INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 14, No. 2, p. 197-208, 2019

RESEARCH PAPER OPEN ACCESS

Pesticides use in Khyber Pakhtunkhwa Province Pakistan: present scenario

Rehmat Ullah*, Khalid Nawab

Department of Agriculture Extension Education and Communication, The University of Agriculture Peshawar, Pakistan

Key words: Pesticides, Khyber Pakhtunkhwa, Carbofuran, Cartap, Class.

http://dx.doi.org/10.12692/ijb/14.2.197-208 Article published on February 12, 20199

Abstract

Use of pesticide is common to control diseases, weeds and insects in crop, vegetables and fruits, but usually at the expense of the human health. This present study was conducted in 2018 which was an attempt to find out the present scenario of pesticides use in Khyber Pakhtunkhwa. Khyber Pakhtunkhwa Province was selected as a universe of study. A total of 384 respondents were selected through unknown population sampling formulae i.e. 96 from each Union Council. Data were collected using well-structured interview schedule through personal interview method whereas simple frequencies, percentages and One Sample t-test were applied. The results showed that overall 49 different sorts of pesticides were reported by the farming community as the most commonly used by them and majority were insecticides. Mostly the insecticides were from Class-II of the pesticides toxicity level followed by the Class III and Class U. Only two insecticides i.e. Carbofuron and Cartap from Cartap Hydrochloride chemical group were from Class-Ib which are highly hazardous. Similarly, in 13 pesticides overdose was observed whereas in 8 pesticides low dose was observed in comparison to the recommended dose. It is suggested that the Agriculture Extension Department should initiate massive awareness campaign regarding health and environmental peril of pesticides use alongside the trainings to the farming community in safe use of pesticides. Furthermore, it was also suggested that the Agriculture Extension Department ought to strictly check the sub-standard and highly toxic pesticides in the local market.

* **Corresponding Author:** Rehmat Ullah ✉ rehmat.agrico854@yahoo.com

Introduction

Pesticides are poisonous by nature and constitute one of the most hazardous groups of toxin to the ecosystem and human health (UNU, 2003; Belmonte *et al.*, 2005; Pimentel, 2005; Ahouangninou *et al.,* 2012). Likewise, the other developing countries the hazard of pesticides use is also increasing day by day (e.g. Karlsson, 2004; Hoi *et al.,* 2013; R1´os-Gonza´lez *et al.,* 2013; Jansen and Dubois 2014). Due to its diversity in nature the pesticides is widely used for to fight against pest in agriculture, gardening, homes, and soil (Cooper and Dobson, 2007). But inspite of these returns, pesticide poisoning is definitely a public health problem globally and its use is still increasing day by day (Wesseling *et al.*, 2001). Pesticides act like a double edge sword i.e. on one side it fights against the agricultural pests but on the other hand it also has an adverse effect both on the health of the human beings and the environment as well. Agricultural pests can cause considerable reductions in farm yields and income. As a result, pesticides are profoundly used in attempts to alleviate this problem. Use of pesticide is a cheaper way to increase farm productivity. Pesticide is a poison but its use is essential and increasing day by day. According to an estimate, 85-90% of pesticides never even arrive at their intention organisms (Repetto and Baliga, 1996). It is very likely that many non-target organisms are exposed to multiple pesticides throughout their lifetimes.

According to WHO in estimates in 1973 the human poisoning cases reported annually were 500000 whereas in 1986 the figure crossed the one million mark plus 20,000 deaths. Furthermore, three million cases has also been reported in a joint study of WHO and UNEP (WHO, 1990). The situation is more alarming in developing countries where the people death rate is high instead of infections. As farmers use increasing quantity of pesticides, poisonings will continue to increase (WHO, 1990). Unsafe use of pesticides i.e. low dosing, high dosing and not using personal protective equipment is posting sever threat to the farmer's health and other local inhabitants and thus resulting in annual deaths of 10,000 whereas 500000 suffered from poisoning (Dawn, 2004). Thus, due to the adverse effect pesticides the present study was designed to examine the most commonly used pesticides in the region by farming community and its comparison with WHO toxicity classes, and to compare the actual vs recommended dose of pesticides use by farming community.

