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FARMERS PERCEPTION REGARDING CLIMATE CHANGE IN RANCHI, JHARKHAND

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Abstract: *Change is law of nature', everything in world keeps changing may it be human evolution or any celestial phenomena. Climate change is a vital natural process. But after beginning of industrial revolution, its frequency had increased many folds due to release of various green house gases. Today, climate change is a worldwide problem. It posses various effect on each and every living organism of this blue planet. Farmers especially of developing and under developed countries are one of the vulnerable groups of this problem, due to poor adaptation and mitigation behaviour. Farmers' perception and response regarding climate change are key factor in making strategies to cope with this problem for sustainable development. This study shows the perception of farmers of Ranchi district regarding effect of climate change on agriculture and farmers, contribution of agriculture in accelerating climate change and climatic contingencies faced by farmers. Geographically Ranchi is located on higher elevation having undulating topography with pleasant weather condition. Findings of this study would be helpful in making effective strategies for sustainable development of farmers.*
Keywords: *Climate change, Farmers, Perceptions.*

Introduction: India is an agrarian country with around 54.6% of its population depending directly and indirectly upon agriculture. Agriculture sector has 17.4 % contribution in total Gross Value added (GVA) of India in 2014-15 year, which was 18.5% in 2011-12, 18.2% in 2012-13 and 18.3% in 2013-14[1]. There has been a continuous decline in the share of agriculture and allied sector in the GVA due to many reasons. Change climate is one of the major causes of this problem. Climate change in Inter Governmental Panel on Climate Change (IPCC) usage refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods[2]. Thus, climate change is a vital process of nature but due to greed of human being to get success and power in various field had activated it many fold and now this had become such an issue that whole world is worried about it. Especially, if we look to farmers of developing countries, who belong to the weaker section of society, are more vulnerable to this problem due to poor adaptation capacity. Farmers with lower adaptation habit do not have irrigation facility and have a very low level of income[3]. Socio economic characters like age, level of education, family size, farming experience and number of family agricultural labourer affect their adaptation behaviour[3]. Climate change posses various effect on agriculture, as Food and Agriculture Organisation have predicted that in developing countries eleven percent of arable land could be affected by it including a reduction of cereal production in up to 65 countries [4]. Rain deficient years causes in extremely low average production/ha, this was simply due to lack of

irrigation systems [5]. Government of Jharkhand have concluded from the analysis of previous temperature in the city of Ranchi in year (2001-2006) that high deviations from normal temperature in comparison to the historic data had seen[6]. Climate change over 21st century is projected to reduce renewable surface water and ground water resources in most dry subtropical regions intensifying competition for water among different sectors[7]. Heat wave reduces milk yield, growth, puberty and maturity of cows and buffaloes[8]. Many weeds, pests and fungi thrives under warmer temperatures, wetter climates and increased CO_2 level[9]. In journal nature Ned Stafford have highlighted reports of decreased protein content and other nutritional content and increase in starch and sugar level due to higher CO_2 presence[10]. Beside this agriculture is a significant driver of global warming and causes 15% of all emissions, half of which are from livestock[11]. Modern agriculture, food production and distribution are major contributors of greenhouse gases. It contributes by emitting methane gas (CH_4) from marshy area of paddy field and ruminant animal husbandry. CH_4 posses direct and indirect global warming potential, directly due to production of troposphere ozone and stratospheric water vapour and indirectly due to production of CO_2 Fertilizers and pesticides used in agriculture to increase the yield, also contributes in release of Green House Gases (GHGs) like NO_2, CH_4, etc.[12]. All these problems have also raised big question over food security in the coming future. To untangle all these problems various strategies have been built, many programmes have been launched at different level for adaptation to the changing situation and mitigation of the root of the problem. But, before making any strategies the most important matter is to know the knowledge level of farmers. What are their socio economic condition? How they perceive climate change? How much worried they are about the changing situation? Are they ready to face this problem? As, people who perceive that they are vulnerable to hazards are more likely to cooperate in relevant disaster preparedness initiatives than those who do not. Keeping these problems in mind study was designed and conducted with objectives: (a) To study socio economic profile of farmers. (b) To study the farmer's perception about climate change.

