Impact of Rainfall on Rural Agriculture: A Study of Dhule District in Maharashtra

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***ABSTRACT*:** Climate is one of the main determinants of agricultural production. In any change of climate over time that is attributed directly or indirectly to human activity. since climatic factors serve as direct inputs to agriculture any change in climatic factors is bound to have a significant impact on crop yields and production. Agriculture represent a core part of the Indian population. While the magnitude of climate change impact varies greatly by region. This paper presents an analysis of changes in the production of agricultural crops. Agriculture is the largest occupation and source of livelihood to most people in Dhule district about 70% of total population. Agricultural activity is mainly rain dependant. Rainfall is crucial factor for the success of crop production. The performance of crops directly related to rainfall received during the crop season. The rainfall has shown variation in different tahsil. Dhule district consists of four tahsil which are further divided into three agro ecological situations. The agro-ecological situations dominate the farming system. The district as per agro climatic situation falls under scarcity zone, assure rainfall zone and transition zone. The average rainfall in the district is adequate (80)but variation is much higher. Dhule district experienced decline in rainfall by 5 to 30 presents. The relation sheep between rainfall proportion and crop production has been positive in all their climatic situation. This research paper attempts to show to overcome the problem of water scarcity in region and its impact on crop productivity in the Dhule district.

***Index Terms*:** Rainfall zone, water scarcity, crop productivity, Rainfall distribution

I.INTRODUCTION

The amount and variability of rainfall is the dominant natural factor that affects basically the life of economy of the people. A major part of the rainfall is received during south – west monsoon season. For the study of rainfall, daily rainfall data available for the period of 1901 to 2004 of all tahsil places have been used. The data have been collected from Indian Meteorological Department (IMD), Pune. Maharashtra is that the third largest state in population and second largest in space. Dhule district placed within the northern facet of Mahrashtra. It belongs to khandesh region. In comes below Nashik revenue division, that contains of four districts viz Dhule, Jalgaon,Nandurbar & Nashik. Agriculture Department of Dhule District comes below the jurisdiction of Joint board of Agriculture, Nasik. Dhule district contains of four tahasils viz. Dhule, Shirpur, Shindkheda and Sakri the overall region of the district is 8063 sq.km. The panzara and Tapi are the most rivers flowing through the district. The soils are principally shaped from igneous rocks and are black, shallow and chalky varieties having totally different depths. Agriculture in the district for the most part depends upon monsoon downfall. the common traditional precipitation of district is 592 metric linear unit, Shirpur tahasil receives highest downfall 1154 metric linear unit. wherever as Dhule 21 mm, tahsil receives lowest downfall 621mm. the very best temperature goes upto 45Â°c in summer wherever as minimum temperature is ascertained upto 8°c in winter season. At present the irrigation potential by wing all sources is fourteen.5%. The cultivatable land return to be 5,14,211 ha. As per 2011 census total population was seventeen 112374333 The share of rural population is seventy-three.73%.

II. LOCATION OF STUDY AREA:

Dhule district, formerly known as west Khandesh is located in northern part of Maharashtra State. It is spread between Latitude 200 38’ to 210 61’ N. And Longitude 730 50’ to 750 11’ E. Dhule district is bounded by the district Jalgaon is located to the East, Nashik to the South, Gujarat State and Nandurbar district is located to the North-West. It is Located at the crossing of three National Highways namely NH-6 (Surat-Nagpur), NH-3 (Mumbai-Agra), and NH-211 (Dhule-Solapur) Because of the Satpuda ranges. Dhule district is separated from Madhya Pradesh. A Satmala range also separates it from Western Maharashtra. Dhule district has an area of 8061 sq.km and it Contributes 2.62% area of the Maharashtra state. The height of the district varies from 300 to 600 Metres above mean sea level. Dhule district comprises four tahasils namely, 1) Dhule 2) Shirpur.3) Shindkheda 4) Sakri Dhule district forms a distinct geographical unit as it is occupied by ‘Satpuda’ ranges in the north, ‘Satmala’ in the South and central Part is occupied by Tapi basin with its major tributaries like Panzhara, Burai and Arunawati. Most part of theSakri and Dhule Tahsil is occupied by Dhanora and Galana hills ‘Hanuman’is highest peak on Galana hills, Kondaibari and Laling bari are minor Ghats in the district. Babakuvar is the highest peak in shirpur tahsil, Bijasan Ghat to the North- East of Shirpur tahsil. Central and Eastern part of district is occupied by fertile plain. Shindkheda, Shirpur and Dhule tashil are included in central fertile plain.

