Impact of Climate Change on Sugarcane and Wheat Crops in District Hyderabad Sindh, Pakistan

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Abstract: Present research was conducted to observe the effect of climatically changes on agricultural crops, especially focusing on major climatic variable changes such as (temperature and rainfall) on wheat and sugarcane productions. Therefore this study is attempt to examine the climate change impact on production of wheat and sugarcane crops in Hyderabad district to measure the fluctuations every month during last 12 years from 2002 to 2014. Thus the following objectives were studied. To examine climate change (temperature and rainfall) scenario in the study area. To observe climate change impact on sugarcane and wheat crops of Hyderabad district, and to see the effect of temperature on the growth performance of wheat and sugarcane crop since 2002 to 2014. Findings of the study shows positive impact on sugarcane and wheat crop. Moreover 1 ^{o}C temperature increases then wheat yield increases 30.04 kgs/acre. Similarly 1^{o}C increase temperature increases sugarcane yield rise by the amount of 450 kgs/acre respectively. Additional, to see the average growth rate from 2002 to 2014, where it reveals that the temperature growth rate was increased 0.6 ^{0}C in April. While 1 ^{o}C increased in June which is highest growth rate, similarly in July and August were 0.5 ^{0}C and 0.5 ^{0}C was increased respectively, Kharif temperature having increasing trend. Moreover in Rabi season there is high fluctuation in February which was 0.4 ^{o}C. It Is concluded that in last the trend of temperature fluctuations from 2002 to 2014. in the Kharif season temperature in April, May, June, July, August and September were 2.4, 1.25, 6.1, 0.85, 2.75, 3.55, moreover the fluctuations of Rabi season in October, November, December, January, February, March were average 2, 1.42, 1, 2.3, 1.1, and 2.2 respectively.

Keywords: Climate change, Impact, temperature, Rainfall, Wheat, Sugarcane.

INTRODUCTION

The study is attempt to examine the trends of climate change of Hyderabad district to measure the fluctuations every month during last 12 years from 2002 to 2014. The climatic change can be defined all changes occur in areas over the time, which may be due to either natural unexpected or by the activities of human beings [1]. Now a day's major cause of climates changes are Greenhouse Gases (GHGs) by Industries use of dry FYM for the purposive of fuel in the rural areas, as well as deforestation which lead to variation in rainfall, weather temperature and solar energy. In major South Asian countries Environmental variations are largely affecting the human society and their economic because of sudden fluctuation on environmental and ecological changes [1]. In addition, fluctuations in climate factors viz: rainfall and temperature, elevated level of carbon dioxide, further increasing frequencies of climatic disasters like cyclone, floods droughts in all over Indian sub-continent and adversely affecting agriculture production not on production but also human life also affected [3-6]. Similar Pakistan, in India universally be around surface temperature has augmented, which led great impact on country's agriculture yield [7]. However, anthropogenic causes are mostly responsible, they are; increases volume of Green House Gases in the atmosphere, changes in land use pattern in terms of industrial unit's set-up and urbanization and increase volume of industrial aerosols recent intergovernmental pooled on climate change reported that widespread heating is observed from the surface of earth throughout the troposphere [8].

MATERIALS AND METHODS

The methodology is proposed to estimate a pooled data based on past 12 years from (2002-2014) Hyderabad Sindh, Pakistan. For present study, secondary data were collected from various public and private sources. The data comprised over the Yield of

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major two crops sugarcane and wheat in the Hyderabad district. In this research we were selected major crops because to see the impact on above two crops either they have positive impact or negative impacts on crops yield.

Regression

In order to investigate what changes in the crops production occurred due to weather changes, thus the regression results was used to interpret the impacts as follows:

$$y=\beta_0 + \beta_1 MxT + \beta_2 MnT + \beta_3 MxR + \beta_4 MnR+\varepsilon$$

Where: *Dependent variable*

y = Productivity of major crops in the country.

Independent variable(s)

Tm = Maximum average temperature

Tn = Minimum average temperature

Rm = Maximum average rainfall

Rn = Minimum average rainfall

ε = error term including other inputs.

