

A B S T R A C T

Studies were carried out to identify plant characteristics that contribute to drought resistance, and to increase our understanding of yield determining physiological processes in a number of dwarf pigeon pea varieties.

Water stress resulted in rapid stomatal closure, reduced leaf area, reduced specific leaf area, paraheliotropy and increased root/shoot dry weight ratio. The pressure chamber was found to be unreliable for leaf water potential measurement in these plants, and pre-dawn leaf water potential measured with the thermocouple hygrometer appeared to be a poor indicator of plant water deficit. As water stress increases, osmotic adjustment may occur to some extent.

Levels of net  $\text{CO}_2$  exchange rate (CER) were comparable to those of other leguminous plants, and showed similar irradiance and  $\text{CO}_2$  concentration responses. CER and leaf diffusive conductance remained highly correlated in plants of varying water status, and the results suggest that carboxylation enzyme activity may be the limiting photosynthetic sub-process in both control and water stressed plants.

Water use efficiency (WUE) was increased by water stress under certain conditions, and on rewatering there was rapid recovery of water status, together with compensatory levels of growth and gas exchange. Extreme dehydration avoidance as demonstrated by cowpea appeared to confer no special advantage in terms of WUE or rate of gas exchange recovery.

Levels of reserve carbohydrates (glucose, sucrose and starch) in vegetative organs were generally too low to provide much buffering of

carbohydrate supply during stress conditions. The results suggest that photosynthate availability may be limiting the accumulation of these reserve carbohydrates, and experiments using  $^{14}\text{C}$ -sucrose and liquid chromatography suggest the involvement of other storage compounds.

It is concluded that these pigeon pea varieties already show several dehydration avoidance characteristics. Possible improvements in drought resistance may be obtained by increasing WUE, compensatory growth following rewatering and reserve carbohydrate storage.

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