The effects of transient waterlogging on the yield of sunflower and sorghum

P.W. Orchard and H.B. So

Department of Agronomy and Soil Science,
University of New England,
Armidale. N.S.W. 2351.

Many cropping areas of Australia are characterised by flat topography and soils of low hydraulic conductivity or duplex profile. Under irrigation or intense rainfall, excess water may be present in the root zone for periods during crop growth, resulting in waterlogging damage. To date, little assessment has been made of the effects of waterlogging on yield of summer crops, although winter cereals have received some attention (1,2). This paper reports a preliminary controlled environment study to assess the interaction between waterlogging and stage of development on yield of sorghum and sunflower.

Methods

Sunflower and sorghum plants were grown in steel cylinders (30 cm diameter x 60 cm depth) filled with a solodic soil which had previously been air-dried and passed through a 2 mm sieve. Waterlogging treatments were imposed at the 5-leaf (V), initiation (I) and 50% anthesis (A) stages of growth for sorghum, and the 6-leaf (V), buds visible (I) and 50% anthesis for sunflower, by raising the water table to the soil surface for 9 days. At maturity, plants were destructively sampled and separated into vegetative (stem-leaf) and reproductive components before drying to a constant weight. With sorghum, comparisons were restricted to main stem data since all treatments resulted in late tillers that were immature at the time of harvest.

Results and Discussion

The results indicate marked differences in the response of the two species to waterlogging (Table 1).

Table 1. Plant Dry Weights and Yield Components

	SORGHUM				SUNFLOWER			
Treat-ment	Leaf-Stem (g)	Seed Wt. (g)	Seed No.	1000-seed wt. (g)	Leaf-Stem (g)	Seed Wt. (g)	Seed No.	1000-seed wt. (g)
Control	36.2a	44.2a	2243a	19.6b	25.4a	11.0a	343b	32.0b
V	33.1a	42.4a	1817a	23.5a	19.6a	9.9a	260b	38.4a
I	23.1b	8.0b	375b	21.3b	23.8a	8.3a	447a	18.5c
A	31.4a	33.1a	2101a	15.7c	21.7a	0 b	0c	0 d

All means followed by the same letter are not significantly different (Duncan's Multiple Range Test $P < 0.05$)

Waterlogging sorghum at initiation resulted in reduced vegetative dry weight and seed yield, the latter being due to a reduction in seed number. In contrast, waterlogging had no effect on stem-leaf weight of sunflower but led to a complete loss of yield at anthesis. The physiological basis underlying the differences between species and growth stages is being investigated in relation to the adaptive responses of the two species.

1. Watson, E.R., Lapins, P. and Barron, R.J.W. 1974. Aust. J. Exp. Ag. Animal Husb. 16:114-122.

2. Mann, A.P. 1981. Drainage of Agricultural Lands Seminar, Melbourne, 18-21 May, pp. 16-22.