

## **Effect of Climate Change on Cereals Production, Productivity and Area under crop in Solapur District**

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### **Abstract**

Increase of greenhouse gases generates global warming and global warming leads to the climate change. Climate change means change in mean/ average of rainfall humidity and temperature. As the agriculture is a very sensitive sector to climate change, it directly affects the agriculture. For this purpose we used the regression analysis to study effect of climate change on agricultural production, productivity and area under crop of Solapur district. The effect of climate change on cereal production productivity and area under crop were noted very clearly in Solapur district.

**Keywords:** climate change, agriculture and regression analysis.

### **Introduction**

Climate Change is one of the most burning issue in the present period. The problem is not limited to any one nation but it is faced by all the developed and underdeveloped countries of the world. After 1980s the ratio of greenhouse gases increased rapidly. In these emissions, the ratio of Co<sub>2</sub> is 405.5 ppm (WMO 2018). Though it seems small, in really it means a significant increase in accumulated heat of the earth environment. This extra heat is creating the environmental extremities like heavy rainfall, humidity, imperfect rainfall, drought, cyclone, hail storm that also affects agriculture sector.

### **Location**

Solapur district located at the south-east part of Maharashtra. The extension of district is at 17<sup>0</sup>10'N to 18<sup>0</sup>32' N latitudes and 74<sup>0</sup>42' E to 76<sup>0</sup>15' E longitudes. At the north of district there are Ahamadnagar and Osmanabad districts to its east Osmanabad, to its south Sangli and Karnataka state and to west Satara, Pune districts. The total geographical area of Solapur district is 14895 sq km, it is 4.84% of Maharashtra state.

### **Climate and rainfall**

Solapur district is under the category of dry (arid and semi arid) region. The district experience three distinct seasons summer, monsoon and winter. Summer months are from March to May with maximum temperature 30 to 40<sup>0</sup>c, the typical maximum temperature being 40<sup>0</sup>c or more. The highest temperature ever recorded is 46.0<sup>0</sup>c. Winter begins in November to February temperature dropping below 10<sup>0</sup>c. The monsoon begins June to September average rainfall is 533.07mm per year.

### **Drought prone district**

The Pardasani committee in 1960 had studied rainfall and famines till 1957 back to 30 year and declared Solapur as the drought prone district. the part of Barshi and Malshiras areas are excluded from drought prone district. Second Central Irrigation Commission (1962) has also declared drought prone district excluding Malshiras tehsil. Sukthankar Committee (1973) studied the arbitrary and scanty rainfall area and declared whole district drought prone except canal area of Malshiras and Pandharpur. The central government had approved it. Even Maharashtra government had approved all 11 tehsils as drought prone tahsils.

### **Objectives of the Study**

- 1) To study the nature and magnitude of change in cereal due to possible climate change.
- 2) To analyze the available data the impact on the cereal namely jowar, wheat, maize, paddy, under the condition of climate change.
- 3) To examine the available data the impact on Area under crop production and productivity in Solapur under the condition of climate change.

#### Methodology

The study is based on the secondary source of data. Primary data collection may be un-necessary exercise, hence avoided. The secondary source of data includes, temperature, rainfall, production and productivity of selected crops. The secondary source of data has been obtained from Indian Meteorological Department, District Social and Economic Review, Disaster Management departments of Government of Maharashtra, IPCC Research Reports, Journals,

#### Statistical Tools:

Regression analysis for the environmental parameters is used to investigate the Temperature Rainfall Humidity (TRH) impact on the Area under crop Production and productivity (APP) of the crops. The constant value of combined TRH is derived along with un-standardized co-efficient B value. Besides, t value and level of significance is calculated for estimating TRH impact on PP of the selected crops. Similarly, for estimating the PP agricultural parameters we have used R square values and F value are derived from the data.

#### Table no 1

#### Regression Analysis between Temperature, Rainfall, Humidity and Area under Crop in Solapur District

Solapur district totally belongs to the imperfect rainfall or drought area. The TRH impacts on the area under crops, is found significant in the case of crops. Tables 1 explore the facts. The temperature impact is significant in the case of the paddy (0.003) and wheat (0.045) crops for area under crops. The humidity impact is seen for the maize (0.018) in respect of area under maize. But other cereals jowar, Bajara, the TRH impact on area under crop remains not significant.

#### Table no 2.

#### Regression Analysis between Temperature, Rainfall, Humidity and Production of cereals in Solapur District

Crop production has been affected significantly by humidity for paddy (0.043). But Wheat, Jowar, Bajara, Maize, the TRH impact on Production not significant.

#### Table no 3

#### Regression Analysis between Temperature, Rainfall, Humidity and Productivity of cereals in Solapur District

The productivity of the jowar has been affected by Temperature (0.005) and Rainfall (0.011) significantly. But Paddy, Wheat, Bajara and Maize, the TRH impact on productivity not significant.

