1984

Effect of various crop and pasture species on the growth of a subsequent wheat crop

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Summary of Experimental Results for the 1984 Season

83WH29:- The effect of various crop and pasture species on the growth of a subsequent wheat crop.

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TRIAL: 83WH29

SOIL: WONGAN LOAMY SAND 0-10 cm samples 6/83: pH(water), 5.4; clay, 9%; N, 0.044%; C,0.55%; CEC, 2.4C; Bic. K, 66 ppm.

HISTORY: See Hamblin, Perry et. al. 1983 results summary.

AIM: To characterise the effect of various crop and pasture species on the growth and yield components of a subsequent wheat crop with special emphasis on the nitrogen nutrition of that crop. To provide validation data for modelling wheat growth and nitrogen uptake.

MEASUREMENTS:

Factors to be monitored through time were

: Soil moisture profiles
: Mineral nitrogen profiles
: Root growth profiles
: Top growth and nitrogen uptake
: Development score
: Incidence of disease and pests

1. PRELIMINARY CONDITIONS

Seasonal Notes:

A very wet summer/autumn period allowed widespread germination of the previous crop and pasture species as well as weeds such as melons and rye grass. Pre seeding spraying and cultivation treatments (Round up 1L ha^{-1} on 5/5, spray seed 7L ha^{-1} on 18/5 spray seed at 2L and DICAMBA at 1L ha^{-1} on 29/5, Scarified to 10 cm on 30/5, Worked back on 12/6) allowed the crop to be sown into a weed free seed bed on 12/6/84. By mistake an unspecified mixture of gamenya and eradu wheat was sown at 52 kg ha^{-1} with super Number 2 mix at 97 kg ha^{-1}. Seed size was small (29 mgm) and seeding was deep (between 5 and 8 cm). Emergence was delayed until about 24/6/84. Establishment counts on 24/7/84 gave 157 plants M^{-2}.

2.

Trial Design:

The original trial was of simple randomised block design with 8 treatments (wheat, barley, eregulla and yandee lupins, serradella, sub-clover, peas and bare fallow) and four replicates. Each plot was sown with two passes with a 24 run drill. Plots on reps 1 and 2 were 40 m long and those on seps 3 and 4 were 65 m long. The northern most run of each plot was used for sampling of plant growth and water use in 1983. The southern run was harvested (when appropriate) by machine for crop yield.

Over summer, the trial area was spasmodically and lightly grazed by sheep on a communal basis. Ten metres of each plot were exclosed from grazing and these areas were sampled over summer so that we could follow dry matter and nitrogen losses from the residues.

The original 1983 plots were topdressed with 148 kg N ha^{-1} on a 6.3 m cross strip on 27/3/84. This strip was subsequently topdressed at 74 kg N ha^{-1} on 14/6/84 (2 DAS) and again at 113 Kg N ha^{-1} on 7/8/84 (57 D.A.S.) with NH_4NO_3 to guarantee areas with no nitrogen deficiency. Other nitrogen sub plots (20 M^2) were laid out on the original plots to provide nitrogen levels of 50 and 150 kg ha^{-1}. The fallow plots also had treatments of 100 and 300 kg N ha^{-1} applied at the same time (2 D.A.S.).

Thus the trial had eight 1983 treatments sub plotted with grazed and ungrazed zero nitrogen treatments. Some of the 1983 treatments had harvested and unharvested comparisons (yandee lupins and the peas) on the grazed area. There was a luxury Nitrogen strip across all 1983 plots and nitrogen treatments were topdressed 2 D.A.S. as subplots on all 1983 main treatments.

Not simple!

3.

Weed Diseases and pests

(i) The crop was weed free.

(ii) Leaf diseases were obvious on the wheat following wheat crops on 30/7/84 (36% of the leaf area of the second leaf compared with 3.3% on the wheat following lupins) on the 50 kg N ha^{-1} plots. Unfortunately these measurements were not made on other treatments or at other times. It was noted that the disease had disappeard by the middle of August. There was no obvious effect of the disease on dry matter production or root growth at the time it was observed.

(iii) Root diseases were not obvious except for some rhizoctonia patches which were seen late in the season but not related to treatments.

Samples were taken from 1983 wheat and yandee lupin treatments on two occasions for inspection and plating out. No obvious pathogens were found.

(iv) Samples were also taken on two occasions to check for Nematodes. None of significance were found.

(v) No other pests or disease were seen. However, there was some shedding of grain between samplings on 6/11 and 26/11 and some empty heads were observed in the final samples. The cause of these is unknown.

RESULTS: The results are presented in the following tables. As yet they have not been subject to statistical analysis and conclusions drawn from them should be treated with caution.

Table 1. Records the rainfall at WHRS in 1984.

Table 2. 1983 production and estimates of nitrogen balance.

Table 3. Summer dry matter balance.

Table 4. Mineral nitrogen levels.

Table 5. Anthesis cuts and yield components.

Table 6. Dry matter production through time.

Table 7. Soil nitrogen profiles.

Table 8. Root lengths.

Table 9. ZADOK development scores.

Table 10. Water use to 2 metres depth.

Table 11. Pre anthesis water use by depth.

Table 12. Post anthesis water use by depth.