$\beta_0, \beta_1, \beta_2, \beta_3,$ *and* β_4 are the parameters of the model.

Model Specification

The parameters from this estimation have been used along with data on projected rain fall and temperature changes. Thus, the growth performance was analysed by using the following model:

Growth Rate Model

$$g = \left(\frac{x_T}{x_t}\right)^{\frac{1}{T}} - 1$$

Where:

G = Growth rate (average)

X_t = Initial value of variable X

X_T = Variable values (final)

t = Base year

T = Final year

RESULTS AND DISCUSSIONS

The result about average growth rate was taken from 2002 to 2014, where it reveals that the temperature growth rate was increased 0.6 ^{0}C in April. While 1 ^{o}C increased in June which is highest growth rate, similarly in July and August were 0.5 ^{0}C and 0.5 ^{0}C was increased respectively, Kharif temperature having increasing trend. Moreover in Rabi season there is high fluctuation in February month was 0.4 ^{o}C.

Furthermore, it has also been showed that effect of (Tm) temperature was found positively related to production of important food crops such as wheat and

Table 1: Growth Rate from 2002 to 2014

S. No	Kharif season	Station	Maximum and minimum average mean growth rate					
			April	May	June	July	August	Sept
1		Hyderabad	0.6	0.8	1	0.5	05	0.4
			October	November	December	Jan	Feb	March
2	Rabi season		0.3	0.1	0.2	0.1	0.4	0.25

Table 2: Results for Regression Estimates of the Impact of Rainfall and Temperature on Agriculture Crops Production

Variables	Minimum average temperature with average Minimum rainfall		Maximum average temperature and rainfall	
	Sugarcane	Wheat	Sugarcane	Wheat
Constant	-12.453	-6.109	24.132	-1.023
Temperature	200.452***	72.358***	450.243***	30.04***
Rainfall	52.365**	- 5.453	37.236**	-5.475
R-square	0.859	0.958	0.878	0.867
F-statistic	145.303	152.167	206.007	126.063

Note: ***,1 **, * represents 1%, 5% and 10% level of significance respectively.

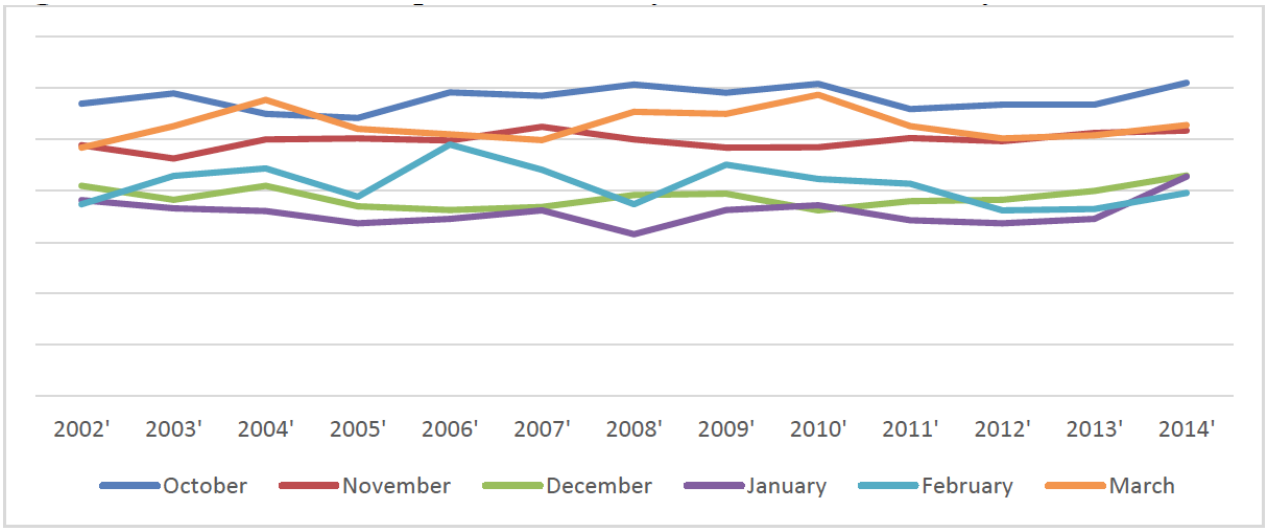

Figure 1: Fluctuation of temperature last 12 years Rabi season of Hyderabad.

