A COMPREHENSIVE ANALYSIS OF CHEMICAL APPLICATIONS FOR ENHANCED CULTIVATION OF OPTIMIZING BRINJAL CROP

ABSTRACT

Brinjal is one of the most popular tropical vegetables grown in India. The damage caused by the Shoot & Fruit Borer and other major pests is estimated to range between 50.00 and 70.00 per cent. Out of the sixty-two villages in the Puducherry district, five significant villages that grow brinjal were chosen for a reason created a structured interview schedule for the independent factors and an unstructured questionnaire for the dependent variables. Direct, arranged, in-person interviews were used to gather data. A range of appropriate and standardised statistical tools were used to evaluate the data. Three dependent variables and fifteen independent factors are present. The evaluation of chemicals utilised in brinjal production, methods for handling chemicals, and effects on human health. Data for the current study were gathered in the study area by a deliberate non-probability sampling strategy, utilising an Ex-post Facto research design. The farmers in the chosen sample utilised the chemicals as organic manure, fertilisers, insecticides, micronutrients, and regulators of plant growth. For the grading variable, the coefficient of correlation between the independent variable and Pesticide (Y3) was substantial for the farm power variable, it was the most significant. For the variables related to agricultural mechanisation and education, the coefficient of correlation between the independent variable and micronutrient (Y4) was substantial.

Keywords: Brinjal cultivation, chemical use, fertilizers, micro-nutrients and pesticides.

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1. INTRODUCTION

The purple, green, or white pendulous fruit of the soybean plant *Solanummelongena L.*, generally known as aubergine, makes it one of the most significant vegetables cultivated nationwide. Appearing closely related to potatoes and tomatoes, it is a member of the Solanaceae family. India is the birthplace of eggplants. In southern and eastern Asia, it has been grown. Now, after potatoes and tomatoes, brinjal aubergine comes in third. Although aubergine, sometimes known as "the king of vegetables," is still considered unusual in Poland and many other Central European nations, it is a rich and vital source of nutrition throughout Asia and the Mediterranean. Approximately 8 million farmers cultivate brinjal in the nation, meeting the needs of over 160 million individuals (Raza*et al.*, 2018). Brinjal (Solanummelongena L.) is grown extensively (1.86 million ha) globally, with an annual production of 54.08 million tonnes valued at over US$10 billion (reference needed). Almost 84 per cent of Brinjal production is concentrated in China (61%), followed by India (23%) (reference needed). Brinjal cultivation in India covers 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 (reference needed). In Chhattisgarh, brinjal is grown on 35,173 hectares with an annual production of 6,42,335 metric tonnes and a productivity of 18.26 metric tonnes of fruits per hectare, which is lower than the national average (Mishra *et al*., 2023). The nature of vegetables being a higher productivity nature in a short duration with a valuable source of income generation for the improvement of livelihood (Singh *et al*., 2023). The area under cultivation for vegetables and fruits is estimated at 10.86 million hectares and 09.60 million hectares, respectively (APEDA, 2023). Harmful synthetic chemical pesticides have been applied extensively in India to lower early brinjal fallout and boost yield. Pesticides are frequently administered indiscriminately and at high concentrations without the intended purpose being known. Premature brinjalfall prevention is becoming more and more

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dependent on controlling fungus and insect attacks across the entire nation. Insect assaults are a contributing factor to the low yield and subpar quality of brinjal produced. The fruit and shoot borer (FSB), an extremely destructive insect pest that conventional insecticides are unable to successfully control, causes regular and significant losses to brinjal crops. The Fruit and Shoot Borer (FSB) insect is a fact of life for brinjal growers in India. Farmers are forced to apply pesticide 80–100 times during a single planting season in order to protect their brinjal (Reference needed). However, farmers are forced to try using insecticides to control infestations when they are severe. The World Health Organization (WHO) report that 20.00 per cent of pesticide use in the world is concentrated in developing countries posing a danger to human health and the environment. Families residing in agricultural areas were found to have elevated levels of pesticides in their bodies (Afari-Sefa*et al*., 2015). This study gives the clear analysis of organic and inorganic chemicals, their association with socio-economic profile of brinjal growers which knows the behavioural knowledge of farmers. The main objectives of the study are the chemical use patterns of brinjal farmers and correlation between chemicals usage and profile characteristics of brinjal farmers.

