RESEARCH PAPER

Climate-Smart Agriculture and Sustainable Farming Practices in Bastar, Chhattisgarh: Assessing Farmers' Attitudes Toward Technology Adoption

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Abstract
Climate-Smart Agriculture Technologies (CSATs) are essential for promoting sustainable farming and enhancing resilience to climate change. The present study was conducted during 2022–23 and 2023–24 across the three agro-climatic zones of Chhattisgarh, namely the Northern Hills, Chhattisgarh Plains, and Bastar Plateau, with special reference to the Bastar region. A total of 360 farmers were selected through proportional random sampling, and data were collected through personal interviews and group discussions to assess farmers' attitudes toward CSATs.
The findings revealed that the majority of farmers exhibited moderately favourable attitudes toward major CSAT practices, including land levelling (66.95%), zero tillage (68.89%), residue management or mulching (65.56%), precision nutrient management (72.77%), crop diversification (66.94%), and alternate wetting and drying (68.89%). Overall, 52.50 per cent of respondents had a moderately favourable attitude toward CSATs, while 30.56 per cent showed favourable attitudes and 16.94 per cent expressed less favourable attitudes.
The predominance of moderately favourable attitudes indicates growing awareness and partial acceptance of climate-smart practices among farmers. However, gaps in technical knowledge and confidence regarding long-term benefits still exist. The study highlights the need for stronger extension services, farmer training, and policy support to enhance CSAT adoption and promote resilient rural development in the Bastar region of Chhattisgarh.
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1. Introduction

Climate change has emerged as one of the most serious challenges affecting agricultural sustainability and rural livelihoods across developing countries. In India, rainfed and tribal regions are highly vulnerable to climate variability because farming systems depend heavily on monsoon rainfall and natural resources. The Bastar district of Chhattisgarh represents one such ecologically sensitive and socio-economically vulnerable region where agriculture is predominantly subsistence-oriented and closely connected with forest ecosystems. The adoption of Climate-Smart Agriculture (CSA) has gained increasing importance in such regions because it combines sustainable productivity, climate adaptation, and environmental conservation.

Recent literature highlights that CSA is particularly relevant for tribal and rainfed agricultural systems because it promotes low-input farming, indigenous knowledge, crop diversification, water conservation, and climate resilience. Bastar's traditional agricultural practices, especially millet cultivation, mixed cropping, agroforestry, and organic farming, align strongly with CSA principles. Researchers have emphasized that integrating traditional knowledge with modern sustainable technologies can strengthen food security, improve rural livelihoods, and reduce climate risks in the region.

Despite substantial research on climate adaptation and technology adoption, a significant gap remains in understanding the relationship between climate-smart agricultural technology (CSAT) adoption, subjective well-being, and farmers' attitudes. Existing studies have primarily examined the role of digital technologies and associated behavioural changes in shaping subjective well-being (Zheng et al., 2023a; Li et al., 2023; Ma et al., 2022; Zheng et al., 2023b) [22, 12, 14, 22]. However, limited attention has been given to the direct causal relationship between climate change adaptation through CSAT adoption and farmers' subjective well-being.

Climate-smart agricultural practices—including minimum tillage, improved planting methods, irrigation management, fertilizer optimization, and crop residue incorporation—have been widely recognized for their potential to enhance agricultural productivity while reducing greenhouse gas emissions (Branca et al., 2011) [4]. Likewise, the adoption of improved seed varieties, ICT-based agro-advisory services, crop and livestock insurance, and rainwater harvesting techniques can strengthen farmers' resilience to climate variability and production risks (Altieri and Nicholls, 2017; Mittal, 2012) [15, 1]. Farmers' exposure to and experiences

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with these practices are likely to shape their perceptions, attitudes, and overall well-being. However, empirical evidence on how CSAT adoption influences subjective well-being and farmers' attitudes remains limited, highlighting the need for further investigation in this area.

Climate-Smart Agriculture (CSA) has emerged as a sustainable approach to address the interconnected challenges of food security, environmental sustainability, and climate resilience. CSA emphasizes three primary objectives:

1. Sustainable increase in agricultural productivity
2. Adaptation and resilience to climate change
3. Reduction of greenhouse gas emissions where possible

In Bastar, where agriculture is mostly rainfed and resource-poor, CSA can support resilient rural development by promoting ecological farming systems and strengthening local livelihoods.

