**Gender Perspectives on Climate Change: A Perceptual Analysis of Agricultural activities among Farmers in India**

**Abstract**

This paper includes a household survey of 240 households from purposively selected 4 districts of Bihar to understand the region and gender specific adaptation strategies of farmers. The result suggests that majority of the men farmers agreed to the statement that climate change is affecting the crop yield, whereas to the same statements, women farmers were undecided. This result can be interpreted as comparatively low level of awareness of women farmers, less extension contacts and also less exposure to digital gadgets like mobile phone, radio from where they can get the weather updates. The findings further shows that the short-term strategies which involved major decision making like early sowing, increased seed rate, bunding, drought tolerant variety, use of farm implements, deep rooted crop, application of urea and long term strategies like tube wells, late harvesting were adopted by men farmers which also tells about the level of awareness and decision making in the household. Therefore, this study put light on the fact that adaptation fund is more utilized if the policy makers make plans more inclusive.

**Keywords:** Climate change adaptation, Gender-specific strategies, Farmers’ awareness, Decision-making in agriculture and Policy inclusion

**Introduction**

Sustainable Development Goal (SDG) 13 emphasizes urgent action to combat climate change and its impacts by strengthening resilience and adaptive capacity to climate-related hazards and natural disasters globally (Bodansky, 2023). Climate change necessitates renewed attention from all stakeholders to mitigate its adverse effects on agricultural productivity and food security (Mallick *et al.*, 2023; Jain & Mazhar, 2024). According to the Intergovernmental Panel on Climate Change (IPCC, 2007), climate change refers to a statistically significant variation in either the mean state of the climate or its variability persisting for an extended period (Lal *et al.*, 2023), typically decades or longer. Earth is now approximately 1.1°C warmer than in the 1800s (FAO). Climate models predict that without imperative mitigation and adaptation measures, global temperatures could rise by 2.5 to 2.9°C above pre-industrial levels by the end of this century (IPCC, 2021).

Evidence indicates that climate change is already impacting India and the world. The United Nations (UN) reports that 40% of countries attribute economic losses directly to climate change, affecting major sectors such as agriculture, services, industry, and infrastructure (UN, 2023). Floods, droughts, and erratic rainfall are some of the extreme weather phenomena experienced over the past decade, underscoring the urgent need for adaptation strategies (El Kenawy, 2024). Climate-smart agriculture (CSA) revolves around three pillars: sustainably increasing agricultural productivity and incomes, building resilience to climate change, and reducing greenhouse gas (GHG) emissions (van Wijk et al.2020). To support these objectives, the National Adaptation Fund for Climate Change (NAFCC) was established in August 2015 to finance adaptation measures in India’s vulnerable states and Union Territories.

Bihar is one of India’s most climate-vulnerable states (Lal, 2014), with 14 out of 50 districts nationally identified as highly susceptible to climate change (National Institute of Disaster Management, 2021). Agriculture contributes approximately 19% to Bihar’s Gross State Domestic Product (GSDP) and employs about 70% of the rural workforce. However, the state’s agriculture is highly vulnerable to hydro-meteorological disasters. North Bihar frequently experiences severe flooding, while South Bihar is prone to drought. Floods affect up to 56% of Bihar’s geographical area, leading to significant economic and human losses (Senapati, 2022). For instance, the 2004 floods caused 885 human deaths, 3,272 animal deaths, crop losses worth ₹522.06 million, and public property damages amounting to ₹1,030.49 million (Disaster Management Department, Bihar, 2004). Similarly, in 2007, floods affected 11.9 lakh hectares and resulted in 650 human deaths and the destruction of 59,610 houses (Bihar State Disaster Management Authority, 2007).

