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Short communication

Probability of dry/wet spell and rainwater availability at Dapoli for rice crop planning

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In India, rainfed agriculture occupies nearly 58% of the cultivated area, contributes 40% of country's food production, and supports 40% of the human and 60% of the livestock population, generally with low yields and a high risk of crop failure. One of the main reasons for crop failure is the occurrence of dry spells during the growing season. Knowledge of the distribution of dry spells during the monsoon period is essential for successful rainfed farming. It is also important to know the chances of occurrence of dry spells during the critical stages of the crops for deciding the sowing date, cropping pattern and planning for protective irrigation and intercultural operations. Tomar *et al.* (2001) analysed dry and wet spells at Chhindwara in Madhya Pradesh, and suggested sowing of short duration varieties in *kharif* season for enhancing production while Anil Kumar (2009) investigated the occurrence of meteorological drought for sustenance of agricultural productivity in Hilly areas of Uttarakhand.

In this analysis weather data of Dapoli station for 30 years (1985 to 2014) was collected from the Department of Agronomy, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli was used. Probability analysis of dry and wet rainfall weeks was carried out by applying Markov chain model. For considering a week as dry or wet, the criteria given by Raj (1997) were applied. A week receiving more than 40 mm rainfall was considered as wet week and a week receiving less than 40 mm rainfall was considered as a dry week.

The results pertaining to initial and conditional probabilities of dry and wet spell and consecutive dry and wet spells as of Dapoli station is presented in Table 1, for rainy season. Markov chain modeling of wet/dry spells and probability analysis of rainwater availability was made in the study area. Subsequently, analysis of water requirement at the various growth stages of the rice crop was performed to determine water surplus/deficit and comprehensive planning of rice crop was suggested.

The average weekly rainfall varies from 317 mm in 24th SMW to 10 mm in 42nd SMW. Weekly rainfall during nursery, seedling and vegetative stages were more and crop water requirement was less. Average weekly rainfall was high during nursery, seedling and vegetative growth stage and continuously decreasing from vegetative to maturity stage.

From Table 1, it is evident that during 23th to 36th SWM the initial probability of being wet week ranged from 70 to 100 %, indicating a good number of wet spells during vegetative growth period of rice crop. The surplus water may be stored in water harvesting structures for later use during moisture stress period. During reproductive stage (34th to 39th SMW), the initial probability of getting a wet week varied from 53% to 87 %. The highest initial probability of occurring wet week was observed in 26th, 29th and 32nd SMW with 100 % probability and lowest 10 % initial probability observed in 42nd SMW. The conditional probability of wet weeks was 100 % in 33th week during which continuous rains may occur. It means at Dapoli station sufficient amount of excess rainwater can be harvested in storage structures.

Crop water requirement and rainwater surplus/deficit

Weekly average evapotranspiration of rice and average weekly rainfall at 75 % probability of 30 year (1985 to 2014) is presented in Table 2. The expected rainfall amounts during different standard meteorological weeks were determined by probability analysis of rainfall and ET requirement of rice crop at different growth stages were also worked out. Based on these two parameters, water requirement of rice crop was computed. It is found that water requirement of rice crop during nursery stage at Dapoli station was 69.1 mm and rainwater availability at 75 % probability level was 565.3 mm. This indicates that there was no shortage of water during nursery stage. At seedling stage of 2 weeks also, the rainwater availability is more than the evapotranspiration of rice. Only during maturity stage (40th and 42ndSMW) there might be need of supplemental irrigation. All growth stages except maturity stage water

Table 1: Initial and conditional probability of weekly wet/dry spell during monsoon at Dapoli.

SMW	Initial probability (%)		Conditional probability (%)				Probability of consecutive 2dry and wet weeks (%)	
	P(W)	P(D)	P(W/W)	P(D/W)	P(D/D)	P(W/D)	P(2W)	P(2D)
23	77	23	70	30	14	86	53	0
24	83	17	80	20	0	100	67	0
25	90	10	93	7	0	100	83	0
26	100	0	97	3	0	100	97	0
27	93	7	96	4	50	50	90	0
28	93	7	96	4	0	100	90	0
29	100	0	97	3	0	100	97	0
30	97	3	97	3	0	100	93	0
31	93	7	96	4	0	100	90	0
32	100	0	97	3	0	100	97	0
33	90	10	100	0	33	67	90	0
34	90	10	90	11	33	67	80	0
35	70	30	52	48	22	78	37	1
36	77	23	83	17	42	57	63	1
37	53	47	81	19	64	36	43	4
38	60	40	67	33	42	58	40	2
39	57	43	59	41	39	61	33	2
40	33	67	30	70	65	35	10	9
41	23	77	0	100	74	26	0	13
42	10	90	33	67	93	7	3	23

Table 2: Computation of rainwater surplus/deficit at Dapoli.

Growth stage	SMW	ET_{rice} (mm)	Rain water availability (mm) at 75 % probability	Rainwater surplus /deficit (mm)
Nursery	23-25	69.1	565.3	496.2
Seedling	26-27	43.4	388.2	344.7
Vegetative	28-29	42.8	447.7	404.8
Vegetative	30-31	44.5	370.8	326.3
Vegetative	32-33	46.9	261.8	214.8
Reproductive	34-35	49.8	283.2	233.3
Reproductive	36-37	52.0	137.9	85.8
Reproductive	38-39	55.5	107.9	52.4
Maturity	40-41	50.2	54.7	4.4
Maturity	42	23.8	7.6	-16.1
Total		478.4	2625.3	2146.9

requirement of rice is always less than the rainwater availability at 75 % probability level. Amount of surplus water from nursery to reproductive stage is varies from 50 mm to 496 mm and deficit at maturity stage with 16.1 mm. It is seen that Dapoli station may experience appreciable water surplus during most of the growth stages and at maturity stage rainwater availability is negligible which is beneficial in respect of timely harvesting of quality rice.

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