Research Methodology

Locale of Study: The study was performed at two CD blocks in Ranchi district of Jharkhand state of India. The main reason for selection of these two blocks was due to its association with Climate Change Knowledge Network in Indian Agriculture (CCKN-IA) programme. CCKN-IA programme is an initiative of government of India with technical support from Deutsche Gesellschafts fur International Zuammenarbit (GIN) with an aim to improve the agriculture extension service delivery to contribute towards sustainable agricultural development under the context of climate change adaptation. This programme is active in 6 districts of three states of India that are Jharkhand, Orissa and Maharastra. Out of these Ranchi district was selected purposively. Jharkhand is located in north eastern part of India and homes 3.3 crore population in 79.70 lakh ha[13]. This is basically a plateau region. Ranchi district is capital of this state. Ranchi is located on southern part of the chhota Nagpur plateau which forms the eastern edge of the deccan plateau system. The district is spread over 18.73 lakh acre and homes 29,14,253 peoples. It has a humid subtropical type of climate with temparature range from 42^0C to 20^0C during summer and 25^0C to 0^0C during winter. The average annual rainfall is about 1430mm. Subarnrekha river and its tributaries enhance the beauty and fulfils the water demand of this state. However due to its undulating topography most of water losses occurs. According to Gupta in Jharkhand 20% of annual precipitation is lost in the atmosphere, 50% flow as surface runoff and 30%soacks into the ground as soil moisture and ground water. The higher elevation and forest cover makes its climate pleasant and provides favourable condition for orchards, pulses, millet and vegetable cultivation in up hills and paddy cultivation in middle and lower areas as rainfed crop. Only 8.30% of cultivated area has irrigation facilities. Major source of irrigation are well and canal. These conditions make the district more prone to drought and mainly affect the farming community of this area.

Selection of Villages and Respondents: Respondents were selected from two CD block (Ormanjhi and Angara) of the Ranchi district. These two CD blocks were selected because they were two blocks that were provided information under CCKN-IA programme. Ormanjhi and Angara blocks are spread in 22,796.86ha and 39,856ha and homes 94,137 and 112,759 peoples respectively. CCKN-IA programme is operational in 12 out of 87 villages and 14 out of 82 villages of Ormanjhi and Angara block

respectively. 4 respondents were selected randomly from all 24 villages and 5 respondents from one of the village. Thus total 105 respondents were interviewed. In most cases head of the family were interviewed who could response to asked questions, perform most farm work and takes decision. In case if head of family was unable to response and evolved in off farm work, family member who was responsible for most of farm work were interviewed.

Research Design: The research design adopted for this study was exploratory research design. Under this study it had been tried to explore how farmers perceive climate change and its effect? What major climatic contingencies they are facing? According to them which agricultural activity is harmful for environment and contributing in addition of green house gases, thus accelerating climate change? And how they perceive risk developed due to climate change at local as well as global level?

Data Collection and Analysis: Data were collected through interview schedule consisting of structured open as well as close ended questions. Questions were prepared keeping in view the objective of the study after consulting relevant literature and experts on the subject under study. The interview schedule was pre tested with 15 respondents on a non sampled village in order to find out the weakness of the interview schedule. The schedule was suitably modified on the basis of the pre-test analysis. The collected data were analysed and classified through use of some statistical tools like calculation of frequencies, percentage, mean, standard deviation and mean score.

