

Study on the Impact of Agrochemicals on Environment and Human Health in North 24 Parganas District of West Bengal: An Insight of Farmers' Perception

Susmita Mondal¹, Biswajit Pal^{2*}

¹Research Scholar, Department of Rural Studies, West Bengal State University, Barasat, Kolkata-700126, West Bengal, India

²Assistant Professor, Department of Rural Studies, West Bengal State University, Barasat, Kolkata-700126, West Bengal, India

DOI: [10.36347/sjavs.2023.v10i03.001](https://doi.org/10.36347/sjavs.2023.v10i03.001)

| Received: 28.01.2023 | Accepted: 06.03.2023 | Published: 11.03.2023

*Corresponding author: Dr. Biswajit Pal

Assistant Professor, Department of Rural Studies, West Bengal State University, Barasat, Kolkata-700126, West Bengal, India

Abstract

Original Research Article

Nowadays farmers use more and more chemical pesticides and fertilizer per acre of land in return to maximize crop production. Crop Protection from various types of pests and weeds is another concerning issue. Climate also plays more significant role by increasing temperature, it multiplies the use of insecticides. Excessive use of chemical fertilizer and pesticides pollutes the environment simultaneously and it also affects the food chain and human health. Farmer is the primary user of chemical inputs in the field. Therefore, this study aims to analyze farmers' knowledge and information related to safety concern of agrochemical uses and their impact on the environment and human health. The data of this cross-sectional study has been collected from randomly selected 50 farmers of Amdanga Block of North 24 Pargana district, West Bengal through a semi-structured interview schedule. In this study, it has been found that 54% of farmers use crop-wise fertilizer more than the recommended amount; only 10% of farmers abstain from chemical fertilizer use. There is a significant relationship between crop-wise fertilizer use and the application of weedicides and pesticides to the environment. The farmers who are using this kind of chemical pesticides reported severe environmental hazards like 62% of farmers observe any birds extinction surrounding their agricultural field, 36% responded that the water quality of the pond nearest to the agricultural field deteriorates and 28% reported occurrence of fish death and 36% farmer reported that on monsoon season their field water goes to low water region (Bil) and contaminate water. On the other hand, most of the respondents experience health issues like nausea, headache, and skin problem immediately after spraying on the field. It has been also found that 62% of respondents knew that the use of pesticides and weedicides impacts our health. Still, only 40% always use any protective measure while spraying on the field. Farmers perceived that agrochemicals have negative impact on environment but they have been using those for high economic return. Systematic and long term agricultural development plan towards sustainable agricultural practices along with effective extension activities can develop the situation towards healthy agricultural practices.

Keywords: Agrochemicals, Health, Environmental Hazard, Farmer perception, Pesticide use.

Copyright © 2022 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

1. INTRODUCTION

In developing countries, an increase in population is a concerning issue for us. For meeting the food demand modern agriculture inevitably depend on the contribution of various types of agrochemicals. These agrochemicals are chemical products comprised of chemical pesticides and fertilizers (Pal, *et al.*, 2006). Pesticide includes insecticide, nematocide, herbicide, and fungicide (Osibonjo, *et al.*, 1980, Igbedioh, 1991). Though chemical pesticide protects plants they also threatened the environment and human health (Shetty, 2010). Agrochemical uses increase crop production which later consequence the deterioration of soil health

and also hampered sustainable agriculture (Sharma, 2003). Long-term use of agrochemicals creates a toxic impact on soil health; affecting the soil nutrient cycle and biochemical health that results soil deterioration (Mondal *et al.*, 2000) Agrochemicals are considered the easiest and less costly method for preventing pests and weeds. The outcome is high yielding at the same time leftover pesticide residue threatened the environment by contaminating water, soil, and air. This poses a serious risk to the non-target organism that is fish, bird, and aquatic animals (Biswas, *et al.*, 2014). Overuse of agrochemicals affects non-target organisms and it is also responsible for natural enemy decline thus playing

an important role in maintaining ecological balance and the food web. Due to natural enemies decline, farmers have to spend more expenditure on the chemical pesticide (Shetty, 2002).

