The effect of sorghum row spacing on fallow cover distribution and soil water accumulation in central Queensland

Richard Routley, Brendan Lynch and Maurice Conway

The Department of Primary Industries and Fisheries, Emerald, Qld. Email richard.routley@dpi.qld.gov.au

Abstract

An experiment was conducted near Emerald, Qld, to investigate the effect of sorghum row spacing on groundcover distribution and soil water accumulation in the fallow period following the sorghum crop.

16 – 29% more soil water accumulated during a 12 month fallow period in the 0.5 m row spacing treatment than in wider row spacing treatments. Average surface cover at the conclusion of the fallow was higher in the 0.5m treatment than in the 1.5 and 2 m treatments. Groundcover in the inter-row space was substantially lower than along the row in the wide row spacing treatments.

Keywords

Sorghum, fallow soil water accumulation, cover, wide rows

Introduction

Wide (>1m) and skip row sorghum planting configurations are now commonly used in sorghum production in Central Qld. These configurations confer yield stability to sorghum crops by 'rationing' out stored soil water so that it is more likely to be available to the plant during the critical flowering and grain fill phases. This rationing effect is a result of the fact that roots take time to grow into and exploit the soil water that is present in the centre of the skip area or inter-row space. (Routley *et al.* 2003; Whish *et al*. 2006)

A consequence of wide and skip row configurations is that crop residue is concentrated in bands along the rows with large areas between the rows left with little stubble cover during the following fallow period. This may result in increased runoff and soil loss and reduced infiltration and soil water storage from the inter-row spaces. Many farmers have observed that inter-row areas can be difficult to 'wet up' and that this can restrict planting opportunities for the following crop. This paper reports an experiment conducted to quantify the effect of row spacing on surface cover distribution and soil water accumulation in the fallow period following a sorghum crop.

Methods

A field experiment was conducted at the property 'Wyntoon', approximately 35 km SSE of Emerald in Central Qld in 2005 and 2006. Treatments included sorghum row spacings of 0.5, 1.0, 1.5 and 2m. The experiment was planted on 31 Dec 2004 and harvested on 25 Apr 2005 using a randomised block design with four replicates. Volumetric soil water (VSW) was monitored at intervals throughout the life of the sorghum crop and during the following fallow period using a Diviner 2000 capacitance probe with permanent PVC access tubes positioned in the crop row and at 50 cm intervals perpendicular to the crop row extending into the inter-row space. Total soil water content (mm) for each treatment was calculated as the mean of the VSW at each access tube position. Fallow water storage was calculated as the increase in total soil water content between 29 Mar 05 and 26 Apr 06.

Ground cover due to surface crop residues was measured on 12 April 2006 by taking vertical digital photographs at intervals corresponding to the location of moisture access tubes, and analysing these using an overlayed grid method. Ground cover and fallow soil water accumulation data was analysed using REML and Analysis of Variance routines in GenStat (ver 8.1.0.152) to determine treatment and positional effects.

Results

Fallow water storage

More soil water was stored during the fallow period in the 0.5m treatment than in the wider row treatments (Fig 1).

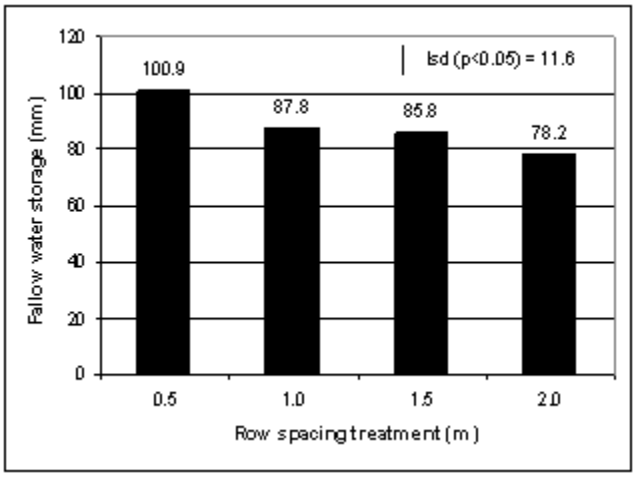

Fig 1. Effect of row spacing on fallow water storage between 29 Mar 05 and 26 Apr 06

Groundcover

Average groundcover declined significantly as row spacing increased (Fig 2). There was no significant interaction between the effects of row spacing and distance from the plant row on groundcover. Groundcover was significantly lower in the inter-row space in all wider row treatments.