Paradoxically, Bihar’s southern regions, such as Gaya, Nawada, and Jamui, suffer from recurrent droughts despite the state’s abundance of water bodies. Rainfall variability significantly affects agricultural activities, with average annual rainfall in Bihar being 1,120 mm, ranging from 2,000 mm in the eastern regions to less than 750 mm in the south (India Meteorological Department, 2020). Such climatic extremes have far-reaching implications for crop production. For example, a 1°C rise in temperature is projected to reduce wheat production by 45 million tons nationally (Agrawal, 2008), and maize yields may decrease by 35% to 50% in rain-fed and irrigated systems, respectively, in coastal districts (Government of India, 2010). Furthermore, the Indian Council of Agricultural Research (2013) estimates a 4–5 million tonne reduction in wheat production with every 1°C increase in temperature during the growing season. Mall et al. (2006) reported that climate variability, particularly temperature increases, would lead to substantial reductions in crop yields across the Indo-Gangetic plains, with Bihar being highly vulnerable due to its dependence on monsoon rains. According to the Bihar State Action Plan on Climate Change (2015), rainfall irregularity and increasing frequency of extreme events, such as droughts and floods, are becoming major impediments to sustainable agricultural production in the state. The Intergovernmental Panel on Climate Change (IPCC, 2021) also highlights that climate change will exacerbate regional disparities, making dryland and semi-arid regions like southern Bihar more drought-prone and less agriculturally viable without significant adaptation measures.

Understanding farmers’ coping strategies is crucial to formulating effective adaptation policies. The type of climate shocks experienced and historical responses to these shocks provide valuable insights into future strategies (Adger et al., 2003). Gender dynamics also play a significant role in climate adaptation. In natural resource-dependent communities, particularly agrarian economies, men and women often have distinct roles, responsibilities, and vulnerabilities, which influence their adaptive capacities and decision-making processes (Djoudi & Brockhaus, 2011; Nelson & Stathers, 2009). Research indicates that gender inequalities exacerbate women’s ability to cope with climate change (Demetriades & Esplen, 2010; Masika, 2002; Mitchell et al., 2007). For instance, women’s adaptation capacity is influenced by factors such as land ownership, financial resources, access to credit, health, and mobility (Lambrou & Piana, 2006).

Studies show that men and women perceive and respond to climate risks differently. Jost et al. (2016) observed that men predominantly make decisions on cropping patterns and marketing. Similarly, Hassan and Nhemachena (2008) found that male farmers in Africa were more responsive to adopting new practices like crop diversification during temperature changes. However, in contexts such as Bihar, where climatic shocks like floods and droughts affect entire families, decision-making often involves joint discussions, though men typically make the final decisions (Disaster Management Department, Bihar, 2015).

Given the above, this study aims to analyze the gender-differentiated perceptions and adaptation strategies of men and women farmers in Bihar. Specifically, it examines their experiences in agricultural activities due to climate change and the coping mechanisms they adopt. This research is critical to developing targeted interventions that address the unique vulnerabilities and capacities of both genders in adapting to climate change.

**Methodology**

**The Study Area**

In Bihar, 90 per cent of the population lives in rural areas as a result of which around 75 per cent of the inhabitants are dependent on climate sensitive sectors such as agriculture, fishing and forests. In Bihar, two zones III A (south east) and zone III B (south west) were selected for the present study. The present study was carried out in the plains of Bihar state during the years 2015-2018 in Zone III A (South East) and Zone III B (South West). As zone III A is prone to floods and zone III B is most vulnerable to drought, Bhagalpur and Banka districts from zone IIIA and Patna and Jehanabad district in zone III B were selected. Two blocks from one district was selected out of which one was more vulnerable than the other. Two blocks namely Sabour and Goradih from Bhagalpur, Katoria and Amarpur from Banka, Paliganj and Dulhan bazaar from Patna and Modanganj and Kako from Jehanabad was selected purposively. From each selected block, 1 village (total 8 X 1 = 8) was selected. Therefore 8 villages were selected for the present study. To get the appropriate sample size 15 men and 15 women respondents were selected from each village for the present study. Therefore, a total of 240 respondents were selected, 120 being men and 120 women.



**Fig.1:** Districts of Bihar to study the Gender perception on Climate Change

**Table 1: Selection of villages**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No** | **Agro-ecological Zone** |  **Selected District** | **Selected****Block** | **Selected****Village** |
| 1. | Zone III A | Banka | 1.Katoria | Merha |
| 2.Amarpur | Sijhua |
| Bhagalpur | 1.Sabour | English |
| 2.Goradih | Barhari |
| 2. | Zone III B | Jehanabad | 1. Modangang | Sakroha |
| 2. Kako | Maniawa |
| Patna | 1.Paliganj | Dariyapur |
| 2.Dulhan Bazaar | Kaab |

In the present study Multistage Random sampling method, a non-probability sampling technique was followed. Both purposive and random sampling was used under this sampling procedure.

