Simulations assessing the effects of sowing date, maturity type and irrigation frequency on wheat yields in the Murrumbidgee Irrigation Areas.

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Average yield of irrigated wheat in south-eastern Australia is about 2.5 t/ha. which compares unfavourably with paddock averages of 6 t/ha for the best irrigation farmers and potential yields of 9 t/ha (1). Increasing productivity of irrigated wheat grown on the poorly drained red-brown clay loam soils in the area, is one of the objectives of the SIRAGCROP program. SIRAGCROP is a collaborative effort between CSIRO and the NSW Department of Agriculture to improve both crop yields and water use efficiency (2).

The development of a computer-based crop management model is central to the project. Crop models enable the effect of different environmental and management factors on crop performance to be evaluated. both independently and as they interact together in their effects. This enables the dynamic behaviour over time of the crop system to be both described and studied theoretically. A crop systems model for wheat is being developed and is based on the wheat model SIMTAG (3). This research model will be adapted and made 'user-friendly' for use as the SIRAGCROR Irrigated Wheat Management Model by farmers and advisory officers of the NSW Department of Agriculture.

To recommend management decisions such as sowing date and cultivar requires a good description of the underlying principles of plant growth and development. The present wheat growth model contains sub-models describing phasic, vegetative and reproductive development, plant growth and a soil water balance. Sub-models describing the effects of nutrients, waterlogging and diseases on crop growth and development will be added in the near future. The model is based on physiological, ontogenetical. morphological and physical principles, but these are not modelled at a process level. The degree of detail is similar for equally important processes.

Several field experiments have been carried out in the Murrumbidgee Irrigation Areas (MIA) to examine the effects of irrigation frequency and genotype on wheat yields (4.5). It is difficult. however, to extrapolate these results to other years. different sowing dates and new varieties. The model, which is based on field studies. can generate the effects on yield of year to year and within year variations in weather. The present model has been used to study irrigated wheat production in the MIA. The analysis examined factors limiting production (soil types; soil water storage) and the effects of manipulating both crop genotype (spring or winter habit) and management (sowing date; irrigation) for the purpose of identifying strategies which will maximize potential yields given the climatic and water constraints. The analysis was carried out using 22 years of historical weather data for Griffith. Cumulative probability functions were developed for grain yield as influenced by sowing date, maturity type and irrigation frequency for different soil types.

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