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2. MATERIALS AND METHODS

2.1 Study Area

Four districts, spread across many Indian states, situated ofPuducherry's union territory. They are Yanam in Andra Pradesh, Mahe in Kerala, Puducherry, and Karaikal in Tamilnadu. The purposeful selection of the study location was in the Puducherry district of Puducherry, which has a higher number of farmers and a brinjal cultivation region than other districts within the Union Territory of Puducherry. Five communities out of 62 that cultivate brinjal have been chosen; each village has ten samples, for a total of 50 samples chosen. Koonichampet, Manalipet, Sellipet, Sorapet, and Thirukkanur are the names of them. The union territory of

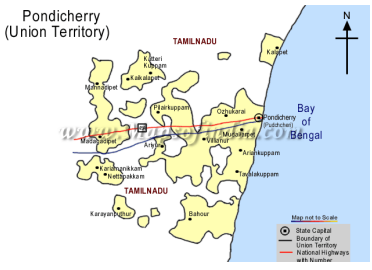
Puducherry contains the latitude and longitude of Koonichampet (11°59'28"N 79°38'18"E), Manalipet (12°01'28"N 79°37'52"E), Sorapet (11°57'21"N 79°39'22"E), Sellipet (11°56'58"N 79°41'50"E), and Thirukkanur (11°59'46"N 79°38'29"E).

2.2 Research Design

Ex-post facto design and purposive sample techniques were used in this investigation. If the sample farmers are excluded, there were ten samples in all that participated in the pre-test interviews. Following the pilot study, recommendations and edits were crucial in order to determine whether or not the questions were appropriate. It was helpful, on time, and had a clear objective. Farmers who grow brinjal provided information through in-person interviews. There are both closed-ended and open-ended questions on the Schedule that are based on actual needs. In order to obtain first-hand information for the research study, the data was collected through interpersonal or face-to-face communication. Every interview schedule verifies and double-verifies the information provided by farmers who grow brinjal. Sample farmers provided the data, which were then analysed using statistical software that can be utilised in Microsoft Excel for data analysis. After that, the data analysis could be developed into an objective-oriented form, which was necessary for tabulation, graphic representation, categorization, and quantitative numeric forms.

2.3 Statistical analysis

Frequency, Arithmetic Mean, Standard deviation (S.D), Pearson's Correlation Coefficient (r), and't'– test.



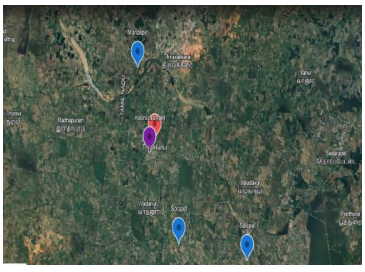


Figure 1: Map of selected districts

Figure 2: Pin point the selected villages using Google earth

3. RESULT AND DISCUSSION

The mean, percentage, pearsons' correlation coefficient (r value), and "t" test are among the study's findings. The greatest amounts of organic manures should be administered in a smaller quantity than what is advised. More fertilizers than is advised being applied. More micronutrients were used than were advised. In the same way, plant growth regulator was applied in higher amounts than advised. a group of chemicals used as pesticides that are applied in amounts that are either the same or less than those that are advised.

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Table 1: Application of organic and inorganic chemicals used in brinjal crop Cultivation in Puducherry

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Sl. No	Application of Chemicals	(Kg / Acre)			
		Recommend	Mean	Maxi	Mini
A.	**Organic Manure**				
1.	Farm Yard Manures	1000	345	750	250
2.	Vermi-compost	500	432	750	300
B.	**Fertilizers**				
1.	Fractomphos (19:19:0:13)	400	777	1250	300
2.	DAP (18:46)	100	154	200	100
3.	Complex (IPL- All -17)	400	184	200	100
C.	**Micro-Nutrient**				
1.	Sulphur	0.5	1.58	2	1
2.	Boron	0.15	0.341	0.5	0.3
D.	**Plant Growth Hormone**				

