1981

Influence of planting systems on crop growth and soil water relations.

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SUMMARY OF EXPERIMENTAL RESULTS 1981

INFLUENCE OF PLANTING SYSTEMS ON CROP GROWTH AND SOIL WATER RELATIONS

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Influence of Planting Systems on Crop Growth and Soil Water Relations

The continuous cropping sites at Avondale (77 A 16) and Wongan Hills (77 WH 17) were sampled throughout the growing season for:-

1. Mineralised NH_4^+ and NO_3^- in the surface 10 to 20 cm of soil.
2. Dry matter production.
3. Nitrogen uptake.
4. Soil water availability and use.

Some early root penetration data were obtained at Wongan Hills to compare deep ripped and conventionally cultivated treatments.

Confirmation of previous (1979, 1980 Reports) dry matter production and water use results was sought at each of these sites. Additionally, data on interaction of applied N with dry matter production and water use were also obtained for triple disc drill direct drilled (TDD), combine direct drilled (CDD) and conventionally sown treatments (DP). Analysis of data is at a very early stage - observations reported here are only first impressions from a quick inspection of computer output just come to hand.

Seeding and fertiliser details for these trials are presented by R. JARVIS in his summary of experimental results.

RESULTS

[A] 77 WH 17 - Wongan Hills Research Station

Soil mineralised N and plant uptake

Available data are presented by W.J. BOWDEN in his summary of experimental results.

Dry matter production

1. Dry matter production at each time of sampling (Table 1) was higher with increasing level of applied N with each planting system.

2. Dry matter production with TDD - SN and TDD - 2N were similar to that of DP - 1/2 N and DP - SN respectively, suggesting a greater fertiliser N need with TDD than DP for equivalent dry matter production. Except at the 1/2 N level when DP dry matter production was significantly higher, the CDD and DP results were similar.

Rainfall infiltration, drainage and water use

1. Rainfall in 1981 was sufficient to penetrate beyond the root zone with each planting system. Comparison of early season daily water use data for 1980 (when there was no deep drainage) with that of 1981 suggest deep drainage in 1981 of the order of 20 to 30 mm. This figure is consistent with estimates from water balance modeling and with figures reported by Peck and Hurle (1973). Further data analyses are required to establish differences if any in deep drainage between planting systems.

2. Because of high rainfall and neutron moisture meter monitoring to 170 cm only, no evidence was obtained on differential depths of water penetration with each of the planting systems.

3. There was a suggestion in the total and daily water use data (Table 2) that more water was used mid season with DP than with TDD and that a reversal occurs at the latter end of the season. Significance levels have not as yet been determined.

4. Though there was some suggestion in the data of differential patterns of water use, total water loss from the soil (drainage + transpiration + soil evaporation) was similar with each planting system.

5. The interactive patterns of water use with applied N were similar with each of the planting systems. Once dry matter differences were established, daily water use was higher mid season with increasing level of N. Consequently, as stored soil water became limiting sooner with increasing level of N, a reversal in levels of daily water use developed. By the 14th of October, daily water use tended to be highest with the ON levels of each planting system and lowest with the 2N levels.

Yields

Yields were higher with DP than CDD than TDD at each level of N and with increasing level of N.

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Yield relationships with water use have as yet to be established.

Deep Ripping

The two late sown treatments of previous years were replaced in 1981 with deep ripping treatments. Details are presented in R. Jarvis' report.

1. Previously reported data on patterns of root penetration to depth have reported a lag phase in penetration from 1 to 6 to 8 weeks from planting. This lag phase appears to be associated with a hard pan located about 20 cm from the soil surface. The object of the deep ripping was to shatter this pan.

2. Preliminary measurements of rooting depth made in 1981 suggest that the lag phase may not exist with deep ripping. At a time when roots with DP had reached 30 cm depths, roots with deep ripping were down to 60 cm.

