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To determine the perception about climate change among the farmers

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Abstract

The present study was conducted in Ahmednagar and Pune districts of Maharashtra state during the year 2022-23. The districts were purposively selected for the present study as they have highest area under crop cultivation. The village-wise list of the farmers for the selected tahsils was prepared. 30 farmers from each selected village were selected randomly. Thus, total 360 farmers were selected for this study. The research design ex post facto were used.

It was observed that 69.16 percent farmers had medium level of perception towards climate change on agriculture followed by 17.50 and 13.34 percent high and low perception about climate change on agriculture.

Keywords: Perception, farmers, agriculture, climate change

Introduction

Agriculture is the mainstay of Indian economy and about 65% of Indian population depends directly on Agriculture. It has to support almost 17% of world population from 2.3% of the global geographical area and 4.2% of world's water resources. Climate change is one of the biggest environmental challenges in all countries in the world. (Singh, 2019) Climate change refers to any change in climate over time, whether due to natural variability and as a result of human activity (IPCC, 2007a) ^[7]. Agriculture is extremely vulnerable to climate change. Climate change can affect agriculture in a variety of ways. Beyond a certain range of temperatures, warming tends to reduce yields because crops speed through their development, producing less grain in the process. And higher temperatures also interfere with the ability of plants to get and use moisture. In 2022, the Intergovernmental Panel on Climate Change (IPCC) released its 6th Assessment Report on climate change. It warned that greenhouse gas emissions and meet the targets set for 1.5 °C. It provides specific figures, such as the need to peak emissions before 2025 and reduce them by 43% by 2030, to have a chance of meeting the 1.5 °C target. (IPCC, 2022) ^[6].

Agriculture and Climate are mutually dependent. The Bureau of Meteorology reports that, the world climate is changing at a rapid pace. Now it is widely accepted that though climate change is a natural process, its pace of change has increased over the last 150-200 years, especially after industrial revolution in western world during 1970's (IPCC 2007) ^[7]. The International Food Policy Research Institute's (IFPRI) Global Food Policy 2022 Report has warned that climate change may push 90 million Indians

towards hunger by 2030. The effects of climate change on agriculture can result in lower crop yields and nutritional quality due to drought, heat waves and flooding as well as increase in pests and plant diseases. The effects are unevenly distributed across the world and are caused by changes in temperature, precipitation and atmospheric carbondioxide levels due to global climate change. In 2019, millions were already suffering from food insecurity due to climate change. Further, the predicted decline in global crop production is 2% to 6% with each decade. In 2019, it was predicted that food prices would rise by 80% by 2050. This will likely lead to increased food insecurity, disproportionately affecting poorer communities.

Objective

To study perception of farmers about climate change on agriculture.

Methodology

The Objective of the present research aimed to determine the perception of farmers about climate change on agriculture. The present study was conducted in Ahmednagar and Pune districts of Maharashtra state. The districts were purposively selected for the present study as they have highest area under crop cultivation. The village-wise list of the farmers for the selected tahsils was prepared. 30 farmers from each selected village were selected randomly. Thus, total 360 farmers were selected for this study. The perception scale was designed for the present study. The data were collected with the help of well constructed and pretested interview schedule. The independent variables namely Age, education, farming

experience, land holding, total annual income, crop insurance, irrigation, extension contacts, mass media exposure, awareness, innovativeness, scientific orientation. The perception as a dependent variable has been selected for this study. The collected data were processed through primary and secondary tables and statistical methods and

testes such as frequency, percentage, mean, standard deviation, Karl Pearson's correlation coefficient method was used for the analysis of the data ex-post facto research design was used in this research and computed to find out the relationship between the selected independent and dependent variables.

