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QUANTIFYING THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURE – LESSONS FROM IDUKKI DISTRICT

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Abstract—*The entire development of agricultural sector for Kerala state is focused into real and financial components. The agricultural output of Kerala clearly mentioned the changing cropping pattern in the state may be the result of changes in price and other factors which leads to economic and environmental consequences. Changes in climate and variability in climate became a reality at present. The overall change in climate is noticed altogether, especially for all sectors of life including agriculture. The temperature changes could also result in natural internal processes or external influencing factors, within the composition of the ecosystem. Agriculture in Kerala mainly includes a substantial share of plantation crops like rubber, tea, coffee and cardamom.*

Keywords: *Climate Change, Agriculture Sector, Agro-Climatic Specialties.*

INTRODUCTION

Climate change that we face today is a watchword in commercial, ethical and social context. There is an emergent awareness among the people in all over the world today that we face climate change. It is a serious issue, which affect the whole world in all fields. Major impacts of climate change are agricultural failure, commercial imbalance, temperature rise, melting of glaciers, sea level rise, flood, drought, methane release and so on. Climate change and agriculture are interrelated process. There are many reasons for the affect of climate change on agriculture. Temperature rise, heavy storms, drought, flood, sea level rise, changes on monsoon days, acid rain and acidification of water, etc. disrupt the crop production.

Kerala is the major producer of spices that form the cash crops mainly from Idukki District. Kerala have around 3000 years old spices trade and it is accepted by foreigners from the medieval ages. Any change in climate will affect the production of crops. In other words, agriculture is the base of the economy of Kerala and climate changes will affect the economy of the state also. Hence it is much relevance on the study of impact of climate change on agriculture. Climate changes are affecting plantation crops in general and it basically provides special significance from the national point of view.

STATEMENT OF THE PROBLEM

The study is mainly propagated the climate change, how it affects the agricultural fields in Idukki district and to find out how the impacts of climate change on agriculture affect economy. The specialties of Kerala climate are unique and diverse, which influence varieties of crops cultivation in different areas. It results in a gradual shift from the food crops to cash crops and presently the cropping pattern in the state is shared by cash crops. But agriculture stands as the main employment sector and is the source of income of Kerala. The main reason of suicides and failure in agriculture of farmers is understood as the changes in climate and natural calamities. In this context, this study is to analysis the relationship between climate change and agriculture failure in Kerala with special emphasize on Idukki district.

SIGNIFICANCE OF THE STUDY

Climate Change has deeply affected the agriculture in Kerala. Kerala agriculture mainly depends on Monsoon season. In the current years, frequent failure, change or break in monsoon across the State led to lack of water, flood, and increased level of temperature; and it affected seriously the agriculture production. Due to the flooding, major crop systems within the state are negatively impacted. The flooded has also affected tea, rubber, cardamom and black pepper plantations; many acres of plantations have been destroyed because of landslides in Idukki. In short, global climate change has serially affected the agriculture. The study is based on the climate change on agriculture in Kerala and mainly focused on the Idukki district. Idukki district is the best example of the affected area of climate change in Kerala and the study will help to understand the impact of climate change in whole Kerala.

OBJECTIVES OF THE STUDY

- To know how climate change affects agriculture in Idukki district.
- To know the socio economic conditions of farmers due to climate change.

RESEARCH HYPOTHESIS

- H0: There is no significant relationship between the climate change affect in farming and important changes in production in farmyard during last five years.
- H1: There is significant relationship between the climate change affect in farming and important changes in production in farmyard during last five years.

RESEARCH METHODOLOGY

The primary and secondary data are used for the study. A sample of 100 respondents has been selected from the Idukki district. Sample has been selected on convenience. The primary data has been selected through questionnaire. Secondary data are collected from magazines, newspapers and various websites. The data collected are analyzed by using simple arithmetic calculations and statistical tools. The study also uses ANOVAs statics in order to evaluate test of independence

LIMITATIONS OF THE STUDY

The study is based on Idukki district, since it is difficult to understand the impacts of climate change on agriculture of other areas of Kerala, where the situation is different from Idukki. It will be challenge to find out impacts of climate change on different kinds of agriculture, because climate change affects different cultivations in different ways. It will be challenge that to complete the study in a limited period.

