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Analysis in terms of environmental awareness of farmers' decisions and attitudes in pesticide use: the case of Turkey

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The aim of this study was to analyze in terms of environmental consciousness farmers' decisions and attitudes in pesticide use. Data were obtained from melon growers of the villages of Cankiri Province of Turkey. The farms were chosen by the random sampling method. Chi-square test (χ^2) was used for analyzing the relationships between some selected socio-economic characteristics and the decisions and attitudes in pesticide use. The decision-making of pesticide application time showed significant relationships between the information sources used by the farmers, their age, education and farm size. A relationship was also found between the information sources used by the farmers and their experience in identifying diseases or insect pest. An intensification of extension services to educate farmers on safe use of pesticides in melon production is recommended. A communication gap between the farmers and research centers was established. Extension programs, brochures and field visits are the sources of information that farmers rely on.

Keywords: environmental awareness, pesticide use decisions, attitudes, Turkey

INTRODUCTION

Vegetable cultivation is one the most economically important and dynamic branches of agriculture. It has become an important source of income for both farmers and field laborers, serving as a vehicle for reducing poverty in rural areas. At the same time, vegetable cultivation is becoming more costly due to the increased use of purchased inputs, such as pesticides and fertilizers, to sustain production levels. If used improperly, many of these inputs have deleterious effects on human health and environment.

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. [1]

Pesticides have substantially contributed to control pests and increase crop yields in meeting the food demand of escalating population and control of diseases. Exposure to pesticides is one of the most important occupational risks among farmers in developing countries. [2,3]

Pesticide usage is inevitable in modern agriculture. However, both crop protection against pests and diseases and human health and environment should be considered in pesticide treatments. Excessive use of pesticides has shown negative effects on the environment and human health. [4] The environmental effects include damage to agricultural land, fisheries, fauna and flora. Increased mortality and morbidity of humans due to exposure to pesticides are also recorded, especially in several developing countries. [5] In developed countries, old techniques have been replaced by new systems that are based on minimum use of chemical ingredients and new pesticides that are less persistent in the environment. On the other hand, farmers in developing countries still use classic pesticides that are cheaper but carry more risks for the environment and health.[6] In developing countries, from the viewpoint of farmers, pesticides continue to be regarded both as a guarantee against crop loss, for maximum efficiency to be gained from cultivation.[7]

Agricultural and rural development for many developing countries depends on modern technologies and innovations proposed by research institutes and universities, or imported by developed countries. Two key factors may play major role on the use of technology by farm operators; one of them is the availability of public or private organizations disseminating recent innovations to rural areas; and the other factor is farm operators' socio-economic characteristics and information seeking behavior influencing their decisions for using information sources. [8] Agricultural development achieved through these initiatives also created an interest on the use of

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sophisticated chemical input and technologies to replace old traditional agriculture with modern high input based agriculture.

This paper focuses on the analysis of farmers' information sources as the most important factor in pest management. This study examines to which information sources farmers resorted for the use of pesticides and how they got the decisions regarding the use of sources of information. The analysis was focused on comparing the characteristics of farmers using both modern and traditional information sources In addition, farmers' pest management practices, attitudes and decisions about pesticide use and the resulting effects on the environment were discussed.

MATERIALS AND METHODS

In this study, the central district of Cankiri province and the eleven villages of Kızılırmak were selected considering the distances from the district center, agricultural potential, population intensity, and socio-economic characteristics of the villages. Taking farm size as the criterion, and using [9] stratified sample size determination formula, 87 farmers were chosen for sample data collection. In the study a questionnaire developed by a panel of experts was used. The survey was conducted in October 2009. Data were collected through face to face interviews with farmers at their farms. In Cankiri Province, the mean annual rainfall, humidity and temperature are 397 mm, 63.7 % and 22 ºC, respectively.

For this analysis, information sources were divided into two categories such as information acquired from modern sources and traditional sources. Modern sources included extension agents, farmer cooperatives, input dealers, mass media, and the internet. Traditional sources, on the other hand, included information coming from farmers' own personal experience, own family members, and neighbor farmers.

Contingency tables were prepared to evaluate the association between the variables and Chi-square test [10] (χ^2) was used to analyze the relationships between the socio-economic variables. Age of the farmer's (AGE), was categorized as: (20-40), (41-60), (61 and over)

According to educational level (ED), farmers were grouped as: primary school (5 years), secondary school (8 years), and high school (11 years). None of the respondents in the sample had any university degree.

According to farmer's experience (FE), the grouping was: (less than 10 years), (between 11-20 years), (21 years and over)

According to the size of melon production (MPS), the grouping was: (1-10 decare), (11-20 decare), (21 and more decare)

According to farm size (FS) the grouping was: (1-50 decare), (51-100 decare), (101 and more decare)

RESULTS AND DISCUSSION

Basic characteristics of farms

The average age of farmers was 47.59 years and the average experience of farmers in agriculture was 27.75 years. Their average years of education were 6.34. The average size of the farms was 119.41 decare. The average melon production area was 16.55 decare.

