International Journal of Agricultural Sciences
Volume 9 | Issue 1| January, 2013 | 237-241

RESEARCH PAPER

Rainfall and rainy day trends at Dharwad, Karnataka

U.V. MUMMIGATTI*, N.E. NAVEEN AND B.T. NINGANUR
Agromet Advisory Service Unit, Directorate of Research, University of Agricultural Sciences,
DHARWAD (KARNATAKA) INDIA (Email : aasunitdharwad@gmail.com)

Abstract : Rainfall data of 27 years (1985-2011) obtained from Agromet Observatory, Main Agricultural Research Station (MARS), University of Agricultural Sciences, Dharwad was analysed for rainfall and rainy days. The trend indicated that the tract received a mean annual rainfall of 720.2 mm in 54 rainy days with maximum contribution (62.93%) from south west monsoon (June to September). July was the rainiest month (129.7mm) with 11 rainy days. This region experienced severe drought (mean rainfall of 379.8 mm) during the period 2000 to 2004. On the contrary, during recent the last 7 years (2005-2011), the annual rainfall was exceptionally above normal, which ranged from 866.2 mm to 1140.4 mm with a mean value of 986.8 mm and lower standard deviation (97.72) and co-efficient of variation (13.56 %), indicating lesser variability and more dependability. The annual rainfall variability during the last 27 years (1985 to 2011) indicate that 17 years normal rainfall (-4.8 to 58.2%) and 5 years slightly drought (-13.2 to -24.4%) and 2 years moderate drought (-26.9 to -39.6%) and 3 years severe drought (-49.7 to -75.7%).There were no significant trend in the mean annual rainfall. The mean annual 54 rainy days of 27 years (1985-2011) was recorded with maximum contribution of 68.72 per cent with 37 rainy days from south west monsoon (June to September).

Key Words : Rainfall, Rainy days, Annual, Seasonal

View Point Article : Mummigatti, U.V., Naveen, N.E. and Ninganur, B.T. (2013). Rainfall and rainy day trends at Dharwad, Karnataka. *Internat. J. agric. Sci.*, **9**(1): 237-241.

Article History : Received : 16.08.2012**; Revised :** 16.10.2012**; Accepted :** 04.12.2012

INTRODUCTION

Main Agriculture Research Station (MARS) Dharwad is located in University of Agriculture Sciences Dharwad main campus on the Pune-Bangalore National Highway No.4 at an latitude of 15-26' N , longitude of 75-07' E and altitude of 678 meters (MSL) with mild summers and winters, with mean annual rainfall of 720.2 mm rainfall (1985 to 2011). The area experiences tropical climate/semiarid climate with a distinct seasons (1) summer (2) rainy season and (3) the winter. The relative humidity is generally high as over 80 per cent in the monsoon season and less in non-monsoon periods. In April month the whirlwinds are common.

Rainfall variability is a major factor influencing the agricultural productivity and sustainability in tropics (Virmani, 1994). The development of improved crop production technology in the rainfed areas to increase food production requires spatial quantitative understanding of temporal variation of rainfall during crop growth. The annual and seasonal rainfall received and its variability directly influences the success or failure of crop through its favourable or adverse effect on crop growth and yield. Therefore, the study of variability of annual and seasonal rainfall is essential in selection of suitable crops and to take appropriate mitigating measures based on rainfall characteristics of a given location and dependability. Such analysis is helpful in prediction of annual and seasonal rainfall probability for the next one or two years, in turn crop planning. Similarly, rainfall variability analysis at Akola was done by Tupe *et al.* (2010), Singh *et al.* (2009) reported for Bihar and Krishnakumar and Prasad Rao (2008) for Kerala and Hanumanthappa *et al*. (2010) reported the rainfall variability in coastal district of Karnataka. Therefore, the study of general trend and distribution of monthly rainfall and rainy day is essential in selection of suitable crops and to take appropriate mitigating measures based on rainfall characteristics of a given location and dependability. Rainfall and rainy days are important weather inputs that limit the crop productivity in a particular location. Hence, it is essential to understand characteristics of these parameters for better agricultural planning.

*** Author for correspondence**

MATERIALS AND METHODS

The annual and monthly rainfall and rainy days data of 27 years (1985-2011) available. Daily rainfall data of last 27 years (1985-2011) were collected from Agromet Observatory, Main Agricultural Research Station (MARS), University of Agricultural Sciences, Dharwad (15º25' N to 75º07' E , 678 msl.) were used in this study. The variability of rainfall and rainy days on monthly and annual basis was studied by using standard statistical methods (Panse and Sukhatme, 1985). The percentage of contribution of rainfall during different seasons and months were worked out. The normal range of annual rainfall was also computed by keeping IMD classification: N: Normal RF (mean ± 10%), SLD: Slight drought (-11 to -25 %), MD: Moderate drought (-26 to -49 %) and SD: Severe drought (-50 % and above). Daily rainfall was divided into different intensity groups *viz.*, very light rain(0.1-2.4mm), light rain (2.5-7.5 mm), moderate rain (7.6-35.5 mm), rather heavy (35.6-64.4 mm), heavy rain (64.5-124.4 mm), very heavy rain (124.5-244.4 mm) and extremely heavy rain (>244.5 mm) and their distribution was studied.

