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ADOPTION OF PLANT PROTECTION PRACTICES BY PADDY GROWERS

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ABSTRACT

*Paddy, a staple crop in India, faces substantial challenges from pests and diseases, which can severely impact yields and lead to economic losses for farmers. Effective plant protection practices are essential for reducing these risks and ensuring food security. However, many farmers lack awareness and access to the latest plant protection techniques, resulting in limited adoption of these methods and increased crop vulnerability. Addressing this gap requires a focused approach to information dissemination, technology transfer, and capacity building to promote sustainable, cost-effective protection practices. This study examined the adoption of plant protection practices among paddy growers in Valsad district of Gujarat State, using a sample of 150 farmers selected through multistage random sampling. Data were gathered through personal interviews, analyzing thirteen independent variables, with adoption as the dependent variable. Findings showed that Majority of respondents had medium mass media exposure (62.00%), medium fatalism (62.67%), medium level of risk orientation (66.00%), medium Economic motivation 68.67% and medium management orientation (74.00%); half or nearly half of the respondents were in the category of medium-sized land holdings (46.67%), scientific orientation (50.00%), middle-aged (52.00%), innovativeness (52.00%), Decision-making ability (53.34%) and moderate annual incomes (58.67%), whereas, nearly one third of respondents demonstrated primary education (30.67%) and had membership in one organization (37.33%). Results also revealed that the majority (66.67 %) of respondents had a medium level adoption of plant protection practices of the paddy crop. In case of practice-wise adoption, the flooding method for controlling weeds secured **the** highest rank with 83.33 per cent of paddy growers. Key factors influencing viz; risk orientation (r=0.447), mass media exposure (r=0.585), scientific orientation (r=0.717) and management orientation (r=0.276), decision-making skills (r=0.543), economic motivation (r=0.520), and innovativeness (r=0.430) had a significant influence on the adoption of plant protection practices of paddy crop. Conversely, age (r=-0.270) had a negative correlation, while fatalism (r=-0.016) showed a non-significant relationship. These insights highlight the need to encourage paddy growers to adopt plant protection practices.*

Keywords: *paddy crop, adoption, plant protection practices, valsad, gujarat*

INTRODUCTION

Agriculture is a cornerstone of India's economy, supporting the livelihoods of millions and contributing significantly to national development. Among the staple crops, paddy holds a central place, serving as a primary food source for much of the population. However, paddy cultivation in India faces significant challenges, particularly from pests and diseases that threaten crop yields. Addressing these issues through effective plant protection practices is essential to ensure food security and enhance agricultural productivity. The state of Gujarat, and specifically the Valsad district, is a notable region for paddy cultivation. However, farmers in Valsad encounter various obstacles that impact their ability to protect and maintain healthy crops. Factors such as pest infestations, disease outbreaks, climate variability, and limited access to advanced plant protection technologies hinder yield potential. As reported by Kumar et al. (2023), in India pest causes 33% production loss in rice crop, the major pest weed causes 12.5 per cent whereas insect 9.5 per cent and disease 6.5 per cent besides other pests 4.5 per cent. Therefore, minimizing the pest losses can be the most important approach to increased productivity.

Over the years, various plant protection practices have been developed to address these threats, including the use of bio-pesticides, pheromone traps, and integrated pest management (IPM) techniques. However, there exists a wide gap in the adoption of these techniques among farmers, often due to factors such as insufficient knowledge, lack of training, and resource constraints (Vinaya and Tapan, 2023). For small-scale farmers, the cost and complexity of adopting

modern protection methods can be prohibitive, particularly for practices that require initial investment or specialized knowledge. As a result, many farmers continue to rely on traditional methods, which may be less effective in managing pest and disease pressures sustainably.

Increasing the adoption of modern plant protection practices is crucial for enhancing paddy yield and farmer resilience. Addressing the knowledge gap, building capacity, and fostering access to sustainable, cost-effective plant protection solutions can empower farmers to minimize yield losses and reduce the economic risks associated with pest and disease outbreaks. This study, therefore, aims to identify key areas where intervention is needed to support farmers in adopting better protection measures, ultimately contributing to sustainable agricultural development in Valsad and similar regions. This investigation will serve as a basis for developing targeted extension programs and policies to strengthen paddy production and ensure the stability of local agricultural livelihoods. Considering this, the present research is designed to assess the extent of adoption of plant protection practices among paddy growers in Valsad district.