Objectives

The major objectives of this research are:

- To analyse the agricultural and climatic challenges in Bastar.
- To examine sustainable farming and climate-smart agricultural practices suitable for the region.
- To evaluate the role of CSA in enhancing rural resilience and livelihoods.
- To propose a framework for resilient rural development through sustainable agriculture
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Literature review

1. Climate Change and Agricultural Vulnerability in Bastar

Several studies have examined the impact of climate change on agriculture in tribal regions of central India. According to the Intergovernmental Panel on Climate Change (IPCC, 2023), rising temperatures, irregular rainfall, and increasing frequency of droughts are significantly affecting rainfed agricultural systems. Tribal districts such as Bastar are considered highly vulnerable because of their dependence on natural resources and low adaptive capacity.

Research conducted by the Indian Council of Agricultural Research (ICAR, 2022) observed that rainfall variability in Chhattisgarh has increased over the last two decades, causing delays in sowing, reduced crop productivity, and moisture stress. Bastar farmers face challenges such as declining groundwater levels, soil erosion, shrinking forest resources, and biodiversity loss. The study further reported that small and marginal farmers are more vulnerable because they lack access to irrigation, institutional support, and modern technologies.

Kumar and Patel (2021) argued that climate change has intensified socio-economic vulnerabilities among tribal communities by reducing agricultural income and increasing seasonal migration. Their study highlighted that prolonged dry spells and erratic monsoon patterns negatively affect paddy cultivation, which is the principal crop of Bastar.

Similarly, Singh et al. (2020) found that agricultural sustainability in Bastar is threatened by land degradation, deforestation, and excessive dependence on monocropping systems. The authors recommended diversification toward climate-resilient crops such as millets and pulses to improve resilience and reduce risks.

2. Concept and Importance of Climate-Smart Agriculture

The concept of Climate-Smart Agriculture was introduced by the Food and Agriculture Organization (FAO) to address the dual challenges of climate change and food security. FAO (2021) defined CSA as an integrated approach that aims to sustainably increase agricultural productivity, strengthen adaptation and resilience, and reduce greenhouse gas emissions wherever possible.

Recent studies emphasize that CSA is particularly effective in rainfed and tribal agricultural systems because it promotes sustainable resource management and ecological balance. According to Vermeulen et al. (2022), CSA practices improve resilience by encouraging crop diversification, water conservation, agroecological farming, and integrated nutrient management.

Lipper et al. (2021) highlighted that CSA not only enhances productivity but also contributes to poverty reduction and livelihood security among smallholder farmers. The study emphasized that indigenous farming systems often contain climate-resilient characteristics that can support sustainable rural development.

In the Indian context, the National Innovations in Climate Resilient Agriculture (NICRA) programme has played a major role in promoting CSA technologies such as drought-tolerant crop varieties, integrated farming systems, rainwater harvesting, and climate-resilient seed management. Studies by ICAR-NICRA (2023) reported significant improvements in productivity and resilience in rainfed districts where CSA practices were adopted.

3. Climate-Smart Crops in Bastar

According to Sahu and Netam (2022), traditional indigenous rice varieties in Bastar possess better drought tolerance and adaptability to local agro-climatic conditions compared to high-input hybrid varieties. The authors observed that local varieties require fewer chemical fertilizers and are more resistant to climatic stress.

Research on the System of Rice Intensification (SRI) by Thakur et al. (2021) demonstrated that SRI methods can reduce water consumption while increasing rice productivity through improved root growth and efficient nutrient utilization. Organic rice farming practices were also found to improve soil fertility and biodiversity.

A study by Rao et al. (2023) suggested that integrating organic manure, mulching, and rainwater conservation practices with paddy cultivation can significantly improve climate resilience in tribal farming systems.

Millets are increasingly recognized as "smart foods" because of their nutritional value and climate resilience. In Bastar, traditional millets such as Kodo, Kutki, and Ragi have historically been cultivated by tribal communities.

The United Nations declared 2023 as the International Year of Millets, highlighting their importance for sustainable agriculture and food security. According to FAO (2023), millets require less water, tolerate drought conditions, and grow successfully in poor soils with minimal external inputs.