Table 1: Distribution of respondents according to their perception about climate change on agriculture

Sr. No.	Statements	SA	A	UD	DA	SDA
A.	Weather and Climate					
1.	Rainy Season					
1)	Drought and floods contribute to decrease in crop yield	153 (42.50)	125 (34.72)	22 (6.11)	19 (5.27)	41 (11.38)
2)	Occurrence of dry spell during the growing season which cause deficiency of soil moisture	162 (45.00)	138 (38.33)	25 (6.94)	17 (4.72)	18 (5.00)
3)	Optimal amount of rainfall is necessary for optimal crop growth and yield	148 (41.11)	157 (43.61)	20 (5.55)	20 (5.55)	15 (4.16)
4)	Flooding during farming season causes crop losses due to the low quality of soil	133 (36.94)	115 (31.94)	12 (3.33)	9 (2.50)	31 (8.61)
5)	Global warming would cause an increase in rainfall in some areas, which would lead to an increase of atmospheric humidity and the duration of wet season	161 (44.72)	123 (34.16)	34 (9.44)	31 (8.61)	20 (5.55)
6)	Drought condition can lead to moisture stress causing plants wilt and reducing crop yields	280 (77.77)	60 (16.69)	10 (2.77)	10 (2.77)	0 (0.00)
2.	Winter season					
1)	Cold waves impede the vegetation growth of plants/ seeding and may result in crop failure	89 (24.72)	198 (55.00)	36 (10.00)	9 (2.50)	6 (1.66)
2)	Extreme cold soil can reduce the survival rate of some insects, resulting in less insect pressure on crops during the growing season	95 (26.38)	162 (45.00)	40 (11.11)	22 (6.11)	41 (11.38)
3)	Low temperature affects several aspects of crop growth i.e., survival, cell division, growth and finally yield	15 (4.16)	19 (5.27)	22 (6.11)	28 (7.77)	276 (76.66)
4)	Significant loss of crop due to reduced plant growth and crop efficiency is usually caused by cold stress	104 (28.88)	171 (47.50)	37 (10.27)	21 (5.83)	27 (7.50)
5)	Change in weather pattern and temperature due to climate change leads to dispersal of plant pathogens as hosts migrate to areas with more favourable condition	68 (18.88)	215 (59.72)	35 (9.72)	23 (6.38)	19 (5.27)
6)	Cold temperature at night in the winter months would kill off insects, bacteria and fungi	25 (6.94)	19 (5.27)	22 (6.11)	28 (7.77)	266 (73.88)
3.	Summer Season					
1)	Rising temperature leads to more frequent droughts, wildfires and invasive pest outbreaks, leading to the loss of plant species	171 (47.50)	127 (35.27)	19 (5.27)	30 (8.33)	13 (3.61)
2)	Global warming will increase the frequency & severity of heatwaves and results in a decline in the intensity and frequency of extreme cold spells	112 (31.11)	188 (52.22)	31 (8.61)	18 (5.00)	11 (3.05)
3)	Due to rise in temperature and changes in water availability, climate change can affect irrigated agricultural production throughout Agro-ecological zones	190 (52.77)	100 (27.79)	50 (13.89)	20 (5.55)	0 (0.00)
4)	Extreme period of high temperature is particularly harmful for crop production if they are flowering	147 (40.83)	150 (41.66)	20 (5.55)	19 (5.27)	24 (6.66)
5)	Higher temperature tends to lead to faster crop development, a shortened grain-filling stage and reduced yield	21 (5.83)	41 (11.38)	14 (3.88)	13 (3.61)	271 (75.27)
B.	Agriculture					
1)	Change in crop rotation	135 (37.50)	111 (30.83)	24 (6.66)	21 (5.83)	9 (2.50)
2)	Change occurred in flowering and fruiting time of crops	89 (24.72)	198 (55.00)	36 (10.00)	19 (5.27)	18 (5.00)
3)	Climate change condition getting favourable to flourish weeds/ insects/ diseases	112 (31.11)	178 (49.44)	41 (11.38)	18 (5.00)	10 (2.77)
4)	Irrigation of crops is able to reduce or even remove the impacts on yield of lower rainfall and higher temperature through localised cooling	200 (55.55)	100 (27.77)	60 (16.66)	00 (0.00)	00 (0.00)
5)	Wind speed affects the pollination in fruit crops	133 (36.94)	174 (48.33)	19 (5.27)	16 (4.44)	18 (5.00)
6)	Ripening time of crops/ fruits are changed	165 (45.83)	136 (37.77)	23 (6.38)	20 (5.55)	16 (4.44)
7)	Strong wind and storms result in heavy lodging and uprooting of crops	170 (47.22)	134 (37.22)	23 (6.38)	19 (5.27)	14 (3.88)
C.	Livestock					
1)	Disease outbreak- FMD/ Lumpi	181 (50.27)	127 (35.27)	19 (5.27)	20 (5.55)	13 (3.61)

