



ISSN: 0976-3031

Available Online at <http://www.recentscientific.com>

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 10, Issue, 03(E), pp. 31463-31465, March, 2019

**International Journal of
Recent Scientific
Research**

DOI: 10.24327/IJRSR

Research Article

INFLUENCE OF WEATHER ON YIELD OF SORGHUM IN AKOLA DISTRICT

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DOI: <http://dx.doi.org/10.24327/ijrsr.2019.1003.3265>

ARTICLE INFO

Article History:

Received 13th December, 2018

Received in revised form 11th

January, 2019

Accepted 8th February, 2019

Published online 28th March, 2019

Key Words:

Weather, Rainfall, Yield

ABSTRACT

The study was undertaken in Akola Districts entitled "Influence of weather on yield of sorghum in akola district" to examine the influence of weather change on Sorghum. The Sorghum crop was selected to study the influence of weather change on yield of the Sorghum crop for the year 2001-2015. The data for present study was collected from the Publication of Dept. of Agriculture, Govt. of Maharashtra. The data of rainfall and temperature for Akola was taken from the Meteorological Department Dr. P.D.K.V. Akola.

The following conclusions of the study were drawn in Akola District. Rainfall had inconsistency within weeks over the period of 2001-2015 as revealed by C.V. The consistency in minimum and maximum temperature was observed within weeks over the period 2001-2015. Rainfall, minimum temperature and maximum temperature did not affect the crop yield at seedling, flowering and grain filling stage of sorghum crop during 2001-2015. Cotton and other pulses were major crops of the district during 2000-2001 constituting 67.50 per cent of Total cropped area, but now soybean emerged as one of major crop occupying 43.50 per cent of gross cropped area of region. Now area under cotton and kharif Jowar is reduced and soybean emerged as a major crop occupying 66.24 per cent of gross cropped of region.

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INTRODUCTION

Influence of weather is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). It may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme weather events).

Influence of weather on food production are not limited to crops. It will affect food production and food security via its direct or indirect impact another components of the agricultural production systems, especially livestock production which is closely linked with crop production. The interannual monsoon rainfall variability in India leads to large-scale droughts and floods, resulting in a major effect on Indian food grain production (Parthasarathy and Pant, 1985, Selvaraju, 2003; Kumar *et al.*, 2011) and on the economy of the country (Gadgil *et al.*, 1999). Rice (*Oryzasativa*L.) and sorghum (*Sorghum bicolor*armoench.) are two major food crops of India contributing around 42.5 and 34.5 percent, respectively to the total food grain production of the country (DES, 2007). Rice and Sorghum is mostly grown in Kharif (June - October) season. Due to importance of these crops in the national agricultural scenario, it is important to study the influence of

weather change on these crops with the help of following objectives: To study the changes in temperature and rainfall, To study the impact of climate change on yield of selected crops and To study implication of climate change on farm level adjustment.

DATA & METHODOLOGY

The present study was based on secondary data. The data of area and production of these crops was taken from the Publication of Dept .of Agriculture, Govt. of Maharashtra. The data collected on weekly rainfall and temperature for the Akola district for the years from 2001 to 2015 from the Meteorological Department Dr. P.D.K.V. Akola. The study was based on data for the period 2001-2015.

Changes in Temperature and Rainfall

Mean and CV (%) for weekly rainfall and temperature data is calculated for the behavior of Weekly rainfall and temperature in selected district.

$$CV (\%) = \frac{SD}{Mean} \times 100$$

Where,

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CV(%) = Coefficient of Variation

SD = Standard Deviation

Influence of Weather Change on Yield

Yield(Y) are dependent variable, Rainfall and Temperature at three crop stages, Independent variable. The three crop stages of Sorghum is taken such as seedling, flowering and grain filling stage

$$Y = a + b_1X_{1tmin} + b_2X_{2tmax} + b_3X_{3r} + b_4X_{4tmin} + b_5X_{5tmax} + b_6X_{6r} + b_7X_{7tmin} + b_8X_{8tmax} + b_9X_{9r}$$