**Results:**

**Perception of farmers on experience in different agricultural activities due to climate change**

The data of the perception of farmers on experience in different agricultural activities due to climate change are presented in the Table 2.

**Table 2. Distribution of men respondents perception on experience in different agricultural activities due to climate change (n = 120)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl No.** | **Statements** | **SA** | **A** | **U** | **DA** | **SDA** |
| *f (%)* | *f (%)* | *f (%)* | *f (%)* | *f (%)* |
| 1. | Decrease in crop yield due to change in climate. | 12 (10.00) | 44(36.67) | 20(16.67) | 33(27.50) | 11(9.16) |
| 2. | There is less use of traditional crop varieties. | 19 (15.84) | 66(55.00) | 10(8.33) | 14(11.66) | 11(9.16) |
| 3. | Change in flowering & fruiting time of crop.  | 22 (18.33) | 68(56.18) | 10(8.33) | 12(10.00) | 8(6.66) |
| 4. | Time of harvesting of crop has changed. | 16 (13.33) | 58(48.34) | 32(26.66) | 10(8.33) | 4(3.33) |
| 5. | Time of ripening of crop or fruits has changed.  | 28 (23.33) | 62(51.66) | 10(8.33) | 15(12.50) | 5(4.16) |
| 6. | Quality of edible crop has decreased. | 27 (22.50) | 70(58.33) | 3(2.50) | 14(11.66) | 6(5.00) |
| 7.  | Cropping practices have changed.  | 9(24.16) | 21(50.83) | 38(6.66) | 46(13.33) | 6(5.00) |
| 8. | Availability of irrigation water has decreased due to climate change. | 32(26.67) | 66(55.00) | 6(5.00) | 9(7.50) | 7(4.16) |
| 9. | Decrease in ground water level due to climate change. | 30(25.00) | 72(60.00) | 5(4.16) | 12(10.00) | 1(0.83) |
| 10. | Increase in water stagnation due to climate change.  | 26(21.66) | 39(32.50) | 13(10.83) | 28(23.33) | 14(11.66) |
| 11. | Availability of fresh fruits and vegetable has decreased.  | 8(6.67) | 11(9.16) | 10(8.33) | 74(61.66) | 17(14.17) |
| 12. | Disease incidence in crop has increased.  | 31(25.84) | 73(60.83) | 0(0.00) | 12(10.00) | 4(3.33) |
| 13. | New verities of pest/disease have emerged.  | 29(24.17) | 49(40.83) | 2(1.67) | 24(20.00) | 16(13.33) |
| 14. | New varieties of weed species have emerged. | 18(15.00) | 45(37.50) | 7(5.83) | 26(21.66) | 24(20.00) |
| 15. | Seasonal weed infestation has increased.  | 17(14.17) | 50(41.66) | 3(2.50) | 25(20.83) | 25(20.83) |
| 16. | Climate is becoming favourable for weed disease.  | 18(15.00) | 38(31.66) | 9(7.50) | 39(32.50) | 16(13.33) |
| 17. | Climate is becoming favourable for insect | 26(21.67) | 59(49.16) | 4(3.33) | 21(17.50) | 10(8.33) |
| 18. | Climate is becoming favourable for disease | 28(23.33) | 67(55.83) | 5(4.16) | 14(11.67) | 6(5.00) |
| 19. | Extinction of various crop & animal species due to climate change.  | 20(16.67) | 46(28.33) | 19(15.83) | 21(17.50) | 14(11.67) |
| 20. | Decrease in forest area.  | 5(4.17) | 9(7.50) | 19(15.83) | 67(55.83) | 20(16.67) |
| 21. | Availability of wild varieties has changed due to change in climate.  | 15(12.50) | 40(33.33) | 7(5.84) | 40(33.33) | 18(15.00) |
| 22. | Climate change is one of the reasons responsible for reduction in forest area. | 10(8.34) | 30(25.00) | 28(23.33) | 40(33.33) | 12(10.00) |
| 23. | Increase in soil erosion due to climate change.  | 25(20.84) | 5(4.16) | 60(50.00) | 30(25.00) | 0(0.00) |
| 24. | Increase in expenses in farming due to climate change. | 30(25.00) | 59(49.17) | 4(3.33) | 20(16.66) | 7(5.83) |
| 25. | Decrease in fodder due to climate change. | 5(4.17) | 18(15.00) | 25(20.83) | 40(33.33) | 32(26.66) |
| 26. | Change in behaviour of animal due to climate change  | 22(18.33) | 49(40.83) | 19(15.83) | 27(22.50) | 3(2.50) |
| 27. | Health of animals is negatively affected due to climate change. | 28(23.33) | 47(39.17) | 20(16.66) | 13(10.83) | 12(10.00) |
| 28. | Extinction of old fish varieties emergence of new fish verities in rivers due to climate change.  | 1(0.83) | 26(21.66) | 64(53.33) | 22(18.35) | 7(5.83) |
| *(Note: Data in parentheses indicates per cent)*S A= Strongly agree, A= Agree, UD= Undecided, D= Disagree, SDA = Strongly disagree |