Table 1. General characteristics of surveyed farms

Component	mean	St. d.
Farm size (decare)	119.41	73.19
Melon production area (decare)	16.55	13.15
Farmer's age (years)	47.59	12.83
Farmer's experience (years)	27.75	14.03
Farmer's education (years)	6.34	2.46

A decare is 1.000 square meters; 10 decares is 1 hectare.

Most common pesticides used by melon farmers

A common way of summarizing pesticide use is by summing the pounds of active ingredient for all pesticides used. This allows for some aggregation of the numerous pesticide products used in agriculture. Using conversion factors it is quite simple to summarize pesticides with common active ingredients in terms of kilograms of that active ingredient.[11] In the study area, the most commonly used trade names and active ingredients are listed in Table 2. The pesticide commonly used by the farmers was identified as Fenthion (86.21 % of the farmers). Other pesticides used were Chlorpyrifos ethyl (18.39%) and Diazinon (2.30%). This is an indication that pesticides play an important role in the control of pests and for increasing crop yields. [12]

Table 2. Pesticides used by melon farmers in Cankiri province.

Trade Name	Active ingredient	*Frequency	Percentage
Lebaycid EC 50	Fenthion	75	86.21
Dursban 4	Chlorpyrifos ethyl	16	18.39
Basudin 60 EM	Diazinon	2	2.30

* Multiple responses

Opinions of farmers on pesticide application and their information sources and attitudes

Data presented in Table 3 indicate the attitudes and opinions of farmers in pesticide application. Farmers have used traditional information sources

as main information sources for deciding pesticide application time (72.41%), identifying the disease or insect pest (62.07%), pesticide choice (49.43%) and pesticide application dosage (70.11%). This means that farmers used more information from farmers' own personal experience, own family members, and neighbor farmers. As the table shows, the rate of farmers who exactly fulfilled the instructions was 74.71%. The reason for this is that farmers consider excessive pesticide as harmful for the crops. Despite this fact, 25.29% of the farmers stated that sometimes they use more or less than the recommended dosage. Most of the farmers who use more than the recommended dosage assume that resistance might be developed against pesticide by pests and suggested dosage might be ineffective in this region.

Table 3 shows farmers' answers to the question whether to leave or not residues harmful to human health on the crops. While 31.03% of farmers stated no opinion on the issue, approximately two third of them (68.97%) declared may leave harmful residues of some pesticides on the crops.

Table 3 shows farmers' answers to whether there are harmful effects of pesticides on the environment and human health. While 85.06% of the farmers stated that excessive and incorrect pesticide application will harm environment and human health, 14.94% of the farmers considered no damage.

Disposal of empty containers was also an important issue of environmental and health concern. Therefore, the utilization of empty pesticide containers after application was also examined. 51.72% of the farmers were throwing the empty containers to the environment carelessly, while 48.28% buried the packages in the ground after applying the pesticide (Table 3).

Table 4 shows the chi-square (χ^2) test of relationships between attitudes and opinions of farmers in pesticide application and their selected socio-economic characteristics.

In addition, relationships were looked for between information sources used by farmers on pesticide use and farmer's age, education, experience, melon production area and farm size. For education, experience, and melon production area there was no statistically significant relationship. Age and farm size were found statistically significant ($p<0.05$).

No statistically significant relationship was found between pesticide choice, pesticide application dosage and compliance recommended with farmer's age, education, experience, melon production area and farm size ($p>0.05$). No statistically significant relationship was found between identifying the disease or insect pest and farmer's age, education, melon production area and farm size ($p>0.05$). However, farmer's experience was a statistically significant factor ($p<0.01$). Farming experience was also found to have significant influence on farmers' pesticide applications. The reason for this can be attributed to the experiences gained in the past by farmers on pesticide hazards.

The opinions of farmers on harmful residues of pesticides were compared in terms of farmer's age, education, experience, melon production area, and farm size. Statistical analysis (chi-square test, $p>0.05$ there is not any association) indicated that farmers' opinions regarding harmful residues of pesticides do not have any impact on selected socio-economic characteristics. The opinions of farmers about the environmental and human health harm of pesticides were compared with the farmer's age, education, experience, melon production area, and farm size. Results of statistical analysis indicated that there was a relationship between farmer's age, education and experience variables (chi-square test, $p<0.05$ and $p<0.01$). Chi-square results pointed to a significant association between age variable and farmers' opinions. This means that about the environmental hazards of pesticides due to accumulated knowledge and experience of farming systems, the elder farmers are much better perceived compared to the young farmers.[1] Education had also a significant influence on farmers' opinions. This might be due to the ability of the literate farmers to read and follow the instructions on pesticides containers. But no statistically significant relationship was found between melon production area and farm size ($p>0.05$). We also analyzed whether or not there is an association between destruction methods for pesticide packages and farmer's age, education, experience, melon production area, and farm size. No statistically significant relationship was found between destruction methods used by farmers for pesticide packages with selected socio-economic characteristics ($p>0.05$).

