

Original Research Article

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Survey on Pesticide Use Pattern and Farmers Perceptions in Cauliflower and Brinjal Growing Areas in Three Districts of Himachal Pradesh, India

Gaganpreet Singh Brar*, Surender Kumar Patyal,
Jatiender Kumar Dubey and Gagandeep Singh

Department of Entomology, Dr YS Parmar University of Horticulture and Forestry, Nauni,
Solan - 173 230, H.P., India

*Corresponding author

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Pesticides have substantially contributed for controlling of pests and increasing crop yields. But over the years there is growing concern about indiscriminate use of pesticides in agriculture. A survey was conducted among 150 farmers in cauliflower and brinjal cultivating areas of Hamirpur, Bilaspur and Una districts Himachal Pradesh, India in 2015-2016. Most commonly used pesticides applied by the farmers on cauliflower and brinjal were malathion, chlorpyrifos, cypermethrin, carbendazim and mancozeb. It was also observed during the survey that most of the farmers stored the pesticide bottles (81.33%) at safe places in their houses and the remaining (16.66%) placed the bottles in unsafe areas without any safety measures. It was revealed that no farmer was familiar with Central Insecticides Board and Registration Committee (CIBRC) guidelines about the use of labelled and non-labelled pesticide application and majority of the farmers (57.33%) were mainly dependent on the advice of pesticide dealers. CIBRC recommendations are yet to percolate down through various agencies to arrive at the farmers' level by educating them at various forums.

Introduction

Pest and disease infestations are common occurrences in agricultural production. Productivity of crops grown for human consumption is at risk due to the incidence of pests, especially weeds, pathogens and animal pests. Crop losses due to these harmful organisms can be substantial and may be prevented, or reduced, by crop protection measures (Oerke, 2005). Adequate knowledge on how farmers perceive pests, their attitude, and practices to crop protection

problems are required to implement successful pest control programs (Ajayia, 2000). Horticulture is the main occupation of the people of Himachal Pradesh and has an important place in the economy of the state. It provides direct employment to about 70 per cent of the total workers of the state. Out of the total geographical area of 55.67 lakh hectares of the state, the area of operational holding is about 9.99 lakh hectares and is being operated by 8.63 lakh farmers (Anand 2015). Farmers of Hamirpur, Bilaspur and Una grow tomato, cabbage, capsicum,

cauliflower, broccoli and other season crops as well as off season crops vegetables. These vegetable crops are attacked by various insect pests and diseases and cause reduction in yield.

In order to meet the growing demands of vegetables, fertilizers are used to increase productivity whiles pesticides are used to control pests. Pesticides, poisons chemical substances used in certain circumstances to kill specifically targeted pests (Wassemann, 1972). However, the recommended use of these pesticides vis-à-vis their effectiveness on wide range of pests; provoke the farmers to use them against pests of other crops also, on which they are not recommended to boost their economy. Though strict regulations have been laid down by international agencies like EPA and WHO (Nyakundi *et al.*, 2010), in India agencies like Central Insecticide Board and Registration Committee (CIBRC) and Food Safety and Standard Authority of India (FSSAI) work regarding the pesticide manufacturing and usage however, the recommended dose, time and frequency of application of the pesticides are generally overlooked by the farmers (Gagan *et al.*, 2016). At the same time not much attention is given to the requisite safety measures to be adopted and the recommended mode of application for different kinds of commonly used pesticides particularly in developing countries. In India Survey conducted by Gagan *et al.*, (2016) in Solan, Shimla and Sirmour districts of Himachal Pradesh observed that farmers use pesticides to control pests which are not recommended by Central Insecticide Board and Registration Committee (CIBC) on vegetable crops. 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 ground water, 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 ground water for long periods thus imposing serious health threat for humans and animals (Ongley, 1996). Apart from affecting the target pest, they also influence the native micro and maroflora of the agricultural soils and water (Lupwayi *et al.*, 2009; Beketov *et al.*, 2013). A number of ecological functions and properties are unfavorably influenced by chemical pesticides such as nutrient cycling, natural food webs and food chains, soil structure and fertility, soil and water biodiversity, natural balance between pest and predator insects and many others (Zacharia, 2011).