The data in Table 2 shows that 36.67 per cent and 10.00 per cent of the men respondents “agreed “and “strongly agreed” with the statement that decrease in crop yield is due to change in temperature. Majority (60.00 per cent) of the men respondents “disagreed” with the statement that there is more use of traditional crop varieties. The data also reveal that majority (56.18 per cent) of the respondents agreed with the statement that there is change in the timing of flowering and fruiting. Time of harvesting of crops has changed was also agreed by 48.34 per cent of the farmers and 13.34 per cent were strongly agreed with it. Majority (51.67 per cent and 22.50 per cent) of the men farmers agreed and strongly agreed with the statement that time of ripening of crop has changed. It was also reported that majority of the farmers ( 58.34 per cent and 22.50 per cent ) agreed and strongly agreed with the statement the statement that quality of edible crop has decreased. Majority (55.00 per cent and 26.67 per cent) of the farmers agreed and strongly agreed with the statement that availability of irrigation water has decreased due to climate change. The data also pointed out that majority (60.00 per cent and 25.00 per cent) of the respondents agreed and strongly agreed with the statement that there is decrease in the ground water level due to climate change. Majority (60.83 per cent and 25.84 per cent) of the men farmers agreed and strongly agreed that there is increase in disease incidence in crops. It was also found that majority (49.17 per cent and 21.67 per cent) of the respondents agreed and strongly agreed with the statement that climate is becoming favorable for insect and 55.84 per cent of the farmers agreed with the statement that climate is becoming favorable for diseases. The findings also state that majority (55.84 per cent) of the men respondents disagreed with the statement that there is decrease in the forest area due to climate change. Considerable no of farmers (49.17 per cent) and (40.00 per cent) have agreed that there is change in the behavior of animals and health of the animals is negatively affected due to climate change.

**Women farmers’ perception on experience in different agricultural activities due to climate change**

The data of the perception of farmers on experience in different agricultural activities due to climate change are presented in the Table 3.

