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An observational analysis on chemical handling practices among brinjal growers in Puducherry, a union territory of India

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ABSTRACT

The present observational analysis has taken to assess the chemical handling practices and its impact on human health among brinjal farmers in Puducherry, union territory of India. The study area comprises of five brinjal-growing villages in Puducherry. Ex-post facto research design has been adopted, and the data has been collected using the purposive non-probability sampling technique through direct face to face personal interview method. The collected data has analysed using various statistical tool such as Mean, Standard deviation Frequency and Percentage. The study revealed that almost all the farmers were used a mixture of two or more chemicals for spray. In addition, 54.00 per cent of the farmers were not aware about the use of protective measures while handling chemicals. The majority of the of farmers (94.00%) found that morning time was suitable for chemical spraying. However, nearly 52.00 per cent of the farmers were wearing the face mask and 86.00 per cent of the farmers were not aware about wind direction while spraying. Nearly 48.00 per cent of farmers categorized as obesity class-I based on their Body Mass Index. The study also documented the harmful effects on human body due to exposure of chemicals among brinjal farmers and found that almost all the farmers were experienced burning symptoms, followed by 88.00 per cent of them has felt the symptoms of weakness and dizziness. In this regard, brinjal farmers need to be provided with awareness and training on proper chemical usage in the crop.

Keywords: *Brinjal farmers, Brinjal Cultivation, Chemical handling practices and Harmful effects of chemicals.*

Introduction

India is the second largest producer of vegetables that contributing about 14.00 per cent to global vegetable production. Interestingly, vegetable cultivation has emerged as an important livelihood option for small and marginal farmers, helping them to generate income. Further, the demand for cultivation of vegetables has increased during rising population and urbanization because of their richness in minerals and vitamins in addition to dietary fibre [4]. India ranks second in vegetable production. Interestingly, potato (28.00%), tomato (11.00%), onion (10.00%) and brinjal (09.00%) together account for 58.00 percent of total vegetable production. In that Brinjal (Solanum melongena L.) is one of the most important indigenous vegetable crops that grown extensively all over the world, covering 01.86 million hectares with an annual production of 54.08 million tonnes valued at over US$10 billion. Almost 84.00 per cent of brinjal production is associated with China (61.00%) followed by India (23.00%). The production of brinjal in India is about 127.79 lakh tonnes in 2022-23 which accounts for about 09.00 per cent of India's total vegetable output. Nearly 08.00 million Indian farmers cultivate brinjal that spans over 711.30 thousand hectares, with an estimated annual production of 13,557.80 thousand metric tonnes and a productivity of 19.10 metric tonnes per hectare. This production meeting the needs of over 160 million individuals. However, brinjal cultivation faces severe constraints due to pest infestations, especially the brinjal fruit and shoot borer that can cause 70 to 90 percent yield loss. Pesticides assist farmers in minimizing potential crop yield loss due to pests and diseases but they also pose potential hazards to human health when inappropriately handled [1]. Pesticides are toxic in nature and do not differentiate between target and non-target species of plants and animals, and hence should essentially be subject to safe and judicious use. Due to noncompliant and indiscriminate use of pesticides, many accidents have occurred in different parts of the world, and the presence of pesticides in foods, fruits, vegetables and the environment is a matter of great concern. It was estimated that about a million people are being poisoned by pesticides annually and most of these toxicities and fatal consequences are through pesticides used by small-scale farmers without adequate knowledge acquired through formal training and failure to wear appropriate clothing [12].

Hence, the present study was carried out to understand the chemical handling practices of brinjal (eggplant) growers the aiming to shed light on the prevalent methods and their implications for health, safety and the environment.

Materials and Method

Study area

The study area was within Puducherry's union territory, which consists of four distinct and geographically separated regions including Puducherry (Pondicherry) which is the largest and most well-known region, it serves as the capital of the Union

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Territory and is located on the Coromandel Coast. Yanam which is located on the eastern coast surrounded by Andra Pradesh, Mahe on the Malabar coast that bounded by the state of Kerala and Karaikal, situated along the Coromandel coast and enclosed by Tamil Nadu. Puducherry district was selected as the study location because of its larger farmer population that cultivates brinjal in their region.

In Puducherry, brinjal which is also known as eggplant is cultivated by farmers, specifically, among five villages within the Puducherry district, Koonichampet, Manalipet, Sellipet, Sorapet, and Thirukkanur are known for their brinjal farming and their latitudinal and longitudinal locations are mentioned in Table 1. and the map of study are depicted in fig.1. These villages were selected for a study on chemical applications in brinjal cultivation due to higher concentration of farmers and brinjal production compared to other districts within the Union Territory. Out of the 62 villages that grow brinjal, five were chosen and ten samples in total from each village was selected and thus 50 brinjal-growing farmers in final were considered for the present study.

