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Pesticide Application Behavior of Farmers in Apple Production System in South Kashmir of Jammu and Kashmir State

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ABSTRACT

The present study was conducted to assess the pesticide application behavior of farmers with respect to apple production system in Southern region of Kashmir valley. A total of 500 farmers were selected as respondents throughout the four districts of South Kashmir through four stage sampling procedure. The selected respondents were interviewed personally using a pre-tested well structured questionnaire. The results revealed that almost all the farmers were dependant on chemical pesticides for the management of diseases and insect pests but had a preliminary knowledge about them and knew the pesticides only by their trade names without their active ingredients and mode of action. The most frequently used were fungicides followed by insecticides and acaricides. The majority of farmers followed a calendar based spray schedule based on the different phenological stages of apple and sprayed different fungicides and insecticides and partially taking into consideration the recommended spray schedule. However, the farmers were observed to rotate different fungicides in each spray. The data revealed that majority of the farmers were dependant mostly on input dealers followed by extension personnel and progressive farmers for their need of technological information on various aspects of pesticide use.

KeyWords: Apple, Knowledge. Farmers, Pesticide Application, Sampling.

INTRODUCTION

Horticulture forms the backbone of the economy of Jammu and Kashmir state. Most of the people especially those living in Kashmir are directly or indirectly dependant on it. Amongst the fruit crops apple production constitutes about 86 per cent of the total horticultural produce (Dar *et al,* 2010). The valley of Kashmir especially the South Kashmir has name and fame in producing quality temperate fruits especially well known for apple, almond and walnut. However, apple is prone to a number of diseases caused by fungi, bacteria, viruses, etc such as scab, *Alternaria* leaf blotch, cankers, root/collar rot, etc and is also severely attacked by many insect pests like San Jose Scale, woolly apple aphid, borers, etc which result in severe economic losses and sometimes lead to partial or complete plant death in distress. Therefore, various strategies are necessarily followed by the farmers for their management which include sanitation, removal of infested and diseased branches, etc and particularly spraying different pesticides like fungicides, insecticides and acaricides. The farmers follow a calendar based spray schedule spraying indiscriminately different pesticides for management of diseases and insect pests without taking into consideration their adverse effects. This necessitates the conducting of survey programmes for generating data with regard to the current pesticide usage among farmers and other related aspects for the judicious use and efficient management. Therefore, this study was conducted to analyze the pesticide use and application behavior of farmers in apple production system. The main objective of this study was to investigate farmers' perception and the factors that influence their intention to apply pesticide to their crop for pest management with the purpose of improving the IPM extension program.

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MATERIALS AND METHODS

The study was conducted in South Kashmir region of Jammu and Kashmir state during 2018. A four stage sampling design was used to select the sample households. In the first stage four different districts of Kashmir valley in South *viz.,* Anantnag, Kulgam, Pulwama and Shopian which are famous for apple cultivation in the valley were purposively selected for the study. In the second stage three different blocks were selected randomly from each district which covers the major apple belts in the district. In the third stage, six different villages were selected randomly from different blocks to ensure good representation of the selected blocks. Finally, in the fourth stage a total of 500 farmers, representing 100 households from each district belonging to six different randomly selected villages in proportion to the population in each village, were selected as respondent farmers. The selected farmers were interviewed personally by trained BHT (Basic Horticulture Trained) students with the help of a well structured questionnaire. Knowledge was assessed as the information possessed by the farmers about nature of disease/insect pest/ physiological disorder, pesticide use, phenological stage of crop, number of fungicide, insecticide and pesticide applications used as per recommended spray schedule or otherwise, during the year and time of application. The four different sources of information used by farmers for consultation purposes about the selection, right use, dose and time of application of a pesticide for spraying orchards include his own, input dealer, progressive farmer and extension worker. The farmers were categorized on the basis of utilizing the source of information as mostly, occasionally and seldom. Data thus obtained were analyzed using statistical procedures wherever required.

Table 1. District wise extent of knowledge of farmers about identification of pesticides, diseases, insect pests and physiological disorders in apple .

Sr. No	Particular	Extent of Knowledge of farmers (%)			
		Anantnag	Kulgam	Pulwama	Shopian
1.	Major diseases				
a	Apple scab	94	96	97	100
b	*Alternaria* leaf spot	75	80	85	80
c	Apple cankar, root/collar rot	65	75	80	75
2.	Major insect pests				
a	SanJose Scale	65	70	75	70
b	WoollyApple aphid	70	85	90	85
c	Borers/leaf roller,etc	65	75	80	70
d	Mites	45	65	75	80
3.	Pesticides				
a	Fungicides	100	100	100	100
b	Insecticides	100	100	100	100
c	Weedicides	45	65	75	70
d	Acaricides	55	65	75	70
4.	Physiological Disorders				
a	Ca/B deficiency	40	50	65	55
b	NPK deficiency, drought, etc	30	45	45	40

Table 2. Pesticide utilization by farmers of South Kashmir (Anantnag, Kulgam, Pulwama and Shopian) on apple during 2018.

