

IMPACT OF CLIMATE CHANGE ON CASH

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CROPS PRODUCTIVITY IN MADURAI DISTRICT

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ABSTRACT

This related to “An Impact of Climate Change on Cash Crops Productivity in Madurai District” and I analyses the problem faced by agricultural. It access the production and productivity. This paper also estimates the rainfall production and productivity.

Introduction

India is a developing nation with majority of agricultural population and high cultivation area when compared to the other developing countries. According to 2011 census 71 percent of the Indian people are living in rural areas and mostly they are employed in agriculture and related activities. It is a primary source available for generation of income and employment in rural area. The growth rate of agriculture has come down to 1.1 percent from 4.69 percent in contrast to the 6 percent growth rate of Indian economy for the last ten years. Around 93 percent of the farmers are small farmers having land holdings of less than 4 hectare but the average farm size is only 1.57 hectares and they cultivate nearly 55 percent of the available land and the reasons are as follows, due to Industrial growth in India more number of industrial units was started in the past decades. In recent years, the climate changes have been a complex issue due to foreign climate policy. The climate changes affect the existing cultivating areas due to unscheduled rainfall, high temperature, high tensed cyclones and so

on. This micro level study made an attempt to make an assessment about the level of changes occurred in the cultivation area, temperature and rainfall and its effects on the area of cultivation and cropping pattern in study region.

Agricultural production and productivity are sensitive to global climatic changes in our country and therefore, its impacts need to be evaluated as climate affects many aspects of plant and animal biology, the effects of climatic elements and their extremes will significantly alter the productivity of agriculture sector. The disturbance to "Eco systemic balance" may generate negative impacts on the socio-economic condition of many societies.

Agriculture growth seems to be "Climate change" because Indian Agriculture is associated with the monsoon patterns, Co₂ level in atmosphere, soil conditions, sea level surface and atmospheric pressure are highly dependable upon rainfall

This chapter focuses on the relationship of climate especially temperature, rainfall, production and productivity jingelly and cash crop such as cotton and sugarcane.

Statement of the Problem

Climate has focused largely on changes in atmospheric composition. A large body of work has demonstrated that a change in area of cultivation provides an additional major forcing of climate, through changes in the physical properties of the land surface. Surface albedo change can be compared with greenhouse-gas emissions through the concept of radiative forcing (Betts 2000), but changes in vegetation cover can also modify the surface heat fluxes directly. Long-term weather conditions, regional-scale land-cover change can impact on the global climate system through tele connections (Avisar 1995; Pielke 2001a; Claussen 2002). Atmospheric and ocean circulation patterns and their subsequent involvement within the planets climate are dynamic, variable and difficult to predict. These limit our ability to predict the impact of changes of area in the cultivation and landscape dynamics on climate patterns. A more complete indication of human contributions to climate change will require the climatic influences on the cultivation pattern and other processes to be factored into climate-change mitigation strategies. Area of cultivation has changes due to global warming; cropping pattern has change highly in the recent decades.

Need and Importance of the Study

India is a large agricultural country with a high population. During the historic development of several thousand years, large areas of forest and grassland have been converted into arable lands.

Objectives of the Study

1. To study the climate changes and problems of global warming in the study area.
2. To analyses the rainfall and cash crops productivity in the study area.
3. To suggest the suitable measures to reduce the global warming and improve the cash crops productivity.



IN THE AREA OF PRODUCTION AND PRODUCTIVITY ANALYSIS OF GINGILY CULTIVATION IN MADURAI DISTRICT

Year	Mean Maximum Temperature	Variation	Gingily Cultivation					
			Area (In hectares)	Variation	Production (in Tonnes)	Variation	Productivity (in kg/ha)	Variation
2007-08	35.1	-	526b	-	261	-	497	-
2008-09	34.4	-0.7	415	-111	206	-55	497	0
2009-10	36.2	1.8	599	184	298	92	497	0
2010-11	35.9	-0.3	665	66	330	32	497	0
2011-12	35.5	-0.4	604	-61	459	129	760	263
2012-13	36.2	0.7	604	0	262	-197	434	-326
2013-14	35.3	-0.9	526	-78	261	-1	457	23
2014-15	36.1	0.8	808	282	345	84	427	-30
2015-16	36.2	0.1	813	5	570	225	463	36
2016-17	34.2	-2.0	863	50	485	-85	562	99
2017-18	36.2	2.0	1460	597	301	-184	211	-561.8
2018-19	35.9	-0.3	1757	297	841	540	471	0.27
Average Total	35.6	0.06	803.3	102.6	57.2	48.3	433.2	-41.4

Source: Computed from Secondary Data, Statistical Handbook Madurai District 2019..

