

Rainfall behaviour of Belval and Bhusawal stations of Jalgaon district

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Received : 24.08.2012; Revised : 21.12.2012; Accepted : 30.01.2013

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■ **ABSTRACT** : Rainfall is one of the most important natural resources for human being in rainfed farming. The crop planning and its success depend upon amount and distribution of rainfall. The rainfall in Jalgaon district is very uncertain, most of the area under rainfed condition. The weekly rainfall data of 30 years (1976-2005) for Belval and Bhusawal stations was collected. The behavior of rainfall, occurrence of dry spell and critical dry spell was worked out by using initial and conditional probability methods. It can be inferred that the initial probabilities >20 mm varied between 60-70 per cent at Belval while at Bhusawal it was 75-80 per cent. The conditional probability (W/W) of both the stations varied between 80-90 per cent. At >30mm rainfall initial probabilities varied between 50-60 per cent at both the stations and the conditional probability (W/W) varied between 60-70 per cent at Belval, while at Bhusawal it was in the range of 70-80 per cent. The conditional probability (W/D) varied in between 40-50 per cent at Belval and Bhusawal. The dry spells were found 62 at Belval, and 44 at Bhusawal and the critical dry spells were 12 and 9 for Belval and Bhusawal respectively.

■ **KEY WORDS** : Rainfall behavior, Dry spell, Conditional probability

■ **HOW TO CITE THIS PAPER** : Nikam, S.P. and Dhanphule, S.S. (2013). Rainfall behaviour of Belval and Bhusawal stations of Jalgaon district. *Internat. J. Agric. Engg.*, 6(1) : 231-235.

The success or failure of crop particularly under rainfall condition is closely linked with the rainfall pattern and the basic source of water is precipitation in the form of rainfall and snowfall. India receive adequate amount of rainfall annually through the four different type weather phenomenon, south-west monsoon 74 per cent, north east monsoon 5 per cent, pre monsoon 13 per cent, and post monsoon 10 per cent. Rainfall is one of the most important natural resources for human being in rainfed farming. The three fourth of the net cultivated area of India in under rainfed agriculture is greatly influenced by the characteristic of the monsoon (Ashok Raj, 1979). The crop planning and its success depend upon amount and distribution of rainfall. Weekly data are more useful than monthly, seasonal and annual rainfall for planning agriculture operation (Gupta *et al.*, 1975; Venkantraman, 1979).

The crucial months for agriculture are July and August and fate of rained *Kharif* crop largely depends upon amount and distribution of rain especially during these two months. Even though most parts India is blessed with fairly high rainfall, average annual rainfall of India is 1140 mm. The agriculture productivity remains poor. One of the reasons for this poor productivity is the non availability of water for timely application to the crop. Rainfall during the monsoon period is not a continuous process; breaks in monsoon are common

phenomenon. Knowledge of the occurrence of dry and wet spell is of vital important for successful planning of agricultural crop. Aagnihotri *et al.* (1984) studied the conditional probability based dry and wet spell occurrence by fitting it in the first order Markova chain model.

The rainfall pattern of Jalgaon district of Maharashtra state is very uncertain with most of the area under rainfed condition. Knowledge of the distribution of dry spells during the monsoon period is very much essential for successful management of dry land agriculture. Also it is important to know the chance of occurrence of dry spell during the critical period of lifecycle of the crop planning the sowing period along the variety of current crops.

■ METHODOLOGY

Study area :

The present study was carried out for Jalgaon district. The selected stations were, Belval station located at latitude 20°58' NS, longitude 75°42' EW and Bhusawal at latitude 21°42' NS and longitude 75°47' EW.

Data collection :

The daily rainfall data of Belval and Bhusawal stations for 30 years (1976-2005) were collected from State Surface

Water Data Centre Hydrology Project, Irrigation Department, Government of Maharashtra, Nashik.

