The development and evaluation of a computer-based management system for irrigated wheat

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The farms of the inland irrigation areas in south east Australia are relatively small and generally owner-operated. The capital invested in the average farm in the Murrumbidgee Irrigation Area in 1981/82 was estimated to be almost $600.000 but the return to capital was less than 2%. This return is continuing to decline as costs increase more rapidly than the increase in returns for most enterprises. One method whereby farmers can maintain their viability is by improved farm management. CSIRO, NSW Department of Agriculture, Bureau of Agricultural Economics and the Irrigation Research and Extension Committee (IREC) are collaborating to develop a new system for information transfer to support departmental advisors and agricultural consultants. This paper examines the development and evaluation of this management system called SIRAGCROP, which will assist farmers in making decisions concerning the management of irrigated wheat.

The average yield of irrigated wheat in south east Australia is about 2.5 t ha^{-1} while the yields of the best crops approach 7 t ha^{-1}. Irrigated wheat was chosen to develop this computer-based management system because improved crop management can double the current average yield and so produce a larger return per ML water than most other enterprises. The model will contain submodels dealing with irrigation scheduling, disease prediction, fertiliser and herbicide requirements and the time for the pre-sowing irrigation. The final objective will be to produce information on the cost/benefit for alternative management decisions and the likely return on each M1 of water applied.

The model is located on a central computer so that farmers and advisors are able to log in via a telephone link. The irrigation scheduling component is based on the water budget model developed by the USDA (1) and has been modified for local conditions. Climatic information from an established meteorological site at the CSIRO Centre for Irrigation Research is updated daily and used to calculate the potential evapotranspiration. Farmers are able to input specific information for individual paddocks such as the date sown, date of last irrigation and rainfall. The model then computes the soil-water depletion to date and forecasts the deficit for the next fortnight. An irrigation is recommended when the deficit reaches the depletion allowable for that soil.

The farmers selected to test the irrigation scheduling component have found it easy to use. Studies in the 1983 season showed that generally 40% of the water was extracted from the surface 15 cm and 75% from the top 35 cm of soil.

The model tended to predict a greater loss of water through evapotranspiration than actually occurred. Factors which may have contributed to this error include an upward water movement from the groundwater table and a lower actual ground cover than predicted. These factors are being studied again in the 1984 season.

An irrigation before sowing is necessary in most seasons so that crops can be sown at the optimum time. The water loss after an irrigation and the optimum time for cultivation was measured so that a model could be developed to predict the optimum time for an irrigation before sowing. This study showed that the rate of water loss varied between sites receiving a normal cultivation and deep ploughing with gypsum applied. The optimum time for cultivation occurred when the soil water potential at 7.5 cm was -180 kPa.

1. Jensen. M.E.. Wright, J.L. and Pratt, B.J. (1971) Trans of the ASAE 14: 954-59.