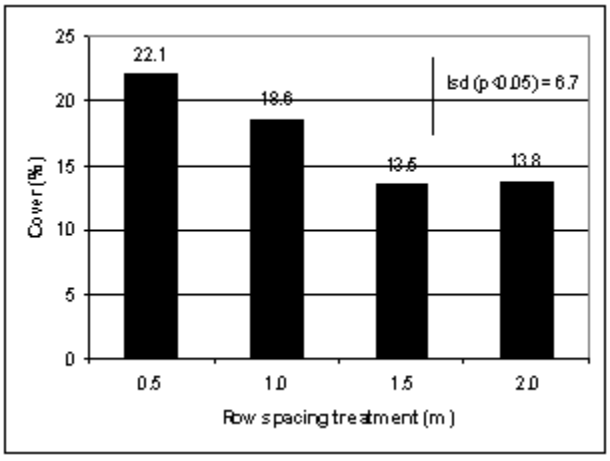

Fig 2. Average groundcover for each row-spacing treatment at 12 April, 2006

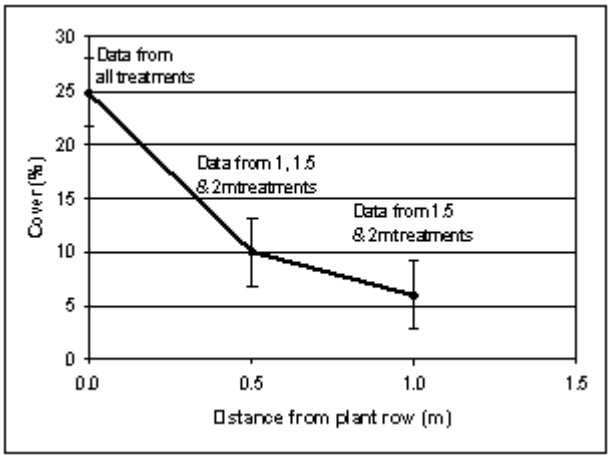

Fig 3. Effect of distance from plant row on groundcover.

Conclusion

The small decrease in fallow moisture accumulation observed in the wider row treatments in this experiment, while undoubtedly influenced by fallow rainfall patterns applying in this particular season, gives weight to producer concerns regarding soil water accumulation in wide row systems. For example, the 22.7 mm difference if fallow water storage between the 0.5m and 2 m row spacing treatments could result in a yield reduction in the order of 300 kg/ha in a following cereal crop. Lower average cover levels under wide row spacings, and the concentration of cover close to plant rows, suggest that the generally negative consequences of low cover levels (in terms of soil water accumulation and soil biology) may be present in at least part of paddocks where wide row systems are used. Novel solutions to this issue, for example the use of cover crops in following fallow periods, are worthy of further investigation.

References

Routley, R.A., Broad, I., McLean, G., Whish, J. and Hammer, G.L. (2003). The effect of row configuration on yield reliability in grain sorghum. I. Yield, water use efficiency and soil water extraction. In *Proceedings 11th Australian Agronomy Conference*, Geelong.

Whish, J., Butler, G., Castor, M., Cawthray, S., Broad, I., Carberry, P., Hammer,G., Routley, R. and Yeates, S. (2005) Modelling the effects of row configuration on sorghum yield reliability in Australia. *Australian Journal of Agricultural Research* 56:11-23