Table 1.1 reveals that the maximum temperature recorded was 36.2°C during 2009-10, 2012-13, 2015-16, and 2017-18, whereas the lowest temperature recorded was 34.2°C. At the highest mean temperature, the areas of cultivation, production, productivity, have been varied, but it was not at the same ratio. The areas of cultivation have fluctuated between 2008-09 and 2016-17, hence the production and productivity have a considerable fluctuations. The highest production was 841mt in 2018-19 whereas the lowest was 206mt in 2008-2009 in case of productivity the highest was 760kg in 2011-12 and the lowest was 211kg in 2017-18. Hence the temperature causes the main reason to determine the fluctuation in Gingily production.

TABLE 1.2
RAINFALL IN THE AREA OF PRODUCTION AND PRODUCTIVITY ANALYSIS OF GINGILY CULTIVATION IN
MADURAI DISTRICT

Year	Rainfall Average	Variation	Gingily Cultivation					
			Area (In hectares)	Variation	Production (Tonnes)	Variation	Productivity (in kg/ha)	Variation
2007-08	37.4	-	526	-	261	-	497	-
2008-09	68.3	30.9	415	-111	206	-55	497	0
2009-10	82.7	14.4	599	184	298	92	497	0
2010-11	49.5	-33.2	665	66	330	32	497	0
2011-12	97.9	48.4	604	-61	459	129	760	263
2012-13	69.2	-28.7	604	0	262	-197	434	-326
2013-14	67.9	-1.3	526	-78	261	-1	457	23
2014-15	90.0	22.1	808	282	345	84	427	-30
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2016-17	56.7	-24.7	863	50	485	-85	562	99
2017-18	72.1	15.4	1460	597	301	-184	211	-561.8
2018-19	92.3	20.2	1757	297	841	540	471	0.27
Average Total	72.1	4.6	803.3	102.6	376	48.3	433.2	-41.4

Source: Computed from Secondary Data, Statistical Handbook Madurai District 2019..

Table 1.2 shows that the average rainfall recorded was the highest as 97.9mm during the year of 2011-12. whereas the lowest value recorded was 37.4mm in 2007-08. At the highest rainfall, the areas of cultivation, production and productivity, have been varied, but it is not at the same ratio. The areas of cultivation have fluctuated between 2007-08 and 2018-19, hence the production and productivity have a considerable fluctuations. The highest production was 841mt whereas the lowest was 206mt for the period 2014-15 and 2008-09. in case of productivity the highest was 760kg and lowest was 211kg, during the year 2011-12 and 2017-18 respectively.

TABLE 1.3
TEMPERATURE IN THE AREA OF PRODUCTION AND PRODUCTIVITY ANALYSIS OF COTTON CULTIVATION
IN MADURAI DISTRICT

Year	Mean Maximum Temperature	Variation	Cotton Cultivation					
			Area (In hectares)	Variation	Production (in Tonnes)	Variation	Productivity (in kg/ha)	Variation
2007-08	35.1	-	3290	-	997	-	303	-
2008-09	34.4	-0.7	5137	1847	1556	559	303	0
2009-10	36.2	1.8	2454	-2683	744	-812	303	0
2010-11	35.9	-0.3	1861	-593	563	-181	303	0
2011-12	35.5	-0.4	1363	-498	1929	1366	2224	1921
2012-13	36.2	0.7	1367	4	3570	1641	445	-1779
2013-14	35.3	-0.9	1490	123	997	-2573	493	48
2014-15	36.1	0.8	1456	-34	780	-217	536	43
2015-16	36.2	0.1	1587	131	1095	315	690	154
2016-17	34.2	-2.0	1173	-414	6274	5179	909	219
2017-18	36.2	2.0	1341	168	4789	-1485	356	-905.4
2018-19	35.9	-0.3	2854	1513	4784	-5	167	-1.89
Average Total	35.6	0.06	2114.4	-36.3	2339.8	315.6	586.0	-25.1

Source: Computed from Secondary Data, Statistical Handbook Madurai District 2019.