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Annual rainfall :

Analysis of 27 years (1985-2011) rainfall data indicated that the mean annual rainfall of this region was 720.2 mm spread with co-efficient of variation of 34.26 per cent. The maximum rainfall was 1140.4 mm in 2009 followed by 1104.8 mm in 1991 and the minimum was 175.5 mm in 2003 followed by 247.0 mm in 2001. The normal range *i.e.* between ± 10 of mean annual rainfall was 648.2 mm and 792.2 mm. Out of 27 years, three years *viz.*, 2009, 1991, 2007 received excess of 58.2 per cent, 53.3 per cent and 50.7 per cent rainfall, respectively. Whereas three years *viz.*, 2003, 2001 and 2002 received less than -75.7 per cent, -65.7 per cent and -49.7 per cent, respectively than the normal range and these three years were declared as severe drought (Table 1and Fig.2). In general, the annual precipitation receipt in this region was normal.

Table 1: Mean annual rainfall and rainy days from 1985 to 2011 and deviation from the normal

Year	Rainfall (mm)	Deviation from normal	Per cent deviation from normal (mm)	Category	Rainy day (days)	Deviation from normal (days)	Per cent deviation from normal
1985	551.3	-169.6	-23.5	SLD	41	-13	-24.1
1986	594.7	-126.2	-17.5	SLD	57	3	5.6
1987	626.0	-94.9	-13.2	SLD	52	-2	-3.7
1988	749.0	28.1	3.9	N	61	7	13.0
1989	545.0	-175.9	-24.4	SLD	50	-4	-7.4
1990	730.5	9.6	1.3	N	52	-2	-3.7
1991	1104.8	383.9	53.3	N	71	17	31.5
1992	824.2	103.3	14.3	N	59	5	9.3
1993	806.3	85.4	11.8	N	68	14	25.9
1994	741.5	20.6	2.9	N	68	14	25.9
1995	731.9	11.0	1.5	N	46	-8	-14.8
1996	686.6	-34.3	-4.8	N	48	-6	-11.1
1997	775.6	54.7	7.6	N	58	4	7.4
1998	753.8	32.9	4.6	N	40	-14	-25.9
1999	435.7	-285.2	-39.6	MD	31	-23	-42.6
2000	528.7	-192.2	-26.7	MD	43	-11	-20.4
2001	247.0	-473.9	-65.7	SD	27	-27	-50.0
2002	362.3	-358.6	-49.7	SD	26	-28	-51.9
2003	175.5	-545.4	-75.7	SD	18	-36	-66.7
2004	585.8	-135.1	-18.7	SLD	42	-12	-22.2
2005	1011.1	290.2	40.3	N	77	23	42.6
2006	866.2	145.3	20.2	N	76	22	40.7
2007	1086.2	365.3	50.7	N	68	14	25.9
2008	928.9	208.0	28.9	N	61	7	13.0
2009	1140.4	419.5	58.2	N	69	15	27.8
2010	952.5	231.6	32.1	N	69	15	27.8
2011	922.3	201.4	27.9	N	71	17	31.5
Mean	720.2	0.0	0.0		54	0	0.0

IMD Classification: N: Normal RF (mean ± 10%), SLD: Slight drought (-11 to -25 %), MD: Moderate drought (-26 to -49 %), SD: Severe drought (-50 % & above)

The rainfall of 27 years (Table 2 and Fig. 1) ranged from 175.5 mm to 1140.4 mm with a mean of 720.2 mm. The standard deviation (SD) was higher (246.75) with a co-efficient of variation (CV) of 34.26 per cent, indicating higher variability and lesser dependability on rainfall. During better rainfall years, 1985- 1995 (10 years) mean rainfall was 727.7 mm with lower SD (158.40) and CV (21.97 %) (Table 4). During the period 2000 to 2004, this region experienced severe drought (mean rainfall of 379.9 mm) with high SD (176.27) and CV (30.02 %). It indicated very high variability in rainfall. On the contrary, during recent the last 7 years (2005-2011), the annual rainfall was high, which ranged from 866.2 mm to 1140.4 mm with a mean value of 986.8 mm and lower SD (97.72) and CV (13.56 %), indicating lesser variability and more dependability. As per IMD drought intensity classification, the region has experienced severe drought (drought intensity > 50 %) during the three consecutive years (2001- 2003) and excess rainfall continuously from 2004 onwards till date.

