



Farmer's Awareness Regarding Climate Change and its Effect on Ground Water

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ABSTRACT

The growing impacts of extreme weather events due to climatic variations have already been felt throughout the world. Be it incessant rains, floods, long droughts, extreme heat, wildfires, etc., the impacts are visible across the globe affecting the lives and professions in many ways. Agriculture is one of the severely hit areas due to climatic variations. In light of such events, it has become imperative to study the environmental awareness of the farmers and their agricultural practices. The present study was carried out in 2023 in randomly selected five villages namely from two randomly selected blocks of Ludhiana, Punjab. From each village a sample of 25 farmers was selected randomly comprising a total of 125 respondents. The data was collected through a survey using the questionnaire. Percentages and mean were used to analyze the data. The findings revealed that the respondents were aware of climate change and its repercussions but they were not always following water-saving practices in their fields. Suggested creation of awareness and educating farmers regarding various technologies to save groundwater. Extension functionaries should work to sensitize farmers to mitigate climate change.

INTRODUCTION

The climate plays a role in determining the existence of life on Earth. It is essential for maintaining a balance and providing nourishment to all living beings. However over the decades there has been a significant change in the climate due to various factors such as pollution, deforestation and industrialization. Climate change has emerged such as one of the environmental issues in today's world. It has effects on ecosystems, as augmented temperatures, mounting sea levels, changes in rainfall patterns, melting glaciers and devastating floods. According to the IPCC (2014) there was a temperature increase of 0.6 °C, over the century and it is projected that temperatures will rise by 2–3 °C by the end of this century. In countries, with developing economies, where poverty is widespread and agriculture serves as the livelihood for many people, climate change poses a significant and pressing

issue (Huong et al., 2018). For households in underdeveloped regions, the effects of climate change are severe owing to a variety of factors, including low awareness, a lack of skills and education, a lack of adequate infrastructure, a lack of financial resources, etc (Jamshidi et al., 2019).

Water and climate change have a connection. Climate change exacerbates water scarcity and water related hazards. The impacts of climate change are directly linked to water, such, as rainfall patterns, melting ice sheets, sea level rise, floods and droughts. Climate change can also lead to a decline in groundwater levels due to alterations, in timing and availability (IPCC, 2014). The Indian Express claimed in a piece that Punjab's unpredictable rainfall over a short period has both a negative impact on crop water productivity and a negative impact on the ability to recharge subsurface aquifers. If this situation persists, there will be serious food insecurity (Goyal, 2023). Significant drops in crop output

reported in many Asian regions due to erratic rainfall patterns during the past few decades, as well as decreased timely availability of water (Aryal et al., 2020). Even with the green revolution, maintaining production and maintaining food security for Asia's impecunious rural communities would be difficult in times of climate change. Damage from climatic shifts may put at risk the national economic productivity and food security (Myers et al., 2017). Given the unfavorable effects it becomes imperative to be aware of the climate change and its repercussions. Understanding the nature of climate change issues, such as temperature increases, sea level rises, extreme weather, and global warming, is referred to as climate change awareness (Abbass et al., 2022). Farmers are in a unique position to offer first-hand observations, allowing for a greater knowledge of the effects of climate change because they deal with the complexity of both natural and human systems (Talanow et al., 2021). Adoption of techniques and processes is only possible if they are aware of climate change and its effects on our resources. Therefore the study was conducted to know farmers' awareness of climate change, its reasons, effects and mitigation practices to save ground water.

METHODOLOGY

The study was carried out in the Ludhiana district of Punjab. Two blocks were randomly selected from the district. From these two blocks five villages namely *Jandiali*, *Rampur*, *Sudhar*, *Humanyupura* and *Boparai Kalan* were also selected randomly. From each village a sample of twenty five farmers, was identified through a survey making a total of 125 respondents. The data was then collected from the respondents through the questionnaire method. Each farmer was questioned separately to obtain the data. The questionnaire was divided into two parts that were socio-economic profile and farmers' awareness regarding climate change and their water-saving practices. The socio-economic profile was studied in part one while the awareness about climate change, its reasons, effects and farmer's water saving practices were studied in part two. Awareness about climate change was recorded with "yes" and "no" statements with every "yes" response, a score of 1 was assigned and every "no" response was assigned a score of 0. Awareness about the reasons for climate change, the effects of climate change on water resources and the factors responsible for the depletion of water noted in terms of fully aware, somewhat aware and not at all aware with coding of 2, 1, and 0 respectively. The frequency of adoption of water saving practices in farms was studied in terms of Always, Sometimes, and Never scored as 2, 1, and 0 respectively. The compiled data was analysed by different statistical tools viz. frequency, percentages, and mean. The awareness of the farmers regarding climate change was analysed through frequency and percentage while its reasons, effects and the usage of water- saving practices by the farmers were recorded in terms of mean values. The higher mean values indicated the main reason or effect of the climate change and also the main practices of the farmers to save water in agriculture.