Results and Discussion

1.1 Socio Economic Status of Farmers: Table 1 shows that majority of respondents were in the age group 29-48 years followed by age group of 22-28 years and age group 49 – 58 years. This finding may be due to reason that respondents of age group 29-48 years bears majority of family responsibility and have more involvement in social activity as compared to other age group. Similar result was also reported by[14] in his study on "Status and prospects of smallholder milk production system in Eastern Haryana" that half of the respondents (49.16%) were in middle age category, i.e. 36 to 50 years of age, followed by 26.67 per cent in old age category and rest belonged to young age category. Education status is one of the major social factors that influences the behaviour and culture of any society. Majority of respondents were educated upto middle school followed by intermediate and primary school. This finding may be due to the reason that there were lack of colleges for higher study area and lack of higher income. Somewhat similar result was observed by[15] in his study on "Technological gap in relation to feeding practices of dairy animals in Jhansi district of Bundelkhand Region" that majority of the respondents (27.08%) were educated up to primary level followed by middle (22.08%) and matric (17.50%). Landholding refers to possession of land (in acre) by the respondents. It has been categorised in six groups[16]. Majority of respondents had small land holdings followed by marginal land holdings. This is due to increased population density; undulating topography and the reason being respondents were of labour class. This result matches with the data of Jharkhand government that "83% of the agricultural land in the state belongs to small and marginal farmers and only 1% of holdings are above 10 hectares". Annual income of any population affects their expenditure characteristic and simultaneously influence their view about nature and natural resources. Majority of the respondents have estimated annual income range between 13.98-66.81 thousand. This result matched with the Singh Baseline survey[17] report of the project area for developing farming system models for pritorised micro watersheds in rainfed areas of Jharkhand that the average total household annual income was Rs.24465/- (Rs.11608-Rs.42707) which vary depending upon the landholding. However, a slight higher result in present study may be due to the effect of CCKN-IA programme in the study area. Majority of population have medium farming experience of 9.23 – 27.95 years. This was due to the presence of majority of respondents being in medium age group.

Table 1: Socio- economic status of farmers (N = 105)

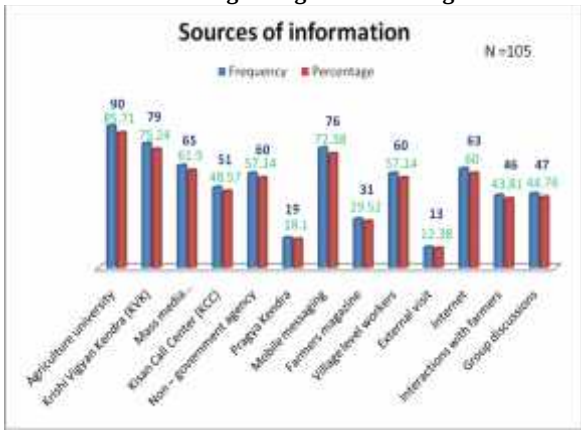
Group	Classification	Household	Percentage
Age	22-28 years	20	19.05%
	29-48 years	66	62.85%
	49-58 years	19	18.10%
Education	Illiterate	5	4.76%
	Primary school	15	14.29
	Middle school	43	40.95
	Intermediate	35	33.33
	Graduation	5	4.76
	Post graduation	2	1.90
\Type of land holding	Marginal (<0.005 acre)	38	36.19
	Small (0.005-2.5 acre)	46	43.81
	Semi-medium (2.5-5 acre)	19	18.10
	Medium (5-10 acre)	2	1.90
	Large (10-25 acre)	0	0.00
Estimated annual income	12-16.98 (in thousands rupees)	5	4.77
	16.98-66.81(in thousands rupees)	86	81.90
	66.81-150 (in thousands rupees)	14	13.33
Farming experience	4-9.23 (years)	10	9.52
	9.23-27.95 (years)	76	72.38
	27.95-42 (years)	19	18.10

1.2 Sources of Information: Table 2 reveal that 85.71% respondents used agricultural university as their information source and ranked it 1st. Seventy nine respondents (75.24%) got information from KVK and ranked it 2nd. Seventy six respondents (72.38%) got information through mobile messaging and ranked it 3rd. Sixty five respondents (61.90%) got information through mass media and ranked it 4th. Sixty three respondents (60%) used internet to seek information and ranked it 5th.