Research by Deshmukh and Sharma (2022) found that millet-based farming systems in Chhattisgarh are economically viable and environmentally sustainable. The study reported that millets enhance household nutrition and reduce the risks associated with climate variability.

Another study by Reddy et al. (2021) emphasized that millet cultivation contributes to biodiversity conservation and soil health improvement. The authors argued that promoting traditional millets can strengthen tribal food systems and reduce dependency on water-intensive crops.

Studies conducted in Bastar also indicate that millet revival programmes have increased farmer participation in sustainable agriculture and improved income opportunities through value addition and local market development.

Pulse crops play an important role in climate-smart agriculture because of their low water requirement and nitrogen-fixing capacity. Pulses such as Arhar, Urad, Gram, and Horse Gram are commonly cultivated in Bastar.

According to Meena et al. (2020), pulse-based cropping systems improve soil fertility and reduce dependence on synthetic fertilizers. The study found that intercropping pulses with cereals increases overall farm productivity and strengthens resilience under drought conditions.

Horse gram has received particular attention in recent literature because of its exceptional drought tolerance. Research by Kumar et al. (2022) described horse gram as a "future smart crop" suitable for dryland and marginal farming systems. The crop contributes to food security, livestock nutrition, and sustainable land management.

Studies also show that pulse cultivation enhances dietary diversity and protein intake among tribal households. This is particularly important in regions where malnutrition remains a serious concern.

Oilseed crops such as sesame, mustard, niger, and linseed are important components of climate-smart farming systems in Bastar.

According to Yadav and Verma (2021), oilseed crops require relatively less irrigation and can withstand dry conditions better than many cereal crops. Crop diversification through oilseeds reduces production risks and increases farm income stability.

Research by the Directorate of Oilseeds Development (2022) reported that traditional oilseed cultivation supports sustainable farming because these crops can be grown under low-input conditions and contribute to agro-biodiversity conservation.

The inclusion of oilseeds in mixed cropping systems also improves soil health and reduces vulnerability to pest outbreaks.

4. Traditional Knowledge and Indigenous Farming Systems

A growing body of literature recognizes the importance of indigenous agricultural knowledge in climate adaptation. Tribal communities in Bastar have traditionally practiced mixed cropping, shifting cultivation, seed preservation, forest-based farming, and organic nutrient management.

According to Das and Mishra (2021), indigenous farming systems are inherently climate-resilient because they are based on ecological principles and local resource use. The authors emphasized that traditional crop diversity reduces the risks associated with climatic uncertainty.

Research by the Tribal Research Institute of Chhattisgarh (2022) highlighted that community seed banks and traditional seed exchange systems play a significant role in preserving drought-resistant crop varieties.

Several scholars have argued that sustainable rural development in Bastar requires integration of scientific innovations with traditional ecological knowledge. Such integration can improve adaptation capacity while preserving cultural identity and biodiversity.

5. Sustainable Farming Practices and Rural Livelihoods

Sustainable agricultural practices are closely linked with livelihood security in tribal regions. Studies indicate that CSA practices can generate multiple socio-economic and environmental benefits.

Agroforestry has emerged as an important CSA strategy in Bastar because it combines trees, crops, and livestock within integrated farming systems. According to Nair et al. (2021), agroforestry improves carbon sequestration, soil conservation, and income diversification.

Water conservation practices such as farm ponds, contour bunding, rainwater harvesting, and mulching are widely recommended for dryland agriculture. Research by ICAR (2023) found that moisture conservation techniques significantly improve crop productivity under erratic rainfall conditions.

Organic farming is another major area of interest in recent literature. Studies show that low external input farming systems reduce production costs and improve long-term soil health. Bastar's relatively low use of chemical fertilizers provides favorable conditions for organic agriculture development.

Women's participation in climate-smart farming has also been highlighted in recent studies. Tribal women contribute significantly to seed conservation, millet processing, forest produce collection, and household food security. Strengthening women's participation in CSA programmes can improve livelihood resilience and community sustainability.