According to PAN Asia-Pacific report, a survey on 2025 small-scale farmers was carried out in 7 Asian countries, the result revealed that every 7 out of 10 farmers were undergoing from acute pesticide poisoning. The reason behind this is that 50 highly hazardous pesticides were used by the users and the majority of them did not use personal protective equipment. Direct contact with pesticides, sprayed pesticides opposite to the direction of the wind leads to farmer's health hazards. Apart from that pesticide container was improperly disposed of and stored at home with food items. So lack of proper information and guidance; farmers unsafely deal with this leading to major health issues.

In our country, the growing population is the root cause of production enhancement that leads to the farmer using more pesticides. In the Patuakhali and Kumilla districts of Bangladesh, it was observed that rice farmers use more pesticides than the required amount and they increased the application by twice or thrice in past few years. Pest resistance develops at a lower dose so farmers rely on the use of high-dose pesticides. As a result environment and human health at jeopardy (Islam, *et al.*, 2016) Soil water and different seasonal vegetables are contaminated with different types of pesticides. Most of the pesticide residue is present in the environment and detect as a threat to the ecological system because it exceeds the maximum residue level (MRI) proposed by the European Union (EU) (Bormon, *et al.*). As we know farmer is the main user of pesticide in the field. So their perception and practice about the impact of pesticides on the environment and health is a major concerning issue now a day for decision-making in agrochemicals management. Several researchers tried to analyse the farmer's perception of this matter in different regions. In this context, the present research work has been conducted to analyse farmer's perception and practices in Amdangnga Block of North 24 Parganas, West Bengal. According to the district census handbook (2011)19% of cultivators and 35.59% work as

agricultural workers among the total population (191673).

2. RESEARCH METHODOLOGY

Agrochemicals are one of the most important elements in farming. It needs the production of optimum food to compete for the food demand. After analysis of literature, it has been found that the use of agrochemicals increased. On the other hand, it's growing use pattern results in environmental degradation and contributes to various types of health problems. So this contemporary global issue became a threat to mankind in the upcoming days.

Farmers are the primary users of agrochemicals in the field therefore this study focused to know farmer perception about the use of agrochemicals there impact on health and the environment. For this study, Amdanga Block in North 24 Parganas district of West Bengal has been selected purposively. Data has been collected from randomly selected 50 farmers from Tangatangi Gram panchayat of Amdanga Block where agricultural activities are comparatively higher than in other Gram panchayats. For this study, semi-structured Interview schedule were prepared. Question schedules were prepared based on our objectives-driven variables. After the collection of data, has been processed for further statistical analysis.

3. RESULT AND DISCUSSION

Knowledge about the proper use of fertilizer and pesticides, and adaptation of technology are controlled by user socioeconomic status (UNEP, 2022). The socio-economic background of the farmers is an important parameter for analysing their perception of agrochemicals' impact on environments and human health. Such parameters like age, education, land holding, house type, and income of sample farmers are present in (table 3. 1). It has been found that only 16% of farmers belong to the age group below 30 years,32% belong to the 51- 60 years age group. Among them, 58% are Hindu and 42% are Muslim religion. In the case of the social category, 96% of respondents belong to the general class and only 4% are from other backward classes.

Table no 3.1: Socio-economic status of respondents

Variables	Category	Responses in % (n=50)
Age (years)	<31	16
	<41	32
	<51	20
	<61	32
Religion	Hindu	58
	Muslim	42
Marital status	Married	96
	Unmarried	4
Social category	General	96
	OBC	4

Variables	Category	Responses in % (n=50)
Education	<i>illiterate</i>	6
	<i>Can read and write</i>	24
	<i>primary</i>	10
	<i>Middle school</i>	56
	<i>High school</i>	4
Family Type	<i>nuclear</i>	90
	<i>joint</i>	10
Family Size	<i>Up to 5</i>	84
	<i>More than 5 Hut</i>	16
House type	<i>Hut</i>	8
	<i>Kutch house</i>	12
	<i>Mixed house</i>	8
	<i>Pucca house</i>	72
Respondent income	<i><24000</i>	16
	<i><60000</i>	34
	<i><96000</i>	6
	<i><120000</i>	8
	<i><240000</i>	22
	<i><360000</i>	10
	<i>>360000</i>	4

There is a significant relation between IPM training, farmer level of education, and toxicity class of pesticides. That means the probability of overuse of pesticides decreases with high-level education and they also abstain from the use of toxic pesticides (khan *et al.*, 2015). In the case of the present study, only 4% completed higher secondary while 56 % completed

secondary or middle school, 6% were illiterate and 24% can read and write only. Considering their economic status, 16% of them annually earn below Rs.24000, 34% earn Rs. 24001 to Rs.60000, second majority income groups fall under Rs. 120000 to 240000 annually and only 4 % respondents earned more than Rs. 360000 per annum.