Table 2: Distribution of respondents according to their information source regarding climate change (N = 105)

Sr. No.	Information Source	Rank
A	Agriculture university	1st
B	KrishiVigyan Kendra (KVK)	2nd
C	Mass media (TV, Radio, news paper)	4th
D	Kisan Call Center (KCC)	7th
E	Non – government agency	6th
F	Pragya Kendra	11th
G	Mobile messaging	3rd
H	Farmers magazine	10th
I	Village level workers	6th
J	External visit	12th
K	Internet	5th
L	Interactions with farmers	9th
M	Group discussions	8th

Figure 1: Distribution of respondents according to their information source regarding climate change



Sixty respondents seek information from Village level workers and NGOs and ranked them at 6thposition. Fifty one respondents (48.57%) asked KCC to seek information and ranked it at 7th position. Forty seven respondents (44.76%) prefer group discussion to seek information and ranked it at 8thposition. Forty six respondents (43.81%) get information by interacting with other farmers and ranked it at 9th position. Thirty one respondents (29.52%) collect information from farm magazines and ranked it at 10th position. Nineteen respondents (18.10%) gather information from Pragya Kendra and ranked it at 11th position. Thirteen respondents (12.28%) went for external visit to gather information and ranked it at 12th and last position.

Table 3: Classification of information sources

Categories	Frequency range	Sources of information
Less used ($\bar{x} - \sigma$)	13 – 31	Pragya Kendra, Farmers magazine and External visit
Average used ($\bar{x} \pm \sigma$)	32–76	Mass media, Kisan Call Center, Non – government agency, Mobile messaging, Village level workers, Internet, Interactions with farmers and Group discussions
Most used ($\bar{x} + \sigma$)	77–90	Agriculture university and KVK

$\bar{x}$ =53.85 σ =22.80

Table 3 shows that 'agricultural university and KVK' were most used information source by farmers. 'Mass media, Kisan Call Center, non – government agency, mobile messaging, village level workers, internet, interactions with farmers and Group discussions' were average used sources of information related to climate change. While, 'Pragya Kendra, farmers magazine and external visit' were less used information sources.

Farmer's Perception about Climate Change

2.1 Farmers Perception about Effect of Climate Change: Since, climate change has various affects on farmers and their farm land, so they were asked what affect they have seen. The result is in table 4. Table 4 depicts that 'decline in ground water level' was perceived as 1st and the most visible impact of climate change by respondents followed by 'Change in rainfall pattern' (2nd position). Respondents also reported that "10 year earlier there was frequent rainfall during evening throughout the year, which had disappeared now". 'Decrease in soil productivity' held 3rd position. 4th position was given to 'Emergence of new pests and diseases'. 'Decrease in production from livestock' consists of decrease in milking from milking animal, degradation in their health due to heat stroke or cold waves, lowering of their population due to various diseases, etc. and was perceived as effect of climate change at 5th position. 'Damage to wildlife and aquatic life' and 'Water scarcity in surface water bodies' shared 6th position. One of the respondent shared that "many small pond of their village had disappeared now". 'Degradation in soil fertility' perceived at 7th position in the list.

Table 4: Ranking of effects that farmers perceive was due to climate change (N=105).

Sr.No.	Effect of climate change	Mean Score	RANK
1	More increase in temperature during summer	3.41	16
2	More decrease in temperature during winter	3.52	11
3	Water scarcity in surface water bodies	3.76	6
4	Decline in ground water level	4.17	1
5	Biodiversity loss	3.55	10
6	Change in crop cycle	3.64	9
7	Emergence of new pests and diseases	3.79	4
8	Frequent occurrence of natural hazard like earthquake, cyclone, etc.	3.41	16
9	Frequent occurrence of flood	3.07	20
10	Frequent occurrence of drought	3.38	18
11	Decrease in productivity in terms of quantity	3.66	8
12	Decrease in nutritional content of food	3.46	14
13	Degradation of soil fertility	3.68	7
14	Decrease in soil productivity	3.93	3
15	Decrease in production from livestock	3.77	5
16	Soil erosion	3.51	12
17	Change in rainfall pattern	3.97	2
18	Problem in seed quality	3.45	15
19	Damage to wildlife and aquatic life	3.76	6
20	Reduction in marginal GDP	3.55	10
21	Fluctuation in market prices	3.39	17
22	Change in geographical distribution of trade regimes	3.15	19
23	Migration and civil unrest	3.47	13

