

**COMPARATIVE STUDY OF PERFORMANCE AND WATER USE OF
EUCALYPTUS GRANDIS, EUCALYPTUS HYBRIDS, *GREVILLEA
ROBUSTA* AND
CORDIA AFRICANA IN THIKA KENYA.**

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ABSTRACT

Improved eucalyptus varieties have attracted considerable attention in Kenya due to their fast growth and quick economic returns. However, there are growing environmental concerns over inclusion of eucalyptus in farmlands due to presumed high water use. This raises the need to identify other suitable trees which utilize environmental resources in a sustainable manner at the same time fulfilling the farmers' objective. This is in view of broadening farmers' choice especially in arid and semi-arid areas.

This study was conducted to determine the performance of eucalyptus clones (GC 15, GC 584 (*Eucalyptus grandis* W. Hill ex Maiden x *Eucalyptus camaldulensis* Dehnh), *E. grandis*, *Cordia africana* (Lam) and *Grevillea robusta* (A. Cunn) and their influence on soil moisture content. Tree height and diameter were measured fortnightly using tape measure and vernier calipers respectively. Soil moisture content, gas exchange and chlorophyll content were determined using profile probe, infrared gas analyzer and Minolta SPAD-502 meter. A survey of 125 homesteads was done to establish the status of eucalyptus in Meru Central District.

The species examined exhibited vastly contrasting growth rates. In the field trial, eucalyptus trees were 2.5 times and 3.5 times taller than *C. africana* and *G. robusta* respectively. After 12 months, the maximum height reached was 5.0 m in eucalyptus compared to 2.3 m and 1.4 m in *C. africana* and *G. robusta* respectively. Basal diameter for *G. robusta* (1.8 cm) was four times smaller than that of eucalyptus hybrids and three times smaller than that of *E. grandis* and *C. africana*. Soil water abstraction down the soil profile differed significantly among the species ($P < 0.01$) with eucalyptus having evenly higher soil water deficits over the observation period, (898.6, 892.9, 736.7, 583.4 and 544.4 for GC 15, GC 584, *E. grandis*, *C. africana* and *G. robusta* respectively).

Photosynthetic rate (A), transpiration (E) and stomatal conductance (g_s) varied between species; A being highest in GC 15 ($24.6 \mu\text{mol m}^{-2}\text{s}^{-1}$) compared to GC 584 ($21.0 \mu\text{mol m}^{-2}\text{s}^{-1}$) *E. grandis* ($19.2 \mu\text{mol m}^{-2}\text{s}^{-1}$) *C. africana* ($17.7 \mu\text{mol m}^{-2}\text{s}^{-1}$) and *G. robusta* ($11.1 \mu\text{mol m}^{-2}\text{s}^{-1}$). Decline in soil water content resulted in reduced A , E and g_s in all species. A , E , g_s and instantaneous water use efficiency (WUE_i) increased with leaf age up to a maximum at the young mature stage after which it declined as the leaf senesced. WUE_i ranged between 3-5 $\mu\text{mol mmol}^{-1}$ and generally decreased with decline in soil moisture in water stressed plants but increased with declining soil moisture in field-grown trees.

Socio-economic survey revealed that the dominant species in Meru Central is *G. robusta* although eucalyptus is increasing steadily; being planted primarily for sale, timber and firewood. Fast growth exhibited by the eucalyptus is desirable since they yield relatively quick returns. However, the high water use of eucalyptus and its competitive nature may reduce growth of crops and other trees on the farm by altering availability of growth resources such as water. Therefore planting of eucalyptus species in water limited areas should be discouraged.