Materials and methods

The present study was conducted in the state of Chhattisgarh during the agricultural years 2024–25 and 2025–26. The state comprises three agro-climatic zones, namely the Northern Hills, Chhattisgarh Plains, and Bastar Plateau, each characterized by distinct climatic and agricultural conditions. To ensure adequate representation of the entire state, districts were selected from each agro-climatic zone using a proportional random sampling technique, wherein 20 per cent of the districts from each zone were included in the study. Accordingly, one district, Sarguja, was selected from the seven districts of the Northern Hills zone. From the Chhattisgarh Plains zone, comprising twenty districts, four districts—Raipur, Rajnandgaon, Bemetara, and Dhamtari—were selected. Similarly, from the Bastar Plateau zone, which consists of six districts, one district, Kanker, was selected. Thus, a total of six districts were included in the study.

From each selected district, two blocks were chosen, and from each block, two villages were selected. Farmers from the selected villages constituted the respondents for the study, resulting in a total sample size of 360 farmers. Primary data were collected through personal interviews and group discussions using a structured interview schedule. The collected data were systematically coded, tabulated, and analyzed using appropriate statistical tools in accordance with the objectives of the study.

Attitude was conceptualized as a learned evaluative tendency reflecting an individual's favourable or unfavourable disposition toward specific objects, situations, or practices. In the present study, attitude refers to farmers' evaluative orientation toward Climate-Smart Agricultural Technologies (CSATs), which varies in intensity among individuals and influences their responses toward such practices. Farmers' attitude toward CSATs was measured using the standardized attitude scale developed by Shitu et al. (2018). The scale consisted of 30 statements, including 18 positive and 12 negative statements. These statements were distributed across six major components of CSATs, namely land levelling (4 statements), zero tillage (5 statements), residue management/mulching (4 statements), precision nutrient management (5 statements), crop diversification (6 statements), and alternate wetting and drying practices (6 statements).

Respondents were asked to indicate their level of agreement with each statement on a five-point Likert-type continuum consisting of strongly agree, agree, undecided, disagree, and strongly disagree. For positive statements, scores ranging from 5 to 1 were assigned for responses from strongly agree to strongly disagree, respectively. In the case of negative statements, the scoring pattern was reversed to maintain directional consistency. The overall attitude score for each respondent was obtained by summing the scores across all 30 statements. Based on the aggregate scores, respondents were categorized into three groups according to their level of attitude toward CSATs.

In addition to the overall attitude assessment, a component-wise analysis was carried out to examine farmers' attitudes toward specific CSAT practices. Mean scores were computed for each component, and rank orders were assigned based on the aggregated mean values to determine the relative importance of different CSAT components.

Table 1: District/Block-wise List of Climate-Smart Agriculture (CSA) Crops in Chhattisgarh

District	Selected Blocks	Major CSA Crops	Important Climate-Smart Features
Raipur	Arang, Tilda	Paddy, Gram, Mustard, Vegetables	System of Rice Intensification (SRI), crop diversification, water-efficient irrigation practices
Rajnandgaon	Dongargarh, Chhuikhadan	Paddy, Maize, Arhar, Soybean	Integrated farming systems, mixed cropping, drought-resilient crop practices
Bemetara	Saja, Berla	Paddy, Wheat, Gram, Mustard	Precision nutrient management, residue management, conservation agriculture
Dhamtari	Kurud, Magarlod	Paddy, Black Gram, Vegetables, Maize	Efficient water management, alternate wetting and drying, integrated nutrient practices
Kanker	Charama, Bhanupratappur	Paddy, Gram, Mustard, Linseed, Ragi	Crop diversification, oilseed cultivation, sustainable farming practices

Results and Discussion

Climate Smart Agriculture Technologies (CSATs) Adaption

Understanding respondents' attitudes toward Climate-Smart Agriculture Technologies (CSATs) is crucial, as positive attitudes can significantly enhance the adoption of these technologies. Farmers' perceptions and attitudes provide valuable insights into how they view the usefulness, effectiveness, and practicality of CSATs. Such insights can assist policymakers in formulating appropriate climate-smart agricultural policies and strategies that promote wider adoption and sustainable agricultural development.

