Climate change effect on area under crop, production and Productivity of Kolhapur district

Mr. Shesabhare S.Y. Associate Professor in Economics, ACS College Palus Dist SANGLI.
Mobile- 9421127141. Email sudhirshesabhare@gmail.com.

Abstract

The Monsoon may disrupt in its regularity due to climate change. Climate plays an important role in shaping the agricultural production and productivity in India. Lack of irrigation makes agriculture a gamble with nature. The effects of climatic variability are quite visible in case of majority of farmers who are marginal and small and lack resources required for adjustment for climatic variations. Excessive rains and extreme variation in temperature would affect the production and productivity of crops adversely thereby affecting the incomes of farming families in a negative manner.

Keywords: Climate change. Agriculture and Regression analysis

Introduction:

Agriculture is almost dependent on the natural characters. The climate change directly hit the natural characters obviously agriculture sector is the first victim of climate change. The climatic change affects agriculture in several ways: production productivity, in terms of quantity and quality of crops. Agricultural practices, environmental effects, in particular in relation of frequency and intensity of soil drainage (leading to nitrogen leaching), soil erosion, reduction of crop diversity, Adaptation, organisms may become more or less competitive, as well as humans may develop urgency to develop more competitive organisms, such as flood resistant or salt resistant varieties of rice.

The years 2005, 2006, and 2007 are known as the years of heavy rainfall. It had affected the paddy crop in Konkan, soybeans crops in Marathwada and Vidharbha. Despite thousands of tons of fertile soil had carried away with the rain on these years. The heavy rains have increased humidity in air on large scale, that arise bacterial blight (*telya*) on pomegranates Hence, the researchers have intend to undertake a research on impact of Climate Change on agriculture sector under the condition of with reference to Kolhapur with the following objectives.

Objectives of the Study

 1) To study the nature and magnitude of change in yield of crops due to possible climate change.
 2) To analyze the available data the impact on the important crops namely paddy, wheat, jowar bajara, maize, gram, sugarcane, all cereals, and all pluses under the condition of climate change.
 3) To examine the available data the impact on Area under crop production and productivity in Kolhapur 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 Kolhapur District

The experience of Kolhapur district about TRH on the selected crops indicates variations on Jowar for humidity in the area under crops. The area under crops of jowar has experienced the impact of humidity. The calculated value of 'f' for jowar is estimated at 11.334 and 'p' value is 0.006 signifies the test is significant and model can further be interpretive. The calculated adjusted R^2 is 0.463, which is good and acceptable. For the dependent variable of jowar, the constant is significant; since its 't' value is - 2.620 and 'p' is 0.024 with another independent variable i.e. humidity, the 'p' value is 0.006; it's found significant. An independent variable i.e. temperature and rainfall is found to be not significant. It can be said that one independent variables i.e. humidity is significantly contributing the variations in the area under jowar. The experience of maize indicates variations due to temperature and rainfall in the area under crops. The area under crops of maize has experienced the impact of T and R. The calculated value of 'f' for maize is estimated at 15.735 and 'p' value is 0.001 signifies the test is significant and model can further be interpretive. The calculated adjusted R^2 is 0.711, which is good and acceptable. For the dependent variable of maize, the constant is significant; since its 't' value is 0.000 and 'p' is 0.001for temperature and p value for rainfall is 0.008 with two independent variable is significant. An independent variable i.e. humidity is found to be not significant. It can be said that two independent variables i.e. T and R is significantly contributing the variations in the area under maize.

Table no 2.

Regression Analysis between Temperature, Rainfall, Humidity and Production of Crop in Kolhapur District

For all other crops the TRH impact on production remains not significant. (see Table 2)

Table no 3.

Regression Analysis between Temperature, Rainfall, Humidity and Productivity of Crop in Kolhapur District

In the case of productivity (Table 3) the temperature impact is observed with wheat and jowar. The productivity of wheat has experienced the impact of T. The calculated value of 'f' for wheat is estimated at 7.462 and 'p' value is 0.020 signifies the test is significant and model can further be interpretive. The calculated adjusted R^2 is 0.350, which is good and acceptable. For the dependent variable of wheat, the constant is significant; since its 't' value is 3.562 and 'p' is 0.004 and for temperature alone p value is 0.020 with two other independent variables i.e. R and H as insignificant. It can be said that only independent variables i.e. T is significantly contributing the variations in the productivity of maize. In the case of productivity of jowar the T impact is observed. The calculated value of 'f' for jowar is estimated at 20.176 and 'p' value is 0.001 signifies the test is significant and model can further be interpretive. The calculated adjusted R^2 is 0.615, which is good and acceptable. For the dependent variable of jowar, the constant is significant; since its 't' value is - 4.164 and 'p' is 0.002 and for temperature alone p value is 0.001 with two other independent variables i.e. R and H as insignificant. So it can be said that only independent variables i.e. T is significantly contributing the variations in the productivity of maize. In rest other crops no significance is observed.