2)	Reduction in grazing areas, fodder crisis due to less growth and green fodder yield (GYF) and decrease in production of milk, egg and meat	166 (46.11)	113 (31.38)	27 (7.50)	19 (5.27)	35 (9.72)
3)	Grazing animals help to improve soil health and vegetation growth, while also reducing greenhouse gas emission	20 (5.55)	31 (8.61)	11 (3.05)	14 (3.88)	284 (78.88)
4)	Heat stress affects animal growth and reproduction as well as their feed intake	95 (26.38)	187 (51.94)	36 (10.00)	29 (8.05)	13 (3.61)
5)	In animals heat stress can result in lower productivity and fertility and it can also have negative effects on immune system	87 (24.16)	205 (56.94)	30 (8.34)	27 (7.50)	11 (3.05)
D.	Health					
1)	Migration of birds and animals has increased	104 (28.88)	181 (50.27)	27 (7.50)	21 (5.83)	27 (7.50)
2)	Increasing deaths due to floods, storms and droughts	116 (32.22)	157 (43.61)	37 (10.27)	18 (5.00)	32 (8.88)
3)	Increasing malnutrition	172 (47.77)	120 (33.33)	21 (5.83)	18 (5.00)	29 (8.05)
4)	Human and animal health problems are increasing	170 (47.22)	129 (35.83)	23 (6.38)	20 (5.55)	18 (5.00)
E.	Marketing					
1)	In rural areas stones are used as weights and in urban markets also defective weights are found	134 (37.22)	174 (48.33)	23 (6.38)	19 (5.27)	14 (3.88)
2)	Due to lack of proper standardization and grading the customers have a problem in purchasing the product	157 (43.61)	140 (38.88)	20 (5.55)	19 (5.27)	24 (6.66)
3)	Agricultural marketing generates economywide gains in output and wages, rises agricultural producer prices, reduce consumer food prices and increase private consumption	172 (47.77)	120 (33.33)	21 (5.83)	18 (5.00)	29 (8.05)
4)	Advertising can also play a pivotal role in fighting climate change	120 (33.34)	100 (27.78)	100 (27.78)	20 (5.55)	20 (5.55)
5)	Demand in rural markets depends on the agricultural situation, which in turn depends on the monsoon	271 (75.27)	41 (11.38)	14 (3.88)	13 (3.61)	21 (5.83)

a) Perception of respondents about climate change in relation to weather and climate

1. Rainy season

It is evident from the Table 1. that majority of the respondents i.e. 77.22 percent (42.50% Strongly Agree and 34.72% Agree) perceived that 'Drought and floods contribute to decrease in crop yield', whereas, 16.65 percent (11.38% Strongly Disagree and 5.27% Disagree) respondents disagreed and 6.11 percent were undecided. The probable reason for this may be that changing weather patterns often result in lower crop yields due to water scarcity caused by drought, heat waves and flooding. Hence, it has been acknowledged that farmers are aware of this.