#### Table no 1

#### Regression analysis between temperature rainfall humidity and area under cereals in Solapur district

Crop	Adjusted R Square	F	Sig.	Model	Unstandardized Coefficients		T	Sig.
					B	Std. Error		
Paddy*	.609	16.567	.003 <sup>b</sup>	(Constant)	11.047	2.259	4.897	.001
				Temperature	-.222	.055	-4.070	.003

				Mean				
				Rainfall			.234	.821
				Humidity Mean			.268	.795
<b>Wheat*</b>	<b>.306</b>	<b>5.415</b>	<b>.045<sup>b</sup></b>	(Constant)	<b>159.740</b>	<b>42.785</b>	<b>3.734</b>	<b>.005</b>
				Temperature Mean	<b>-2.404</b>	<b>1.033</b>	<b>-2.327</b>	<b>.045</b>
				Rainfall			-.082	.937
				Humidity Mean			2.074	.072
<b>Jowar</b>	<b>.343</b>	<b>2.742</b>	<b>.123<sup>b</sup></b>	(Constant)	5345.671	2321.264	2.303	.055
				Temperature Mean	18.496	8.760	2.111	.073
				Rainfall	-.453	.312	-1.452	.190
				Humidity Mean	-185.869	81.652	-2.276	.057
<b>Bajra</b>	<b>-.217</b>	<b>.405</b>	<b>.754<sup>b</sup></b>	(Constant)	27.777	382.246	.073	.944
				Temperature Mean	-1.013	1.443	-.702	.505
				Rainfall	-.012	.051	-.232	.823
				Humidity Mean	2.054	13.446	.153	.883
<b>Maize*</b>	<b>.421</b>	<b>8.262</b>	<b>.018<sup>b</sup></b>	(Constant)	<b>244.982</b>	<b>94.286</b>	<b>-2.598</b>	<b>.029</b>
				Temperature Mean			.074	.943
				Rainfall			.829	.431
				Humidity Mean	<b>9.726</b>	<b>3.384</b>	<b>2.874</b>	<b>.018</b>

Table no 2

Regression analysis between temperature rainfall humidity and production of cereals in Solapur district

Crop	Adjusted R Square	F	Sig.	Model	Unstandardized Coefficients		T	Sig.
					B	Std. Error		
<b>Paddy*</b>	<b>.312</b>	<b>5.533</b>	<b>.043<sup>b</sup></b>	(Constant)	<b>417.155</b>	<b>174.951</b>	<b>2.384</b>	<b>.041</b>
				Temperature Mean			-.416	.688
				Rainfall			-1.487	.175
				Humidity Mean	<b>-14.768</b>	<b>6.278</b>	<b>-2.352</b>	<b>.043</b>
<b>Wheat</b>	<b>.488</b>	<b>4.181</b>	<b>.054<sup>b</sup></b>	(Constant)	899.990	4868.247	.185	.859
				Temperature Mean	28.997	18.373	1.578	.159
				Rainfall	.919	.655	1.404	.203
				Humidity Mean	-71.921	171.244	-.420	.687

<b>Jowar</b>	.653	7.278	.015 <sup>b</sup>	(Constant)	20634.679	15398.665	1.340	.222
				Temperature Mean	114.681	58.115	1.973	.089
				Rainfall	2.847	2.072	1.374	.212
				Humidity Mean	-872.213	541.660	-1.610	.151
<b>Bajra</b>	.198	1.824	.231 <sup>b</sup>	(Constant)	2612.267	1326.640	1.969	.090
				Temperature Mean	-2.850	5.007	-.569	.587
				Rainfall	.030	.179	.167	.872
				Humidity Mean	-87.083	46.666	-1.866	.104
<b>Maize</b>	.193	1.799	.235 <sup>b</sup>	(Constant)	2707.728	3465.472	.781	.460
				Temperature Mean	13.933	13.079	1.065	.322
				Rainfall	.258	.466	.552	.598
				Humidity Mean	-109.803	121.901	-.901	.398

**Table no 3**

Regression analysis between temperature rainfall humidity and productivity of cereals in Solapur district

Crop	Adjusted R Square	F	Sig.	Model	Unstandardized Coefficients		T	Sig.
					B	Std. Error		
<b>Paddy</b>	-.201	.442	.730 <sup>b</sup>	(Constant)	12916.248	11944.423	1.081	.315
				Temperature Mean	29.048	45.078	.644	.540
				Rainfall	-1.229	1.607	-.764	.470
				Humidity Mean	-453.210	420.154	-1.079	.316
<b>Wheat</b>	.703	8.900	.009 <sup>b</sup>	(Constant)	-577.682	4239.160	-.136	.895
				Temperature Mean	25.702	15.999	1.607	.152
				Rainfall	1.590	.570	2.787	.027
				Humidity Mean	-12.847	149.116	-.086	.934
<b>Jowar*</b>	.840	20.223	.000 <sup>b</sup>	(Constant)	521.227	150.724	-3.458	.009
				Temperature Mean	16.642	4.264	3.903	.005
				Rainfall	.440	.133	3.312	.011
				Humidity Mean			-1.358	.217

<b>Bajra</b>	.082	1.296	.349 <sub>b</sub>	(Constant)	-2196.500	2203.941	-.997	.352
				Temperature Mean	-4.130	8.318	-.497	.635
				Rainfall	.552	.297	1.861	.105
				Humidity Mean	86.573	77.525	1.117	.301
<b>Maize</b>	-.009	.973	.465 <sub>b</sub>	(Constant)	-12103.05	15854.851	-.763	.474
				Temperature Mean	74.647	57.568	1.297	.242
				Rainfall	.114	2.073	.055	.958
				Humidity Mean	366.639	557.090	.658	.535

### Result and conclusion

All selected cereal (05) have experienced the significant value in area under crop three cereals (paddy, wheat, maize) are climate change sensitive. The significant value in production paddy is climate change sensitive. And the significant value in productivity jowar is climate change sensitive. But the more climate change sensitive crop is paddy. Solapur district experiences high amount of temperature impact. Obviously the rainfall and humidity is less.

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### E-Resources

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