**Table 3. Distribution of women respondent’s perception on experience in different agricultural activities due to climate change (n = 120)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl No.** | **Statements** | **SA** | **A** | **U** | **DA** | **SDA** |
| *f (%)* | *f (%)* | *f (%)* | *f (%)* | *f (%)* |
| 1. | Decrease in crop yield due to change in climate. | 6 (5.00) | 34 (28.33) | 50 (41.67) | 23(19.17) | 7( 5.83) |
| 2. | There is less use of traditional crop varieties. | 9 (7.50) | 46 (38.33) | 60 (50.00) | 4(3.33) | 1(0.83) |
| 3. | Change in flowering & fruiting time of crop. | 2(1.67) | 18(15.00) | 81(67.50) | 18(15.00) | 1(0.83) |
| 4. | Time of harvesting of crop has changed. | 11(9.17) | 38(31.67) | 35(29.17) | 20(16.67) | 16(13.33) |
| 5. | Time of ripening of crop or fruits has changed. | 6(5.00) | 44(36.67) | 30(25.00) | 25(20.83) | 15(12.50) |
| 6. | Quality of edible crop has decreased. | 7(5.84) | 28(23.33) | 56(46.67) | 22(18.33) | 7(5.83) |
| 7. | Cropping practices have changed. | 9(7.50) | 31(25.83) | 58(48.33) | 18(15.00) | 4(3.34) |
| 8. | Availability of irrigation water has decreased due to climate change. | 12(10.00) | 32(26.67) | 39(32.50) | 30(25.00) | 7(5.83) |
| 9. | Decrease in ground water level due to climate change. | 20(16.67) | 42(35.00) | 29(24.17) | 19(15.83) | 10(8.33) |
| 10. | Increase in water stagnation due to climate change. | 6(.00) | 19(15.83) | 53(44.17) | 38(31.67) | 4(3.33) |
| 11. | Availability of fresh fruits and vegetable has decreased. | 15(12.50) | 26(21.67) | 17(14.17) | 52(43.33) | 10(8.33) |
| 12. | Disease incidence in crop has increased. | 11(9.17) | 33(27.50) | 48(23.33) | 26(21.67) | 2(1.67) |
| 13. | New verities of pest/disease have emerged. | 9(7.50) | 19 (15.83) | 44(36.67) | 32(26.67) | 16(13.3) |
| 14. | New varieties of weed species have emerged. | 0(0.00) | 25(20.83) | 70(58.33) | 15(12.50) | 10(8.33) |
| 15. | Seasonal weed infestation has increased. | 3(2.50) | 13(10.83) | 71(59.16) | 63(35.83) | 10(8.33) |
| 16. | Climate is becoming favourable for weed disease. | 5(4.17) | 18(15.00) | 79(65.83) | 10(25.00) | 8(6.67) |
| 17. | Climate is becoming favourable for insect | 4(3.33) | 26(21.67) | 59(49.17) | 21(17.5) | 10(8.33) |
| 18. | Climate is becoming favourable for disease | 5(4.17) | 28(23.33) | 67(55.83) | 11(9.17) | 9(7.50) |
| 19. | Extinction of various crop & animal species due to climate change. | 20(16.67) | 19(15.83) | 46(38.33) | 21(17.50) | 14(11.67) |
| 20. | Decrease in forest area. | 0(0.00) | 14(11.67) | 65(54.17) | 34(28.33) | 7(5.83) |
| 21. | Availability of wild varieties has changed due to change in climate. | 10(8.33) | 20(16.67) | 60(50.00) | 30(25.00 | 0(0.00) |
| 22. | Climate change is one of the reasons responsible for reduction in forest area. | 0(0.00) | 30(25.00) | 57(47.50) | 30(25.00) | 3(2.50) |
| 23. | Increase in soil erosion due to climate change. | 0(0.00) | 20(16.67) | 80(66.67) | 20(16.67) | 0(0.00) |
| 24. | Increase in expenses in farming due to climate change. | 15(12.50) | 31(25.83) | 64(53.33) | 10(8.83) | 0(0.00) |
| 25. | Decrease in fodder due to climate change. | 5(4.17) | 7(5.83) | 45(37.50) | 31(25.83) | 32(26.67) |
| 26. | Change in behaviour of animal due to climate change | 32(26.67) | 39(32.50) | 29(24.17) | 17(14.17 | 3(2.50) |
| 27. | Health of animals is negatively affected due to climate change. | 28(23.33) | 47(39.17) | 20(16.67) | 13(10.83 | 12(10.00) |
| 28. | Extinction of old fish verities emergence of new fish verities in rivers due to climate change. | 4(3.33) | 23(19.17) | 84(70.00) | 7(5.83) | 2(1.17) |
| *(Note: The data in parenthesis indicates per cent).*S A= Strongly agree, A= Agree, UD= Undecided, D= Disagree, SDA = Strongly disagree |

The data in the Table 3 indicates that majority (41.67 per cent and 42.50 per cent) of the women farmers were undecided about the statement that there is any increase and decrease in crop yield due to climate change. Further 43.33 per cent of the women respondents disagreed with the statement there is increase in use of traditional crop varieties. The data also shows that 48.33 per cent of the women respondents agreed with the statement that quality of edible crop has decreased. Considerable (44.17 per cent) no of women respondents agreed with the statement that disease incidence in crop has increased. Majority (58.33 percent, 42.50 per cent and 49.17 per cent) of the women respondents were undecided about the statement that new varieties of diseases have emerged, seasonal weed infestation has increased and climate is becoming favourable for weed and insects. Similarly, majority (54.17 per cent,50.00 per cent, 66.67 per cent, 53.33 per cent and 70.00 percent) were undecided about the statements that there is decrease in forest area, availability of wild varieties have changed, there is increase in soil erosion due to climate change, there is increase in expenses in farming due to climate change and there is extinction of old fish varieties and emergence of new fish varieties in rivers due to climate change. At the same time, it was also noticed in the data that 32.50 per cent and 26.67 per cent of the women respondents agreed and strongly agreed with the statement that there is change in behaviour of animals due to climate change.

