AATCC Review

20 March 2023: Received
13 July 2023: Revised
15 September 2023: Accepted
18 November 2023: Available Online

www.aatcc.peerjournals.net

Research Article Open Access

A Comparative analysis on the attitude of farmers and practices followed by them regarding agrochemical usage on rice crop in the Amritsar district of Punjab.

Swati Dhiman*, Priyanka Sharma, Tariq Iqbal and Harkirat Kaur

Department of Agriculture, Khalsa College Amritsar, Punjab-143002 India.

ABSTRACT

Agrochemicals are widely used in Indian agriculture for crop protection and to increase yield. They are known to have a negative impact on both the environment and human health. This study aims to explore the attitude of rice farmers and various practices followed by them regarding agrochemical usage in the Amritsar district of Punjab. A five-level Likert scale questionnaire was applied to measure the respondents' attitude. The data was collected from 100 respondents, compiled, and interpreted in accordance with the study's objectives. The farmers were all men belonging to the age group of 24-43 years (45 %). A total of 64 percent of the respondents lived in nuclear households, specifically those with a medium family size of between 5-8 individuals, which made up 44 percent of the population researched. About 38 percent of the farmers have semi-medium (5-10 acre) and medium (10-25 acre) operational land holdings. Agriculture came out as the primary occupation of the majority of the farmers, with approximately 77 percent of them engaged in this sector. Only four per cent of them participated in any training or extension programs on the use of agrochemicals because the majority were unaware of it.Farmers were found to have a low amount of mass media exposure, with only 56 percent of them reporting any such exposure. About 65 per cent of the farmers indicated a highly favorable attitude of the use of agrochemicals. It was also revealed that farmers follow various kinds of practices regarding agrochemical usage like soil testing, applying neem-coated urea, using leaf color chart, ETL (Economic Threshold Level) observation, and a lot more practices which highlights the need for educational initiatives to increase awareness about various practices that can lead to improved rice cultivation and agrochemical usage. It was also revealed that farmers face various challenges like high prices of agrochemicals, lack or awareness and many other which impact the growth and overall production.

Keywords: *Rice, Agrochemicals, Attitude, ETL, Production , Amritsar, Punjab.*

INTRODUCTION

Agriculture is the leading sector in providing livelihood to most of the Indian people. Agricultural intensification has occurred in previous decades as a result of rising food demand caused by a fast population increase. Over the period of time, farmers have developed and adopted various new technologies to increase their productivity to earn profit and also to meet the rising food demands. Without a doubt, the rise and adoption of these new technologies has helped farmers a lot in tackling various problems, lacking any loss. However there are a number of problems faced by agriculturists like numerous diseases, dangerous pests and weed attack in their crop which leads to crop failure and causes great losses to farmers as a result. So as a solution to these problems' agrochemicals were created and used by the farmers to save their crops.

Agrochemical means the chemical product used in agriculture. It includes various insecticides, pesticides, fertilizers, herbicides, fungicides and etc. Agrochemicals are used in agriculture to promote plant growth and protection, as their name suggests. Agricultural chemicals are another term for them. It is also known as Agrichemical[1].

Agrochemicals are used extensively in modern agriculture to improve crop productivity by controlling harmful pests, pathogens, and undesirable weeds. Recent decades experienced agricultural intensification as a result of increased food demand brought on by rapid population growth.To address the developing food demands, agrochemicals are carefully utilized in agriculture which accomplishes the gap between food manufacturing and intake however, simultaneously unbalanced use of agrochemicals additionally causes environmental deterioration and poses intense demands situations to aquatic and terrestrial ecosystems. So, there is a need to minimize the use of these chemicals and to use the available natural resources carefully[2].

The first recorded use of insecticides was about 4500 years ago by Sumerians. They used sulfur compounds to control insects and mites. About 3200 years ago, the Chinese used mercury and arsenical compounds to control body lice [3].

