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Impact of High Temperature and Drought Stress Induced at Different Growth Stages on Flowering Phenology of Three Maize (*Zea mays*) Varieties

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Abstract

Growth and flowering patterns of three Ethiopian maize varieties (viz. A-511, ACV” 6 and Katumani) were tested at five different soil-moisture regimes (i.e., no drought stress throughout the growth - control, and soil-moisture stress induced at one week before tasseling, at silking, at grain filling, and throughout the growth). The study was carried out under field conditions (in Ethiopia) and in a greenhouse (Thailand). Mean daily air temperatures in Ethiopia were 21°C and in Thailand 28°C.

Under field conditions, the drought-stress regimes significantly modified the flower development of all tested varieties when compared to the control. Moisture deficit throughout the growth period prolonged the time to tasseling ($p < 0.01$). This shortened the interval between tasseling and silking (TSI) ($p = 0.01$). On the other hand, drought stress induced at one week before tasseling delayed silking ($p < 0.001$) without an affect on the time to tasseling. This widened the TSI by 36% ($p = 0.016$).

In the greenhouse study, induced drought stresses at different growth stages did not show significant differences in flowering. However, the overall average days to tasseling and silking were reduced by 18% and 22%, respectively, while the average TSI of the three varieties increased by 47% compared to the experiment conducted under field conditions. In the greenhouse, the cumulative heat-unit requirement in terms of growing degree-days (GDD) showed an increase of 9% for tasseling and 15% for silking. The general thermal index (GTI) showed changes of 9% for tasseling and -1% for silking.

The response of the three maize varieties to drought stress — due to the changes in temperature — was significantly different in respect to the time to tasseling and silking, and the required average heat units for flowering. These are critical determinants of grain yield of maize.

Keywords: Flowering pattern, growing days, Ethiopia