Land preparation

The data presented in Table 2 indicate that the respondents exhibited varying attitudes toward land levelling practices under Climate-Smart Agriculture Technologies (CSATs). The statement *"Run-off occurs in unlevelled fields"* received the highest mean score (4.21) and was ranked first, indicating that most respondents strongly agreed with the importance of proper land levelling in reducing water run-off.

Table 2: Distribution of Respondents involved for land preparation under Climate-Smart Agriculture Technologies

Sl. No.	Statements	Mean Score	Rank
1	Run-off occurs in uneven fields	4.21	I
2	Water harvesting strategies should be adopted	4.01	II
3	Modern land levelling methods are difficult to adopt	3.78	III
4	Traditional land levelling methods are considered effective	3.63	IV

This was followed by the statement *"Adopt water harvesting strategies"*, which secured the second rank with a mean score of 4.01, reflecting a favorable attitude toward water conservation practices. The statement *"New land levelling methods are difficult"* ranked third with a mean score of 3.78, suggesting that farmers perceived some challenges in adopting modern land levelling techniques.

On the other hand, the statement *"Traditional levelling methods are good"* obtained the lowest mean score (3.63) and ranked fourth, indicating comparatively lower preference for conventional levelling methods among the respondents.

Table 2 shows that the majority of respondents (66.95%) had a moderately favourable attitude toward land levelling. Meanwhile, 20.00 per cent of the respondents exhibited a favourable attitude, whereas 13.05 per cent showed a less favourable attitude toward land levelling. The findings indicate that only a limited proportion of respondents possessed a highly favourable attitude regarding land levelling. The predominance of a moderately favourable attitude among farmers may be attributed to their inadequate and imprecise understanding of land levelling and its associated benefits.

Table 3: Distribution of respondents according to their level of attitude toward land levelling under Climate Smart Agriculture Technologies

Sl. No.	Category	Frequency	Percentage
1	Less favourable	47	13.05
2	Moderately favourable	241	66.95
3	Favourable	72	20.00

Zero Tillage method adoption

Table 3 clearly indicates that the respondents had a favorable attitude toward the statement that traditional tillage does not lead to degradation of soil resources, which secured the first rank with a mean score of 3.75. This was followed by the statement that innovative tillage technology improves water use efficiency, ranked second with the same mean score of 3.75. The statement that sowing in unploughed fields reduces the cost of production ranked third with a mean score of 3.28, while the perception that zero tillage reduces greenhouse gas emissions ranked fourth with a mean score of 3.22. In contrast, respondents showed a comparatively less favorable attitude toward the statement that early sowing of wheat is not necessary, which ranked fifth with a mean score of 3.16.

Table 4: Distribution of respondents according to attitude towards zero tillage of Climate Smart Agriculture Technologies (CSATs).

Sl. No.	Statements on Zero Tillage	Mean Score	Rank
1	Innovative tillage technology improves usage of water	3.73	II
2	Traditional tillage does not lead to degradation of soil resources	3.75	I
3	Sowing in unploughed field reduces cost of production	3.28	III
4	Zero tillage reduces greenhouse gas emission	3.22	IV
5	Early sowing of wheat is not necessary	3.16	V

Table 4 reveals that the majority of respondents (68.89%) possessed a moderately favorable attitude toward zero tillage practices. In contrast, 16.94 percent of the respondents exhibited a highly favorable attitude, while only 14.17 percent showed a less favorable attitude toward zero tillage. The predominance of a moderately favorable attitude among the respondents may be attributed to limited awareness regarding the benefits of zero tillage, particularly its role in reducing energy consumption during land preparation without adversely affecting crop productivity. Additionally, inadequate knowledge about its effectiveness in lowering crop water requirements and minimizing soil moisture evaporation may have influenced their perceptions toward the technology.

Table 5: Distribution of respondents according to the level of attitude towards zero tillage under Climate Smart Agriculture Technologies (CSATs).

Sl. No.	Category	Frequency	Percentage
1	Less favourable	51	14.17

2	Moderately favourable	248	68.89
3	Favourable	61	16.94

Residue management

Table 5 reveals that the respondents exhibited a favorable attitude towards the statement *"Leaving residue on the field competes with fodder availability"*, which secured the first rank with a mean score of 3.91. This was followed by the statements *"Mulching increases the cost of cultivation"* and *"Mulching is useful for weed control"*, which were ranked second and third with mean scores of 3.68 and 3.60, respectively. In contrast, respondents showed comparatively less favorable attitudes towards the statement *"Mulching maintains the productive soil layer"*, which was ranked fourth with a mean score of 3.50.