III. OBJECTIVE:

The present paper has attempted to make an assessment of rainfall characteristics of Dhule district Maharashtra and computing assure rainfall at different agro zone and demarcate distribution of rainfall regions for study area.

IV. Database and Methodology:

The present study is based on the rainfall data collected from Indian Meteorological department pune for 25 years. The data has been grouped in decadal variations from 1991 to 2014.The arithmetical procedure involves the average annual rainfall determination of average rainfall for a 1991 to 2014.The departure of the rainfall from the average annual rainfall provides the information regarding the total departure of rainfall from mean value over a specific period. The computation of statistical parameters includes mean,median.

V. Rainfall Distribution:

Most of the rainfall is received by study region from south-west monsoon winds, from June to September. The average annual rainfall within the district is .592mm. Hence, this district comes under Drought Prone Zone of the state (Table:1).The average annual rainfall shows high variation from year to year. According to P.K. Das, 7th June is the onset of the south-west monsoon in the study area. On an average 3679 mm rainfall receives in 1999, which is the highest among rainy period during 1991 to 2014. Shirpur tehsil records highest rainfall with an average of 665.12 mm per annum. On downward part of Shirpur tahsil wadi sule pankhed, hadakhed villages the amount o rainfall is rapidly decreasing due to adiabatic heating. On downward part of Shirpur tahsil Wadi, Sule, Pankhed, Hadkhed the amount of rainfall is rapidly decreasing due for adiabatic heating. Plain area like Vikhran, Savalde, Thalner and Shirpur away from Satpura ranges towards north south have 360 to 760 millimetres of rainfall with 40 persent rainfall variation. The central region consists of bablaj arthe wagadi, karvand,dahivad village area varies in rainfall from 380 to 760 millimetres and have variability 20 to 40 present the west part of Shirpur tahsil consisting Jalod,kodid T,haradi receive less than 400 millimetres rainfall showing 20 to 30 percent variability. Satistical analysis of the rainfall data of recent 30 years reveals that the mean annual rainfall of the area is 2499.1 (Table;2).time series analysis generates important information regarding the trend of a series observations and the trend line is depicted in figure 2.It helps to measure the deviation from the trend and also provides information pertaining to the nature of trend. The analysis can be used as forecast of future trend.

Table:2 Time series analysis of rainfall of Dhule district.(1991-2015)

YEAR	x	Y TOTAL RAINFALL	x2	XY	TREND VALUE
1991	-12	2270	144	-27240	2745.32
1992	-11	2250	121	-24750	2724.81
1993	-10	2304	100	-23040	2704.29
1994	-9	2263	81	-20367	2683.77
1995	-8	3115	64	-24920	2663.26
1996	-7	2650	49	-18550	2642.74
1997	-6	2518	36	-15108	2622.23
1998	-5	3547	25	-17735	2601.71
1999	-4	3679	16	-14716	2581.19
2000	-3	1449.3	9	-4347.9	2560.68
2001	-2	1987.7	4	-3975.4	2540.16
2002	-1	2084.3	1	-2084.3	2519.64
2003	0	3458.4	0	0	2499.13
2004	1	3093.5	1	3093.5	2478.61
2005	2	1996	4	3992	2458.10
2006	3	3705.4	9	11116.2	2437.58
2007	4	3274	16	13096	2417.06
2008	5	2052	25	10260	2396.55
2009	6	2389	36	14334	2484.61
2010	7	2420	49	16940	2355.51
2011	8	2189	64	17512	2335.00
2012	9	1624.3	81	14618.7	2314.48
2013	10	3259.1	100	32591	2293.97
2014	11	2193.3	121	24126.3	2273.45
2015	12	706.9	144	8482.8	2252.93
TOTAL	**∑=0**	**62478.2**	**1300**	**-26671.1**	
ANNUAL AVERAGE RAINFALL-2499.1mm					

Rainfall zones:

Further rainfall zones are based on the annual receiving rainfall. Dhule district was divided in to three zones according to Agro-ecological situation prevailing in different parts of the district. These situations are based on rainfall topography, soil type etc. The situation wise survey helped in understanding the situation, specific research and extension priorities and needs for strategic planning of the district. Agro-climatic situations including their characteristics and coverage. type etc. The situation wise survey helped in understanding the situation, specific research and extension priorities and needs for strategic planning of the district. Agro-climatic situations including their characteristics and coverage. Agro-Climatic Zones:The major part of the district is agro-climaxing falls under scarcity and Assured rainfall zone. The distribution and the characteristic features of agro-climatic zone in district are shown below:

Table:3 Rainfall Agro-climatic zone

Sr.no	Agro Climatic zone	Characteristics	Block covered
1	Transition Zone I	High rainfall medium to deep black soil	Wesern part of sakri
2	Scarcity zone	Lower rainfall,light to medium, soils	Easern part of Sakri ,Dhule and Shindkheda tahasils
3	Assured Rainfall Zone	Medium rainfall, light to deep black soils	Shirpur

Table: 1 Annual Rainfall data (mm) OF Dhule district

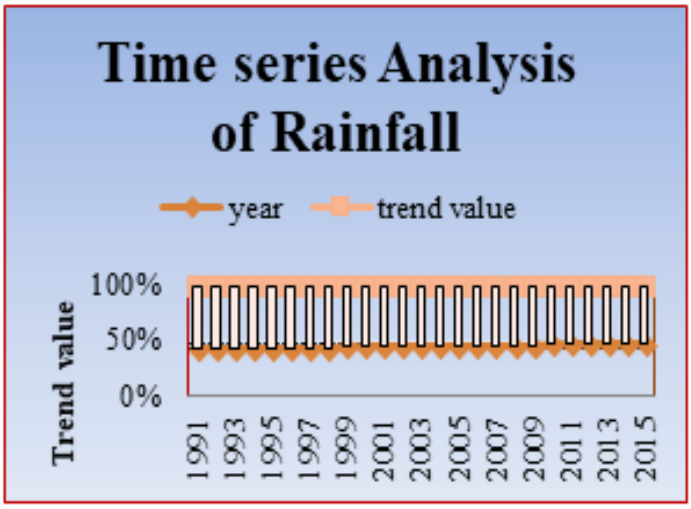
	January		February		March		April		May		June		July		August		September		October		November		December		Total Rain for Year	
Year	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days	Rainfall	Rainy Days
1991	0	0	0	0	0	0	0	0	38	11	457	21	761	23	394	24	482	26	138	10	0	0	0	0	2270	115
1992	0	0	0	0	0	0	0	0	26	5	431	18	667	26	433	22	459	21	234	13	45	5	0	0	2250	105
1993	0	0	0	0	0	0	0	0	27	2	465	16	678	32	512	23	377	18	245	16	0	0	0	0	2304	107
1994	0	0	0	0	0	0	0	0	46	6	385	11	579	18	378	23	654	29	221	10	0	0	0	0	2263	97
1995	0	0	0	0	0	0	0	0	73	8	535	16	712	29	756	37	671	37	368	14	31	3	0	0	3115	141
1996	0	0	0	0	0	0	0	0	0	0	487	14	650	38	560	25	712	41	241	13	0	0	0	0	2650	131
1997	0	0	0	0	0	0	0	0	0	0	512	18	591	34	611	23	624	36	180	8	0	0	0	0	2518	119
1998	0	0	0	0	0	0	0	0	0	0	596	28	933	45	535	33	1057	51	426	19	21	4	0	0	3547	180
1999	0	0	0	0	0	0	0	0	0	0	596	28	933	45	667	33	1057	51	426	19	21	4	0	0	3679	180
2000	0	0	0	0	0	0	0	0	0	0	615	30	596.3	21	144	11	93	8	1	0	0	0	28	3	1449.3	73
2001	0	0	0	0	0	0	0	0	0	0	751	29	380	38	313.6	23	353.6	19	190	17	0	0	0	0	1987.7	126
2002	0	0	14	1	0	0	0	0	12	1	740	32	111	12	682.3	23	523	24	2	0	0	0	0	0	2084.3	93
2003	16	1	0	0	0	0	78	4	32.4	2	864	44	885	44	802	37	777	23	4	1	0	0	0	0	3458.4	156
2004	0	0	0	0	0	0	0	0	170	9	555	25	780	41	858	47	554	29	177	11	42	3	0	0	3093.5	165
2005	0	0	0	0	0	0	0	0	0	0	590	29	490	36	180	24	736	49	0	0	0	0	0	0	1996	138
2006	0	0	0	0	14	1	0	0	0	0	452.5	32	1081	52	1074	50	944.9	45	139	8	68	1	0	0	3705.4	189
2007	0	0	0	0	0	0	0	0	203	4	485	30	1336	51	530	34	720	37	0	0	0	0	0	0	3274	156
2008	0	0	0	0	0	0	0	0	0	0	146	14	609	36	320	27	889	50	88	6	0	0	0	0	2052	133
2009	0	0	0	0	0	0	0	0	0	0	335	13	776	52	455	22	621	22	202	10	404	15	79	5	2389	139
2010	0	0	0	0	21	1	0	0	33	4	458	20	845	47	663	45	236	21	164	14	327	20	0	0	2420	172
2011	0	0	0	0	0	0	0	0	0	0	173	16	584	43	849	53	563	29	20	2	0	0	0	0	2189	143
2012	0	0	0	0	0	0	0	0	0	0	130	9	685	52	448	26	319.3	27	42	3	0	0	0	0	1624.3	117
2013	0	0	0	0	0	0	0	0	15	1	720.9	52	968.3	67	649.4	39	609.2	40	296	27	0	0	0	0	3259.1	226
2014	0	0	0	0	0	0	0	0	0	0	96.4	10	899.4	50	461.7	41	687.1	29	48.7	5	185	9	99.5	8	2193.3	152
2015	0	0	0	0	0	0	0	0	0	0	160	14	290.1	21	31.5	6	222.2	19	3.1	1	0	0	0	0	706.9	61
TOTAL	16	1	14	1	35	1	78		675	53	11736	569	17820	953	13308	751	14941	781	3856	227	1144	64	207	16	62478.2	3414
ANNUAL AVERAGE RAINFALL-2499.1mm																										