Where,

- Y = Yield per ha.
- a = Intercept
- X_{1tmin} = Minimum temperature at seedling stage
- X_{4tmin} = Minimum temperature at flowering stage
- X_{7tmin} = Minimum temperature at grain filling stage
- X_{2tmax} = Maximum temperature at seedling stage
- X_{5tmax} = Maximum temperature at flowering stage
- X_{8tmax} = Maximum temperature at grain filling stage
- X_{3r} = Rainfall at seedling stage
- X_{6r} = Rainfall at flowering stage
- X_{9r} = Rainfall at seedling stage

Implication on Farm Planning

The implication on farm planning was studied with help of change in cropping pattern based on previous year rainfall. The year for which rainfall was marked and cropping pattern and changes these in were observed for the next year.

RESULTS AND DISCUSSION

Changes in Rainfall

The average rainfall, maximum and minimum temperature along with CV (%) as a measure of variability for 20 weeks for Akola district are presented in table.1.

Table 1 Changes in Weekly Average, Maximum and Minimum Rainfall in Akola District

Akola Rainfall				
Weeks	Mean	CV(%)	MIN	MAX
22	6.47	265.52	0	45
23	15.09	163.28	0	47.30
24	40.29	112.34	0	138
25	26.29	72.63	1.52	59.40
26	48.59	120.10	0	195
27	47.33	109.50	0	144
28	20.28	81.84	0	48.60
29	38.61	48.41	13	68.90
30	63.05	73.86	1.81	89.70
31	60.97	111.26	0.52	185
32	42.63	131.12	4.21	231.90
33	22.44	115.81	0	100.41
34	28.15	86.38	0	69.62
35	29.77	101.17	0	82.12
36	51.86	65.93	0	109.14
37	30.08	139.19	0.60	145.64
38	27.79	118.64	0	104.26
39	17.47	154.65	0	74
40	26.05	133.12	0	103.10
41	4.15	160.63	0	18

Table 2 Changes in Maximum Temperature in Akola District

Akola Max Temp.				
Weeks	Mean	CV(%)	MIN	MAX
22	41.58	3.86	37.16	43.71
23	39.63	5.48	35.33	43.03
24	37.14	8.73	31.10	41.56
25	35.21	7.87	32.06	40.80
26	33.54	9.18	29.03	38.23
27	32.76	6.44	29.91	36.43
28	32.55	6.50	30.07	35.99
29	31.37	6.91	27.44	34.64
30	29.82	5.47	26.71	32.83
31	30.18	5.51	26.80	32.23
32	29.28	5.25	26.26	32.23
33	30.33	5.08	27.80	33.61
34	30.29	7.67	25.13	33.83
35	30.52	5.08	28.29	34.04
36	30.60	5.83	26.93	33.39
37	31.65	4.73	29.91	34.29
38	31.62	5.37	29.54	35.24
39	32.78	4.97	30.11	35.51
40	33.54	6.10	29.76	37.31
41	34.16	4.79	31.53	37.03

Table 3 Changes in Minimum Temperature in Akola District

Akola Min Temp.				
Weeks	Mean	CV(%)	MIN	MAX
22	28.63	4.37	28.63	30.19
23	27.26	6.66	27.26	29.56
24	25.79	6.82	25.79	28.93
25	25.56	5.31	25.56	28.10
26	24.91	4.41	24.91	26.76
27	24.47	2.94	24.47	26.29
28	24.53	2.93	24.53	26.21
29	24.11	3.61	24.11	26.13
30	23.37	1.81	23.37	23.93
31	23.42	2.52	23.42	24.19
32	23.25	2.33	23.25	24.26
33	23.39	2.82	23.39	24.91
34	23.06	2.52	23.06	24.03
35	22.97	2.65	22.97	23.74
36	22.89	2.63	22.89	23.54
37	22.82	2.92	22.82	23.51
38	22.80	2.50	22.80	23.86
39	22.45	4.15	22.45	24.46
40	21.71	5.12	21.71	23.69
41	20.37	2.40	20.37	22.67

