



## **Climate Change Impact on Cotton Crop In Haryana, India**

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### **ABSTRACT**

*Cotton (Gossypium hirsutum L.) is a leading cash crop of India. The study was carried out to know the impacts of climate change on cotton productivity at Department of Agricultural Meteorology, CCS Haryana Agricultural University, Hisar. In IPCC 2019 special report, increase in temperature 1.5°C from pre-industrial level has been reported. Correlation analysis between weather parameters and cotton productivity showed positively correlation with maximum and minimum temperature, morning and evening relative humidity and rainfall at Sirsa station, and at Hisar station, minimum temperature, morning and evening relative humidity showed positive and maximum temperature and rainfall showed negative correlation with cotton productivity during the long period 1987-2014. On the basis of analysis, it can be concluded that cotton crop had not showed effective reduction in production in the region because of climate change. Irrigation facilities are well available in state, besides crop are coincides with monsoon season may be the reason. At Sirsa station, cotton production decrease in irregular trend due to combined impact of temperature and relative humidity that could be favorable for insect-pests incidence at anthesis stage.*

**KEYWORD:** Climate change, Cotton, Correlation, Productivity, weather parameters

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### **INTRODUCTION**

Cotton (*Gossypium hirsutum* L.) "The king of fibre" and the leading fibre crop of the India. In India area under cotton crop was 12.35 million hectares with production of 36.5 million bales during the year 2018-2019 (Anonymous, [2]). Important cotton producing states are Gujarat, Maharashtra, Tamil Nadu, Punjab and Haryana. Cotton is also one of the most important commercial crops cultivated in India. In the raw material consumption basket of the Indian textile industry, the proportion of cotton is around 59% (Cotton section, [1]. The cotton crop called as 'white gold' enjoys a premier position amongst all commercial crops in India. With the acceptance of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) in December, 1997, possible climate change due to anthropogenic pollution of the atmosphere in the 21<sup>st</sup> century became a higher profile issue than ever before. Climate change is rise in temperature, variation in rainfall, declining groundwater, soil erosion, rising sea level, cyclone, wind speed, hail storm, fog, earthquake and tsunami etc. all the visualize phenomenon of climate change. According to IPCC, temperature has by 1.5 °C rise after industrialization. Increase in CO<sub>2</sub> concentration is more helpful to increase crop production and yield. All process leading to square, blossom and boll initiation and maturation of the crop are temperature dependent. Cool nights are beneficial during the fruiting period but extremes in temperature (low or high) can result in delayed growth and aborted fruiting sites. Sub-optimum temperature retarded growth and fibre development. Cotton development rates are related to air temperature during the growing season and can be expressed as accumulated heat units or growing degree days [6]. Plant takes more CO<sub>2</sub> concentration, increase biomass and grain quality, boll size and plant height, leaf, chlorophyll concentration is also increase but on other side increase temperature which is adversely impact on crop production and yield. Imperative sucking insect pests as whitefly (*Bemisia tabaci*), jassid (*Amrascabi guttula*), thrips (*Thrips tabaci*) also aphid (*Aphis gossypii*) which harm to cotton crop also has noticeable correlation with weather variables. Water is major limitation to crop production and variation in yield over year has two components it may include anthropogenic activity and another is climatic variability to induce fluctuation in yield (McAneny and Arrue, [5]; Cantero-Martinez *et al.*[4]. The present study was on climatic change impact on cotton

productivity. To improve cotton production, Government of India in February 2000, launched “Technology Mission on Cotton” to achieve increasing yield and productivity through development of high yielding varieties, better farm management practices, increased area under cultivation of *Bt* cotton hybrids.

## MATERIAL AND METHODS

The state of Haryana fall in “Trans-Gangatic plain Region” has further divided in two agro-climatic regions *viz.* western and eastern zone. The weather data were collected for different station *viz.* Hisar (29° 09' N, 75° 43' E) and Sirsa (29° 55' N, 75° 02' E) from Department of Agricultural Meteorology, CCS Haryana Agricultural University, Hisar. The crop production data of cotton were collected from Haryana statistical Abstract during period 1987-2014. The climatic region lie semi-arid condition. The correlation analysis was carried out between rainfall, minimum and maximum temperature and cotton productivity data during 1987-2014 of Hisar and Sirsa districts of Haryana using Excel spread sheet at Department of Agricultural Meteorology, CCS Haryana Agricultural University, Hisar .

**Table 1: Cotton productivity data of study location Sirsa and Hisar during period 1987-2014**

Year	Sirsa (Cotton productivity)	Hisar (Cotton Productivity)
1987	295	313
1988	336	365
1989	457	473
1990	417	440
1991	473	474
1992	465	480
1993	360	353
1994	499	440
1995	440	369
1996	447	410
1997	302	326
1998	248	251
1999	391	438
2000	451	418
2001	183	178
2002	377	392
2003	509	424
2004	652	512
2005	512	365
2006	667	518
2007	689	672
2008	745	711
2009	706	610
2010	558	497
2011	770	734
2012	774	617
2013	697	502
2014	628	372

## RESULT AND DISCUSSION

Weather data plays a dominated role on growth and overall condition of a crop. Different weather parameters

affect differently on different stages of crop growth. The present study is an effort to find out the weather element that are responsible for cotton crop yield. Correlation was carried out using Excel spread sheet.

**Table 2: Correlation coefficient between weather parameter and cotton productivity**

Station	T <sub>max.</sub>	T <sub>min.</sub>	RH (M)	RH (E)	Rainfall
Hisar	-0.21	0.11	0.38	0.19	-0.04
Sirsa	0.017	0.328	0.215	0.131	0.022

The correlation analysis was carried out between weather parameters and cotton productivity of *Kharif* crop in different district of Haryana and the correlation coefficient are presented in Table 2. Cotton crop showed positively correlation with minimum temperature, morning and evening relative humidity but it showed negative correlation with maximum temperature and rainfall in Hisar. In Sirsa station, there was

positively correlation with maximum and minimum temperature, morning and evening relative humidity and rainfall as showed in Table 2. Shekhar *et al.* ([7]) showed the correlation between the cotton production and rainfall gave narrow deviation represented the most suitable area for cotton crop in Sirsa as compared to Hisar district of Haryana. The result revealed that the weather parameters are changing marginally but effect of this on cotton yield as limited. The reasons may be other man made factor like irrigation, farm practices adjust the effect of climate change were highly correlated with cotton productivity in Sirsa as compared to Hisar districts of Haryana.

## CONCLUSION

It was found that different weather parameters showed different correlation with cotton but consistent trend in yield of cotton was not observed and could not be account for climate change. The anthropogenic activities have a good correlate over production in the region.

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