RESULTS

The data in Table 1 shows the awareness of selected farmers regarding climate change. All the farmers were aware about

Table 1. Farmer's awareness about climate change, its reasons and awareness

Parameters	Yes f(%)
Change in climate	124 (99.2)
Increase in temperature	123(98.4)
Variation in rainfall	124(99.2)
Shifting of season	70(56.0)
Changes in soil moisture	57(45.6)
Increased risk of drought	90(72.0)
Harmful effects of too much or too little rainfall	125(100)
Depleting ground water	125 (100)
Reasons of climate change	Mean value (0-2)
Paddy cultivation	1.30
Paddy straw burning	1.36
Increased use of generators	0.80
Pollution	1.98
Industrialization	1.92
Mechanization	1.30
More use of pesticide	1.80
Deforestation	1.88

groundwater level. The data further depicts that most of the farmers (99.2%) were aware of changes in the climate. Most of the farmers (98.4%) were aware of the increase in temperature and 99.2 per cent were aware of the variation in rainfall. All of them were aware of harmful effects of rainfall variation. The majority of the farmers (72%) were aware of the fact that climate change can increase the risk of drought. Comparatively less percent of farmers were aware of shifting of season (56.0%) and changes in soil moisture (45.6%).

The mean values given in Table 2 represent that the respondents were fully aware that pollution (1.98), industrialization (1.92), deforestation (1.88) and more use of pesticides (1.80) were the major causes of climate change. The majority of the farmers' somewhat agreed that burning of paddy straw (1.36), mechanization (1.30), paddy cultivation (1.30) and increased use of generators (0.80) can also lead to climate change.

Table 2 signifies that majority of the farmers were fully aware of the increase in the number of tube wells (1.83), variation in rainfall (1.80) and depleting water table (1.74) as the effects of

Table 2. Farmer's awareness about effects of climate change on water resources factors responsible for depletion of groundwater

Effects	Mean value (0-2)
Water table depletion	1.74
Increase in number of tube wells	1.83
Variation in rainfall	1.80
Factors	
Surplus area under paddy	1.46
Over irrigation of crop	1.42
Wrong methods of irrigation	1.57
Early transplantation of paddy	1.43
Stick to rice-wheat rotation only	1.33
Boost in number of tube wells	1.59
Declining trend of rainfall	1.90

Mean range: 0 (Not at all aware) - 2 (Fully Aware)

climate change. The farmers were fully aware of the declining trend of rainfall with the mean score of 1.90 followed by an increase in the number of tube wells (1.59) and wrong practices of irrigation (1.57) as factors of water depletion. They were somewhat aware of the other factors like more area under paddy cultivation (1.46), early transplanting of paddy (1.43), over-irrigation of crop (1.42) and sticking to rice-wheat rotation only (1.33).

Table 3 showcases the frequency of using water saving practices. The mean scores depicts that the majority of the farmers' always leveled their fields (1.87) and had regular maintenance and cleaning of water channels (1.78) while preparing fields for sowing. The data further revealed that majority of farmers preferred transplanting paddy after 15th June (1.64). Majority of the farmers' sometimes divided their fields into small plots (1.49) and were sometimes using organic manure (1.08) in their fields. Some of the farmers reported that they were sometimes sowing crops on ridges (0.86) and ploughing field after each rain (0.78).

They were rarely doing intercropping (0.38) and were rarely sowing less water consuming crops other than paddy and wheat (0.22). The other water-saving practices were rarely followed by the farmers such as using a tensiometer for irrigating paddy (0.07), mulching (0.07), rain-water harvesting (0.05), use of water flow meter to measure water usage (0.04) and change of irrigation schedule (0.03).

DISCUSSION

In terms of awareness regarding climate change the finding suggests that farmers of Punjab were aware of climate change. These findings were in congruence with the results of the similar studies carried out by Ghanghas et al., (2015); Sohail et al., (2022) & Mehmood et al., (2022). The research reports that more than 70 per cent of the farmers were aware of the climate change. As for variation in rainfall was concerned similar results were observed in the study conducted by Belay et al., (2017) where 68.5 per cent of the respondents observed increase in temperature and 85 per cent observed declining trend of rainfall. In the study done in Khyber