Table 1.3 conveys the maximum temperature recorded was 36.2°C during 2009-10, 2012-13, 2015-16, and 2017-18, whereas the lowest temperature recorded was 34.2°C. At the highest mean temperature, the areas of cultivation, production, productivity, have been varied, but not at the same ratio. The areas of cultivation have fluctuated between 2007-08 and 2018-19. Hence the production and productivity have a considerable fluctuation. The highest production was 6274 mt in 2016-17 whereas the lowest was 563 mt in 2010-11. In case of productivity the highest was 2224 kg in 2011-12 and the lowest was 167 kg in 2018-19 in the study areas.

TABLE 1.4
RAINFALL IN THE AREA OF PRODUCTION AND PRODUCTIVITY ANALYSIS OF COTTON CULTIVATION IN
MADURAI DISTRICT

Year	Rainfall Average	Variation	Cotton Cultivation					
			Area (In hectares)	Variation	Production (Tonnes)	Variation	Productivity (in kg/ha)	Variation
2007-08	37.4	-	3290		997		303	
2008-09	68.3	30.9	5137	1847	1556	559	303	0
2009-10	82.7	14.4	2454	-2683	744	-812	303	0
2010-11	49.5	-33.2	1861	-593	563	-181	303	0
2011-12	97.9	48.4	1363	-498	1929	1366	2224	1921
2012-13	69.2	-28.7	1367	4	3570	1641	445	-1779
2013-14	67.9	-1.3	1490	123	997	-2573	493	48
2014-15	90.0	22.1	1456	-34	780	-217	536	43
2015-16	81.4	-8.6	1587	131	1095	315	690	154
2016-17	56.7	-24.7	1173	-414	6274	5179	909	219
2017-18	72.1	15.4	1341	168	4789	-1485	356	-905.4
2018-19	92.3	20.2	2854	1513	4784	-5	167	-1.89
Average Total	72.1	4.6	2114.4	-36.3	2339.8	315.6	586.0	-25.1

Source: Computed from Secondary Data, Statistical Handbook Madurai District 2019

Table 1.4 shows that the average rainfall recorded was the highest as 97.9mm during the year 2011-12. whereas the lowest rainfall recorded was 37.4mm in 2007-08. At the highest rainfall, the areas of cultivation, production, productivity, have been varied, but not at the same ratio. The areas of cultivation have fluctuated between 2007-08 and 2018-19, despite the production and productivity have a considerable fluctuations. The highest production was 6274mt in 2016-17 whereas the lowest was 563mt in case of productivity 2010-11, the highest was 2224kg in 2011-12 and the lowest was 167kg in 2018-19.

TABLE 1.5
TEMPERATURE IN THE AREA OF PRODUCTION AND PRODUCTIVITY ANALYSIS OF SUGARCANE
CULTIVATION IN MADURAI DISTRICT

Year	Mean Maximum Temperature	Variation	Sugarcane Cultivation					
			Area (In hectares)	Variation	Production (in Tonnes)	Variation	Productivity (in kg/ha)	Variation
2007-08	35.1	-	6978	-	9,11,562	-	1,32,673	-
2008-09	34.4	-0.7	5940	-1038	7,88,077	-123485	1,32,673	0
2009-10	36.2	1.8	7510	1570	9,96,374	208297	1,32,673	0
2010-11	35.9	-0.3	9054	1544	12,01,222	204847	1,32,673	0
2011-12	35.5	-0.4	7658	-1396	8,80,670	-320551	1,15,000	-17673
2012-13	36.2	0.7	7658	0	7,69,794	-110876	1,01,578	-114899
2013-14	35.3	-0.9	4957	-2701	1,97,212	-572582	1,32,678	132577
2014-15	36.1	0.8	5980	1023	8,01,320	604108	1,34,000	1322
2015-16	36.2	0.1	7130	1150	8,55,600	54280	1,20,312	-133880
2016-17	34.2	-2.0	6408	-722	9,31,905	76305	1,45,412	145292
2017-18	36.2	2.0	1424	-4984	8,06,079	-125826	12,547	-145286.5
2018-19	35.9	-0.3	4766	3342	6,72,685	-133394	14,112	15.65
Average Total	35.6	0.06	6288.6	-184.3	817708.2	-19906.4	108861.7	-11044.3