The history of Pesticides is divided into 3 parts. The first period was before the 1870s, in which pests were controlled by using various natural compounds. During the second period, between 1870 and 1945, people began to use inorganic synthetic materials. The third period started after 1945 [3], represented by the use of synthetic pesticides with the discovery of the effects of Dichlorodiphenyltrichloroethane (DDT), β-Hexachlorocyclohexane (BHC), aldrin, dieldrin, endrin,

Corresponding Author:* ***Swati Dhiman*
Email Address: ***swatidhimanpkt@gmail.com***

DOI: https://doi.org/10.58321/AATCCReview.2023.11.04.349

chlordane, parathion, captan, and 2,4-D [4].

Application of chemical pesticides dates back in India since 1948 while the production started in 1952 with the establishment of the manufacturing plant of DDT & BHC near Calcutta. The pesticide consumption in India during the period 1954-2000 shows that it has risen from 434 MT to 46,195.16 MT [5].

Among all the crops, Rice (*Oryza sativa)* is regarded as the primary crop. More than 50per cent of the world population consumes it as a staple food, making it the most common and important food crop. It is mainly produced in Asian countries. Rice is a major source of energy, it provides fat, protein, and carbohydrate along with other energy sources. It is a cereal crop belonging to the grass family (Family: Poaceae) of the plant kingdom. Recognizing the significance of rice due to its large influence on human nutrition, the year 2004 was declared as the international year of Rice by the UN (United Nations).

India is the world's fourth-largest producer of crop protection chemicals, behind China, Japan, and the United States. Three levels of crop protection firms can be found in India: multinational, domestic, including public sector firms, and small sector organizations. There are about 800 formulators, over 125 technical grade producers, including over 10 multinationals, over 145,000 distributors, and more, according to the Pesticide Monitoring Unit. In India, there are many companies producing and marketing agrochemicals, including international, domestic, and even some local businesses.

MATERIALS AND METHODS

2.1 Study Area

The present study was undertaken in Amritsar district of Punjab. Amritsar is one of the border districts lies in the North West frontier of Punjab. It lies between 31.6340 ° North latitude and 74.8723° East longitude and has an international boundary with Pakistan.It comprises 5 tehsils, and 9 community development blocks and 776 villages with a geographical area of 2.64 lac hectares, out of which 2.22 lac hectares are cultivable.

2.2 Sampling and data collection

From Amritsar district, out of nine blocks, two blocks were selected on the basis of the availability of rice growers i.e. Chogawan and Jandiala Guru. At the next stage of sampling, two villages were selected from each block purposively on the basis of availability of rice growers i.e. Kamaska and Chhiden from Chogawan block and Bandala and Wadala Johal from Jandiala Guru block. At the last stage from each village, 25 farmers were selected randomly making a total sample size of 100 respondents. For the purpose of gathering the primary data, an interview schedule was developed and details regarding the socioeconomic status, attitude, and practices followed by farmers while using agrochemicals on rice crops was gathered. The interview schedule was developed as a result of interactions with the department of Extension Education subject matter experts. Additionally, relevant literature was consulted. For pre-testing, 20 farmers were chosen at random from the non-sample region to administer the schedule. The answers were dichotomized as correct/incorrect with 1 and 0 scores respectively. In addition to primary data, Government-centred departments provided the secondary data for purpose.

2.3 Attitude

It was operationally defined as a disposition or feeling of farmers towards use of agrochemicals. Or it is the degree to which the respondents were favorably or unfavorably oriented toward the use of agrochemicals. The Likert scale was used to develop an attitude scale. It was assessed using a continuum of five points. The participant is asked to rate a series of items (statements) on the Likert scale. Instead of neutral or slightly favorable or unfavorable stimuli, objects that seem to be either definitely advantageous or obviously unfavorable to the attitude under consideration are used. Each item is marked with the respondents' agreement or disagreement. A numerical score is assigned to each response indicating whether it is favorable or unfavorable. The person's overall score represents where they stand on a scale of good to bad attitudes towards the object. The subjects are asked to rate their level of agreement or disagreement with each statement, with possible responses being strongly agree-5, agree-4, undecided-3, disagree-2, and severely disagree-1. The method is called summated rating because a subject's reaction to each item can be interpreted as his or her attitude rating on a 5-point scale, and the final score is determined when all these weights are added up. Although Likert employed five categories for agreement and disagreement, numerous researchers have used fewer or more categories for the attitude items. The Likert scale, which ranks people according to how favorable they are towards a given thing, is an ordinal scale. The general procedure for the construction of a Likert-type scale is given in brief, following Selltiz and others (1976).

