# Adaptability of Farmers to Climate Change in North Bank Plains Zone of Assam


## ABSTRACT

The study was carried out to assess the adaptability of farmers to climate change in North Bank Plains Zone of Assam. A household level survey was carried out with the selected farmers to obtain the primary data. For this, total 120 farmers were selected from 6 different villages through proportionate random sampling. The adaptability was assessed by following the procedure of Shankar *et al.* (2013). Adaptation Index for each management practice was calculated and the score ranged from 0 to 100. Findings revealed that adaptation practices such as use of organic manure, summer deep ploughing, conservation tillage, bunds and change in variety were followed by most of the farmers to cope up with the climate change. The adaptation practices such as water harvesting, use of ITK, bird perched, intercropping and protected cultivation were followed by least number of farmers to cope up with climate change. The study also revealed that majority of the respondents (67.67%) belonged to medium adaptability category followed by 19.17 per cent of respondents in low adaptability category and 14.17 per cent respondents in high adaptability category. The mean adaptability score was 11.71 indicating that, on an average, respondents had medium adaptability.



**Key words: Adaptability, Climate change, North bank plains zone, Adaptation practices**




## 1. Introduction

Climate change is a usual weather change found in a place. This could be a change in how much a place usually gets rain in a year or it could be a change in a usual temperature of a place for a month or season. Today, Climate change has been recognized globally as the most important critical issue affecting the survival of the mankind in the 21st century. No one can deny it any longer. One can feel it in heat, one can see it in ice and one can observe it in the storms. The most obvious significance of climate change is the rising of average worldwide temperature rapidly, popularly known as global warming. The average annual temperature of the Earth's surface has risen more rapidly over the last several years. Not only the temperature, but also the rate of warming itself is increasing at a significant rate. The mean global annual temperature increased between 0.4 to 0.7°C and this is a very rapid rate at which temperature is changing in ecological term (IPCC, 2007). Climate change has the

potential to affect everyone, but one most particular vulnerable group is farmers. India is more vulnerable in view of the large population of the country that depends on agricultural as well as natural resources. There are evidences of negative effects on yields of wheat and paddy in some parts of India due to raised temperature, moisture stress and lessening of rainy days. Under medium-term (2020–2039) climate change scenario, crop yield is projected to reduce by 4.5 to 9 per cent, depending on the magnitude and distribution of warming (NICRA, 2013). Climate change is a global environmental threat to all economic sectors, particularly the agricultural sector. Adaptation to climate change is constrained by several factors such as lack of information, lack of money, resource constraints and shortage of irrigation water in the study area (Abid *et al.*, 2015). Several global studies have indicated that India is particularly vulnerable to climate change, and is likely to suffer with damage to agriculture, food and water security, human health and cattle populations. Although farmers has low knowledge regarding climate change (Sanodiya *et al*., 2019). As agriculture sector has to face the hostile effects of climate change and climate variability, hence adaptation strategies are indispensable for farmers to deal with them (Chunera and Amardeep, 2018). The choice of adaptation methods by farmers depends on various social, economic and environmental factors (Deressa, 2007; Bryan *et al*., 2013). This knowledge will ultimately enhance the credibility of policies and their strength to tackle the challenges being imposed by climate change on farmers (Deressa *et al*., 2009). Adaptation will require the participation of multiple players from sectors such as research and policy, those in the agricultural extension services and private welfare organizations, as well as local communities and farmers (Bryan *et al*., 2013). Agriculture in India with more than half is rainfed area, is mostly dependent on monsoon besides the interplay of other biotic and abiotic factors (Harikrishna *et al*., 2019). Rainfed farming system is more vulnerable to the devastating environmental, economic and social impacts of climate change. Farmers in these environments have to face various biophysical stresses resulting in lower and unstable yields due to frequent drought, submergence and unfavourable soil condition as a result of climate change. Apart from losses caused due to adverse climate change, it also affecting the decision making ability of farmers due to lack of awareness and knowledge (Chouksey *et al*., 2021). So, to cope with the situation, proper assessment of vulnerabilities to climate change and suitable technologies for adaptation to climate change are of prime importance. Adaptation to climate change involves management in agricultural production practices by the farmers in line with the changing climate condition. UNDP (2005) defined adaptation as a process by which strategies to moderate, cope with and take advantage of the consequences

of climatic events were enhanced, developed and implemented. In the present study, adaptability was conceptualized as the extent of use of agricultural management practices by the farmers to moderate or cope with the perceived negative impact on agriculture due to changes in climate conditions.

