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Impact of pesticide use on farmer's health in Sri Ganganagar and Jaipur district of Rajasthan

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Abstract
Though the use of agrochemicals has led to an increase agricultural productivity, their use has also been associated with many direct and indirect negative impacts on human health resulting in loss of working efficiency. 2000 people receive emergency care annually for actual or suspected pesticide poisoning, and approximately 10% are admitted to the hospital. Each year, 20-40 people die of acute pesticide poisoning in Rajasthan. Still unknown, however, is the number of affected workers in the Rajasthan who never see a doctor and who therefore go undiagnosed and unreported Pesticides as such are toxic chemicals and represent risk to use. 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. This section presents different aspects of pesticides use by the sample households like the respondent's characteristics, pesticides impact on farmer's health, use of protective clothing while spraying pesticides, sources of awareness, knowledge of the households related to pesticides use, level of safety/precautionary measures, health impact or symptoms of diseases, and treatment measures of pesticide poisoning.

Keywords: Pesticide, farmer's health, agricultural

1. Introduction
Agrochemicals used to increase agricultural productivity, have also been associated with many direct and indirect negative impacts on human health. These effects are increasingly manifested in loss of working efficiency resulting in higher cost of production. In recent times, the effects of commercialization of agriculture on environment and human health have attracted the attention of both the scholars and policy makers (Pingali *et al.*, 1997).
The severity and risks of adverse impacts are higher in developing countries where users are quite often illiterate, ill trained, and do not possess appropriate protective equipments. It is estimated that only 0.1 per cent of applied pesticides reach the target pests, leaving the bulk of pesticides (99.9 per cent) to impact the environment and human health (Pimental, 1995) [7, 12]. The emphasis on organic agriculture is the direct outcome of the increasing awareness of the adverse effects of the excessive use of agro-chemicals. The present study is a modest attempt in this direction. Against this background, the present study aims at documenting the high value cash crops cultivation led adverse changes in the natural resource base, the strategies adopted by the local people to minimize the adverse impacts, monetary valuation of environmental costs, understand their implications for the livelihoods of the local people and suggest possible solutions. Such a study is essential in estimating the true cost of the cultivation of these crops.

2. Materials and Methods
2.1 Selection of study area
Out of 33 districts of the state of Rajasthan, two districts namely Sri Ganganagar and Jaipur 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 kinnow and off-seasonal vegetable is being practiced since the late sixties and early seventies. Second, these two districts together account for more than three-fourths of the total area under fruits and vegetables.

2.2 Collection of Data

The study is based both on primary and secondary data. The primary data were collected from the sample households using a pre-tested schedule through a personal interview method for the agricultural year 2015-2016. The data were collected on the following aspects : family size, educational status of the family, land holding size, land utilization pattern, cropping pattern, farm inputs and prices; pesticide exposure; farmer's and family characteristics and other variables affecting health; symptoms due to prolonged exposure to pesticides; medicinal history and expenditures incurred in treating the illness of farmers particularly impacts caused by use of pesticide; farmers awareness of the change in health condition due to greater or prolonged use of pesticide; farm outputs and prices; and income from the farm. In addition the height and weight of the person in a household who was doing spray for most of the time and for the last many years was also recorded to construct Body Mass Index (BMI). The secondary data were collected from the statistical outline of Rajasthan, 2015-16 on demographic features of the study area.

3. Results and Discussion

3.1 Farmers Using Various Types of Plant Protection Chemicals

Table 1: Percentage of farmers using various types of plant protection chemicals used in Sri Ganganagar district

Pesticide class	Cauliflower	Cabbage	Tomato	Pea
Insecticides	100.00	100.00	100.00	100.00
Fungicides	30.36	28.40	9.67	11.22
Bio pesticides	1.00	1.67	0.00	1.67
Botanical pesticides	0.00	1.21	0.00	0.00

Table 2: Percentage of farmers using various types of plant protection chemicals used in Jaipur district

Pesticide class	Cauliflower	Cabbage	Tomato	Pea
Insecticides	100.00	100.00	100.00	100.00
Fungicides	19.13	8.17	6.33	3.41
Bio pesticides	3.42	3.40	0.00	1.53
Botanical pesticides	0.00	1.49	0.00	0.00

Farmers used 100 percents of insecticides in Cauliflower, Cabbage, Tomato and Pea in both of the districts. Fungicides used about 30 percents in cauliflower. Average use of botanical pesticides was very low in both of the district.

3.2 Frequency of pesticides application

Farmers used pesticides frequently since pest infestation was relatively high in vegetable crops, particularly in cauliflower, cabbage, tomato and pea. Frequency of pesticides application by farmers is presented in Table 1 to 2.

In Sri Ganganagar district frequency of pesticide spray was found more in the four crops studied. For cauliflower, the number of spraying ranged from 11 to 17, with an average of 14. About 60 per cent of the farmers had an average of 14 or less sprayings, while the remaining gave 14-17 sprayings. For cabbage, the number of spraying ranged from 11 to 22, with an average of 15. About 81 per cent of the farmers had on the average 15 or less sprayings, while the remaining applied 16 or more sprayings.

