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## **Pesticides use in potato cultivation: A sample survey study from the Hooghly district, West Bengal, India**

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**Abstract**---After rice, wheat, and maize, potato (*Solanum tuberosum* L.) is India's fourth most significant food crop. In India, the cultivation of this crop has altered over the last few decades, becoming increasingly reliant on fertilisers and pesticides. Through a simple random survey approach, the current study seeks to assess understanding of the farmer community about the environmental implications of potato agriculture. Farmers in the Hooghly district of West Bengal, India, which is a significant potato growing district, were interviewed for primary data. According to this survey, a considerable number of farmers (65.6 percent) are aware of the issue of soil-fertility loss in the cultivated field as a result of the use of chemical fertilisers. Applying greater amount of fertiliser than the prescribed amount by the manufacturer with the loss of fertility over the years is another issue of concern. Negligible percentage of farmers (2.7%) employ regular soil-testing for fertility assessment. Amount of pesticide used on the other hand is dependent on several factors like breeds of potato, pest species infestation, infection of plant disease etc. In this case also there is a tendency of using greater concentration of pesticide than the prescribed amount especially due to ignorance of farmer community and false assumption of quick action. Resistance to the pesticide in pest community has been noted by about 70% of the farmers. This study also identifies beneficial practises in potato cultivation from the viewpoint of environment. 32.5% of the farmers reported the use of bio-fertilisers and herbal pesticides. About 58.7% farmers reported the practise of crop-rotation. The findings of this study are critical for raising community awareness, and the data can be used to develop policies and plans for adaptation and mitigation

actions to address the environmental issues related with potato growing techniques.

**Keywords**---potato cultivation, hooghly, pesticide, chemical fertiliser, soil fertility.

## **Introduction**

Potato (*Solanum tuberosum* L.) is popularly known as 'The king of vegetables'. It is the fourth most important food crop in India after rice, wheat and maize. All over India it is used as a major vegetable. The energy and available protein content of potato make it nutritionally superior vegetable as well as staple food not only in our country but also throughout the world. In recent times it has become an essential part of breakfast, lunch and dinner worldwide. Over the last few potato production has increased significantly all over the world and also in India. It is also noteworthy that this increase is mainly due to area expansion and not for increase in productivity (Rana 2015). West Bengal as a leading potato producing state is witnessing and experiencing ups and downs in the market of this crop and in an effort to cope with this situation the whole agricultural practice of potato cultivation is evolving interestingly. In this research attempt, Hooghly district where Potato is the prime cash crop even before rice and jute will be taken as a model district. In this district the procedure of farming has been changed considerably in last few decades which increases the production but at the same time some problems has emerged. Specially the effect of indiscriminate use of fertilizers, pesticides and newer varieties of potato seeds over the traditional varieties not only produce better production and newer opportunities but also leads to the unprecedented problems. The problems include growing infertility of land and damage of ecological balance. These aspects of the potato farming is little discussed area and needs thorough examination and assessment.

## **Methods and methodology**

The sources of primary data relevant to the present work include the data and information generated from intensive field studies, data collected through geographical instrument and chemical testing of edaphic parameters. Structured questionnaire schedule has been prepared to get reliable information about the problems. Data has been collected at Block level and village level through oral interview from different categories and social classes of farmers.

## **Study area**

Hugli is one of the central Districts in West Bengal. The present District is one of the six constituent units of the Burdwan division and extends between 22°39' 32" N (right of the Rupnarayan river) to 23°01' 20" N (Guptipara char on the Bhagirathi river) latitudes and between 87° 30' 20" E (Tilari village of the Goghat Police station) to 88°30' 15" E (Bhabanipur char on the Bhagirathi river) longitudes. The longitudinal extend of the District is 2.8 times greater than the latitudinal extension. Its approximate shape is like that of a butterfly, the western wing of which is much smaller than the eastern counterpart. It has an area of

3149.4 km<sup>2</sup>. Sample survey has been done in randomly chosen 5 villages in block Pursura of Hooghly district. 200 families were involved in this survey who were interviewed door-to-door. The data was analysed with MS excel.

## Results and findings

### Variety of potato cultivated

In the study mainly Kufri Jyoti variety of potato is cultivated. Only two family reported they cultivate chandramukhi variety of potato but for personal consumption.