First, the investigator assembles a large number of items considered relevant to the attitude being investigated that are either clearly favorable or unfavorable.

Second, the items were administrated to a group of subject representatives of those with whom the final study shall be made. The subjects indicated their responses to each item by checking one of the categories of agreement-disagreement.

Third, the responses to the various items were scored in such a way that a response indicative of the most favourable attitude was given the highest score, and the least favourable the lowest score.

Fourth, each individual's total score is determined by the summation of the individual's score on each item.

Fifth, the responses were analyzed to determine which of the items discriminate most clearly between the high scores and the low scores on the total scale.

The responses for positively worded statement was scored as follows:

Response category	score
Strongly agree	5
Agree	4
Undecided	3
Disagree	2
Strongly disagree	1

The scores were reversed for negative-worded statements.

2.4 Practices Followed

Practices followed by the farmers were referred to as the practices followed by the farmers with regard to the agrochemicals use i.e. economic threshold level, use of recommended nozzle while spraying the fluid, spraying at the recommended height, leaf colour chart, site-specific pesticide application, biological insect control methods and use of safety measures like: gloves, gas mask, full sleeve shirt, and full trouser. These were measured using items with dichotomous responses.

RESULTS AND DISCUSSION

Demographic Profile of Respondents:

The socio-personal characteristics of the respondents has been concluded in the table 1.The average age of overall respondents was 45.878 (±15.128).The results affirmed that in both blocks nearly half of the population of the respondents belong to age group of 24-43 years.The younger generations of respondents may not be as interested in farming since they may lack the passion and knowledge for it. The possible reasons could include change in mindset, modernization, and interest in taking on additional government and private jobs.The findings align with the findings of [6] and [7] as they observed comparable outcomes in their studies. The respondents' ability to make decisions is influenced by their education level, which has a positive impact on production.Table 1 provides an overview of the educational levels and allows for understanding the distribution of educational accomplishments at various levels within the specified areas. The Table provided the comparison between the education levels of two blocks, Chogawan and Jandiala Guru. Chogawan has a higher percentage of illiterate individuals compared to Jandiala Guru. In block Chogawan, 56 per cent of the respondents had an educational level up to senior secondary while from Jandiala Guru 36 percent of the respondents had an educational level up to senior secondary. This interprets that more respondents from Jandiala guru are qualified up to senior secondary level. Interestingly, these results contradict the conclusions drawn by [8], while aligning with the outcomes reported by [9].The majority of the respondents from both blocks belong to the nuclear family i.e., 70 percent in Chogawan and 58 percent in Jandiala Guru. Shifting values, urban lifestyle, economic factors, and changing gender roles have led people to prefer nuclear families for more autonomy, independence, and financial stability.It is evident from table 1 that the majority of the families belongs to a medium family size that is 36 percent from block Chogawan and 56 per cent from block Jandiala Guru with five to eight members per family.A large proportion of farmers i.e.,38 percent farmers belongs to Semi-medium and Medium category (36% & 44 % from Chogawan and 40% & 32 % from Jandiala Guru).

Table 1:Demographic profile of the respondents (n=100)