'Decrease in productivity in terms of quantity' was placed at 8th while 'Change in crop cycle was ranked at 9th position in list position however, few of the respondents also accepted that use of advanced seed varieties and new cultivation method helps them to overcome from these problem. 10th position was shared by 'reduction in marginal GDP' and 'Biodiversity loss'. Farmers ranked 'More decrease in temperature during winter' at 11th position, 12th position was given to 'Soil erosion', 13th position was covered by 'migration and civil unrest', 14th position was covered by 'Decrease in nutritional content of food', 'problem in seed

quality' held 15th position, 16th place was given to 'More increase in temperature during summer' and 'frequent occurrence of natural hazard like earthquake, cyclone, etc.', 'fluctuation in market prices' got 17th position, 18th place was covered by 'frequent occurrence of drought', 'Change in geographical distribution of trade regimes' placed at 19th position, 20th rank was covered by 'Frequent occurrence of flood' in effect list perceived by farmers due to climate change.

Position of statement 'more increase in temperature during summer' (16th), 'more decrease in temperature during winter' (11th) when compared with the prediction of WORLDCLIM mentioned in Jharkhand Action Plan on Climate Change by Government of Jharkhand (2013) that "there will be rise in average summer maximum temperature and average winter minimum temperature"[13] indicates that very few farmers have knowledge about these affect. Similarly, lower position of statement 'frequent occurrence natural hazard' indicates lower knowledge about this statement, as according to Intergovernmental Panel on Climate Change (IPCC), 2014 report, "increase in extreme weather events have been observed"[7].

Farmer's perception about statement 'biodeversity losses' (10st) when comparedwith the prediction of Jayaraman that "biodiversity is expected to decrease and different species may suffer varying degrees of stress, leading to changes in the composition of forests"[18] shows that they are concern about the problem of biodiversity.

Farmer's perception about statement 'damage to wildlife and aquatic life' (6th) matches with statement in Karla and Sharma in Keysheet 6 on Climate Change Impact on Agriculture in India that "Marine ecosystems, especially coral reefs and polar ecosystems are at risk from ocean acidification".

Table 5: Classification of effects that farmers perceive was due to climate change

Categories	Frequency Range	Effect of climate change
Less common ($\bar{x} - \sigma$)	<3.33	Frequent occurrence of flood and Change in geographical distribution of trade regimes
Common ($\bar{x} \pm \sigma$)	3.33-3.84	More increase in temperature during summer, More decrease in temperature during winter, Water scarcity in surface water bodies, Biodiversity loss, Change in crop cycle, Emergence of new pests and diseases, Frequent occurrence of natural hazard, Frequent occurrence of drought, Decrease in productivity in terms of quantity, Decrease in nutritional content of food, Damage to wildlife and aquatic life, Degradation of soil fertility, Decrease in livestock production Decrease in production from livestock , Soil erosion, Problem in seed quality, Reduction in marginal GDP, Fluctuation in market prices, Migration and civil unrest
Most common ($\bar{x} + \sigma$)	>3.84	Decline in ground water level, Decrease in soil productivity and Change in rainfall pattern

Mean = 3.59 S.D.= 0.25

Table 5 shows that 'Decline in ground water level, Decrease in soil productivity and Change in rainfall pattern' were most common affect that farmer perceived as consequences of climate change. While, 'More increase in temperature during summer, More decrease in temperature during winter, Water scarcity in surface water bodies, Biodiversity loss, Change in crop cycle, Emergence of new pests and diseases, Frequent occurrence of natural hazard, Frequent occurrence of drought, Decrease in productivity in terms of quantity, Decrease in nutritional content of food, Degradation of soil fertility, Decrease in livestock production Decrease in livestock production, Soil erosion, Damage to wildlife and aquatic life, Problem in seed quality, Reduction in marginal GDP, Fluctuation in market prices and Migration and civil unrest' were less commonly perceived effect. Since, the study area is a plateau region and have undulating topography, so very few population perceive that 'Frequent occurrence of flood and Change in geographical distribution of trade regimes' were effect of climate change.

