RAINFALL ANALYSIS OF JALNA, MAHARASHTA STATE

M. R. More[1], A. S. Kadale[2]
[1]Ph.D.Scholar [2]Head
Department of Soil and Water Conservation Engineering, College of Agricultural Engineering and Technology
Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani-431 402 (M.S.)

INTRODUCTION

Rainfall is a very important natural resource, which plays a pivotal role in the success or failure of agricultural crop production. Agriculture is mostly dependent on the monsoon. Drought constitutes a major hazard in the Marathwada region. Intermittent gaps in precipitation and, moisture stress during the monsoon season gives rise to serious setback in production during *kharif* season, which is the main stay of agriculture in the region. Several rainfall related risk analysis have been reported by several authors for different agro climatic conditions of India with the help of incomplete gamma distribution (Thom, 1958) as well as Markov Chain Method. In most of the studies the scientist has suggested cropping pattern considering the rainfall amount at different probability levels. Keeping this in view, agricultural drought, meteorological drought, seasonal rainfall and rainfall probability at Jalna in Maharashtra state were analyzed using Markov Chain Model.

METHODOLOGY

The daily rainfall for the period 1981-2010 (30 years) Jalna station was collected from India Meteorological Department Pune and has been used for the analysis. According to National Commission on Agriculture, 1976 Agricultural drought is the period of at least four consecutive weeks receiving less than half of the normal rainfall (> 5 mm) ding *kharif* season. According to India Meteorological Department there are three types of droughts based on rainfall deficit from normal: Mild (0-25% deficit), Moderate (26-50% deficit) and Severe (> 50% deficit)

RESULTS AND DISCUSSION

Analysis of 30 years weather data of Jalna showed that *kharif* season drought was observed during the18 years(60 %) out of 30 years.(Table 1)

Table 1: Agricultural Drought at Jalna during Kharif (1980-2010)

Year	Drought Weeks	Year	Drought Weeks
1981	28 - 31	1997	29 - 32
1984	32 - 36	2001	25 - 30
1986	33 - 37		35 - 38
	39 - 42	2002	22 - 25
1987	35 - 39		37 - 41
1989	34 - 37	2003	28 - 34
1991	38 - 42		39 - 42
1992	36 - 40	2004	24 - 28
1995	22 - 26		39 - 42
	31 - 34	2006	36 - 40
1995	31 - 34	2014	37 - 40
	38 - 41	2015	26 - 31
1997	28 - 33		39 - 42

METEOROLOGICAL DROUGHT ANALYSIS

The average rainfall of the district is 779.01 mm. It was observed that, among 30 years average annual rainfall was below normal rainfall for 15 years and was above normal rainfall for 15 years. Out of 30 years moderate drought was observed for the years (16.67%). (Table 2)

Table 2: Meteorological drought at Jalna (1981-2010)

Sn.	Year	Annual RF(mm)	Deviation (%)	Drought Condition
1.	1981	1079.80	38.6118	No Drought
2.	1982	727.20	-6.6507	No Drought
3.	1983	1037.40	33.1690	No Drought
4.	1984	620.20	-20.3861	No Drought
5.	1985	566.20	-27.3180	Moderate
6.	1986	499.00	-35.9443	Moderate
7.	1987	988.00	26.8276	No Drought
8.	1988	933.40	19.8187	No Drought
9.	1989	680.50	-12.6455	No Drought
10.	1990	967.00	24.1319	No Drought
11.	1991	649.40	-16.6378	No Drought
12.	1992	784.30	0.6791	No Drought
13.	1993	908.00	16.5582	No Drought
14.	1994	494.00	-36.5862	Moderate
15.	1995	405.10	-47.9981	Moderate
16.	1996	756.50	-2.8896	No Drought
17.	1997	821.50	5.4544	No Drought
18.	1998	1232.00	58.1494	No Drought
19.	1999	650.00	-16.5608	No Drought
20.	2000	671.00	-13.8650	No Drought
21.	2001	559.00	-28.2423	Moderate
22.	2002	696.00	-10.6558	No Drought
23.	2003	702.80	-9.7829	No Drought
24.	2004	813.70	4.4531	No Drought
25.	2005	674.20	-13.4543	No Drought
26.	2006	954.40	22.5145	No Drought
27.	2007	951.30	22.1165	No Drought
28.	2008	884.60	13.5544	No Drought
29.	2009	784.80	0.7432	No Drought
30.	2010	879.00	12.8355	No Drought

No Drought = 25 years (8.333%)
Moderate Drought = 5 years (16.67%)

SEASONAL RAINFALL ANALYSIS

It is seen from Table 3 that the average annual rainfall and rainy days at Jalna station was 779.01mm and 41.83 days respectively. The rainfall amount and rainy days for different season namely Winter, Summer, South West and North East were respectively 0.26, 1.55, 85.95 and 12.23 % of the total rainfall and 1.46, 4.38, 81.86 and 12.59 % of total rainy days, The coefficient of variation of seasonal rainfall was highest (286.82%) during winter followed by summer(205.37%), North East(90.71%). Coefficient of variation of seasonal rainfall was lowest (26.18 %) for South West season. Likewise

coefficient of variation of seasonal rainy days was highest (318.40) during winter followed by summer (199.28%), North East (75.54%). Coefficient of variation of seasonal rainy days was lowest (22.65 %) for South West season.