Table 6: Distribution of respondents according to attitude towards management/mulching of Climate Smart Agriculture Technologies

Sl. No.	Residue management/mulching statements	Mean Score	Rank
1	Leaving residue on the field competes with fodder availability	3.91	I
2	Mulching is useful for weed control	3.60	III
3	Mulching maintains productive soil layer	3.50	IV
4	Mulching increases cost of cultivation	3.68	II

The findings in Table 6 reveal that the majority of respondents (65.56%) possessed a moderately favourable attitude toward residue management/mulching practices under Climate Smart Agriculture technologies. About 20.27 per cent of the respondents exhibited a less favourable attitude, while only 14.17 per cent showed a favourable attitude toward residue management/mulching practices.

The results indicate that although respondents were somewhat positive toward residue management/mulching, only a small proportion demonstrated a highly favourable attitude. This may be due to inadequate awareness regarding the benefits of mulching, such as protection against soil erosion caused by wind and rain, conservation of soil moisture, improvement in soil organic matter, and enhancement of soil infiltration, aeration, and tilth. The predominance of a moderately favourable attitude could also be attributed to limited knowledge, low interest, and lack of conviction regarding mulching practices.

Table 7: Distribution of Respondents According to Level of Attitude Towards Residue Management/Mulching under Climate Smart Agriculture Technologies

Sl. No.	Category	Frequency	Percentage
1	Less favourable	73	20.27
2	Moderately favourable	236	65.56
3	Favourable	51	14.17
	Total	**360**	**100.00**

Table 9 reveals that the respondents had a favourable attitude toward growing different crops for achieving higher yield, which ranked first with the highest mean score of 3.72. This was followed by the perception that multiple cropping increases yield and income, and that a diversified cropping system reduces risk, which ranked second and third with mean scores of 3.70 and 3.62, respectively. The findings also indicate that respondents agreed that cultivating only one type of crop depletes soil nutrients, and that adaptation to crop diversification remains a major challenge for income generation; these statements ranked fourth and fifth with mean scores of 3.55 and 3.54, respectively. In contrast, the statement that multiple crops do not assure an increase in productivity and income received the least favourable response and ranked sixth with the lowest mean score of 3.43.

Table 8: Distribution of Respondents According to Attitude Towards Crop Diversification under Climate Smart Agriculture Technologies

Sl. No.	Crop Diversification Statements	Mean Score	Rank
1	Multiple cropping increases yield and income	3.70	II
2	Diversified cropping system reduces risk	3.62	III
3	Multiple crops do not assure an increase in productivity and income	3.43	VI
4	Growing different crops for higher yield	3.72	I
5	Adaptation of crop diversification is a major challenge	3.54	V
6	Cultivation of a single crop depletes soil nutrients	3.55	IV

The data presented in Table 10 clearly indicate that the majority of respondents (66.94%) possessed a moderately favourable attitude towards crop diversification. This was followed by 18.89 per cent of respondents who exhibited a favourable attitude towards crop diversification. In contrast, 14.17 per cent of the respondents were found to have a less favourable attitude toward crop diversification.

The findings reveal that only a limited proportion of respondents exhibited a highly favourable attitude toward crop diversification, while the majority demonstrated a moderately favourable attitude. Crop diversification offers several advantages, such as overcoming water scarcity, reducing weather-induced risks, and stabilizing farm income. Therefore, farmers are generally expected to develop a favourable attitude toward such practices. However, the predominance of a moderately favourable attitude among respondents may be attributed to their limited knowledge and awareness regarding crop diversification and its associated benefits.

Table 9: Distribution of Respondents According to Attitude Towards Crop Diversification under Climate Smart Agriculture Technologies

Sl. No.	Category	Frequency	Percentage
1	Less favourable	51	14.17
2	Moderately favourable	241	66.94
3	Favourable	68	18.89

Table 11 reveals that the respondents had a favourable attitude toward the practice that "efficient water use in paddy is now a priority," which secured the first rank with the highest mean score of 3.77. This was followed by the statement "prefer the technology related to flooding and drying the field," which ranked second with a mean score of 3.62. The statement "alternate wetting and drying decreases the cost of irrigation in paddy" ranked third with a mean score of 3.50.

