Drought tolerance mechanism in coconut

Other teams involved in drought tolerance research are invited to present their own results in the Bulletin in the same summary format.

Presentation of CPCRI research works

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Coconut being a perennial tree with long productive life span is exposed to frequent soil and atmospheric droughts during summer months. Among the several agro-meteorological variables, rainfall is found to have more impact on production than any other parameters. The critical agro-meteorological parameters by which the palms regulate the internal water balance is at a temperature >35°C, radiation >265 Wm-2 and vapour Pressure deficit >2.6 KPa (i.e., RH <50%). Extensive investigations for over a decade and half at CPCRI, Kasaragod, India, brought out some of the important findings such as impact of irrigation levels and weather parameters on the physiology and biochemistry of this crop (Kasturi Bai *et al.*, 1988; Rajagopal *et al.*,1989; Shivashankar *et al.*,1991; Voleti *et al.*, 1993). By employing the stress sensitive physiological and biochemical parameters 23 coconut cultivars have been categorized into drought tolerant and susceptible types (Rajagopal *et al.*, 1990). This categorization was further supported by the biochemical investigations especially membrane integrity and related enzyme activities (Chempakam *et al.*, 1993; Kasturi Bai *et al.*, 1996b). Further Rajagopal *et al.* (1992) have elucidated the relation between stress sensitive parameters and nut yield thereby validating the usefulness of the screening methods for drought tolerance in coconut.

Higher dry matter (DM) production characteristics of some of the drought tolerant types implies the higher stomatal regulatory mechanism of these types leading to higher water use efficiency (WUE) (Kasturi Bai *et al.*,1996a). Adaptation to drought has been further elucidated by the leaf let anatomy (Naresh Kumar *et al.*, 2000). Even there is an indication on osmotic adjustment taking place in coconut palms during severe stress conditions (Kasturi Bai and Rajagopal, 2000).

These findings have helped in deciphering the mechanism of drought tolerance and stability in yield under water stress conditions. To sum up drought tolerance in coconut is the cumulative effect of several inductive morphological, anatomical, Physiological and biochemical mechanism (schematic diagram).

Maintenance of high leaf water status is achieved through effective stomatal regulation, deposition of wax on the leaf surface and accumulation of organic solutes aided by anatomical adaptations. Significant relationship exist between leaf anatomical features and gas exchange characteristics. Further the high WUE leads to higher DM production. The high Fv/Fm supports the higher photosystem II efficiency under drought. Positive relationship exist between instantaneous WUE and DM production which contribute significantly to the harvest index. Thus the mechanism of drought tolerance, in it's totality is highlighted for the first time in coconut.

The genotypes with the above traits for tolerance to drought can be used in the selection for breeding strategies. Further the genetics of these important traits are being looked into for developing future crop improvement strategies.

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