Material and methods

Population of study

The population of the study was the respondents from the province of Khyber Pakhtunkhwa (KP) province of Pakistan which is divided into 4 Agro Ecological Zones Viz. Northern Mountainous Zone, Eastern Mountainous Zone, Central Plain Valley and Southern Piedmont Plain. Therefore a Multistage Sampling technique was utilized for selection of the respondents.

Multistage sampling

Multistage sampling technique was used in the present study. The multistage or cluster sampling is imperative because it is economically apt and secondly it is suitable when the sampling frame of the individual elements is not available. It is the selection of sample from the subset at each stage. The multistage sampling of the respondents is as under Stage 1. Selection of districts: One district was selected from each Agro ecological zones. In this connection District Dera Ismail Khan (D.I.Khan) was selected from Southern Piedmont Plain, District Charsadda was selected from Central Plain Valley, District Mansehra was selected from Eastren Mountainous Zone whereas District Swat was selected from Northern Mountainous Zone. Stage II: Selection of tehsils: Single Tehsil was selected from each district keeping in mind the time and financial resource. The tehsils selected were as; Tehsil Paharpur, selected from district D. I. Khan, Tehsil Charsada was selected in district Charsada, Tehsil Mansehra was selected in Mansehra whereas Tehsil Matta was selected in Swat district. All these tehsils were selected in collaboration of Agriculture Extension Department Govt. of KP and these were the agriculture rich tehsils.

Stage III: Selection of Union councils: From each selected Tehsils single Unions council was selected i.e. Union council Band Kurai, Baidara, Khanmai, Baffa was selected from tehsil Paharpur, Matta, Charsadda and Mansehra respectively. These UCs were selected purposively with the collaboration of Agriculture Extension Department that these UCs are the agriculturally rich.

Stage IV: Selection of Sample size and respondents: Due to no proper study available regarding the selection of the potential respondents as sampling units, the sample size was determined on assumed variability such as 50 % for the farmers those are involved in the use of pesticides on their farms as suggested by Kasely and Kumar (1989). Consequently, the number of farmers (respondents) included in the present study were determined using formula for unknown population which is defined in the following Equation (i).

$n = Z^2 \sigma^2 / d^2$---------- (i)

Where, Z^2= statistic for a level of confidence. (For the level of confidence of 95%, which is conventional, Z value is 1.96).

n = Sample size

σ= estimated standard deviation that 50% of the farmers would apply pesticides in their fields

d = precision. (d is considered 0.05 to produce good precision and smaller error of estimate) (5%)

$$\frac{(1.96)^2\ (50)^2}{(5)^2} = 384$$

Therefore through equal allocation formula, 96 respondents were selected from each of the selected Tehsil. The respondents were selected using convenience sampling technique.

Research design

Cross sectional survey design was utilized as a part of the current investigation. Data collection at one point is the fundamental concept of cross sectional survey. It is best suited in determining the perceptions, expectations and respondents interests. The cross sectional survey is also most appropriate in a view to establish correlation between two and more variables and could be examined by a range of methods. It is also useful for small as well as for large population by selecting studying samples, to discover the incidence distribution and relationships of various social and psychological aspects.

Research instrument

Keeping in view the importance of interview schedule and objectives of the present study, well-structured interview schedule was developed which was based on open, close and partially open ended questions. The farmers were queried regarding these questions/information. The questions were based on the precautionary measures and PPE used while using pesticides and self-reported acute poisoning cases. Face and content validity of the interview schedule was measured. Face validity was measured by asking questions from the respondents who were not actually involved in the study and appropriate response was obtained whereas for content validity the research instrument was checked by the panel of experts from Agriculture Extension Education and Communication, The University of Agriculture Peshawar and necessary amendments were made thereafter. For reliability of the research instrument, data from 30 farmers were collected which was not included in actual study. After collection of the data, the data were subjected to SPSS ver. 20 for scale reduction test i.e. Cronbach's alpha test. Cronbach alpha value obtained was 0.831 representing good internal consistency.

Data collection

Data collected for the present study was based on both primary and secondary data. Various published and unpublished sources were used for the purpose of secondary data whereas primary data were collected using well developed interview schedule. Face to face interviews were conducted in order to record firsthand information and to remove any ambiguity of the respondents as and when prevails regarding any question.

Statistical analysis of the data

Statistical Package for Social Sciences (SPSS) ver. 20 was used for analysis of the data. Simple frequency, percentages and one sample t-test was utilized.

