

Deep placement of ammonium-type nitrogen fertiliser in South-West Victoria

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Introduction

Nitrogen availability during late winter and spring is a major limitation to crop production in south-west Victoria as evidenced by responses to applied nitrogen observed during the 1930s and experiments conducted during 1983 to 1985 [(1) and unpublished results]. Nitrification (NH_4^- , NO_3^-) requires oxygen, whereas denitrification ($\text{NO}_3^- \rightarrow \text{N}_2$) is an anaerobic process. In the duplex soils of south-west Victoria, waterlogging occurs because restricted water movement in the clay subsoil causes a temporary perched watertable during rainy periods. Thus, the surface layers are subject to alternating periods of aerobic and anaerobic conditions with consequent rapid loss of nitrogen as nitrification is followed by denitrification. The possibility exists that deep placement of ammonium-type fertiliser could avoid this problem as it would not be converted to nitrate or be subjected to denitrification under anaerobic conditions. This procedure is well documented for flooded rice fields (2) and a preliminary examination of the technique in south-west Victoria is reported here.

Methods

In March 1984, ripping to 30 cm with and without the simultaneous application of 35 kg P/ha and 68 kg N/ha (as ammonium nitrate) was investigated on a duplex soil type near Horsham. In May 1986, the following treatments were examined at the same location and on five farm properties.

- Placement of 50 kg N/ha at approximately 15 to 20 cm depth using a chisel plough (four tynes, 32 cm spacing).
- Ripping with the chisel plough.
- Application of 50 kg N/ha to the soil surface.

Nitrogen was applied as an ammonium sulphate solution (20% N w/v). Yields and yield components were examined by sampling five 0.36 m² quadrats per treatment from the farm pack. : Its and yield by machine harvesting plots at the site near Horsham.

Results

1984		1986					
		Near Horsham	Farm paddocks				
			1	2	3	4	5
(a) Yield (t/ha)							
Nil	3.10a	Nil	1.9	3.40a	3.68a	2.00a	3.32a 3.24a
Rip	4.22a	Rip	2.6	3.03a	4.25b	2.44a	4.61b 2.94a
Rip + 60 kg N/ha	4.86b	Surface 50 kg N/ha	2.4	3.66a	3.32ab	2.45a	4.22a 2.98a
		Rip + 50 kg N/ha	2.6	3.36a	4.52b	3.63b	6.12c 3.04a
LSD (5%)	0.50		n.s.				
(b) Kernel weight (mg)							
			27.5	28.8	38.0	38.3	36.9 25.6
(c) Preceding crop							
		wheat	past.	rape	oats	rape	wheat

There was a significant response to deep placement of nitrogen in 1984 and at farm sites 2, 3 and 4 in 1986 and some response to ripping alone was evident at sites 2 and 4. There was little or no response in 1986 to surface applied nitrogen at these sites. The low kernel weights (30 mg) at the remaining sites reflect the high incidence of root diseases which overrode any treatment effects. These preliminary results suggest deep placement of ammonium-type nitrogen fertiliser may result in more efficient use and improved crop response in soils prone to intermittent waterlogging.

1. McDonald, G. K. and Gardner W. K. 1987. A.J.E.A.A.H. (in press).
2. Reddy, K. R. and Parick, W. H. 1984. CRCR Critical Reviews in Environmental Control 13(4) 273-309.