## 2. Materials and Methods

The study was conducted purposively in North Bank Plains Zone of Assam as it is the highly flood affected and drought prone areas of Assam. The zone consists of 6 districts, out of which 2 districts were selected randomly for the study, *viz.*, Sonitpur district and Udalguri district. From each selected district 3 villages were selected randomly, viz., chitalmari no. 2 village, chitalmari no. 3 village and chitalmari sapori village from Sonitpur district and Fatasimolu village, Biscuti village and Kasarison village from Udalguri district. Total 120 farmers were selected from these 6 selected villages through proportionate random sampling. The head of each farm household was the respondent of the study. The primary data for the study were collected by the personal interview method with the help of a structured interview schedule. The primary data for the study were collected during the period from February to March, 2019. The adaptability of farmers to climate change was assessed by following the procedure of Shankar *et al.* (2013). To assess the adaptability of farmers to climate change, 15 agricultural management practices followed by farmers due to climate change practices were selected after consulting concerned agricultural scientists and agricultural meteorologist of Biswanath College of Agriculture, AAU. The farmers were asked to mention the frequency of use of each of the given management practices. The responses of the respondents against each practices were recorded on a 3 point continuum as regularly, sometimes and not at all with scores 2,1 and 0 respectively. The total maximum obtainable score for a particular practice by all the respondents was 240 and the score for an individual respondent ranges from 0 to 30. Adaptation Index for each management practice was calculated by using the formula given by Shankar *et al.* (2013) and Adaptation Index score ranged from 0 to 100. Data were analyzed using frequency, percentage, mean, standard deviation and coefficient of variation.

The adaptation index for a given practice was computed as fallows

$$\text{Adaptation index} = \frac{\text{Obtained total adaptation score}}{\text{Maximum obtainable score}} \times 100$$

## 3. Results and Discussion

### Adaptation pattern to climate change

Distribution of respondents according to adaptation pattern of different agricultural management practices is presented in Table 1. Data presented in Table 1 reveal that adaptation index was highest in use of organic manure (62.08%) followed by summer deep ploughing (58.33%) and conservation tillage (50.83%). During data collection, respondents reported that they used organic manure to maintain soil health which in turn helped them in management of dry spell. Similarly, they adopted summer deep ploughing to eliminate soil borne insect pests and diseases. Most of them were also found to adopt conservation tillage for moisture conservation. Adaptation Index was 50.00 per cent in use of bunds followed by change in variety (45.42%), diversified farming (45.42%), changing planting dates (40.83%), mulching (40.42%) and contingency crop planning (37.50%). Some of the respondents adopted bunds for water conservation in their crop field and some of them were found to use different crop variety (short duration, medium duration, long duration and water submergence tolerant) to cope with the effects of flood and drought. Some of them adopted diversified farming for managing the risk that might arise due to changing climate conditions. Some of the respondents were found to change planting/sowing dates of different crops (pre pond or post pond) to escape seasonal floods and dry spells. Some of the respondents adopted use of mulching for in-situ moisture conservation and some of them adopted contingency crop planning to overcome unforeseen climatic situation. The findings are in line with Dupdal *et al.* (2021). The findings are also in line with Fosu-Mensah *et al.* (2012) who revealed that the major adaptation strategies to climate change includes crop diversification, planting of short season varieties, change in crops species, and changing in planting date

