INTERNATIONAL JOURNAL OF PLANT PROTECTION | VOLUME 7 | ISSUE 1 | APRIL, 2014 | 147-150
e ISSN-0976-6855 | *www.researchjournal.co.in* | Open Access

IJPP

RESEARCH ARTICLE

Economic and health consequence of pesticide used in cotton crop in western region of Tamil Nadu

■ R. SUDHA

Department of Agricultural Economics, Centre for Agricultural and Rural Development Studies, Tamil Nadu Agricultural University, COIMBATORE (KARNATAKA) INDIA

ARITCLE INFO

Received : 31.12.2013
Revised : 03.03.2014
Accepted : 14.03.2014

Key Words :
IPM, Non-IPM, Cotton, Pesticides, Health consequence, EIQ, Safety measures

***Correspondance author:**
Email: sudha.ramasamy500@gmail.com

ABSTRACT

Pesticides help the producer to minimize the pest damages to crops and there by minimize the yield losses. This paper examines the economic and environmental impacts of plant protection measures in IPM and non-IPM cotton growing areas in the western zone of Tamil Nadu. Cobb-Douglas production function was utilized to analyze the resource-use efficiency in IPM cotton non-IPM cotton. The co-efficients of pesticides were negative and significant indicating the over usage of pesticides and increased cost of production there by reducing yield. Environmental Impact Quotient Index (EIQ) was used to quantify the impact of pesticides on human health and environment in sample farms. The high EIQ values denoted in non-IPM cotton (46.93) compared to IPM cotton. The important safety precautions like using masks or gloves were followed by only very few farmers in all sample farms. This study suggested that to assure the environmental hazards and the government needs to promote training on IPM practices and the farmers should be educated to follow safety norms while handling the pesticides.

How to view point the article : Sudha, R. (2014). Economic and health consequence of pesticide used in cotton crop in western region of Tamil Nadu. *Internat. J. Plant Protec.*, **7**(1):147-150.

INTRODUCTION

The main intention of the introduction of pesticides was to prevent and control insect pests and diseases in the crops. After the green revolution the consumption of pesticides increased in India. Pesticides, besides being poisonous in nature to the targeted pests, there are the environmental costs and human health hazards associated with the use of pesticides. The term pesticide covers a wide range of compounds including insecticides, fungicides, herbicides, rodenticides, molluscicides, nematicides, plant growth regulators and others. Pesticides are used in a wrong way and most of the farmers are not aware of spraying equipments (FAO, 2003). The increased application of pesticides failed to significantly increase income. The economic efficiency was measured by Cobb-Douglas production function (Nagaraju *et al.*, 1994; Khan *et al.*, 2002). The country uses just two per cent of world's pesticides, but, half of the world's pesticide poisoning cases and almost three quarters of the deaths take place here (Ramesh Babu *et al.*, 1999). The pesticides not only increased the cost of production but the health cost also associated in the application of pesticides (Kim, 2000; Gupta, 2004). The findings of other studies done in developing countries also support this observation (Van Der Hoek *et al.*, 1998; John and Pingali, 1994). In these often result in symptoms of toxic poisoning ranging from itching to headaches, eye irritation, vomiting, sleepiness, fever, stomach cramps and even death (Salameh *et al.*, 2004; Huang *et al.*, 2005). To reduce the extent of use of pesticides to reduce the extent of human risks and environmental pollution through Integrated Pest Management approach. The study was conducted in western zone of Tamil Nadu. The state department of agriculture is conducting IPM training in rice, cotton and other crops, among all crops cotton crop occupies very less area and consumes more than half of pesticides in the western zone. The present study focused (i) To analyses the economics of pesticide use and its efficiency in paddy and cotton; and (ii)

To assess the environmental damage potential of pesticide use in paddy and cotton.

MATERIAL AND METHODS

The study was conducted in the year of 2005-06 in the Western zone that comprises of Erode and Coimbatore districts. In Tamil Nadu. Among all the crops, cotton and paddy are the two crops that consume greater share of the total quantity of the pesticides. In the districts two talukas were chosen based on the proportion of area under cotton crop to the gross cropped area at the Zonal level. Two villages, one representing the IPM adopters and one non-IPM adopters were randomly selected from each taluka. In the third stage, fifteen farmers each growing IPM cotton and non-IPM cotton respondents were randomly chosen from each village, to constitute a total of 60 sample respondents. Cobb-Douglas type of production function was used to analyze the resource-use efficiency in IPM and non-IPM cotton. Environmental Impact Quotient (EIQ) index was used to quantify the potential impact of pesticides on human health and environment in sample farms.

Cobb-Douglas type of production functions :

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 b_5 \ln X_5 + b_6 \ln X + b_7 \ln X_7 + b_8 \ln X_8 + e$$

Y = Yield of cotton (qtls/ha)
X_1 = Quantity of seeds used (kg/ha)
X_2 = Use of FYM (tones/ha)
X_3 = Use of N (kg/ha)
X_4 = Use of P (kg/ha)
X_5 = Use of K (kg/ha)
X_6 = Labour (man days)
X_7 = Expenditure on plant protection chemicals (Rs./ha)
X_8 = Dummy variables to account for influence of Bt cotton (Bt cotton - 1, non- Bt – 0) on yield
e = Error term.

