

Farmers' Perceptions about Effects of Pesticides Use in Vegetables in Taluka Usta Muhammad of Jaffarabad district, Balochistan

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Abstract:

This study was carried out to assess the vegetable growers of Taluka Usta Muhammad District of Jaffarabad, Balochistan for their awareness about the effects of pesticides use in vegetables and their opinion in relation to situation improvement and major problems they face. The study covered the 80 vegetable growers. Apart from the demographic information of the respondents, the farmers were also asked to perceive on their knowledge about pesticide application, impact of pesticides on vegetables, human health and environment and some other related aspects. The study revealed that majority of growers were 31-40 years of age (32%); educated up to primary (31%); >40 acre landholding (31%); tenant (46%); mostly having 5-10 years farming experience (39%); cultivate vegetables on 11-20 acres (38%) growers, respectively. The likert type scale results on different assumptions for

majority growers show: 'not satisfied' (81%) about the usefulness extension services regarding proper use of pesticides; 'satisfied to some extent' (68%) on their awareness regarding techniques of pesticide application; (56%) on awareness regarding unsafe pesticide application as a health risk; 'satisfied to some extent' (62%) following label instructions; 'satisfied to some extent' (45%) on awareness of safe use of pesticides; 'satisfied to some extent' (55%) knowledge regarding precautions for pesticide application; 'satisfied to some extent' (63%) on their awareness on unsafe pesticide application is a health risk; 'satisfied to some extent' (49%) for awareness on adverse pesticide effects on animals and other ecosystem; 'not satisfied' (45%) with the traditional methods. Majority growers 'strongly agreed' (82%) that use of pesticide increases the yield of vegetables; (72%) disagreed the pesticides as cause of unground water contamination; (44%) strongly agreed that use of pesticides is harmful for biological life; (51%) strongly agreed that abundant use of pesticides pollutes the atmosphere; (46%) strongly agreed on changed natural taste of food due to pesticidal sprays; (40%) strongly agreed that birds are affected by the indiscriminate use of pesticides; (71%) strongly agreed that due to residual effects of pesticides in vegetable produce human health is at high risk. Majority of growers suggested training programs on proper pesticide application on vegetables, motivation campaigns, effective extension services, effective role of mass media, demonstration plots, role of EPA, training of residual effects and human health. Neighboring farmer was rank-1 source of information while 'financial constraints' was rank-1 problem faced by the growers.

Key words: Vegetables, Pesticides, Awareness, Ecosystem, Knowledge, Farmer and Growers

INTRODUCTION

Agriculture is central to economic growth and development in Pakistan. The Pakistan is fifth largest producer of vegetable in the world, about 1.3 million farmers, out of a total of 5 million.

This accounts for 15% of the cultivable area of the country, and 10.5% of the value added in agriculture. Vegetables cover the largest area in Rabi crops session, which is 45% of the total area. This is followed by Fodder which covers 23.5% of the area. More than 65% of the area under vegetables' cultivation is being irrigated(GOP 2011-12). The usage of pesticide has increased manifold since 1960s worldwide. The use of pesticides has helped considerably to reduce crop losses and to get better yield. Agro-chemicals have become an integral part of crop production and knowledge on their use is considered to be an essential factor in gaining an optimum yield under any set of climatic conditions and production practices (Shetty, 2004). For optimum utilization of production technology and inputs, it is necessary to avoid unnecessary use of agro-chemicals. Pesticide abuse is increasing in many Asian countries with negative effects not only on environment and farmer's health but it also affects the consumer's health. The pesticides have adverse effects on human beings as well, but the actual figures are not available. The rough figures say that around 40,000 lives are annually lost across the world for pesticides (WHO, 2005), equaling to 10% of all casualties in the agricultural sector (Sharma Atul, 2007).