REVIEW OF LITERATURE

Dankleman (2008) The effects of climate change, smallholder farmers in Soroti took up climate change adaptation practices which included shifting gardens from lowland to highland during the droughts, use of drought tolerant and early maturing crop varieties, changing planting dates or early planting in expectation of the rains, tree planting and diversifying the enterprises on their farms. Asha Guptha (2009) identified that the changes in climate is due to occurrence of floods and droughts, heat and cold waves across the world. It badly affected on livelihood of many farmers in different regions. The Institute for Social and Economic Change, Bangalore (2012) It focused on the impact of changes in climate on agriculture in India, which leads to poverty and low level of agricultural output. It concludes that global change in climate is probably going to throw back agricultural yields significantly. Climatology and meteorology (2014); Global climate change isn't a replacement phenomenon. The global climate changing is directly affecting the quality and quantity of water resources and crop production. It will be concluded that the Indian region is very sensitive to global climate change. Japaneet Kaur (2016) The study states that Indian agriculture depending upon the variations of climate and changing pattern of precipitation. Meteorological changes are mainly affected for the production of sugarcane and rice. Sristy Choudhary (2018); recommended that the ministry of earth sciences envisaged a project to study the impact of climate change in Kerala. She also suggested that floods in Kerala affected by the climate change and it became main evident of low productivity in Kerala.

DATA ANALYSIS AND INTERPRETATION

Age	No. Of Respondents	Percentage
Up To 30 Years	13	13
30 -60 Years	60	60
Above 60 Years	27	27
Gender		
Male	61	61
Female	39	39
Educational Qualification		
S.S.L.C	41	41
+2/Pdc	27	27
Degree	18	18
Own Land For Agriculture		
Yes	84	84
No	16	16
Total	100	100
Main Source As Agriculture		
Yes	68	68
No	32	32
Total	100	100

Crops Cultivating	No. Of Respondents	Percentage
Coconut& Ginger	20	20
Coconut& Cocoa	10	10
Cardamom& Black Pepper	30	30
Black Pepper &Rubber	12	12
Black Pepper &Vegetable	16	16
Vegetable &Others	12	12
Total	100	100
Source Of Water	**No. Of Respondents**	**Percentage**
Well	51	51
Pond	28	28
River	6	6
Rain	15	15
Total	100	100

Information About Climate Change	No. Of Respondents	Percentage
Yes	93	93
No	7	7
Total	100	100
Source Of Information	**No. Of Respondents**	**Percentage**
TV Radio	54	57
News Paper& T V	22	24
Public/Journal & News Paper	14	15
School/College& Internet	3	4
Total	93	100

Pattern Of Weather Changing	No. Of Respondents	Percentage
Yes	83	83
No	17	17
Total	100	100
Opinion About Loss Of Land, Farmyard, Livestock Etc…	**No. Of Respondents**	**Percentage**
Yes	48	57
No	36	43
Total	84	100
Effect Of Climate Change On Farming	**No. Of Respondents**	**Percentage**
Yes	78	78
No	22	22
Total	100	100
Extent To Which Climate Change Affected On Farming	**No. Of Respondents**	**Percentage**
Strong	42	54
Smoothly	36	46
Total	78	100

Type Of Changes Due To Climate Changes	No. Of Respondents	Percentage
Production Increased	11	15
Production Decreased	60	85
Total	71	100
Increase In Farming Cost	**No. Of Respondents**	**Percentage**
Yes	66	66

No	34	34
Total	100	100
Financial Loss In Farming	**No. Of Respondents**	**Percentage**
Yes	85	85
No	15	15
Total	100	100

Opinion About Stopped Cultivation Of Any Crop And Changing Cultivation Of One Crop To Another	**No. Of Respondents**	**Percentage**
Yes	58	58
No	42	42
Total	100	100
Compensation From Government For Loss	**No. Of Respondents**	**Percentage**
Yes	30	30
No	70	70
Total	100	100
Opinion About Selection Of Precautionary Measures	**No. Of Respondents**	**Percentage**
Yes	19	19
No	81	81
Total	100	100

ANOVA

H0: There is no significant difference in the climate change affect in farming.

