) of participants had stored in normal store room; 10.94% of farmers had kept in the field; (6.25%) of participants bought and used it immediately. Negligible proportion (1.56%) had stored it in the kitchen (Figure 9). It was found that most of the participants (96.87%) kept the pesticide in original container and 3.13% of participants kept in another container.

It showed that majority of farmers stored the pesticide in separate/ locked room.Literate farmers would be expected to have high knowledge or awareness of the health and environmental implications associated with pesticides and as a result more farmers were

inclined to store pesticide outside their house. Storage of pesticide inside house was also reported by some of the farmers which may be due to unawareness of farmers. The storage of pesticide inside house indicated a high potential for exposure of farmers and family members due to storage in highly accessible places.

Disposal of Leftover Pesticide and Pesticide Container

More than half (56.25%) of participants said that they prepare the pesticide in limited amount. About (34.38%) disposed by burial, (6.25%) disposed by throwing anywhere and only (3.13%) stored the leftover pesticide in a container for future use (Figure 10). The study revealed that most of the farmers were aware about the disposal of leftover pesticide.

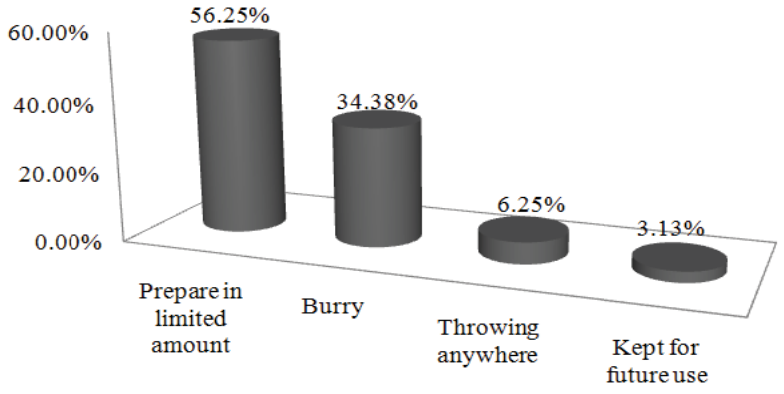


Figure 10: *Disposal of leftover pesticide*

Regarding disposal of pesticide container, more than one third (34.38%) of the participants indicated that they dispose by burial method, around 25.56% of participants threw used pesticide container and boxes anywhere in the open field, may be due to lack of awareness among farmersabout the long-term adverse effect of pesticide to human health and environment. About 20.31% of participants disposed by burning, 15.63% put in rubbish/ trash and very few (3.13%) re-use the pesticide container for household activities representing a route of non-occupational human exposure (Figure 11).

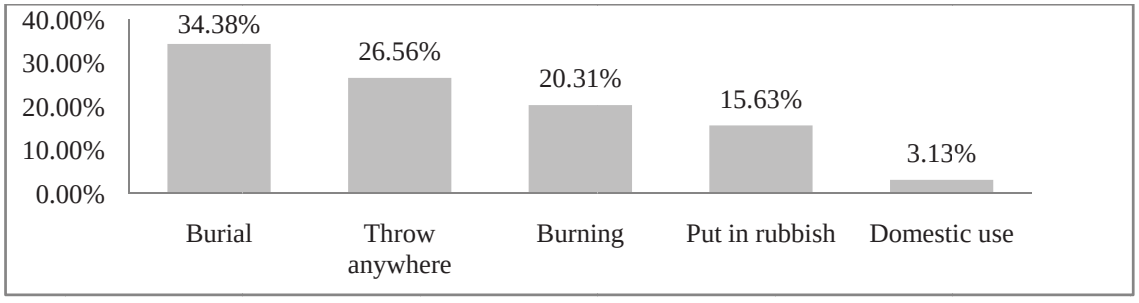


Figure 11: *Disposal of pesticide container*

Throughout the study, improper disposal of leftover pesticide and pesticide container was reported by some of the farmers. Unsafe disposal may be an important source of pesticide exposure which may lead to environmental contamination.

Information source for farmers

Growers often take advice from various sources that help them make pest management decisions. This study revealed that (46.88%) of the respondents obtained information about the pesticide use and other technical advice from pesticide retailers, (32.81%) obtained information from local farmers/ neighbour, (12.5%) farmers use their own discretion and (7.81%) of farmers obtained information from government or agricultural authorities (Figure 12).

