



Research Article

## Association of flowering delay under stress and drought tolerance in upland rice (*Oryza sativa* L.)

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**ABSTRACT :** Days to flowering was negatively correlated with grain yield, panicle length, spikelet fertility and 1000 grain weight under moisture stress conditions. Delayed flowering under stress is a strong indication of susceptibility to drought because of retarded growth. Significant negative correlation of RWC with days to 50 per cent flowering (-0.37\*\* and -0.41\*\* in IB and TB NILs, respectively) was noticed indicating RWC as an important indicator of plant water status which significantly influenced the plant phenology and productivity traits under drought stress.

**KEY WORDS :** Drought tolerance, Flowering delay, Physiological traits, Upland rice

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### INTRODUCTION

Upland rice is grown in permanent fields in rotation with a range of winter crops like, wheat, vegetables, pulses, oilseeds or fallows, depending on the availability of residual soil moisture. These areas usually have a continuum from upland to lowland fields along the top sequence, with farmers often processing fields in all hydrological conditions. This system of rice cultivation is located mainly in South Asia and Bangladesh. The rainfed drill sown rice area in Karnataka is similar to this system, in which hydrological conditions like, upland, midland and lowlands are noticed all of which are drought prone (Hanamaratti *et al.*, 2005).

The rainfall pattern in rainfed drill sown rice area is generally mono-modal, with 800 to 1400 mm per annum with a

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peak in July-August. The terminal drought is most common situation which coincides with flowering/grain filling stage a most critical phase for moisture stress. However, the risk of intermittent vegetative stress is also not uncommon. The productivity in rainfed uplands is poor (0.8 to 1.2 t/ha) mainly because of erratic rainfall and moisture stress at flowering stage (Courtois and Lafitte, 1999; Singh, 2006). Therefore, association of flowering behaviour with productivity is more critical for selection and improvement of yield in upland rice.

A delay usually occurs in flowering date, when rice experiences a water deficit before flowering (Lafitte *et al.*, 2003). The period of delay is partly related to extent of stress, the rice genotypes experienced and those with longer delay will tend to produce less grain (Ravindrakumar *et al.*, 2003). The delay in heading under stress was negatively associated with plant water status indicators and stress yields (Blum *et al.*, 1999 and Babu *et al.*, 2003; Pantuwan *et al.*, 2002). The delay in heading is an expression of growth retardation during the drying cycle as well as upon recovery and this delay is a strong indication of susceptibility to stress (Blum *et al.*, 1999).

Absolute yield of the genotypes under stress represents their relative drought tolerance in terms of plant production,