2.2 Major Climatic Contingencies: Table 6 shows that occurrence drought got 1st rank followed by pest and disease outbreak (2nd), heat wave(3rd), cold wave (4th), cyclone (5th), frost(6th) hail storm (7th), flood (8th) and sea water intrusion (9th).

Table 6: Ranking of major climatic contingencies according to farmers perception about their district is prone to (N= 105)

Sr.No.	Major contingencies	Mean Score	Rank
1	Drought	2.34	1
2	Flood	1.45	8
3	Cyclone	1.68	5

4	Hail storm	1.57	7
5	Heat wave	1.82	3
6	Cold wave	1.79	4
7	Frost	1.65	6
8	Sea water intrusion	1.16	9
9	Pest and disease out break	2.10	2

Table 7: Classification of climatic contingencies

Categories	Mean score range	Climatic Contingencies
Least occurred ($\bar{x} - \sigma$)	< 1.38	Sea water intrusion
Occasional ($\bar{x} \pm \sigma$)	1.38-2.08	Flood, Cyclone, Hail storm, Heat wave, Cold wave and Frost
Frequent occurring ($\bar{x} + \sigma$)	>2.08	Drought and Pest and disease out break

Mean = 1.73 S.D. = 0.35

Table 7 reveals that drought and pest and disease attack are most frequently occurred contingencies. Flood, cyclone, hail storm, heat wave, cold wave and frost are occasionally occurred climatic contingencies in the study area.

Similar result has been found in baseline survey report of Ranchi district in which farmers perceive "drought as most frequent occurring event. Heat wave, Cold wave, Frost and Pest and diseases had occurred occasionally". This result also matches with finding of Udmale *et al*. study on "Farmer's perception of drought impacts, local adaptation and administrative mitigation measures in Maharashtra State"[19]. Here, he had reported that 'among all the natural hazards, drought ranks first in terms of the number of people directly affected'.

2.3 Agricultural Activity as Cause of Climate Change: Table 8 reveals that 'Excess use of fertilizers' was perceived as 1st and main agricultural activity responsible for causing climate change followed by 'Deforestation' (2nd position).

Table 8: Ranking of agricultural activities that farmers consider as cause of climate change (N = 105)

Sr.No.	Activity	Mean Score	Rank
1	Puddling of rice field	3.21	9
2	Excess use of fertilizers	3.98	1
3	Excess use of insecticide and pesticides	3.06	10
4	Wastage of water in irrigation due to inappropriate irrigation method	3.42	5
5	Burning of crop residue	3.30	7
6	Inappropriate waste management	3.55	3
7	Open dumping of cowdung	3.22	8
8	Burning of biotic component as fuel (cowdung cake, dry woods)	3.55	3
9	Deforestation	3.70	2
10	Burning of fossil fuel used for transportation	3.45	4
11	Industrialization	3.33	6

3rd rank held by 'Burning of biotic component as fuel (cowdung cake, dry woods)' and 'Inappropriate waste management' while 'Burning of fossil fuel used for transportation' had been perceived at 4th position. 5th rank was given to 'Wastage of water in irrigation due to inappropriate irrigation method' followed by 'industrialization' at 6th position. 'Burning of crop residue' causes emission of higher amount of CO_2 and 'Open dumping of cowdung' cause emission of methane gas, even after that respondents ranked these activities at 7th and 8th position respectively. Paddy fields are one of the major sources for emission of CH_4 gas however respondents ranked 'Puddling of paddy field' at 9th position this may be due lack of knowledge and unacceptability of fact among them, as paddy cultivation is the main crop grown by them in rainfed condition. 10th position covered by 'Excess use of insecticide and pesticides' (3.06) for contribution in climate change.