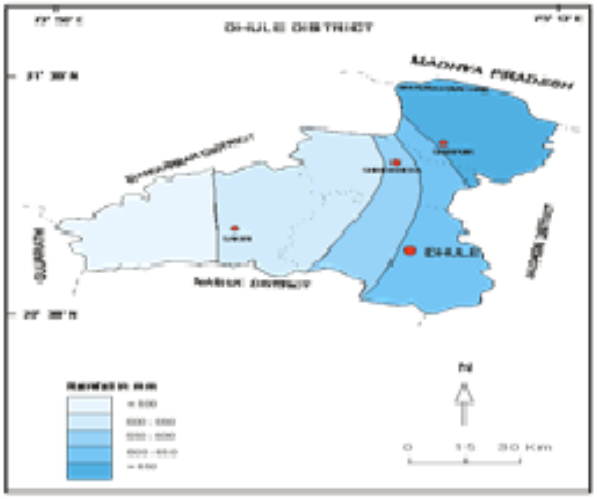
Impact of Agriculture : Climate change and variability are concerns of human being. The district economy is mostly agrarian based and depends on onset of monsoon and its further behaviour. The year 2015 was a classical example to show how district food grains' production depends on rainfall of July and it was declared as the all-district drought, as the rainfall deficiency was 23% against the long period average of the state and 35 % of the area was affected due to drought.Based on some of the past experiences indicated above, impact of rainfall on agriculture will be one of the major deciding factors influencing the future food security of mankind on the earth. Agriculture is main occupation of the people in the district. In year 2011-12total area available for cultivation was 3.59 lakh ha. It is 59.59% of total geographical area of the district but only 80% of cultivable area was under cultivation. The total net sown area in the district was 3.672 lakh ha. of which about 22984 ha. sown more than once. More than 80% area of the district exclusively comes under rain fed cropping. The total area under kharip crop is 356900 ha. while 32900 ha. of land is under rabbi crop. The area under summer crop is 8100 ha. According to Kharip cropping pattern of the district, the cotton occupies an area of 84364 ha. , which is 18.38% of total cropped area. Other major crops of the kharip season are Jowar 21169 ha, Bajara 26742 ha, maize 26211 ha, Cereals 45296 ha, Sugarcane 5747 ha, oil seeds 18766 ha. An area of 190947 ha has been brought under food grain crops. Rabbi Jowar, wheat, gram are some of the important crops grown in the rabbi season. The area under wheat was 11322 ha. followed by ground-nut 10438 ha, gram 4337 ha, rabbi Jowar 3483 ha. Agriculture in the study area is supported by the various means of irrigation.for prodcing the food crops in the dhule district area the farmers mainly depend upon on the ground water and rain fall. Dug wells, tube wells and surface irrigation serve to irrigate total 57372 ha area. In 2009-10 an area of 53372 ha was irrigated by dug wells and tube wells while 4000 ha by surface irrigation. Cotton, sugarcane, gram, chilly, vegetables, fruits, onion,groundnut etc. are major crops that require irrigation facility and rainfall. Drought extending over a period of 2011-18.

