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FARMERS AWARENESS ABOUT CLIMATE CHANGE: A SHORT STUDY

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ABSTRACT: Agriculture is the backbone of Indian economy and climate change significantly affects agriculture productivity. Climate Change is the long-term changes in characteristics of climate of a region due to astrophysical, geophysical or human-induced parametric variations. Such changes of climate at global or regional level have significant influences on life processes on earth, especially man and his living environment. One characteristic of climate, under normal circumstances is its stability and predictability which governs not only the human activities like agricultural practices, but even other living beings for example timely flowering of plants, regulating the reproductive behaviour of animals and so on. With climate change, the predictability of climate is destroyed; and that creates lots of problems to cope with by both the living world in general, but human beings, in specific . Climate change is the long-term weather patterns during a period; it potentially affects the frequency of natural disasters,damages natural ecosystems and human-built infrastructures, and causes human health issues via food shortages, increased heat,pollution, etc. The region depends on the monsoon for the rainfall,but rainfall is changing, and monsoon rainfall is declining year on year . Climate change, the most threatening issue is hitting almost all spheres of life. Agriculture, being an open field activity, is directly affected by climate change and is also the most vulnerable to this query.

INTRODUCTION:

Climate change currently contributes to the global burden of many problems at very high confidence. Human being and earth system are exposed to climate change through changing weather patterns, temperature rise, precipitation imbalance, sea level rise and more frequent and extreme events and indirectly through change in water, air and food quality and changes in Eco-systems agriculture, industry and economy. At this stage the effects may not appear big but, are projected to progressively increase in all regions of our country. Climate change is the change in the statistical distribution of weather over periods of time that range from decades to millions of years. It is one of the key components influencing agricultural production and has large scale inputs on food production and overall economy. Agriculture is an important driver of wheels of Indian economy and also treated as backbone of the country. Thus agriculture sector needs to be improved steadily on sustainable, viable and in Eco- friendly way. The present study is an attempt to explore the co-relation of impact of climate change on

Agricultural sector like (Animal husbandry, Fishery, Forestry and hydro-logical sector) and how the Green house gases, Carbon dioxide, Temperature and all meteorological phenomena affect the agricultural production. It also highlights the relationship of climate change on agriculture by relating with the crop, soil, rainfall, green house gases, and temperature and how the threatening of agriculture can mitigate in a sustainable and viable way by adopting suggested agricultural measures like crop varieties, drought and flood management, and restoration of waste and degraded lands.

The IPCC Fourth Assessment Report of the Working Group II: Impacts, Adaptation and Vulnerability describe the likely effects of climate change, including from increases in extreme events. The effects on key sectors, in the absence of countermeasures, are summarized as follows:

Water: Drought affected areas are likely to be more widely distributed. Heavier precipitation events are very likely to increase in frequency leading to higher flood risks. By mid-century, water availability is likely to decrease in mid-latitudes, in the dry tropics and in other regions supplied by melted water from mountain ranges. More than one sixth of the world‘s population is currently dependent on melt water from mountain ranges.

Food: While some mid latitude and high latitude areas will initially benefit from higher agricultural production, for many others at lower latitudes, especially in seasonally dry and tropical regions, the increases in temperature and the frequency of droughts and floods are likely to affect crop production negatively, which could increase the number of people at risk from hunger and increased levels of displacement and migration.

Industry, settlement and society: The most vulnerable industries, settlements and societies are generally those located in coastal areas and river flood plains, and those whose economies are closely linked with climate sensitive resources. This applies particularly to locations already prone to extreme weather events and especially to areas undergoing rapid urbanization. Where extreme weather events become more intense or more frequent, the economic and social costs of those events will increase.

Health: The projected changes in climate are likely to alter the health status of millions of people, including increased deaths, disease and injury due to heat waves, floods, storms, fires and droughts. Increased malnutrition, diarrhea disease and malaria in some areas will increase vulnerability to extreme public health, and development goals will be threatened by long term damage to health systems from disasters.