Probability analysis of rainfall data :

Mathematical or graphical methods are generally used for the initial and conditional probability analysis (Patil *et al.* 1988). Rainfall data of 30 years for Belval and Bhusawal in Jalgaon district were converted into standard meteorological week pattern. The analysis has been carried out by using following formula :

Initial rainfall probability (per cent) (W) :

Initial rainfall probability of getting >20 mm rainfall of X week = W_x

$$W_x = \frac{\text{Number of years during which } > 20 \text{ mm rainfall of } x \text{ weeks}}{\text{Total number of years}} \times 100$$

Conditional rainfall probability (per cent) (W/W) :

Conditional rainfall probability (per cent) of getting >20 mm rainfall during next week also when there was rainfall of >20 mm during this week (x).

$$W/W_x = \frac{\text{Number of years during which next week received } > 20 \text{ mm rainfall when this week also received } > 20 \text{ mm rainfall}}{\text{Number of years during which this week } (W_x) \text{ received } > 20 \text{ mm rainfall}} \times 100$$

Conditional rainfall probability (per cent) (W/D) :

Conditional rainfall probability (per cent) (W/D) of getting >20 mm rainfall during next week when this week was dry *i.e.* the rainfall <20 mm

$$W/D_x = \frac{\text{Number of years during which next week received } > 20 \text{ mm rainfall when this week } (x) \text{ received } < 20 \text{ mm rainfall}}{\text{Number of years during which this week was dry } (< 20 \text{ mm rainfall})} \times 100$$

Critical dry spell :

The interval between the end of seven day spell beginning with the onset of effective monsoon and another rainy day with "5e" or more of rain or the commencement of another 7 days wet spell. The third criteria considered at least 4 days out of these 7 days are rainy days with not less than 2.5 mm of rain each day and with a total rain of "5e" mm or more during this spell is called as the any first dry spell. If the duration of this dry spell is exceed a certain value depending on the crop-soil complex of the region. This dry spell is called the first critical dry spell.

RESULTS AND DISCUSSION

Daily rainfall data for Belval and Bhusawal in Jalgaon

District were obtained and analyzed. The analysis of data, initial and conditional probability, and mean rainfall were plotted on a graph. The dates of onset of effective monsoon, rainy days and dates of occurrence of critical dry spell were also calculated. Results obtained are discussed in depth in this chapter.

The daily rainfall data of 30 years (1976-2005) was converted into weekly and annually and work out the initial (W), conditional probability (W/W) and (W/D) for Belval and Bhusawal stations.

It is observed from Table 1 that, The initial probability >20 mm varied between 65-70 per cent rainfall probability and conditional probability on wet week followed by wet week varied between 80-85 per cent rainfall probability and conditional probability on dry week followed by wet week varied between 55-60 per cent rainfall probability, while in case of initial probability >30 mm varied between 40-50 per cent rainfall probability and conditional probability on wet week followed by wet week varied between 60-70 per cent rainfall probability and conditional probability on dry week followed by wet week varied between 40-50 per cent rainfall probability. The average annual rainfall 720 mm occurrence at Belval station in *Kharif* 561 mm, in *Rabi* 125 mm and summer season 34 mm occurred Fig. 1 Shows that at Belval station the average annual rainfall was 720 mm and more than 60 per cent rainfall probabilities of getting more than 20 mm rainfall per week were observed from 27 MW, while conditional probabilities (W/W) were above 75 per cent for getting more than 20 mm rainfall. The conditional probabilities (W/D) were above 65 per cent for getting more than 20 mm rainfall. It can be also inferred from Fig. 2, that more than 30 mm rainfall per week of getting more than 50 per cent rainfall probabilities were observed from 28 MW. While conditional probabilities (W/W) were above 60 per cent for getting more than 30mm