In response to a statement whether 'Occurrence of dry spell during the growing season which cause deficiency of soil moisture'. Majority of respondents i.e. 83.33 percent agreed (45.00% Strongly Agree and 38.33% Agree) with this statement, while, 9.72 percent (5.00% Strongly Disagree and 4.72% Disagree) respondents had disagreed and 6.94 percent respondents were undecided. It can be illustrated that farmers rightly perceived that study area has cumulative deficiency of monthly rainfall creates dry weather which directly results in soil water deficit and subsequently crop water stress.

Near about 84.72 percent respondents perceived (41.11% Strongly Agree and 43.61% Agree) agreed, while, 9.71 percent (4.16% Strongly Disagree and 5.55% Disagree) respondents disagreed and 5.55 percent respondents had undecided that cause of climate change was 'Optimal amount of rainfall is necessary for optimal crop growth and yield'. The probable reasons for this may be that it can be said that rainfall is essential to crop health, as it provides the water and nutrients needed for the growth and development of crops.

Most of the respondents i.e. 68.88 percent perceived

(36.94% Strongly Agree and 31.94% Agree) that cause of climate change was 'Flooding during farming season causes crop losses due to the low quality of soil; whereas, 11.11 percent (8.61% Strongly Disagree and 2.50% Disagree) respondents disagreed and 3.33 percent respondents were undecided. The probable reasons for this may be that floodwaters can submerge and drown crops leading to significant losses in yield and quality. So, it can be observed that farmers have perceived this fact.

Majority of the respondents i.e. 78.88 percent perceived (44.72% Strongly Agree and 34.16% Agree) that cause of climate change was 'Global warming would cause an increase in rainfall in some areas which would lead to an increase of atmospheric humidity and the duration of wet season', whereas, 14.16 percent (5.55% Strongly Disagree and 8.61% Disagree) respondents disagreed and 9.44 percent respondents were undecided. The probable reasons for this may be that as the air warms it can hold more water. Most of the respondents i.e. 94.46 percent perceived (77.77% Strongly Agree and 16.69% Agree) that cause of climate change was 'Drought condition can lead to moisture stress causing plants wilt and reducing crop yields', whereas, 2.77 percent respondents had 'disagreed' and 'Undecided'. The probable reasons for this may be that it may be attributed to the respondents having harsh experiences with the climatic change related to agriculture.

2. Winter season

About 79.72 percent (55.00% Strongly Agree and 24.72% Agree) respondents perceived that 'Cold waves impede the vegetation growth of plants/ seeding and may result in crop failure', while, 4.16 percent farmers (1.66% Strongly Disagree and 2.50% Disagree) farmers 'disagreed' and 10.00 percent were 'undecided'. Probable reason for this may be that farmers did experience changes in the pattern of

cold and heat wave. Therefore, it has been recognized that respondents have acknowledged this fact.

In response to a statement whether 'Extreme cold soil can reduce the survival rate of some insects, resulting in less insect pressure on crops during the growing season'. Majority of the respondents i.e. 71.38 percent (26.38% Strongly Agree and 45.00% Agree) agreed with this statement. Whereas, 17.49 percent (11.38% Strongly Disagree and 6.11% Disagree) respondents 'disagreed'; and 11.11 percent were 'undecided'. It can be said that most of the respondents perceived that climate change is harmful; as insects can cause more crop damage and yield loss due to climate change. This implies that now climate change seems to be real as respondents could realize the effects.

The respondents were asked that whether 'Low temperature affects several aspects of crop growth i.e., survival, cell division, growth and finally yield'. Majority i.e. 84.43 percent respondents (76.66% Strongly Disagree and 7.77% Disagree) disagreed and about 9.43 percent (4.16% Strongly Agree and 5.27% Agree) respondents agreed; and 6.11 percent respondents were undecided. It can be concluded that respondents have perceived that there is change in rainfall pattern and its distribution. Hence, survival and geographical spreading of plants are also greatly affected by low temperatures.