**Table 1: Distribution of respondents according to adaptation pattern of different agricultural management practices**

| Sl. No | Practices | Frequency of use | | | Adaptation Index |
|---|---|---|---|---|---|
| | | Regularly | Sometimes | Not at all | |
| 1. | Use of organic manure (vermicompost/compost) | 45 (37.50) | 59 (49.17) | 16 (13.33) | 62.08 |
| 2. | Summer deep ploughing | 46 (38.88) | 48 (40.00) | 26 (21.67) | 58.33 |
| 3. | Conservation tillage | 32 (26.67) | 58 (48.33) | 30 (25.00) | 50.83 |
| 4. | Use of bunds | 28 (23.33) | 64 (53.33) | 28 (23.33) | 50.00 |
| 5. | Change in variety | 38 (31.67) | 33 (27.50) | 49 (40.83) | 45.42 |

| | | | | | |
|---|---|---|---|---|---|
| 6. | Diversified farming | 30 (25.00) | 49 (40.83) | 41 (34.17) | 45.42 |
| 7. | Changing planting dates | 32 (26.67) | 34 (28.33) | 54 (45.00) | 40.83 |
| 8. | Use of mulching | 23 (19.17) | 51 (42.50) | 46 (38.33) | 40.42 |
| 9. | Contingency crop planning | 19 (15.83) | 52 (43.33) | 49 (40.83) | 37.50 |
| 10. | Change in crop | 24 (20.00 | 39 (32.50) | 39 (32.50) | 36.25 |
| 11. | Water harvesting | 28 (23.33) | 26 (21.67) | 66 (55.00) | 34.17 |
| 12. | Use of ITK | 19 (15.83) | 40 (33.33) | 61 (50.83) | 32.50 |
| 13. | Bird perched | 8 (6.67) | 40 (33.33) | 72 (60.00) | 23.33 |
| 14. | Intercropping | 12 (10.00) | 23 (19.17) | 85 (70.83) | 19.58 |
| 15. | Protected cultivation | 5 (4.17) | 11 (9.17) | 104 (86.67) | 8.75 |

Adaptation Index was 36.25 per cent in change in crop followed by water harvesting (34.17%), use of ITK (32.50%), bird perched (23.33%), intercropping (19.17%) and protected cultivation (8.75%). Some of the respondents adopted change in crop to escape flood, drought situation and also to escape from insect and disease infestation and some of them adopted water harvesting in farm pond for ex-situ water conservation. Some of the respondents were found to use ITK like neem leaves extract as insect repellant and some of them adopted bird perched for insect pest management. A relatively small proportion of resspondents adopted intercropping for dry spell management and protected cultivation of high value crops to cope with changing climate condition. The management practices such as summer deep ploughing (38.88%), use of organic manure (37.50%), change in variety (31.67%), changing planting dates (26.67%) and use of bunds (23.33%) were used regularly by most of the respondents and the management practices use of bunds (53.33%), use of organic manure (49.17%), conservation tillage (48.33%), contingency crop planning (43.33%) and use of mulching (42.50%) were used sometimes by most of the respondents.

**Adaptability to climate change**

Considering the use of all the 15 selected management practices, the adaptation score for each respondent was worked out. Adaptation score of a respondent ranged from 0 to 30. Based on the mean and standard deviation of the obtained adaptation scores respondents were classified into 3 categories, viz., low adaptability, medium adaptability and high adaptability. The results revealed (Table 2) that majority of the respondents (67.67%) belonged to medium adaptability category followed by 19.17 per cent of respondents in low adaptability category and 14.17 per cent respondents in high adaptability category.

**Table 2. Distribution of respondents according to their adaptability to climate change**

| Category | Range | Number (%) | Mean score | SD | CV |
|---|---|---|---|---|---|
| Low adaptability | 1- 6 | 23 (19.17) | | | |
| Medium adaptability | 7-17 | 80 (66.67) | 11.71 | 5.53 | 47.00 |
| High adaptability | 18-26 | 17 (14.17) | | | |
| Total | | 120(100.00) | | | |

The mean adaptability score was 11.71 indicating that, on an average, respondents had medium adaptability. The value of co-efficient of variation (47.00%) indicated that the respondents were relatively homogeneous with respect to their adaptability to climate change.