EIQ technique :

Kovach *et al.* (1992) developed a formula for determining the Environmental Impact Quotient (EIQ) of individual pesticides capturing the effects on farm worker, consumer and ecology. It is explained below :

$$EIQ = \{C [(DT*5) + (DT*P)] + [(C*((S+P)/2)*SY) + (L)] + [F*R] + (D*((S+P)/2)*3) + (Z*P*3) + (B*P*5)]\}/3$$

where,
DT = Dermal toxicity D = Bird toxicity
C = Chronic toxicity S = Soil half-life
Sy = Systemicity Z = Bee toxicity
F = Fish toxicity B = Beneficial arthropod toxicity
L = Leaching potential P = Plant surface half-life.
R = Surface stress potential.

To account for different formulations of the same active ingredient and different use patterns, a simple equation called EIQ field use rating was developed.

RESULTS AND DISCUSSION

The estimates of the production functions are presented in Table 1. The variables included in the function explained 84 per cent and 66 per cent of the variation in the production of IPM and non-IPM cotton cultivation, respectively.

In IPM-cotton, the result showed that, seeds, organic manure, nitrogen fertilizer and human labour were significant indicating that increase on the use of these resources over and above the present level lead to a significant increase in the yield. Plant protection cost was negative and non-significant indicating that in IPM-cotton, plant protection not only by the chemical pesticides as well as the cultural, physical,

Table 1 : Results of production function analysis of IPM and non-IPM cotton

Variables	Co-efficients	Standard error	Co-efficients	Standard error
Constant	4.999***	0.816	9.855***	1.682
Seeds (kg)	0.037**	0.016	0.068*	0.036
Organic manure (tone)	0.007*	0.003	0.006	0.004
Nitrogen (kg)	0.133**	0.054	0.064	0.074
Phosphorous (kg)	0.034	0.045	0.026	0.071
Potassium (kg)	-0.004	0.031	0.192**	0.090
Labour (man days)	0.289**	0.112	-0.5618**	0.279
Plant protection cost (Rs.)	-0.008	0.033	-0.469**	0.058
R^2	0.84	-	0.66	-
Adjusted R^2	0.78	-	0.55	-
'F' Statistic	15.993	-	6.020	-
Number of observations	30	-	30	-

*, ** and *** indicate significance of values at P=0.01, 0.05 and 0.1, respectively

mechanical and biological control methods were integrated to replace the excessive use of pesticides and the environment also protected in IPM cotton.

In non-IPM cotton, the results showed that the variables namely, seed, labour, plant protection cost and potassium were significantly influencing the yield. It also revealed that the influence of variables namely; the regression co-efficients of potassium, labour and plant protection cost were negative and significant indicating the need to cut the use of plant protection chemicals, which would not only enhance the efficiency in use of plant protection chemicals and reduce environmental pollution, but also enhance the yield and net returns through the reduction in cost.

Usage of different pesticides in cotton cultivation :

The usages of pesticide in the sample farms are represented in Fig. 1. The number of pesticides used and the application rate were less in IPM cotton compared to non-IPM cotton. Use of highly hazardous chemicals like carbofuran and monocrotophos were only 0.457 kg/ha and 1.793 kg /ha, respectively. Whereas in non-IPM cotton, it was 4.620 kg/ha of carbofuran and 5.652 kg/ha of monocrotophous, Phorate (6.34 kg/ha) and methomyl classified under highly hazardous categories were used only in non-IPM cotton growing areas. Eco-friendly bio control agents like *Bacillus thurngiensis* and Azaractin were applied only in IPM paddy and IPM cotton growing areas. The average cost of pesticides used was less significantly in IPM cotton at Rs.729.52 compared to Rs.1795.27 in non-IPM cotton. Average cost of pesticides used for Bt cotton was also less as Rs.899.50 compared to non-IPM cotton.

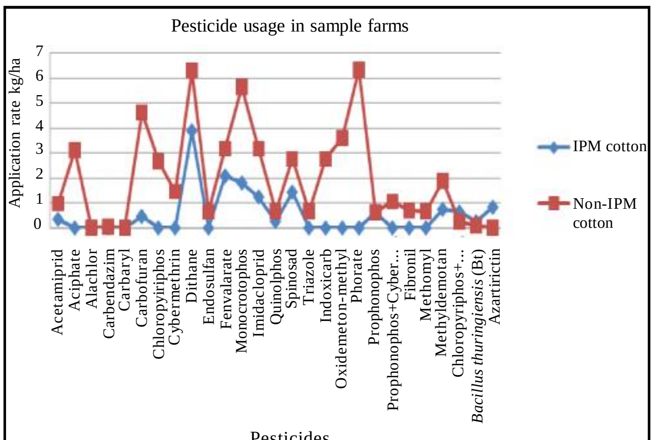

Fig. 1 : Pesticides usage in sample farm households

Environmental impact quotient (EIQ) :

The EIQ values of the results furnished in the Table 2 show that cultivation of non-cotton resulted in more EIQ values than IPM-cotton. The EIQ values were 36.93 in IPM and in 46.93 non-IPM cotton indicating the number of highly hazardous chemical application and environmental ill effects present in these farms.