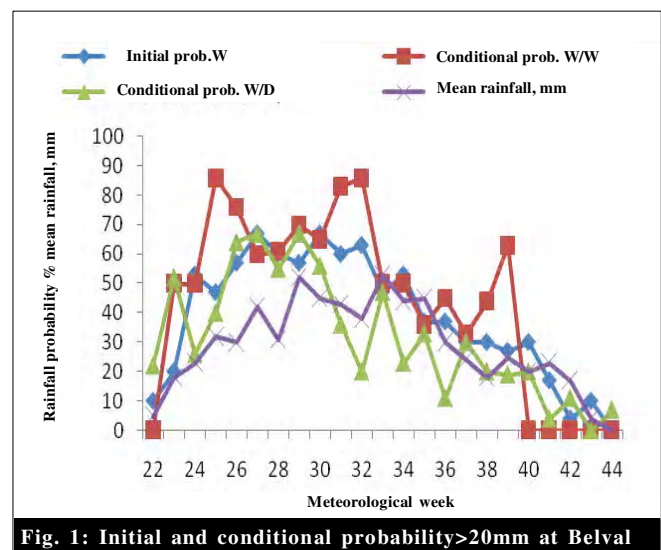


Fig. 1: Initial and conditional probability >20mm at Belval

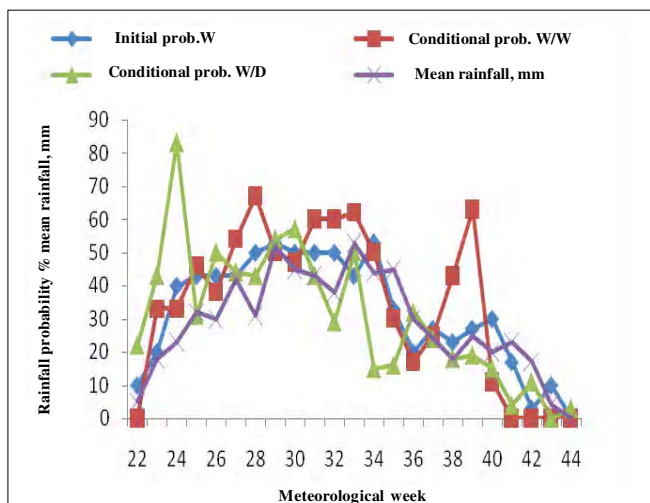


Fig. 2: Initial and conditional probability >30 mm at Belval

rainfall and conditional probabilities (W/D) were above 55 per cent for getting more than 30 mm rainfall.

The Table 2 revealed that, the initial probability >20 mm varied between 60-65 per cent rainfall probability and conditional probability on wet week followed by wet week varied between 85-90 per cent rainfall probability and conditional probability on dry week followed by wet week varied between 55-60 per cent rainfall probability. It also shows that in case of initial probability >30 mm varied between 50-60 per cent rainfall probability and conditional probability on wet week followed by wet week varied between 70-80 per cent rainfall probability and conditional probability on dry week followed by wet week varied between 40-50 per cent rainfall probability. The average annual rainfall 580 mm occurrence in *Kharif* 460 mm, in *Rabi* 105 mm and summer season 30 mm after all the probability analysis graph were plotted in between initial, conditional probability and mean rainfall. It is observed from Fig. 3 that, at Bhusawal station the average annual rainfall

Table 1: Rainfall probabilities at Belval

SMW	Rainfall probabilities %					
	> 20 mm			> 30 mm		
	W	W/W	W/D	W	W/W	W/D
22	10	0	22	10	0	22
23	20	50	52	20	33	43
24	53	50	26	40	33	83
25	47	86	40	43	46	31
26	57	76	64	43	38	50
27	67	60	67	43	54	44
28	60	61	55	50	67	43
29	57	70	67	53	50	54
30	67	65	56	50	47	57
31	60	83	36	50	60	43
32	63	86	20	50	60	29
33	47	50	47	43	62	50
34	53	50	23	53	50	15
35	37	36	33	33	30	16
36	37	45	11	20	17	32
37	30	33	30	27	25	24
38	30	44	20	23	43	18
39	27	63	19	27	63	19
40	30	0	20	30	11	15
41	17	0	4	17	0	4
42	4	0	11	3	0	11
43	10	0	0	10	0	0
44	0	0	7	0	0	3
45	7	0	4	3	0	4
46	4	0	7	3	0	7
47	7	50	7	7	50	4
48	10	33	4	7	0	8
49	7	0	0	7	0	0
50	0	0	0	0	0	0
51	0	0	7	0	0	0
52	7	0	4	0	0	0

was 580 mm and more than 60 per cent rainfall probabilities of getting more than 20 cm rainfall per week were observed from 28 MW, while conditional probabilities (W/W) were above

85 per cent for getting more than 20 mm rainfall. The conditional probabilities (W/D) were above 65 per cent for getting more than 20 mm rainfall. From Fig. 4 more than 30 mm rainfalls per

