

## Effects of irrigation and nitrogen on wheat production on a red-brown earth

D.M. Whitfield, C.J. Smith and O.A. Gyles

Institute for Irrigation and Salinity Research, Tatura, Vic., 3616.

Irrigation provides scope for high productivity but yield becomes increasingly dependent on nutritional and other factors, and quality may suffer. An experiment was therefore established to investigate effects of irrigation and nitrogen treatments on wheat production and quality.

### Methods

Three irrigation treatments and two nitrogen treatments were combined factorially in an experiment begun in 1984 on a red-brown earth at Tatura, Vic. Treatments were reimposed in 1985. Irrigation treatments included a rainfed control (treatment  $R_F$ ) and irrigation, commencing in the spring and maintained until maturity, on either a weekly or fortnightly basis (treatments  $I_W$  and  $I_F$ , respectively). Nitrogen treatments were nil ( $N_0$ ) and 150 kg N ha ( $N_{150}$ ) applied at sowing as  $NH_4NO_3$ . The cultivar was 'Condor'.

### Results and discussion

In 1984, yield ranged from 4 tonne ha<sup>-1</sup> in rainfed treatments to 6.8 tonne ha<sup>-1</sup> under irrigation. There were no significant effects of nitrogen application. By contrast, irrigation increased yield in 1985 only where nitrogen was applied (Table 1). Differences in yield in 1984 were largely attributable to differences in grain weight per spike as opposed to spike number. In 1985, effects on spike number were significant whereas kernel size was unimportant.

The uniformly high spike numbers indicate that nitrogen did not limit irrigated production in 1984, but was suboptimal in 1985 where no additional dressing was applied. There was no apparent benefit conferred by the more frequent irrigation treatment.

Nitrogen concentrations in the grain (Table 1) ranged between 1.7% and 2.9%. Low concentrations were consistently recorded with irrigation in the absence of applied nitrogen and high concentrations were achieved where nitrogen was applied under rainfed conditions. Apart from treatment  $I_WN_{150}$  in 1985, nitrogen application increased nitrogen concentrations in the grain by an average of 0.5%. Thus, nitrogen applications at sowing have had pronounced effects on both productivity and quality. However, the more frequent irrigation treatment may negate the positive effects on quality.

**Table 1. Effects of treatment on yield and N concentration in the grain.**

| Treatment |                                 | $N_0$ |       |       | $N_{150}$ |       |       |
|-----------|---------------------------------|-------|-------|-------|-----------|-------|-------|
|           |                                 | $R_F$ | $I_F$ | $I_W$ | $R_F$     | $I_F$ | $I_W$ |
| 1984      | Yield (tonne ha <sup>-1</sup> ) | 4.2   | 6.0   | 6.5   | 3.9       | 7.0   | 6.7   |
|           | N conc. grain (%)               | 2.3   | 1.7   | 1.7   | 2.9       | 2.2   | 2.3   |
| 1985      | Yield (tonne ha <sup>-1</sup> ) | 3.4   | 3.1   | 2.7   | 3.3       | 5.9   | 5.4   |
|           | N conc. grain (%)               | 1.9   | 1.7   | 1.7   | 2.8       | 2.2   | 1.9   |