A Study of Pesticide Consumption Pattern and Farmer’s Perceptions towards Pesticides: A Case of Tijara Tehsil, Alwar (Rajasthan)

Sucheta Yadav* and Subroto Dutta

Department of Environmental Science, MDS University, Ajmer-305009, India

*Corresponding author

ABSTRACT

Agriculture is the most important sector of the economy in India as it provides food and livelihood security. The industrialization of agriculture has favored the use of plenty of agrochemicals including fertilizers, pesticides, micro nutrients, and plant growth regulators in the agricultural fields. Pesticides are an integral part of modern agriculture. The use of pesticides in agriculture is obvious for the prevention of crop-damaging pests, fungus, unwanted plants (weeds) and a number of crop-eating animals like rodents etc. The present research was designed to study the consumption pattern of pesticides, farmer’s knowledge about the safe handling and application of pesticides and their practices on pesticide usage. In-depth field surveys were undertaken with 500 farmers and complemented with focus Group Discussions, Interview, Questionnaires, and Field Observation. The results showed that the consumption pattern of pesticides included Insecticides (61.11%), Herbicides (22.22%) and fungicides (11.11%). Organophosphates were the most frequently used pesticides followed by neonicotinoid and pyrethroid. It was found that the cotton (93.27%) was the high pesticide consuming agroproduct followed by vegetables (87.2%), wheat (66.4%), millet (52.6%) and mustard (12.6%). It was also observed that the farmers have poor scientific knowledge of handling and spraying of pesticides. Safety measures while spraying of pesticides is not being practiced by the farmer at large. Many of the farmers were found smoking and chewing tobacco while spraying pesticides. 49.8% of the respondents claimed immediate health hazards after pesticide application. There is no safe chemical, but there are safe ways to use chemicals.

Keywords
Organophosphate, Pesticides, Insecticides, Consumption, Neonicotinoid, Pyrethroid

Accepted: 04 March 2019
Available Online: 10 April 2019

Introduction

Agriculture is the most important sector of the Indian economy providing employment and livelihood to nearly 70% of the total population. A UN study on global population trends predicts that India will surpass China to become the most populous nation in the world by 2022. With a present size of 1.32 billion, India currently supports nearly 17.84% of the world population, with 2.4% land resources and 4% of water resources (A report on Indian Agrochemical Industry July 2016). The rising population has led to increasing food demand. To meet the food & nutrition needs of a growing population requires a sustainable approach that puts thrust on increasing productivity against the
background of lower yields and decreasing farm sizes. The industrialization of agriculture has favored the use of plenty of agrochemicals including fertilizers, pesticides, micronutrients and plant growth regulators in the agricultural fields. Pesticides are an integral part of modern agriculture. The use of pesticides in agriculture is obvious for the prevention of crop-damaging pests, fungus, unwanted plants (weeds) and a number of crop-eating animals like rodents etc. It is also noted that about 15-25% of potential crop production is lost due to pests, weeds, and diseases.

Further, pesticides play a significant role in keeping many dreadful diseases. In India, pesticides are registered for agriculture, public health and for use in households. As on 30th October 2016, 275 pesticides were registered for use in India, of which about 255 are chemical poisons. An analysis by PAN India revealed that more than 115 pesticides out of the 275 are highly hazardous (Kumar and Reddy, 2017).

A vast majority of the population in India is engaged in agriculture and is therefore exposed to the pesticides used in agriculture. However, exposure to pesticides both occupationally and environmentally causes a range of human health problems. It has been observed that pesticide exposures are increasingly linked to immune suppression, hormone disruption, diminished intelligence, reproductive abnormalities, and cancer. At present, per hectare consumption of pesticides in India is amongst the lowest in the world and stands at 0.6 kg/ha against 5-7 kg/ha in the UK and ~ 13 kg/ha in China.