Table no 3.2: Agricultural background of respondents

Variables		Responses in % (n=50)
Years of engagement with agricultural activity	<i><5years</i>	8
	<i><10 years</i>	12
	<i><15 years</i>	8
	<i><20 years</i>	8
	<i><25 years</i>	10
	<i>>25 years</i>	54
Types of engagement	<i>1st generation</i>	6
	<i>Ancestral</i>	94
Cropping pattern	<i>Mono cropped</i>	62
	<i>Double cropped</i>	3
	<i>Multiple cropped</i>	10
	<i>Mixed cropped</i>	74
Agricultural land holding (acre)	<i><1</i>	60
	<i><2</i>	24
	<i><3</i>	4
	<i><4</i>	8
	<i>>4</i>	4
Have you any Soil health card	<i>yes</i>	96
	<i>no</i>	4
income from agriculture (per annum)	<i><24000</i>	2
	<i><60000</i>	56.8
	<i><96000</i>	2.0
	<i><120000</i>	17.6
	<i>>120000</i>	21.6

According to the Ministry of Agriculture and Farmers Welfare, Govt. of India, farmers are categorized according to their land holdings 86%

belong to the marginal farmer (<1 ha), 7% belong to the small farmer (1-2ha), 4% belong medium farmer (2-4 ha).

Table no 3.3: Agrochemicals practice, storage, health impact

Variables	Category	Response (%) N=50
Types of pesticide formulations used	Dust/powder	88
	Liquid/Aqueous	96
	Granules	96
The stage at which pesticides are usually applied	Preventive	60
	Observing a few insects without damages	40
	Noticing few insects, when they start damaging	14
How many days later started working on the field after spray	One day	24
	Immediately after spray	14
	Depend on the types of pesticide	31
Application method of pesticide solution method of pesticide granules application pesticide store place	With a sprayer	100
	With hand	100
	In the original container locked area	52
	In an unlocked area	42
	Anywhere it does not mater	6
Type of protective measure	Gloves	4
	Goggles	4
	Full sleeved shirt	60
	Mask covering the nose and mouth	16
	Others(Towel)	30
Experienced any health issue immediately after spray	Headache	10
	Burning sensation in eyes	10
	Burning sensation in nose	8
	Skin irritation	46
Experience health issues due to long-term use of chemical pesticides	Yes	16
	No	84

Table-3.3 describes the types of pesticide formulations that farmers mostly used are dust 88%, liquid 96%, and granules 96%. Liquid pesticide is used mostly with the help of sprayer and granules are applied by hand. In most cases, farmers applied pesticides by themselves, only 12 % of farmers hired labour for this work. Crop protection from pests is an important issue. To protect field crops, 60% of farmers have used pesticides at the preventive stage without any pest attacks. Among them, 90% of farmers responded that they has increase the application of pesticides more than earlier. Some farmers (16%) answered that the pesticide did not solve pest problems. The reason may be pests increased their potency to tolerate pesticides. The consequence is farmer use more pesticides which are harmful to their health and the environment as a whole. It was also observed that farmers spray pesticides opposite to wind directions without proper masks. Only 16% used masks that covered the mouth and nose, 60% used full-sleeved shirts and only 4% used goggles and gloves. Others use a towel or cloth to cover their nose at the time of spraying.

Storage of agrochemicals with proper safety is also important. Only 52% of farmers stored pesticides in a locked area, and 42 % stored them in an unlocked

area with lesser safety concerns. Among them, 52% of respondents did not experience any health issues immediately after pesticide application. Only 48% of farmers experienced various types of health issues like skin irritation (48%), burning nose sensation (8%), headache (10%), and burning sensation in the eyes (10%). Apart from that, only 14% responded experienced long-term health issues due to pesticide use. Revisits of the field within a short period after spraying can create health issues like respiratory problems. Through inhalation residue of leftover pesticides in the air can enter our body. So it's better to avoid revisiting of field within a short period. In this study, 31% of farmer revisits the field within a short period after spraying agrochemicals.