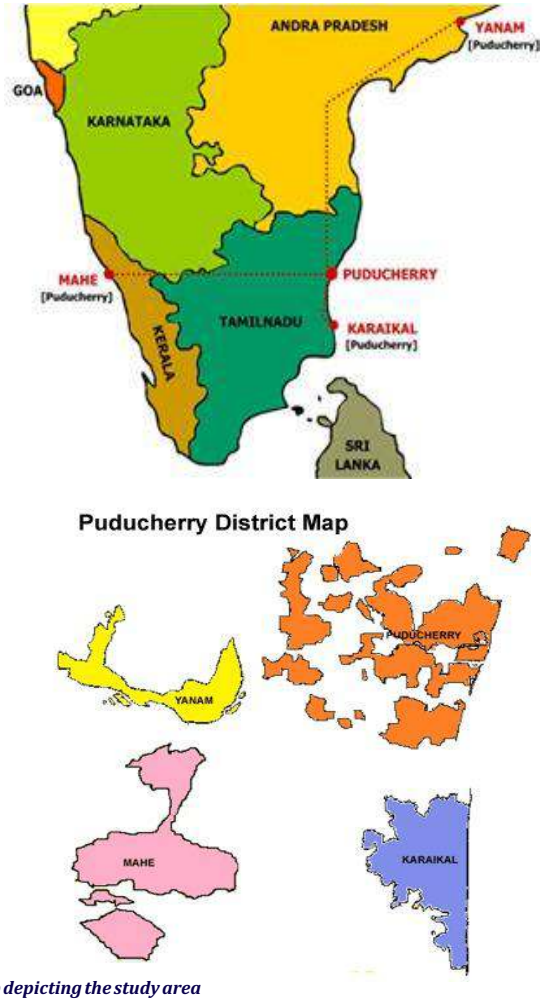

Fig.1. Map depicting the study area

Table 1: Latitudinal and Longitudinal location of brinjal cultivating areas included in the study

Villages	Latitudes	Longitudes
Koonichampet	11°59'28"N	79°38'18"E
Manalipet	12°01'28"N	79°37'52"E
Settipet	11°56'58"N	79°41'50"E
Sorapet	11°57'21"N	79°39'22"E
Thirukkanur	11°59'46"N	79°38'29"E

Sampling Procedure

To evaluate the objective of the study, the information was collected from sample farmers by interviewing them personally using a pre-tested structure interview schedule. Ex-post facto research design and purposive sample methods were employed in the study. Pre-test interviews had been conducted to determine whether the questions were appropriate or not and adjustments were made according to the requirements. After the pilot survey, Information was obtained from in-person conversations with brinjal farmers. Both closed-ended and open-ended questions based on real needs are included in the agenda.

Data for the research study were gathered through interpersonal or face-to-face communication to get first-hand information. The information submitted by farmers of brinjal is verified with each interview schedule. The various data collected were subjected to descriptive statistics such as frequency distribution, percentage and the data have been compressed to form appropriate tables using mean and percentage.

Findings and Discussion

I. Chemical handling practices followed by sample farmers in Brinjal cultivation

Chemical handling practices adopted by brinjal growing farmers in the study area is shown in Table 2. The study showed that 54.00 percent of the respondents were not aware of the protective measures for the use of chemicals on their farms with mean and standard deviation are 0.54 and 0.50, respectively. The results also revealed that almost all the brinjal growing farmers were adopted the use of chemicals after mixing at least two chemicals for application and more than one-third of farmers (70.00%) were involved in the application of chemicals for brinjal plants on their own. Whereas 26.00 per cent of the farmers had the practice of reading the label of instruction. The time of application adopted was morning by almost all the respondents (94.00%) in the study areas. Moreover, 52.00 per cent of the farmers used face mask followed by 32.00 per cent of farmers used polybags to hand cover while applying the chemicals and seventy-two per cent (72.00%) of the farmers had the habit of washing hands with soap. However, about thirty percent (30.00%) of the respondents had the inappropriate habit of drinking water while spraying chemicals to the brinjal crop.

Table 2: Chemical handling practices followed by sample farmers in Brinjal cultivation (N=50)