Table no 1

Regression analysis between temperature rainfall humidity and area under crop of Kolhapur district

Crop	Adjusted R Square	F	Sig.	Model	Un-standardized Coefficients		t	Sig.
					B	Std. Error		
Paddy	-.002	.994	.439[b]	(Constant)	138.786	123.602	1.123	.291
				Temperature Mean	-2.431	2.679	-.907	.388
				Rainfall	-.002	.004	-.575	.580
				Humidity Mean	.598	1.196	.500	.629
Wheat	.060	1.258	.346[b]	(Constant)	83.094	41.301	2.012	.075

				Temperature Mean	-1.649	.895	-1.842	.099
				Rainfall	.000	.001	-.266	.796
				Humidity Mean	-.598	.400	-1.496	.169
Jowar*	.463	11.334	.006b	(Constant)	-86.576	33.046	-2.620	.024
				Temperature Mean			-3.387	.707
				Rainfall			-604	.559
				Humidity Mean	2.013	.598	3.367	.006
Bajra	.348	3.138	.080b	(Constant)	-1.241	1.543	-.804	.442
				Temperature Mean	-.014	.033	-.404	.696
				Rainfall	-7.491	.000	-.152	.883
				Humidity Mean	.030	.015	2.028	.073
Maize*	0.711	15.735	.001b	(Constant)	31.987	6.081	5.260	.000
				Temperature Mean	-.504	.110	-4.591	.001
				Rainfall	.001	.000	3.310	.008
				Humidity Mean			.455	.660
Gram	.270	2.480	.127b	(Constant)	154.412	81.324	1.899	.090
				Temperature Mean	-3.108	1.763	-1.764	.112
				Rainfall	.003	.003	1.187	.266
				Humidity Mean	-1.188	.787	-1.509	.166
All cereals	.186	1.912	.198b	(Constant)	304.055	375.940	.809	.439
				Temperature Mean	-7.253	8.148	-.890	.397
				Rainfall	.017	.012	1.445	.182
				Humidity Mean	.722	3.638	.199	.847
All Pulses	-.021	.918	.471b	(Constant)	222.439	143.292	1.552	.155
				Temperature Mean	-2.689	3.106	-.866	.409
				Rainfall	-.001	.005	-.290	.779
				Humidity Mean	-2.268	1.387	-1.636	.136
All Oil Seed	NA	NA	NA	(Constant)	NA	NA	NA	NA
				Temperature Mean	NA	NA	NA	NA
				Rainfall	NA	NA	NA	NA
				Humidity Mean	NA	NA	NA	NA
All Fruits	NA	NA	NA	(Constant)	NA	NA	NA	NA
				Temperature Mean	NA	NA	NA	NA
				Rainfall	NA	NA	NA	NA
				Humidity Mean	NA	NA	NA	NA
All food grain	.251	1.003	.435b	(Constant)	163.739	75.721	2.162	.059
				Temperature Mean	-.256	1.641	-.156	.879
				Rainfall	-.001	.002	-.336	.745
				Humidity Mean	.868	.733	1.185	.266
Sugarcane	.124	1.566	.264b	(Constant)	-267.474	436.173	-.613	.555

			Temperature Mean	14.968	9.454	1.583	.148
			Rainfall	.007	.014	.496	.632
			Humidity Mean	-.296	4.221	-.070	.946

Table no 2
Regression analysis between temperature rainfall humidity and production of Kolhapur district

Crop	Adjusted R Square	F	Sig.	Model	Unstandardized Coefficients		t	Sig.
					B	Std. Error		
Paddy	-.261	.172	.912[b]	(Constant)	6281.439	11001.208	.571	.582
				Temperature Mean	-64.606	238.439	-.271	.793
				Rainfall	.166	.352	.472	.648
				Humidity Mean	-37.892	106.466	-.356	.730
Wheat	.004	1.018	.429[b]	(Constant)	1727.169	1740.629	.992	.347
				Temperature Mean	-39.080	37.726	-1.036	.327
				Rainfall	.050	.056	.890	.397
				Humidity Mean	-11.075	16.845	-.657	.527
Jowar	.292	2.647	.113[b]	(Constant)	16542.4	9910.863	1.669	.129
				Temperature Mean	-507.853	214.807	-2.364	.042
				Rainfall	-.052	.317	-.165	.873
				Humidity Mean	-56.485	95.914	-.589	.570
Bajra	NA	NA	NA	(Constant)	NA	NA	NA	NA
				Temperature Mean	NA	NA	NA	NA
				Rainfall	NA	NA	NA	NA
				Humidity Mean	NA	NA	NA	NA
Maize	-.096	.648	.604[b]	(Constant)	1868.408	2735.728	.683	.512
				Temperature Mean	-45.239	59.294	-.763	.465
				Rainfall	.068	.088	.772	.460
				Humidity Mean	-11.382	26.475	-.430	.677
Gram	-.212	.301	.824[b]	(Constant)	1.753	568.525	.003	.998
				Temperature Mean	-3.247	12.322	-.264	.798
				Rainfall	.000	.018	-.016	.987
				Humidity Mean	2.807	5.502	.510	.622