OBJECTIVES

(1) To study the characteristics of the paddy growers

(2) To measure the extent of adoption of plant protection practices by paddy growers

(3) To ascertain the relationship between the profile of growers and their adoption of plant protection practices of the paddy crop.

METHODOLOGY

This study was conducted in the Valsad district, Gujarat, aiming to assess paddy growers' adoption of plant protection practices and the factors influencing it. An ex-post-facto research design was employed with a sample of 150 paddy growers selected through multistage random sampling. First, three talukas—Valsad, Vapi, and Dharampur—were chosen randomly from Valsad district's six talukas. Then, five villages per taluka were selected via lottery: Muli, Hariya, Dived, Chanvai, and Dungri from Valsad; Chhiri, Rata, Kaval, Morai, and Pandor from Vapi; and Bilpudi, Bamti, Luheri, Gadi, and Khoba from Dharampur. In each village, 10 paddy growers were randomly chosen, totalling 150 respondents. Data were collected using a structured interview schedule covering paddy growers' profiles—age, education, landholding, income, risk orientation, social participation, media exposure, scientific orientation, management and decision-making abilities, innovativeness, economic motivation, and fatalism as independent variables and attitude of growers about plant protection practices of paddy crop as dependent variable. The study also analysed the relationship between growers' adoption of plant protection (dependent variable) and the profiles (independent variables) to understand their influence on adoption levels. Data were analyzed in accordance with the study's objectives using IBM SPSS Statistics 20, frequencies, proportion, ranking, Pearson's correlation coefficient, mean, standard deviation and t-test were worked out for valid results and reliable interpretation.

RESULTS AND DISCUSSION

Characteristics of paddy growers

More than half (52%) of the respondents were in the middle age category, while 30% were in the old age group and 18% were young. It may be due to the fact that in rural India, particularly among tribal families, the eldest brother often assumes leadership in the family after the father, influencing all major decisions, including those related to farming. This cultural hierarchy may limit the involvement of younger members, many of whom are less interested in agriculture as a livelihood.

Educationally, the largest proportion (30.67%) had primary school education, followed by those with high school (24%), middle school (17.33%), college/postgraduate (13.33%), functionally literate (11.34%), and illiterate (3.33%) backgrounds. This limited educational attainment can be attributed to the tribal background of many farmers, poor economic conditions, and inadequate educational infrastructure in rural and tribal areas. Moreover, those with higher education often migrate to urban centers in search of better-paying jobs, leaving behind less-educated farmers to continue agriculture.

Regarding landholding, nearly half (46.67%) had medium-sized holdings, while smaller proportions had small (24%), large (16%), and marginal (13.33%) holdings. In terms of annual income, a majority (58.67%) fell into the medium-income category, followed by low (28.67%) and high (12.67%) income groups. It indicates that most respondents

possessed small to medium landholdings and medium annual income. This is largely due to land fragmentation resulting from family divisions and the generally poor economic conditions of the tribal population. Consequently, their medium land size directly influenced their medium level of annual income, as smaller farms tend to yield lower profits.

Psychologically, the majority (66%) of respondents exhibited a medium level of risk orientation, with smaller groups showing low (18.67%) and high (15.33%) levels. Regarding mass media exposure, more than half (62%) had medium exposure, while 38% and 20.67% had low and high exposure, respectively. Similarly, half (50%) demonstrated medium scientific orientation, followed by 27.33% with high and 22.67% with low levels. The data also indicated that a majority (74%) of respondents had medium management orientation, whereas 14% and 12% showed high and low orientations, respectively. In terms of psychological factors, most respondents exhibited medium levels of risk orientation, mass media exposure, scientific orientation, and management ability. These moderate levels may be influenced by limited financial resources, average education, and traditional belief systems prevalent in tribal societies. For example, many farmers attribute natural events to divine forces, reducing their scientific outlook. However, the availability of television, newspapers, and mobile phones has improved access to information, even in remote villages.