Source: Computed from Secondary Data, Statistical Handbook Madurai District 2019.

Table 1.5 explains that the maximum temperature recorded was 36.2°C during 2009-10, 2012-13, 2015-16, and 2017-18, whereas the lowest temperature recorded was 34.2°C. At the highest mean temperature, the areas of cultivation, production, productivity, have been varied, but it was not at the same ratio. The areas of cultivation have fluctuated between 2007-08 and 2018-19. Hence, the production and productivity have a considerable fluctuations. The highest production was 12,01,221mt in 2010-11 whereas the lowest was 1,97,212mt in 2013-14 in case of productivity the highest was 1,34,000kg in 2014-15 and the lowest was 12,547kg in 2017-18.

TABLE 1.6
RAINFALL IN THE AREA OF PRODUCTION AND PRODUCTIVITY ANALYSIS OF SUGARCANE CULTIVATION IN
THENI DISTRICT

Year	Rainfall Average	Variation	Sugarcane Cultivation					
			Area (In hectares)	Variation	Production (Tonnes)	Variation	Productivity (in kg/ha)	Variation
2007-08	37.4	-	6978	-	9,11,562	-	132673	-
2008-09	68.3	30.9	5940	-1038	7,88,077	-123485	1,32,673	0
2009-10	82.7	14.4	7510	1570	9,96,374	208297	1,32,673	0
2010-11	49.5	-33.2	9054	1544	12,01,22	204847	1,32,673	0
2011-12	97.9	48.4	7658	-1396	8,80,670	-320551	1,15,000	-17673
2012-13	69.2	-28.7	7658	0	7,69,794	-110876	1,01,578	-114899
2013-14	67.9	-1.3	4957	-2701	1,97,212	-572582	1,32,678	132577
2014-15	90.0	22.1	5980	1023	8,01,320	604108	1,34,000	1322
2015-16	81.4	-8.6	7130	1150	8,55,600	54280	1,20,312	-133880
2016-17	56.7	-24.7	6408	-722	9,31,905	76305	1,45,412	145292
2017-18	72.1	15.4	1424	-4984	8,06,079	-125826	12,547	-145286
2018-19	92.3	20.2	4766	3342	6,72,685	-133394	14,112	15.65
Average Total	72.1	4.6	6288.6	-184.3	817708.2	-19906.4	108861.7	-11044.3

Source: Computed from Secondary Data, Statistical Handbook Madurai District 2019.

Table 1.6 depicts the average rainfall recorded was the highest as 97.9mm during the year 2011-12. where as the lowest value recorded was 37.4mm in 2007-08. At the highest rainfall, the areas of cultivation, production and productivity, have been varied, but it was not varied at the same ratio. The areas of cultivation have fluctuated between 2007-08 and 2018-19, hence, the production and productivity have a considerable fluctuations. The highest production was 12,01,221mt in 2010-11 where as the lowest was 1,97,212mt in 2013-14 in case of productivity the highest is 1,34,000kg 2014-15 and the lowest was 12,547kg in 2017-18 respectively.

