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Effect of rainfall, number of rainy days and length of rainy season on productivity of rice (*Oryza sativa L.*) crop at Jabalpur

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ABSTRACT

Rainfall variability and it's effect on yield of rainfed rice in Jabalpur region has been analysed by use of rainfall data for the period of 1971 to 1996. Total of rainfall for monsoon months show high degree of variability with 30% coefficient of variation. Unsteady productivity of rainfed rice is in consonance with fluctuating total of rainfall, total number of rainy days and period of monsoon season. Further analysis of daily and weekly rainfall data suggests that for few years when the quantum of rainfall during monsoon months was close to it's normal value the low yield of rice can be attributed to the moisture stress during reproductive stage of rice crop. Remedial measures are suggested for obtaining sustainable yield of rice even in the years when plant growth is affected by early withdrawal of the monsoon.

Key Words : Rainfed rice, Rainfall, Rainy days

Almost half of the rice production area of the world depends entirely on rainfall to supply the water needs of the crop. Therefore, variability of rainfall and it's effect on crop productivity, specially in context of rice production, has been an important subject of study, particularly for the areas where farming is rainfed, Rao and Vijayalakshmi 1993, Ramana Rao *et al.*; 1993, Sastri and Patel, 1984). In Jabalpur region 82% of gross area cultivated is under rainfed farming which quite often is seriously affected by high degree of variability of rice (589 kg/ha) which is a major crop grown in the region during the rainy season, is quite below the national average of 1879 kg/ha. Consequential to variability of rainfall during the monsoon period and events associated with it, even this low level of practices. Therefore a case study has been conducted for this region to understand the exact effect of rainfall variability on rainfed rice production and suggest, if any, remedial measures to stabilize rainfed rice yields at satisfactorily high level.

MATERIALS AND METHODS

Rainfall data of twenty six years (1971 to 1996) recorded at Agro-meteorological observatory installed in Adhartal farms of JNKVV, Jabalpur (23°9' N, 78°58'E and 411 m above msl) were used for analysis work. Data regarding productivity of rice for these years has been taken from Basic Agricultural Statistics of M.P., published by Commissioner, Land Records and

Settlements, M.P. Gwalior. For Jabalpur average value of precipitation for monsoon months for the period under study is 1225 mm and for these years, 589 kg ha^{-1} is the average amount of productivity of rainfed rice. Normal dates of onset and withdrawal of south-west monsoon are 19th June (25 SMW) and 21st September (38 SMW) respectively, and on an average, duration of south-west monsoon is 95 days having 49 rainy days.

RESULTS AND DISCUSSION

Average productivity level during the period of report was only at 589 kg ha^{-1} and varied between 13 kg ha^{-1} and 1000 kg ha^{-1}. Thus productivity has not been only very low but also highly unstable during the period of report, when green revolution has made it's impact all over the country. Major area of rice production is rainfed and therefore larger proportion of the variability in yields can be attributed to one of the main elements of weather, i.e. rainfall, in terms of quantum and it's pattern of distribution during the monsoon months. It is obvious from Figure 1 that in most of the years rice production is in consonance with quantum of rainfall of monsoon months. A simillar pattern in yield levels is observed with the length of rainy season and number of rainy days during monsoon season as shown in Table 1. Rice yields were found to be significantly correlated with quantum of rainfall (r=0.64), length of rainy season (r=0.33) and number of rainy days (r=0.53).

