Grain yield of a hybrid sorghum and its parents

U. Jayasuriya, G.L. Wilson and S. Fukai

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

It has never been clear whether the higher grain yield potentials of hybrid sorghums, compared with the inbreds which they replaced, derives from physiologically understood factors, or includes a component which is not understood and is to be attributed to heterozygosity. A study was undertaken to compare the development of yield in some hybrids and their parents.

Methods

Field trials were carried out, and stands established at three densities. Grain yield, under favourable conditions, normally approximates closely to dry weight production after anthesis, provided that the capacity of grains, represented by numbers and potential sizes, is sufficient to store this

material. Tests of storage capacity of individual grains were made by removing one third of the spikelets at anthesis and recording the increase in size of those which remained.

Results and Discussion

Results for only one trial, at high and low densities, using Texas 610 SR and its parents, are tabulated here.

Population plants ha^{-1}		Grain no. $\times 10^{-8}$ ha^{-1}	% incr. in grain size after spikelet removal	Weight incr. during grain filling t ha^{-1}	LAI at anthesis	% light interception at anthesis	K Extinction coefficient	Grain yield t ha^{-1}
250,000	hybrid	2.94	36	7.28	4.8	91.2	0.50	7.04
	male	3.03	48	5.62	5.2	96.0	0.61	5.95
	female	2.37	19	6.50	4.8	92.0	0.52	5.31
667,000	hybrid	3.40	23	9.37	9.6	96.2	0.34	9.39
	male	3.59	40	6.93	9.9	98.8	0.45	7.56
	female	3.04	13	8.98	8.9	96.0	0.35	7.19

The grain storage capacity of the female was, at all densities, much inferior to that of the hybrid. The male, on the other hand, had far more unused storage capacity than the hybrid.

Dry matter production after anthesis was always lowest in the male, and somewhat lower in the female than the hybrid. This latter may not however be so on a whole plant basis. Other work has shown that where there is a limitation to grain storage capacity, surplus assimilates go to the root.

The differences in dry weight accumulation did not arise from differences in Leaf Area Index and interception of solar radiation. In fact these were always slightly higher in the male. The male had inferior canopy structure for efficient conversion of radiation. The vertical separation of leaves and their angle to the horizontal were less, and their widths greater. Their effect is integrated in light extinction coefficients (K values) shown in the Table.

Thus the male had superior grain storage capacity associated with poor rates of dry weight production during grain filling; the female had the same capability for dry weight accumulation as did the hybrid, but lacked grain storage capacity; and the hybrid combined the better characteristics of each parent, outyielding them.