Linking Changes in Chlorophyll A Fluorescence with Drought Stress Susceptibility in Mung Bean [*Vigna Radiata* (L.) Wilczek]

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ABSTRACT

In the present study, the mung bean cv. NM-13-1^{Tol} was selected as drought-tolerant and NM-54^{Sens} as drought-sensitive. The effects of progressive drought (16 days) on the photosystem II (PSII) activity was assessed using OJIP and JIP-test in the selected two mung bean cultivars differing in drought tolerance. Drought stress reduced the relative water content to 70% (at threshold) and 62% (below the threshold) in cv.NM-13-1^{Tol} and NM-54^{sens}, respectively. The greater reduction in quantum yield of PSII in cv.NM-54^{sens} due to drought stress was due to PSII photodamage. Raw OJIP induction curves and F_o and F_m normalised curves showed that significant changes in fluorescence occurred at the O, J, I and P steps only in cv. NM-54^{sens}. Double normalised differential kinetics indicated adverse effects at the antennae, oxygen evolving complex and intersystem electron acceptors in cv.NM54^{sens}. Moreover, JIP-test analysis showed that drought stress caused a greater decrease in performance index (PI_{ABS}) in cv.NM-54^{sens} as compared to that in cv. NM-13-1^{Tol}, which is associated with an increase in V_j, rate of accumulation of closed reaction centres (M_o), energy fluxes for absorption (ABS/RC), trapping (TR_o/RC), electron transport (ET_o/RC), and dissipation of absorbed energy as heat (DI_o/RC). In conclusion, two-week drought stress reduced the RWC below the threshold in cv.NM54^{sens}, which resulted in damages at the donor and acceptor sides of PSII. However, cv.NM-13-1^{Tol} somehow maintained the RWC around the threshold and thus protected PSII. Of various JIP-test parameters, PI_{ABS}, F_v/F_m, V_j, and M_o are key indicators of drought stress tolerance in mung bean cultivars.

Keywords: Drought, F_v/F_m, JIP-test, OJIP, PI_{ABS}, Photosystem-II, RWC

ACKNOWLEDGEMENT

The research work presented in this manuscript is a part of PhD of Hussan Bano (PhD scholar).

HB, ZUZ and HRA conceived the idea and design the experiment, HB performed the experiment, HRA and ZUZ analyse the data, HB wrote the first draft of the MS, HRA, MA and HMK revised the MS.