

A COMPARATIVE PHYSIOLOGICAL STUDY OF COWPEA AND PEANUT GROWN IN SPECIALIZED POTS

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Introduction

Cowpea and peanut react remarkably differently and yet show efficient mechanisms of adaptation to soil drying (Turk et al., 1980; Annerose 1990). Some of these differences have been revealed after plant water status measurements. Under soil drying conditions, cowpea maintains a relatively high leaf relative water content (RWC) and water potential (Ψ_L), whereas a drop in these parameters is observed in peanut. However, these results have been obtained with plants grown separately, with possible variations in soil conditions of the different pots or plots. The maintenance of a higher leaf water status by cowpea than peanut may be due to events taking place in its roots, which may be better understood when the plants are grown in a common pot.

Methods

Cowpea, (*Vigna unguiculata* [L.] Walp), variety 58-11 I, and groundnut, (*Arachis hypogaea* L.), variety 55-437, were grown on sandy soil packed to a bulk density of 1.45 g cm^{-3} in 1570 cm^3 capacity PVC pots. Each pot was divided into two equal vertical halves with a fine plastic mesh which allowed unrestricted water movement between, but confined roots to the two halves. Seeds were sown in each half of the pot in such a manner that allowed either an association between the two species or of the same species, with a maximum of two plants per pot. The experiment was a completely randomised design with treatment replicated four times. The plants were irrigated and supplied with NPK fertilizer at the rate of 150 g m^{-2} until day 26, when irrigation was suspended on day 26 after sowing to induce soil moisture stress which lasted for 17 days, while irrigation continued for non-stressed plants. Maximum irradiance at midday in the glasshouse was greater than $1000 \mu\text{mol m}^{-2} \text{ s}^{-1}$; temperature was 18°C to 22°C at night, and 39°C to 50°C in the day. Day length was 13 h. Gas exchange, Ψ_L and RWC measurements were made.

Results

There were no significant differences in the leaf water status of the two species when grown either in association or separately, under irrigated conditions (Fig. 1). Under soil drying conditions, the leaf RWC and Ψ_L of peanut decreased more rapidly when associated with cowpea than with peanut (Fig. 2). Cowpea maintained relatively high leaf RWC and Ψ_L (Fig. 2). A similar pattern in midday stomatal conductance and transpiration rate was observed in both species under soil drying conditions (Fig. 3).

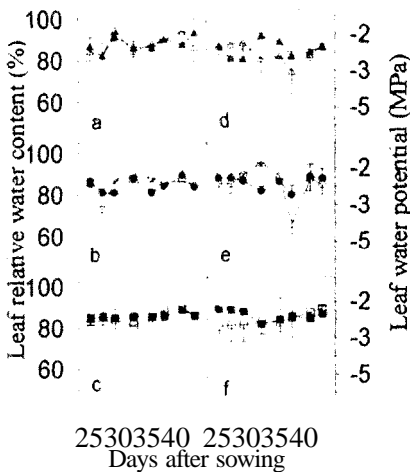


Fig. 1 Leaf relative water content (a, b and c) and water potential (d, e and f) of irrigated plants of peanut (▲)/peanut (○), cowpea (●)/cowpea (○), and cowpea (■)/peanut (○) associated in the same pot.

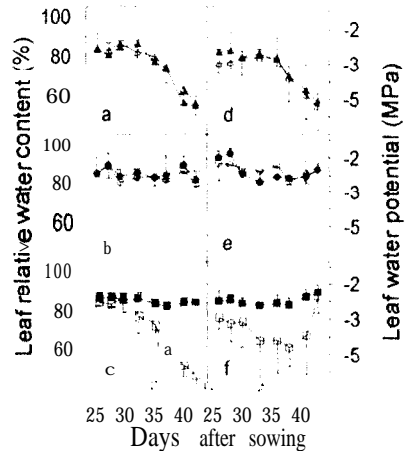


Fig. 2. Leaf relative water content (a, b and c) and water potential (d, e and f) of peanut (▲)/peanut (○), cowpea (●)/cowpea (○), and cowpea (■)/peanut (○) plants, associated in the same pot under soil drying conditions. Soil drying commenced on day 26 after sowing, and lasted for 17 days.

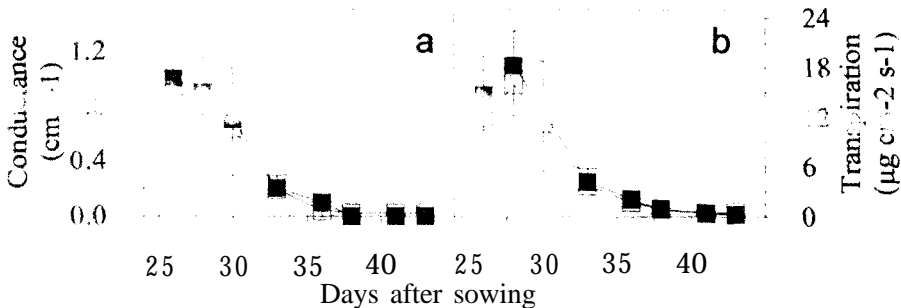


Fig. 3 Stomatal conductance (a) and transpiration (b) of cowpea (■)/peanut (○) plants associated in the same pot under soil drying conditions. Soil drying commenced on day 26 after sowing and lasted for 17 days.

Conclusions

Under humid conditions, soil water extracting mechanisms of cowpea were not influencing water uptake of peanut. Under soil drying conditions, however, the roots of cowpea seem to have a higher water extracting capacity, thus rendering the association cowpea/peanut detrimental to peanut. The observed similar pattern in midday stomatal conductance and transpiration rate in both species may further confirm that the high leaf water status maintained by cowpea was due to a more efficient water absorbing capacity of its roots.