Farmers' knowledge about pesticide; use and their perception of the harmful effect of pesticides on the environment is important to develop a plan for sustainable agriculture. Result reveals that in the study area 40% of farmers bought pesticides without any label. Only 38% farmers followed the information that provides along with pesticide bottles before use. Only 14% consult with the nearest Krishi Vigyan Kendra before the use of any new pesticide or chemical fertilizers. Otherwise, the majority took the suggestion

from fertilizer sellers or other farmers who previously applied the same.

Indication of bright colour marks on pesticide bottles provides information about the poison's grade. In

the study area, 16% answered that they know about different bright colour marks. Among them, 18% know that red colour means more toxic pesticides and green colour means less toxic pesticides.

Table 3.4: Parameters of environmental impact analyses

Environmental parameters	Response (%) (n=50)
Observe any birds extinction in the last 10 years	62%
Observe any insects extinction in the last 10 years	16%
Observe any plant species extinction in the last 10 years	26%
Observe the occurrence of new weeds due to the use of pesticides	44%
Observe the extinction of weeds due to the use of pesticides	28%
Faced soil health deterioration due to the use of pesticide	88%
Incident of fish death in the study area	28%
Water contamination nearby lakes or ponds	38%

It has been proved that chemical pesticides adversely affected the environment. We don't know the area-specific user perception and knowledge about pesticide impact on the environment. In the study area, 62% of farmers agreed that pesticide residue is left in the air, soil, water plants stem roots. To enhance

production, 62% use an excessive amount of pesticides than the required amount. 88% of farmers faced soil health deterioration. To improve the fertility of soil they use more chemical input which leads to the hazardous situation for the environment and also acts as a catalyst to turn the soil infertile in long run.

Table no 3.5: Impact of excessive pesticide use on income level of farmers and environment

Exces_pesticide use than require amount	AGI INCOME	Environmental impact
No	56142.86	1.33
Yes	91275.86	2.34
F score	3.711	4.854
df	49	49
Sig	.060	.032

In the study, it has been found that 60% use excessive pesticides more than the required amount and their mean agriculture income is Rs.91275. On the other hand, for the respondents who did not use excessive pesticides, their mean annual income is Rs.56142. The result shows that the relation between excessive pesticide uses not significantly ($p < 0.005$) differ from agricultural income whereas it has significantly affected the environment. That means excessive pesticide use does not increase the income of farmers significantly ($p < 0.005$) but it impacts negatively on the environment. Farmers have responded, and they have observed some long-term impacts on the environment surrounding the agricultural field. 62% of respondents have also replied

that in the study area bird extinction observed in the last 10 years. They said that birds like a kite, vulture, sparrows, dove, black dronge, magpie, and cuckoo have not been spotted near agricultural fields. Farmers also observed the extinction of (6%) plants, (16%) insects, and (28%) weeds. The occurrence of new weeds also impacts the environment. *Parthenium hysterophorus* is a noxious weed considered to be a cause of allergic respiratory problems, contact dermatitis, and mutagenicity in humans and livestock (Patel, 2011). 44% of farmers observe the occurrence of new weeds like *Spinacia oleracea* in the agricultural field that previously did not exist.

Table no 3.6: Correlation between crop-wise fertilizer apply, weedicide, and environmental impact

Correlations		
	Crop wise fertilizer application	Application of weedicides
Environmental impact Pearson Correlation	.326*	.299*
**. Correlation is significant at the 0.01 level (2-tailed).		
*. Correlation is significant at the 0.05 level (2-tailed).		

In this study, it has been found that 54% of farmers use crop-wise fertilizer more than the recommended amount; only 10% of farmers abstain from chemical fertilizer use. There is a significant relationship between crop-wise fertilizer use and the

application of weedicides and environmental impact. That means the application of excessive synthetic fertilizers harms the environment. Chemical fertilizer temporarily provides nutrient for crop and increase production but afterward, it can deteriorate soil

productivity. In the study region, 88 % of respondents agreed that they faced soil health deterioration.

4. CONCLUSION

Agrochemicals are an important element for present agricultural production to meet the increasing food demand. Farmer uses it to increase production and prevent crop loss. Results revealed that the use of excessive agrochemicals negatively impacts the environment and loss of soil productivity. Simultaneously it impacts farmers' health. Therefore to prevent this kind of situation, the agricultural sector should adopt a sustainable development approach. Because increasing temporary production is not the proper way to mitigate food demand. Instead of it, the agriculture sector should follow increased productivity. To promote sustainable agriculture, the government should take more initiative in providing IPM training, Organic farming, use of Bio-pesticides, Green technology, and creating awareness among farmers. It is also necessary to create awareness about the health impact of chemicals and provide training on the handling of pesticides and their storage.

