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Transpiration and Assimilation and their Relationships to other Morphophysiological Characteristics in Cowpeas under Water Deficit Stress

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Abstract

This study on cowpea (*Vigna unguiculata* (L.) Walpers) was carried out from October 2003 to March 2004. The aim was to determine the effect of water deficit stress, just before flowering, on transpiration and assimilation rates and their relationship to each other and to other characteristics particularly water-use efficiency (WUE), leaf area (LA) and specific leaf area (SLA).

Six cowpea genotypes from Zimbabwe, Nigeria, India, Kenya and USA were subjected to drought stress or well-watered throughout. Drought stress was induced 43 days after sowing (DAS) for 21 days. A gradual dry-down of the substrate (sand) took place until the soil water potential was $-350 \text{ hPa} \pm 50$. Up to 64 DAS (14 days) the soil water potential was maintained at this level. From 65 DAS all plants were well-watered (soil water potential $-60 \text{ hPa} \pm 20$). Four plants per genotype and water treatment were harvested at day 42 and 64. Two days before harvest transpiration and assimilation were measured and leaf area determined.

42 DAS (before water deficit stress) UCR 328 had the highest transpiration rate, which differed significantly from that of UCR 1340. There were no significant differences between all the other genotypes ($p < 0,05$). UCR 386 had the highest assimilation rate. This genotype showed a significant difference to UCR 1340, which had the lowest assimilation rate. 64 DAS (at the end of water deficit stress) UCR 328 had the highest assimilation rate for the well-watered treatment, UCR 386 had the lowest. For the well-watered treatment transpiration and assimilation rate showed a weak correlation to WUE but a strong one to each other ($0,935$; $p < 0,01$) 64 DAS. In the drought treatment transpiration and assimilation rate showed a strong linear correlation to each other, to WUE and to stomatal conductance.

More studies are going to be carried out to determine and verify these and other relationships in cowpea under drought stress in the greenhouse.

Keywords: Assimilation, cowpea, transpiration, water deficit stress, water-use efficiency