Results and discussion

Most commonly used pesticides

Toxicity of pesticides based on their formulation are been classified by the WHO and been termed as WHO pesticides toxicity classes. It consists of extremely hazardous (Class Ia), highly hazardous (class Ib), moderately hazardous (Class-II), slightly hazardous (Class-III), unlikely to present acute serious hazards in normal use (Class-U) whereas obsolete chemicals to be considered as pesticide are included in Class-O (WHO, 2009). Nearly 90 percent ofthe banned pesticides fall into category of Class-Ia, Class-Ib and Class-II of the WHO hazard grades.

Table 1. Overall Sketch of the Sampling Procedure Using Multistage Sampling Technique.

Sr. #	Zones	Districts	Tehsils	Union Council	Sample
1	Northern Mountainous Zone	Swat	Matta	Baidara	96
2	Eastern Mountainous zone	Mansehra	Mansehra	Baffa	96
3	Central Plain valley	Charsadda	Charsadda	Khanmai	96
4	Southern piedmont Plain	D.I.Khan	Paharpur	Bandkurai	96
Total					384

Results in Table 2, 3 and 4 showed the various types of pesticides in use by the farming community. The instant survey depicts that there were 49 different sorts of pesticides most commonly in use by the farming community as per the present study. Among the 49 various pesticides 14 were weedicides (Table 2), 25 were insecticides (Table 3) whereas 10 were fungicides (Table 4). Instant results showed that majority of the pesticides in use were insecticides which showed the prevalence of insect pest in the area is high enough in contrast to the diseases and weeds. Similarly, majority (5) of the weedicides were from Class III of hazardous followed by 3No.s weedicides which were from Class II whereas 5 were from Class U. only one weedicides from Class-O was observed in the present study. These weedicides were from different chemical groups i.e. Triazine, Amide, Dinitroanilin, Organic, Phenylpyrazolin, Aryloxyphenoxypropionate, Organophosphorus, Chloroacetamide, Nitrile, Phenoxy, Pyridinecarboxylic acid, Sulfonylurea, Diphenylether and Sulfonylurea. The weedicides used for various purposes are showed in the Table 2. This showed that the farming community was using pesticides from moderately hazardous and slightly hazardous classes (WHO Recommended Classification of Pesticides by Hazard, 2009). The instant results are in contrast with that of Chitra *et al.* (2013) who reported in their study that majority of the respondents were using pesticides from highly hazardous Class of WHO.

Similarly, 25 different sorts of insecticides were reported by the respondents (Table 3). Among them the majority (14) of the insecticides were from Class-II of the pesticides toxicity level followed by the Class III and Class U i.e. 4 each respectively. Only two insecticides i.e. Carbofuron and Cartap from Cartap Hydrochloride chemical group were from Class-Ib which represents highly hazardous (WHO, 2009).

The insecticides were from the chemical group of Anthranilic Diamide, Nicotinoid, Pyrethroid, Organophosphates, Neonicotinoids,Organochlorines, Avermectins and Urea. The insecticides used for various pests as reported by the respondents were presented in Table 2**.** Our results are in conformity with that of Jamali *et al.* (2014) who also reported that majority of the pesticides were from Class-II of WHO toxicity classification. Similarly, Mengistie *et al.* (2017) reported that most commonly used pesticides were Mancozeb, Karate, Malathion and Ridomil Gold which are in conformity with our results. Moreover, they also reported that majority of the pesticides were from Class-II of WHO toxicity classes.

Table 2. Status of the most commonly used weedicides.

