

The Impact of Pesticides on Farmer's Health: A Case Study of Fruit Bowl of Himachal Pradesh

Shanta Kumari¹, Hansraj Sharma²

¹Department of Agricultural Economics, College of Agriculture and Natural Resources, Dilla University, Ethiopia

²Department of Economics & Public Policy, School of Social Sciences, Central University of Himachal Pradesh, India

Abstract: *The impact of pesticides on farmer's health was studied in Himachal Pradesh, India. The study was based on the farmers of Kullu and Shimla district. The 100 farmers were interviewed in each district, using pre-tested questionnaire. Majority of the farmers were doing the spray themselves in high value cash crops which create direct exposure to them and environment. While doing spray, only 22 per cent and 8.11 per cent of the farmers were using polythene to cover their nose and mouth in Kullu and Shimla, respectively. Most of the farmers were not willing to use the protective measures while doing the spray because they were feeling uncomfortable after wearing it. Majority of the farmers were not adopting the integrating pest management in Kullu (80 per cent) and Shimla (86.35 per cent). Due to indiscriminate use of pesticides farmers were suffering from different types of problems. In Kullu, farmers responded that they were suffering from the eye irritation (86 per cent), fatigue (81 per cent), skin irritation (66 per cent), back pain and headache (59 per cent), vomit (56 per cent) and dizziness (22 per cent). While in Shimla, more farmers were suffering from the symptoms of back pain and eye irritation (77.5 per cent) followed by fatigue (77.30 per cent), headache (77 per cent), skin irritation and vomit (41 per cent) and eye flu (31 per cent). The use of pesticides also kills insects and bees were reported by 90 per cent of the farmers in Kullu and 62 per cent in Shimla. This implies that the usage of pesticides impacting adversely on human health and environment. Therefore, there is a need to provide more awareness to farmers by the responsible authorities regarding the usage of integrating pest management and protective gears while handling and using pesticides.*

Keywords: Pesticides exposure, symptoms of pesticide exposure, environmental health, health impact of pesticides

1. Introduction

Exposure to pesticides both occupationally and environmentally causes a range of human health problems [1]. It is estimated that nearly 10,000 deaths annually to use of chemical pesticide worldwide, with about three-fourths of these occurring in developing countries [2]. At present, India is the largest producer of pesticides in Asia and ranks twelfth in the world for the use of pesticides with an annual production of 90,000 tons. A vast majority of the population in India (56.7 %) is engaged in agriculture and is therefore exposed to the pesticides used in agriculture [3,4]. Pesticides being used in agricultural tracts are released into the environment and come into human contact directly or indirectly. It is widely recognized that agricultural workers are the largest occupational group at risk of adverse health effects although public health workers and workers in manufacturing/ formulating factories may also be exposed. The most of the agricultural workers may be facing pesticides hazards, spray men are usually the most highly exposed group because of the inadequate clothing, drift of spray droplets, leaks and other defects in the spray equipment. Humans are exposed to pesticides found in environmental media (household pesticides use, contaminated food, soil, water and air) by different routes of exposure such as inhalation, ingestion and dermal contact. [5, 6]. Exposure to pesticides results in acute and chronic health problems. These range from temporary acute effects like irritation of eyes, excessive salivation and chronic diseases like cancer, reproductive and developmental disorders etc.

Though the use of agrochemical has lead to an increase agricultural productivity, but their use has also been associated with many negative direct and indirect impacts on

human health resulting in loss of working efficiency. Pesticides as such are toxic chemicals and represent risk to users. The level of risk increases, where users are often illiterate, ill trained and do not possess appropriate protective equipments. This leads to higher incidences of ill effects of pesticides. Therefore, human pesticide poisoning and illnesses are clearly the largest "environmental costs" paid by the society for their use.

Pesticide exposure has many long-term chronic effects; to assess those impacts is beyond the scope of this study. The morbidity effects of pesticide exposure have been studied by several researchers [7-15]. However, very weak association has reported between the farmers' self-reported symptoms of pesticide exposure and actual poisoning through the result of blood test [15]. Hence studies, which depend on self-reported symptoms, may reflect a lower estimate than that which might be said to prevail in actual fact.