No denying to the fact that chemical pesticides are the most effective, short-term control method for a variety of crop pests and pathogens but their ill effects on human, animal and environmental health have also been well established as they may enter into the environment through a variety of channels. Some of these modes include percolation through soil particles and groundwater, as a part of run-off water thus entering into surface water bodies, as aerosols when applied as sprays, as residues in various plant parts as well as soil and water organisms. Chemical pesticides tend to persist in soil, surface water bodies as well as groundwater for long periods thus imposing serious health threat for humans and animals (Prashar et al., 2015). The present study aims to assess the consumption pattern of pesticides, the farmer’s knowledge about pesticides and their use in the agriculture field.

Study area

The study area is Tijara Tehsil of Alwar district, Rajasthan. It is one of the 14 blocks of Alwar district, situated 48 km to the northeast of Alwar. The importance of the city lies with the presence of Jain temple dedicated to Chandraprabha. It is a pilgrimage site for the Jains and a tourist attraction. The tehsil is situated at latitude of 27° 56’ 3N and longitude of 76° 51’ 21E. Tijara is one of the major agriculture intensive areas of Alwar. Agriculture is the prime source of livelihoods. There is a wide range of crops grown in the area. Agro products include carrots, cauliflowers, mustard, radishes, onions, peas, watermelons, wheat, corn, spinach, guar, bajra (millet) and cotton. Consequently, there is a good supply of fresh vegetables. Many villages have orchards or small collections of fruit trees, so a supply of fresh fruit is also available in season.

Materials and Methods

The study was conducted in the agriculture area of Tijara tehsil, Alwar, Rajasthan for 2 years (2016-2018). The villages were
purposely selected to reflect the importance and scale of agriculture production in the study area. A total of 500 farmers were randomly selected for interviewed and questionnaires. Field survey, group discussion, questionnaire methods are used for data collection. Then, the data collected were tabulated and statistically analyzed using simple statistical tools like average and percentage to interpret the results. From these methods, information was gathered on the cropping system, type of vegetable and crop grown, frequently used pesticides, farmer's knowledge about pesticide handling, application, safety measure and final disposal of a container.

Results and Discussion

Frequently used pesticides in Tijara tehsil

The present study revealed that the farmer uses a variety of pesticides under different trade names belonging to different chemical groups. Many of the pesticides fall under the highly hazardous category of WHO guideline. Table 1 shows the most frequently used pesticides their category, chemical formula, toxicity and the crops in which the pesticides are applied. Most of the farmers reported using pesticides for their crops. The main groups of pesticides used included Insecticides (61.11%), Herbicides (22.22%) and Fungicides (11.11%). The study revealed that Organophosphate were the most frequently used pesticides followed by neonicotinoid and pyrethroid.

Consumption pattern of pesticides in the study area

Regarding the consumption of pesticides in agriculture, cotton (93.27%) is the high pesticide consuming agro product followed by vegetables (87.2%), wheat (66.4%), millet (52.6%) and mustard (12.6%) (Table 2). From Table 3 it was observed that for the production of cotton most of the farmers sprayed pesticide twice (52.28%) or thrice (41.42%) in whole cropping season. 64.8% of respondent farmers were applying pesticides 1-2 times for cropping wheat and 33.6% farmers were not using any type of pesticide for wheat production. Mustard is the least (12.6%) pesticide consuming crop. It was found that 263 (52.6%) respondent were consuming pesticide once (39.2%) or twice (13.4%) for the cultivation of millet and remaining 47.4% respondent was not using any pesticide. Most of the Vegetable producer respondents (82%) were applying pesticides 3 to 4 times in the whole growing season of a particular vegetable.