3. Relative to SN Data for TDD, CDD and DP, Dry matter production was significantly higher after deep ripping at all times of sampling other than 15/7

4. Midseason water use was significantly highest with deep ripping (Table 2) with subsequent reversal relative to TDD in particular with earlier exhaustion of reserves.

5. Yields were up to 35 per cent higher with deep ripping (see report by R. JARVIS).

   Detailed experiments to investigate the interaction of cultivation depth and deep ripping on root growth, water infiltration, nutrient availability, nutrient leaching, nutrient uptake, dry matter production and water use are proposed for 1982.

Table 1. Effect of Planting System and Level of Applied N on Dry Matter Production (kg/ha) - 77WH17 1981 Data.

Treatment	Date of Sampling					
	15/7	11/8	3/9	21/9	14/10	5/11
Triple Disc Drill*						
ON	28.24	119	220	887	1,535	2,467
1/2N	55.56	202	718	1,636	3,404	4,742
SN	66.20	209	934	2,367	3,688	4,510
2N	70.83	353	1,307	3,254	4,892	6,187
Combine Drill*						
ON	49.76	138	399	937	2,225	2,710
1/2N	57.41	303	900	1,932	2,982	4,116
SN	78.01	315	1,494	2,822	4,709	4,843
2N	83.10	381	1,830	3,611	6,409	7,140
District Practice						
ON	56.48	134	349	1,160	2,126	2,997
1/2N	71.29	303	1,111	2,417	5,088	4,907
SN	84.49	335	1,587	2,766	5,143	5,963
2N	91.43	428	2,127	4,010	6,692	7.047
Deep Ripped						
SN	76.62	385	1762	3663	6716	7488

* Direct Drill Treatments

Table 2. Effect of Planting System on Water Loss (Drainage + Transpiration + Soil Evaporation + Run Off) from Soil Profile - 77WH17 1981 Data*.

(a) Total Water Loss (mm)

Sampling Interval	Planting System			Deep Ripped
	TDD	CDD	DP	
15/7 - 11/8 (27 days)	77.73+	76.33+	73.82+	N/A
11/8 - 3/9 (23 days)	65.10	62.86	73.02	76.61
3/9 - 21/9 (18 days)	44.53	49.98	52.81	59.38
21/9 - 14/10 (24 days)	43.25	46.10	41.01	40.55
14/10 - 5/11 (22 days)	25.73	24.40	18.85	18.92
5/11 - 24/11 (19 days)	5.09	0.40	0.51	3.33
Total 15/7 - 24/11	261.43	260.07	260.02	-
Total 3/9 - 24/11	183.70	183.74	186.20	198.79

(b) Daily Water Loss (mm/day)

Sampling Interval	Planting System			Deep Ripped
	TDD	CDD	DP	
15/7 - 11/8 (28 days)	2.88+	2.83+	2.73+	N/A
11/8 - 3/9 (23 days)	2.83	2.73	3.17	3.33
3/9 - 21/9 (18 days)	2.47	2.77	2.93	3.30
21/9 - 14/10 (24 days)	1.80	1.92	1.71	1.69
14/10 - 5/11 (22 days)	1.17	1.11	.86	.86
5/11 - 24/11 (19 days)	.27	.02	.03	.18

+ High Drainage component in 15/7 - 11/8 data
* First read out of data - no checks for errors in computer output

Table 3. Effect of Planting System and Level of Applied N on Yield (kg/ha) 77WH17 1981 Data*.

Planting System	Level of applied N (kg/ha)				Mean
	ON (O)	1/2N (20)	SN (40)	2N (80)	
TDD	638	1,286	1,623	1,930	1,369
CDD	1,007	1,590	1,890	2,272	1,690
DP	1,165	1,968	2,098	2,433	1,916
Mean	937	1,615	1,870	2,212	1,658

* Detailed data in report of R. JARVIS

[B] 77 A 16 - Avondale Research Station

Mineralised N and plant uptake

Available data are presented by W.J. BOWDEN in his summary of experimental results.

