Effect of root size on the water relations and growth of two sorghum cultivars

G.S. Jayasekara and H.B. So

Department of Agriculture, University of Queensland, St. Lucia, 4067.

The size of the root system necessary for optimum growth of the top is an unknown factor. This paper describes an experiment conducted to investigate the "effective size" of the root system, in the absence of limitations by water supply, upon the water relations and the yield of two sorghum cultivars.

Methods

Sorghum (Sorghum bicolor L. Moench) cultivars E57 and Gem were grown in 4.8 1 plastic pots filled with 1:1 mixture of sand and peat to provide non-limiting conditions for the root growth. The plants were grown in a glasshouse during the 1983/1984 summer. They were fertilized regularly and the soil was kept at field capacity throughout the growth period. Eight different root sizes with 4 replicates) were imposed at the boot stage by severing the portions of the roots at the base of the stems. Leaf water potental (LWP) and transpiration per unit leaf area (T) were measured several days after root pruning. Seed yields and root sizes were measured at physiological maturity.

Results and Discussion

Results in Fig. 1 show that approx. 35% of the E57 root system was sufficient to maintain a non-limiting water supply to the top, whereas for Gem that figure was approx. 65g. Similar results were obtained by Jordan at al. (1).

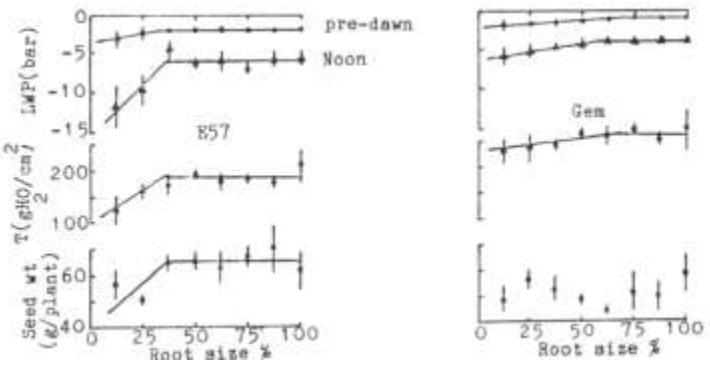

Fig. 1. LWP, T and seed yield of two sorghum cultivars E57 and Gem.

Despite the similar size of tops and roots in both cultivars, F57 showed much lower leaf water potentials than Gem, both under non-limiting and limiting water supply, indicating a lower plant resistance in Gem as compared to E57. Transpiration rates in E57 were slightly lower than in Gem. The effect of limiting water supply was reflected in the seed yields of E57 but not in that of Gem. Although the reduction in yield of E57 was statistically not significant, the trend was clearly in agreement with the pattern of reduction of LWP and T. This lack of significance is due to the plant variability and partly due to the compensatory growth of roots after pruning as indicated by the root measurements. The failure of Gem to show any reduction in yield at the low root sizes is most probably due to the low levels of water stress (high LWP) developed under the prevailing experimental conditions.

1. Jordan, W.R., McCrary, M. and Miller, F.R. 1979. Agron. J. 71,803-6.