## 4. . Conclusion

The study on adaptability of farmers to climate change revealed that adaptation practices such as use of organic manure, summer deep ploughing, conservation tillage, bunds, change in variety and diversified farming were followed by most of the farmers to cope up with the climate change. Findings implied that the extension functionaries and agricultural scientists should promote these agricultural management practices among the farmers to enable them to cope with changing climate conditions. The study also revealed that majority of the respondents belongs to medium adaptability category followed by low and high adaptability category. Thus, the need for increasing adaptation strategies is very crucial for the farmers.

## References

Abid, M.; J. Scheffran; U.A. Schneider and M.J.E.S.D. Ashfaq. 2015. Farmers' perceptions of and adaptation strategies to climate change and their determinants: the case of Punjab province, Pakistan. *Earth System Dynamics*, 6(1): 225-243.

Bryan, E.; C. Ringler; B. Okoba; C. Roncoli; S. Silvestri and M. Herrero. 2013. Adapting agriculture to climate change in Kenya: Household strategies and determinants. *Journal of environmental management*, 114: 26-35.

Chouksey, R.; K.C. Singh; C. Singh and Y. Birle. 2021. Adaptation of Farmers Regarding Climate Resilient Technologies in Rewa Block of Rewa District in Madhya Pradesh. *Indian Journal of Extension Education*, 57(1): 26-31.

Chunera, A. and Amardeep. 2018. Information Needs for Climate Change Adaptation among Farmers of Uttarakhand, India. *Indian Journal of Extension Education*, 54(2): 41-47.

Dupdal, R.; B.L. Patil and B.S. Naik. 2021. Perceptions and adaptation strategies to changing climate: evidence from farmers of northern dry zone of Karnataka. *Indian Journal of Extension Education*, 57(3):60-64.

Deressa, T.T. 2007. Measuring the economic impact of climate change on Ethiopian agriculture: Ricardian approach. World Bank Policy Research Working Paper, 4342.

Deressa, T.T.; R.M. Hassan; C. Ringler; T. Alemu and M. Yesuf. 2009. Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global environmental change*, 19(2): 248-255.

Fosu-Mensah, B.Y.; P.L. Vlek and D.S. MacCarthy. 2012. Farmers' perception and adaptation to climate change: a case study of Sekyedumase district in Ghana. *Environment, Development and Sustainability*, 14(4): 495-505.

Harikrishna, Y.V.; S. Naberia; S. Pradhan and P. Hansdah. 2019. Agro-Economic Impact of Climate Resilient Practices on Farmers in Anantapur District of Andhra Pradesh. *Indian Journal of Extension Education*, 55(4): 91-95.

IPCC. 2007. *Climate change 2007: The physical science basis*. Working Group I Contribution to the Fourth Assessment Report of the IPCC. Cambridge University Press, Cambridge.

NICRA. 2013. National Initiative on Climate Resilient Agriculture AICRIPAM Component: Annual Report-2013. Central Research Institute for Dryland Agriculture, Hyderabad, India.

Sanodiya, S.; K.C. Singh; V. Shrivastava and C. Singh. 2019. Effect of climate change on cropping pattern of vegetables in Madhya Pradesh, India. *International Journal of Current Microbiology and Applied Sciences*, 8(4): 1350-1358.

Shankar, R.K.; K. Nagasree; S.G.R. Maruthi; M.S. Prasad; B.M.K. Raju; R.A.V.M. Subba and B. Venkateswarlu. 2013. Farmers' Perceptions and Adaptation Measures towards Changing Climate in South India and Role of Extension in Adaptation and Mitigation to Changing Climate. Central Research Institute for Dryland Agriculture, Hyderabad. Extension Bulletin No.03:7-28

UNDP. 2005. *Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies and Measures*. (B. Lim and E. Spanger-Siegfried, Ed.). Cambridge University Press, Cambridge.