▼ Journal of Research (Science), Bahauddin Zakariya University, Multan, Pakistan.
Vol.14, No.1, June 2003, pp. 43-48 ISSN 1021-1012

SOCIO-ECONOMIC CORRELATES OF PESTICIDE USAGE: THE CASE OF CITRUS FARMERS

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Abstract: The socio-economic factors affecting adoption of pesticides on citrus trees in Sargodha Division, Pakistan was studied. Six villages were selected (three from each sub division) for data collection. Overall 150 orchard owners (25 from each sample village) were interviewed. Data were analyzed using SPSS programme. Gamma test and chi-square were used to check the direction and magnitude of relationship between independent and dependent variables. Among the sample, 48% respondents were spray users. The socio-economic factors that influenced farmer's receptivity to citrus spray were age (negatively correlated), education (positively correlated), social status (positively correlated), farm size (negatively correlated) and farming experience (negatively correlated). By incurring Rs. 3,600/= per ha on spray farmers received Rs. 19,000/= as an incremental benefit. Marginal rate of return indicated that by spending Re. 1.00 on spray farmers would get an increase of Rs. 5.27 in their income.

Keywords: adoption, citrus, pesticide, socio-economic correlates.

INTRODUCTION

Citrus, among various fruits grown in Pakistan, is considered to be the most important for better economic earning and its dietetic value. The importance of citrus has generally been recognized throughout the world. Citrus has generally been a source of foreign exchange earning and its domestic need is also growing in the country. As a result of its importance more area is brought under cultivation to enhance its production.

Area under citrus is increasing substantially every year but production is increasing at a very low pace. The production of citrus was consistent from 1994 to 1998. The fruit yield during 1994-95 was 10,135.0 kg per hectare and after five years (in 1999-2000) it fell down to 9,829.0 kg [Pakistan Agricultural Statistics 2001]. In Pakistan, average productivity is 9.5 tones per hectare [Pakistan Agricultural Statistics 2001], which is very low as compared with developed countries like United States, Japan and Australia. In developed countries average yield is approximately 40 tons per hectare [FAO 1998]. There are a number of obstacles in obtaining higher yield of citrus. It is generally thought that the primary factor responsible for decrease in citrus production and quality is poor plant nutrition. Low yield in Pakistan is also attributed to disease incidence and insect pests' attack and poor or no pest management practices by the farmers [PARC 1989]. AKRSP [1987] revealed that prior to introduction of pest and disease control technology, not only fruit production was low, but quality was also of low standard.

To increase yield and improve the quality of citrus in Pakistan, there is a need to introduce proper pests and disease control technology. It has been reported that adoption of insect and disease control methods has not only helped to increase the quantity of fruit but improved the quality as well [Cheema *et al.* 1989, Cheema and Asghar 1990]. Thus, there is a need to introduce disease and insect control technology among all the citrus growers in the country. Not much work has been done in Pakistan despite significant importance of citrus fruit. So, the present study aims at filling this gap and identifies the characteristics of the citrus growers who are using spray and examines the impacts of spray on citrus in Sargodha district.

Some studies have been conducted on the adoption of plant protection measures against pests and diseases of different fruits but no specific work has been carried out on the use of pesticide spray and its socio-economic correlates. Related work is reviewed as follows:

Milne and Willers [1980] treated two mature Valencia orange orchards with Fenamiphos 40% E.C. in 1978. In 1980 these were retreated and there were significant increase in yield, i.e. 83 to 130 kg per tree. Rashid [1980] studied some personal and socio-economic factors associated with adoption of recommended agricultural practices in Rural Egypt. He reported that education and income were associated with the uses of pesticide. However, age of farmer was not related to the said uses. Ahmad [1992] conducted a study on the adoption of plant protection measures by citrus growers and found that there was a positive relationship between age group, educational level, social status, size of holding, size of orchard and adoption of plant protection measures.

Cheema *et al.* [1989] in their study in Gilgit district found that net benefit for apple tree received was Rs. 111/= per tree with a spray cost of Rs. 5.00 per tree, this gives a ratio of 1: 22. Cheema and Asghar [1990] reported that on the basis of cost structure involved in spray application to citrus, it was found that an average return to investment on citrus spray was 1 to 2.60.

MATERIALS AND METHODS

The average production of citrus in Pakistan is 1960.80 ('000' tones) per annum. The Sargodha district is producing 744,000 tones (37% of Pakistan's total production) citrus fruit per annum [Pakistan Agricultural Statistics 2002]. Based on information gathered from the Revenue Department of the District Management Office two sub divisions were selected. Six villages, three from each sub-division, Sargodha and Bhalwal were taken randomly. Over all samples of 150 orchard owners (25 from each village) were drawn. The data were collected with the help of personal interviews based on structured questionnaire. Questionnaire contained information on the socio-economic factors, which were likely to influence the adoption of pesticide spray on citrus. Farmer's age,

education (years of schooling), social status, farm size and farming experience were used as the main indicators for the use of pesticide technology.

Fieldwork was done in August-September 2001. Using SPSS program, data were analyzed to identify the various socio-economic characteristics of the users and non–users of pesticides application. Gamma statistics and chi-square test were also used to check the direction and magnitude of relationship between independent and dependent variables. Calculations were made by using the following formula:

$$\text{Gamma} = (Ns - Nd) / (Ns + Nd)$$

Where

Ns = number of same order-pairs.

Nd = number of different order-pairs.

If gamma is equal to 1.0, it means that dependent variable is explained fully by independent variable without error.