Decision-making ability was medium in 53.34% of respondents, high in 25.33%, and low in 21.33%. In terms of innovativeness, over half (52%) exhibited a medium level, followed by 25.33% with low and 22.67% with high innovativeness. Study revealed that innovativeness among farmers remained moderate to low, possibly because of limited exposure to new technologies and moderate educational attainment.

Also, Economic motivation was medium among 68.67% of respondents, with 20% showing low and 11.33% high motivation. Findings about economic motivation can be inferred that large number of respondents possessed medium economic motivation. The probable reason for above situation might be due to the fact that majority of the respondents considered their profession as more remunerative as compared to other professions.

In social participation, around 37.33% had membership in one organization, 28.67% had none, 26.67% were members of more than one, and only 7.33% held positions in organizations. Results revealed that social participation among respondents was relatively active, as many were members of local organizations such as milk cooperatives, village panchayats, and farmer groups. Such participation likely encouraged greater awareness and collective action. Finally, the majority (62.67%) demonstrated medium fatalism, while 26.67% had high and 10.66% had low levels attributed. The probable reason for the moderate level of fatalism among paddy growers in Navsari district might be that most farmers belong to tribal and rural backgrounds where traditional beliefs and customs are strong.

Extent of adoption assessment of paddy growers regarding plant protection practices

Table 1: Distribution of the respondents according to their adoption of plant protection practices

(n=150)

Sr. No.	Categories	Frequency	Percent
1	**Low** (Up to 52.73 score)	27	18.00
2	**Medium** (52.73 to 58.61 score)	100	66.67
3	**High** (Above 58.61 score)	23	15.33
Mean = 55.67			SD = 2.94

Data from Table 1 about the extent of adoption of plant protection practices of paddy crop indicated that the majority (66.67 %) of respondents had medium level adoption of plant protection practices of paddy crop, followed by 18.00 per cent and 15.33 per cent of them who had high and low level adoption of plant protection practices of paddy crop, respectively.

In general, the majority of the respondents had medium to low adoption of plant protection practices of the paddy crop. The probable reason for the above findings might be due to their medium land holding, social participation, economic motivation and medium to low knowledge about plant protection practices of paddy crop. This finding is in support of the findings revealed by Nath *et al.* (2020), Jat *et al*. (2020) and Patel and Patel (2022), but in contract to findings of Patel *et al.* (2020).

Practice-wise adoption of plant protection practices by the paddy growers

Table 2 : Distribution of respondents according to practice-wise adoption of plant protection measures in paddy cultivation (n=150)

Sr. No.	Parameter	*f**	%tage*	Rank
1	Use of pest/disease-resistant varieties	45	30.00	XVIII
2	Deep ploughing during summer to kill pupa and larva in the soil	80	53.33	IX
3	Destroying the stables and roots of previous crop to control pests/diseases	39	26.00	XX
4	Draining the field to control pests	28	18.67	XXIII
5	Seed treatment	56	37.33	XVII
6	Collect and destroy the egg masses and larvae	00	00.00	XXVIII
7	Adjusting sowing/transplanting time of rice to escape the period of pests/diseases attack	91	60.67	V
8	Clipping of rice seedling tips at the time of transplanting to minimize carryover of rice hispa and case worm infestation from nursery to field	15	10.00	XXVI
9	Use of coir rope in rice crop for dislodging case worm and leaf folder larvae	00	00.00	XXIX
10	Use of light trap	20	13.33	XXV
11	Use of pheromone trap	27	18.00	XXIV
12	Use of bird scatter	00	00.00	XXX
13	Use of bio-control agents	31	20.67	XXII
14	*Application of Trichogramma japonicum* for rice stem borer and *Trichogramma chilonis* of leaf folder	42	28.00	XIX
15	Application of pesticides/fungicides in the morning/ evening	71	47.33	XI
16	Use of Monocrotophos to control stem borer/thrips/gall midge	69	46.00	XIII
17	Use of Monocrotophos/Chloropyriphos/ Quinalphos @0.5 kg a.i. /ha to control leaf folder	70	46.67	XII
18	Use of Phosphamidon/ Carbaryl/ Monocrotophos @0.5 kg active ingredient. /ha to control Green leafhopper	90	60.00	VI
19	Use of 800 ml Quinalphos 25 EC in 100 litres of water/acre to control BPH	84	56.00	VII
20	Use of Carbendazim @0.1% or Isoprothione @0.15% to control blast in paddy	96	64.00	II
21	Use of Carbofuran granules @1 kg a.i. /ha to control vector population of Tungro disease	67	44.67	XIV
22	Use of Mancozeb @ 0.25% or Carbendazim 50 WP @ 0.1% to control Brown leaf spot/ Sheath rot	95	63.33	III
23	Use of flooding method to control the weeds in paddy	125	83.33	I
24	Use of Collego Myco-herbicide to control Jointvech in rice fields	32	21.33	XXI
25	Use of recommended weedicides to control weeds in paddy.	57	38.00	XV
26	Spraying of ZnSO4 @5 kg/ha or application of ZnSO4 @25 kg/ha at the time of sowing to control Khaira disease of rice	82	54.67	VIII
27	Purchase of pesticides/fungicides which has proper/ approved labels	72	48.00	X
28	Take precautions for preparing spray solutions to protect your nose, eyes, mouth, ears and hands	93	62.00	IV
29	Use of hand gloves for seed treatment	12	08.00	XXVII
30	Do you make spray solution as per the instruction given on the label on the container before preparing?	57	38.00	XVI