The results showed that 78.2 % of farmers were having basic knowledge of safe handling, application of pesticides and risk associated due to pesticide exposure but they were not ready to change their attitude towards pesticide practices. Most of the respondents (76.2%) didn't read labels on pesticide containers. Handling and application of pesticides require the use of appropriate protective measures and equipment’s, which includes the use of gloves, masks, goggles etc. A large proportion of respondents (46.8%) were using a stick or bare hand (33.8%) for mixing the pesticides. Only 19.4% of respondents use safety measure i.e mask, goggles and gloves to protect themselves from direct exposure to the pesticide. About 47% of respondents were using the mask and the remaining 33.6% were not taking any safety measure. During the field study, it was found that many of the farmers were having the habit of smoking and chewing tobacco while spraying pesticides. Only 166 respondent (33.2%) take bath immediately after application of the pesticide, rest of respondent wash their hand and engaged in their daily routine work (Fig. 1–4).
Farmers' knowledge and attitude towards pesticides

| Variable                                                                 | Total respondents |           |           |
|-------------------------------------------------------------------------|-------------------|-----------|-----------|
|                                                                         | Number            | Percentage (%) |
| 1. Do you have Knowledge of safe handling, application of pesticides and health hazards? |                   |           |           |
| Have complete knowledge                                                 | 174               | 34.8      |           |
| Have a little knowledge                                                 | 217               | 43.4      |           |
| Don’t have any knowledge                                                | 109               | 21.8      |           |
| Total                                                                   | 500               | 100%      |           |
| 2. Do you read pesticide’s labels before use?                           |                   |           |           |
| Always                                                                  | 37                | 7.4       |           |
| Sometimes                                                               | 82                | 16.4      |           |
| Never                                                                   | 381               | 76.2      |           |
| Total                                                                   | 500               | 100%      |           |
| 3. How do you mix pesticides?                                           |                   |           |           |
| With bare hand                                                          | 169               | 33.8      |           |
| With stick                                                              | 234               | 46.8      |           |
| Wear hand gloves and protective eyes goggles and masks.                 | 97                | 19.4      |           |
| Total                                                                   | 500               | 100%      |           |
| 4. Do you use safety measures?                                          |                   |           |           |
| Only mask                                                               | 235               | 47        |           |
| Mask, Goggles, Gloves                                                  | 97                | 19.4      |           |
| No- safety measure                                                      | 168               | 33.6      |           |
| Total                                                                   | 500               | 100%      |           |
| 5. What you immediately after a pesticide application                    |                   |           |           |
| Hand wash                                                               | 273               | 54.6      |           |
| Take bath                                                               | 166               | 33.2      |           |
| Take rest and smoke and eat and drink something                         | 61                | 12.2      |           |
| Total                                                                   | 500               | 100%      |           |
| 6. Disposal of empty pesticide containers?                              |                   |           |           |
| Incineration                                                            | 48                | 9.6       |           |
| Burring                                                                 | 12                | 2.4       |           |
| Throw away on the farm or outside                                       | 364               | 72.8      |           |
| Reuse the empty container                                               | 76                | 15.2      |           |
| Total                                                                   | 500               | 100%      |           |
| 7. Health effect after pesticide application?                           |                   |           |           |
| Least health hazard effects: - Headache, itching, tiredness, dizziness   | 249               | 49.8      |           |
| Moderate health hazard:- Dizziness, vomiting or blurred vision or skin sores | 88                | 17.6      |           |
| Extreme health hazard:- long term illness and need to hospitalize.      | 7                 | 1.4       |           |
| No health hazard                                                        | 156               | 31.2      |           |
| Total                                                                   | 500               | 100%      |           |
### Table 1 Frequently used pesticides in Tijara tehsil