Further, the respondents agreed that "excess moisture may lead to infestation of diseases and pests in paddy crops," which ranked fourth with a mean score of 3.32. The statement "alternate wetting and drying may promote weeds" received the lowest preference and ranked fifth with a mean score of 3.22.

Table 10: Distribution of Respondents According to Attitude Towards Alternate Wetting and Drying under Climate Smart Agriculture Technologies

Sl. No.	Alternate Wetting and Drying Statements	Mean Score	Rank
1	Efficient water use in paddy is now a priority	3.77	I
2	Prefer the technology related to flooding and drying the field	3.62	II
3	Alternate wetting and drying decreases the cost of irrigation in paddy	3.50	III
4	Yield is more important than water use efficiency in paddy fields	3.19	VI
5	Alternate wetting and drying may promote weeds	3.22	V
6	Excess moisture may cause infestation of diseases and pests in paddy crops	3.32	IV

Overall attitude

The overall attitude of the respondents toward Climate Smart Agriculture Technologies (CSATs) was assessed, and the results are presented in Table 13. The findings revealed that a majority of the respondents (52.50%) possessed a moderately favourable attitude toward CSATs, followed by 30.56 per cent who exhibited a favourable attitude. In comparison, 16.94 per cent of the respondents showed a less favourable attitude toward Climate Smart Agriculture Technologies.

The results indicate that most farmers have a moderate level of acceptance toward CSATs, suggesting that they are aware of the importance and relevance of climate-smart practices in agriculture. However, the comparatively lower proportion of respondents with a highly favourable attitude implies that many farmers are still hesitant to adopt these technologies fully. Factors such as limited technical knowledge, uncertainty regarding long-term benefits, and perceived complexity of climate-smart practices may have influenced their attitudes.

The findings further suggest that only a small proportion of respondents demonstrated a strongly favourable attitude toward CSATs. This highlights the need for effective extension activities, practical demonstrations, and capacity-building programmes to enhance farmers' understanding, confidence, and positive perception regarding Climate Smart Agriculture Technologies.

Table 11: Distribution of Respondents According to Overall Attitude Level Towards Climate Smart Agriculture Technologies

Sl. No.	Category	Frequency	Percentage
1.	Less favourable	61	16.94
2.	Moderately favourable	189	52.50
3.	Favourable	110	30.56
	Total	**360**	**100.00**

Conclusion

The present study revealed that farmers' attitudes play a crucial role in the adoption of Climate Smart Agricultural Technologies (CSATs) in Chhattisgarh. The predominance of a moderately favourable attitude toward various CSAT components, such as land levelling, zero tillage, residue management, precision nutrient management, crop diversification, and alternate wetting and drying, indicates that farmers are generally aware of and positively inclined toward climate-smart agricultural practices. However, they have not yet developed sufficient confidence for their regular and sustained application.

This pattern of attitude suggests a stage of gradual acceptance rather than complete resistance, reflecting that farmers are transitioning from basic awareness to actual adoption of CSATs. The overall findings further support this observation, as the majority of respondents expressed a moderately favourable attitude, while only a smaller proportion demonstrated a highly favourable attitude toward these technologies.

The results imply that although farmers recognize the significance of CSATs in coping with climate variability, resource limitations, and productivity-related challenges, their attitudes are still influenced by inadequate technical knowledge, the perceived complexity of the practices, and uncertainty about long-term outcomes and benefits. The study highlights that insufficient knowledge and limited practical exposure are major factors contributing to the moderate level of acceptance among farmers.

Furthermore, the findings indicate that traditional extension methods alone may not be adequate to create the confidence and motivation required for large-scale adoption of CSATs. Therefore, there is a strong need for targeted interventions such as capacity-building programmes, field demonstrations, hands-on training, and participatory learning approaches to strengthen farmers' understanding, trust, and positive attitude toward Climate Smart Agricultural Technologies.

Conflict of Interest

The authors of the paper declare no conflict of interest.

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