There are few studies related to these issues in India. But so far there is no such studies has been done in the Himachal Pradesh in this context. Therefore, the present study dealing with the agricultural practices of the farmers regarding pesticide use and its impact on the health of farmers in the area of high value cash crops. Hence, studying the impact of pesticides exposure on farmer's health in the fruit bowl of Himachal Pradesh is worth to fill the research gap.

2. Methodology

2.1 Selection of Study Area

Out of 12 districts of the state of Himachal Pradesh, two districts namely Shimla and Kullu were purposively selected for the study. The selection of the districts was influenced by

two factors. First, in these districts the cultivation of high value crops namely apple and off- seasonal vegetable is being practiced since the late sixties and early. Second, these two districts together account for more than three-fourths of the total area under fruits and more than two-thirds of the total fruit production in the state.

2.2 Sampling Design

Two blocks namely, Kullu block in Kullu district and Theog block in Shimla district were purposively selected for the study. Thereafter, a list of panchayats falling in each selected blocks was prepared. In the next stage of the sampling, one panchayat from the each selected blocks was randomly selected. The selected panchayats were Jallugran from Kullu block and Matiyana from Theog block. Later on the list of the villages falling in two selected panchayats was prepared. Thereafter, 50 per cent of the villages were selected randomly in each of the panchayats.

2.3 Selection of Sample Households

In each selected panchayats, hundred households were allocated among the selected villages through a proportional allocation method. Thus, the total sample size consists of 200 households. The data was collected from the pesticide applicator from each house household. The farmer who was doing the spray in high value cash crops (apple and vegetables) for most of the time and for the last many years considered pesticide applicator.

2.4 Stratification of sample households:

For the construction of strata, cumulative square root frequency method was used [16]. The small farmers were those who had land up to 2.08 hectare and the large farmers had land more than 2.08 hectare (Table 1).

Table 1: Farm size category of sample households

Category of Farmers	Land holding (hectare)	Block and Sample size		
		Kullu	Theog	Total
Small	Up to 2.08	90	70	160
Large	>2.08	10	30	40
Total	-	100	100	200

Source: Field Survey, 2006

2.5 Data Collection and Analysis

The study is based on primary data. The primary data was collected from the sample households using a pre-tested questionnaire through a personal interview method for the agricultural year 2005-2006. The data were collected on the following aspects such as pesticide exposure, farmers and family characteristics and other variables affecting health, smoking and drinking, year and frequency of spraying pesticides, adoption of IPM, Number of pesticide sprayed and time of spray, symptoms due to prolonged exposure to pesticides and farmers perception about the effect of prolonged use of pesticides etc. In addition the height and weight of the pesticide applicator from each household was also recorded to construct Body Mass Index (BMI). BMI has been calculated by the ratio of weight (in kg) to the Height² (in m). The collected data has been presented

by frequency and percentages.

3. Results & Discussion

3.1 Results

Result of the study in table 2 reveals that average age of a person who did spray was 40.33 years, weight was 57.64 kg and height was 1.61 meters in Kullu block while in Theog block, these features were 41.01 years, 60.24 kg and 1.66 meters.

Table 2: Physical characteristics of respondents

Particulars	(Person/farm)					
	Kullu			Theog		
	Small	Large	All	Small	Large	All
Age (Year)	40.66	37.40	40.33	40.59	42.00	41.01
Weight (Kg)	57.58	58.20	57.64	58.20	65.00	60.24
Height (m)	1.61	1.64	1.61	1.64	1.71	1.66

Source: Field Survey, 2006

The majority of the farmers were having normal weight in Kullu block. However, a majority of the farmers in Theog had the problems of underweight, overweight and obese [17] (Table 3).

Table 3: Physical characteristics of the respondents in terms of body mass index

Particulars	(Percentage of respondents)					
	Kullu			Theog		
	Small	Large	All	Small	Large	All
Under weight	8.89	10.00	9.00	18.57	13.33	17.00
Normal	77.78	90.00	79.00	67.14	66.67	67.00
Overweight	11.11	0.00	10.00	14.29	16.67	15.00
Obese	2.22	0.00	2.00	0.00	3.33	1.00

Source: Own computation by using classification of WHO, 1998

Results in Table 4 shows that farmers in Theog block were using pesticides for a long time. For example, more than two fifths of them (42.00 per cent) were using pesticides for the last 25 to 30 years. In both the blocks, 50 per cent or more farmers were using pesticides in the range of 20-25 years. The table also reveals that frequency of spraying was a little higher in Theog compared to kullu. It was interesting to find that 28 and 15.50 per cent of the households had adopted integrated pest management in Kullu and Theog blocks, respectively.