| S.No | Pesticide             | Type Of Pesticides          | Category               | Chemical formula | Toxicity labels | Crop Used                          |
|------|-----------------------|----------------------------|------------------------|------------------|-----------------|------------------------------------|
| 1    | Monocrotophos         | Organophosphorus           | Insecticide Acaricide  | C_{7}H_{14}NO_{5}P | Class Ib       | Cotton, vegetables                  |
| 2    | Chlorpyrifos          | Organophosphorus           | Insecticide Acaricide Miticide Nematicide | C_{9}H_{11}Cl_{3}NO_{4}PS | Class II | Vegetables, All Crops               |
| 3    | Acephate              | Organophosphorus           | Insecticide Acaricide  | C_{10}H_{10}NO_{3}PS | Class II       | Cotton, vegetable                   |
| 4    | Phorate               | Organophosphorus           | Insecticide Acaricide  | C_{7}H_{17}O_{2}PS | Class Ia       | Vegetables, Cotton, Paddy.          |
| 5    | Profenofos            | Organophosphorus           | Insecticide Acaricide  | C_{11}H_{15}BrClO_{3}PS | Class II       | Cotton, Vegetables                  |
| 6    | Triazophos            | Organophosphorus           | Insecticide Acaricide  | C_{12}H_{16}N_{3}O_{3}PS | Class Ia | Vegetables                          |
| 7    | Imidacloprid          | Neonicotinoid              | Insecticide Acaricide  | C_{10}H_{11}ClN_{4} | Class Ia       | Cotton, Vegetables                  |
| 8    | Thiacloprid           | Neonicotinoid              | Insecticide Acaricide  | C_{10}H_{11}ClN_{4} | Class II       | Cotton, Vegetables                  |
| 9    | Profenofos            | Organochlorine             | Miticide               | C_{14}H_{9}Cl_{5}O | Class II       | Fruits, cotton vegetables,          |
| 10   | Deltamethrin          | Pyrethroid                 | Insecticide Acaricide  | C_{22}H_{19}Br_{3}NO_{3} | Class II | Vegetables                          |
| 11   | Cypermethrin          | Pyrethroid                 | Insecticide Acaricide  | C_{22}H_{19}Br_{3}NO_{3} | Class II | Vegetables                          |
| 12   | Dicofol               | Organochlorine             | Miticide               | C_{13}H_{19}N_{3}O_{4} | Class II | Wheat, barley                       |
| 13   | Carbendazim           | Benzimidazole              | Fungicide              | C_{9}H_{9}N_{3}O_{4} | * Class | Groundnut, Crops, Fruits           |
| 14   | Mancozeb              | dithiocarbamate            | Fungicide              | C_{12}H_{12}MnN_{4}S_{8}Zn | * Class | Groundnut, Vegetables, Fruits      |
| 15   | 2,4 D                 | Dichlorophenoxy acetic acid| Herbicide              | C_{8}H_{8}Cl_{2}O | Class II       | Wheat, barley                       |
| 16   | Pendimethalin         | Dinitroaniline             | Herbicide              | C_{13}H_{19}N_{3}O_{4} | Class II | Wheat, Cotton, Vegetable, Groundnut|
| 17   | Atrazine              | Triazine                   | Herbicide              | C_{8}H_{13}ClN_{5} | Class III | Millet, Maize, sugarcane           |
| 18   | Imazethapyr           | Imidazolinone              | Herbicide              | C_{13}H_{13}N_{3}O_{5} | Class III | Groundnut, soybean                  |

*S. No. 13, 14 in above table are under technical grade active ingredients of pesticides unlikely to present acute hazard in normal use, as per WHO guideline.*

### Table 2 Consumption of pesticides among farmers for various agro products

| S.No | Agro products | Total no. of farmers respondent | No. of farmer consuming pesticide | % of farmers consuming pesticides |
|------|---------------|---------------------------------|----------------------------------|----------------------------------|
| 1    | Cotton        | 350                             | 328                              | 93.27                            |
| 2    | Wheat         | 500                             | 332                              | 66.4                             |
| 3    | Mustard       | 500                             | 63                               | 12.6                             |
| 4    | Millet        | 500                             | 263                              | 52.6                             |
| 5    | Vegetables    | 250                             | 218                              | 87.2                             |
Table 3 Pesticides consumption pattern in various agroproducts