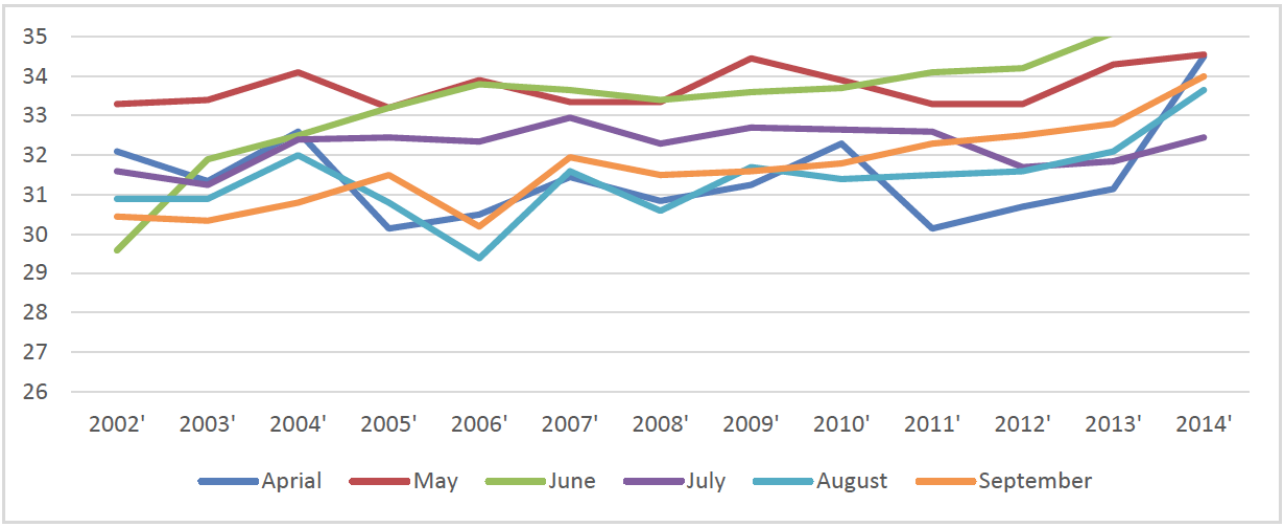

Figure 2: Fluctuation of temperature last 12 years Kharif season of Hyderabad.

sugarcane. While it is reported that maximum increase in the 1^0C of temperature production of wheat crop was 30.04 kg/acre. The results of the current study are in agreement with the findings of [9]. Same statement has been repeated by [10], who has also reported that increase in 1 ^{0}C temperature (Tm) the production of sugarcane crop was observed found 450 kg/acre respectively. Above mention results showing positive impact on sugarcane and wheat crops, while rainfall has also been reported positively impact on the production of sugarcane. Moreover specifically, it is stated that increased in 1 millimeter (mm) cause increased in the production about 37.23 kg/acre respectively. The findings of study also showed that rainfall has negatively related to the production of wheat crop.

Above figure reveals the average temperature from the month of October, to March have major fluctuations in these years from 2002 to 2014. It was estimated that during the 12 years the average temperature was increased. It shows the increasing trend of temperature October, November, December, January, February, March were average temperature 2, 1.42, 1, 2.3, 1.1, and 2.2 respectively.

Above graph reveals the average temperature from the month of April to September from 2002 to 2014. It was estimated that during the last 12 years the average temperature was increased. It show the increasing trend of temperature April, May, June, July, August and September were 2.4, 1.25, 6.1, 0.85, 2.75, 3.55 respectively.

CONCLUSION

The study concluded that under normal climatic conditions, climate variables show the positive impact on sugarcane and wheat production. It is also concluded that important variable of climatic impact are (rainfall and weather temperature) average minimum and maximum has been showed positive and favourable effect on the production of sugarcane and wheat. While the empirical findings of current research showed that major 2 climatic variable cause significantly impact on the production of two important crops in study districts.

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