Chi – Square Test:

$$X^2 = \sum(o - e)^2 / e$$

Where

o = observed frequency

e = expected frequency

Both Gamma and Chi-Square values were considered significant at 0.05 probability level.

RESULTS AND DISCUSSION

It was found that over all 48% of the respondents were adopters of spray based on the parameters given in Table 1. The relationship between different socio-economic factors and adoption of pesticides spray is presented in Table 1. The relationship between age and adoption of pesticide spray is strongly negative. It is clear that farmers between age group of 22-40 adopted the pesticide spray more (57.6%) than elders. Our results are similar to those of Cheema and Asghar [1990].

A strongly positive relationship was found between education level and adoption. Farmers with higher education were better adopters (61.5). These findings are in accordance with what Ali [1972] and Cheema and Asghar [1990] have reported.

Size of holding is one of the main determinant of financial status of a farmer, which in turn affects farmer's receptivity to adopt modern production practices, like uses of pesticides. The relationship between adoption of pesticide spray and size of holding was weak, which indicates that size of holding did not affect the adoption of citrus spray in the study area.

Table 1: Distribution of pesticides application adopters on citrus in Sargodha Division in 1999.

Factor	Adopters (%)	Frequency	Gamma	Chi-square
Age (years)		150		
22-39	57.6	66		
40-50	48.3	58	-0.370	8.897
51 and above	23.1	26		
Years of schooling		150		
0-5	38.1	63		
6-8	50.0	48	0.308	5.417
9 and above	61.5	39		
Size of land holding (acres)		150		
Up to 12.5	51.0	49	0.021	1.625
12.5-25	44.7	76		
25 and above	52.0	25		
Farming experience (years)		150		
1-10	52.6	38	-0.314	10.198
11-25	56.4	76		
26 and above	25.0	36		
Social status		150		
Low	43.4	121	0.466	15.220
High	67.9	28		

There was a strong and negative relationship between farming experience and adoption of insecticide spray. Farmers adopted pesticide spray when they had less farming experience as compared with those having more farming experience. The relationship between social status and adoption was strongly positive, which shows that higher social status leads to adoption of pesticides spray more as compared to low social status. These findings are similar to those of Cheema and Asghar [1990].

Table 2: Economic impacts of pesticides uses on citrus (*kinnow*, sweet orange and lemon).

Treatments	Total Area of Citrus (Hectares)	Total Production in tons	Production per Hectare in tons	Total value (Rs. 000)	Value per Hectare (Rs. 000)	Spray Cost Hectare (Rs. 00)
Non-Users	234	4059	17	20294	86	-
Users	238	5003	21	25014	105	3.6

Data presented in Table 2 indicate the difference in production between users and non-users of pesticides. Non-users had 17 tons citrus yield per hectare, valuing Rs. 86,000/= whereas users produced 21 tons per hectare, valuing Rs. 105,000/=. A significant difference was found in production by incurring Rs. 3,600/= on pesticide spray. Farmers were able to get extra 4 tones of citrus per hectare.

Data presented in Table 3 reveal that farmers, who made use of spray had gross benefit of Rs. 105,000/= per hectare by spending Rs. 3,600/= as a cost of spray. So, by incurring Rs. 3,600/= per hectare farmers received Rs. 19,000/= as an incremental benefit. Marginal rate of return on citrus spray is 1:5.27 showing that by increasing cost on spray per hectare by Re. 1.00 farmers were able to get an increase of Rs. 5.27 in their income. Results of the study were quite encouraging.

Table 3: Average return to investment on citrus spray (Rs.).

Treatments	Gross Benefit per Hectare (000)	Spray Cost per Hectare (00)	Incremental Benefit per hectare (000)	Incremental Cost per Hectare (00)	Marginal Rate of Return/ Rupee Investment on Citrus spray
Non-Users	86	-	-	-	-
Users	105	3.6	19	3.6	1:5.27

CONCLUSIONS AND POLICY IMPLICATIONS

The present study is an attempt to identify the socio-economic factors affecting the use of pesticide, which ultimately affects the rate of return per unit of investment on citrus spray. Information on the socio-economic factors that were likely to influence farmer's receptivity to citrus spray was gathered and was analyzed. Farmer's age had negative and strong correlation with pesticide usage; it implies that farmers used citrus spray in younger age. The positive and strong correlation was also found with education. Educated farmers used more sprays than those with little education or uneducated. Size of holding had no effect on usage of citrus spray, while strong and negative relationship has been found with farming experience. Farmers used spray when they had less farming experience. In case of social status farmers with higher social status used spray. As far as the economic benefit of pesticide use is concerned farmers, who made use of spray, had gross benefit of Rs. 105,000/= per hectare by spending Rs. 3,600/= per hectare. So, farmers received Rs. 19,000/= as an incremental benefit. Marginal rate of return on citrus spray is 1: 5.27 showing that by increasing cost on spray per hectare by Rs. 1.00 farmers were able to get an increase of Rs. 5.27 in their income.

Taking all the findings into account following suggestions are given for policy implication:

1) The extension people should play an important role for the dissemination of knowledge regarding pesticide applications and should create awareness among farmers for the said application, so that farmers could get benefit and have better production by reducing losses.
2) The pesticide should be made available to the farmers at the proper time and proper places.
3) The application of pesticides to citrus fruit requires mechanical sprayers, which are expensive, and beyond the purchasing power of farmers, so these should be made available at cheaper prices.

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