Table 9: classification of agricultural activities responsible of climate change (N = 105)

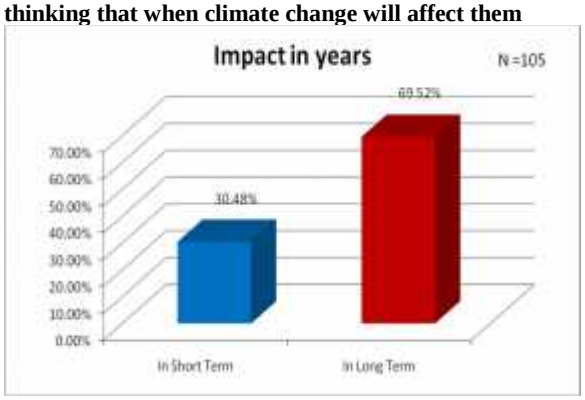
Categories	Mean score range	Agricultural activities
Minor cause ($\bar{x} - \sigma$)	<3.18	Excess use of insecticide and pesticides
Common cause ($\bar{x} \pm \sigma$)	3.18-3.69	Puddling of rice field, Wastage of water in irrigation due to inappropriate irrigation method, Burning of crop residue, inappropriate waste management, Burning of biotic component as fuel, and Industrialization
Major cause ($\bar{x} + \sigma$)	>3.69	Excess use of fertilizers and Deforestation

Mean = 3.43 S.D. = 0.26

Table 9 depicts that respondents pecieved 'Excess use of fertilizers and Deforestation' as major climate change causing agricultural activities. 'Puddling of rice field, Wastage of water in irrigation due to inappropriate irrigation method, Burning of crop residue, in appropriate waste management, Burning of biotic component as fuel, and Industrialization' were common activities responsible for climate change. 'Excess use of insecticide and pesticides' were minor activities causing climate change.

2.4 Climate Change Impact (in Year): 69.52% respondents thought that climate change will affect their farm after 10 years in long term while, 30.48% respondents thought that climate change impact will affect them within 10 years in short term.

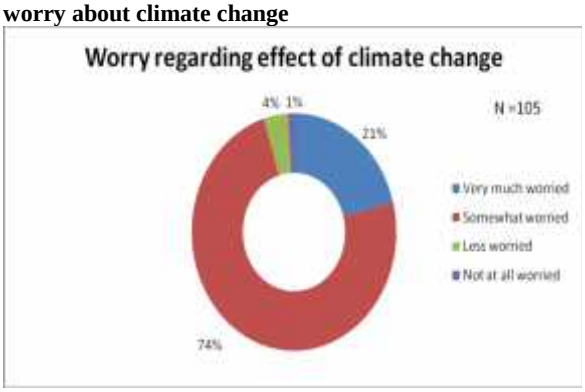
Figure 2: Distribution of respondents according to their thinking that when climate change will affect them



This result contradicts with the result of Quiroga et al.[20]. They found in their study on "Exploring coffee farmers' awareness about climate change and water needs: Smallholders' perceptions of adaptive capacity" that 70.24% farmers think that climate change will affect their farm in short term (less than 10 years from now) while 29.76% farmers think that climate change will affect their farm in long term (more than 10 years from now). This may be due to poor support from local and nation authorities with climate related issues in study area.