Parameters	Categories	Block Chogawann=50	Block Jandiala Guru n=50	Overall n= 100
Age	24-43	23(46)	24(48)	47(47)
	43-62	21(42)	22(44)	43(43)
	62-81	3(6)	4(8)	7(7)
	81-100	3(6)	0	3(3)
	Average Age (Mean ± SD)	48.300±17.015	43.020±12.794	45.878±15.128
Education	Illiterate	9 (18)	4 (8)	13 (13)
	Primary	3 (6)	0 (0)	3 (3)
	Middle	1 (2)	1 (2)	2 (2)
	Secondary	8 (16)	13 (26)	21 (21)
	Senior secondary	28 (56)	18 (36)	46 (46)
	Graduate	1 (2)	14 (28)	15 (15)
	Average education (Mean ± SD)	9.040±4.844	11.300±3.918	10.170±4.528
Family type	Nuclear	35 (70)	29 (58)	64 (64)
	Joint	15 (30)	21 (42)	36 (36)
Family size	2-5 (Low)	24 (48)	8 (16)	32 (32)
	5-8 (Medium)	18 (36)	26 (52)	44 (44)
	8 & above (High)	8 (16)	16 (32)	24 (24)
	Average family size (Mean ± SD)	5.120±2.026	6.400±1.969	5.760±2.089
Operational land holding (In acres)	Marginal(1-2.5)	5 (10)	1 (2)	6 (6)
	Small (2.5-5)	4 (8)	8 (16)	12 (12)
	Semi medium (5-10)	18 (36)	20 (40)	38 (38)
	Medium (10-25)	22 (44)	16 (32)	38 (38)
	Large(25 and above)	1 (2)	5 (10)	6 (6)
	Average operational land (Mean ± SD)	8.990±5.817	10.930±9.350	9.960±7.808

Note: *figures in parenthesis show percentage.*

Land ownership status of the respondents

Table 2 describes that in block Chogawan, 90 percent of the farmers has high land ownership which means most of the farmers cultivate on their own land and only two and three percent of farmers had low and medium land ownership respectively which means they cultivate more on leased land. Similarly, in Jandiala Guru, 96 percent of the farmers had high land ownership and only two percent farmers had low and medium land ownership. This indicates that almost all the farmers cultivate paddy on their own land.

Table 2: Land ownership status of the respondents

Status of land ownership (In per cent)	Block Chogawan n=50	Block Jandiala Guru n=50	Overall
Low (0-33)	2 (4)	1 (2)	3(3)
Medium (33-66)	3 (6)	1 (2)	(4)
High (66-100)	45 (90)	48 (96)	(93)

Note: *figures in parenthesis show percentage.*

Occupational status of the respondents

The occupational status was divided into four categories as given in table 2. It was found that the majority of the farmers (76 % from Chogawan and 78 % from Jandiala Guru) are solely engaged in Agriculture, 22 percent of the respondents from Chogawan and 16 percent from Jandiala Guru had their own business along with agriculture. A very small proportion of respondents were involved in any govt. or private job alongside, two percent in Chogawan, four percent from Jandiala Guru and one percent from Jandiala Guru respectively.

The data indicates that despite having diverse occupations, a significant portion of farmers remains actively involved in agricultural activities. This suggests a continued connection to the farming sector even amidst other job opportunities. These numbers highlight the importance of agriculture as a livelihood for many individuals and finding go in line with the findings of [10].

Table 3: Occupational status of the respondents

Occupation	Block Chogawan n=50	Block Jandiala Guru n=50	Overall
Only Agriculture	38 (76)	39 (78)	77 (77)
Agriculture + Govt. Service	1 (2)	2 (4)	3 (3)
Agriculture + Business	11 (22)	8 (16)	19 (19)
Agriculture+Private job	0 (0)	1 (2)	1 (1)