Dry matter production

1. Dry matter production (Table 4) was higher with increasing level of applied N with each planting system.

2. Dry matter production at the ON and 1/2N levels was higher with DP than TDD. CDD was intermediate at the ON level and lowest at the 1/2N level (not consistent with trends). There was little difference between planting systems in dry matter production at the SN and 2N levels.

Rainfall infiltration, run off and water use

1. Run off data obtained by K. Bligh suggests greater loss from DP than CDD. His data showed no differences in run off between DP and TDD.

2. The water profile data indicate greater rainfall infiltration with TDD and CDD (114 and 115 mm) than DP (98 mm).

3. Water use data (Table 5) show greater daily use midseason with DP than TDD and slightly greater use with TDD than DP towards the end of the growing season. Greater midseason use with DP probably reflects greater run off. Later greater use with TDD and CDD (not significant in 1981, highly significant in 1980) is likely to be a consequence of greater availability of soil water at depth.

Yields

Planting system yields were similar at the SN and 2N levels. Yields at the ON and 1/2N levels were higher with DP than TDD. Overall, yield differences were consistent with expectation from the dry matter production data.

Table 4. Effect of Planting System and Level of Applied N on Dry Matter Production (kg/ha) - 77A16 1981 Data.

Treatment	Date of Sampling					
	30/6	6/8	19/8	9/9	29/9	12/11
Triple Disc Drill*						
ON	20	196	329	1,186	3,128	3,890
1/2N	20	396	853	2,425	5,178	7,910
SN	20	520	1,018	3,533	6,236	9,205
2N	21	527	1,435	4,227	7,686	10,495
Combine Drill*						
ON	19	191	365	870	2,556	4,180
1/2N	18	400	788	2,151	4,516	7,450
SN	17	442	1,037	2,709	6,375	9,520
2N	22	474	1,291	3,708	7,139	10,860
District Practice						
ON	19	192	488	1,778	3,768	6,480
1/2N	21	301	748	2,336	5,710	8,775
SN	19	482	968	2,684	6,166	9,320
2N	22	410	1,106	3,642	7,042	10,770

* Direct drill treatments

Table 5. Effects of Planting System on Water Loss (Drainage + Transpiration + Soil Evaporation + Run off) from Soil Profile - 77A16 1981 Data*.

Sampling Interval	Measurement/Planting System			
	Total water loss (mm)		Daily water loss (mm/day)	
	TDD	DP	TDD	DP
30/6 - 16/7 (16 days)	9.7	12.73	.61	.80
16/7 - 5/8 (20 days)	48.75	59.60	2.44	2.98
5/8 - 19/8 (14 days)	45.31	48.20	3.24	3.44
19/8 - 9/9 (21 days)	40.71	38.31	1.94	1.82
9/9 - 29/9 (20 days)	53.59	50.84	2.68	2.54
29/9 - 13/10 (14 days)	25.01	24.19	1.79	1.73
13/10 - 10/10 (6 days)	10.84	4.68	1.81	0.78
19/10 - 11/11 (23 days)	29.72	26.28	1.29	1.14
11/11 - 1/12 (20 days)	18.66	27.21	.93	1.36
Total	282.29	292.04		

* First read out of data - no checks for errors in computer output.

Table 6. Effect of Planting System and Level of Applied N on Yield (kg/ha) 77Alb 1981 Data*.

Planting System	Level of applied N (kg/ha)				Mean
	ON (O)	1/2N (29)	SN (58)	2N (116)	
TDD	1,347	2,113	2,562	2,918	2,235
CDD	1,633	2,184	2,413	2,980	2,302
DP	2,247	2,634	2,703	2,913	2,624
Mean	1,742	2,310	2,559	2,937	2,387

* Detailed data in report of R. JARVIS

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