Table 3: Seasonal rainfall analysis of Jalna (1981-2010)

Season		**Winter**	**Summer**	**South West**	**North East**	**Annual**
Rainfall	Mean	2.01	12.1	669.59	95.3	779.01
	SD	5.58	24.85	175.3	86.45	191.78
	CV	296.82	205.37	26.18	90.71	24.62
Rainy days	Mean	0.17	1.03	35.97	4.67	41.83
	SD	0.53	2.06	8.15	3.53	9.63
	CV	318.40	199.28	22.65	75.57	23.02

Table 4 shows highest rainfall event in a year with date (on which date) and amount of rainfall. In the year 1987 heave rainfall of 180.0mm was observed at Jalna

Table 4: Maximum Heavy Rainfall Events at Jalna(1981-2010)

Date	**Rainfall (mm)**	**Date**	**Rainfall (mm)**
07/08/1981	140.8	08/29/1996	75.0
06/24/1982	155.0	12/09/1997	84.0
09/18/1983	108.0	06/12/1998	95.0
10/10/1984	77.0	09/11/1999	57.0
10/06/1985	75.0	08/12/2000	58.0
06/04/1986	70.2	10/02/2001	67.0
10/05/1987	180.0	06/26/2002	94.0
07/09/1988	76.0	06/30/2003	69.8
07/22/1989	126.0	09/13/2004	152.0
06/09/1990	91.0	07/19/2005	54.6
06/10/1991	132.0	08/24/2006	125.0
09/02/1992	136.0	07/24/2007	131.5
07/02/1993	97.0	08/24/2008	109.0
09/05/1994	45.0	08/06/2009	121.0
09/14/1995	38.0	07/02/2010	42.0

Table 5: Probabilities of dry Spells of Consecutive Weeks(Markov chain probability) for Jalna (1981-2010)

SMW	**Consecutive 2 dry weeks**			**Consecutive 3 dry weeks**			**Consecutive 4 dry weeks**		
	30mm	**40mm**	**50mm**	**30mm**	**40mm**	**50mm**	**30mm**	**40mm**	**50mm**
23	0.2667	0.3000	0.4333	0.2222	0.2308	0.3569	0.1333	0.1678	0.2528
24	0.3333	0.3333	0.4667	0.2000	0.2424	0.3306	0.1176	0.1847	0.2731
25	0.4000	0.5333	0.5667	0.2353	0.4063	0.4681	0.1107	0.2438	0.2766
26	0.3333	0.5333	0.6333	0.1569	0.3200	0.3742	0.0560	0.1694	0.2422
27	0.2667	0.4000	0.4333	0.0952	0.2118	0.2804	0.0733	0.1456	0.2214
28	0.1667	0.3000	0.3667	0.1282	0.2063	0.2895	0.0945	0.1547	0.2237
29	0.3333	0.3667	0.5000	0.2456	0.2750	0.3864	0.1351	0.1500	0.2520
30	0.4667	0.5000	0.5667	0.2567	0.2727	0.3696	0.2396	0.2545	0.3490

31	0.3667	0.4000	0.5000	0.3422	0.3733	0.4722	0.1996	0.2389	0.2973
32	0.4667	0.4667	0.5667	0.2722	0.2987	0.3568	0.1441	0.1572	0.2498
33	0.4667	0.5333	0.5667	0.2471	0.2807	0.3967	0.1647	0.1816	0.2975
34	0.3000	0.3333	0.4667	0.2000	0.2157	0.3500	0.1368	0.1725	0.2864
35	0.2667	0.3667	0.5000	0.1825	0.2933	0.4091	0.1014	0.1760	0.2727
36	0.4333	0.5333	0.6000	0.2407	0.3200	0.4000	0.1605	0.2526	0.3619
37	0.3333	0.4000	0.4667	0.2222	0.3158	0.4222	0.1637	0.2334	0.3410
38	0.4000	0.5000	0.6333	0.2947	0.3696	0.5115	0.0000	0.0000	0.0000
39	0.4667	0.5667	0.7000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PROBABILITIES OF DRY SPELLS OF CONSECUTIVE WEEKS

It is the probability of getting two or three or four weeks as a dry week consecutively for a given amount of rainfall. Probability of two, three and four consecutive dry weeks with different amounts (30mm, 40 mm and 50 mm) of weekly total rainfall is presented in Table 5.

CONCLUSION

The study on rainfall probability of Jalna has provided an idea of micro-level agro-climatic resource characterization for proper crop planning, which assumes greater significance in view of erratic rainfall situation under climate change scenarios.

LITERATURE CITED:

[1] Thomb, H.C.S. (1958). A note on gamma distribution. Mon. Weath. Rev. 86(04):247-50

[2] Kushal Sarnah, Rijumani Rajbongshi, Prasanta Neog andarcy Maibangsha. (2013). Rainfall probability analysis of Lakhimpur Asaam. Journal of Agrometeorology. Vol. 15 (Special Issue-II):247-250