Active ingredient	Brand name	Chemical group	Pest	WHO class
Atrazine+Smetolachlor	Primextra gold 720 SC	Triazine and amide	Controls certain annual grasses and broadleaf weeds in Maize, Sugarcane and Sweet Corn, Barnyard Grass, Blackberry Nightshade, Caltrop, Common Thornapple, Crowsfoot Grass, Liverseed Grass	III
Pendimethalin	Stomp 455 g/l CS	Dinitroaniline	A pre-emergent herbicide for the control of grass weeds	III
S metolachlor	Dual gold 960 EC	Organic	Annual grasses and some annual broad-leaved weeds	III
Penoxaden	Axial 050 EC	Phenylpyrazolin	Controls wild oats and ryegrasses in winter and spring wheat and winter and spring barley. Controls blackgrass in winter and spring barley as part of an integrated control strategy	-
Fenoxaprop	Puma super 69 EW	Aryloxyphenoxypropionate	Annual and perennials grass weeds	O
Glyphosate	Round up PM 540 g/l SL	Organophosphorus	Annual and perennial weeds	III
Atrazine+Smetolachlor	Primextra gold 720 SC	Triazine+chloroacetamide	Controls certain annual grasses and broadleaf weeds in maize, sugar cane and sweet corn, also in sorghum	III
Bromoxynil+MCPA	Buctril super 60 EC 60	Nitrile+ Phenoxy	Broad leaf weeds	II
Aminopyralid+florasulam	Lancelot 45 WG	Pyridinecarboxylic acid	Crow pea, Common Goosefoot, Field bindweed	U
Fluroxypyr+MCPA	Harvester 50 EC	Pyridinecarboxylic acid+ Phenoxy	Crow pea, Jungle onion, Common vetch,	U+II
Metsulfuron+ tribenuron	Allymax 66.7 WG	Sulfonylurea	Common Goosefoot, Field bindweed, Broadleaf dock, Blue pimpernel, Fathen, nettle leaved goosefoot, Bur clover, Yellow sweet clover Fumitory,	U
Oxyfluorfen	Axifin 24 EC	Diphenylether	Field bindweed	U
Triasulfuron	Logran 75 WG	Sulfonylurea	Broadleaf dock, Blue pimpernel, Fathen, nettleleaved goosefoot, Jungle onion,	U
Haloxyfop	Percept 10.8 EC	Aryloxyphenoxypropionate	Bermuda grass, Water couch, Johnson grass,	II

From the instant results, it can be seen that majority of the respondents rely on Organophosphorus group of chemical in order to fulfill their needs which are the esters derived from phosphoric acid. This is toxic because of the fact that it effect on human being central nervous system by inhabiting acetyl cholinesterase. Acetyl cholinesterase is an enzyme which modulates the level of neurotransmitter acetylcholine, thus disrupting the nerve impulse by serine phosphorylation of the hydroxyl group in the active site of the enzyme (Sorgob and Vilanova, 2002). This results in loss of reflexes, head ach, dizziness, nausea and even death (Perry *et al.,* 1998). Organophosphorus compounds are most commonly used in agriculture, most are insecticides &miticides, and their way of joining these organizations is by ingestion and contact. High levels of exposure to organochlorines (one type of pesticides) have been shown to cause cloracne, a type of acne cause by chlorine containing chemicals and skin rashes. There is some evidence that organophosphate insecticides affect the immune system and can cause psychiatric problems such as paranoid behaviour, disorientation, anxiety and depression (Garcia *et al.,* (2012).

Among ten fungicides as reported by the farming community the majority (8) were from the Class-II whereas only two were from Class-U (Table 4).The

fungicides reported by the farming community were from Dithio-carbamates, Triazoles, Oximino-acetates, Methoxy-acrylates and Organophosphorus chemical group. The results of the present study indicated a wide variety of chemicals were utilized as pesticides in the area. Although 49 different pesticides were reported by the respondents which were being used in the locality yet but it could be lower than actual number of pesticides in use because of the fact that different farmers have different interest of applying pesticides and due to the sample of 384 respondents only 49 were reported.

Table 3. Status of the most commonly used insecticides.