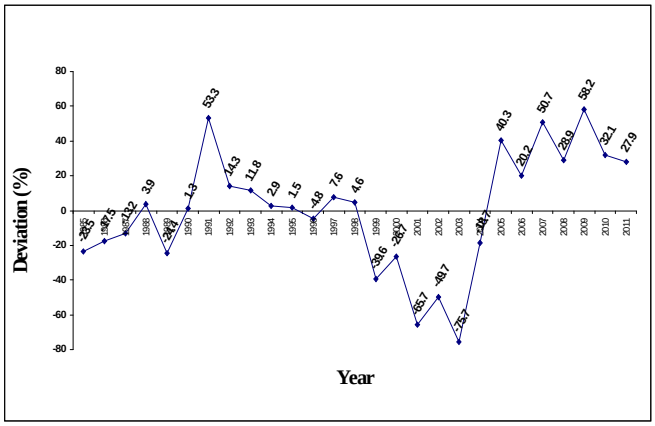

Fig. 1: Annual rainfall deviation from the normal from 1985 to 2011

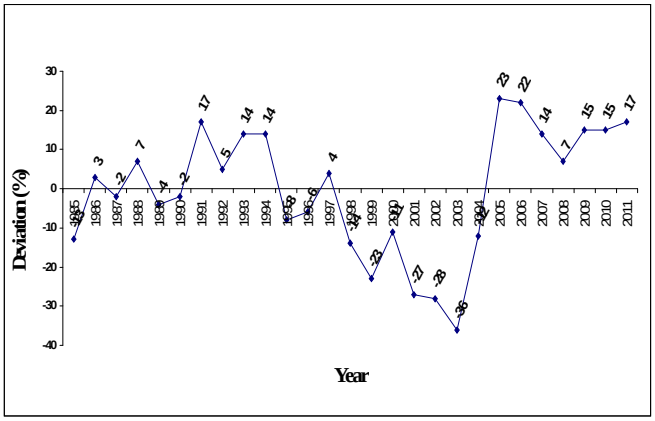

Fig. 2: Annual rainy days deviation from the normal from 1985 to 2011

Rainy day (a day with rainfall greater then 2.5mm) indicated that the mean rainy day of this region was 54 days spread with co-efficient of variation of 30.28 per cent. The maximum rainy days were 77 from (1011.1 mm) in 2005 followed by 76 (866.2 mm) in 2006 and 69 rainy days in 2009 with highest rainfall of 1140.4 mm. The minimum was 18 rainy days (175.5 mm) in 2003 followed by 26 in (362.3 mm in 2002). Out of 27 years, four years *i.e.* 2005, 2006, 2009 and 1991 received 23 days, 22 days, 17 days and 17 days, respectively that are excess of 42.6 per cent, 40.7 per cent and 31.5 per cent and 31.5 per cent higher then the normal rainy days. Whereas three years *i.e.* 2003, 2002 and 2001 received 18 days, 26 days and 27 days that are less than -66.7 per cent, -51.9 per cent and -50.0 per cent than the normal range (Table 1).

Monthly rainfall :

Monthly rainfall analysis indicates that receipt of rainfall during the first three months (January to March) was less

Table 2 : Characteristics of monthly rainfall from 1985 to 2011 at Main Agicultural Research Station Dharwad, Karnataka

Months	Max*	Min*	Mean (1985 to 2011)	S.D.	C.V.%	S.E.M.	% of annual
January	0.0	0.0	1.6	5.08	309.15	0.98	0.23
February	0.0	0.0	3.1	12.46	401.03	2.40	0.43
March	29.8	0.1	11.8	25.31	213.72	4.87	1.64
April	52.8	54.4	39.6	30.46	76.93	5.86	5.50
May	91.6	0.0	64.0	38.67	60.42	7.44	8.89
June	144.8	31.1	116.4	74.79	64.25	14.39	16.16
July	256.8	14.6	129.7	73.20	56.43	14.09	18.01
August	72.2	8.6	104.0	57.26	55.05	11.02	14.44
September	229.0	16.1	103.1	69.76	67.63	13.43	14.32
October	141.0	48.7	107.9	63.51	58.85	12.22	14.99
November	46.0	1.9	32.1	35.93	111.47	6.91	4.46
December	76.4	0.0	6.9	16.84	243.45	3.24	0.96
Total	1140.4	175.5	720.2	246.75	34.26	47.49	100.00

*SD-Standard Deviation * CV- Coefficient of Variation

than 16.5 mm with high CV (213.72 to 401.03 %). In the subsequent months, rainfall gradually increased to 39.6 mm in April and 64.0 mm in May (Table 2). After the commencement of SWM, the rainfall in June increased to 116.4 mm and reached its peak in July by 129.7 mm and subsequently declined gradually and reached minimum in December with 6.9 mm. Four months *viz.*, June, July, August and September contributed maximum (62.94%) to the annual rainfall. Similarly in case of rainy days analysis indicates that during the first three months (January to March) was 1 rainy day with high CV (179.81 to 259.81 %). In the subsequent months, rainy day gradually increased to 3 days in April and 4 days in May (Table 3). After the commencement of SWM, the rainy day in June increased to 9 days and reached its peak in July by 11 days and subsequently declined gradually and reached minimum in December with 1 day. Four months *viz.*, June, July, August and September contributed maximum (68.72%) to the annual rainy days.