The farming communities are less aware of the recommended dosage and methods of insecticidal application and in result natural fertility of the soil is being adversely affected, soil structure is disturbed and a reduction in the water holding capacity of the soil along with increased susceptibility to soil erosion, that has adversely affected the soil productivity (Barik and Gautam, 2009).A wide range of pesticides is used for pest management and vector control in agricultural areas, but many farming communities are not adequately informed about the hazards associated with the chemicals. As a result, farmers use pesticides without full understanding of their impact on human health and the environment(Ajayi, 2000).The awareness

of farmers regarding the effects of pesticide application is the key factor not only for effective and efficient use of pesticides, particularly in vegetable crops, but also adverse effects and risks can be minimized and positive impact on crop production can be enhanced (Hoque *et al.* 2008). Although, the farmers field schools and other non-governmental organizations are apparently looking busy to develop awareness among the farmers regarding the recommended pesticide application for different crops, in relation to proper dosage and method of pesticide application and about the consequent effects of such indiscriminate use of pesticides. Moreover, the farmers do not have sufficient knowledge regarding the economic implications associated with indiscriminate use of synthetic pesticides (WHO, 2005; Lalitha and Ramaswami, 2007; USDA, 2011).

Vegetable farmers use a wide range of pesticides at different levels to reduce losses from pests and diseases. However, despite the contribution of pesticides to agricultural production, evidences in the last few decades have shown that they could also be detrimental to human health and the ecosystem (Tadesse and Asferachew, 2008). Pesticides have substantially contributed to the controlling of pests and increasing crop yields in meeting the food demand of escalating population and control of vector-borne diseases. Exposure to pesticides is one of the most important occupational risks among farmers in developing countries, and also a major factor responsible for contamination or poisoning in developing countries (Coronado *et al.* 2004). Past research have identified elements of unsafe use of pesticides as; lack of attention to safety precautions, environmental hazards, and information about first aid and antidotes given by the label, the use of faulty and proper maintenance of spraying equipment, and lack of the use of protective gear and appropriate clothing during handling of pesticides (Sosan and Akingbohunge, 2009). The main issue of pesticides mismanagement starts at the local area where it

causes severe damage to land, soil water, farmer's/worker's health and the environment. In view of the adverse environmental effects from the unsafe pesticide use, lack of awareness of the adverse health consequences of pesticides by some farmers; it therefore becomes imperative to identify farmers' pest management practices in vegetable cultivation by investigating farmers' awareness and perceptions about the effects of pesticides use in vegetables in Taluka Usta Muhammad District Jaffarabad, Balochistan.

MATERIAL AND METHOD

This study was conducted to descriptive survey. A descriptive survey design is appropriate for obtaining people's perceptions on social issues and social facts concerning the current status of phenomena and/or for describing the nature of existing conditions in a situation. The descriptive survey design was selected because the primary purpose of the present study was to assess farmers' perceptions about effects of pesticides use in vegetables particularly in Taluka Usta Muhammad.

Target Population's Area and Representative Sample

This study entirely focused on vegetable growers in Taluka Usta Muhammad district of Jaffarabad in Balochistan; because in the study area almost all the field crops and vegetables are cultivated. A representative sample of 80 farmers was selected for this study which was according the Central Limit Theorem, sampling distribution becomes approximately normal when sample size is high (Anderson *et al.*, 1993). Therefore, in most of the cases a minimum sample recommended for the studies is less than 80 in which personal limited resources are involved. This study is based on primary data collected from vegetable growers. Thus, 80 vegetable growers were interviewed considering the study objectives and hypothesis in mind

through the questionnaire. Due to time constraints and the availability of respondents the sample size was kept restricted up to 80 with the assumption of representing the whole population of farmers. Ten villages were nominated for selection of respondents which included Rustam Khan Jamali, Faizabad, Aliabad, Faqeerabad, Allabad, Allah Bux, Ghouspur, Rayan Shah, M. Salleh and Attaullah Khan Buledi as one representative village each from ten union councils including Kabula, Samaji, Aliabad, Khanpur, Sowbd Rami, Hadiro, Khanki, Chuki Jamali, Ghouspur and Faizabad, respectively in taluka Usta Muhammad of Jafferabad district. From each village, 8 farmers were selected at random for interview to know their perceptions on the effects of pesticide application on vegetable in the study area.