For tomato, the number of spraying ranged from 12 to 19, with an average of 15. About 63 per cent of the farmers applied on the average 15 or less sprayings, while the remaining gave 16-19 sprayings. For pea, the number of spraying ranged from 9 to 16, with an average of 13. About 76 per cent of the farmers gave on the average 13 or less sprayings, while the remaining applied 13 or more sprayings.

In Jaipur district frequency of pesticide spray was found more in the four crops studied. For cauliflower, the number of spraying ranged from 11 to 17, with an average of 13.About 60 per cent of the farmers had an average of 13 or less sprayings, while the remaining gave 14-17 sprayings. For cabbage, the number of spraying ranged from 11 to 22, with an average of 15. About 80 per cent of the farmers had on the average 15 or less sprayings, while the remaining applied 16 or more sprayings.

For tomato, the number of spraying ranged from 12 to 20 with an average of 15. About 58 per cent of the farmers applied on the average 15 or less sprayings, while the remaining gave 16-19 sprayings. For pea, the number of spraying ranged from 9 to 16, with an average of 11. About 48 per cent of the farmers gave on the average 11 or less sprayings, while the remaining applied 11 or more sprayings.

Table 3: Frequency of pesticide application on the selected vegetable in Sri Ganganagar district

No. of application	Cauliflower		Cabbage		Tomato		Pea	
	% of farmers	Cumulative %	% of farmers	Cumulative %	% of farmers	Cumulative %	% of farmers	Cumulative %
<11	3.46	3.46	2.17	2.17	9.18	9.18	14.67	14.67
11	6.20	9.66	5.67	7.84	5.44	14.62	18.33	33.00
12	18.30	27.96	11.20	19.04	5.13	19.75	23.40	56.40
13	22.40	50.36	23.44	42.48	17.55	37.30	20.00	76.40
14	18.17	68.53	27.20	69.68	22.67	59.97	15.17	91.57
15	18.14	86.67	12.18	81.66	2.55	62.52	2.13	93.70
>15	13.33	100	18.14	100	37.48	100	6.30	100
Average	14		15		15		13	
Range	4-17		11-22		12-19		9-16	

* Applications included both spraying and dusting

Table 4: Frequency of pesticide application on the selected vegetable in Jaipur district

No. of application	Cauliflower		Cabbage		Tomato		Pea	
	% of farmers	Cumulative %	% of farmers	Cumulative %	% of farmers	Cumulative %	% of farmers	Cumulative %
<11	4.00	4.00	0.00	0.00	0.00	0.00	20.00	20.00
11	6.50	10.50	5.44	5.44	1.85	1.85	26.67	46.67
12	21.20	31.70	13.25	18.69	4.69	6.54	20.00	66.67
13	27.36	59.06	15.16	33.85	10.51	17.05	13.33	80.00
14	25.30	84.36	18.00	51.85	18.21	35.26	10.00	90.00
15	4.59	88.95	27.93	79.78	21.88	57.14	6.67	96.67
>15	11.05	100.00	20.22	100.00	42.86	100.00	3.33	100.00
Average	13		15		15		11	
Range	4-17		11-22		12-20		9.16	

* Applications included both spraying and dusting

Table 5: Years and frequency of spraying pesticides and adoption of IPM

Years	Sri Ganganagar			Jaipur		
	Small	Large	All	Small	Large	All
10-15	1.11	0.00	1.10	0.00	0.00	0.00
15-20	21.11	60.00	21.59	11.43	0.00	9.66
20-25 25-30	53.33	20.00	52.93	50.00	50.00	50.00
Frequency of spraying(no.)	24.44	20.00	24.39	38.57	50.00	40.34
Adoption of IPM						
Yes	20.00	100.00	28.00	11.43	25.00	13.65
No	80.00	0.00	80.00	88.57	75.00	86.35

The table also reveals that frequency of spraying was a little higher in Sri Ganganagar compared to Jaipur. It was interesting to find that 28 per cent and 13.65 per cent of the households had adopted integrated pest management in Sri Ganganagar and Jaipur district, respectively.

3.3 Pesticide use and its impact on pollinators

Table 6 shows different aspects of pesticide use like frequency of spray, type of pesticides, time of spray and intensity etc. The table reveals that 45 per cent of the households were resorting to 9 to 10 sprays in Sri Ganganagar while around 43 per cent of households were carrying out 6-8 sprays. On the other hand, in Jaipura little more than three fourths of the farmers were spraying pesticides from 6 to 8 times while one-fifth of households were doing so 3 to 5 times. Further, 100 per cent of the large households reported using insecticides and fungicides for the spray in both the blocks.