There are few studies related to these issues in India. Thus, studies focused on pesticide application practices and usage trends are highly required in order to understand farmer's perception. The present investigation was therefore undertaken to assess various aspects of pesticide usage patterns, farmer's views in pest knowledge and management in cauliflower and brinjal cultivating areas of districts Hamirpur, Bilaspur and Una, Himachal Pradesh, India.

Materials and Methods

A detailed random survey was carried out to gather information on various aspects of pesticide usage like knowledge of farmers about pest management, perceptions of the kind and frequency as well as severity of pests and diseases, sources of information, awareness of farmers, safety measures followed during pesticide application etc was collected. Out of 12 districts of the state of Himachal Pradesh, three districts namely

Bilaspur, Hamirpur and Una were purposively selected for the study. The selection of the districts was influenced by two factors. First, these districts are the main brinjal crop producing districts of the state (Anonymous, 2015). Second, these three districts also cultivated good account of cauliflower crop. The information pertaining to knowledge and perception of pests and the pesticide use pattern by the growers in vegetable cultivation was collected from 150 farmers of the selected districts (50 farmers from each district). The respondents were not pre-informed so as to avoid biased responses and to gain actual insight of the farming practices. However, at the time of interview the farmers were apprised with the aim of the study. Interviews were conducted in local language and a verbal consent was taken from all the participants.

A clear cut understanding of farmers' knowledge, attitude and practices regarding labeled/non-labeled pesticide use as per the CIBRC approval and recommendation was the first step towards understanding the reasons for overuse/ misuse of pesticides by farmers. In order to have a better insight into farmers' pest management practices in crop production a detailed examination of farmers' pest control practices, intensity and composition of pesticides used, sources of information on the adoption of pesticide use and decision criteria on pesticide application at farm level was conducted. In addition to this, information regarding sources of information on pesticide use, toxicity levels, storage, disposal, application practices, sprayer maintenance, safety measures followed etc were also probed at farm level. An attempt to collect the data pertaining to the entry of pesticides in the state through various agencies involved in procurement such as government/private dealers/distributors was also made to draw the meaningful inference. Percentages and averages were computed and compared to draw meaningful inferences.

Results and Discussion

The results presented here are based on the voluntary participation of 150 randomly selected farmers of cauliflower and brinjal cultivating areas of districts Hamirpur, Bilaspur and Una, Himachal Pradesh, India. Among the 150 interviewed farmers, 14.25 per cent had received no formal education, 21.89 per cent were educated below secondary level, and 25.36 per cent farmers had finished schooling up to secondary level while a maximum of 30.85 per cent farmers had completed senior secondary schooling (Table 1). A small percentage of them i.e. 7.62 per cent have managed to achieve graduation degree. Majority of the interviewed farmers were varied between 21 years to 50 years of age. Only 11.48 per cent farmers were above the age of 50 year.

As was expected, all the farmers interviewed in this study reported to use various kinds of chemical pesticides. On the basis of information received during the survey it was concluded that three types of pesticides were prevalent in this area i.e. insecticides, fungicides and acaricides. Insecticides were found to be more popular than fungicides in both cauliflower and brinjal crops. A total of 10 pesticides were found as most widely used by the farmers (Table 2). Malathion (73.56 per cent) was discovered as the most popular and effective insecticide followed by chlorpyriphos (67.59 per cent) and cypermethrin (61.62 per cent) while among fungicides mancozeb (57.63 per cent) was found as the most commonly used and effective fungicide by the respondents followed by carbendazim (Table 2). Propargite (41.62 per cent) was found to be commonly used acaricide to control mite infestation in brinjal crop. Some systemic insecticides like imidacloprid, dimethoate and methyl demeton were also used to control sucking pests of cauliflower and brinjal.