Climate change and agriculture:

As our climate continues to heat up and the impacts of that warming grow more frequent and severe, farmers and farm communities around the world will be increasingly challenged. And US farmers won't be spared the damage that climate change is already beginning to inflict.

In fact, the industrial model that dominates our nation's agriculture—a model that neglects soils, reduces diversity, and relies too heavily on fertilizers and pesticides—makes US farms susceptible to climate impacts in several ways.

The combination of advancing climate change and an already-vulnerable industrial system is a "perfect storm" that threatens farmers' livelihoods and our food supply. The good news is that there are tools—in the form of science-based farming practices—that can buffer farmers from climate damage and help make their operations more resilient and sustainable for the long term. But farmers face many obstacles to changing practices, so it's critical that policymakers shift federal agriculture investments to support and accelerate this transition.

Based on some of the past experiences indicated above, impact of climate change on agriculture will be one of the major deciding factors influencing the future food security of mankind on the earth. Agriculture is not only sensitive to climate change but also one of the major drivers for climate change. Understanding the weather changes over a period of time and adjusting the management practices towards achieving better harvest are challenges to the growth of agricultural sector as a whole. The climate sensitivity of agriculture is uncertain, as there is regional variation in rainfall, temperature, crops and cropping systems, soils and management practices. The inter-annual variations in temperature and precipitation were much higher than the predicted changes in temperature and precipitation. The crop losses may increase if the predicted climate change increases the climate variability. 5 Different crops respond differently as the global warming will have a complex impact. The tropics are more dependent on agriculture as 75% of world population lives in tropics and two thirds of these people's main occupation is agriculture. With low levels of technology, wide range of pests, diseases and weeds, land degradation, unequal land distribution and rapid population growth, any impact on tropical agriculture will affect their livelihood. Rice, wheat, maize, sorghum, soybean and barley are the six major crops in the world grown in 40% cropped area, and contribute to 55% of non-meat calories and over 70% of animal feed (FAO, 2006). Consequently, any effect on these crops would adversely affect the food security.

Farmers awareness :

Agriculture is crucial for ensuring food, nutrition and livelihood securities for India. Indian agriculture had made a significant progress in the past, but currently it is facing many

challenges. Stagnating net sown area, plateauing yield levels, deterioration of soil quality, reduction in per capital land availability and the adverse effect of climate change are the major challenges for Indian agriculture. On the other hand, the increased rate of population is pressurizing the agricultural sector for enhanced food production. The task is very challenging because about 60% of the net cultivated area is rain-fed and exposed to biotic and abiotic stresses arising from climatic variability and climate change. More than 80% of Indian farmers are marginal and small with poor coping capacity. Furthermore, the Indian farmers are heterogeneous and unorganized. Climate change and variability are likely to aggravate the problem of future food security by putting pressure on agriculture affecting its sustainability.

METHODOLOGY

The study was carried out in the Rupnagar district of Punjab. Five villages were randomly selected from the district. From these five villages namely Mirpur, *Barwa, Chanoli, Kumbewal, Bajrur* 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 analyse by different statistical tools viz. frequency, percentages, and mean. The awareness of the farmers regarding climate change was analyse 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.

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)
Change in soil moisture	57(45.6)
Increased risk of drought	90(72.0)
Depleting Ground water	125(100)
Reason 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

RESULTS:

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

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
Variations 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

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 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 15thJune (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 inter cropping (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.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 Tube wells 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.

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
	1.49
Division of fields into small plots	1.78

Regular maintenance and cleaning of water channels	0.30
Use of underground pipes for irrigation	0.86
Sowing crops on ridges	1.64
Transplanting paddy after 15th June	0.07
Use of Tensio meter for irrigating paddy	0.56
Irrigation by alternative ridges	1.08
Use of organic manure	0.07
Mulching	0.22
Sowing of less water consuming crops instead of paddy and wheat	0.38
Inter cropping	0.04
Use of water flow meter to measure water usage	0.05
Rain-water harvesting	
Changing irrigation schedule	0.03

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 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.

Conclussion:

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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