Conclusion :

– There was no trend in the annual rainfall totals and rainy days over pre monsoon, monsoon and post monsoon in the period 1985 – 2011, erxcept in 2001 to 2004.

– In contrast, the annual total rainfall in 1995 to 2004 was 528.3 mm and 2005 to 2011 was 986.8 mm this shows the significant increase in the rainfall since 2005 over the normal rainfall of 720.2 mm of 27 years.

– Similarly in case of mean annual rainy days in 1995 to 2004 was -16 days from the normal (54 rainy days) and from 2005 to 2011 was increase in 16 rainy days this showed the significant increase in the rainy days since 2005 over the normal rainy days of 54 days of 27 years.

Table 3: Characteristics of monthly number of rainy days from 1985 to 2011 at Main Agricultural Research Station Dharwad, Karnataka

Months	Max*	Min*	Mean (1985 to 2011)	S.D.	C.V.%	S.E.M.	% of annual
January	1	0	0	0.58	259.81	0.11	0.41
February	0	0	0	0.27	360.29	0.05	0.14
March	0	0	1	1.27	179.81	0.24	1.30
April	5	2	3	2.14	75.15	0.41	5.28
May	3	0	4	2.06	50.18	0.40	7.61
June	10	5	9	3.56	38.91	0.69	16.94
July	19	2	11	5.43	48.39	1.05	20.78
August	15	1	10	3.91	41.04	0.75	17.63
September	14	2	7	3.91	54.08	0.75	13.37
October	9	6	6	3.04	49.13	0.58	11.45
November	1	0	2	1.96	101.75	0.38	3.57
December	0	0	1	0.91	181.11	0.17	0.93
Total	77	18	54	16.25	30.28	3.13	100.00

Maximum Minimum* S.D. – Standard Deviation *S.E.M. – Standard Error Mean

Table 4: Annual rainfall (mm) variability from 1985 to 2011 at Main Agricultural Research Station Dharwad

Period	Rainfall range (mm)	Average (mm)	S.D.	C.V.%
1985 to 1990	545.0 - 749.0	632.8	88.20	12.24
1991 to 1995	731.9 - 1104.8	841.7	152.38	21.14
1985 to 1995	545.0 - 1104.8	727.7	158.40	21.97
1995 to 2000	435.7 - 775.6	652.1	137.99	19.14
2000 to 2004	175.5 - 585.8	379.9	176.27	24.45
1995 to 2004	175.5-775.6	528.3	216.42	30.02
2005 to 2011	866.2 - 1140.4	986.8	97.72	13.56

*SD-Standard Deviation * CV- Co-efficient of Variation

REFERENCES

Hanumanthappa, M., Ananda, M.R., Sridharaherle,P., Nagesha, L. and Sudhir kamath, K.V. (2010). Annual and seasonal rainfall variability in coastal district of Karnataka. *J. Agrometeorol,* **12**(2): 266-267.

Krishnakumar, K.N.and Prasada Rao, G.S.L.H.V. (2008). Trends and variability in north east monsoon rainfall over Kerala. *J. Agrometeorol,* **10**(2): 123-126.

Panse, V.G. and Sukhatme, P.V. (1985). *Statistical methods for agricultural workers*. Indian Council of Agricultural Research, NEW DELHI, INDIA.

Singh, P.K., Lathore, L.S., Singh, K.K. and Baxla, A.K. (2009). Rainfall characteristics of North West alluvial plains of Bihar, *J. Agrometeorol*, **11**(1): 37-41.

Tupe, A.R., Wanjari, S.S.and Bhale,V.M. (2010). Rainfall variability analysis for crop planning at Akola. In: *Agro meteorological services for farmers*, ed. Vyas Pandey, Anand Agricultural University, Anand (GUJARAT) INDIA pp.46-50.

Virmani, S.M. (1994). Climate resource characterization in stressed tropical environment. Constraints and opportunities for sustainable agriculture. In: *Stressed ecosystem and sustainable agriculture*. Oxford and IBA publishing Co. (P) Ltd., NEW DELHI, INDIA pp. 149-160.

*_*_*_*_*_*