Crop	Adjusted R Square	F	Sig.	Model	B	Std. Error	t	Sig.
				(Constant)	3987.192	17088.691	.233	.821
All cereals	-.276	.135	.937[b]	Temperature Mean	-56.462	370.379	-.152	.882
				Rainfall	.247	.547	.451	.663
				Humidity Mean	16.001	165.379	.097	.925
				(Constant)	1080.338	798.868	1.352	.209
All Pulses	.236	2.235	.153[b]	Temperature Mean	-34.804	17.315	-2.010	.075
				Rainfall	-.019	.026	-.744	.476
				Humidity Mean	-.700	7.731	-.091	.930
				(Constant)	NA	NA	NA	NA
All Oil Seed	NA	NA	NA	Temperature Mean	NA	NA	NA	NA
				Rainfall	NA	NA	NA	NA
				Humidity Mean	NA	NA	NA	NA
				(Constant)	NA	NA	NA	NA
All Fruits	NA	NA	NA	Temperature Mean	NA	NA	NA	NA
				Rainfall	NA	NA	NA	NA
				Humidity Mean	NA	NA	NA	NA
				(Constant)	NA	NA	NA	NA
All food grain	NA	NA	NA	Temperature Mean	NA	NA	NA	NA
				Rainfall	NA	NA	NA	NA
				Humidity Mean	NA	NA	NA	NA
				(Constant)	-697964.2	732500.97	-.953	.366
Sugarcane	.190	1.939	.194[b]	Temperature Mean	29494.35	15876.162	1.858	.096
				Rainfall	11.165	23.460	.476	.645
				Humidity Mean	584.085	7088.901	.082	.936

Table no 3
Regression analysis between temperature rainfall humidity and productivity of Kolhapur district

Crop	Adjusted R Square	F	Sig.	Model	Unstandardized Coefficients		t	Sig.
					B	Std. Error		
				(Constant)	958.915	9181.447	.104	.919
Paddy	-.248	.205	.891[b]	Temperature Mean	89.940	198.998	.452	.662
				Rainfall	.107	.294	.364	.724

				Humidity Mean	-14.544	88.855	-.164	.874
Wheat *	.350	7.462	.020[b]	(Constant)	9184.395	2578.296	3.562	.004
				Temperature Mean	-127.431	46.651	-2.732	.020
				Rainfall			.959	.360
				Humidity Mean			1.334	.212
Jowar *	.615	20.176	.001[b]	(Constant)	-18865.59	4530.923	-4.164	.002
				Temperature Mean	800.175	178.140	4.492	.001
				Rainfall			-.432	.675
				Humidity Mean			.427	.678
Bajra	NA	NA	NA	(Constant)	NA	NA	NA	NA
				Temperature Mean	NA	NA	NA	NA
				Rainfall	NA	NA	NA	NA
				Humidity Mean	NA	NA	NA	NA
Maize	-.014	.946	.458[b]	(Constant)	432.752	14096.748	.031	.976
				Temperature Mean	224.486	305.532	.735	.481
				Rainfall	.361	.451	.800	.444
				Humidity Mean	-80.308	136.424	-.589	.571
Gram	.136	1.630	.250[b]	(Constant)	2293.286	5617.217	.408	.693
				Temperature Mean	78.649	121.747	.646	.534
				Rainfall	-.013	.180	-.071	.945
				Humidity Mean	-62.158	54.362	-1.143	.282
All cereals	.202	2.011	.183[b]	(Constant)	10741.36	5672.265	1.894	.091
				Temperature Mean	-79.443	122.940	-.646	.534
				Rainfall	.036	.182	.198	.847
				Humidity Mean	-119.658	54.894	-2.180	.057

All Pulses	-.089	.674	.589[b]	(Constant)	349.983	3773.990	.093	.928
				Temperature Mean	32.335	81.797	.395	.702
				Rainfall	.141	.121	1.170	.272
				Humidity Mean	-13.260	36.523	-.363	.725
All Oil Seed	NA	NA	NA	(Constant)	NA	NA	NA	NA
				Temperature Mean	NA	NA	NA	NA
				Rainfall	NA	NA	NA	NA
				Humidity Mean	NA	NA	NA	NA
All Fruits	NA	NA	NA	(Constant)	NA	NA	NA	NA
				Temperature Mean	NA	NA	NA	NA
				Rainfall	NA	NA	NA	NA
				Humidity Mean	NA	NA	NA	NA
All food grain	NA	NA	NA	(Constant)	NA	NA	NA	NA
				Temperature Mean	NA	NA	NA	NA
				Rainfall	NA	NA	NA	NA
				Humidity Mean	NA	NA	NA	NA
Sugarcane	.109	1.489	.282[b]	(Constant)	-389.130	255.684	-1.522	.162
				Temperature Mean	11.459	5.542	2.068	.069
				Rainfall	.003	.008	.407	.694
				Humidity Mean	3.268	2.474	1.321	.219

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