| Variables                        | Number of Respondent | Percentage (%) of respondent |
|----------------------------------|-----------------------|-----------------------------|
| No. of time pesticides applied on cotton? |                       |                             |
| One time in the whole growing season | -                     | -                           |
| Two times in the whole growing season | 145                   | 41.42                       |
| Three-time in the whole growing season | 183                   | 52.28                       |
| Don't Use Pesticides             | 22                    | 6.28                        |
| Total                            | 350                   | 100%                        |
| No. of time pesticides applied on wheat? |                       |                             |
| One time in the whole growing season | 187                   | 37.4                        |
| Two times in the whole growing season | 137                   | 27.4                        |
| Three-time in the whole growing season | 8                     | 1.6                         |
| Don't Use Pesticides             | 168                   | 33.6                        |
| Total                            | 500                   | 100%                        |
| No. of time pesticides applied on Mustard? |                       |                             |
| One time in the whole growing season | 63                    | 12.6                        |
| Two times in the whole growing season | -                     | -                           |
| Three-time in the whole growing season | -                     | -                           |
| Don't Use Pesticides             | 437                   | 87.4                        |
| Total                            | 500                   | 100%                        |
| No. of time pesticides applied on Millet? |                       |                             |
| One time in the whole growing season | 196                   | 39.2                        |
| Two times in the whole growing season | 67                    | 13.4                        |
| Three-time in the whole growing season | 00                    | 00                          |
| Don't Use Pesticides             | 237                   | 47.4                        |
| Total                            | 500                   | 100%                        |
| No. of time pesticides applied to vegetables? |                       |                             |
| One time in the whole growing season | -                     | -                           |
| Two times in the whole growing season | 13                    | 5.2                         |
| Three-time in the whole growing season | 82                    | 32.8                        |
| Four-time in the whole growing season | 123                   | 49.2                        |
| Don't Use Pesticides             | 32                    | 12.8                        |
| Total                            | 250                   | 100%                        |

Fig.1 Percentage consumption pattern of pesticides
**Fig. 2** Safety measure adopted by the farmer

![Safety measure utilization]

**Fig. 3** Showing spray handling method without any protective measures

![Spray handling method without protective measures]

**Fig. 4** Disposal methods for empty pesticide container

![Disposal of empty pesticide container]

![Disposal of empty pesticide container graph]
The commonest way of disposing of empty pesticide containers among the respondent farmers (72.8%) was by throwing or discharging them on the field or outside. 9.6% farmer follows the incineration process for disposing of the empty container of pesticide. It was also revealed during the group discussion that some farmers (15.2%) reuse the empty pesticide containers.

Exposure to pesticides both occupationally and environmentally results in serious health hazards. In addition inappropriate and excessive pesticide use and application, lack of proper storage and adopting inadequate protective measures frequently result in harmful health hazards and cause tremendous harm to the environment. The most common health hazards among the sprayer were itching, headache, tiredness, skin sore and blurred vision. Actual health hazards of pesticides are not easily mapped in most circumstance, as they could also be confused with common illnesses. After pesticide application 249 (49.8%) claimed that they felt discomfort and the least health hazards. Moderate health hazard was felt by 88 (17.6%) whereas 156 (31.2%) respondent were not indicating any adverse symptoms.

From the present study, it was concluded that the consumption pattern of pesticides includes Insecticides (61.11%), Herbicides (22.22%) and Fungicides (11.11%). Organophosphate was the most frequently used pesticide followed by neonicotinoid and pyrethroid. In the study area cotton (93.27%) was the high pesticide consuming agro product followed by vegetables (87.2%), wheat (66.4%), millet (52.6%) and mustard (12.6%). From the questionnaire survey done from the farmers concluded that only 78.2 % of respondents were having basic knowledge of safe handling and application of a pesticide. Only a least 19.4% of respondents are using scientific safety measures during the application of a pesticide. The generalized way of disposing of empty container among (72.8 %) farmer were throwing away on the farm and some farmers (15.2%) reuse the empty pesticide containers. It was found that most farmers are aware of risk due to pesticide exposure but they are not ready to change their attitude to take safety measures. The most common effect due to pesticide exposure is skin itching, headache, tiredness, and blurred vision.

