Efficient fertiliser management of wheat crops in the high rainfall western districts of Victoria.

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Field experiments were performed in the years 1987-1990 in order to determine the optimum fertiliser strategy for wheat crops in the high rainfall western district of Victoria. This region suffers from winter waterlogging followed by spring drought. and *its* soils are deficient mainly in nitrogen. It was hypothesised that Methods of fertiliser application that improve plant growth after (rather than during) waterlogging would be most effective in improving wheat yields. To this effect, different Methods of applying nitrogen were investigated.

Methods

Four experiments were conducted to investigate the effects of type, rate and depth of placement of N fertiliser applied before sowing and the effects of foliar N applied in spring after waterlogging. In all trials, wheat cv. Matong was sown with 20 kg P/ha superphosphate (9% P, I I% S) in fully randomised complete block designs with four replicates. Soil at Lake Bolac was yellow duplex (Dy) and that at Hamilton was brown duplex (Db).

Experiment I. Type of N fertiliser. At Lake Bolac in 1989 the following treatments were applied at a depth of 25 cm: (i) nil (control), (ii) 50 kg N/ha as KNO_3 (14% N) and (iii) 50 kg N/ha as urea (46% N) with KCI (50% K) sufficient to equal K in KNO_3 treatment.

Experiment 2. Rate of N fertiliser. At Lake Bolac in 1987 anhydrous ammonia (82% N) was applied to a depth of 10-15 cm immediately before sowing. The following rates were applied: nil, 20, 40, 80 or 120 kg N/ha.

Experiment 3. Foliar N application. 50 kg N/ha applied as a foliar spray (42% N (w/v) comprising 22% urea, 10% NH_4^+ and 10% NO_3^-) to crops at Hamilton and Lake Bolac in 1988-1989.

Experiment 4. Deep placement of urea. Ripping and fertiliser treatments (46 kg N/ha) were applied factorially to give the following treatment combinations at Hamilton, 1990: (i) nil rip, nil N (R_oN_o); (ii) rip to 12 cm, nil N ($R_{12}N_0$); (iii) rip to 25 cm, nil N ($R_{25}N_0$); (iv) nil rip, N (R_0N_{46}); (v) rip to 12 cm, N at 12 cm ($R_{12}N_{46}$); (vi) rip to 25 cm, N at 25 cm (R25N46).

Results and discussion

Urea significantly increased grain yield as compared with nitrate fertiliser (4.04 cf. 3.64 t/ha, respectively. l.s.d = 0.18 t/ha) in Experiment I. In Experiment 2, peak grain yield was attained when 40 kg N/ha was applied. In Experiment 3, foliar application of nitrogen failed to have any effect on grain yield or protein. In Experiment 4, deep placement of N, especially at 25 cm, increased grain yield, protein content and protein yield compared with nil or surface placement of fertiliser (Table 1). The yield effect was largely due to an increase in individual kernel mass. Ripping, *per se,* had no effect on grain yield or protein. Deep placement of urea fertiliser at a depth of 25 cm was the most effective means of increasing grain yield and protein content of wheat, largely because it is less susceptible to losses during flooding events and promotes growth after waterlogging more effectively than N fertiliser applied at a lesser depth.

Table 1. Effect of deep placement of N fertiliser on yield and yield components of a wheat crop.

Treatment	Kernel wt (mg)	Grain yield (t/ha)	Grain protein (%)	Grain protein yield (kg/ha)
R_oN_o	29.4	3.76	10.1	378
$R_{12}N_o$	31.0	3.33	9.7	323
$R_{25}N_o$	29.8	3.B6	9.9	382
R_oN_{46}	29.8	3.82	9.9	380
$R_{12}N_{46}$	29.9	3.15	10.8	339
$R_{25}N_{46}$	32.9	4.96	11.1	549
l.s.d. (P=0.05)	1.9	0.77	0.5	108