Research Note

Indian Journal of Extension Education
Vol. 60, No. 2 (April–June), 2024, (95-99)

ISSN 0537-1996 (Print)
ISSN 2454-552X (Online)

Constraints Faced by Paddy Farmers in Adoption of Climate Smart Agricultural Practices: A Comparative Study

Ayush Mishra[1]*, Joginder Singh Malik[2] and Bhavesh[3]

[1]Ph.D. Scholar and [2]Professor, Department of Agricultural Extension Education, [3]PG Scholar, Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana, India
*Corresponding author email id: ayush96.mishra@gmail.com

ARTICLE INFO

Keywords: Adoption, Climate change, Climate smart agriculture, Constraints, Farmers, Paddy crop

https://doi.org/10.48165/IJEE.2024.602RN1

Conflict of Interest: None

Research ethics statement(s): Informed consent of the participants

ABSTRACT

The study was conducted in 2023 to identify the major constraints faced by paddy farmers in the adoption of climate-smart agricultural practices in the eastern climactic zone of Haryana. The data was collected with a structured interview schedule from two groups of villages namely climate-smart and non-climate-smart villages randomly selected 120 respondents from four blocks of Karnal and Kaithal districts. The constraints were divided into three categories i.e., economic constraints, socio-personal constraints, and technological constraints. The analysis revealed that technical constraints such as lack of awareness about climate-smart agricultural practices, lack of training, and complexity of climate-smart practices were the major barriers to the adoption of climate smart agricultural practices among the farmers of non-climate smart villages whereas, economic constraints such as increased cost of paddy production, higher initial investments in inputs and lower paddy yields were the most serious constraints faced by farmers in climate smart villages. Furthermore, it was observed that, while there was not much difference in socio-personal and economic constraints faced by both groups of respondents, however, respondents from non-climate smart villages faced a significantly higher degree of technical constraints as compared to the respondents from climate smart villages.

INTRODUCTION

Climate-smart agriculture practices (CSAP) are a comprehensive strategy for sustainable farming that tries to tackle the difficulties caused by climate change, while also assuring food security and environmental sustainability (Wakweya, 2023). It combines three primary goals: boosting agricultural productivity and incomes, strengthening resilience to the effects of climate change, and mitigating greenhouse gas emissions (Aryal et al., 2018). The adoption of climate-smart agricultural methods is crucial for rice crop cultivation, as it is widely recognised as having the most significant environmental impact among primary crops farmed in India (Sarkar et al., 2022). Although there are potential advantages to implementing CSAP, paddy farmers face numerous obstacles that impede their adoption of these methods. One of the major constraints faced by farmers concerning climate smart technologies is the lack of relevant information and expertise about climate-smart agricultural methods (Jasna et al., 2016). Several paddy farmers, particularly those in isolated or resource-limited regions, may lack knowledge of the presence or efficacy of climate smart agriculture approaches (Ghanghas et al., 2015; Singh et al., 2020). The lack of information in this area is generally caused by the restricted availability of extension services, inadequate training programmes, and insufficient distribution of research findings. In the absence of dependable information (Ravikumar et al., 2015), farmers may exhibit reluctance in embracing novel techniques or persist with conventional ones, regardless of their vulnerability to climate change (Singh et al., 2023). Financial limitations also present

Received 15-03-2024; Accepted 22-03-2024

a substantial obstacle to the implementation of CSAP among paddy growers. The implementation of climate-smart technologies and approaches typically necessitates initial investments in infrastructure, equipment, inputs, and training. Nevertheless, numerous paddy farmers operating on small-scale face financial constraints may not have the necessary funds to make such investments (Ghimire et al., 2015). The presence of climate variability and market changes discourages paddy farmers from making investments in CSAP because of the accompanying risk and uncertainty (Kumar et al., 2022). The presence of unpredictable market circumstances and volatile prices can weaken the economic feasibility of investing in climate smart agricultural practices (Zakaria et al., 2020).