Active ingredient	Brand name	Chemical group	Pest	WHO class
Chlorantraniliprole+Thiamethoxam	Voliam Flexi 300 SC	Anthranilicdiamide	key sucking, chewing and lepidopteran pests in citrus and tree fruit	U
Imidacloprid	Confidor 200 SL	Nicotinoid	Spinola bug, pod bug, Mango hopper, Citrus psylla, WB Plant hopper, Aphids, White fly, Mango mealy bug, Cotton mealybug, S. cane Leaf hopper, Red pumpkin beetle, Mirid bug	II
Bifenthrin	Talstar10 EC	Pyrethroid	Spinola bug, pod bug, Black bug, Cutworm, Shoot fly, Citrus leaf miner, Vegetable leaf miner,	II
Lemdacyhalothrin	Karate 5 CS	Pyrethroid	Plant hopper, Green leaf, hopper, Thrips, sucking insects/wide range of insects, Hairy caterpillar, Rice leaf folder, Capsule borer, Mango hopper, Rice grass hopper, Cutworm, Citrus leaf miner,	II
Gamacyhalothrin+chlorpyrifos	Bolten 31EC	Pyrethroid+ Organophosphates	Black bug, Brinjal stem borer, Pink bollworm, Cabbage butter fly,	II
Chlorantraniliprole	Coragen 20 SC	Anthranilicdiamide	Protects a variety of vegetable crops, corn and canola from insects such as, cutworms and armyworms.	U
Trichlorfon	Dipterex 30 T 60	Organophosphates	Fruit fly	II
Gama cyhalothrin	Proaxis 60 SC	Pyrethroids	Spinola bug, pod bug, Rice leaf folder	II
Cypermethrin	Cypermethrin 10 EC	Pyrethroid	Defoliators, Green leaf Hopper	II
Chlorantraniliprole+Thiamethoxam	Virtako 0.6 Gr	Anthranilicdiamide	White stem borer, Yellow stem borer, Top borer, Stem borer, Sugarcane root borer	U
Chlorantraniliprole	Ferterra 0.4 G	Diamides	White stem borer, Yellow stem borer	U
Thiamethoxam	Actara 25 WG	Neonicotinoids	A broad spectrum of sucking soil and leaf-feeding pests like Aphids, Jassids	III
Chlorpyrifos	Larsbin 40 EC 40 EC	Organophosphates	Stalk borer, termites, soil born insects	II
Malathion	Malathion 57 EC	Organophosphates	Green leaf hoppers, Thrips, Rice bug	III
Endosulfan	Thionex 35EC	Organochlorines	Ball worm, thrips,	II
Emamectin	Several	Avermectins	Lepeidopterous fruit worm	III
Acetamiprid	Several	Nicotiamide	Sucking pests and mites	II
Profesofos+Cypermethrin	Polytrin C	Pyrethroids	Caterpillars, aphids, mites and sucking pests	II
Emamectin benzoate	Proclaim	Avermectins	armyworms, pinworms, diamondback moths, fruitworms and leafrollers	-
Dimethoate	Dimethoate4C	Organophosphate	Key insect pests in a variety of crops including citrus, soybeans, corn, cotton	II
Carbofuron	Furadan 3 G	Cartap hydrochloride	Meloidogyne species, Root, stem, top,	Ib
Cartap	Padan 4 G	Cartap hydrochloride	Plant hopper, Green leafHopper	Ib
Profenophos	curacran 500 EC	Organophosphorus	Against lepidopterous larvae	II
Lufenuron	Match 50 EC	Urea	Against lepidopterous larvae	II
Diafenthiuron	Diafenthiruron 50% SC	Urea	Sucking pests & mites	III

The vegetable and fruits farmers depended heavily on use of pesticides for control of different pests and diseases and over 49 different formulations were used. This might be because of the reason that their attitude has been developed that solely the pesticides use is the solution of the controlling pests thus they were busy in spraying various sort of pesticides.

The same was also reported by the Jamali *et al.,* 2014 that farmers were much interested to control the pests by using pesticides and thus were using diverse pesticides in the study area.

Table 4. Status of the most commonly used fungicides.

Active ingredient	Brand name	Chemical group	Pest	WHO class
Propineb	Antracol 70 WP	Dithio-carbamates	Early blight	U
Difenoconazole	Score 250 SC	Triazoles	Powdery mildew, early blight, Decline,	II
Trifloxystrobin+Tebuconazol	Nativo 75 WG	Oximino-acetates+ triazoles	Leaf spot, Rice blast, Powdery mildew	II
Azoxystrobin+flutriafol	Nanok 25 SC	Methoxy-acrylates	Leaf spot, Rice blast, Downy mildew	II
Mencozeb+metalaxal	Ridomil gold 68 WG	Dithiocarbamate +Anilide	Late blight, powdery mildew, Collar rot	II
Copper hydroxide	Champion 77 WP	-	Bacterial leaf blight	II
Propeconazol	Tilt	Organophosphorus	Blast, Rust	II
Copper Oxychloride	Several	Inorganic	Early blight	II
Delamethrin	Pyrethroid	Inorganic	Chewing and sucking pest	II
Thiophanate methyl	Several	Benzimidazole	Powdery Mildew	U

Note: Ia = Extremely hazardous, Ib = Highly Hazardous, II = moderately hazardous;III = Slightly hazardous; U = Unlikely to present acute hazard in normal use;O = Obsolete as pesticide, not classified.