Table 6: Pesticide use and its impact on pollinators (per cent of responses)

Factors	Sri Ganganagar			Jaipur		
	Small	Large	All	Small	Large	All
No. of spray						
1-2	0.00	0.00	0.00	4.29	0.00	3.62
3-5	12.22	0.00	12.07	24.29	0.00	20.52
6-8	42.22	100.00	42.93	71.43	100.00	75.86
9-10	45.56	0.00	45.00	0.00	0.00	0.00
Pesticide sprayed during flowering						
Type of pesticide						
Insecticide	100	100	100	100	100	100
Fungicides	100	100	100	100	100	100
Time of spray						
Before flowering	100.00	100.00	82.00	71.43	100.00	44.00
During flowering	77.78	20.00	63.20	92.86	83.33	53.00
During fruiting	100.00	100.00	100.00	100.00	100.00	100.00
After fruiting	77.78	20.00	63.20	92.86	83.33	53.00
For color	61.11	60.00	60.99	0.00	6.67	2.00
Do pesticide kill insect pollinators and bees						
Yes	88.89	100.00	89.02	57.14	73.33	59.66
No	2.22	0.00	2.20	28.57	10.00	25.69
Don't know	8.89	0.00	8.78	14.29	16.67	14.66

All farmers in both the districts applied pesticides at the time of flowering, fruiting and after fruiting. In Sri Ganganagar district, 50 per cent of the households applied pesticides for colour, but barely 2 per cent of the farmers did such in Jaipur. The use of pesticides kill insects, pollinators and bees was reported by 89 per cent of the farmers in Sri Ganganagar and 60 per cent in Jaipur

3.4 Farmer's perception about the effect of prolonged use of pesticides

Table 7 presents response of the farmers about the effect of prolonged use of pesticides on health. The table shows that

94.34 per cent of the farmers in Sri Ganganagar were aware of fact that prolonged pesticides use can effect health. The proportion of such households was 70.69 per cent in Jaipur. In Sri Ganganagar district, on overall farms, 72.07 per cent of the farms reported that pesticides had very high effect on their health followed by 22.20 per cent of households who reported high effect of pesticide use

Table 7: Farmer's perception about the effect of prolonged use of pesticides (per cent)

Particulars	Sri Ganganagar			Jaipur		
	Small	Large	All	Small	Large	All
Yes	90.10	100.00	94.34	71.43	66.67	70.69
No	10.90	0.00	6.56	28.57	33.33	29.31
Degree of effects						
Very little	5.56	0.00	5.49	11.43	0.00	9.66
High	22.22	20.00	22.20	74.29	16.67	65.34
Very high	72.22	60.00	72.07	14.29	76.67	23.97
Extremely high	0.00	20.00	20.00	0.00	6.67	6.67

3.5 Pesticide poisoning: symptom of pesticides

Table 8 shows that majority of the farmers reported to have experienced acute illnesses due to pesticides exposure. Most of them (86 per cent) opined that they had experienced eye irritation (86 per cent) followed by 81 per cent who reportedly experienced fatigue, 66 per cent skin irritation, head ache and back pain, 56 per cent vomiting, 22 per cent dizziness and 1 per cent eye discharge. In Jaipur district, 77.5 per cent of the respondents reported eye irritation and back pain, 77.30 per cent fatigue and headache, 41 per cent vomit and skin irritation, 31 per cent eye discharge and 9 per cent dizziness.

Table 8: Pesticide poisoning: symptom of pesticides (per cent of respondents)

Symptom	Sri Ganganagar			Jaipur		
	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 flue	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
Available clinical facilities						
Yes	82.22	100.00	82.44	74.29	80.00	75.17
No	17.78	0.00	17.78	25.71	20.00	24.83

The clinic facilities were availed by 82 per cent and 75 per cent of the respondents after the illness caused by pesticide exposure in Sri Ganganagar and Jaipur district, respectively. In Sri Ganganagar, 17.78 per cent farmers and in Jaipur district 24.84 per cent farmers had not availed clinic facilities after the illness due to pesticides exposure

4. Conclusion

In both the districts, 100 per cent of the large households reported using insecticides and fungicides for the spray. All farmers in both the districts applied pesticide at the time of flowering, fruiting and after fruiting. In Sri Ganganagar district, 60.99 per cent of the households applied pesticides for colour, but barely 2 per cent of the farmers did so in Jaipur. Further, 89 per cent of the households in Sri Ganganagar and 60 per cent in Jaipur reported that the use of pesticides kill insects, pollinators and bees. Further, in Sri Ganganagar 94.34 per cent of the households were aware of fact that prolonged pesticides use could affect health. The proportion of such households was 70.69 per cent in Jaipur. Majority of the farmers reported to have experienced acute illnesses due to pesticides exposure. In Sri Ganganagar, most of them (86 per cent) opined that they had experienced eye irritation (86 per cent) followed by those who reportedly experienced fatigue (81 per cent), skin irritation, head ache and back pain (66 per cent each), vomiting (56 per cent) and dizziness (54 per cent). In Jaipur district, 77.5 per cent of the respondents reported eye irritation and back pain, 77.30 per cent fatigue and headache, 41 per cent vomit and skin irritation, 31 per cent eye discharge and 9 per cent dizziness. The clinic facilities were availed by 82 per cent and 75 per cent of the respondents after the illness caused by pesticide exposure in Sri Ganganagar and Jaipur district respectively. Farmers were not willing to adopt any protective measure at the time of spraying because it was uncomfortable. Half of the farmers in Sri Ganganagar and two- fifths in Jaipur also reported that were not interested in the use of the protective measures.

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