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Sowing systems, effect on mineralisation of soil nitrogen and fallow re-assessment.

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DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA

SUMMARY OF RESULTS
1978

1. Sowing Systems - Effect on mineralisation
of soil nitrogen
2. Fallow Re-assessment

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I. PLANTING SYSTEMS INVESTIGATION

Trials were initiated in 1977 for long term investigation of four planting systems. These were monitored in 1978 for NH_4^+ and NO_3^- nitrogen in the surface 10cm of soil.

The planting systems investigated included:

- (i) Triple disc drill direct drilling - chemical weedkill, triple disc drill planted.
- (ii) Combine direct drilling - chemical weedkill, combine planted.
- (iii) Minimum tillage - single cultivation after first rains, chemical weedkill, triple disc drill planted.
- (vi) District practise - cultivated after weed germination following first rains, cultivated subsequently if necessary, combine planted.

Details of the timing of all operations are presented by D. Jasper in his summary of results for 1978.

Results

Heavy rain in February upset plans for dry sampling at most sites. Soil samples collected in April and/or May were high in NH_4^+ and NO_3^- , due probably to the stimulatory effect of rainfall on the mineralisation of soil N. Highest levels were obtained at Avondale and Mt. Barker.

Avondale Research Station

At the continuous cropping site (Table 1), initial high levels of NH_4^+ and NO_3^- in April and May were significantly lower with the district practise than other treatments. These lower levels were maintained to mid July. The continuity of the data suggested a real effect. Yet, a preliminary analysis of plant uptake of N shows higher levels with the district practise than other treatments. Further analysis of the data is continuing.

The data for the rotation cropping site (Table 1) also show lower levels of NH_4^+ and NO_3^- with the district practise than other treatments over the period late June - early July. The relative mineralisation and leaching patterns of these treatments are probably contributory.

- (i) Rapid mineralisation and leaching of N after cultivation with the district practise.
- (ii) Slower mineralisation and leaching of N with the directly drilled treatments.

This argument can be extended to the minimum tillage treatment which similarly recorded lower levels of NH_4^+ and NO_3^- over the late June - early July period than with either of the directly drilled treatments. This difference was small relative to that with the district practise.

General Comments

- (i) The stimulative effect of cultivation on the mineralisation of soil Nitrogen was recognisable at most of the rotation cropping sites. These sites were cropped for the first time in 1978 after several years of pasture.
- (ii) Cultivation had little stimulatory effect on mineralisation of soil nitrogen at most of the continuous cropping sites. These were cropped for the third successive year in 1978. It is too early to say whether there has been a change in the nitrogen status of these soils relative to first year crop situations.
- (iii) Mineralisation of soil nitrogen was stimulated greatly by the February rains experienced at most sites. Response was greatest at Avondale and Mt. Barker.
- (iv) Yield response to applied nitrogen (see yield data - D. Jasper) was minimal. There were no indications of differential treatment responses to applied nitrogen.

2. Yields have also increased by 50 kg ha⁻¹ for every 10 mm increase in growing season rainfall.
3. Several points have arisen from inspection of data from fallow trials done over the period 1929 - 1937.
 - (i) Yields from long fallow and conventional cropping practise were of the order of 1569 and 1140 kg ha⁻¹ respectively. These compare with the 1321 and 989 kg ha⁻¹ yields obtained for 72M29 up to and including the 1977 data.
 - (ii) There was no indication that fallow had the effect of reducing yield fluctuations. The range in yields from 17 years data was similar for long fallow and conventional cropping.
 - (iii) An analysis of yield frequencies (Number of years in 10 when yields below specified levels are obtained) showed a significant benefit to fallow. With fallow yields were below 1000 kg ha⁻¹ between zero and 1 year in 10, whereas with conventional cropping, yields were below 1000 kg ha⁻¹ between 3 and 4 years in 10. The complete analysis is presented in Table 8.