Table.1 General characteristics of the farmers growing cauliflower and brinjal

S. No.	Particulars	Individuals (%)
1	Age	
	20-30	19.56
	30-40	35.12
	40-50	33.84
	more than 50	11.48
2	Qualification	
	Illiterate	14.25
	Primary School	21.89
	Secondary School	25.36
	High School	30.85
	College	7.62

Table.2 Commonly used pesticides, their classification and usage in the site of study

S. No.	Type of pesticide	Common name	Trade name	Toxicity class*	%age of Farmers using
1	Insecticide	Malathion	Cythion 50 EC	III	73.56
2	Insecticide	Chlorpyriphos	Dursban, Durmet 20 EC	II	67.59
3	Insecticide	Cypermethrin	Shakti 25 EC	II	61.22
4	Fungicide	Mancozeb	Indofil M-45/Dithane M-45	U	57.63
5	Fungicide	Carbendazim	Bavistin 50 WP	U	53.65
6	Insecticide	Profenofos	Profex 50 EC	II	43.69
7	Acaricide	Propargite	Omite/Simba 57 EC	III	41.62
8	Insecticide	Imidacloprid	Confidor 200 S.L	II	31.00
9	Insecticide	Dimethoate	Tafgor 30 EC	II	27.52
10	Insecticide	Methyl demeton	Metasystox 25 EC	Ib	24.33

Ib= Highly hazardous, II= Moderately hazardous, III= Slightly hazardous, U= Unlikely to cause acute hazard in normal use

Table.3 Farmers' knowledge about pest management practices

Particulars	Hamirpur	Bilaspur	Una	Average
Have knowledge about pesticide hazards	67	63	57	62.33
Have Heard about IPM practice	43	35	31	36.33
Having knowledge about the pests	59	51	47	52.33

Table.4 Source of information for the adoption of pest management

Sources of information	Hamirpur	Bilaspur	Una	Average
Fellow farmer/ friends/ relatives	20	27	24	23.66
SAU personnel / State Deptt. of Agric/ ICAR Institute	25	14	19	19.33
Pesticide dealers/ company representatives	55	59	57	57.00
CIBRC guideline	0	0	0	0

Table.5 Severity of pests in cauliflower and brinjal as perceived by the farmers

District	Crop	Pest	Severity of insects and diseases		
			Slight	Medium	Heavy
Hamirpur	Cauliflower	Insects	15	19	66
		Diseases	33	52	15
	Brinjal	Insects	12	29	59
		Diseases	29	49	22
Bilaspur	Cauliflower	Insects	14	25	61
		Diseases	54	27	19
	Brinjal	Insects	14	26	60
		Diseases	46	37	17
Una	Cauliflower	Insects	11	19	63
		Diseases	45	37	18
	Brinjal	Insects	14	30	56
		Diseases	51	32	17

Table.6 Pesticide storage, disposal and application practices adopted by farmers

Particulars	Hamirpur	Bilaspur	Una	Average
Pesticide storage after purchase				
Safe storage	82	78	84	81.33
Unsafe storage	18	22	16	18.66
Disposal of pesticide containers				
In field	22	18	21	20.33
Sold/reuse	59	66	60	61.66
Crushed/buried in soil	19	16	19	18.00
Safety measures used by applicants				
Use of face masks/ hand gloves	37	35	36	36.00
Wash hands with soap	80	79	81	80.00
Sprayer use practices				
Use after wash	77	71	74	74.00
Wash rarely or never wash	23	29	26	26.00

Majority of the farmers generally tend to use combination of one or more pesticides on the basis of their effectiveness and cost.