Note: *figures in parenthesis show percentage.*

Attitude of respondents towards agrochemical usage on rice crop

Based on the results of table 4, it was seen that majority of the farmers owns similar attitude towards respective statements from both blocks. Large proportion of the farmers strongly agreed that usage of agrochemicals in the cultivation of rice crop was unavoidable while, most of them strongly disagreed with the fact that organic farming is the best alternative for agrochemical usage. Furthermore, 30 percent farmers of block Chogawan agrees while same number from Jandiala Guru strongly disagrees that rice cultivation is not successful without the use of pesticides. The majority farmers from both blocks agreed that it is easy to use agrochemicals on rice crops. It was observed that from both blocks equal per cent of farmers (20 %) were unsure that it would be better to introduce natural methods to control diseases and pests in rice crop. Additionally, 40 percent of respondents strongly agreed about the requirement of training/ awareness regarding agrochemical usage.However, 28 percent from Chogawan and 20 percent from Jandiala Guru agreed that used pesticide containers can be cleaned and used for other purposes whereas, 20 percent from Chogawan and 16 percent from Jandiala Guru agreed that biofertilizers can be effective alternative. A major part of respondents from Jandiala Guru strongly disagrees while from Chogawan disagrees that a larger amount of pesticide use would have better effects on pest control and high-quality pesticides are not dangerous for rice crop. Respondents from both blocks strongly agree with the fact that using agrochemicals in rice crop is necessary and essential whereas they strongly disagree that use of inorganic fertilizers is not necessary for rice cultivation. Moreover, 22 percent of respondents from Chogawan disagree and 20 percent from Jandiala Guru strongly disagree that wearing protective clothes doesn't have significant effect while spraying pesticides. Respondents from both blocks have undecided attitudes towards using extra amount of fertilizer to increase rice yield. Interestingly, majority of respondents i.e., 12 percent from Chogawan strongly disagree while 18 percent from Jandiala Guru strongly agrees that pesticides only have lethal effects on pests.

Table 4: Attitude of respondents towards agrochemical usage on rice crop

S. No	Statement	Block Chogawan (n=50)					Block Jandiala Guru (n=50)				
		S. A (f)	A (f)	U. D (f)	D.A (f)	S.D. A (f)	S. A (f)	A (f)	U. D (f)	D.A (f)	S.D. A (f)
1	It is unavoidable to use agrochemicals in cultivation of rice crop.	42	6	0	0	2	40	2	8	0	0
2	Organic farming is the best alternative of agrochemicals for rice cultivation.	0	12	10	8	20	0	10	2	8	30
3	Rice cultivation is not successful without the use of pesticides.	16	30	0	0	4	0	6	4	10	30
4	Organic methods of rice cultivation will be very successful.	6	6	12	0	16	4	18	14	14	0
5	Agrochemicals are easy to use in rice crop.	4	40	2	4	0	0	42	6	4	0
6	It is better to introduce natural methods to control diseases and pests in rice crop.	4	18	20	4	4	4	18	20	4	4
7	There is requirement of training/ awareness among farmers for the use of agrochemicals.	40	10	0	0	0	40	8	0	2	0
8	Used pesticide containers can be cleaned and used for other purposes.	10	28	8	4	0	16	20	4	4	6
9	A larger amount of pesticide use would have better effects on pest control in rice crop.	0	8	8	22	10	2	2	6	10	30
10	High quality pesticides are not dangerous for rice crop.	6	6	8	26	4	0	4	8	8	30
11	Using agrochemicals in rice crop is necessary and essential.	26	20	0	2	2	30	18	2	0	0
12	Pesticides only have lethal effects on pests.	10	6	10	12	12	18	10	12	8	2
13	Use of inorganic fertilizers is not necessary for rice cultivation.	2	4	0	20	24	4	2	0	20	24
14	Wearing protective clothes doesn't have significant effect while spraying pesticides.	0	6	10	22	12	2	8	4	16	20
15	Using extra amount of fertilizer will help in increase of yield.	4	6	16	12	12	4	4	18	14	10
16	Use of biofertilizers can be an effective alternative.	10	20	10	4	6	16	16	8	8	2

*Abbreviations:
- S.A: Strongly Agree
- A: Agree
- U.D: Undefined
- D.A: Disagree
- S.D.A: Strongly Disagree

Categorization of attitude of respondents towards agrochemical usage

Table 5 depicts the attitude score of farmers towards the usage of agrochemicals on rice crop. It is clear from the table that a significant number of respondents (65%) had highly favorable attitudes towards usage of agrochemicals with high attitude scores. Further, 32 per cent of respondents had moderately favourable attitudes regarding agrochemical usage and only three percent of the respondents had less favourable attitudes towards agrochemical usage. These results let outs that potential reasons for farmers' highly favourable attitude regarding the use of agrochemicals could be that it can lead to increased crop production,to mitigate the risk of crop loss due to pests and diseases, increase yields can lead to greater financial gains and positive experiences shared by fellow farmers who have reaped benefits from agrochemicals can positively shape farmers' attitudes and practices, thus reinforcing their inclination towards these substances. The results aligned with the results obtained by [11].