Additionally, institutional and policy constraints serve as limiting factors in the implementation of CSAP among paddy farmers. Lack of sufficient government assistance, ineffective extension services, and ambiguous agricultural regulations can hinder farmers' capacity to embrace and maintain climate smart agriculture initiatives (Shelar et al., 2022). Current agriculture policies and subsidy programmes may prioritise conventional farming methods over climate-smart strategies, maintaining the existing state of affairs and impeding progress and creativity (Aggarwal et al., 2018). Farmers' decision-making about the adoption of climate smart agricultural practices is also influenced by social and cultural aspects (Naik et al., 2022). Farmers' perspectives of risk, creativity, and collaboration can be influenced by traditional beliefs, social norms, and cultural practices (Singh et al., 2017). The adoption of smart practices by farmers can be hindered by resistance to change, distrust in new technologies, and societal pressures to adhere to traditional standards (Kumbhare & Singh, 2016; Mishra et al., 2022).

METHODOLOGY

The study was conducted in the eastern climatic zone of Haryana which is a major paddy-producing region in India based on the total production and productivity. Two districts namely Karnal and Kaithal were purposively selected based on the highest productivity of paddy crops among the districts of eastern Haryana. Further two blocks were randomly selected from each district and in each block two villages, one climate smart village (CSV) and one non-climate smart village (Non-CSV) were selected. A climate smart village is one of the 250 villages that have been identified under the Climate Smart Village project started by the Department of Agriculture and Farmer's Welfare, Government of Haryana in 2016 to build agricultural resilience through adopting a community-based approach (Anonymous, 2016). A non-climate smart village is any village other than the 250 villages selected under the project. Fifteen paddy growers were randomly selected from each village, thus a total sample size of 120 respondents, that is 60 respondents from four climate smart villages and 60 from non-climate smart villages were personally interviewed for the study. The constraints were categorized under three categories vis, economic constraints, socio-personal constraints and technological constraints. The responses were obtained on a three-point continuum signifying the degree of that particular constraint, i.e., very serious, serious and not so serious. Also, weighted mean score for each of the constraint was obtained by dividing the total weighted score with the number of respondents. The ranking of constraints was done based on the weighted mean score, obtained for each constraint. The respondents were classified into three categories based on degree of constraints faced by them, i.e. high, moderate and low. The classification was done by using the mean and standard deviation. Furthermore, an independent sample t-test was conducted to find out if there was a significant difference in the degree of constraints faced by farmers from climate smart villages to that of non-climate smart villages.

RESULTS

Constraints faced by paddy farmers in the adoption of climate smart agricultural practices

The data in Table 1 and Table 2 reveal that the communication gap among farmers is the most serious socio-personal constraint faced by respondents in climate smart villages followed by a lack of trust in the effectiveness of climate smart agricultural practices and the inability to take risks by the respondents, whereas cultural inability and inability to accept new practices or technologies were the least serious constraint faced by the respondents in climate smart villages (CSV). For respondents in non-climate smart villages, lack of trust in the effectiveness of climate smart agricultural practices followed by inability to take risks and possession of small and fragmented landholdings were the major constraints in the adoption of climate smart agricultural practices, while the inability to accept new practices or technologies and communication gap among farmers were the minor constraints.

In terms of economic constraints, increased cost of paddy production (in comparison to the conventional method) followed by higher initial investment in equipment and machinery and lower paddy yields, were the major barriers faced by the respondents from climate smart villages, whereas lack of market access, increased incidence of weeds, pests & diseases, and lack of labour availability were the minor constraints in the adoption of climate smart agricultural practices for the respondents from climate smart villages. For respondents from non-climate smart villages, lack of financial support from government institutions followed by the increased cost of production, and increased incidence of weeds, pests & diseases were the most serious economic constraints in the adoption of climate smart agricultural practices while lack of market access, the higher initial cost of investment in equipment and machinery and lower paddy yield were the minor constraints faced by them.