Questionnaire Design and Analysis of Data

Semi structured questionnaire was developed. Efforts were made to design most of the closed ended questions. Farmers' perceptions were recorded using 5 point likert scale and questionnaire was developed in such a way also to facilitate the questionnaire contents to computer package Statistical Package for Social Sciences (SPSS) for analysis purpose. The data was collected through personal interview using the questionnaire by the researcher himself to get the accurate information from the respondent farmers. The structured interview schedule contained items concerning personal characteristics of the farmers included age, qualification (education), land holding, type of tenure, farming experience, area brought by the farmers under vegetable cultivation, type of irrigation, knowledge and perceptions of farmers regarding pesticide application, perceptions on impact of pesticides on vegetables, effectiveness of pesticide application and effects of pesticide application on human health and environment. The data was analyzed by calculating means, percentage and Grand point Averages for

individual importance. Ranking of the importance were assigned by the researcher based on mean score using likert scale.

RESULTS

It is evident from the data that there was observed in Table-1. The majority of respondent vegetable growers (32.75%) were in the age group of 31-40 years, while 21.25% and 23.75% respondents were in the age groups of 20-30 and 41-50 years, respectively. Moreover, the majority (31.25%) of the respondent vegetable growers reported to have primary level education, 23.75% were uneducated, while 6.25% graduates and 2.5% Master's degree holders. Furthermore, majority (31.25%) of the respondents were landlords having >40 acre land, 22.5% of the respondents owned 31-40 acres land, 15.00% possessed 21-30 acres of agricultural land, and big landlords dominate the area of study, while small holding are scarce.

Table-1: Distribution of respondent farmers for their age, education and land holder

Characteristics	Frequency	Percentage		
Age group	-	-	-	-
20 - 30 years	1	7	2	1
31 - 40 years	2	6	3	2
41 - 50 years	1	9	2	3
51 - 60 years	1	2	1	5
> 60 years	0	6	7	5
Total	8	0	1	0
Education	-	-	-	-
Uneducated	1	9	2	3
Primary	2	5	3	1
Mid d l e e	1	4	1	7
Masteric	8	1	0	0
Intermediate	7	8	7	5
Graduation	5	6	2	5
Master's	2	2	5	5
Total	8	0	1	0
Land holder	-	-	-	-
Up-to 10 acres	1	4	1	7
11 - 20 acres	1	1	1	3
21 - 30 acres	1	2	1	5
31 - 40 acres	1	8	2	2
> 40 acres	2	5	3	1
Total	8	0	1	0

Table-2 showed that the majority (46.25%) of the respondents were tenant, while 28.75% had status of owner + tenant; whereas 25.00% of the respondents were landlord. In the farming experience, majority of growers (38.75%) having only 5-10 years farming experience; while 31.25 and 30.00% respondents possessed 10-20 and >20 years farming experience. Whereas the majority (37.50%) of growers cultivated vegetables on 11-20 acres, while 36.25, 16.25, 3.75 and 6.25% growers cultivated vegetables up-to 10, 21-30, 31-40 acres and >40 acres of land.

Table-2: Distribution of respondent farmers according to their farm size, farming experience area under vegetable cultivation

Characteristics	F	Frequency	Percentage		
Type of tenure	-				
Landlord	2	0	2	5	0
Tenant	3	7	4	6	2
Owner + Tenant	2	3	2	8	7
Total	8	0	1	0	0
Farming experience	-				
5 - 10 years	3	1	3	8	7
10 - 20 years	2	5	3	1	2
> 20 years	2	4	3	0	0
Total	8	0	1	0	0
Area under vegetable cultivation	-				
Up-to 10 acres	2	9	3	6	2
11 - 20 acres	3	0	3	7	5
21 - 30 acres	1	3	1	6	2
31 - 40 acres	3	3	3		7
> 40 years	5	6			2
Total	8	0	1	0	0