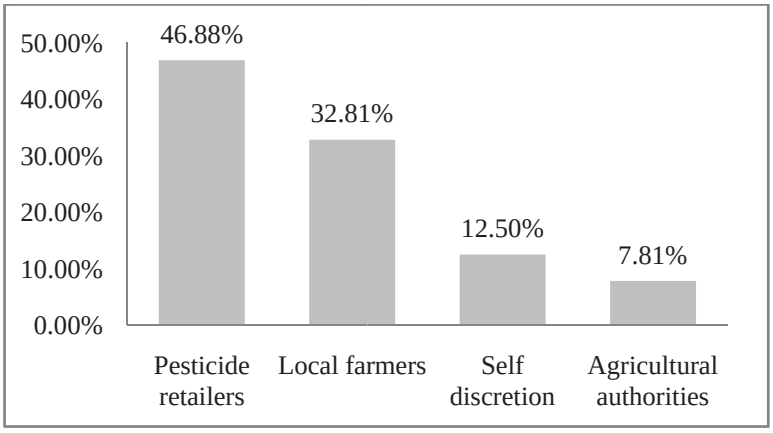


Figure 12: *Information source for farmers*

It indicated that pesticide retailer were the main information source for farmers, may be due to easier access for farmers to apply the pesticide according tothe guideline provided by pesticide retailer.

Farmers Participation in Training

Out of 64 participants, 18 (28.13%) respondents had participated in pesticide related training and 46 (71.88%) respondents had never taken pesticide related education and training (Figure 13). Lower number of farmer's participation in training may be due to lack of sufficient technical support and oversight of extension officers for small farmers.

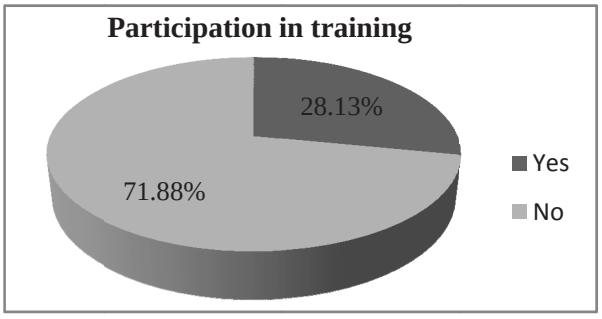


Figure 13: *Participation in training*

Majority of respondents felt that vocational education and training has a positive effect. People in vocational education and training acquire skills that are needed by farmers. Trained farmers make better predictions on expected yield loss associated with pests and diseases while making pesticide use decisions.

d. Use of Date Expired Pesticide

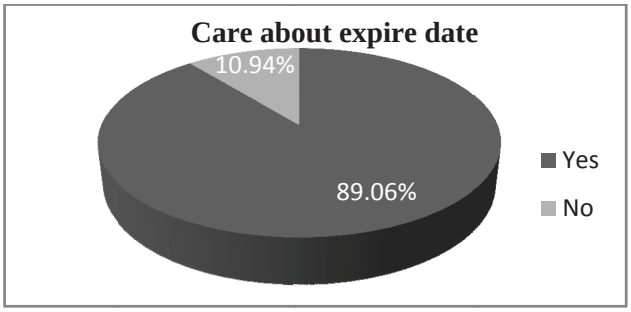


Figure 14: *Care about expire date of pesticide*

Regarding the use of date expired pesticides, about 89.06% of farmers said that they check expire date of pesticide and didn't use such pesticide and remaining 10.94% of farmers didn't care about the expire date of pesticide (Figure 14). It showed that most of the participants were well familiar with the expiry date of pesticide which may be due to literate farmers were capable of reading the labels written in pesticide container. Use of date expired pesticide may be less effective in the plant protection and may cause more adverse impact on non-targeted pests, animals, human health and environment.

e. Farmers Perception about Pesticide

Result of the study showed that out of 64, 52 (81.25%) respondents regarded pesticide as poison and 12 (18.75%) respondents as medicine (Figure 15). According to 18.75% of farmers, pesticides are useful to kill the pests and they help to increase the yield of crops that's why pesticide is regarded as medicine. However according to 81.25% of vegetable growers, they were more knowledgeable about the harmful effect of pesticide to other non- targeted organisms, human health and environment so pesticide is regarded as poison by them.

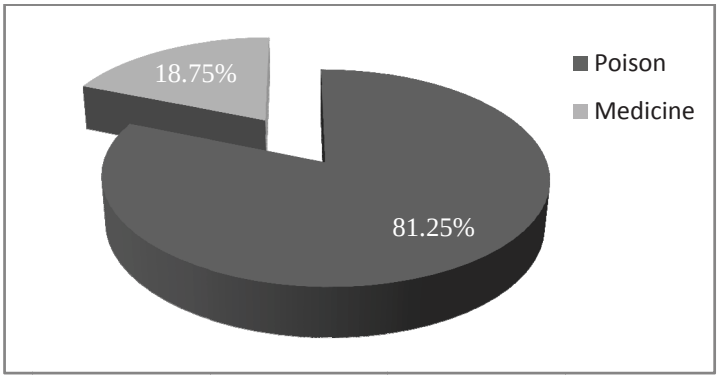


Figure15: *Perception about pesticide*

Conclusion

There was wide use of pesticides mostly in vegetable crops. Farmers were using various Pesticides among them insecticides were prevalent. Nuvan, Malathion, Bullet, Di-ethane M-45, Himil were the most commonly used pesticides. Many (57.81%) farmers had been using pesticide for more than 5 years which implies that a large number of farmers get exposed to