Sl. No	Particulars	Frequency	Percentage	Mean	SD
1.	Not aware of protective measures	27	54	0.54	0.50
2.	Mixing of Two chemicals	50	100	1	0.00
3.	Pesticide applied by farmer himself	35	70	0.7	0.46
4.	Read the label of instruction	13	26	0.26	0.44
8.	Practice of dress change after spraying	43	86	0.86	0.35
9.	*Time of application:*				
	a. Morning	47	94	2.12	0.48
	b. Evening	3	6		
10.	*Safety practice adopted during chemicals spraying:*				
	a. Use of face mask	26	52	0.52	0.50
	c. Use of polybags to hand cover	16	32	0.32	0.47
11.	*Eating habit during Spraying activities:*				
	a. Smoking	6	12	0.12	0.33
	b. Drinking water	15	30	0.3	0.46
12.	*Practices adopted after chemicals sprayed:*				
	a. Taking a bath	14	28	2.72	0.45
	b. Wash hands with soap	36	72		
13.	*Measuring Instrument:*				
	a. Bottle cap	42	84	2.18	0.44
	b. Measuring jar	8	16		
14.	*Mixing of chemicals:*				
	a. Wooden stick	40	80	2.36	0.75
	b. Bare hand	2	4		
	c. Mix pour into water	8	16		
15.	*Wind direction during chemicals application*				
	a. Along with wind	7	14	3.72	0.70
	c. Not aware about direction	43	86		
16.	*Disposal of empty chemical bags and containers:*				
	Aware about safe disposal	8	16	3.04	0.60
	Not aware about safe disposal: a. Put into crop field side	32	64		
	b. Put into road side	10	20		

Nearly 84.00 per cent of the farmers had used a bottle cap as a measuring instrument and 80.00 per cent of the brinjal farmers used a wooden stick for mixing the chemicals for application. It is also evident from the study that 86.00 per cent of the brinjal farmers were not aware of the direction of wind while application of chemicals and only 16.00 per cent of the brinjal farmers were aware of the safe disposal of used empty chemical bags and containers. The findings are in line with the similar of [10].

II. Number of sprays during Brinjal cultivation by sample farmers

The number of sprays adopted by brinjal growing farmers in the study area is shown in Table 3. The study showed that 50.00 Percent of the respondents had sprayed the chemicals fifteen times to their brinjal crop during the crop period, followed by 16.00 per cent of the farmers had sprayed fourteen times and 12.00 per cent and 10.00 per cent of the farmers had sprayed thirteen and sixteen times, respectively. However, only 4.00 per cent each of the farmers had sprayed seventeen times followed by twelve times and eleven times respectively. The results are similar to the findings of [10].

Sl. No	Number of Spray	Frequency	Percentage
1.	11	2	4
2.	12	2	4
3.	13	6	12
4.	14	8	16
5.	15	25	50
6.	16	5	10
7.	17	2	4

Table 3: Number of sprays during Brinjal cultivation by sample farmers (N=50)

III. Body Mass Index of sample farmers in Brinjal Cultivation

Body Mass Index range of sample farmers indicated in the Table 4, specifically for Brinjal crop grown farmers in the study area. Categorization of nutritional status of brinjal farmers has been done on the basis of the calculated Body Mass Index value. The study revealed that out of total 50 brinjal growing farmers, 52.00 per cent of the farmers belonged to Pre-obesity and their BMI ranges of 25.0 – 29.9, followed by 48.00 per cent of the brinjal farmers belonged to Obesity Class – I and their BMI value ranges 30.0 – 34.9. The findings are similar to the results of [10].

Table 4: Body Mass Index of sample farmers in Brinjal Cultivation (N=50)

Sl. No	BMI	Nutritional Status	No. of farmers	Percentage
1	Below 18.5	Underweight	0	0
2	18.5 – 24.9	Normal Weight	0	0
3	25.0 – 29.9	Pre-Obesity	26	52
4	30.0 – 34.9	Obesity Class - I	24	48
5	35.0 – 39.9	Obesity Class - II	0	0
6	Above 40	Obesity Class - III	0	0

(Source: BMI, World Health Organization)

IV. Harmful effects of chemical use on health of farmers in Brinjal cultivation

The result of the health hazards associated with chemical handling among the brinjal farmers in the study area is shown in Table 5 and Fig.2.

From Table 5, it revealed that Fifty (50) farmers, corresponding to 100% of the sample, reported having experienced at least one of the symptoms on the occasion of chemical handling. The most majorly reported symptom was burning, followed by 80.00 per cent of the farmers had experienced eye irritation, weakness and dizziness. In addition, Headache and Breathing problems have faced by nearly 78.00 per cent and 72.00 per cent of the brinjal farmers, respectively. The findings also reported that 62.00 per cent of the brinjal growers have experienced sneezing and 34.00 per cent of the farmers have faced nausea.