Spray No.	Phenological stage of apple	Fungicide	No. of farmers who sprayed during different phenological stages of crop	% age of farmers who sprayed as per spray schedule	No. of farmers who skipped sprays during different phenological stages of crop*
1st	Dormant/ delayed dormant Stage	HMO @ 2L/ 100L of water	455	91	28
		HMO @ 2L/ 100L of water+ Ethion 50EC @ 1ml/L	17	3.40	
2nd	Silver tip to green tip	Captan 50WP	265	53	85
		Mancozeb 75WP	150	30	
3rd	Pink bud	Dodine 50WP	295	59	65
		Mancozeb 75WP	140	28	
	Flowering stage	No spray	-	-	-
4th	Petal fall	Difenconazole 20EC	305	61	68
		Flusazole 30EC	77	15.40	
		Trifloxystrobin 25 + Tubeconazole 50 WG	30	6.00	
		Mancozeb 75WP	20	4.00	
5th	Fruit let (pea size)	Mancozeb 75WP + Chloropyriphos 20EC	205	41	55
		Difenconazole 20EC+ Chloropyriphos 20EC	155	31	
		Mancozeb 75WP + Quinalphos 35EC	45	9.00	
		Propneb 75WP+ Chloropyriphos 20EC	30	6.00	
		Cyclone(Chloropyriphos 50 +C ypermethrin 5 EC)	10	2.00	
6th	Fruit Dev.-I	Zineb 68% + Hexaconazole 4%+ Chloropyriphos 20EC	125	25	75
		Propneb 75WP+ Chloropyriphos 20EC	115	23	
		Mancozeb 75WP+ Dimethoate 30 EC	150	30	
		Difenconazole 20EC + Chloropyriphos 20EC	35	7.00	

7th	Fruit Dev.-II	Propineb 75WP	45	9.00	54
		Metiram 55%+Pyraclostrobin 5%	53	10.60	
		Mancozeb 75WP+ Dimethoate 30 EC	102	20.4	
		Zineb Z78+Fenzaquin 10EC	103	20.6	
		Mancozeb 75WP + Fenzaquin 10EC	65	13.00	
		Mancozeb 75WP + Spiromecifen 22.9EC	23	4.60	
		Mancozeb 75WP + Quinalphos 35EC	38	7.60	
		Myclobutanil 10WP + Dimethoate 30 EC	17	3.40	
8th	Fruit Dev.-III	Ziram 80WP	175	35	57
		Ziram 27SC	268	53.60	

* No consecutive sprays were skipped away by the farmers during calendar spray schedule

RESULTS AND DISCUSSION

Knowledge level of farmers

The district wise data collected regarding the extent of knowledge of farmers on identification of diseases, insect pests and physiological disorders in apple (Table1) revealed that majority of the farmers in all the districts possessed knowledge about major diseases and insect pests attacking apple and different types of pesticides required for the management of these pests. However, a low percentage of farmers were recorded aware about the physiological disorders caused due to deficiency of nutrients like Ca, B, N, K, etc or other abiotic factors.

Pesticide utilization

The results (Table 2) revealed that majority of the farmers used chemical pesticides like fungicides, insecticides and acaricides for the management of insect pests and diseases. The data also revealed that majority of the farmers were well aware of the different phenological stages of the apple crop and partially followed up the spray schedule recommended by the university.

The respondent farmers have utilized a variety of pesticide formulations of different groups for different purposes. It was observed that farmers used 4-8 fungicide sprays with majority of the farmers spraying 8 followed by 6, 7, 5, and 4 sprays and 1-3 insecticide sprays with majority of the farmers spraying 2 followed by 3 and 1 spray during the entire growing season at different phenological stages of the crop. A small percentage of farmers were observed to skip fungicide sprays during different phenological stages but not consecutively. The tank mixing of insecticides and acaricides with fungicides was mostly performed with Mancozeb 75WP, Propineb 75WP, Zineb 78WP, Myclobutanil 10WP and Difenconazole 20EC. The results also revealed that majority of the farmers remembered the pesticides by their trade names without having any awareness of their technical names and different modes of action. A minor group of farmers was found aware about the contact and systemic action of fungicides and insecticides. However, the farmers were observed rotating different fungicides and insecticides in the consecutive sprays during the different phenological stages of the crop as

recommended in the spray schedule. As revealed by the questionnaire the farmers were observed to have maintained an interval of 10-20 days between the consecutive sprays. It was also observed that some farmers have widened the gap between consecutive fungicide sprays by counting insecticide spray as a normal fungicide spray which is not recommended as it increases the chances of disease incidence in the apple orchards. The farmers were observed very particular in managing the primary inoculum of apple scab as revealed by the interval gap of 10-12 days hardly between the different fungicide sprays from green tip stage to fruit let stage. Kaur (2018) revealed that amongst the various reasons cited by the farmers for using higher doses of pesticides, spurious quality of pesticides has emerged as the main reason, 100 per cent of the farmers were of the view that pesticide usage should decline in the state because of the ill effects of pesticides on the human and animal health. Fifty per cent of the total sampled farmers suggested that quality of the pesticides must be ensured for effective control of pests/diseases while 26 per cent were in favour of developing new formulations of better quality than existing ones.