Adaptation strategy to climate change: Adaptation refers to a wide range of measures to reduce vulnerability to climate change impacts (Shukla *et al.*, 2022), planting disease and drought resistant crop varieties and enhancing climate change information and early warning systems to build stronger defense against floods. These adaptation measures require proactive measures at the local level inclusive of all sectors of the society which requires strategic planning at the highest level. Both men and women participate in the adaptation measures due to climate change, women have invaluable expertise in adapting to extreme environmental changes from time immemorial. Thus, this finding of the adaptation strategies adopted by men and women farmers shows the level of awareness and dedication among the farmers to address the climate change issues.

**Table 4. Distribution of men respondents according to their adaptation strategy against agricultural activities due to climate change since last 10 years (n = 120)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl No.** | **Climatic events** | **Mitigation strategy** | ***f (%)*** |
| 1. | Heavy rainfall  |
| A | Before sowing  | Short Term: |  |
| Early sowing | 78 (65.00) |
| Crop Insurance |  6 (5.00) |
| Mixed cropping | 45 (37.50) |
| B | At the time of sowing  | Short Term: |  |
| Increased seed rate | 88 (73.33) |
| Flood tolerance variety | 25 (20.83) |
| Strengthening of bund | 110 (91.66) |
| C | After sowing  | Short Term: |  |
| Drainage | 44 (36.66) |
| Bunding | 84 (70.00) |
| D | Before harvesting  | Long term |  |
| Fish farming | 26 (21.66) |
| E | At the time of harvesting  | Short Term: |  |
| Late harvesting | 55 (45.83) |
| F | After harvesting  | Fodder bank | 1 ( 0.83) |
| 2. | Less rainfall  |
| A | Before sowing  | Short term: |  |
| Mulching | 48 (40.00) |
| Drought tolerance variety | 77 ( 64.16) |
| Deep rooted crop | 64 (53.33) |
| Early maturity variety | 64 (53.33) |
| Low water requiring crop | 40 (33.33) |
| Long term: |  |
| Poly house | 10 (8.33) |
| Tube well | 90 (75.00) |
| Ponds | 15 (12.50) |
| Check Dam | 14 (11.66) |
| B | At the time of sowing  | Short Term: |  |
| Increased Irrigation | 8 ( 6.66) |
| Application of Potash | 40 (33.33) |
|  |  | Application of Urea | 110 (91.66) |
| C | After sowing  |  |  |
| D | Before harvesting  | Short Term: |  |
| Thinning | 59 (49.16) |
| E | At the time of harvesting  |  |  |
| F | After harvesting  | Long term: |  |
| Seed Bank | 1 (0.83) |
| Renovation of well | 6 (5.00) |
| SRI & DSR | 22 (18.33) |
| 3. | Uneven rainfall  |
| A | Before sowing  | Short Term: |  |
| Use of Farm implements | 90 (75.00) |
|  Long Term : |  |
| Conservation tillage | 16 (13.33) |
| B | At the time of sowing  | Short Term : |  |
| Crop diversification | 34 (28.33) |
| C | After sowing  | Long term: |  |
| Sprinkler irrigation | 5 (4.16) |
| D | Before harvesting  | Long term: |  |
| INM in crops | 4 ( 3.33) |
| E | At the time of harvesting  |  |  |
|  |  | Long term: |  |
| Renovation of pond | 10 ( 8.33) |
| 4. | Cloudy Days  |
| A | Before sowing  |  |  |
| B | At the time of sowing  | Short Term : |  |
| Pest resistant variety | 23 (19.16) |
| C | After sowing  |  |  |
|  |  |
| D | Before harvesting  | Long term:Backyard PoultryDuck farming | 8 (6.66)5 (4.16) |
| E | At the time of harvesting  |  |  |
| F | After harvesting  | Renovation of pond | 10 ( 8.33) |

(Multiple Response)

