

Effects of soil management and irrigation method on the yield and water-use efficiency of soybean

K.E. Pritchard and D.R. Small

Institute for Sustainable Agriculture. Kyabram Centre Vic 3620

Flood irrigation is widely used to grow soybean in northern Victoria because of its simplicity. However the practice is detrimental to the structure of cultivated surface soil, and thus reduces future yield potential. The effect of flood, furrow or drip irrigation on the yield and water-use efficiency of soybean (cv. Stephens) was measured in 1991-92 on a duplex red-brown earth to assess the benefits of alternative soil management and irrigation Methods.

## Methods

A split plot design with three replicates compared two irrigation Methods (surface and drip), and four soil managements; (i) hill/furrow: cultivated seedbed hilled for furrow irrigation, (ii) cultivated bay: cultivated seedbed, smoothed for flood irrigation, (iii) beds: "no-till" permanent beds, furrows 1.5m apart, and (iv) direct drill: sown into uncultivated ex-pasture soil. Surface irrigation (furrow or flood) was applied at 65mm of nett evaporation. Drip irrigation using "trickle" tape was monitored with tensiometers to supply soil-water at a maximum suction of 80kPa, and to avoid waterlogging. Irrigation water was measured through meters and runoff through electronically recorded flumes. Crop water-use was calculated from nett water applied at 10 crop irrigations, plus rainfall and water used from profile storage as measured with a neutron probe.

## Results and discussion

**Table 1. Seed yield (kg/ha), crop water-use (mm) and water-use efficiency (kg seed/ha/mm) for soybean under 4 soil managements on a red-brown earth with surface irrigation.**

Soil Management	Seed Yield	Crop Water-Use	Water-Use Efficiency
Hill/Furrow	4384	569	7.7
Cultivated Bays	4167	611	6.8
"No-till" beds	4337	556	7.8
Direct Drill	3128	588	5.3
L.s.d. (p=0.05)	627		

Seed yields were similar for flood and furrow irrigation on cultivated seedbeds but significantly lower for direct drill. "No-till" beds had equivalent yield to furrow irrigated cultivation. Hail at physiological maturity prevented accurate yields being obtained from drip irrigation. Flood irrigation used more water than furrow irrigation and thus had a lower water-use efficiency. On cultivated seedbeds furrow irrigation produced 13% more seed per mm of water than flood. Drip irrigation used 510mm (equivalent to 5.1 ML/ha) to grow a crop without stress, compared with 611mm or 6.1ML/ha for flood irrigated cultivation. Nett "A" pan evaporation for the 135 day growing period was 752mm.

The higher water-use for flood irrigated crops may be due to a higher surface evaporation component prior to canopy closure. Furrow irrigation did not produce higher yields for soybean as previously reported for maize at this site (1), but is likely to sustain long term yields better, particularly if "no-till" beds are used. Soybeans, direct drilled into uncultivated soil and flood irrigated, performed unsatisfactorily in this soil type which has a bulk density of 1.5 g/cm<sup>3</sup> in the surface soil.

## References

1. Pritchard and Small. Proc. 6th Aust Agron Conf