The present research study authenticate that the pesticides sellers who aim at business profit, shy away the environmental and health risk that are entailed due to excessive use of pesticides. It is in conformity with similar pattern in African countries (Abate *et al.,* 2000). This situation is also true in many developed countries where the choice of pesticides to be used by farmers is influenced by the suppliers (Epstein and Bassein, 2003).

Table 5. One Sample t-test of recommended Vs actual used weedicides dose by the respondents.

Brand name	Active ingredient	Recommended Use/Ha	Mean farmers dose/Ha±SD	Difference	t-value	Freq. (%)
Primextra gold 720 SC	Atrazine+Smetolachlor	1600 ml	1612.71±30	+12.71	4.891**	103(26.82)
Stomp 455 g/l CS	Pendimethalin	2000 ml	1997.9±80	+2.09	0.297NS	129(33.59)
Dual gold 960 EC	S metolachlor	1600 ml	1611.95±18.67	+11.95	7.09**	123(32.03)
Axial 050 EC	Penoxaden	660 ml	636.78±20.88	-23.21	11.92**	115(29.95)
Puma super 69 EW	Fenoxaprop	1000 ml	1001.54±8.33	+1.54	1.827NS	97(25.26)
Round up PM 540 g/l SL	Glyphosate	4000 ml	3993.82±27.03	-6.17	-2.157*	89(23.18)
Buctril super 60 EC 60	Bromoxynil+MCPA	800 ml	802.43±5.91	+2.43	2.53*	123(32.03)
Lancelot 45 WG	Aminopyralid+florasulam	25 g	26.27±3.1	+1.27	3.143**	59(15.36)
Harvester 50 EC	Fluroxypyr+MCPA	800 ml	799.71±8.21	-0.285	-0.206NS	68(17.71)
Allymax 66.7 WG	Metsulfuron+ tribenuron	16 gram	16.45±1.05	+0.45	1.97NS	128(33.33)
Axifin 24 EC	Oxyfluorfen	600 ml	603±13.01	+3	1.01NS	86(22.40)
Logran 75 WG	Triasulfuron	32 gram	34.35±0.81	+2.35	12.93**	113(29.43)
Percept 10.8 EC	Haloxyfop	700 ml	696±13.13	-4	-1.361NS	39(10.16)

It is because of the pest and disease which badly affects the vegetable yield hence the farmers are compelled to apply and spray pesticides excessively, in order to have better crop. In Pakistan there is public agriculture extension wing which upholds the facilities for the farmers to provide pesticides on subsidized rates but still farmers relied continuously on pesticides dealers. Because of the illiteracy and lack of knowledge farmers do not select the right pesticides and right amount of the dose, in order to avoid the bad effect upon the environment and health. That fact has also been rightly pointed out by

Epstein and Bassein (2003), wherein they had observed that farmers prefer the application of pesticides upon their own settled out method of calendar rather keeping in view the effect upon health and environment.

A wide range of pesticides are globally used for crops protection during the cultivation of vegetables due to heavy pest infestation throughout the season of crop and food (Agnihotri, 1999), Literature reveals that in most of the vegetables the Maximum Residual Limit (MRL) were crossed by the residues of the pesticides and this may pose severe health hazards to consumers (Mukherjee and Gopal, 2003). Monitoring of pesticides is conducted globally to assess the environmental load of their residues. Currently pesticides wide use in the world as an alternative pest control replaying persistent organochlorines (Toan *et al.,* 2007). Because of wide spread use of pesticides, the presence of their toxic residues have been reported in various environmental component/ commodities (Kumari *et al.,* 2006; Kumari and Kathpal, 2009; Wang *et al.,* 2008).

These pesticide residues find their way into the human body through food, water, and environment.

Table 6. One Sample t-test of recommended Vs actual used insecticides dose by the respondents.