### Sociodemographic Profile

Table 1: Demographic characteristics of potato farmers interviewed in May June 2021

	Entire Sample N = 120	Percent		
		Area1 (n=50)	Area2 (n=35)	Area3 (n=35)
Age class				
0-20		6	5.71	2.86
20-40		34	28.57	22.86
40-60		50	51.43	57.14
60-80		10	14.29	17.14
Sample Mean ± SE	47.71 ± 2.43	42.80 ± 2.12	44.86 ± 2.64	47.71 ± 2.43
no education (0 years)		10	8.57	14.29
Primary (1-7 years)		40	20.00	28.57
Secondary (8-10 years)		30	34.29	34.29
Graduate (11-13 years)		20	28.57	20.00
Post graduate (>=13 years)		0	8.57	2.86
Sample Mean ± SE	11.35 ± 0.37	6.70 ± 0.55	8.43 ± 0.68	7.00 ± 0.71
Mean values are not significantly different at $P \leq 0.05$ .				

Of the 120 respondents that were interviewed in three locations, the age difference and educational profile was not significantly different at  $P \leq 0.05$  (Table 1). Respondents were mainly between the ages of 40-60 years, followed by the youth (20-40 years). Most of the respondents had attended school for secondary education.

### Pesticide Groups Used by Potato Farmers

Sl No	Commercial Pesticide Name	Active ingredients	Activity	WHO toxicity class
1	Bluecopper	Copper Oxychloride 50% WP	Blue Copper (Copper Oxy Chloride) is Broad spectrum Contact, Systemic Fungicide and is used on major fruits and vegetables for the control of Leaf Spot, Early and Late Blight, Canker etc.	III
2	Blitox	Copper Oxychloride 50 % WP	effective Fungicide, used on blights of potato	III
3	Antracol	Propineb 70% WP	a polymeric zinc-containing dithiocarbamate, contact fungicide with broad spectrum activity for Early and Late Blight	U
4	Dithane M45	Mancozeb 75% WP	multi-site action in target fungi, its ideal for resistance management	U
5	Indofil M45	Mancozeb 75% WP	multi-site action in target fungi, its ideal for resistance management	U
6	Marlett M45	Mancozeb 75% WP	Fungicide	U
7	Satsuma M45	Mancozeb 75% WP	Fungicide	U
8	Uthane M45	Mancozeb 75% WP	Fungicide	U
9	Manzate M45	Mancozeb 75% WP	Fungicide	U
10	Mancozeb 75WP	Mancozeb 75% WP	Fungicide	U
11				
12	Dunali 505	Chlorpyriphos 50% Cypermethrin 5 % Ec	Insecticide	II
13	Regent GR	Fipronil 0.3 GR (0.3% w/w)	Insecticide	
14	Future 10 GR	Chlorpyrifos 10%	Insecticide	II
15	Ultimet	Imidacloprid 0.3% GR	nicotine-based, systemic insecticide	II
16	Mida	Imidacloprid 17.8% SL		II
17	TataMida	Imidacloprid 17.8% SL	Neonicotinoid group of insecticide, systemic activity against Colarodo Potato Beetle	II
18	Takume	Flubendiamide 20%	Control of broad range of	III

		WDG	Lepidoptera pests army worm, <i>Spodoptera sp</i>
19	Tagamycin	Streptomycin Sulphate + Tetracycline Hydrochloride 90:10 SP	broad spectrum chemical bactericide

**Table 3: percentage of potato farmers using each group of pesticide**

	Total Sam n=120	Percentage of farmers using pesticide in an area			are probability between area pa		
		Area 1 n=50	Area 2 n=35	Area 3 n=35	1 vs 2	1 vs 3	2 vs 3
Fungicide	99.17	100	100	97.14	ns	.857 ns	1 ns
Insecticide	90	82	97.14	94.29	0.0734	0.183	1
Herbicide	75.83	86	71.43	65.71	0.168	0.0518	0.797
Bactericide	59.17	40	82.86	62.86	0.000205	0.0637	0.107

### Frequency of pesticide use

Table 4: Reported number pesticide use per season

	Area 1	Area 2	Area 3
Fungicide	3--4	4--6	3--5
Insecticide	1	2	1
Herbicide	2	2--3	2
Bactericide	1	1	1

### Source of pesticide information

Table5: Source of pesticide information

	Area 1	Area 2	Area 3
Retailer	22	21	16
Fellow farmers	28	25	26
Own experience	34	36	37
Agriculture officer	0	0	0
Radio bulletin	2	2	1

### Knowledge and attitude of farmers towards pesticide

Issue	Numbers of farmers		
	Area 1	Area 2	Area 3
read label	2	2	1

Know about toxicity	26	19	16
Know about pollution	5	4	5
Know about right dose	18	20	31
actually apply right dose	3	4	2
increase dose in last 10 year	48	34	33