The results on the farmer's perceptions regarding to pesticide application on vegetables in table-3. A high majority (81.25%) of the growers were 'not satisfied' about the usefulness extension agents regarding proper use of pesticides; 12.5% were 'satisfied to some extent' and 6.25% were 'highly satisfied'. The majority (67.5%) of growers were 'satisfied to some extent' on their awareness regarding techniques of pesticide application; and 20.00% 'highly satisfied' and 12.5% were 'not satisfied'. While,

the high majority (91.25%) of growers were 'not satisfied' with the help of extension agents, 6.25%'satisfied to some extent' and 2.5 percent 'highly satisfied'. The majority (56.25%) was 'satisfied to some extent', 28.75% 'not satisfied' and 15.00% 'highly satisfied' on the statement that unsafe pesticide application is a health risk for the growers. On follow-up of label instructions, majority (62.5%) perceived 'satisfied to some extent', 21.25% 'not satisfied' and 16.25% were 'highly satisfied' regarding follow-up of instructions on label. Whereas, majority (45.00%) perceived 'satisfied to some extent' over awareness of safe use of pesticides, 27.5% 'not satisfied' and 27.5% were 'highly satisfied'. Furthermore, the majority (55.00%) were 'satisfied to some extent', 22.5% 'highly satisfied' and 22.5% were 'not satisfied' for their knowledge regarding precautions for pesticide application. The majority (62.5%) of the growers were 'satisfied to some extent', 26.25% 'highly satisfied' and 11.25% were 'not satisfied' on their awareness on unsafe pesticide application is a health risk. Moreover, the majority (48.75%) of growers were 'satisfied to some extent', 26.25% 'not satisfied' and 25.00% were 'highly satisfied' for their awareness on adverse pesticide effects on animals and other ecosystem. The majority (45.00%) of the respondents were 'not satisfied' with the traditional methods, 32.5% 'satisfied to some extent' and 22.5% were 'highly satisfied'. The table-4 indicated that high majority (82.5%) of farmers 'strongly agreed' with the assumption that the use of pesticide increases the yield of vegetables; while 72.5% 'disagreed' the pesticide application as cause of unground water contamination; 43.75% 'strongly agreed' that use of pesticides is harmful for biological life. While, the 51.25% farmers 'strongly agreed' that abundant use of pesticides pollutes the atmosphere; while 46.25% 'strongly agreed' on changed natural taste of food due to pesticidal sprays, 41.25 percent 'disagreed' this assumption. Majority (40.00%) of respondents 'strongly agree' that birds are affected

by the indiscriminate use of pesticides; while 71.25% 'strongly agreed' that due to residual effects of pesticides in vegetable human health is at high risk.

Table-3: Farmers' perceptions regarding pesticide application on vegetables

A s s u m p t i o n s	Not satisfied		Satisfied to some extent		Highly satisfied		Total		
	Freq.	%	Freq.	%	Freq.	%			
Help from extension agent regarding proper use of pesticides is useful	6	5	81.25	1	0	12.50	5	6.25	100
Awareness of farmer regarding techniques of pesticide application	1	0	12.5	5	4	67.5	1	6	20.00
Knowledge of farmer regarding proper pesticide products	1	8	22.5	4	7	58.75	1	5	18.75
Help of farmer from extension agent for proper method and knowledge of pesticide application	7	3	91.25	5		6.25	2	2.50	100
Pesticide application is of health risk (farmers' knowledge and perception)	2	3	28.75	4	5	56.25	1	2	15.00
Following of instructions on label and understand these instructions on pesticide pack	1	7	21.25	5	0	62.50	1	3	16.25
Awareness of farmer regarding safe use of pesticides	2	2	27.50	3	6	45.00	2	2	27.50
Awareness of farmer regarding precautions for pesticide application	1	8	22.50	4	4	55.00	1	8	22.50
Awareness of grower regarding human health risk by pesticidal spray	0	9	11.25	5	0	62.50	2	1	26.25
How farmers find it difficult to get extension services, particularly in remote areas	2	1	26.25	3	9	48.75	2	0	25.00
Adoption of traditional methods and whether these methods of pesticide application are effective	3	6	45.00	2	6	32.50	1	8	22.50

Table-4: Farmers' perceptions regarding the impact of indiscriminate use of pesticides on vegetables