Table 4: Years and frequency of spraying pesticides and adoption of IPM

Particulars	(Per cent)					
	Kullu			Theog		
	Small	Large	All	Small	Large	All
Years						
10-15	1.11	0.00	1.00	0.00	0.00	0.00
15-20	21.11	60.00	25.00	11.43	0.00	8.00
20-25	53.33	20.00	50.00	50.00	50.00	50.00
25-30	24.44	20.00	24.00	38.57	50.00	42.00
Frequency of spraying (No.)	7	8	7	9	8	9
Adoption of IPM						
Yes	20.00	100.00	28.00	11.43	25.00	15.50
No	80.00	0.00	72.00	88.57	75.00	84.50

Source: Field Survey, 2006

Table 5 reveals different aspects of pesticide use like no. of spray, type of pesticides and time of spray, etc. The table reveals that 41 per cent of the households were resorting to 9 to 10 sprays in Kullu block while around 48 per cent of households were doing 6-8 sprays. On the other hand, in Theog a four fifth of the farmers were spraying pesticides from 6 to 8 times while less than one-fifth of households were doing so 3 to 5 times. Further, 100 per cent of the small and large households reported using insecticides and fungicides for the spray in both the blocks.

Table 5: Pesticide use and its impact on pollinators

Factors	(Per cent of responses)					
	Kullu			Theog		
	Small	Large	All	Small	Large	All
No. of spray						
1-2	0.00	0.00	0.00	4.29	0.00	3.00
3-5	12.22	0.00	11.00	24.29	0.00	17.00
6-8	42.22	100.00	48.00	71.43	100.00	80.00
9-10	45.56	0.00	41.00	0.00	0.00	0.00
Pesticides sprayed during flowering						
Type of pesticides						
Insecticide	100	100	100	100	100	100
Fungicides	100	100	100	100	100	100
Time of spray						
Before flowering	100.00	100.00	100.00	71.43	100.00	88.00
During flowering	77.78	20.00	72.00	92.86	83.33	90.00
During fruiting	100.00	100.00	100.00	100.00	100.00	100.00
After fruiting	100.00	100.00	100.00	100.00	100.00	100.00
For colour	61.11	60.00	61.00	0.00	6.67	2.00
Do pesticides kill insect and bees?						
Yes	88.89	100.00	90.00	57.14	73.33	62.00
No	2.22	0.00	2.00	28.57	10.00	23.00
Don't know	8.89	0.00	8.00	14.29	16.67	15.00

Source: Field Survey, 2006

All the farmers were applied pesticide before flowering in Kullu, where as 88 per cent farmers did same in Theog. All farmers in both the blocks applied pesticide at the time of fruiting and after fruiting. In Kullu block, 61 per cent of the households applied pesticides for colour, but barely 2 per cent of the farmers did so in Theog. The use of pesticides kills insects and bees was reported by 90 per cent of the farmers in Kullu and 62 per cent in Theog.

Table 6 shows the response of farmers for the partial use of kit was more (75 per cent) in Theog than Kullu block. It was also found that all the farmers were wearing old clothing at the time of spraying and 22 per cent of the farmers in Kullu and 8.11 per cent in

Table 6: Use of protective measures while spraying pesticides

Particulars	(Per cent of respondents)					
	Kullu			Theog		
	Small	Large	All	Small	Large	All
User	66.67	100.00	70.00	64.29	100.00	75.00
Non-user	33.33	0.00	30.00	35.71	0.00	25.00
Use of kit						
Fully	0.00	0.00	0.00	0.00	0.00	0.00
Partially	66.67	100.00	70.00	64.29	100.00	75.00
No	33.33	0.00	30.00	35.71	0.00	25.00
Measures used						