In terms of technical constraints, the non-involvement of local communities in the planning and implementation of CSAP followed by lack of extension support, and inadequate provision of services by custom hiring centres were the major constraints in the adoption of climate smart agricultural practices faced by respondents from climate smart villages whereas ineffectiveness of weather-based agro-advisory services, lack of awareness about climate smart agricultural technologies and complexity of adopting climate smart agricultural practices were the minor constraints faced by them. For respondents from non-climate smart villages, lack of awareness about climate smart agricultural technologies was the major technical constraint followed by a lack of training on climate smart agricultural practices and the complexity of

Table 1. Constraints faced by paddy farmers in the adoption of CSAP in Climate Smart Villages

S.No.	Constraints	TWS	WMS	Rank
I)	Socio-Personal Constraints			
1	Inability to take risks	100	1.66	3
2	Inability to accept new practices or technologies	89	1.48	5
3	Small and Fragmented landholding	94	1.56	4
4	Cultural Incompatibility	81	1.35	6
5	Lack of trust in the effectiveness of CSAP	121	2.01	2
6	Communication gap among farmers (in sharing CSA-related information)	133	2.22	1
II)	Economic constraints			
1	Increased cost of production in comparison to conventional method	143	2.38	1
2	Higher initial investment in equipment and machinery	142	2.36	2
3	Lack of labour availability	119	1.98	5
4	Lower yield in comparison to the conventional method	135	2.25	3
5	Increased incidence of weeds, pests and diseases after adopting CSAP	115	1.96	6
6	Inadequate financial support from institutions	127	2.11	4
7	Lack of market access	89	1.48	7
III)	Technical constraints			
1	Non-involvement of local communities in planning & implementation of CSAP.	133	2.22	1
2	Lack of awareness about CSA technologies	100	1.67	6
3	Lack of training on CSAP	112	1.86	4
4	Lack of extension support	120	2.00	2
5	Ineffectiveness of weather-based agro-advisory services	87	1.45	7
6	Inadequate services through custom hiring centers (CHC)	118	1.97	3
7	Complexity of adopting CSAP	102	1.70	5

Table 2. Constraints faced by paddy farmers in the adoption of CSAP in Non-Climate Smart Villages

S.No.	Constraints	TWS	WMS	Rank
I)	Socio-Personal Constraints			
1	Inability to take risks	122	2.03	2
2	Inability to accept new practices or technologies	105	1.75	6
3	Small and Fragmented landholding	121	2.01	3
4	Cultural Incompatibility	114	1.90	4
5	Lack of trust in the effectiveness of CSAP	137	2.28	1
6	Communication gap among farmers (in sharing CSA-related information)	113	1.88	5
II)	Economic constraints			
1	Increased cost of production in comparison to conventional method	135	2.25	2
2	Higher initial investment costs in equipment and machinery	123	2.05	6
3	Lack of labour availability	131	2.18	4
4	Lower yield in comparison to the conventional method	129	2.15	5
5	Increased incidence of weeds, pests and diseases after adopting CSAP	133	2.21	3
6	Inadequate financial support from institutions	140	2.33	1
7	Lack of market access	100	1.67	7
III)	Technical Constraints			
1	Non-involvement of local communities in planning & implementation of CSAP.	131	2.18	5
2	Lack of awareness about CSA technologies	148	2.48	1
3	Lack of training on CSAP	142	2.37	2
4	Lack of extension support	133	2.21	4
5	Ineffectiveness of weather-based agro-advisory services	104	1.73	7
6	Inadequate services through custom hiring centers (CHC)	107	1.78	6
7	Complexity of adopting CSAP	138	2.30	3

adopting climate smart agricultural practices. The Ineffectiveness of weather-based agro-advisory services, inadequate services through custom hiring centres (CHC) and non-involvement of local communities in the planning and implementation of CSAP were the least serious constraints in the adoption of climate smart agricultural practices.

The data in Table 3 reveals that economic constraints were the biggest barriers to the adoption of climate smart agricultural practices by the respondents from climate smart villages while technical constraints were the least serious constraint in the adoption of climate smart agricultural practices. For respondents from non-climate smart villages, technical constraints were the

Table 3. Major constraints faced in Climate Smart Villages (CSV) and Non-Climate Smart Villages (Non-CSV)

Constraint Category	WMS (CSV)	Rank	WMS (Non-CSV)	Rank
Socio-Personal Constraints	1.97	2	2.01	3
Economic Constraints	2.07	1	2.12	2
Technical Constraints	1.83	3	2.15	1

biggest hurdle in the adoption of climate smart agricultural practices whereas socio-personal constraints were the least serious constraint.