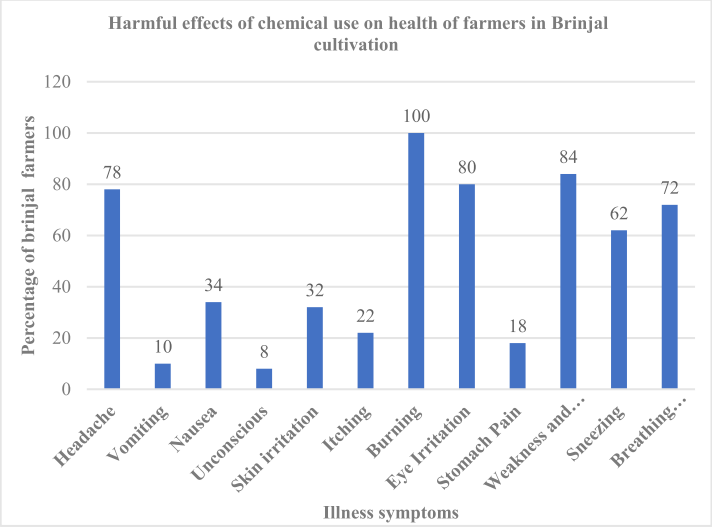

Fig.2. Respondents' distribution based on the harmful effects experienced on use of chemicals on health of farmers in Brinjal cultivation

The skin irritation was experienced by 32.00 per cent of the brinjal growers due to the chemicals meeting the farmer's bare skin during mixing or application., vomiting, and Stomach Pain, unconsciousness and itching were also reported by considerable number of the interviewed farmers as depicted in fig.2.

Table 5: Harmful effects of chemical use on health of farmers in Brinjal cultivation (N = 50)

Sl. No	Symptoms / Illness	Frequency	Percentage
1.	Headache	39	78
2.	Vomiting	5	10
3.	Nausea	17	34
4.	Unconscious	4	8
5.	Skin irritation	16	32
6.	Itching	11	22
7.	Burning	50	100
8.	Eye Irritation	40	80
9.	Stomach Pain	9	18
10.	Weakness and dizziness	42	84
12.	Sneezing	31	62
13.	Breathing Problems	36	72

V. Discussion

The study gives insights into chemical handling practices and related health issues among brinjal growing farmers in Puducherry, union territory of India. This study showed that there were health problems associated with chemical handling practices among brinjal farmers in Puducherry. As the 48.00 per cent of the brinjal farmers belonged to Obesity Class – I with BMI value ranges 30.00 – 34.90 which indicated their vulnerability to illness if pertinently exposed to chemicals and their improper handling practices. Further, the research revealed that 54.00 percent of the respondents were not aware about the protective measures for the use chemicals on their farms, in addition 52.00 per cent of the farmers used face mask followed by only 32.00 per cent of farmers used polybags to hand cover while applying the chemicals and hence this paved the way for the brinjal growing farmers in the studied region suffered from burning and 84.00 per cent of the farmers have showed the weakness and dizziness. This result supports the reports that documented about a million people are being poisoned by chemical exposures that resulted to ill health [16].

The hazards experienced by vegetable farmers as shown in this study indicated that 70.00 per cent of the brinjal growing farmers in Puducherry, union territory, do not engage labour in their farming activities, implying that they are mostly having less land holding for them. This implies that these small and marginal farmers are more prone to chemical exposure due to self-involvement with the chemical handling and lack of training on their usage. This assumption supports the report given by WHO (1996), which mentioned that the major part of chemical toxicities and their consequences are due to usage of those chemicals by small-scale farmers without having sufficient knowledge on chemical handling and not wearing appropriate clothing during chemical application to their brinjal crop.

In addition, only 26.00 per cent of the farmers had the habit of reading the label of instructions on pesticide containers. There are safety precautions that should be taken during pesticide application like avoid eating, drinking or smoking when handling chemicals. Moreover, the lack of safety practices, such as not wearing face masks and covering the hands with polybags, need to be rectified and following the practices of taking bath and washing the hands with soap properly need to be inculcated after handling chemicals to avoid that could be a major source of exposure for other people in the household [12].

Future scope of the study

The future scope of this study includes conducting longitudinal research to evaluate changes in farmers' behavior and knowledge after awareness or training programs on safe pesticide handling. It also emphasizes developing and implementing sustainable pest management practices and promoting organic or eco-friendly alternatives. Further studies can analyze the socio-economic and health impacts of unsafe chemical use, identify barriers to adopting safety measures, and design policy interventions tailored to local contexts. Additionally, integrating digital extension tools and mobile-based advisory services can enhance real-time guidance, ensuring improved safety, productivity, and environmental sustainability among brinjal growers in Puducherry.

VI. Conclusion

It can be concluded from the study that farmers in Puducherry were facing several health issues regarding chemical handling in brinjal cultivation. Therefore, there is a need to take measures to increase the knowledge of brinjal farmers on chemical handling. This can be done through conducting improved training and providing them with information on the usage of optimum quantities of chemicals from agricultural universities and extension workers. In addition, adequate extension supports also need to be provided to create awareness on use of personal protective measures among brinjal growers while handling chemicals. There is also a need to encourage them to go for bio-pesticides and organic farming and it is also necessary to motivate them to adopt Integrated Pest Management (IPM) that reduces the quantity of chemicals used and exposure to them.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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