1.	Gibberlic Acid – 0.001%	0.1	0.1907	0.25	0.125
E.	**Pesticides**				
	Organophosphate				
1.	Monocrotophos	0.35	0.358	0.4	0.3
2.	Choloropyriphos 20% EC	0.25	0.2505	0.3	0.2
3.	Acephate 75% SP	0.25	0.2655	0.35	0.2
	Pyrethroids				
4.	Cypermethrin 25% EC	0.25	0.261	0.3	0.25
	Benzene Dicarboxiamides				
5.	Flubendamide 20% w/w	0.1	0.1025	0.125	0.1
	Neo-Nicotinoid				
6.	Imidacloprid 17.8% SL	0.1	0.1007	0.125	0.05
7.	Acetamiprid 20% SP	0.1	0.1415	0.2	0.1
8.	Thiamethoxam 25%WG	0.1	0.0995	0.125	0.075
	Avermectin				
9.	Emamectin Benzoate 5%SG	0.1	0.1161	0.175	0.1
10.	Dimethoate 30% EC	0.25	0.2476	0.35	0.2
11.	Profonophos 50% EC	0.25	0.261	0.3	0.25
12.	Flonicamide 50% w/w	0.15	0.13	0.2	0.1
13.	Phenthoate 50% EC	0.25	0.245	0.25	0.2
14.	Chloranthranil 18.5% w/w SC	0.05	0.0516	0.06	0.05
15.	Propargite 57% EG	0.25	0.243	0.25	0.2
	Phenyl pyrazole				
16.	Fipronil 5%SC	0.25	0.239	0.25	0.2

	Fungicides				
17.	Carbendazim 50% WP	0.25	0.249	0.275	0.2
18.	Difenoconozole 25% EC	0.1	0.117	0.8	0.1
19.	Copper Oxy Chloride 50% WP	0.5	0.494	0.5	0.45
20.	Azoxystrobin 8.3%WG+ Mancozeb 66.7% WG	0.25	0.2445	0.25	0.225

(Source: Primary and Secondary data)

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Table 2 demonstrated that, at significant 1 percent and 5 percent, there was no positive coefficient of correlation (r value) between the application of organic manure (Y1) and the independent variables (X1 to X15). The application of organic manures was positively and non-significantly correlated with the independent variables of age, family size, house type, maternal possession, technology adoption of television, smart phone, and two-wheeler, irrigation, farm mechanisation and impersonal cosmopolitate in source of information, and social participation.

Table 2: Coefficient of correlation (r value) between application of organic manure (Y_1) and independent variables (X_1 to X_{15}) (n = 50)

X	**Variables**	**Y_1**	
		Pearson's Correlation Coefficient (*r* value)	***p* value**
1.	Age	0.153^{NS}	0.289
2.	Caste	-0.188^{NS}	0.191
3.	Occupation	-0.108^{NS}	0.454
4.	Education	-0.079^{NS}	0.583
5.	Land	-0.21^{NS}	0.143

6.	Family: Type	-0.052 ^{NS}	0.72
	Family: Size of Family	0.044 ^{NS}	0.761
7.	House	0.126 ^{NS}	0.385
8.	Farm Power	-0.034 ^{NS}	0.814
9.	Maternal possession	0.246 ^{NS}	0.085
10.	Grading	-0.147 ^{NS}	0.307
11.	Technology Adoption:		
	Radio	-0.169 ^{NS}	0.242
	Television	0.005 ^{NS}	0.971
	Smart Phone	0.078 ^{NS}	0.59
	Two-Wheeler	0.002 ^{NS}	0.991
	Car	0.00 ^{NS}	0.00
12.	Irrigation	0.26 ^{NS}	0.068
13.	Farm Mechanization	0.059 ^{NS}	0.682
14	Source of Information:		
	a. Impersonal Cosmopolite	0.067 ^{NS}	0.643
	b. Personal Cosmopolite	-0.037 ^{NS}	0.799
	c. Personal Localite	-0.009 ^{NS}	0.951
15.	Social Participation	0.218 ^{NS}	0.128

* *p* value less than 0.05 implies that correlation is significant at 5 %
** *p* value less than 0.01 implies that correlation is highly significant at 1 %
NS - Non-Significant

However, there was a negative and non-significant link found between the application of organic manures and caste, occupation, education, land holding, family type, farm power, grading, technology adoption of radio, personal cosmopolite, and personal localite.