Majority of the respondents i.e. 76.38 percent (28.88% Strongly Agree and 47.50% Agree) agreed that 'Significant loss of crop due to reduced plant growth and crop efficiency is usually caused by cold stress', whereas, 13.33 percent respondents had (7.50% Strongly Disagree and 5.83% Disagree) disagreed; and 10.27 percent respondents were undecided. Plant growth and development are reduced when cells and tissues dehydrate and crystallize due to cold stress. Consequently, respondents have observed these changes.

The respondents were asked that whether 'Change in weather pattern and temperature due to climate change leads to dispersal of plant pathogens as hosts migrate to areas with more favourable condition'. Majority i.e. 78.60 percent respondents had (18.88% Strongly Agree and 59.72% Agree) agreed and 11.65 percent (5.27% Strongly Disagree and 6.38% Disagree) respondents disagreed; and 9.72 percent respondents were undecided. Respondents perceived that there is variation in climatic phenomenon. Therefore, climate change further increases outbreak risks by altering pathogen evolution and host-pathogen interactions and facilitating the emergence of new pathogenic strains. So, respondents have recognized this statement.

Majority i.e. 81.65 percent (73.88% Strongly Disagree and 7.77% Disagree) disagreed that 'Cold temperature at night in the winter months would kill off insects, bacteria and fungi', whereas, 12.21 percent respondents had (6.94% Strongly Agree and 5.27% Agree) agreed; and 6.11 percent respondents were undecided. Insects are more sensitive to cold and may be killed over the winter if they get too cold for too long period. Hence, respondents have observed this fact.

3. Summer season

The respondents were asked that whether 'Rising temperature leads to more frequent droughts, wildfires and invasive pest outbreaks, leading to the loss of plant species'.

Majority of the respondents i.e. 82.77 percent (47.50% Strongly Agree and 35.27% Agree) agreed and 11.94 percent (3.61% Strongly Disagree and 8.33% Disagree) respondents disagreed; and 5.27 percent respondents were undecided. According to respondents, pathogens and pests are often also more active in warmer temperature. The extended growing season increases the pest populations' ability to threaten the viability their target species. Because water absorbs heat well, submerged vegetation is in a better position to weather climate change. Therefore, it is likely that respondents have observed this.

Most of the respondents i.e. 83.33 percent perceived (31.11% Strongly Agree and 52.22% Agree) that cause of climate change was 'Global warming will increase the frequency and severity of heatwaves and results in a decline in the intensity and frequency of extreme cold spells', whereas, 8.05 percent (3.05% Strongly Disagree and 5.00% Disagree) respondents disagreed; and 8.61 percent respondents were 'Undecided'. The probable reason for this may be that it may be attributed to the farmers have harsh experiences with the climatic change related to agriculture.

Majority of the respondents i.e. 80.56 percent (52.77% Strongly Agree and 27.79% Agree) agreed that 'Due to rise in temperature and changes in water availability, climate change can affect irrigated agricultural production throughout Agro-ecological zones', whereas, 5.55 percent respondents disagreed; and 13.89 percent respondents were undecided. The probable reason for this may be that the frequent variation in temperature and rainfall results in decline of agricultural productivity.

The respondents were asked that whether 'Extreme period of high temperature is particularly harmful for crop production if they are flowering'. Majority of the respondents 82.49 percent (40.83% Strongly Agree and 41.66% Agree) agreed and 11.93 percent (6.66% Strongly Disagree and 5.27% Disagree) respondents disagreed; and 5.55 percent respondents were undecided. According to them, high temperature considerably influences the crops by affecting several physiological injuries like leaf abscission, leaf scorching, senescence and root and shoot growth that subsequently leads to a reduction in yield. Therefore, it is likely that respondents have perceived this fact.