** f =Frequency, %tage = Percentage*

Data presented in Table 2 Result indicate that plant protection practices flooding method for controlling weeds, had secured the highest rank with 83.33% paddy growers because it is a traditional, low-cost, and easily manageable method widely known to farmers and high rainfall and availability of plenty of irrigation water.

Use of carbendazim/isoprothione to control blast (64.00%), use of mancozeb or carbendazim to control brown leaf spot/sheath rot (63.33%), precautions while preparing spray solutions (62.00%), take precautions for preparing spray solutions to protect nose, eyes, mouth, ears and hands (62.00%), adjusting sowing/transplanting time to escape pest/disease attack (60.67%), use of phosphamidon/ carbaryl/ monocrotophos for green leafhopper (60.00%), use of quinalphos for brown plant hopper (56.00%), spraying of ZnSO4 @5 kg/ha or application of ZnSO4 @25 kg/ha at the time of sowing to control *Khaira* disease of rice (54.67%), deep ploughing during summer to kill pupa and larva in the soil (53.33%), and purchase of pesticides/fungicides which has proper/ approved labels (48.00%) were adopted by many paddy growers with rank II, III, IV, V, VI, VII, VIII, IX and X, respectively. Moderate adoption across these practices may be partial awareness, limited technical support, cost considerations, and inadequate extension contact are key underlying factors. Strengthening training, demonstration, and regular advisory services can enhance farmers' confidence and lead to higher adoption of recommended plant protection practices.

On the other hand, plant protection practices *viz*; Application of pesticides/fungicides in the morning/ evening (47.33%), Use of Monocrotophos/Chloropyriphos/ Quinalphos @0.5 kg a.i. /ha to control leaf folder (46.67%), Use of Monocrotophos to control stem borer/thrips/gall midge (46.00%), Use of Carbofuran granules @1 kg a.i. /ha to control vector population of tungro disease (44.67%), Do you use recommended weedicides to control weeds in paddy (38.00%), make a spray solution as per the instructions given on the label on the container before preparing? (38.00%), Seed treatment (37.33%), Use of pests/diseases resistant varieties (30.00%), *Application of Trichogramma japonicum* for rice stem borer and *Trichogramma chilonis* of leaf folder (28.00%), and Destroying the stables and roots of previous crop to control pests/diseases (26.00%) were moderately adopted with XI, XII, XIII, XIV, XV, XVI, XVII, XVIII, XIX and XX, correspondingly. Plausible causes of Low adoption of these practices are mainly due to knowledge gaps, poor access to inputs, labour and time constraints, traditional beliefs, dependence on pesticide dealers, and weak extension support**.** Strengthening training, demonstrations, and input supply channels can significantly enhance the adoption of scientific pest and disease management practices among paddy growers in South Gujarat.