The data in the Table 4 indicates both long- and short-term adaptation strategies adopted by men respondents in response to climate change. In long term strategies, 75.00 per cent, 18.33 per cent, 8.33 per cent, 21.66 per cent, 13.33 per cent, 11.66 per cent, 8.33 per cent, 6.66 per cent and 4.16 per cent of the respondents adopted tube well, SRI & DSR methods (Lal *et al.*, 2022), poly house, fish farming, conservation tillage (Lal *et al.*, 2022), check dams, renovation of ponds, backyard poultry, and duck farming, respectively. At the same time they also adopted short term adaptation strategies viz strengthening of bunds, application of potash and urea, use of farm implements, thinning, increased seed rate, bunding, early sowing, drought tolerant variety, deep rooted crops, early maturing variety, increased irrigation, crop diversification, pest resistant variety, mulching, mixed cropping, drainage, and low water requiring crops in 91.66 per cent, 33.33 per cent, 91.66 per cent,75.00 per cent,49.16 per cent,73.33 per cent,45.00 per cent, 65.00 per cent,64.16 per cent, 53.33 per cent, 53.33 per cent, 6.66 per cent, 28.33 per cent, 19.16 per cent, 15.00 per cent, 37.50 per cent, 36.66 per cent and 33.33 per cent respectively.

The data of the distribution of women respondent’s according to their adaptation strategy against agricultural activities due to climate change since last 10 years are presented in the Table 5.

**Table 5: Distribution of women respondent’s according to their adaptation strategy against agricultural activities due to climate change since last 10 years**

 **(n= 120)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl No.** | **Climatic events** | **Mitigation strategy** | ***f (%)*** |
| 1. | **Heavy rainfall**  |
| A | Before sowing  | **Short Term :**Early sowing | 38 (31.66) |
| Mixed cropping |  10 (8.33) |
| **Long term :** |  |
| Crop Insurance | 0 (0.00) |
| B | At the time of sowing  | **Short Term :** |  |
| Increased seed rate | 28 (23.33) |
| Flood tolerance variety |  5 (4.16) |
| Strengthening of bund |  14 (11.66) |
| C | After sowing  | **Short Term :** |  |
| Drainage |  24 (20.00) |
| Bunding |  14 (11.66) |
| D | Before harvesting  | **Long term** |  |
| Fish farming | 6 (5.00) |
| E | At the time of harvesting  | **Short Term :** |  |
| Late harvesting | 25 (20.83) |
| F | After harvesting  | **Long term** |  |
| Fodder bank | 0 (0.00) |
| **2.** | **Less rainfall**  |
| A | Before sowing  | **Short term:** |  |
| MulchingDrought tolerance variety | 2 (1.66) 10 (8.33) |
| Application of Potash  |  20 (16.66) |
| Application of Urea |  61 (50.83) |
| Deep rooted crop |  5 (4.16) |
| Early maturity variety |  14 (11.66) |
| Low water requiring crop |  10 ( 8.33) |
| **Long term:** |  |
| Poly house |  0 (0.00) |
| Tube well |  65 (54.16) |
| Ponds |  0 (0.00) |
| Check Dam |  4 (3.33) |
| B | At the time of sowing  | **Short Term :** |  |
| Increased Irrigation |  18 (15.00) |
| C | After sowing  |  |  |
| D | Before harvesting  | **Short Term :** |  |
| Thinning |  39 (32.50) |
| E | At the time of harvesting  |  |  |
| F | After harvesting  | **Long term :** |  |
| Seed Bank |  0 (0.00) |
| Renovation of well |  0 (0.00) |
| SRI & DSR |  0 (0.00) |
| **3.** | **Uneven rainfall**  |
| A | Before sowing  | **Short Term :** |  |
| Use of Farm implements | 40 (33.33) |
| **Long term:** |  |
| Conservation tillage | 0 (0.00) |
| B | At the time of sowing  | **Short Term :** |  |
| Crop diversification | 14 (11.66) |
| C | After sowing  | **Long term:** |  |
| Sprinkler irrigation | 0 (0.00) |
| D | Before harvesting  | **Long term:** |  |
| INM in crops | 0 (0.00) |
| E | At the time of harvesting  |  |  |
| F | After harvesting  | **Short Term :** |  |
| Late harvesting | 45 (37.50) |
| **Long term:** |  |
| Renovation of pond | 0 (0.00) |
| **4.** | **Cloudy Days**  |
| A | Before sowing  |  |  |
| B | At the time of sowing  | **Short Term :** |  |
| C | After sowing  | **Short Term :** |  |
| D | Before harvesting  | **Long term:** |  |
| Backyard Poultry | 4 (3.33) |
| Duck farming |  1 (0.83) |
| E | At the time of harvesting  |  |  |
| F | After harvesting  | Renovation of pond | 0 (0.00) |