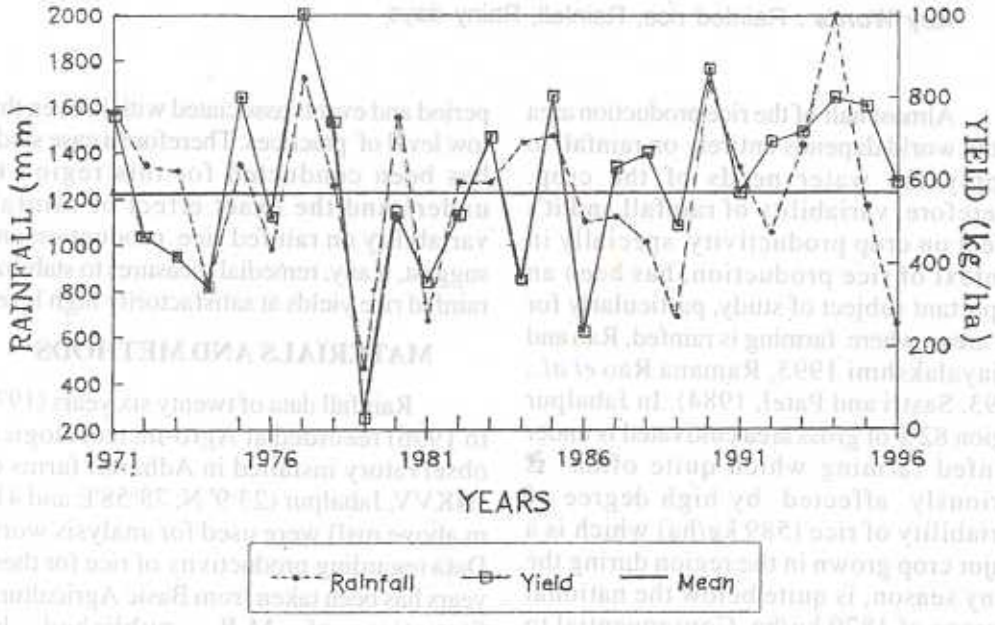

Fig. 1. Variability in rice yield in relation to seasonal rainfall.

However, only in few years, productivity of rice does not match with either of rainfall features mentioned above. For rainfed rice, yield variations in these years can be explained by quantum of precepitation during critical vegetative and reproductive phases. Grain filling stages which normally occurs, at Jabalpur, during 38-41 SMW, after withdrawal of monsoon, deficit soil moisture during this phase drastically reduces the grain yield even if there was a normal rainfall during preceding phases. For example, in 1984 rainfall and duration of south-west monsson, both were above normal even then yield was lower than it's average value, because there was no rainfall in SMW 38 and onwards and crops suffered moisture stress during grain filling stage. On the contrary, however, in 1995 and 1996 more than normal and normal yields of rice were obtained despite deficit rainfall during the season, because respectively 86

Table 1: Rainfall features during monsoon months and yield of rainfed rice at Jabalpur (1971-1996)

S.No.	Year	Rainfall (mm)	No.of rainy (days)	Duration (days)	Grain Yield (kg ha^{-1})
1	1971	1573.1	63	103	753
2	1972	1344.4	34	79	463
3	1973	1320.1	61	104	417
4	1974	835.4	37	54	343
5	1975	1349.3	57	86	799
6	1976	978.0	50	73	513
7	1977	1729.2	53	84	1000
8	1978	1250.1	60	105	738
9	1979	467.2	26	56	13
10	1980	1551.0	56	95	526
11	1981	669.8	39	102	354
12	1982	1273.9	50	68	515
13	1983	1271.1	52	108	700
14	1984	1443.2	48	100	360
15	1985	1471.4	56	80	801
16	1986	1097.1	65	89	234
17	1987	1123.4	45	77	629
18	1988	1011.8	50	98	663
19	1989	685.0	46	102	490
20	1990	1708.9	66	107	868
21	1991	1334.6	48	94	570
22	1992	1050.2	47	86	693
23	1993	1428.9	60	108	716
24	1994	2052.0	60	98	799
25	1995	1170.8	44	71	778
26	1996	658.7	44	68	593

mm and 130 mm of rains were received during grain filling phase, after the cessation of the monsoon. Likewise, for other years also, when rice yield does not match with total quantum of rainfall, yield variations are largely due to rainfall received during grain filling stage of the rice crop. Drought analysis of Jabalpur region for this period by Thorn waite method also classify this as period of mild drought (Upendra Shanker *et al.*, 1990). Therefore, for obtaining higher productivity of rainfed rice either surplus rain water be efficiently managed to overcome the moisture stress during reproductive phase, if need be or to minimise the risk of moisture stress during grain filling, short duration varieties be selected which are better in water use efficiency and drought tolerance.

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