Gloves	8.33	40.00	11.50	17.78	23.33	19.45
Boots	33.33	100.00	40.00	22.22	16.67	20.56
Old clothes	100.00	100.00	100.00	100.00	100.00	100.00
Cover nose and mouth with Polythene	16.67	70.00	22.00	4.44	16.67	8.11
Reasons for non-use						
Not interested	50.00	0.00	45.00	40.00	0.00	28.00
Uncomfortable	100.00	0.00	90.00	100.00	0.00	70.00
Unnecessary	33.33	0.00	30.00	48.00	0.00	33.60

Source: Field Survey, 2006

Theog block used the polythene to cover nose and mouth. Results also show that farmers were not willing to use any protective measure at the time of spraying because they feel uncomfortable. Less than half of the farmers in Kullu and more than one-fifths in Theog also reported that they were not interested in using protective measures. Result in table 7 shows that 83 per cent of the farmers in Kullu were aware of fact that prolonged pesticides use can affect health. The proportion of such households was

Table 7: Farmers perception about the effect of prolonged use of pesticides

Particulars	(Per cent)					
	Kullu			Theog		
	Small	Large	All	Small	Large	All
Yes	81.11	100.00	83.00	71.43	66.67	70.00
No	18.89	0.00	17.00	28.57	33.33	30.00
Degree of effects						
Very little	5.56	0.00	5.00	11.43	0.00	8.00
High	22.22	20.00	22.00	74.29	16.67	57.00
Very high	72.22	60.00	71.00	14.29	76.67	33.00
Extremely high	0.00	20.00	2.00	0.00	6.67	2.00

Source: Field Survey, 2006

70 per cent in Theog. In Kullu block, on overall farms, 71 per cent of the farms reported that pesticides had very high effect on their health followed by 22 per cent of households who reported high effect of pesticide use. Majority of the farmers reported to have experienced acute illnesses due to pesticides exposure (Table 8). In Kullu block, most of them opined that they had experienced eye

Table 8: Pesticide poisoning: symptoms of pesticides

Symptoms	(Per cent of respondents)					
	Kullu			Theog		
	Small	Large	All	Small	Large	All
Eye irritation	84.44	100.00	86.00	74.29	85.00	77.50
Headache	58.89	60.00	59.00	75.71	80.00	77.00
Dizziness	20.00	40.00	22.00	8.57	10.00	9.00
Vomit	55.56	60.00	56.00	51.43	16.67	41.00
Back pain	58.89	60.00	59.00	75.00	83.33	77.50
Skin irritation	64.44	80.00	66.00	30.00	66.67	41.00
Eye flu	0.00	10.00	1.00	30.00	33.33	31.00
Fatigue	80.00	90.00	81.00	77.00	78.00	77.30
Availing clinic facilities						
Yes	82.22	100.00	84.00	74.29	80.00	76.00
No	17.78	0.00	16.00	25.71	20.00	24.00

Source: Field Survey, 2006

irritation (86 per cent) followed by 81 per cent who reportedly experienced fatigue, 66 per cent skin irritation, 59 per cent head ache and back pain, 56 per cent vomiting, 22 per cent dizziness and 1 per cent eye discharge. In Theog

block, 77.5 per cent of the respondents reported eye irritation and back pain, 77.30 per cent fatigue, 77 per cent headache, 41 per cent vomit and skin irritation, 31 per cent eye flu and 9 per cent dizziness. The clinic facilities were availed by 82.44 per cent and 75.17 per cent of the respondents after the illness caused by pesticide exposure in Kullu and Theog blocks, respectively. In Kullu, 16 per cent farmers and in Theog block 24 per cent farmers had not availed clinic facilities after the illness due to pesticides exposure.