Management of insect and mite pests

Regarding management of insect and mite pests in the apple orchards the study revealed that almost all farmers sprayed dormant/delayed dormant oil sprays like HMOs during the dormant season as the first indispensable spray. A minor group of farmers have impregnated an organo-phosphorous insecticide like Ethion 50 EC @ 1 ml/l of water with HMO during the dormant season. This was followed by two insecticide sprays by majority of the farmers first at pea size stage of the fruit crop and second during the fruit development stage-I and fruit development stage-II. Majority of the farmers preferred spraying tank mixture of Mancozeb 75WP with Dimethoate 30 EC or Chloropyriphos 20EC or Quinalphos 35EC as and when needed. However, a small percentage of the farmers' sprayed 3rd insecticide spray during the fruit development stage-II for the efficient management of insect pests. Similar studies were conducted by Kumar *et al* (2017) in studying the pesticide use behavior of farmers in rice-onion production system.

For the management of *Alternaria* leaf spot associated with mite infestation the data revealed that majority of the farmers have sprayed a tank mixture of fungicide + acaricide during the disease incidence. However, an insignificant number of farmers have sprayed an early acaricide during the season followed by second spray as tank mixture of fungicide + acaricide during the incidence of *Alternaria* leaf spot and leaf blotch during the season.

Source of information

It has been usually observed that different sources of information are used by the farmers to adopt a new technology and to solve their problems. It is expected that faith on certain information sources influences the decision making to adopt any crop production and crop protection technology. Similar results were recorded during the survey to know the source of consultation used by farmers about the right use, dose and time of application of a pesticide for spraying orchards. The results (Table 3) revealed that the input dealer (53%) has been the major information provider on pesticide use for the majority of the farmers followed by progressive and fellow farmer (37%), extension personnel (25%) and the farmer (28%) himself. On the other hand progressive farmers were occasionally consulted by majority of the farmers (42%) followed by extension personnel and input dealer. Similarly majority of farmers (47%) never followed any source of information for the selection of pesticide, etc. and used his personnel knowledge in spraying their orchards. The data further revealed that extension personnel were mostly consulted by 25 % followed by occasionally contacted by 37 and seldom by 38 per cent. This depicts that there is an utmost need for awareness of integrated pest management progammes in apple production technologies for sustainable production

Table 3. Source of information for farmers regarding the pesticide use.

Source of information	Mostly		Occasionally		Seldom	
	Number	Per cent	Number	Per cent	Number	Per cent
Input dealer	265	53	130	26	105	21
Extension Personnel	125	25	185	37	190	38
Himself	140	28	125	25	235	47
Progressive/ Fellow farmer	185	37	210	42	155	31
Mass media	70	14	160	32	270	54

and judicious use of pesticides. Mass media was rarely used by farmers in spraying their orchards. Similar studies were conducted by Hoeng and Escalada (1999) in rice pest management decisions.

CONCLUSION

It was concluded that majority of the farmers have only a preliminary knowledge about the major diseases and insect pests of apple and are dependent upon the chemical pesticides like fungicides, insecticides and acaricides for the management of diseases and insect-mite pest complex in the apple orchard system. They followed the calendared spray schedule during different phenological stages of apple mostly in consultation with the input dealers followed by progressive farmer, own self and extension personnel. During survey it was observed that majority of the farmers have sprayed different fungicides/insecticides as per recommended spray schedule during different phenological stages of apple. However, lack of knowledge on various aspects of pesticide application like dose, time and method of application, mode of action, etc have made their adoption to injudicious and indiscriminate use of pesticides. The input dealers were acting as the major source of information on pesticide use which often resulted in application of spurious and injudicious use of pesticides and adoption of other unnecessary and faulty agriculture practices. Thus, agricultural extension needs to be employed to follow, a systematic and well planned approach in the area for improving the status of knowledge of farmers for the judicious use and effective management of insect pests and diseases in the apple agro-ecosystem. Moreover, there is also need to conduct awareness and training camps for the input dealers and progressive farmers who can take a lead in the implementation of judicious application of pesticides and save the environment and agro-ecosystem from the undesirable effects and simultaneously minimize the cost of production and ultimately the yield. There is also immense scope for awaking the farmer in pesticide use regarding selection, dose, time of application and handling aspects for efficient management and need based application for saving the unnecessary loss in increasing the cost of production.

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