Table 2 : EIQ values of pesticides used sample farms

Crop	EIQ values for		Combined IPM and non-IPM
	IPM	Non-IPM	
Cotton	36.93	46.93	38.84

Effect of pesticide exposure on human health :

The effect of pesticide exposure is represented in Fig. 2. Effects on health due to pesticide use in cotton growing sample farmers were more compared to paddy growers. Symptoms like allergic dermaties and tiredness were reported by about 78.33 per cent and 80.00 per cent of sample cotton growers, respectively. More than 40 per cent of the sample cotton growers at the least reported other problems. The analysis revealed that more farmers reported these problems among the non-IPM cotton crops.

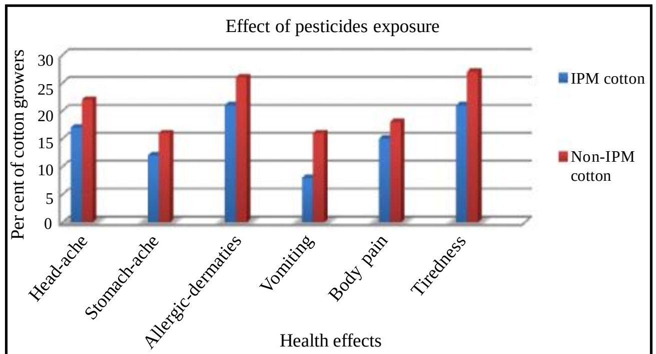

Fig. 2 : Effects of pesticide exposure on health in IPM and non-IPM sample farm household

Nearly 73.00 per cent of the sample respondents of non-IPM cotton growers complained about symptoms of headache, which was less (56.67 %) among IPM cotton growers.

The present study revealed the productivity difference between IPM and non–IPM cotton farmers. The pesticides cost had negative and non-significant influence on yield on IPM-cotton farmers. It was negative and significant in IPM cotton indicating the need to cut the use of plant protection chemicals. The highly hazardous chemicals like monocrotophos, carbofuran and phorate were used more in non-IPM sample farms and the application rate was also high. Symptoms like allergic dermaties and tiredness were reported by more sample farmers among the non-IPM cotton crops. EIQ values on IPM-cotton farm 36.93 compared to non-IPM cotton of 46.93 indicating that the hazardous chemicals not only included the cost of farmers but the negative environmental impacts was also associated within these farms. Therefore, it is necessary to motivate the farmers to highlighting the environmental toxicity of over use of pesticides to cultivation of IPM cotton with appropriate extension strategies and policy measures.

Acknowledgement :

Author is thankful to Dr. M.Chandrasekaran, Director, Planning and Monitoring, Tamil Nadu Agricultural University, Coimbatore for his kind guidance, motivation and unconditional support for this work.

REFERENCES

FAO. (2003). Global IPM, Report on the Global IPM Field Study Tour and Meeting, August - September, 1990, FAO, Manila, p.66.

Gupta, P. (2004). Pesticide exposure – Indian scene. *Toxicology*, **198**(1-3) : 83.

Huang, J., Hu, R., Rozelle, S. and Pray, C. (2005). Insect-resistant GM rice in farmers' fields : Assessing productivity and health effects in China. *Science* (Washington), **308** : 688-690.

John, M. Antele and Pingali, Prabhu L. (1994). Pesticide productivity and farmer health - A Philippines case study, *American J. Agric. Econo.,* **76**(1) : 418-430.

Khan, M., Azeem, Iqbal, Muhammad, Ahmad, Iftikhar, Soomro and Manzoor, (2002). Economic evaluation of pesticide use externalities in the cotton zones of Punjab, Pakistan. *Pakistan Develop. Rev.,* **4** (41) : 683-698.

Kim, J.M. (2000). Analysis of economic and environmental effects of pesticide application with special reference to vegetable production. *Acta-Hort.,* **25**(524) : 33-38.

Kovach, J. and Petzoldt, Degni J. (1992). *A method to measure the environmental impact of pesticides*. New York's Food and Life Sciences Bulletin No. 139, Cornell University, Ithaca, USA.

Nagaraju, T., Khan, H.S.S. and Vijaykumar, H.S. (1994). Resource use efficiency in hybrid cotton in different locations in the Tungabadra command area. *Agric. Econ. Rev.,* **7**(1) : 56-62.

Ramesh Babu, T. (1999). Environmental impacts of pesticides, *CAB Abstract*, **134**(3) : 120.

Salameh, P.R., Baldi, I. and Brochard, P. (2004). Pesticides in Lebanon : A knowledge, attitude and practice study. *Environmental Res.,* **94** (1) : 1-6.

Van Der Hoek, W., Konradsen, F., Athukorala, K. and Wanigadewa, T. (1998). Pesticide poisoning: a major health problem in Sri Lanka. *Social Sci. & Medicine,* **46** (4-5) : 495-504.

★★★★★ 7th Year of Excellence ★★★★★