pesticide over long duration resulting health impacts. Farmers had considerable knowledge regarding health impact of pesticide however they didn't adopt the necessary safety precautions resulting higher risk of exposure with pesticide intoxication. Only 3.13% of respondents used the whole-body covering PPE. Trouser (92.19%) was the most commonly used PPE and 92.19% reported that they were suffering from discomforts and health problems after using pesticide. Higher prevalence of headache (84.38%) was observed among the farmers. This was attributed to the low level of education of users coupled with a lack of formal training in pesticide use, poor extension services, inadequate education and safety systems. Most of the farmers were aware about the storage of pesticide. About 60.94% of farmers stored the pesticide in separate/ locked store room where children can't easily reach, preventing them from danger of accidental poisoning of pesticide.

Farmers had good knowledge about disposal of leftover pesticide and pesticide container. Majority of farmers disposed the leftover pesticide through right manner but 6.25% of farmers throw anywhere resulting higher risk of environmental contamination. About 34.38% farmers disposed pesticide container by burial method which may cause less harm whereas 26.56% farmers throw the pesticide container anywhere which poses higher risk to environment and other non-targeted organism. Perception regarding pesticide among farmers was not so good. Less than one third (28.13%) participated in pesticide related training and remaining farmers didn't get chance to participate which results in improper use and careless handling of pesticide.

The present study concluded that the status of pesticide used in vegetable crops was not satisfactory. Despite considerable knowledge about the harmful effect of pesticide, farmers didn't take the necessary safety precautions during pesticide application; they were not storing pesticide in right manner and disposed the pesticide container anywhere. So, more training and awareness programs regarding correct use and handling of pesticide are required.

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References

Atreya, K., Sitaula, B.K., Mancozeb, (2011). Growing Risk for Agricultural Communities.*Himalayan Journal of Sciences*,**6** (8), 9-10.

Bhandari, G. (2014). An Overview of Agrochemicals and Their Effects on Environment in Nepal.*Applied Ecology and Environmental Sciences*, **2** (2),66-73. doi:10.12691/aees-2-25.

Bohmont, B.L. (1990). *The Standard Pesticide Users Guide.* Upper Saddle River (NJ: Prentice Hall).

CBS, (2011).*National Population and Housing Census 2011*.Central Bureau of Statistics, Kathmandu, Nepal.

Gauchan, D. (2008). Agricultural Development in Nepal: Contribution to Economic Growth, Food Security and Poverty Reduction. *Socio Economic Development Panorama*, **1**(3), 49-64.

Gyawali, K. (2018). Pesticide Uses and its Effects on Public Health and Environment. *Journal of Health Promotion*,**6**, 30-36.

Jha, R.K., and Regmi, A.P. (2009). Productivity of Pesticides in Vegetable Farming in Nepal.*SANDEE Working Paper*,42-09.

Karmacharya, S. (2012). Pesticide Use in Agriculture and its Socio-economic Contexts, A Case Study of Panchkhal Area, Kavre, Nepal.*International Journal of Scientific and Technology Research*, **1**.

K.C., G.K., (2010). *Some Thoughts on IPM Components Institutionalization*.National IPM Review and Coordination Workshop Held at DOA, HariharBhawan, Lalitpur, Nepal.

Manandhar, D.N. (2005). *Inventory of Pesticides in Nepal*. Report Submitted to PoPs Enabling Activities Project, Ministry of Environment, Science and Technology, Kathmandu, Nepal.

MoALD, (2019).*Annual Report*.Singh Durbar, Kathmandu, Nepal.

NARC, (2005).*Annual Report, Entomology Division, Nepal*. Agricultural Research Council (NARC), Khumaltar, Lalitpur, Kathmandu.

PRMP, (2012).*Final Report on Pesticide Consumption Statistics in Nepal*.Mount Digit Technology (p.) ltd. Ekantakuna, Kathmandu, Nepal.

Sharma, D.R. (2015). Use of Pesticides and its Residue on Vegetable Crops in Nepal.*The Journal of Agriculture and Environment*, 16.

Sharma, D.R., Thapa, R.B., Manandhar, H.K., Shrestha, S.M., and Pradhan, S.B. (2012).Use of Pesticide in Nepal and Impacts on Human Health and Environment.*The Journal of Agriculture and Environment*, 13: 64-64.

Sharma, S. (2019).*Documentation of Knowledge on Pesticide Use in Vegetable Crops of Sainamaina Municipality, Rupandehi District, Nepal*.Department of Botany, Institute of Science and Technology, Butwal Multiple Campus, Nepal.

Thapa, C.B. (2017). Survey of Pesticide Use in Vegetable Crops of Rupandehi District, Western Nepal. *Research Highlights, An International Research Refereed Journal*, **4**(3), 92-105. Future Fact Society, Varanashi (U.P.) India.