### **Gear used by farmers during pesticide use**

	Area 1	Area 2	Area 3
Gloves	2	0	0
Boots	17	11	9
Face mask(cover mouth)	15	8	7
long sleeve shirt, trouser	23	16	17

### **Effect of exposure of pesticide in farmers**

#### Effect of exposure

	Area 1	Area 2	Area 3
itching	20	22	15
burning	5	1	0
watery nose	15	17	13
cough	13	16	9
redden eye	7	4	3
headche	12	6	14

### **Resistance to the disease and pesticide**

Fungal disease like blight and late blight are the main problem for the farmers of hooghly district. Bacteria, mites and insect pests are not that much detrimental here according to the farmers, but they have to apply larger and larger amount of fungicide each year to control the blight disease. Dithiocarbamate (Mencozeb) is the main fungicide that is used in this area. 74% of the fermers reported that they have noticed resistance to the fungicide as formulation of previous year is not becoming effective in the next year. 90% of the farmers reported that they have used greater amount of pesticide in the year 2021-22 than last year.

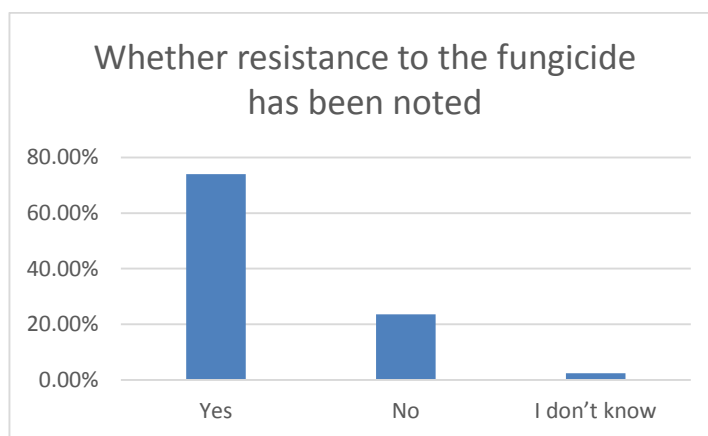


Fig2: Resistance to fungicide.

Other generally used systemic pesticide for moths and insects is also used in larger quantities than previous years. 95% of the farmers reported that they apply pesticide on the basis of personal experience or copying fellow farmers. They usually do not follow the instruction typed on the packet of the pesticide or don't have any idea of scientific protocol of pesticide use.

### **Organic farming**

Organic farming is gaining popularity in this region as more and more farmers are realising the disadvantage of chemical used in farming. 32.5% of the farmers reported the use of bio-fertilisers and herbal pesticides. About 58.7% farmers reported the practise of crop-rotation. Cowdung manure, vermicopost are the main organic manure used in this area as these two are easily available here due to wide practice of dairy farming. Bio-pesticide like neem-khol is also used to control soil inhabiting detrimental pests.

### **Discussion**

For numerous decades, the use of soluble chemical fertilisers in crop cultivation, especially to supply nitrogen, phosphorous, and potassium, has enhanced potato yields and quality. However, in the last ten years, there has been a growing worry over agricultural fertilizer's environmental impact, particularly as non-point sources of water contamination. Another source of worry is applying more fertiliser than the manufacturer recommends, resulting in a decrease of fertility over time. (Davenport et al, 2005). Similar result has been shown in another studies from New Zealand (Zesufi et al, 2017).

Amount of pesticide used on the other hand is dependent on several factors like breeds of potato, pest species infestation, infection of plant disease etc. In this case also there is a tendency of using greater concentration of pesticide than the prescribed amount especially due to ignorance of farmer community and false assumption of quick action. Previous studies has shown pesticide use may pose health hazard to farmers in potato cultivation (Sookhtanlou et al. 2017). Atmospheric deposition, livestock manure, irrigation with wastewater or polluted

water, metallo-pesticides or herbicides, phosphate-based fertilisers, and sewage sludge-based amendments are the principal sources of heavy metals in the soil environment and agriculture. The endocrine system can be disrupted by some substances, including frequently used potato pesticides. A tiny dose of an endocrine disrupting substance at a critical developmental stage can have long-term consequences. (Cox, 1997). The main pesticide used in Hooghly district is mencozeb. Last year Govt. of India has banned this pesticide.

This study also identifies beneficial practises in potato cultivation from the viewpoint of environment. The findings of this study are critical for raising community awareness, and the data can be used to develop policies and plans for adaptation and mitigation actions to address the environmental issues related with potato growing techniques.

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