Majority of the respondents i.e. 78.88 percent perceived (75.27% Strongly Agree and 3.61% Agree) that cause of climate change was 'Higher temperature tends to lead to faster crop development, a shortened grain-filling stage and reduced yield', whereas, 17.21 percent (5.83% Strongly Disagree and 11.38% Disagree) respondents had disagreed; and 3.88 percent respondents were 'Undecided'. The probable reasons for this may be that it may be attributed to the farmers have harsh experiences with the climatic change related to agriculture.

a) Agriculture

The respondents were asked about the statement that 'Change in crop rotation'. Majority of the respondents 67.80 percent (37.50% Strongly Agree and 30.83% Agree) agreed and 8.33 percent (2.50% Strongly Disagree and 5.83% Disagree) respondents disagreed; and 6.66 percent respondents were undecided. The probable reasons for this may be that climate change creates a range of challenges for agriculture and farmers must adapt to these conditions to maintain productivity and sustainability.

Most of the respondents i.e. 79.72 percent perceived (55.00% Strongly Agree and 24.72% Agree) that cause of climate change was 'Change occurred in flowering and fruiting time of crops', whereas, 10.27 percent (5.00% Strongly Disagree and 5.27% Disagree) respondents disagreed; and 10.00 percent respondents were 'Undecided'. The probable reasons for this may be that farmer rightly perceived that due to climate change agriculture production will not increase. Hence, respondents might perceive the impact of climate change in various ways, reflecting their diverse experiences and the specific challenges they face.

Majority of the respondents i.e. 80.55 percent (31.11% Strongly Agree and 49.44% Agree) agreed that 'Climate change conditions getting favourable to flourish weeds/ insects/ diseases', whereas, 11.38 percent respondents were undecided and 7.77 percent respondents (2.77% Strongly Disagree and 5.00% Disagree) disagreed. The plausible explanation for this may be that changes in climatic variables are likely to result in stress to crop plants which are vulnerable to attack by weeds, insect pests and pathogens. Therefore, it is likely that respondents have observed this statement.

The respondents were asked that whether 'Irrigation of crops is able to reduce or even remove the impacts on yield of lower rainfall and higher temperature through localised cooling'. Majority of the respondents 83.32 percent (55.55% Strongly Agree and 27.77% Agree) agreed and 16.66 percent respondents were undecided. The probable reason for this may be that when the soil is wet, part of the sun's energy is diverted from warming the soil to vaporising the moisture, creating a cooling effect. Hence, respondents might have viewed this positively.

About i.e. 85.27 percent of respondents (36.94% Strongly Agree and 48.33% Agree) agreed that 'Wind speed affects the pollination in fruit crops', whereas, 9.44 percent respondents had (5.00% Strongly Disagree and 4.44% Disagree) disagreed; and 5.27 percent respondents were undecided. Wind acts as the pollinating agent as it carries the pollen grains towards the distant female flowers. Hence, respondents may have perceived this favourably.

Most of the respondents i.e. 83.60 percent perceived (45.83% Strongly Agree and 37.77% Agree) the cause of climate change was 'Ripening time of crops/ fruits are changed', whereas, 9.99 percent (4.44% Strongly Disagree and 5.55% Disagree) respondents disagreed; and 6.38 percent respondents were 'Undecided'. The reasonable justification for this may be that *variations* in temperature cause alterations in the developmental stages and ultimately the ripening time of crops/ fruits. So, respondents have recognized this statement.

Majority of the respondents i.e. 84.44 percent (47.22% Strongly Agree and 37.22% Agree) agreed that 'Strong wind and storms result in heavy lodging and uprooting of crops', whereas, 9.15 percent respondents (3.88% Strongly Disagree and 5.27% Disagree) disagreed; and 6.38 percent respondents were undecided. As mass media exposure are making respondents aware about the strong wind and storms, hence, respondents may have viewed this in a positive light.

c) Livestock

The respondents were asked about 'Disease outbreak- FMD/ Lumpi'. Majority i.e. 85.54 percent respondents had

(50.27% Strongly Agree and 35.27% Agree) agreed and 9.16 percent (3.61% Strongly Disagree and 5.55% Disagree) respondents disagreed; and 5.27 percent respondents were undecided. The probable reason for this may be that climate change affects incidence, spread and predictability of animal diseases. Hence, respondents may have perceived this favourably.