Brand Name	Active Ingredient	Recommended Use/Ha	Mean Farmers dose/Ha±SD	Difference	t-value	Freq. (%)
Voliam Flexi 300 SC	Chlorantraniliprole+Thiamethoxam	160 ml	162.5±9.24	+2.5	1.209NS	143(37.23)
Confidor 200 SL	Imidacloprid	400 ml	418±15.07	-18	-5.339**	137(35.67)
Talstar10 EC	Bifenthrin	500 ml	492.25±14.82	-7.5	-2.26*	82(21.35)
Karate 5 CS	Lemdacyhalothrin	500 ml	519.25±8.87	+19.25	9.831**	172(44.79)
Bolten 31EC	Gamacyhalothrin+chlorpyrifos	1000 ml	1014.5±42.48	+14.5	1.526NS	88(22.91)
Coragen 20 SC	Chlorantraniliprole	100 ml	98.32±1.31	-1.68	-0.96NS	171(44.53)
Dipterex 30 T 60	Trichlorfon	200 g	206.5±14.24	+6.5	2.041NS	42(10.93)
Proaxis 60 SC	Gama cyhalothrin	200 ml	210.5±12.76	+10.5	3.67**	21(5.46)
Cypermethrin 10 EC	Cypermethrin	500 ml	509±12.09	+9	3.327**	182(47.39)
Virtako 0.6 Gr	Chlorantraniliprole+Thiamethoxam	8 kg	7.9±0.30	-0.1	-1.45NS	31(8.07)
Ferterra 0.4 G	Chlorantraniliprole	8 kg	7.8±0.42	-0.2	-1.49NS	17(4.42)
Actara 25 WG	Thiamethoxam	50 g	55.3±6.07	+5.3	3.49**	172(44.79)
Larsbin 40 EC 40 EC	Chlorpyrifos	4 litre	4.21±3.72	+0.21	1.031NS	71(18.48)
Match 050 EC	Lufenuron	400 ml	411.24±16.17	+11.24	2.45*	46(11.97)
Malathion	Malathion 57 EC	8 litre	8.03±0.23	-0.03	-0.92NS	21(5.46)
Polytrin C	Profesofos + Cypermethrin	1 liter	0.98±0.32	-0.02	-0.23NS	73(19.01)
Diafenthiuron 50% SC	Diafenthiuron	1600ml	1618.19±23.12	+18.19	2.981*	41(10.67)
Proclaim	Emamectin benzoate	260gm	252.19±12.34	-6.81	-1.29*	27(7.03)
Furadan 3 G	Carbofuron	18 kg	19.9±1.57	+1.9	2.93*	61(15.88)
Diafenthiruron 50% SC	Diafenthiuron	400ml	391.2±6.91	-8.8	-1.02NS	38(9.89)
Padan 4 G	Cartap	9 kg	9.78±1.38	-0.78	-2.013*	74(19.27)

Dosage of Pesticides use in KP

Similarly the respondents were also investigated that what dose you applied in controlling the pest and then was checked with the recommended dose in order to find out the difference. The results of one sample t-test were presented in Table 5, 6 and 7. It was found that majority of the respondents were using high dose then the recommended dose. Lamdacyhalothrin insecticide were the most frequently applied by the respondents i.e. 172 respondents and highly significantly (P≤0.01) above the recommended dose with the mean difference of +19.25 ml ha^{-1} and t-value of 9.831 (Table 6). Similarly highly significant (P≤0.01) difference was also observed in Primextra gold 720 SC with mean difference of +12.71ml ha^{-1}, Dual gold 960 EC (+11.95

ml ha^{-1}), Lancelot 45 WG(+1.2g ha^{-1}), Logran 75 WG (+2.35 g ha^{-1}), Proaxis 60 SC (+10.5 ml ha^{-1}), Cypermethrin 10 EC (+9 ml ha^{-1}), Actara 25 WG (+5.3 g ha^{-1}) and Score 250 SC (+11.5 ml ha^{-1}) (Table 5, 6 and 7). Moreover, significantly (P≤0.05) high dose was observed in Buctril super 60 EC 60 (+2.43 ml ha^{-1}), Match 050 EC (+11.24 ml ha^{-1}), Diafenthiuron 50% SC (+18.19 ml ha^{-}) and Furadan 3 G (+1.9 kg ha^{-1}) then the recommended.

Table 7. One Sample t-test of recommended Vs actual used fungicides dose by the respondents.