Table5: Categorization of attitude of respondents towards agrochemical usage

Categories (Attitude Score)	Frequency (%)
Less favorable attitude(34-44)	3(3)
Moderately favorable attitude (44-54)	32(32)
Highly favorable attitude(54 and above)	65(65)

Note: *figures in parenthesis show percentage.*

Practices followed by farmers regarding agrochemical usage in rice crop

In Punjab, Rice is grown once in a year. Table 6 represents the results of different agricultural practices and their adoption rates in Chogawan and Jandiala Guru.It was observed that 28 percent of the respondents in Chogawan and 20 percent in Jandiala Guru gets their soil tested. None of the respondents in Chogawan use soil health cards, while 22 per cent in Jandiala Guru use them. The results show that 30 percent of the respondents in Chogawan and all respondents (100%) in Jandiala Guru apply neem-coated urea. Only two per cent of respondents in Chogawan and eight percent in Jandiala Guru use leaf color charts. None of the respondents in Chogawan observe ETL, while six percent in Jandiala Guru do. In Jandiala Guru, six percent of respondents employ biological control, compared to zero percent in Chogawan. While eight percent of respondents in Jandiala Guru uses pheromone traps, none of the respondents in Chogawan do. Growth regulators are not used by any of the farmers in either block. Only 16 percent of respondents in Chogawan and significantly 96 per cent in Jandiala Guru apply pre-emergence herbicides while 84 percent of respondents in Chogawan and four per cent in Jandiala Guru apply post-emergence herbicides. In neither block did any of the respondents rotate their spraying routine. All of the respondents in both blocks clean their spray pumps. Proper maintenance of equipment ensures effective pesticide application.

Table 6: Practices followed by farmers regarding agrochemical usage in rice crop

	Practices		Block Chogawan n=50	Block Jandiala Guru n=50	Overall
1.	Soil Testing		14 (28)	10 (20)	24(24)
2.	Soil Health Card		0 (0)	11 (22)	11(11)
3.	Apply neem coated urea		15 (30)	50 (100)	65(65)
4.	Use leaf colour chart		1 (2)	4 (8)	5(5)
5.	Observed ETL		0 (0)	3 (6)	3(3)
6.	Use Biological control		0 (0)	3 (6)	3(3)
7.	Use pheromone trap		0 (0)	4 (8)	4(4)
8.	Use growth regulator		0 (0)	2 (4)	2(2)
9.	First Spray of herbicide				
	i.	Pre-emergence	8 (16)	48 (96)	56(56)
	ii.	Post-emergence	42 (84)	2 (4)	44(44)
10.	Rotate Spray Schedule		0 (0)	2 (4)	2(2)
11.	Use recommended nozzle type		0 (0)	2 (4)	2(2)
12.	Purchase recommended brand of pesticides		0 (0)	2 (4)	2(2)
13.	Clean spray pump		50 (100)	50 (100)	100(100)

Note: *figures in parenthesis show percentage.*

Relationship between attitude of paddy growers and their socio-economic characteristics

Table 7 shows the data regarding relationship between dependent variable attitude of respondents toward agrochemical usage and independent socio-economic variables. The table reveals that mass media exposure and education has highly significant and positive correlation with attitude which means people with more mass exposure and higher education have more favourable attitude towards agrochemical usage whereas, age has highly significant and negative correlation with attitude which means that younger individuals might have slightly more positive attitudes.