A s s u m p t i o n s	Disagreed		Agreed to some extent		Strongly agreed		Total		
	Freq.	%	Freq.	%	Freq.	%			
Use of pesticides creates environmental problems	9	11.25	2	1	26.25	5	0	62.5	100
Use of pesticides increases the yield of vegetables	5	6.25	9	11.25	6	6	82.5	100	
Use of pesticides creates underground water contamination	5	8	72.5	9	11.25	1	3	16.25	100
Use of pesticides is harmful for biological life	1	8	22.5	2	7	33.75	3	5	43.75
Abundant use of pesticides creates pollution in the atmosphere	2	6	32.5	1	3	16.25	4	1	51.25
Use of pesticides on vegetables changes the natural taste of foods	3	3	41.25	1	0	12.50	3	7	46.25
Awareness of the farmers for bad effects of pesticide application on birds	1	7	21.25	3	1	38.75	3	2	40.00
Use of pesticides on vegetables has toxic effects on human health due to residues on crop produce	1	3	16.25	1	0	12.50	5	7	71.25

The results related to the farmers opinion and development through various programs and role of government agencies related to agriculture for motivation of the farmers using proper method of pesticide application on vegetables depicted in table-5. Majority of farmers (91.25%) opined that farmers may be motivated through training programs for proper pesticide application on vegetables, 52.5% were in favor of motivation campaigns, 62.5% favored the motivation of farmers through

education, 82.5% favored the effective training of farmers through extension workers; 92.5% emphasized the role of mass media for this purpose. Furthermore, the majority of farmers (96.25%) suggested demonstration plots at farmers' field as a farmer's training source; 71.25% advocated farmer training by Environment Protection Agency; 82.5% stressed for training of residual effects of pesticides in vegetable produce; 82.5% suggested training on harmful effects on human health due to residual effects. The data on the effectiveness of information sources on pesticides application on vegetables given in table-6. Among source of information, neighboring farmer was the source of information ranking 1st (3.75 ± 0.95); radio ranked 2nd (3.4 ± 0.89); demonstration plots ranked 3rd (2.93 ± 0.71); T.V. ranked 4th (2.66 ± 0.65); extension worker ranked 5th, research worker 6th, contact farmer 7th, newspaper 8th and magazines ranked 9th sources of information as ranked by the farmers in the study area. The results on the farmers' problems they faced in adoption of recommended production practices for vegetables are given in table-7. Among major problems faced by the growers, 'financial constraints' ranking 1st (2.39 ± 0.73), adulterated pesticides problem at rank 2nd (1.88 ± 0.35) and lack of knowledge ranked 3rd (1.79 ± 0.82).

Zahid Ali Sial, Muhammad Ali Siyal, Mujeeb-ur-Rehman Soomro, Aurang Zaib Jamali, Nazia Rais, Zaira Parveen Tunio, Farheen Solongi- **Farmers' Perceptions about Effects of Pesticides Use in Vegetables in Taluka Usta Muhammad of Jaffarabad district, Balochistan**

Table-5: Farmers opinion and development through various programs and role of government agencies related to agriculture for motivation of the farmers for using proper method of pesticide application on vegetables

P r o g r a m s	Y e s		N o		T o t a l
	Frequency	%	Frequency	%	
Through training	7	39.125	7	8.75	100
Through motivation campaign	4	25.0	3	47.5	100
Through education	5	062.5	3	037.5	100
Through extension activities	6	68.25	1	417.5	100
Through mass media	7	49.25	6	7.5	100
Demonstration plots	7	79.625	3	3.75	100
Trainings by Environment Protection Agencies	5	77.125	2	328.75	100
Training of farmers for residual effects of toxic pesticides	6	68.25	1	417.5	100
Training of farmers for residual effects on human health due to residual toxic effect of pesticides	6	68.25	1	417.5	100
IPM practices for control insect pests particularly on vegetables	7	89.75	2	2.5	100

Table-6: Farmers' perceptions regarding the effectiveness of information sources on pesticides application on vegetables