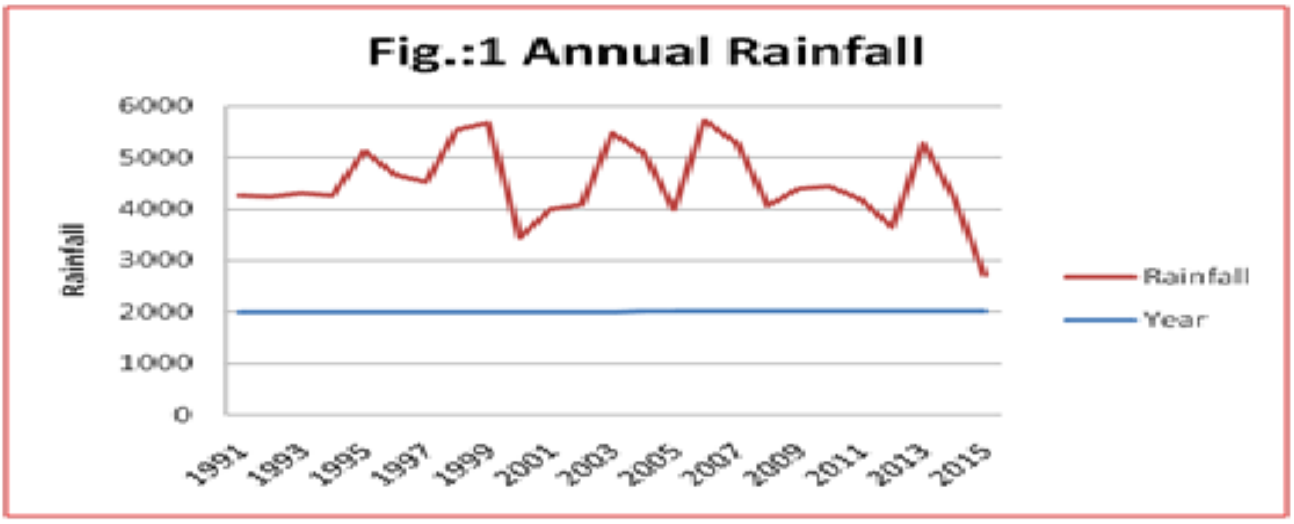
1 Assured rainfall zone: The assured rainfall zone comprises part Shirpur taluka with assured rainfall and medium to heavy soil, similarly. The annual precipitation varies from 700 to 900 mm.

2 Scarcity zone: Scarcity includes eastern part of Sakri and Dhule with Shindkheda erratic rainfall having 500 mm rains and light tone medium soils.

3 Transition-II:- Western part of Sakri taluka having 700-1750 mm rainfall light is medium soil**6**







1.7 CONCLUSIONS:

This paper is an attempt to study typical rainfall characteristics as well as probability level in last thirty year of dhule district..While the observed monsoon rainfall at the all district level does not show any significant trend, regional monsoon variations have been recorded. The study region received 612 millimetres annual average rainfall. The rainfall decrease from period of 2002-2015 having average 290 millimetres in decreses. The study region shows upward and downward trends for the thirty yesrs moving average. The rainfall varies at sakri dhule, shindkheda and shirpur tahsil the levels of different.sakri shindkheda and east part area of dhule distric is scarcity zone of rainfall.

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