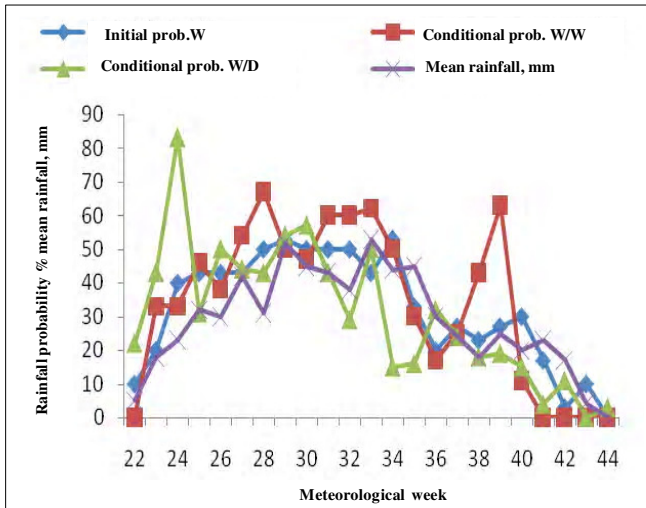


Fig. 3: Initial and conditional probability >20mm at Bhusawal

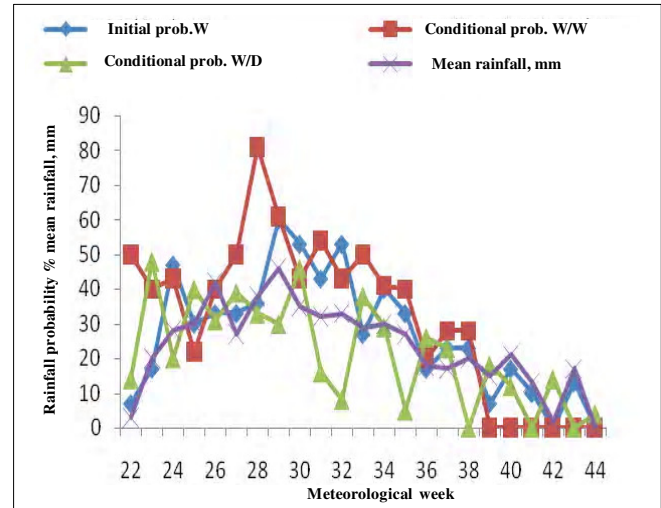


Fig. 4: Initial and conditional probability >30mm at Bhusawal

Table 2 : Rainfall probabilities at Bhusawal

SMW	Rainfall probabilities %					
	> 20 mm			> 30 mm		
	W	W/W	W/D	W	W/W	W/D
22	7	50	15	7	50	14
23	16	20	54	17	40	48
24	53	31	23	47	43	20
25	43	61	37	30	22	40
26	40	50	29	33	40	31
27	43	92	53	33	50	39
28	47	85	36	36	81	33
29	63	42	33	60	61	30
30	57	53	58	53	43	46
31	50	73	64	43	54	16
32	60	39	10	53	43	8
33	40	50	37	27	50	38
34	43	31	33	40	41	29
35	37	9	11	33	40	5
36	20	50	26	17	20	26
37	23	57	38	23	28	23
38	37	0	0	23	28	0
39	13	25	28	7	0	18
40	26	0	25	17	0	12
41	23	0	9	10	0	0
42	7	0	14	0	0	14
43	13	0	0	13	0	0
44	0	0	7	0	0	4
45	6	0	0	3	0	0
46	0	0	13	0	0	10
47	13	0	0	10	33	4
48	6	0	3	7	0	4
49	3	0	0	3	0	0
50	0	0	0	0	0	0
51	0	0	7	3	0	3
52	0	0	0	3	0	0

week of getting more than 60per cent rainfall probabilities were observed from 30 MW. While conditional probabilities (W/W) were above 80per cent for getting more than 30mm rainfall also conditional probabilities (W/D) were above 40per cent for getting more than 30mm rainfall.

It was also found that at Belval 12 critical dry spells occurred, while in Bhusawal 9 critical dry spells occurred.

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