CONCLUSION

The study shows that melon farmers use traditional information sources more than modern sources for decisions and attitudes on pesticide use. Farmers used traditional information as main information sources for deciding on pesticide application time (72.41%), identifying the disease or insect pest (62.07%), pesticide choice (49.43%) and pesticide application dosage (70.11%)

Table 3. Information sources on pesticide management practices

Attitudes and Opinions of Farmers on Pesticide Application	A		B	
	N	%	N	%
Decisions on pesticide application time (DPAT)	63	72.41	24	27.59
Identifying the disease or insect pest (IDIP)	54	62.07	33	37.93
Decisions on pesticide choice (DPC)	43	49.43	44	50.57
Decisions on pesticide application dosage (DPAD)	61	70.11	26	29.89
A: traditional information sources; B: modern information sources				
Compliance with recommended dosage (CRD)	**C**		**D**	
	65	74.71	22	25.29
C: recommendations exactly implemented; D: recommendations not exactly implemented				
	E		**F**	
Farmers' opinions about the residues of pesticides used. (FORPU)	27	31.03	60	68.97
E: I have no information about the problem of left residuals of pesticides on the products *F:Some pesticides may leave residuals*				
	G		**H**	
Farmers' opinions about the environmental and human health harm of pesticides used (FOEHPU)	74	85.06	13	14.94
G: Pesticides are harmful to environment and human health; *H: Pesticides are not harmful to environment and human health*				
	I		**J**	
Destruction methods used by farmers for pesticide packages (DMFPP)	45	51.72	42	48.28
I: Throwing packages to the environment carelessly after applying pesticide; *J: Destroying the packages by burning and burying the packages in the ground after applying pesticide*				

Table 4. Results of chi-square (χ^2) test showing associations between attitudes and opinions of farmers in pesticide application and selected socio-economic characteristics of the farmers

Attitudes and Opinions of Farmers χ^2 *(df=2, N=87)*	AGE		ED		FE		MPS		FS	
	χ^2	*P*	χ^2	*P*	χ^2	*P*	χ^2	*P*	χ^2	*P*
DPAT	7.284	*0.026**	1.919	0.383	1.182	0.554	3.403	0.182	6.535	*0.038**
IDIP	3.468	0.177	5.304	0.071	8.972	*0.011***	0.230	0.891	4.164	0.125
DPC	1.532	0.465	2.052	0.358	5.245	0.073	1.280	0.527	5.371	0.068
DPAD	1.300	0.532	1.495	0.474	1.812	0.404	0.290	0.865	1.127	0.569
CRD	4.697	0.096	0.884	0.643	0.833	0.639	0.128	0.938	0.832	0.660
FORPU	5.636	0.060	3.197	0.202	4.615	0.100	2.934	0.231	0.079	0.961
FOEHPU	8.351	*0.015**	7.883	*0.019**	10.095	*0.006***	3.594	0.166	4.046	0.132
DMFPP	2.182	0.336	0.707	0.702	5.206	0.074	0.244	0.885	0.018	0.991

* $p < 0.05$, **$p < 0.01$; Variables; Age of farmers (AGE), Education level (ED), Farmer's experience (FE), Melon production size (MPS), Farm size (FS)

Other factors that may influence the use of farmers' information sources as age, education, farm size, and farmers' experience were found to significantly affect the decision to use information sources.

The decisions on pesticide application time by farmers revealed positively significant associations between farmers' age, farm size and the used information sources. There were significant relationships between their experience and the information sources used for identifying the disease or insect pest. Furthermore, there were significant associations between farmer's age, education and farmers' experience and their opinions on the environmental and human health harm of pesticides.

Therefore, the ideas of farmers on environmental issues should be taken into consideration before deciding agro-environmental policies. Survey results showed that melon growers need more information about technical issues. The significant influence of information sources on farmers' pesticide management is indicative that extension systems must be strengthened to increase farmers' knowledge and understanding of the effects of pesticides on the environment.

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АНАЛИЗ НА ЕКОЛОГИЧНО СЪОБРАЗЕНИТЕ ЕРЕШЕНИЯ НА ФЕРМЕРИТЕ В ТУРЦИЯ ЗА УПОТРЕБАТА НА ПЕСТИЦИДИ

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(Резюме)

Целта на тази работа е да се анализират от гледна точка екологичното съзнание решенията и отношението на фермерите за употребата на пестициди. Данните са събрани от гледачи на пъпеши от делата в провинция Джанкири в Турция. Фермите са подбрани на случаен принцип. Използван е χ^2-критерия за анализ на връзките между някои подбрани социо-икономически характеристики и решенията спрямо употребата на пестициди. Взимането на решения за прилагането на пестициди показва значителна зависимост между информационните източници, използвани от фермерите, тяхната възраст, образование и размер на фермата. Освен това е намерена връзка между използваните информационни източници и опита на фермерите за определяне на болести и насекоми-вредители. Препоръчва се информационна кампания за образоване на фермерите за безопасна употреба на пестициди. Установена е празнота в комуникацията между фермерите и изследователските центрове.