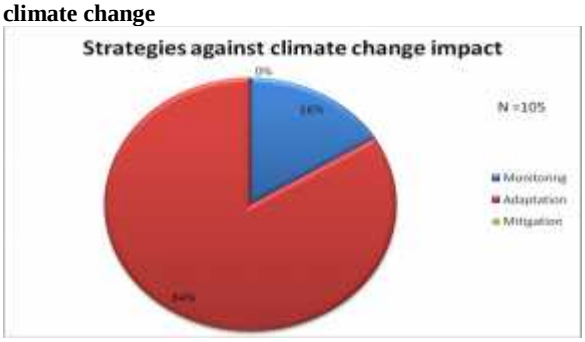
2.5 Worry about Effect of Climate Change: Majority of the respondents (74.29%) were somewhat worried about effect followed by very much worried (20.95%) and less worried (3.81%). However, 0.95 per cent respondent was not at all worried about the effect of climate change on their farm. This all is due to their low income and poor adaptation capacity to cope up from the ill effect of climate change on their farm.

Figure 3: Distribution of respondents according to their worry about climate change



2.6 Strategies to be Adopted against Climate Change: Most of respondents (83.81%) thought that adaptation is the best strategy among three against impacts of climate change followed by monitoring strategy (16.19%). However, none of the respondents thought to go for mitigation strategies. This shows that they have low knowledge about mitigation strategies to cope with impact of climate change.

Figure 4: Distribution of respondents according to their perception about the best strategies to be taken against climate change



2.7 Feeling about climate change risk in agriculture

Table 10 depicts that majority of respondents recognized climate change present more risk than benefit to agriculture globally (1st) followed by climate change posses risk to agriculture globally (2nd), climate change presents more risks than benefits to agriculture in India (3rd) and climate change presents opportunities for agriculture globally.

Table 10 : Ranking of climate change risk in agriculture according to respondents' feeling (N=105)

S. No.	Risks	Mean Score	Rank
1	Climate change posses risk to agriculture globally	3.46	2nd
2	Climate change presents opportunities for agriculture globally	2.94	4th
3	Climate change present more risk than benefit to agriculture globally	3.47	1st
4	Climate change presents more risks than benefits to agriculture in India	3.35	3rd

Thus, it can be concluded that farmer feels that climate change posses more risk than opportunities at global level and India is in less risk zone globally.

Conclusion: This study was conducted to understand how farmers perceive climate change as. So, effective strategies could be developed against the vagaries of climate change. From the study it can be concluded that most of farmers were of age between 29- 48 years with average educational qualification like middle school and intermediate, which also affect their information seeking behaviour as only few of them seek farm magazine and prefer to ask queries from scientist of agriculture. However due to affect of CCKN-IA programme many had started to go through ICT tools for searching information. Eight percent of them were small and marginal farmers with poor irrigation facilities, which directly affect their estimated average annual income. So, there is need to develop a habit of Integrated Farming System for their sustainable growth. Most of them have farming experience between 9 to 27 years this may be due to poor health quality in old age. Farmers were more conscious about the direct effects of climate change like Biodiversity losses, declining ground water trend, decreasing soil productivity, decreasing livestock production etc. But have low concern about indirect effect like migration and civil unrest, changing trade regimes, fluctuating market price, occurance of natural hazard etc. However, flood was not a problem due climate change for them due to higher elevation and undulating topography. Since, drought was the major climatic contingency for farmers of study area. So, there is an urgent need to develop some strong adaptation and mitigation strategies to combat this problem. The average mean score of response regarding agricultural activity that causes climate change is lower than the average mean score of effect of climate change. This shows that farmers have lower understanding regarding sources of GHGs emission than the consequences of these emissions. So, there is need to promote awareness among farming community regarding source of climate change. Most of the population thought that climate change will affect their farm after 10 years as well as they are somewhat worried about it also, but they are quite unknown of mitigation strategies against the problem. "Adaptation and mitigation are complementary strategies for reducing and managing the risks. Adaptation can reduce the risks, but there are limits to its effectiveness, especially with greater magnitudes and rate of climate change"[7]. So, there is a need to promote various mitigation strategies against the problem at various levels like local, state and national level by various agencies like government, non government, educational agencies etc. among farming community. The running programme on CCKN-IA could be a better platform to deal with all these problems and help farmers to help themselves.

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