H0: There is no significant difference in important changes in production in farmyard during last five years.

Effect of climate change on farming	**Important changes in production**			***Total***
	Yes	No	Don't know	
Yes	66	6	6	***78***
No	5	2	***15***	***22***
Total	***71***	***8***	***21***	***100***

N = 6 T = Sum of all the values = 100 $T^2/N = 100^2/6=1667$

SST = Sum of all squares of all values - T^2/ N

= $(66^{2+}6^{2+}6^{2+}5^{2+}2^{2+}15^2)$-1667 = (4356+36+36+25+4+225)-1667 = 3015

For Column, SSC = $(\sum X1)^2/n1 + (\sum X2)^2/n2 + (\sum X3)^2/n3 + \ldots\ldots - T^2/ N$

= $(71/2)^2+(8)^2/2+(21)^2/2$-1667 =2521+32+221-1667 =1107

MSC = SSC/ c-1 =1167/2 = 584

For Row, SSR = $(\sum X1)^2/n1 + (\sum X2)^2/n2 + (\sum X3)^2/n3 + \ldots\ldots - T^2/N$

= $(78)^2/3 + (22)^2/3 - 1667 = 2028+161- 1667 =$ 522

MSR = SSR/r-1 = 522/= 522

SSE = SST – SSC – SSR = 3015-1107-522 = 1386

MSE = SSE/(c-1) (r-1) =1386/3 =462

Source of Variation	Sum of Squares	Degree of Freedom	Mean Square	F
Between Columns	1107	2	554	Fc= 554/693=.79
Between Rows	522	1	522	
Residual	1386	2	693	Fr= 522/693=.75
Total	3015	5	-	

Between Column: Degree of freedom (2, 2) Table value of F= 19.00, Calculated Value of F =.79 which is less than the table value. Their for, we accept the hypothesis that there is no significant difference in important changes on production in farmyard during last five years

Between Row: Degree of freedom (1, 2), Table value of F= 18.51, Calculated Value of F =.75 which is less than the table value. Therefore, we accept the hypothesis that there is no significant difference in the climate change affect in farming.

1. The Calculated Value of F which is less than the table value, therefore we accept the hypothesis that there is no significant difference in important changes on production in farmyard during last five years
2. Calculated Value of F is less than the table value, therefore, we accept the hypothesis that there is no significant difference in the climate change affect in farming.

SUGGESTIONS

1. Farming methods should be encouraged for coming future.
2. Government should take more initiate to start Meteorological Centre in Idukki District.
3. Government should Introduce Insurance scheme for supporting agriculture.
4. Government should take climate Smart Agriculture Techniques to reduce and overcome the impact of climate change on agriculture.
5. More research activities should be introduced in the field of agriculture for bringing new genetic traits.
6. Government must give compensation for loss to farmers or introduce 5 year plans to overcome impact of climate change.
7. Develop policies such as crop protection to make agriculture more resilient to changes in climate.
8. Keep agriculture Green by using land management practices**.**

CONCLUSION

Idukki district is one of the most important centres for agriculture sector in Kerala. The major source of income of most of the people from agriculture. Recently, climate change is one of the major challenges faced by the people at Idukki district. The decrease in production, high production cost, loss of land etc… are main reasons for climate change in agriculture and it will be affected their socio economic status of people. In order to overcome the above problems and to carry out the farming activities smoothly the government has to provide adequate support to the farmers and take necessary steps to reduce their problems. This study also reveals that the agriculture sector should need lot of improvements as it is the major source of income of people.

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