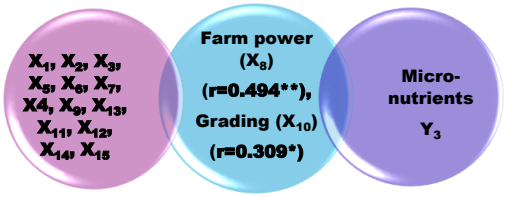
Table 3: Coefficient of correlation (r value) between application of fertilizers (Y_2), Micro-nutrient (Y_3), Pesticides (Y_4), Plant Growth Regulator(Y_5)and independent variables (X_1 to X_{15}) (n = 50)

X	Variables	Y_2		Y3		Y4		Y5	
		Pearson's Correlation Coefficient (*r* value)	***p* value**	**Pearson's Correlation Coefficient (*r* Value)**	***p* value**	**Pearson's Correlation Coefficient (*r* value)**	***p* value**	**Pearson's Correlation Coefficient (*r* value)**	***p* value**
1.	Age	0.118 ^{NS}	0.414	0.199 ^{NS}	0.165	0.019 ^{NS}	0.898	-0.185 ^{NS}	0.198
2.	Caste	0.128 ^{NS}	0.376	-0.05 ^{NS}	0.731	0.062 ^{NS}	0.669	0.163 ^{NS}	0.257
3.	Occupation	0.01 ^{NS}	0.945	-0.194 ^{NS}	0.177	0.003 ^{NS}	0.985	0.325*	0.021
4.	Education	0.063 ^{NS}	0.663	-0.146 ^{NS}	0.313	-0.299*	0.035	-0.063 ^{NS}	0.664
5.	Land	0.091 ^{NS}	0.529	0.035 ^{NS}	0.81	0.229 ^{NS}	0.11	0.264 ^{NS}	0.064
6.	Family: Type	0.006 ^{NS}	0.968	-0.001 ^{NS}	0.993	-0.109 ^{NS}	0.452	-0.136 ^{NS}	0.348
	Size of Family	0.005 ^{NS}	0.972	-0.245 ^{NS}	0.087	0.057 ^{NS}	0.696	-0.176 ^{NS}	0.221
7.	House	-0.008 ^{NS}	0.956	0.186 ^{NS}	0.196	0.053 ^{NS}	0.713	0.001 ^{NS}	0.997
8.	Farm Power	-0.267 ^{NS}	0.061	0.494**	0	0.025 ^{NS}	0.864	0.310*	0.028
9.	Maternal possession	-0.122 ^{NS}	0.398	-0.079 ^{NS}	0.587	-0.191 ^{NS}	0.184	0.104 ^{NS}	0.471
10.	Grading	-0.211 ^{NS}	0.141	0.309*	0.029	-0.141 ^{NS}	0.329	-0.018 ^{NS}	0.903
11.	Technology Adoption:								
	Radio	-0.039 ^{NS}	0.785	-0.243 ^{NS}	0.089	-0.156 ^{NS}	0.279	0.001 ^{NS}	0.993

	Television	0.143 NS	0.321	-0.21 NS	0.143	0.171 NS	0.235	-0.136 NS	0.347
	Smart Phone	-0.091 NS	0.532	0.073 NS	0.614	0.123 NS	0.394	0.072 NS	0.62
	Two-Wheeler	-0.004 NS	0.981	-0.137 NS	0.342	-0.173 NS	0.229	-0.072 NS	0.618
	Car	0.00	0.00	0.00 NS	0.00	0.00	0.00	0.00	0.00
12.	Irrigation	0.237 NS	0.097	0.057 NS	0.695	-0.058 NS	0.689	0.131 NS	0.363
13.	Farm Mechanization	0.213 NS	0.137	-0.017 NS	0.908	-0.289*	0.042	-0.166 NS	0.25
14.	Source of Information:								
	a. Impersonal Cosmopolite	0.079 NS	0.585	0.17 NS	0.237	0.076 NS	0.599	-0.094 NS	0.518
	b. Personal Cosmopolite	-0.139 NS	0.336	-0.056 NS	0.7	-0.084 NS	0.563	0.105 NS	0.468
	c. Personal Localite	-0.239 NS	0.094	0.16 NS	0.268	-0.068 NS	0.638	0.281*	0.048
15.	Social Participation	0.066 NS	0.647	0.106 NS	0.464	-0.117 NS	0.419	0.067 NS	0.646

* *p* value less than 0.05 implies that correlation is significant at 5 %
** *p* value less than 0.01 implies that correlation is highly significant at 1 %
NS – Non - Significant

Figure– 3: Coefficient of correlation (*r* value) between application of Micro-nutrients (Y_3)

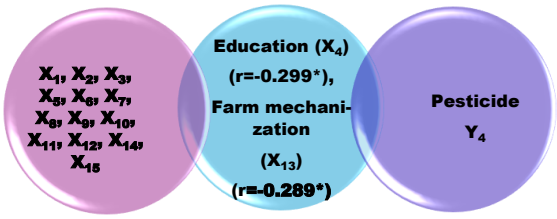


and independent variables (X_1 to X_{15})