Source of information	Not effective		Some-what extem		Effective		Very effective		Extremely effective		Total	Mean	S.D.	Rank
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%				
R a d i o	9	11.25	4	5.0	2	835.0	2	430.0	1	518.75	100	3.4	±0.89	2 nd
T . V .	1	518.75	2	430.0	2	126.25	1	620.0	4	5.0	100	2.66	±0.65	4 th
Extension worker	6	581.25	3	3.0	1	012.5	2	2.5	0	0	100	1.36	±0.46	5 th
Research worker	6	885.00	8	10.0	4	5.0	0	0	0	0	100	1.20	±0.06	6 th
Newspaper	7	695.00	4	5.00	0	0	0	0	0	0	100	1.05	±0.09	8 th
M a g a z i n e	8	0100	0	0	0	0	0	0	0	0	100	1.00	±0.00	9 th
Neighbouring farmer	1	215.00	4	5.0	1	620.0	1	010.0	5	55.0	100	3.75	±0.95	1 st
Dem. Plots	3	240.00	4	5.0	8	10.0	1	111.0	3	434.0	100	2.93	±0.71	3 rd
Contact farmer	7	492.0	8	8.00	0	0	0	0	0	0	100	1.07	±0.06	7 th

Table-7: Farmers' problems they faced in adoption of recommended production practices for vegetables

Source of information	Not at all		To some extent		To a greater extent		Total	Mean	S.D.	Rank
	Freq.	%	Freq.	%	Freq.	%				
Lack of knowledge	2	531.25	4	758.75	8	10.00	100	1.78	±0.82	3 rd
Financial constraints	1	721.00	1	519.00	4	860.00	100	2.38	±0.73	1 st
Afraid of loss	4	860.00	9	11.00	2	329.00	100	1.68	±0.52	4 th
Non-availability of inputs including pesticides	8	0100.0	0	0	0	0	100	1.00	±0.00	5 th
Adultrated pesticides	1	316.00	6	480.00	4	3.00	100	1.87	±0.35	2 nd

DISCUSSION

The findings of the present research indicate that majority of the farmers were positive and feel concern about the harmful effects of pesticides particularly when applied on vegetables. So, there should be effective training of the growers for using proper method and timing of pesticide application, and fruit picking in vegetables may be scheduled in such a way to minimize the residual toxic effects of these pesticides. More particularly they suggested the biological control measures and avoiding synthetic pesticides when they were given awareness about the IPM components. Bush (2001) studied the farmers' awareness level on the use of insect pest control methods, application recommended pesticides against target pests and reported that farmers in South Asian countries do not rely on any set package of chemicals or materials and mostly they rely on the information provided by the pesticide dealers for use of insecticides in their cotton crop. However, the dealers and neighboring farmers are themselves unaware of the proper control of insect pests and possess no considerable knowledge about the integrated use of different pest control methods.

Majority of the growers were 'not satisfied' about the usefulness extension agents regarding proper use of pesticides; 'satisfied to some extent' on their awareness regarding techniques of pesticide application; that the unsafe pesticide application is a health risk for the growers, awareness of safe use of pesticides and follow-up of instructions on label, their knowledge regarding precautions for pesticide application, their awareness on unsafe pesticide application is a health risk, for their awareness on adverse pesticide effects on animals and other ecosystem. Majority of growers were 'not satisfied' with the traditional methods of pesticide application. Adeola (2012) concluded that a high level of awareness on the risks associated with the use of pesticides was found among the respondents.

However, majority of the farmers did not use protective clothes when applying pesticides. Farmers showed favorable attitudes about the risk of pesticide usage. Farmers' age, education and contacts with extension agent had positive and significant associations with perceived effects of pesticides use on the environment. The intensification of extension services to educate farmers on safe use of pesticides in vegetable production is recommended. Sanzidur Rahman (2012) land ownership and agricultural credit are positively related to pesticide usage. Pesticide use is higher in underdeveloped regions. Sharp regional variations also exist in pesticide usage. Major policy thrusts for devising pesticide regulation and effective implementation, increasing farmers' awareness of the effects of pesticide use, and expansion of IPM practices are suggested to safeguard poor farmers in their pursuit of agricultural livelihoods.