Table 4 Contribution of weather parameter on yield of Sorghum in Akola District

Akola		
Variable	Coefficient	S. Error
Intercept	2819.2906	45102.04
X _{1tmin}	92.63	860.2928
X _{2tmax}	-50.349375	168.5275
X _{3r}	9.4345553	17.73775
X _{4tmin}	-156.53536	2898.477
X _{5tmax}	-28.816854	637.6037
X _{6r}	-3.0541948	13.05549
X _{7tmin}	281.90919	393.8847
X _{8tmax}	-105.36892	268.0773
X _{9r}	-0.8748763	14.61461

*Significant at 10% ** Significant at 5% R2 0.5023*

Table 5 Changes in Cropping Pattern in Akola District during 2001-2015(in "00" ha)

CROP	YEARS			
	2001	2005	2009	2015
Cotton	3296	3240	2845	1470
	(41.84)	(39.97)	(40.48)	(27.44)
Kh.Jowar	861	822	465	151
	(10.93)	(10.14)	(6.62)	(2.82)
Tur	734	844	509	501
	(9.43)	(10.41)	(7.24)	(9.35)
Soybean	778	1244	1515	2331
	(9.88)	(15.35)	(21.56)	(43.50)
Other Pulses	2016	1880	1618	822
	(25.59)	(23.19)	(23.02)	(15.34)

The weekly rainfall for 1 to 20 rainfall weeks in Akola district was analysed for statistic average rainfall. It is Minimum and Maximum rainfall & coefficient of variation in percentage are presented in table. It is revealed from the table 1. that wider variability was observed in all the 20 weeks most of the weeks have zero minimum rainfall while the maximum rainfall over the weeks ranges between 45 to 231.9(mm). The inconsistency within week over the years is revealed by CV (%) ranging between 48.41 to 265.52 % indicating unreliability of average the years.

Changes in Maximum Temperature

The changes in maximum temperature was shown in Table 2. Consistency in Maximum Temperature was observed within week over the period 2001-2015

Changes in Minimum Temperature

The changes in minimum temperature was shown in Table 3. Consistency in Minimum Temperature observed within week over the period 2001-2015

Contribution of Weather Parameter on Yield of Sorghum

Data on minimum, maximum temperature and rainfall at three crop stages was used for regression analysis on yield. In all nine independent and one dependent variable studied. The coefficient along with standard error and coefficient of determination are presented in the table4. Table gives the regression between yield of sorghum and weather parameter of (22-41MW) over a period of 15 years. From table 4 was observed that sorghum yield and weather parameter related to (22-41MW) did not show any significant regression.

Changes in Cropping Pattern in Akola District during 2001-2015

Changes in the cropping pattern in Akola district 2001-2015 are depicted and presented in Table.5. Cotton and Other pulses were major crops of the District during 2000-2001 constituting 67.50 per cent of total cropped area. In the span of 15 years cropping pattern has changed substantially in the district. The proportion of area under cotton has reduced by 14 per cent. In case of *kharij* Jowar , its share over gross cropped area has fallen to the level of 2.82 per cent in 2015 from 10.93 per cent in 2001. Soybean crop is emerging as one of the major crops of the region occupying 43.50 per cent of gross cropped area of the region.

CONCLUSION

1. The Rainfall had inconsistency within weeks over the period of 2001-2015 as revealed by C.V. ranging between 48.41 to 265.52 per cent.
2. The consistency in minimum and maximum temperature observed within weeks over the period 2001-2015.
3. The rainfall, minimum and maximum temperature did not affect the crop yield at seedling, flowering and grain filling stage of sorghum crop during 2001-2015.
4. The crop cotton and other pulses were major crops of the District during 2000-2001 constituting 67.50 per cent of total cropped area but during span of 15 years the area under cotton reduced by 14 per cent and soybean emerged as of major crop occupying 43.50 per cent of gross cropped area of region.

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How to cite this article:

Deshmukh R.G., Mohod A.R and Bhopale A.A., 2019 , Influence of Weather on Yield of Sorghum in Akola District. *Int J Recent Sci Res.* 10(03), pp. 31463-31465. DOI: <http://dx.doi.org/10.24327/ijrsr.2019.1003.3265>
