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DEPARTMENT OF AGRICULTURE

Western Australia

EXPERIMENTAL SUMMARY RESULTS 1977

Planting Systems Investigation

1. Planting depths
2. Soil water (0-10cm) near planting
3. Mineralised N near planting

D. Tennant
Plant Research Division

PLANTING SYSTEMS INVESTIGATION

Two trials were initiated on each of five Research Stations in collaboration with G.A. Pearce and J.E. Holmes. Details in respect of treatments, operations, fertilisers, rainfall, yields and weed populations are provided by these officers in their respective reports.

For the purposes of this report, attention is drawn to two findings of a preliminary study of similar planting systems in 1976.

1. Mineralised nitrogen in the form of Ammonium and Nitrate was higher at planting in those planting systems where cultivation was used either to stimulate weed germination or for weed control.
2. Early plant growth was significantly slower with direct drilling using either triple disc drill or combine. At harvest, plant size was generally little different between all planting systems.

To compensate for these apparent deficiencies in direct drilled crops, treatments in 1977 included.

1. Four levels of nitrogen - zero, half recommended level, recommended level and twice recommended level.
2. Up to two weeks earlier planting with the direct drilled and reduced tillage than conventional district practise systems.

Data were obtained in respect of planting depth, soil water at planting, mineralised nitrogen at planting and plant growth. Samples being processed now will provide information in respect of yield components.

RESULTS

a. Depth of Planting

Due largely to difficulties associated with adjusting for different seed bed densities, attempts at obtaining uniform depths of planting (table 1) were never successful. Data for the triple disc drill direct drilling system represent seed cover and not depth from soil surface. Seed cover was equivalent to depth from soil surface with the other planting systems.

b. Soil Water near Planting and four to six Weeks Later

Determinations made near early and late planting and four to six weeks after planting (table 2) suggest higher levels of soil water to 10 cm depths with the triple disc drill direct drilling system than others. This effect was better evident with planting into pasture than stubble. There was some suggestion at Avondale that near surface soil water at planting was higher with late than early direct drilling. The differences were only slight.

The following points arise when speculating on effects of these observations.

1. After rain, water must remain longer on the soil surface with triple disc drill direct drilling than with other planting systems.
2. Waterlogging and attendant effects on plant growth/nutrient availability are more likely to influence crop growth when using triple disc drill direct drilling than other planting systems.

3. Because of greater water storage near the soil surface with triple disc drill direct drilling, water loss through evaporation could significantly reduce water available for plant growth. Alternatively, run off could be greater with this planting system.
4. Insofar as highest levels of near surface soil water with triple disc drill direct drilling were less evident when planted into stubble than pasture, and, as improved water infiltration is expected in time, continued use of direct drilling should go same way towards contending into likely problems in this field.

c. Mineralised N near Planting and four to six Weeks Later

The response to cultivation in respect of increased mineralisation of soil N as demonstrated in 1976 is recognisable in the results. Because of location differences in rainfall during seed bed preparation and a limited frequency of sampling, this response is not readily seen to have consistent effect throughout (tables 3 and 4).

1. Where differences in available N were recognisable there were lower levels of Ammonium N at planting with conventional cultivation. This was in direct contrast to the 1976 results and is a likely result of leaching after initial cultivation. Rainfall in 1976 at those sites for which data were presented (1976 summary) was generally low after cultivation.
2. At some sites, Nitrate N near planting tended to be higher with the combine direct drilling than other planting systems. This can be interpreted as a cultivation effect which because of leaching would not be evident with the conventional district practise.
3. The late direct drilling treatments at Avondale gave high levels of Nitrate N in August. Inexplicably, these levels were also high with conventional district practise. This effect was also evident at Wongan Hills but at a reduced level.
4. At some locations, differences in mineralised N at planting were evident between the pasture and stubble sites.
 - a. Avondale - lupin stubble vs pasture. Levels of Ammonium N at early planting in particular less on pasture than stubble site.
 - b. Esperance - cereal stubble vs pasture. No differences with Ammonium N. Nitrate N by 27th July was of the order of 32 to 59 ppm with the pasture site and 14 to 28 ppm with the stubble site.
 - c. Wongan Hills - lupin stubble vs pasture. Variable results.
 - d. Mt. Barker - rape stubble vs pasture. Higher levels of Ammonium and Nitrate N recorded for the pasture than stubble site.
 - e. Merredin - cereal stubble vs pasture. Levels low throughout.

d. Plant Growth

The impression gained from the 1977 season was that there was no significant visual effect of slower growth with direct drilling than other planting systems. The later planted conventional district practise generally caught up in respect of plant height and dry matter production. At the two sites (Avondale, Wongan Hills) where the directly drilled treatments were also sown late, the triple disc drill sown plants were slower growing initially. The difference was nowhere as great as in 1976.

e. Response to Applied Nitrogen

The data have as yet to be analysed. Differential responses to applied N in respect of plant growth and yield are not evident from a quick inspection of the data.