3.2 Discussion

As indicated earlier in introduction, there was number of studies which suggest that excessive use of agrochemicals has started impacting adversely on human health. The study results revealed that the health problems like under weight, over weight and obese were more prominent in Theog block compared to Kullu. This could be due to the use of pesticides from many years and by using more frequency of spraying. The farmers of Theog block were more engaged in the cultivation of vegetable crops which require more intensification and frequent agrochemicals. In case of apple production, however, the frequency of spraying pesticides was higher in Kullu block in comparison to Theog block. In kullu, all the farmers were doing pesticides spray during flowering time, fruiting and after fruiting and in Theog during fruiting time and after fruiting. Majority of the farmers in both regions opined that pesticides kill insect and bees. This could be due to indiscriminate use of pesticides. As farmers reported that only less than one fifth in Theog and less than two fifth in Kullu were following IPM practices. The farmers were also aware of the ill effects of pesticide use on health. This was reported from response of the farmers about the various diseases associated with the use of pesticides. This could be due to reason of majority of farmers not following the IPM practices in the study area. The occurrence of these diseases was computed on the basis of self reported data so there could be underestimation of these numbers. However, farmers' knowledge was very limited regarding whether a particular pesticide was safe to use or not. The use of full measures to protect themselves from the harmful effects of pesticides was not found among the farmers. More than two-third of the farmers of both blocks partially used the kit provided by the horticultural department with the spray pump. The measures used by most of the farmers include the use of old clothes, gloves and shoes. Very few farmers responded that they are covering their nose and mouth with polythene while spraying. The low adoption of these measures was because while doing spray farmers get sweating and do not feel comfortable by wearing protective equipments.

4. Conclusion

IPM training should be given for farmers by the experts to reduce the indiscriminate use of pesticides. And there is a need to provide more awareness to farmers by the responsible authorities regarding the usage of integrating pest management and protective gears while handling and using pesticides. Further, farmers should be encouraged to use organic pesticides. This could be helpful to protect the health of the farmers and to reduce pollution from

environment. In addition, the blood sample of the farmers should be tested by the health scientists from the study area to know the adverse impact of the pesticides on human health. It could be vital to find out accurate results and for further action.

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Author Profile



Dr. Shanta Kumari is presently working as an Assistant Professor in the Department of Agricultural economics, College of Agriculture and Natural Resources, Dilla University, Ethiopia since, 2012. She did her Ph.D degree (“High Value Cash Crops in Agriculture: Documentation and Valuation of Environmental Costs”) in agricultural Economics from CSK Himachal Pradesh Agricultural University, Palampur, India in 2007. She has worked as an Assistant Professor in the Department of Natural Resource Economics and Management, College of Dry Land Agriculture and Natural Resource, Mekelle University, Ethiopia (Nov.2009-2012). She has also served as a Research Associate from Aug.,2007-Nov.,2008 in two research project entitled, “Agricultural Diversification, Contractual Arrangements and Globalization: An Empirical Study in Patterns, Processes and Determinants in Himachal Pradesh” and “Modern Agricultural Technology and Crop Diversification in Trans -Himalayan Region of Himachal Pradesh” sponsored by the Indian Council of Social Science Research and Department of Science and technology, respectively. She has guided seven master students. In addition, Anamitra Saha Prize awarded by the Indian Society of Agricultural Economics, Mumbai for the best paper published in Indian Journal of Agricultural Economics during the year 2006.



Prof. Hansraj Sharma did his doctorate from Jawaharlal Nehru University, New Delhi. Prior to joining Central University, he was teaching in the Department of Food, Resource and Environmental Economics, Konkuk University, (Chungju Campus), Seoul, South Korea. Before joining his assignment in South Korea, Prof. Sharma was Professor and Head, Department of Agricultural Economics, Extension Education and Rural Sociology, Programme Director Centre for Policy Research in Hill and Mountain Agriculture and Coordinator, Project Monitoring and Evaluation Cell (PME) of the CSK Himachal Pradesh Agricultural University, Palampur. He was a Team Leader of the Core Team that developed the conceptual framework for the preparation of District Agricultural Plans for Himachal Pradesh. He has completed six research projects as Principal Investigator and fourteen research projects as Co-Principal Investigator funded by different agencies like ICAR, ICSSR, DST, Government of Himachal Pradesh and the Planning Commission Government of India. Prof. Sharma has three books to his credit (one as single author, one as co-author and one edited proceedings of an international symposium). He has guided one Ph.D and three M.Sc. students and also served as member on the advisory committees of more than ten M.Sc and Ph.D students. He has published more than seventy research papers/articles in journals of national and international repute and books in areas like Agrarian Relations, Rural Non-Farm Employment, Agricultural and Rural Diversification, Agricultural Wages and Employment, Microfinance, Agricultural Cooperatives, etc. He has also visited China, Pakistan, Nepal, Japan and South Korea in connection with presenting research papers in international conferences.