The respondents were asked that whether 'Reduction in grazing areas, fodder crisis due to less growth and Green Fodder Yield (GYF) and decrease in production of milk, egg and meat'. More than three fourth i.e. 77.49 percent of respondents (46.11% Strongly Agree and 31.38% Agree) agreed, 14.99 percent (9.72% Strongly Disagree and 5.27% Disagree) respondents disagreed; and 7.50 percent respondents were undecided. The plausible explanation for this may be that climate change could indirectly affect livestock production due to the reduction in the quantity and quality of fodder and natural pastures.

About 82.76 percent respondents perceived (78.88% Strongly Disagree and 3.88% Disagree) that cause of climate change was 'Grazing animals help to improve soil health and vegetation growth, while also reducing greenhouse gas emission', whereas, 14.16 percent (5.55% Strongly Agree and 8.61% Agree) respondents had Agreed; and 3.05 percent respondents were 'Undecided'. The probable reason for this may be that grazing animals help to improve soil health and vegetation growth while reducing greenhouse gas emissions. Hence, respondents have recognized this statement.

Majority of the respondents i.e. 78.32 percent perceived (26.38% Strongly Agree and 51.94% Agree) that cause of climate change was 'Heat stress affects animal growth and reproduction as well as their feed intake', whereas, 11.66 percent (3.61% Strongly Disagree and 8.05% Disagree) respondents disagreed; and 10.00 percent respondents were 'Undecided'. The probable reason for this may be that, heat stress in animals is one of the major climate change impacts on domesticated livestock raised in both intensive and extensive production. Hence, farmers might have perceived this statement.

The respondents were asked that whether 'In animals heat stress can result in lower productivity and fertility and it can also have negative effects on immune system', Majority i.e. 81.10 percent respondents had (24.16% Strongly Agree and 56.94% Agree) agreed and 10.55 percent (3.05% Strongly Disagree and 7.50% Disagree) respondents disagreed; and 8.34 percent respondents were undecided. The possible reason for this may be that heat stress cause production losses in animal and impact on their ability to maintain normal function. Therefore, it is likely that respondents have observed this statement.

d) Health

The respondents were asked that due to effect of climate change whether 'Migration of birds and animals has increased'. Majority i.e. 79.15 percent respondents (28.88% Strongly Agree and 50.27% Agree) agreed and 16.33 percent (7.50% Strongly Disagree and 5.83% Disagree) respondents disagreed; and 7.50 percent respondents were undecided. The probable reason for this may be that climate change and extreme weather events are impacting animal and bird migration patterns. Hence, they might have observed this statement.

Most of the respondents i.e. 75.83 percent perceived (32.22% Strongly Agree and 43.61% Agree) that cause of climate change was 'Increasing deaths due to floods, storms and droughts', whereas, 13.88 percent (8.88% Strongly Disagree and 5.00% Disagree) respondents disagreed; and 10.27 percent respondents were 'Undecided'. The probable reason for this may be that climate change will likely increase the frequency and strength of extreme events (such as floods, droughts, and storms) that threaten human health and safety. Hence, respondents might have observed this statement.

Majority 81.10 percent perceived (47.77% Strongly Agree and 33.33% Agree) that cause of climate change was 'Increasing malnutrition', whereas, 13.05 percent (8.05% Strongly Disagree and 5.00% Disagree) respondents disagreed; and 5.83 percent respondents were 'Undecided'. The probable reason for this may be that climate change is increasing the incidence of diseases that contribute to malnutrition. Therefore, it is likely that respondents have perceived this fact.