Plant protection practices viz; use of Collego Myco-herbicide to control Jointvech in rice fields (21.33%), use of bio-control agents (20.67%), draining the field to control pests (18.67%), use of pheromone trap (18.00%), use of light trap (13.33%) clipping of rice seedling tips at the time of transplanting to minimize carryover of rice hispa and case worm infestation from nursery to field (10.00%) and use of hand gloves for seed treatment (8.00%) were least adopted by paddy growers with XXI, XXII, XXIII, XXIV, XXV, XXVI, and XXVII, respectively. The probable reasons for the least adoption of use of Collego Myco-herbicide to control Jointvech in rice fields may be attributed to the complexity and poor technical skill required for application. Poor adoption of use of pheromone trap, use of light trap, clipping of rice seedling tips at the time of transplanting to minimize carryover of rice hispa and case worm infestation from nursery to field, use of hand gloves for seed treatment may be due to **l**ow awareness due to weak extension, whereas low adoption of draining the field rice field and may be attributed to high cost, Labour shortage and time constraints and non-use of bio-control agents due to supply gaps**.** On the other hand, not a single paddy grower had adopted Collect and destroy the egg masses and larvae, use of coir rope in rice crop for dislodging case worm and leaf folder larvae, and Use of bird scatter as plant protection practices. Similar results also supported by Patel, et al. (2020).

Relationship between profile of paddy growers and their extent of adoption of plant protection practices of paddy crop

The data in Table 3 results of correlation of coefficient revealed that age (-0.270) was found to have a negative and significant relationship, whereas education (0.227), land holding (0.354), annual income (0.300), risk orientation (0.447), social participation (0.311), management orientation (0.276), decision-making ability (0.543), economic motivation (0.520), mass media exposure (0.585), scientific orientation (0.717), and innovativeness (0.430) showed positively and significantly correlated with the adoption of plant protection practices for the paddy crop at 0.01 level of probability. On the other hand, fatalism (-0.016) had a negative and non-significant relationship with the adoption of plant protection practices for the paddy crop at

Table 3: Relationship between the profile of paddy growers and their extent of adoption of plant protection practices of paddy crop (n=150)

Sr. No.	Independent variables	Correlation coefficient
X_1	**Age**	-0.270**
X_2	**Education**	0.227**
X_3	**Land holding**	0.354**
X_4	**Annual income**	0.300**
X_5	**Risk orientation**	0.447**
X_6	**Social participation**	0.311**
X_7	**Management orientation**	0.276**
X_8	**Decision-making ability**	0.543**
X_9	**Economic motivation**	0.520**
X_{10}	**Mass media exposure**	0.585**
X_{11}	**Scientific orientation**	0.717**
X_{12}	**Innovativeness**	0.430**
X_{13}	**Fatalism**	-0.016^{NS}

(** significant at 0.01 level, NS Non-significant)

0.01 level of probability. Hence, the null hypotheses (H_0) for education, land holding, annual income, risk orientation, social participation, management orientation, decision-making ability, economic motivation, mass media exposure, scientific orientation, and innovativeness were rejected, while the null hypotheses (H_0) for age and fatalism were accepted. Results of relational study of age, education, land holding, annual income, risk orientation, social participation, mass media exposure, scientific orientation and innovativeness with their adoption of plant protection practices of paddy crop also supported by Rathwa and Bochalya (2023); Khodifad et al. (2025); Nath et al. (2024); Das and Bora (2023).

Probable reasons for the negative but significant relationship between the age and the extent of adoption of plant protection practices of the paddy crop indicates that as age increases, the extent of adoption decreases because younger farmers are generally more adaptable, educated, and open to innovations, while older farmers tend to rely on experience and conventional wisdom, leading to a negative correlation between age and adoption of plant protection practices in paddy cultivation. On the other hand, negatively significant relationship between education of paddy growers and their adoption of plant protection practices of paddy crop may be that education enhances knowledge, comprehension, rationality, and openness to innovation, which collectively lead to a higher extent of adoption of recommended plant protection practices among paddy growers.

