

ABSTRACT

Drought causes a substantial reduction in national yield of coconut and also a loss of coconut palms in severe droughts, thus resulting in severe economic consequences to the coconut industry in Sri Lanka. Therefore, it is of prime importance to identify some putative drought tolerant genotypes for use in drought-prone areas. As the long generation and maturation periods of coconut restrict the selection of genotypes based on yield, the knowledge on physiological and biochemical responses to water deficit conditions plays an important role in developing a rapid selection criterion. Therefore, the objectives of this research was to quantify the variation in drought tolerance in the selected coconut genotypes, based on their biochemical and physiological responses to progressive soil moisture deficits in the field and to apply different classification techniques to classify degree of drought tolerance.

Four genotypes were selected for the experiment. The accession Clovis [*CL*] is believed to be tolerant to drought while the rest (Dwarf Green [*DG*], Dwarf Brown [*DB*] and Cameron Red Dwarf [*CRD*]) is sensitive. All palms were about 15 years of age and grown in adjacent plots in Potthkkulama Research Station, Pallama in IL₁ Agro-Ecological Region and were under the common management practices recommended by the Coconut Research Institute (*CRI*). They were monitored throughout the 80-day natural drought experienced in early 2005. Physiological, biochemical and vegetative growth parameters were studied during the drought period along with the corresponding soil moisture contents at 50 and 100 cm depths.

Physiological and biochemical parameters with the progress of drought were approximately similar among genotypes. The results of relative water content (*RWC*) of leaves showed that the three dwarf genotypes become dehydrated more quickly than *CL*. The reduction in stomatal conductance (g_s) in response to drought occurred in all four genotypes, even though leaf water potential (Ψ) was not reduced substantially. *CL* and *DB* appeared more drought tolerant by maintaining high rates of photosynthesis (*A*) even under low soil moisture conditions and by having low g_s during drought. *DB* responded quickly to subsequent rains by regaining its initial rates of *A* and g_s . Moreover *CL* maintained the highest instantaneous water use efficiency (ω_{inst}) during drought. *CRD* showed highest rate of reduction of g_s with the inception of drought indicating its greater sensitivity to water deficit conditions. Leaf proline, starch and total sugar contents showed slightly increasing trends with progressive water stress while vegetative parameters were not significantly affected by the drought experienced.

The susceptibility index (SI) calculated using ω_{inst} and g_s showed that *CRD* was the most sensitive genotype to drought while *CL* was the most tolerant out of the four tested genotypes. Classification of stability under increasing soil moisture deficits based on the genotype x environment (G x E) interaction using *A* and ω_{inst} as reference parameters also showed a more or less similar pattern. Although *DB* was shown to be sensitive to drought (based on SI and G x E), it showed a certain degree of tolerance, quick recovery, higher rates of *A* in comparison to other two genotypes and thus a potential for higher productivity which was important in a commercial crop. However, duration of natural drought that occurred during the experimental period was shorter

than the dry spells, which are commonly observed in the area. Therefore, it prevented the performance evaluation of the tested genotypes under severe water deficit conditions.

Key words: Coconut, Drought tolerance, Susceptibility Index, Stomatal conductance,
G x E interaction

