

Short communication

Drought management in rainfed rice (*Oryza sativa* L.)*

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In eastern India, comprising the state of Orissa, West Bengal, Bihar, east Madhya Pradesh, east Uttar Pradesh and NE states rice is grown in more than 26 million hectare mostly under rainfed conditions. There are three sub-ecosystems in the rainfed rice ecosystem of eastern India. They are uplands, lowlands and flood-prone or submerged ecosystems. Of the three, the first two ecosystems occupy more than 80 per cent of the rainfed rice area. In eastern India especially in uplands which is drought prone ecosystem, the rice cultivation is always subjected to vagaries of monsoon. The vagaries of monsoon starts right from onset of monsoon as well as intermittent prolonged dry spells due to break monsoon conditions. Under such conditions either a terminal or an intermittent drought is a recurring feature. In view of this, experiments are being conducted for different systems for drought management in rainfed rice.

For assessment of drought climatology the historical rainfall data (1901-1999) has been analysed and based on the criterion for classification (annual rainfall deficit from normal) of drought intensity for rainfed rice have been worked out (Table 1).

On - farm experiments have been conducted in Chattisgarh state under farmer's participatory breeding (FPB)

Table 1: Criterion for drought intensity

Departure of rainfall from average (%)	Drought intensity
0-20%	Nil
21-30%	Moderate
31-40%	Large
41-50%	Severe
>50 %	Disastrous

Table 2: Characterisation of drought tolerance

Yield reduction due to drought (%)	Drought tolerance
0 - 20 %	High
21 - 31 %	Large
31 - 40 %	Moderate
41 - 50 %	Low
> 50%	Least

program in collaboration with IRRI. Sixteen long duration and 16 early / medium duration rice varieties were sown in heavy and light soils respectively under rainfed conditions. Identical sets of experiments were also conducted in the research farm of IGAU under rainfed and irrigated conditions to estimate the yield reduction due to drought. For quantifying the drought tolerance of the rice varieties, the percentage reduction of yield due to drought was used. The criterion that was developed for characterization of drought tolerance

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Table 3: Frequency of drought intensity at Raipur

Drought intensity	Years	Frequency
Moderate	1905, 1916, 1920, 1928, 1946, 1965, 1976, 1979, 1987 and 1999	Once in 10 years
Large	1941, 1962, 1966, 1969, 1991 and 1992	Once in 14 years
Severe	1902 and 1988	Once in 50 years
Disastrous	Nil	
Over all		Once in 5 years

based on yield reduction Table 2.

For assured crop yields, farm based strategies are to be developed so that complete crop failure in endemic areas may not occur. In view of this experiments were conducted for different systems for drought management in rainfed rice in sandy loam soil (locally known as "Matasi" soil) which represent typical rainfed lowlands drought-prone sub-ecosystem. The treatments includes varieties, sowing methods, fertilizer dose and weeding.

Drought climatology of Raipur

Using the criterion, the years under different categories of drought intensity have been worked out (Table 3).

The analysis is based on the annual rainfall only. However due to erratic rainfall distribution water stress / drought conditions occur at one or more stages of crop growth affecting the productivity. Hence there is a need to identify suitable varieties tolerant to drought at different growth stages as well as management of drought in endemic areas.

Drought tolerance of rice varieties

During the year 1998, monsoon withdrew early and hence there was terminal drought, while in 1999 there were early drought conditions due to prolonged break in monsoon causing delayed

beushning which resulted in heavy weed infestation in rice fields. Based on the criterion of drought tolerance 32 different rice varieties under early or terminal drought condition has been analyzed and only a few varieties have been found to be tolerant to drought conditions as below.

Under early drought conditions long duration varieties like RAU 1306, Safri 17, Rajshree, Kishori, R738-1-64 and R 650-1817 performed better but these varieties failed under terminal drought conditions. Only R 827-287 showed tolerance under terminal drought conditions. Among early/medium duration varieties IR 42253, Chapti, Madhuri, IR 36, R 703-1-52-1 and R 288-650 showed higher drought tolerance during early drought conditions.

In case of terminal drought conditions, R 703-1-52-1, IR 42253, IR 42342 and Kranti showed tolerance among the early / medium group. Thus the varieties R 703-1-52-1, IR 42253 and IR 42342 performed well both under early as well as terminal drought conditions.

Farm based strategies for drought

During 2000 drought period extended till harvest and both the varieties suffered from drought during reproductive stages. Hence the productivity of both the varieties was almost the same i.e. 1.45 and 1.48 t ha⁻¹ under weeded condition and 1.16 and