TABLE 1.7

RESULTS OF THE DESCRIPTIVE STATISTICS ON TEMPERATURE, RAINFALL AND PRODUCTION ANALYSIS OF SUGARCANE CULTIVATION IN MADURAI DISTRICT

Indicator	Maximum Temperature	Rainfall	Production (in Tonnes)
Mean	35.6	72.12	817708.3
Median	35.9	70.65	830839.5
Standard Deviation	0.71477905	18.05405	236619.7
Kurtosis	-0.059350397	-0.3232	4.592689
Skewness	-1.070036758	-0.44794	-1.46048
Minimum	34.2	37.4	197212
Maximum	36.2	97.9	1201221

Source: Computed from Secondary data.

It is deduced from table 6.10 that the mean values of maximum temperature, rainfall and sugarcane production are 35.6, 72.12 and 817708.3 respectively. It is to highlight that the value of mean maximum temperature is ranged between 34.2 and 36.2, in case of the value of rainfall is ranged between 37.4 and 97.9, whereas the value of sugarcane production variable ranges from 197212 to 1201221. It is deduced from the analysis that the standard deviation values in respect of mean maximum temperature, rainfall and sugarcane production account for 0.71477905, 18.05405 and 236619.7.

Findings and Suggestion

The present study has attempted to analyse the climate change and its impact on agricultural production and productivity and human health in Madurai district. Madurai district is one of the agricultural dominant districts in Tamilnadu nearly 60 percent of the population is engaged in agricultural activities. under this

circumstances, the present study focuses the inter-relationship between climate change especially temperature, rainfall, wind speed and humidity and agricultural production, productivity and human health in the study areas as a means for research.

The present study depends on secondary data and theoretical literature on climate change. The secondary data used for the present study is mainly drawn from Metrological department, statistical handbook of Madurai district. Climate change vulnerability assessments and adaptation strategies and associated ecosystem.

The maximum temperature recorded was 36.2° C during 2009-10, 2012-13, 2015-16, and 2017-18, whereas the lowest temperature recorded was 34.2°c. At the highest mean temperature, the areas of cultivation, production, productivity, have been varied, but it was not at the same ratio. The areas of cultivation have fluctuated between 2008-09 and 2016-17, hence the production and productivity have a considerable fluctuations. The highest production was 841mt in 2018-19 whereas the lowest was 206mt in 2008-2009 in case of productivity the highest was 760kg in 2011-12 and the lowest was 211kg in 2017-18. Hence the temperature causes the main reason to determine the fluctuation in Gingily production.

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The mean values of maximum temperature, rainfall and sugarcane production are 35.6, 72.12 and 817708.3 respectively. It is to highlight that the value of mean maximum temperature is ranged between 34.2 and 36.2, in case of the value of rainfall is ranged between 37.4 and 97.9, whereas the value of sugarcane production variable ranges from 197212 to 1201221. It is deduced from the analysis that the standard deviation values in respect of mean maximum temperature, rainfall and sugarcane production account for 0.71477905, 18.05405 and 236619.7.

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production and productivity, have been various, but it is not varied at the same ratio. The areas cultivation have fluctuated between 2007-08 and 2018-19. While the production and productivity have a considerable fluctuations. The highest production was 4,53,756mt in 2016-17 whereas the lowest was 14,357mt in 2007-08 in case of productivity the highest was 75665kg in 2015-16 and the lowest was 5539kg in 2007-11 respectively.

Suggestions

1. Effective water supply and management systems are recommended to be in placed with a degree of urgency. Efficient forecasting methods and techniques should be applied effectively specially in the remote rural parts of the country with intense agriculture cultivation.
2. Climate resilient crops must be identified and cultivated in agricultural sector. It is also essential that adequate funds are provided for conducting research to address the impacts of Climate Change on agriculture growth.
3. Cultivation of those crops should be promoted which use less water and are less dependent on monsoon patterns, changes in crop varieties, new agricultural systems and cultural practices such as mixed farming, inter cropping, dry farming and other similar systems are advocated to deal with these problems.

Conclusion

The advance researches are needed to study the extreme events and their consequences of collecting evidence on their effects from long-term observations and experimental studies in various ecosystems. research on weather extremes will contribute substantially to the debate as to whether local weather extremes are relevant to the rainfall and cropping pattern with long-term ecological impacts. Collaborative scientific efforts will contribute to our understanding of the role of climate change and its impacts into the agricultural areas and improve the rainfall.

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