GENERAL COMMENTS

1. The yield data (G.A. Pearce) generally indicate highest yields with combine direct drilling and lowest yields with reduced tillage.. There is some evidence in the nitrogen data that continued release of soil N could have contributed to the highest yields with combine direct drilling. Lowest yields with reduced tillage is not explicable in the N data.
2. Though cultivation stimulates mineralisation of soil nitrogen, availability at planting in respect of planting system differences are largely a function of rainfall after cultivation. As is evident from the 1976 and 1977 data, highest availability of N at planting with cultivation need not always follow.
3. Plant growth with direct drilling was appreciably better in 1977 than 1976. Differences from 1976 include early planting, planting into stubble and better weed control.

TABLE 1 DEPTHS OF PLANTING (cm)
Means of 40 to 80 estimates

Date of Sampling	77A 16		77E 18		77WH 17		77Mt 15		77M 13	
	C	R	C	R	C	R	C	R	C	R
Direct Drilling Early - T.D.D.	2.0	1.4	2.1	1.2	1.8	4.2	1.6	1.0	2.0	+
Reduced tillage	3.9	4.2	2.0	3.6	3.2	3.1	3.0	1.5	3.6	3.2
Direct Drilling Early - Combine	4.0	6.1	4.1	4.8	6.1	*	2.8	2.0	2.3	4.3
District Practise	1.7	1.1	3.0	3.3	2.9	*	3.6	4.6	3.7	4.8
Direct Drilling Late - T.D.D.	2.3	x	x	x	1.4	x	x	x	x	x
Direct Drilling Late - Combine	3.2	x	x	x	2.3	x	x	x	x	x

* Data not available.

+ Not planted. Triple disc drill did not penetrate ground.

TABLE 2 PER CENT MOISTURE (dwb) IN SURFACE 10cm of SOIL
Means of 3 to 6 replications

	77A 16		77E 18		77WH 17		77Mt 15		77M 13	
	C	R	C	R	C	R	C	R	C	R
	Date of Sampling				1 9 7 7					
	8 June		21 June		26 May		19 May		28 June	
Direct Drilling Early - T.D.D.	7.5	6.1	13.8	14.3	8.3	6.8	22.2	25.6	5.7	3.9
Reduced tillage	6.2	4.8	13.2	13.6	6.9	5.1	20.5	22.1	6.0	5.7
Direct Drilling Early - combine	6.9	5.2	13.3	13.6	7.8	5.5	20.9	25.3	6.2	5.0
District Practise	7.2	5.3	13.8	14.2	7.3	5.4	21.3	21.2	5.8	4.4
Direct Drilling Late - T.D.D.	x	x	x	x	x	x	x	x	x	x
Direct Drilling Late - combine	x	x	x	x	x	x	x	x	x	x
Date of Sampling	24 June				13 June		13 June			
Direct Drilling Early - T.D.D.	7.7	8.2			7.5	5.8	18.6	24.4		
Reduced tillage	7.3	6.5			6.9	4.7	24.6	21.4		
Direct Drilling Early - combine	6.8	5.6			6.9	4.8	20.8	21.8		
District Practise	7.2	6.0			6.9	4.8	19.8	17.9		
Direct Drilling Late - T.D.D.	8.2	x			8.2	x	x	x		
Direct Drilling Late - combine	8.9	x			7.9	x	x	x		

Date of Sampling	4 Aug.		27 July		19 July		12 July		17 Aug.	
Direct Drilling Early - T.D.D.	14.3	10.9	9.1	11.4	7.4	6.2	21.6	25.7	9.2	7.5
Reduced Tillage	12.6	9.5	6.9	7.8	6.4	4.9	19.3	23.8	9.4	8.1
Direct Drilling Early - combine	13.1	9.9	7.3	7.7	6.4	4.6	20.8	24.3	10.1	8.3
District Practise	11.3	8.8	6.3	6.9	6.7	5.1	18.3	19.1	10.2	8.6
Direct Drilling Late - T.D.D.	13.5	x	x	x	7.6	x	x	x	x	x
Direct Drilling Late - combine	13.0	x	x	x	6.3	x	x	x	x	x