Comparison of constraints faced in climate smart villages and non-climate smart villages

The results from the independent sample t-test presented in Table 4 revealed that there was no significant difference in the degree of socio-personal and economic constraints faced by the respondents from climate smart and non-climate smart villages, whereas, for technical constraints, the t-value is significant at 0.01 level of significance which signifies a significant mean difference between the respondents from climate smart and non-climate smart villages. It can be inferred from the results that respondents from non-climate smart villages face a higher degree of technical constraints in comparison to the respondents from climate smart villages.

Table 4. Comparison of Constraints faced by respondents of climate smart villages and non-climate smart villages

Constraint Category	Mean (CSV)	Mean (Non-CSV)	Mean difference	t-value
Socio-Personal Constraints	1.97	2.01	0.04	0.343^{NS}
Economic Constraints	2.07	2.12	0.05	0.416^{NS}
Technical Constraints	1.83	2.15	0.32	3.127^{**}

(Note: NS=non-significant, **= Significant at 0.01 level of significance)

The result presented in Table 5 revealed that most of the respondents from climate smart villages faced a moderate degree of constraints in the adoption of climate smart agricultural practices followed by a lower degree of constraints. Only about one-fifth of the respondents faced a high degree of constraint in climate smart villages, whereas, in non-climate smart villages, most of the respondents faced a high degree of constraint followed by a moderate degree of constraint in the adoption of climate smart agricultural practices.

DISCUSSION

The findings of the study show that there is a considerable difference in the degree and types of constraints faced by the two groups of respondents i.e., farmers from climate smart villages and non-climate smart villages. While economic constraints were the biggest barriers for the former type of respondents, technical constraints were the biggest hurdle faced by the latter type of respondents. This could be attributed to the fact that farmers from non-climate smart villages lack awareness about climate smart agricultural practices and does not receive specialised training and support from extension agencies, mainly the Department of Agriculture and Farmers' Welfare, Government of Haryana. The findings are supported by Autio et al., (2021) & Jellason et al., (2021) who observe that lack of extension support, specialized training and the higher initial cost of investments are major barriers to the adoption of climate smart agricultural practices among farmers Further, the findings show that most of the respondents from climate smart villages face low to moderate degree of constraints while most of respondents from non-climate smart villages face moderate to high degree of constraints. Also, while there is no significant difference in the degree of socio-personal and economic constraints faced by the two groups of respondents, there is a significant difference in the degree of technical constraints as highlighted by comparative analysis. This is due to a lack of specialised training and support received by farmers from non-climate smart villages. The results are backed by Saha et al., (2019), who found that, farmers who receive regular training and extension support face fewer problems in adopting climate smart agricultural practices as the adoption of these practices is complex and requires specialized extension support. The results highlight the need for specialised training programmes and economic support to the paddy farmers for greater adoption of climate smart agricultural practices and bridging the gap between climate smart and non-climate smart villages. Pabba & Naik (2022), also recommend dedicated efforts on behalf of extension agencies for scaling up the adoption of climate-resilient agricultural technologies. Shitu et al., (2018) concluded that the PCAPs combination can help in achieving optimum resource stewardship and resource conservation in the farmers' field. However, extension strategies and supports are needed to facilitate the adoption of these best practices at the farmers' level.

Table 5. Classification of Respondents based on the degree of constraints faced in the adoption of climate smart agricultural practices

Categorization of Respondents	CSV Percentage	Non-CSV Percentage
Facing a High Degree of Constraints	21.67	38.33
Facing a Moderate Degree of Constraints	41.67	35.00
Facing a Lower Degree of Constraints	36.66	26.67

CONCLUSION

The study concludes that there is a considerable difference in the degree and type of constraints faced by farmers from climate smart and non-climate smart villages due to differences in extension support, training and awareness about climate smart agricultural practices. Farmers from climate smart villages face low to moderate degrees of constraints as a result of better extension support and specialised training while those from non-climate smart villages, in the absence of dedicated extension support and training face moderate to high degrees of constraints. The study recommends the need for specialised training programmes, extension services and financial support for increasing the adoption of climate smart agricultural practices by paddy growers and for bridging the technological gap between the climate smart and non-climate smart villages.

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