References

Afari-Sefa V., Asare-Bediako E., Kenyon L. and Micah J.A. (2015). Pesticide Use Practices and Perceptions of Vegetable Farmers in the Cocoa Belts of the Ashanti and Western Regions of Ghana. Advances in Crop Science and Technology, 3:3.

Akpagu F.C., Emmanuel N.V., and Chukwuebuka E.G.I. (2015). Analysis of organophosphate pesticide residue on crops in Abakaliki, Ebonyi state. IOSR Journal of Applied Chemistry.8(1):26-29.

Bhandari R. (2015). Pesticide residues in vegetables and fruits. International Journal of Scientific Research in Chemical Sciences. 2(1).

Indira Devi P., Thomas J. and Raju R.K. (2017). Pesticide Consumption in India: A Spatiotemporal Analysis. Agricultural Economics Research Review,30 (1):163-172.

Lwin O.O M., Yabe M. and Khai H.V. (2012). Farmers’ Perception, Knowledge and Pesticide Usage Practices: A Case Study of Tomato Production in Inlay Lake, Myanmar. Journal- Faculty of Agriculture, Kyushu University, 57 (1):327–331.

Mburu N.S., Matuku M.T., Osano O. and Gichuho C.M. (2013). Pesticide Preferences and Pattern of Use along
with the Shore of Lake Naivasha, Kenya. Greener Journal of Environmental Management and Public Safety, 2(3):115-120.

Meena G.L. And Punjabi N.K. (2012). Farmer's Perception of Agriculture Technology in the Tribal Region of Rajasthan. Raj. J. Extn. Edu. 20:92-96.

Mehta M. (2016) Next Generation Indian Agriculture - Role of Crop Protection Solutions: - A report on Indian Agrochemical Industry.

Nonga H.E., Mdegela R.H., Lie E., Sandvik M. and Skaare J.U. (2011). Assessment of farming practices and uses of agrochemicals in Lake Manyara basin, Tanzania. African Journal of Agricultural Research. 6(10):2216-2230.

Ntow W. J., Gijzen H. J., Kelderman P., and Drechsel P. (2006). Farmer Perceptions and Pesticide use Practices in Vegetable Production in Ghana. Pest Management Science, 62:356–365.

Punjabi N.K. and Meena G.L. (2012). Farmer's Perception of Agriculture Technology in the Tribal Region of Rajasthan. Raj. J. Extn. Edu. 20:92-96.

Roy M. (2016). Impact of Pesticide Use on the Health of Farmers: a Case Study in Bankura, W.B., India. International Journal of Innovative Research in Science, Engineering and Technology, 5(7):12370-12374.

Prashar P., Tyagi H. and Gautam T. (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(3):139-146.

Dileep Kumar A. D. and D. Narasimha Reddy (2017). High Pesticide use in India: Health Implications. Health Action,7-12.

Lwin M, Yabe M. and Khai H.V. (2012). Farmers’ Perception, Knowledge and Pesticide Usage Practices: A Case Study of Tomato Production in Inlay Lake, Myanmar. J. Fac. Agr., Kyushu Univ., 57 (1): 327–331.

https://pubchem.ncbi.nlm.nih.gov

How to cite this article:

Sucheta Yadav and Subroto Dutta. 2019. A Study of Pesticide Consumption Pattern and Farmer’s Perceptions towards Pesticides: A Case of Tijara Tehsil, Alwar (Rajasthan). Int.J.Curr.Microbiol.App.Sci. 8(04): 96-104. doi: https://doi.org/10.20546/ijcemas.2019.804.012