Improving irrigation efficiency in a semi arid sub tropical environment B. application efficiency

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A second objective of the Emerald irrigation management research programme (l) is to quantify the soil water balance in terms of irrigation application efficiency (total infiltration/total water application).

Methods

Irrigation application at the head ditch was measured with rectangular weirs (82-83) and V-notch weirs (83-84), one per furrow. Irrigation run-off was measured with HS flumes (82-83) and Parshall flumes (83-84), one flume per irrigation treatment.

Total infiltration = Total application - Runoff.

Results and Discussion

Total infiltration approximated the predicted deficit in the VF and F treatments. This was *expected* since total infiltration equals crop evapotranspiration if drainage is zero, and the predicted deficit also equals crop water use, if evapotranspiration rates are near potential. In the IF and VIF treatments total infiltration was less than the predicted deficit, because our predictive model makes no adjustment for the effects of water stress on crop water use or leaf area expansion. Our model is intended to provide a reproducible basis for irrigation management across seasons in commercial applications and these weaknesses are unlikely to be significant in those applications.

Higher soil water deficits resulted in longer irrigation times typically 12, 16 and 24 hours for the 45, 75 and 150 mm deficit treatments respectively. Runoff rates increased rapidly and generally stabilised within 6 hours. Continued irrigation at final infiltration rates of less than 0.9 mm hour $^{-1}$ (2) contributed little to total infiltration. Irrigation was stopped when the runoff rate was relatively stable and all treatments produced runoff curves of similar shape.

Irrigation application efficiency (total infiltration/total water application) depended on the amount of runoff and was generally 74-89% with higher efficiencies usually being obtained at higher irrigation deficits. Lowest efficiencies were measured in the VF treatment due to the difficulty of limiting runoff during short irrigations.

These results support the findings of Shaw and Yule (2) that cracks dominate the water entry process into these soils under flood irrigation and that total infiltration is related to the volume of cracks present or to soil water deficit. The infiltration process once the cracks are filled with water is similar for all irrigation frequencies. Provided tail drain runoff is minimised surprisingly high application efficiencies are achievable on these steep cracking clay soils.

1. Keefer. G.D., Yule. D.F.. Ladewig. J.H., Nickson. D.J. 1985 Proc. 3rd Aust. Agron.Conf., Hobart.

2. Shaw. R.J. and Yule. D.F. (1978). Tech. Report No. 13. Ag.Chem. Br.. Dept. of Primary Industries. Brisbane.