TABLE 2. PLANTING SYSTEMS INVESTIGATION - ESPERANCE DOWNS RESEARCH STATION

AMMONIUM (AMM) AND NITRATE (NIT) NITROGEN IN SURFACE 10cm OF SOIL (ppm)

TREATMENT	Date of Sampling					
	1/6/78	24/6/78	24/7/78	23/8/78	17/10/78	
	Amm Nit	Amm Nit	Amm Nit	Amm Nit	Amm Nit	Amm Nit
(A)	<u>77E18 - Continuous Crop Site</u>					
Direct Drilling T.D.D.	3.3 11.9	2.9 10.4	1.4 1.9	1.3 1.9	1.5 2.9	
Minimum Tillage Direct Drilling Combine	3.7 11.9	1.3 7.1	0.9 1.6	1.6 1.5	1.7 2.6	
District Practise	4.1 10.5	1.1 10.1	1.2 1.8	2.5 1.7	1.5 3.4	
	3.4 10.5	1.9 8.5	1.3 2.1	1.6 1.6	1.3 2.7	
(B)	<u>77E52 - Rotation Crop Site</u>					
Direct Drilling T.D.D.	5.9 11.4	3.7 12.8	1.9 5.3	1.7 2.9	2.4 2.2	
Minimum Tillage Direct Drilling Combine	5.6 17.4	1.9 14.3	2.4 4.2	2.5 2.7	2.5 1.6	
District Practise	5.9 12.8	2.7 14.8	2.6 4.2	2.5 2.9	2.5 1.5	
	6.3 22.9	2.2 17.8	2.2 4.2	2.4 3.0	2.2 2.7	

TABLE 4. PLANTING SYSTEMS INVESTIGATION - MT. BARKER RESEARCH STATION

AMMONIUM (AMM) AND NITRATE (NIT) NITROGEN IN SURFACE 10cm OF SOIL (ppm)

TREATMENT	Date of Sampling											
	23/5/78		30/5/78		22/6/78		26/7/78		25/8/78		24/10/78	
	Amm	Nit	Amm	Nit	Amm	Nit	Amm	Nit	Amm	Nit	Amm	Nit
(A)	77MT15 - Continuous Crop Site											
Direct Drilling T.D.D.	2.6	83.3	5.0	25.0	4.5	18.2	4.3	9.6	0.9	3.9	2.0	3.9
Minimum Tillage Direct Drilling Combine	5.7	78.5	2.0	39.4	2.0	15.4	4.6	9.6	1.7	3.6	2.1	4.7
District Practise	5.0	67.2	2.8	22.0	1.3	10.7	4.0	6.7	2.4	3.8	1.9	4.3
	5.0	64.8	2.0	30.7	2.7	14.3	7.3	11.2	2.8	3.4	1.7	4.0
(B)	77MT51 - Rotation Crop Site											
Direct Drilling T.D.D.	23.2	72.5	40.6	69.2	23.1	57.7	24.5	37.3	8.5	19.6	4.6	6.9
Minimum Tillage Direct Drilling Combine	13.6	97.5	20.8	89.2	28.5	50.9	19.5	19.9	9.3	18.5	5.2	6.4
District Practise	22.0	69.0	30.5	81.5	31.2	92.8	26.7	18.1	13.7	25.2	7.2	8.7
	27.8	134.8	18.4	123.9	31.4	90.5	17.4	20.5	14.8	23.0	4.9	9.3

TABLE 6 PLANTING SYSTEMS INVESTIGATION - MERRIDIN RESEARCH STATION

LIGHT LAND SITE

AMMONIUM (AMM) AND NITRATE (NIT) NITROGEN IN SURFACE 10cm OF SOIL (ppm)

TREATMENT	Date of Sampling									
	23/5/78	6/6/78	26/6/78	19/7/78	6/9/78	23/5/78	6/6/78	26/6/78	19/7/78	6/9/78
	Amm Nit	Amm Nit	Amm Nit	Amm Nit	Amm Nit	Amm Nit	Amm Nit	Amm Nit	Amm Nit	Amm Nit
	78M25 - Continuous Crop									
Direct Drilling T.D.D.	2.9	13.6	2.5	13.0	3.7	12.9	2.5	4.0	2.4	1.6
Minimum Tillage Direct Drilling	3.4	10.5	2.8	12.0	3.9	16.1	2.3	4.1	0.4	0.7
Combine	4.5	18.8	2.8	13.0	5.0	13.0	3.4	6.7	2.7	1.9
District Practise	2.5	11.5	2.3	13.0	3.5	17.3	1.6	7.9	1.9	2.8

TABLE 8. YIELD FREQUENCIES - NUMBER OF YEARS IN TEN
IN WHICH SPECIFIED YIELDS ARE OBTAINED

SPECIFIED YIELD EXPECTATION	FALLOW	CONVENTIONAL
Below .5 +/-ha	0	0-1
Below .75 +/-ha	0-1	3
Below 1.0 +/-ha	0-1	3-4
Below 1.25 +/-ha	3	5-6
Below 1.5 +/-ha	3-4	7
Below 1.75 +/-ha	7	6