The respondents had asked that whether 'Human and animal health problems are increasing', due to effect of climate change. Majority i.e. 83.05 percent respondents had (47.22% Strongly Agree and 35.83% Agree) agreed and 10.55 percent (5.00% Strongly Disagree and 5.55% Disagree) respondents disagreed; and 6.38 percent respondents were undecided. The probable reason for this may be that climate change can have a complex impact that also influences human and animal health. Hence, farmers might have viewed this positively.

e) Marketing

The respondents had asked that whether 'In rural areas stones are used as weights and in urban markets also defective weights are found'. Majority i.e. 85.55 percent respondents (37.22% Strongly Agree and 48.33% Agree) agreed and 9.15 percent (3.88% Strongly Disagree and 5.27% Disagree) respondents disagreed; and 6.38 percent respondents were undecided. The probable reason for this may be that the grain of the farmer is weighed by a heavier weight for their own gain. Most of the traders keep separate weights for purchase and sale of grain.

Majority of the respondents (82.49%) perceived (43.61% Strongly Agree and 38.88% Agree) that cause of climate change was 'Due to lack of proper standardization and grading the customers have a problem in purchasing the product', whereas, 11.93 percent (6.66% Strongly Disagree and 5.27% Disagree) respondents disagreed; and 5.55 percent respondents were 'Undecided'. Standardization and grading increased compatibility and interoperability between products. Therefore, it is likely that respondents have perceived this fact.

Most of the respondents i.e. 81.10 percent perceived (47.77% Strongly Agree and 33.33% Agree) that cause of climate change was 'Agricultural marketing generates economywide gains in output and wages, rises agricultural producer prices, reduce consumer food prices and increase private consumption', whereas, 13.05 percent (8.05% Strongly Disagree and 5.00% Disagree) respondents disagreed; and 5.83 percent respondents were 'Undecided'. Hence, respondents might have observed this statement.

The respondents were asked that whether 'Advertising can also play a pivotal role in fighting climate change'. About 61.12 percent respondents had (33.34% Strongly Agree and 27.78% Agree) agreed and 11.10 percent (5.55% Strongly Disagree and 5.55% Disagree) respondents disagreed; and 27.80 percent respondents were undecided. The probable reason for this may be that advertising makes a valuable contribution to the social and cultural fabric, not just the economy and has a crucial role in public messaging. Hence, they might have perceived this.

Majority of the respondents i.e. 86.65 percent perceived (75.27% Strongly Agree and 11.38% Agree) that cause of climate change was 'Demand in rural markets depends on the agricultural situation, which in turn depends on the monsoon', whereas, 9.44 percent (5.83% Strongly Disagree and 3.61% Disagree) respondents disagreed; and 3.88 percent respondents were 'Undecided'. The probable reason for this may be that the demand is not stable or regular. Hence, the per-capita income is low in villages compared with urban areas. Therefore, it is likely that respondents have perceived this statement.

Extent of perception of respondents about climate change on agriculture

Table 2: Distribution of the respondents according to the extent of perception about climate change on agriculture

Sr. No.	Perception (Score)	Respondents (n=360)	
		Number	Percentage
1.	Low (Upto 29)	48	13.34
2.	Medium (30 to 34)	249	69.16
3.	High (35 and above)	63	17.50
	Total	360	100.00
Mean = 32.10 SD = 2.86			

It is evident from Table 2 that a substantial proportion of respondents (69.16%) had medium level of perception followed by 17.50 and 13.34 percent respondents had high and low level of perception about climate change on agriculture. This may be due to the fact that most of the respondents had medium experience in farming and were medium in their other attributes. The probable reason might be due to the fact that respondents had good education and mass media exposure which helps them to get knowledge regarding climate change.

These findings are in the line with the findings of Laxman (2016) ^[2], Chadachal (2017) ^[3], Nayak (2018) ^[1], Mundhe (2019) ^[4] and Rathava (2023) ^[5].

Conclusion

The demographic profile as an dependent variables of the respondents belongs to medium and high possession or categorization. To drive meaningful reforms and address the challenges facing the agricultural sector during this critical phase of transformation, it is essential to equip marginalized segment of agriculture communities with the latest digital knowledge and skills in agriculture and allied sectors. Empowering these groups with up-to- date information and training will be key to fostering sustainable development and ensuring their active participation in the sector's evolution.

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