In India, the central government launched the scheme "Paramparagat Krishi Vikas Yojana, 2015. It is an extended version of the soil health management program under (NMSA) the National Mission for Sustainable Agriculture. It aims to promote organic farming by using traditional ways with modern science. According to Reddy (2018), this scheme faced some constraints. Those were lack of funding or delay, duplicate beneficiaries, and lack of market. So government should extend this scheme further and support more farmers by assisting them financially. On the other hand, the wide market of organic food selling should be properly set up and promoted. This will help society as well as a farmer by decreasing their input costs in farming. Therefore it will also minimize the negative consequences on health and the environment produced by agrochemicals.

Declaration of Competing Interest

The authors declare that there is no conflict of interest for this study.

Funding

The study was funded by University Grant commission (UGC) under NFSC scheme for pursuing doctoral research.

REFERENCES

- Biswas, S. K., Rahman, S., Kobir, S. M. A., Ferdous, T., & Banu, N. A. (2014). A review on impact of agrochemicals on human health and environment: Bangladesh perspective. *Plant Environment Development*, 3(2), 31-35.
- Islam, M. S., Alam, M. S., Uddin, M. N., Zahir, A. A., Islam, M. S., Haque, K. A., ... & Hossain, S. A. A. M. (2016). Farm level pesticides use in Patuakhali and Comilla region of Bangladesh and associated health risk. *Journal of Health and Environmental Research*, 2(4), 20-26.
- Khan, M., Mahmood, H. Z., & Damalas, C. A. (2015). Pesticide use and risk perceptions among farmers in the cotton belt of Punjab, Pakistan. *Crop Protection*, 67, 184-190.
- Mandal, A., Sarkar, B., Mandal, S., Vithanage, M., Patra, A. K., & Manna, M. C. (2020). Impact of agrochemicals on soil health. In *Agrochemicals detection, treatment and remediation* (pp. 161-187). Butterworth-Heinemann.
- Osibanjo, O., & Jensen, S. (1980, October). Ecological and environmental health perspectives of pesticide pollution. In *Proc. Of the first National Conference on water Pollution and Pesticide Residues in food. University of Ibadan. Pg* (pp. 206-220).
- Pal, R., Chakrabarti, K., Chakraborty, A., & Chowdhury, A. (2010). Degradation and effects of pesticides on soil microbiological parameters-A review. *International journal of agricultural research*, 5(8), 625-643.
- Patel, S. (2011). Harmful and beneficial aspects of *Parthenium hysterophorus*: an update. *3 Biotech*, 1(1), 1-9.
- Reddy, A. (2018). Impact Study of Paramparagath Krishi Vikas Yojana (Organic Agriculture) Scheme of India. *Reddy A Amarender (2018) Impact Study of Paramparagat Krishi Vikas Yojana, National Institute of Agricultural Extension Management (MANAGE), Hyderabad-500030*, 210.
- Sharma, M. C. (2003). Biopesticides: potential for Indian agriculture. *Biotechnological strategies in agro-processing*, 105-112.
- Shetty, P. K (2002): 'Ecological Implications of Pesticide use in Agro-Ecosystems in India', <http://www.npsalliance.org/Conf2002/PDF2002/PKShetty.pdf>.
- Shetty, P. K., Murugan, M., Hiremath, M. B., & Sreeja, K. G. (2010). Farmers' education and perception on pesticide use and crop economies in Indian agriculture. *Journal of Experimental Sciences*, 1(1), 3-8.
- UNEP, (2019). Highly Hazardous Pesticide Use and Impacts in Asia: The Need for Legally Binding Protocols Beyond 2020. <http://www.saicm.org/Portals/12/Documents/meetings/OEWG3/inf/OEWG3-INF-39-Pan-Asia-Pacific.pdf>
- United Nations Environment Programme (2022). *Synthesis Report on the Environmental and Health Impacts of Pesticides and Fertilizers and Ways to Minimize Them*. Geneva.
- Wu, Y., Chaki, B. M., & Barmon, S. C. (2021). Pesticide Use in Bangladesh: A Review on Potential Impacts. *Asian Journal of Environment & Ecology*, 224-24.