It is clear that the application of fertilizers was positively and non-significantly correlated with age, caste, occupation, education, land, family type, family size, television in the adoption of technology, irrigation, farm mechanisation, impersonal cosmopolitate in the source of information, and social participation. In contrast, there was a negative and non-significant link between the application of fertilisers and the following factors: house, farm power, maternal possession, grading, radio, smart phone, two-wheeler in terms of technology adoption, personal cosmopolitate, and personal localite in terms of information source.

It is clear from Fig. 3 that the application of micronutrients has the most significant correlation coefficient with the independent variable of farm power. Grading's independent variable and the application of micronutrients are significantly correlated. The application of micronutrients was positively and non-significantly correlated with independent variables such as age, land, house, farm power, grading, and adoption of smart phones in technology, irrigation, impersonal cosmopolite, personal localite, and social involvement. In contrast, the application of micronutrients was negatively and non-significantly correlated with caste, occupation, education, family type, size, mother possession, radio, and television, two-wheeler in technology adoption, agricultural mechanisation, and personal cosmopolitate.

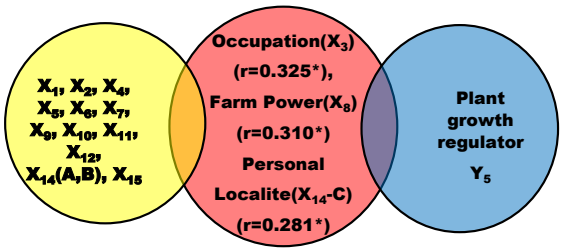
Figure 4: Coefficient of correlation (*r* value) between application of Pesticides (Y_4) and



independent variables (X_1 to X_{15})

Figure 4 it is obvious that the independent variables of farm mechanisation and education have a considerable impact on pesticide use (Y4). The usage of pesticides was positively and non-significantly correlated with independent factors such as age, caste, occupation, land, family size, house, farm power, television, and smart phone in terms of technological adoption and impersonal, cosmopolitan information sources. In contrast, there was a negative and non-significant link found between the use of pesticides and factors such as education, family type, maternal possession, grading, adoption of radio and two-wheelers, irrigation, agricultural mechanisation, personal cosmopolitate, and personal localite as information sources.

Figure 5: Coefficient of correlation (*r* value) between application of Plant growth regulators



(Y_5) and independent variables (X_1 to X_{15})

Figure 5 it is clear from the information source that the independent variables of employment, farm output, and personal location significantly correlate with the use of plant growth regulators ('Y5'). The use of plant growth regulators was positively and non-significantly correlated with independent variables such as caste, occupation, land, house, farm power, maternal possession, irrigation, personal cosmopolitate, personal localite in source of information, and social participation. In contrast, the following independent variables affect the adoption of technology: television, two-wheelers, age, education, family size, type, and status; agricultural mechanisation; and impersonal, cosmopolitan information sources.

According to this study, farmers that grow brinjal applied both inorganic chemicals and organic manures to prevent most pests and diseases. The majority of farmers employed chemicals in excess of what was advised, according to Table 1. obtaining data on the patterns of chemical use from locals and dealers in local input shops. Both acute and long-term human health are impacted. The knowledge acquired would offer a broad viewpoint on the steps involved in conducting research. As a result, research can be planned with measured risk, taking future issues into account. A thorough analysis of the literature was done for the current study, and several pertinent concepts were grouped to choose the dimensions. The findings of the result of chemical handling practices followed by farmers is similar to the research of Kumari and Basavaraja (2018).

4. CONCLUSION

Fertilizer consumption is high in the Union Territory of Puducherry, compared to other Indian states and union territories. Chemicals in form of fertilizers, pesticides, plant growth regulators, and micronutrients areused in agricultural and horticultural crops. Most chemicals are recommended by shop dealers; however, farmers are unaware of recommended

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doses and chemical handling practices. The optimization of brinjal crop yield in Puducherry is based on a balanced chemical application strategy that combines scientific knowledge with practical field management techniques. Continuous research, extension services, and farmer education are all required to promote sustainable agricultural practices and ensure the long-term viability of brinjal cultivation in the region. Indian vegetable cultivation reflected both a glorious past and a bright future.

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