Brand Name	Active Ingredient	Recommended Use/Ha	Mean Farmers dose/Ha±SD	Difference	t-value	Freq. (%)
Antracol 70 WP	Propineb	1000 g	986.23±66.35	-13.77	-0.91NS	134(34.9)
Score 250 SC	Difenoconazole	200 ml	211.5±13.48	+11.5	3.81**	171(44.53)
Nativo 75 WG	Trifloxystrobin+Tebuconazol	130 g	128.92±0.76	-1.08	-0.79NS	178(46.35)
Nanok 25 SC	Azoxystrobin+flutriafol	400 ml	403.29±5.21	+3.29	1.76NS	128(33.33)
Ridomil gold 68 WG	Mencozeb+metalaxal	500 g	483.5±20.07	-16.5	-3.676**	181(47.14)
Champion 77 WP	Copper hydroxide	500 g	486.5±19.54	-13.5	-3.09**	51(13.28)
Tilt 250 EC	Propiconazole	500 g/L	492±17.94	-8	-1.993NS	121(31.51)

It was a matter of serious concern that Furadan 3 G were from the Class-Ib (Table 3) and still farmers were busy to use high dose then the recommended; thus affecting the environment and their health as well. Furadan is a systemic insecticide; it is been absorbed through roots and carried out to the other parts of the plants where insecticidal concentrations are attained. Moreover, carbofuran also serve as contact activity against pests. Furthermore, highly significantly (p≤0.01) low dose was observed in Axial 050 EC (-23.21 ml ha^{-1}), Confidor 200 SL (-18 ml ha^{-1}), Ridomil gold 68 WG (-16.5 g ha^{-1}) and Champion 77 WP (-13.5 g ha^{-1}). Significantly (p≤0.05) low dose then the recommended was recorded in Round up PM 540 g/l SL (-6.17 ml ha^{-1}), Proclaim (-6.81 gm ha^{-1}) and Padan 4 G (-0.78 kg ha^{-1}). Using below the recommended dose of pesticides results in creating resistance against the pest which ultimately results in increasing number of pesticide spray. Therefore it can be concluded that the farming community were not following the exact recommended dose and thus misusing the pesticides. Among the sample respondents majority (47.39%) of the respondents reported Cypermethrin 10 EC followed by the Ridomil gold 68 WG (47.14%), Nativo 75 WG (46.35%), Actara 25 WG (44.79%), Karate 5 CS (44.79%), Coragen 20 SC(44.53%) and Score 250 SC (44.53%) (Table 5, 6 & 7). The increased use of pesticides i.e. cypermethrin, can also be associated with failure of breeding in honey bees. Instant results showed that the problem is not the pesticide but how it is been handled. The indiscrimation in violation of recommendations effects the agriculture sustainability, health of growers/consumers and environment itself. This situation calls for a transformation of these practices. Moreover, farmers were using inappropriate doses of pesticide. Overdosing ha^{-1} introduces surplus pesticides to the environment and may result in crop damage. Furthermore, inaccurate dilution can reduce pesticide efficiency or can increase residues and speed up the development of pesticide resistance.

Conclusion

It is concluded from the present study that most of the farmers were busy using pesticides from Class III, Class II, Class Ib, U and O and mostly rely on the pesticides from Organophasphates group which is dangerous for health. Similarly, it was also concluded from the present study that farmers were busy in overdosing and low dosing which in both cases causes problems for the farming community. In both the cases, misuse of pesticides occurs i.e. by applying pesticides indiscriminately is the violation of the scientific recommendations. By applying the low dose of pesticides it initiates resistivity in the target pest whereas with overdosing create environmental problems i.e. kills other non-targeted organisms and give stress to crops. It is suggested that the massive

campaign should be launched in order to bring awareness among the farming community regarding the classes of WHO toxicity prior to selection of pesticides for their crops. Moreover, Agriculture Extension Department should take initiative by taking the pesticides companies onboard for arrangement of scheduled trainings in order to train the farming community in safe handling and scientific application of pesticides.

Authors' contribution

The present study was the part of PhD dissertation, the whole study was conducted under the supervision of the Prof. Dr. Khalid Nawab. The study was designed by Prof. Dr. Khalid Nawab whereas data collection, analysis and write-up was done by Rehmatullah. Moreover, final revision before submission was also given by Prof. Dr. Khalid Nawab.

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