Pakhtunkhwa (KP) province of Pakistan by Fahad et al., (2020) and study conducted by Vijayabhinandana et al., (2022) the farmers perceived climate change and were using adaptation techniques to counter its adverse effects. Farmers considered pollution, industrialization, deforestation and use of pesticides in agriculture as the major reasons of climate change. But the respondents were somewhat aware that stubble burning causes climate change. Every year, farmers in Punjab have to deal with around 20 million tonnes of paddy straw. In order to make room for wheat to be sown, an estimated 15 million tons of paddy straw are burned in open fields. Burning leftover stubble carelessly has turned into a pollution risk that causes a great deal of environmental damage, significant soil nutritional loss, and health issues (Vasudev, 2023). The farmers' explained that they did not consider burning rice straw to be a particularly serious hazard because it did not have a long-lasting negative impact because they just burned the rice straw after harvesting and prepared for the following crop, which is not a serious problem as compared to industrial effluents which are released every day. A similar observation was reported by Sereenonchai & Arunrat (2022) in their study where farmers did not consider straw burning as a critical problem. Majority of the farmers were also not aware of paddy cultivation as a cause of climate change. Thus there is a need to aware farmers about reasons of climate change.

Majority of the farmers were fully aware of the effects of climate change on water resources. Although, Sidhu & Chopra (2022) in their research, conducted in Punjab, showed that farmers were less aware regarding ground water depletion. Water conservation practices were used only by the large farmers owing to their higher incomes. Majority of the farmers were aware that the numbers of tubewells are increasing Punjab due to climate change. Farmers are aware of this but still no action is being taken in this regard. Thus, there is a need to aware farmers about different ways of mitigating the effects of climate change. According to a blog post by Singh (2022), in Punjab, there were just 7,445 tube wells as of 1961. By 2021, this figure had increased to over 1.5 million. In addition to various other problems, the state's development blocks have seen a steady decrease in groundwater levels as a result of the massive increase in tube-well required to meet paddy's irrigation needs. Similar results are observed in the study conducted by Sharma et al., (2018), where the data establishes that majority of the farmers (71.67%) were aware of the impact of climatic variability on water resources.

According to the research published in 2017 by Kaur et al., Punjab's cultivated land occupies around 85 per cent of its overall area, with cropping intensity beyond 198 per cent. The rotation of paddy and wheat crops has resulted in a significant augment in the need for irrigation water. Scarce surface water supplies pooled with excessive groundwater pumping from free power and farming operations have caused a 41.6 cm/yr long-term groundwater decrease in the state. In a study conducted in Uttar Pradesh by Tripathi and Mishra (2017) it is found that although farmers perceived the climate changes they were not taking any concrete measures to rectify these changes. The reason is either the lack of knowledge of water saving practices or less profitability on applying these practices. In terms of field leveling similar results were observed in a study conducted by Vatta et al., (2022) also reported that almost

Table 3. Frequency of using water saving practices in agriculture

Statements	Mean value (0-2)
Leveling of field	1.87
Ploughing of field after each rain	0.78
Division of fields into small plots	1.49
Regular maintenance and cleaning of water channels	1.78
Use of underground pipes for irrigation	0.30
Sowing crops on ridges	0.86
Transplanting paddy after 15 th June	1.64
Use of Tensiometer for irrigating paddy	0.07
Irrigation by alternative ridges	0.56
Use of organic manure	1.08
Mulching	0.07
Sowing of less water consuming crops instead of paddy and wheat	0.22
Intercropping	0.38
Use of water flow meter to measure water usage	0.04
Rain-water harvesting	0.05
Changing irrigation schedule	0.03

Mean range: 0 (Never) – 2 (Always)

all the farmers surveyed in their study were aware of the importance of field leveling and more than 83 per cent had adopted laser land leveling to level their fields. But with context to organic farming, a news article in Times of India, Punjab has reported lowest number of farmers practicing organic farming under Participatory Guarantee System (PGS India). The farmers reported the lack of potential buyers of organic produce had led them to revert back to the use of chemical fertilizers (Verma, 2022).

Farmers do not diversify and produce alternative crops because the going market prices for those products are significantly lower than the minimum support price and procurement is not guaranteed. In contrast a study conducted in the Bundelkhand region by Jatav & Singh (2023) showed that farmers switched to Chickpea (a less water intensive crop) from wheat cultivation (water intensive crop) as a method to cope with changing climate. The results indicated less use of mulching technique by the farmers despite its several benefits could be due to low awareness in spite of continued inspiration by the agricultural scientist and officers. These are the major reasons which restrict farmers' top practice water saving technologies in agriculture.

CONCLUSION

It can be deduced that although farmers were aware of climate change and its repercussions but they were not always following water saving practices in their fields. Further they were also aware of the reasons for climate change but could not follow some of the water-saving practices due to fear of income loss. The farmers were also not fully aware of the reasons for the depletion of water. Thus, there is a need to educate the farming community on the causes contributing to water depletion so that they can adopt tactics to deal with the problem of climate change as well as water depletion. Implementing adaptation measures is essential to safeguard future agricultural production and food security since climate change poses a severe danger to agricultural sectors and lives. Thus creating awareness about the use of water saving technologies is the need of the hour.

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