Similarly, significant relationship of land holding and annual income with adoption of plant protection practices of paddy crop in the study area may be that growers with bigger farms are more likely to adopt recommended plant protection practices because they have more resources and capacity to spend more on recommended pesticides, fungicides, and bio-control agents, as well as on labour for proper application and crop monitoring. Likewise, social participation increases exposure to reliable information, practical demonstrations, and also peer influence, which encourages adoption of scientifically recommended plant protection practices. On the other hand, frequent mass media exposure provides updated technical knowledge, increases awareness, and motivates farmers to adopt plant protection measures effectively.

The significant relationship of management orientation with the adoption of plant protection practices may be due to that growers with highly management-oriented recognize the financial and yield losses due to pest/disease damage and adopt recommended practices to minimize risks, which may lead to higher adoption of management of plant protection practices. Similarly, growers with a scientific orientation are more likely to follow extension advice and recommended practices for pest and disease management and make decisions based on observation, experimentation, and scientific knowledge rather than tradition or hearsay.

The significant relationship exists because risk-oriented paddy growers in South Gujarat are more open, proactive, and willing to invest in scientific plant protection practices, which enhances the adoption of recommended pest and disease management techniques. Their ability to tolerate uncertainty and take calculated risks translates directly into higher adoption levels. In the case of economic motivation, a significant relationship with the adoption of the plant protection practices may be that profit-oriented paddy growers have more awareness, are informed, and willing to invest in measures that ensure higher yield, reduced crop loss, and better financial returns**.** Likewise, the relationship between paddy growers' decision-making ability and their adoption of recommended plant protection practices in South Gujarat was found to be significant. This may be that growers who are better able to make decisions are more likely to understand, evaluate, choose, and correctly apply recommended plant-protection measures. Hence, a significant positive relationship is observed between decision-making ability and the extent of adoption of plant protection practices in South Gujarat.

A plausible explanation for the significant relationship between the innovativeness of paddy growers and their adoption of recommended plant protection practices in South Gujarat is that innovative farmers are more open to new ideas and technologies. They actively seek information from extension agencies, demonstrations, and progressive farmers, which enhances their awareness and confidence in using improved practices. Their willingness to experiment

and accept change enables them to adopt scientific pest and disease management methods more readily than less innovative growers.

Finally, a plausible explanation for the non-significant relationship between the fatalism of paddy growers and their adoption of recommended plant protection practices in South Gujarat could be that most farmers, regardless of their belief in fate or destiny, rely more on practical experience, advice from extension workers, and observable results in the field when making plant protection decisions. Their adoption behaviour may thus be driven by situational factors such as pest incidence, input availability, and economic returns rather than fatalistic attitudes, minimizing the influence of fatalism on their actual farming practices.

CONCLUSION

The study carried out in Valsad district, Gujarat, revealed that most paddy growers (66.67%) had a medium level of adoption of recommended plant protection practices, reflecting a moderate tendency toward scientific pest and disease control. The flooding method for weed management ranked highest (83.33%) because it is simple, traditional, and suited to the region's abundant water availability. Moderate adoption was observed for chemical control methods like fungicides and insecticides, suggesting that factors such as limited awareness, inadequate technical support, and economic constraints hinder full adoption. In contrast, modern eco-friendly methods like bio-control agents, pheromone traps, light traps, and Myco-herbicides were least adopted due to insufficient knowledge, unavailability of inputs, and weak institutional backing. The correlation analysis indicated that factors such as education, landholding, income, social participation, management orientation, decision-making ability, scientific orientation, and innovativeness positively influenced the adoption of plant protection practices. Younger and middle-aged farmers were found more open to new technologies, while fatalistic beliefs did not significantly affect their practical farming decisions. These findings emphasize that adoption behavior is shaped by both socio-economic and psychological factors.

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CONFLICT OF INTREST

All authors express no conflict of interest in any part of the research

IMPLICATIONS

(1) Extension programmes should holistically address both socio-economic and psychological factors by enhancing farmers' education, decision-making ability, and motivation to ensure sustainable paddy production.

(2) Strengthened training, demonstrations, and use of mass media or ICT tools should focus on young and progressive farmers to promote scientific and eco-friendly plant protection practices such as bio-control agents, pheromone traps, and Myco-herbicides.

(3) Ensuring timely input availability, providing financial assistance, and strengthening linkages among research institutions, extension agencies, and farmer organizations will improve technology dissemination and adoption levels.

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