It was observed that vegetable cultivating farmers in the study area were aware of various issues related to pest management. On an average 62.33 per cent of the farmers were aware about pesticide hazards in vegetable cultivation. About 67.00 per cent farmer in

Hamirpur, 63.00 per cent in Bilaspur and 57.00 per cent of the farmers in Una knew about hazards of pesticide use. The knowledge about crop pests and IPM practices was also examined. Almost 36.33 per cent of sampled respondents were aware of IPM practices indicating their willingness to move towards safer pest control measures, which is a good sign for environmental friendly farming. About 52.33 per cent

farmers knew about the pests of crops in vegetable cultivation (Table 3).

Farmers were accessing pest management information in many ways. Farmers obtained the information on pesticide use from multiple sources (Table 4). In the survey conducted, it was found that about 57.00 per cent of respondents were mainly dependent on the advice of pesticide dealers, followed by relatives/friends (23.66 per cent) as well as information from public extension system/SAU personnel (19.33 per cent). The data presented in Table 4 reveal that no farmer followed CIBRC guidelines for pest management. The inter comparison of the three district shows that farmers of Hamirpur had better access to authentic information, such as SAU personnel/State department of agriculture (25.00 per cent) compared to Bilaspur (14.00) and Una (19.00 per cent), showing the innovativeness as well as higher educational level of farmers in that district (Table 4).

There were various insect pests and diseases associated with cauliflower and brinjal in the monitored area. The farmers' knowledge on severity of insects and diseases in the vegetables was examined on the basis of three criteria namely slight, medium and heavy infestation/infection (Table 5). The severity of insect pests and diseases varied according to the microenvironment of the crops in the region. In cauliflower 66.00, 61.00 and 63.00 per cent of the farmers were of the same opinion that there was heavy severity of insects (diamond back moth, aphid and cabbage butterfly) in Hamirpur, Bilaspur and Una districts. Only 15.00, 19.00 and 18.00 per cent farmers reported heavy attack of diseases like damping off and black rot of cauliflower in Hamirpur, Bilaspur and Una districts, respectively. Farmers also perceived that there existed severity of insects and diseases in brinjal. Fruit and shot borer was major

insect cause major damage to brinjal crop other insects were bettles, jassids and aphids reported by respondents. In brinjal 59.00, 60.00 and 56.00 per cent farmers reported heavy attack of insects in Hamirpur, Bilaspur and Una respectively. Diseases like phomosis blight and fruit rot of brinjal were also reported by brinjal growing farmers in all three surveyed districts of Himachal Pradesh.

It was observed that most of the farmers stored the pesticide bottles (81.33 per cent) at safe places in their houses (Table 6). The remaining (18.66 per cent) placed the bottles in unsafe areas without any safety measures. For the farmers, disposal of empty bottles was not a safety concern. Majority of farmers (61.66 per cent) sold or reused the empty bottles of pesticides after washing them properly especially large size containers. Only few farmers (18.00 per cent) adopted safe disposal methods like crushing/burying the empty containers in the soil (Table 6). Only 20.33 per cent of sampled farmers disposed the empty bottles in the fields or outside their houses. It was also found that 36 per cent of the farmers used self-protection and rest of the applicants did not used any safety measures like face masks/hand gloves etc. Majority of the farmers (80.00 per cent) washed their hands with soap after pesticide. Majority of the farmers (74.00 per cent) washed the sprayers with water after every use and rest (26.00 per cent) did not washed sprayer after use.

It was observed that farmers had limited knowledge of pest management as well as the consequences of pesticide use in vegetable cultivation. The study revealed that most commonly used insecticides, fungicides and acaricides on cauliflower and brinjal were malathion, mancozeb and propargite, respectively. The most effective pesticides in their opinion were malathion, chlorpyrifos, cypermethrin, carbendazim and mancozeb.

Crop protection measures were being adopted by the farmers on the advice of pesticide dealers rather than agricultural extension officers or farm scientists. They also used the pesticides not approved by the CIBRC. The results showed that farmers need to take more precautionary and safety measures to keep their health as well as environment in good state. Increasing farmers' awareness of pesticide hazards to the environment and promotion of alternative pest management strategies such as use of IPM is essential for reducing adverse effect of pesticides on environment.

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