TABLE 3 AMMONIUM N IN SURFACE 10cm of SOIL (ppm)
Means of 3 to 6 replications

	77A 16		77E 18		77WH 17		77Mt 15		77M 13	
	C	R	C	R	C	R	C	R	C	R
Date of Sampling	8 June		21 June		1977 26 May		19 May		28 June	
Direct Drilling Early - T.D.D.	19.4	4.5	1.3	1.8	8.2	9.6	24.8	74.0	4.7	11.5
Reduced Tillage	19.0	7.7	1.4	1.8	7.7	4.1	7.9	38.0	3.0	2.8
Direct Drilling Early - combine	19.2	7.9	1.6	1.8	13.9	12.7	16.2	65.0	3.8	7
District Practise	8.5	5.5	1.2	1.9	6.1	3.8	4.4	21.3	2.6	3.4
Direct Drilling Late - T.D.D.	x	x	x	x	x	x	x	x	x	x
Direct Drilling Late - combine	x	x	x	x	x	x	x	x	x	x
Date of Sampling	24 June				13 June		13 June			
Direct Drilling Early - T.D.D.	9.5	6.5			8.5	4.7	5.1	18.8		
Reduced Tillage	8.4	4.4			6.2	4.2	1.8	13.1		
Direct Drilling Early - combine	17.5	4.7			4.2	7.5	2.4	11.3		
District Practise	6.1	4.5			3.2	5.2	1.2	3.0		
Direct Drilling Late - T.D.D.	19.6	x			7.4	x	x	x		
Direct Drilling Late - combine	22.4	x			6.7	x	x	x		

Date of Sampling	4 Aug.		27 July		19 July		12 July		17 Aug.	
Direct Drilling Early - T.D.D.	17.8	15.2	13.8	8.3	9.8	10.2	13.2	31.7	2.7	2.4
Reduced Tillage	15.4	6.3	10.2	10.7	6.2	12.3	8.6	10.2	0.6	1.8
Direct Drilling Early - combine	19.2	7.7	8.7	3.2	8.3	9.0	10.5	19.7	1.6	2.2
District Practise	5.9	4.9	9.1	7.2	5.2	30.7	5.7	6.4	0.5	0.8
Direct Drilling Late - T.D.D.	15.8	x	x	x	5.2	x	x	x	x	x
Direct Drilling Late - combine	12.5	x	x	x	13.0	x	x	x	x	x

TABLE 4 NITRATE N IN SURFACE 10cm of SOIL (ppm)
Means of 3 to 6 replications

Date of Sampling	77A 16		77E 18		77WH 17		77Mt 15		77M 13	
	C	R	C	R	C	R	C	R	C	R
	8 June		21 June		19 7 7 26 May		19 May		28 June	
Direct Drilling Early - T.D.D.	26.0	21.0	5.5	7.8	12.4	5.2	19.6	34.3	8.8	15.6
Reduced Tillage	24.4	24.3	6.9	12.3	11.2	9.6	17.2	20.3	7.5	8.6
Direct Drilling Early - combine	27.4	23.3	7.5	10.5	18.7	18.3	31.4	54.3	9.0	14.0
District Practise	22.0	18.0	8.0	11.5	14.2	11.3	11.9	26.3	6.8	7.2
Direct Drilling Late - T.D.D.	x	x	x	x	x	x	x	x	x	x
Direct Drilling Late - combine	x	x	x	x	x	x	x	x	x	x
Date of Sampling	24 June				13 June		13 June			
Direct Drilling Early - T.D.D.	46.3	30.7			23.3	11.6	50.2	116.0		
Reduced Tillage	41.8	46.3			19.7	17.7	35.0	113.7		
Direct Drilling Early - combine	42.6	48.0			24.5	20.3	41.2	122.3		
District Practise	30.6	18.3			24.5	18.3	20.2	57.7		
Direct Drilling Late - T.D.D.	30.6	x			8.9	x	x	x		
Direct Drilling Late - combine	28.8	x			18.2	x	x	x		

Date of Sampling	4 Aug.		27 July		19 July		12 July		17 Aug.	
Direct Drilling Early - T.D.D.	15.3	18.7	14.2	32.0	20.5	9.2	29.4	63.3	12.8	20.0
Reduced Tillage	21.0	18.3	21.2	55.7	18.2	31.7	22.2	54.0	9.8	9.9
Direct Drilling Early - combine	28.6	15.3	23.5	41.3	31.7	21.0	23.0	45.3	8.2	8.9
District Practise	51.4	39.7	28.0	58.7	21.0	50.3	28.6	53.0	7.2	7.7
Direct Drilling Late - T.D.D.	64.3	x	x	x	22.3	x	x	x	x	x
Direct Drilling Late - combine	63.3	x	x	x	35.5	x	x	x	x	x