(Multiple Response)

The data in the Table 5 indicates both long and short term adaptation strategies adopted by women respondents in response to climate change. In long term strategies, 12.50 per cent, 6.66 per cent, 5.00 per cent, 4.16 per cent, 3.33 per cent and 0.83 per cent of the respondents adopted tube well, seed bank, fodder bank, fish farming, SRI & DSR methods,backyard poultry and duck farming respectively. At the same time they also adopted short term adaptation strategies viz strengthening of bunds, application of potash and urea, thinning, increased seed rate, bunding, late sowing, drought tolerant variety, early maturing variety, increased irrigation, pest resistant variety, late harvesting, mulching, and low water requiring crops in 11.66 per cent,16.66 per cent, 34.16 per cent, 7.50 per cent, 23.33 per cent, 11.66 per cent,8.33 per cent,11.66 per cent, 15.00 per cent, 2.50 per cent, 37.50 per cent, 1.66 per cent and 8.33 per cent respectively.

**Discussion**

This study on gender perspectives in climate change adaptation among farmers in Eastern India offers valuable insights into the differing perceptions and strategies of men and women in response to climatic variability. The findings reveal significant gender-based disparities in awareness, decision-making, and adaptive measures, emphasizing the need for gender-inclusive policies in climate resilience planning**.**

**Gender Differences in Climate Change Perception**

The research indicates that male farmers are more likely to recognize the adverse effects of climate change on agriculture compared to female farmers. While a substantial proportion of men agreed that climate change has reduced crop yields, women were often undecided. This discrepancy can be attributed to several socio-economic and cultural factors. Women typically have less access to agricultural extension services and digital technologies, such as mobile phones and radio, which are crucial for receiving weather updates and climate-related advisories. Additionally, traditional gender roles in rural households often confine women to domestic and subsistence farming tasks, limiting their exposure to broader agricultural decision-making processes. These findings align with existing literature (e.g., Demetriades & Esplen, 2010; Lambrou & Piana, 2006), which highlights how gender inequalities exacerbate women’s vulnerability to climate change by restricting their access to resources and information.

**Adaptation Strategies: A Gender-Based Analysis**

The study categorizes adaptation strategies into short-term and long-term measures, with men more actively involved in both. Short-term strategies, such as early sowing, increased seed rates, and the use of drought-tolerant varieties, were predominantly adopted by men. These measures require immediate decision-making and control over agricultural resources, areas where men traditionally hold authority. Long-term strategies, including investments in tube wells, check dams, and fish farming, were also more common among male farmers, reflecting their greater access to financial resources and land ownership.

In contrast, women’s participation in formal adaptation strategies was limited. This can be linked to structural barriers such as lack of land ownership, restricted access to credit, and limited mobility. Women’s roles in subsistence farming and household responsibilities further constrain their ability to engage in labor-intensive or financially demanding adaptation practices. However, women often possess valuable indigenous knowledge related to crop diversification and natural resource management, which remains underutilized in mainstream climate adaptation planning.

**Policy Implications for Gender-Inclusive Adaptation**

The findings underscore the necessity of integrating gender perspectives into climate adaptation policies to ensure equitable and effective outcomes. Extension services should be tailored to reach women farmers through female-led training programs and accessible communication channels, such as community radio or mobile-based advisories. Efforts to enhance women’s access to land, credit, and agricultural inputs are critical for empowering them to adopt adaptive measures. Additionally, participatory approaches that include women in local decision-making processes can leverage their traditional knowledge and improve the relevance of adaptation strategies.

**Conclusion**

This study reveals critical gender disparities in climate change awareness and adaptation strategies among farmers in Eastern India. While men actively adopt both short- and long-term adaptive measures, women's participation remains limited due to structural barriers. Bridging this gap requires gender-inclusive policies that enhance women's access to resources, information, and decision-making in agriculture. Empowering women farmers is essential for building equitable and resilient farming systems in the face of climate change.

**Future Research Directions**

Future research could explore intersectional factors, such as caste and economic status, to better understand the layered vulnerabilities faced by women in agriculture. Longitudinal studies tracking the effectiveness of gender-sensitive adaptation programs would also be valuable.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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