Table7: Relationship between attitude of paddy growers and their socio-economic characteristics

Socio-Economic Variable	Correlation coefficient (r- value)	P-Value
Age	-0.249*	0.12
Education	0.292**	0.003
Family Size	-0.166	0.100
Land Holding	-0.95	0.350
Mass media exposure	0.322**	0.001
Training	0.035	0.730

***correlation is significant at 0.01 level (2 tailed), *correlation is significant at 0.05 level (2-tailed)*

CONCLUSION

The study delves into various socio-personal characteristics of the respondents, shedding light on factors that influence their behavior, decisions, and choices related to farming. A significant proportion of younger individuals are there into farming, However, it was observed that younger generations might exhibit reduced interest in farming due to various factors. Education emerges as a pivotal determinant in shaping respondents' decision-making abilities and ultimately impacting production outcomes. Furthermore, the analysis extends to family structures, where the preference of the majority families is to live as a nuclear family.the majority of farmers operate on relatively moderate-sized farms, which could impact their production capacity and overall economic status. Many farmers rely solely on agriculture as their primary occupation this suggests that these farmers are particularly vulnerable to fluctuations in agricultural productivity and market conditions, emphasizing the need for sustainable agricultural practices and support.A significant majority of the farmers displayed highly favorable attitudes towards the usage of agrochemicals. This positive perception might contribute to the widespread use of agrochemicals in farming practices, underscoring the importance of educating farmers about responsible and judicious use to mitigate environmental risks. The study also provides valuable insights into the various practices followed by the farmers like only a small percentage of farmers availed soil testing services, a negligible number of farmers checked Economic Threshold Levels (ETL) before spraying pesticides, and various other practices.

Future scope of the study: The same study can be conducted in other districts or in other states also.
The same study can be conducted in other crops also.
The present study will tend help improve the present situation of farmers by aiding in various policy formations.

Conflict of intrest: All authors declare that they have no conflicts of intrest.

Acknowlwdgement: We gratefully acknowlwdge the respondents' helping hands, without whom this study would not have been possible.

REFERENCES

1. Princy, A. J. (2020).Agrochemicals and their importance in agriculture. Retrieved from (researchdive.com/blog/agrochemicals-and-their-importance-in-agriculture) on 1 April 2023.

2. Majeed, A. (2018). Application of agrochemicals in agriculture: benefits, risks and responsibility of stakeholders. Journal of food science and toxicology, 2(1), 3.

3. Unsworth, J. History of Pesticide Use.(2010). IUPAC-International Union of Pure and Applied Chemistry. Retrieved from agrochemicals.iupac.org/index.php?option= com_sobi2&sobi2Task=sobi2Details&catid=3&sobi2Id=31 on 23 March 2023.

4. Zhang, Q., Xia, Z., Wu, M., Wang, L., & Yang, H. (2017). Human health risk assessment of DDTs and HCHs through dietary exposure in Nanjing, China. Chemosphere,177:211-216.

5. Bhardwaj, T.,& Sharma, J. P. (2013). Impact of Pesticides Application in Agricultural Industry: An Indian Scenario. International Journal of Agriculture and Food Science Techology, 4,817-22.

6. Digambar, J. S., Arjun, K. M., & Patil, C. B. (2020). Effect of different Agro techniques for pod borer complex management in Pigeonpea (Cajanuscajan L. Millsp.). Journal of Pharmacognosy and Phytochemistry,9(3),1113-1118.

7. Samarpitha, A., Vasudev, N., &Suhasini, K. (2016). Socio-economic characteristics of rice farmers in the combined state of Andhra Pradesh. Asian Journal of Agricultural Extension, Economics & Sociology, 13(1),1-9.

8. Tama, R.A.Z., Ying, L., Happy, F. A., & Hoque, M. M. (2018). An Empirical Study on Socio-economic Status of Women Labor in Rice Husking Mill of Bangladesh. South Asian Journal of Social Studies and Economics, 2 (2),1-9.

9. Lal, R., Sharma, S.D., Sharma, J.K., Sharma, V., & Singh, D. (2012). Impact of beekeeping training on socio-economic status of farmers and rural youths in Kullu and Mandi districts of Himachal pradesh. Journal of Human Ecology. 39(3),205-208.

10. Goyal, S., Rai, J.P., & Singh, S.R. (2016). Indian agriculture and farmers–problems and reforms. Indian Agriculture and Farmers,246(2019),79-87.

11. Nunthasen, W., Nunthasen, K., &Jaengsaengthong, W. (2019). Farmers' Health Effects and Attitude Towards Agrochemicals Use in Rice Production. In *IOP* Conference Series: Earth and Environment Science, 265,012016.