Majority of farmers 'strongly agreed' with the assumptions that the use of pesticide increases the yield of vegetables; the pesticide application as cause of unground water contamination; use of pesticides is harmful for biological life, that abundant use of pesticides pollutes the atmosphere, that birds are affected by the indiscriminate use of pesticides, that due to residual effects of pesticides in vegetable human health is at high risk. Bond *et al.* (2012) reported that indiscriminate pesticide use. Farmers had a strong behavioral intention and favorable attitudes, subjective norm and perceived behavioral control to apply pesticide in the coming season. The extension program is likely to be more successful if it dispels myths of pesticide function and includes women and marginal farmers in activities. The key learning's from the study are that farmers have a favorable intention towards pesticide use; attitude was the most important factor influencing behavioral intention. The trend of pesticides use by farmers over years is probably based on farmers' knowledge on

pesticide application in relation to effectiveness of pesticides, pests, farm size, and price and weather condition. The pesticides can be fatal if inhaled, swallowed, or absorbed through the skin, even though the effects of contacts and/or inhalation may be delayed due to its formulation (Santo *et al.*, 2002). The effects of exposure even of a short duration can be delayed but there is a possibility of cumulative effects (Gupta, 1994). Health and environmental problems cannot be isolated from economic concerns due to the fact that incorrect pesticide use results not merely in actual yield loss but also in health and possible effects of air and water pollution. The problem of farmers' health should be an important concern for policymakers when looking at the economic efficiency of horticultural production.

Majority of farmers the farmers are satisfied with the role of government agencies for training the growers for this aspect and suggested strong participation and execution of the training programs, motivation campaigns, strong extension services, effective role of mass media for this purpose and demonstration plots at farmers' fields. Neighboring farmer was rank-1 source of information while 'financial constraints' was rank-1 problem faced by the growers. Erbaugh *et al.* (2001) demonstrate that more active participation old grower's increases knowledge of pest management knowledge, providing preliminary support for participatory research and extension approach. However, recommendations for increasing the number of farmer participants and improving the evaluation process are of paramount importance. The use of pesticide was observed to be high, with over 40 different formulations, probably because farmers assume that the only solution to pest problems is to spray more frequently and using different types of pesticides (Dinham, 2003). The studies (Ngowi, 2003) revealed that farmers were not receiving agricultural extension service hence have attempted various means especially in

pesticides use when dealing with pest problems but were constrained by the lack of appropriate knowledge. However, pesticide usage in the study area seems to be highly influenced by pesticide dealers and neighboring farmers who were carrying out their business right in the farming communities and very interested in achieving large sales of their pesticides. This is a typical situation, the choice of pesticides to be used by farmers is influenced by the pesticide dealers. Insecticides were the most used because insect pests were the most serious problem in vegetable production in the study area. Although in this study it was observed that insecticides were the most commonly used pesticides, usually amounts and types of pesticides used have been reported to show important differences among farmers, type of agricultural production and level of economic development. The tank mixture of pesticides observed in this study indicates that farmers lack basic knowledge of pesticides. In general, the frequencies of pesticides application by farmers were high. Such heavy use of pesticides may result in frequent contact with pesticides, which can lead to significant health problems.

CONCLUSION

It is concluded from the data that the extension services may be made effective to educate the farmers for adoption of proper methods of pesticide application because no other media can play effective as is possible through extension activities. The farmers should be given awareness and motivated for residual effects of pesticides in vegetable produce and subsequent adverse effects on human health due to vegetable consumption. The role of Environmental Protection Agency may be made effective at farmer level to educate and motivate them on concerns related to environmental protection and farmer health. Due to poor advisory services of extension department,

most of the farmer rely on neighboring farmers for decision making regarding choosing of pesticide products and application methods. The extension wing should play effective role to motivate the vegetable producers especially for safe use of pesticides. The experts should develop a schedule for picking/harvesting of vegetable, as there should be gap between pesticide application and picking of vegetables to minimize toxic effects. Innovative methods of vegetable cultivation in view of the biological pest control means should be introduced that should be safe to minimize the application of synthetic pesticides. Biological pest control strategies may effectively be introduced and get implemented at farmer level.

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