Table 1. Rainfall (mm) at WHRS 1984

DAY	1983 DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.9					1.0		0.8			0.4		
2	2.3					1.2			4.2	0.6	3.2		
3				3.4				0.4	4.8	1.6			
4				8.6				21.0	0.4				
5	3.6						1.8	0.4		7.0		0.4	
6						8.0	2.8	4.0	5.4	0.1		2.0	
7				7.4		18.4	tr	1.2	4.6		1.8		
8				13.8		2.6		3.6	0.3		3.0	7.8	
9				3.4		0.4			4.0	0.5		2.4	
10						3.4				2.2			
11					0.4	0.4							
12					36.2	0.6							
13					1.2								
14							5.3			11.2			
15							0.5			5.4			
16				0.2		1.2		4.0	0.8			0.8	
17						0.2		0.9	0.3	0.2			
18						7.6		tr	0.6				
19				0.4	0.4	2.2		tr					
20				3.2		25.0		2.8	7.4				
21					0.3	2.0	6.0	0.4	0.4				
22			13.5				1.5		1.6		0.2		1.0
23	1.8		3.0					1.5	0.3			1.4	
24									0.3				
25						6.2	0.2						
26	1.0				4.0	12.0	4.0	4.0					
27	4.8					14.2	tr	1.6					
28	3.2					5.1	tr	tr		0.8		6.2	
29	2.4									0.4			
30	0.3				22.3	0.8	tr	0.6			2.0		
31						1.0							
TOT.	20.3	NIL	16.5	40.4	64.8	113.5	22.1	46.6	36.0	30.0	10.6	14.8	7.2
AVER	7.3	11.5	14.7	18.4	22.1	45.8	63.4	62.5	47.3	19.4	18.2	9.7	7.3

Table 2. 1983 Production and Nitrogen Balance

1983 Treatments	D.M. max kg ha^{-1}	Nuptake kg ha^{-1}	Seed Yield (N%) kg ha^{-1}	Seed left kg ha^{-1}	N left kg ha^{-1}
1. Northam Subclover	5150 UH	115	270(7)	270	115
2. Pitman Serradella	5200 UH	138	NIL	NIL	138
3. Yandee Lupins	6500 H UH	157	1710 (3.8)	260	102
4. Eregulla Lupins	3990 UH	99	1130 (3.8)	1130	99
5. Dundale Peas	5950 H UH	121	2460 (3.6)	400	46
6. Stirling Barley	5110 H	64	2180 (1.5)	NA	31
7. Gamenya Wheat	7740 H	75	3010 (2.0)	NA	15

Note: (i) UH = unharvested and H = harvested. NA = Not available.

(ii) Barley suffered herbicide damage early - hence the low BY.

(iii) On a nearby site with ripped and non ripped treatments wheat BY went 10 t ha^{-1} and 8 t ha^{-1} respectively - This site (83WH29) was not ripped and had a demonstrable hard pan.

(iv) Both lupins were affected by brown spot early. Eregulla also had poor plant density and did not grow well. Seed N % is low.

(v) The serradella plots were still green in December but did not set seed.

(vi) The pea and fallow plots were badly wind eroded in Autumn 1984 because of a lack of ground cover except where weeds had volunteered after summer rain.

Table 3 Drymatter (t ha^{-1}) changes over summer on ungrazed areas of plots (mean of 4 seps)

	1983 BY max*	Maturity*	15/12/83	26/1/84	28/2/84	10/5/84 Dry	10/5/84 Green
Subclover	5.1	4.2	3.1	2.4	2.2	1.3	1.2
Serradella	5.1	2.9	4.0	2.4	2.6	1.2	1.9
Yandee	6.5	4.8	3.6	3.2	2.4	2.3	0.9
Eregulla	4.0	3.1	5.2	5.4	4.7	3.6	1.6
Pea	5.0	5.8	3.5	2.0	1.8	1.7	2.1
Barley	6.2	5.1	3.6	3.2	2.5	2.9	0.8
Wheat	7.7	7.7	4.3	4.4	4.3	4.5	0.8
Bare	-		0.4	0.4	-	0.7	1.0

* Measured on whole plots (40 M). The other measurements are for a 10 M area at the end of each plot and exclosed from grazing. Maturity measurements were taken in late October and November 1983.

At each of the four summer sampling times, above ground dry matter has been divided into three fractions: > 9.6 mm; 5 to 9.6 mm; 1.6 to 5 mm. the less than 1.6 mm fraction was included with a soil mineral component which was subsequently fractionated (using an elutriator) into three particle size ranges. these samples have been submitted for nitrogen and carbon analyses to the government chemical labs.

There was severe wind erosion between the samplings on 26/1 and 28/2 resulting in a transfer of material between plots. Pea plots were bared by these and earlier winds.

Considerable summer and autumn rain filled soil profiles and caused extensive germination of all species (except eregulla - still in the pods on the erect plants).

Table 4. Soil Mineral Nitrogen Analysis
(NH_4 + NO_3 nitrogen ppm) from 0.10 samples

1983 TREATMENT	Summer*	15/12	24/1	28/2	23/3	10/5	12/6	3/7/84 No	3/7/84 +50N
Subclover	G				21	8	13	17	47
	UG	18	27	26		9	10		
Serradella	G				32	7	9	16	
	UG	22	33	35		9	11		
Yandee	G				18	6	6	10(12)	41
	UG	14	24	23		7	9	9(13)	
Eregulla	G				15	6	8	12	
	UG	11	16	18		6	7		
Pea	G				12	5	7	10	
	UG	14	22	17		8	8		
Barley	G				10	5	5	6	
	UG	12	19	20		6	5		
Wheat	G				8	5	4	4	34
	UG	10	15	14		6	4		
Bare	G				11	3	4	8	38
	UG	11	20	16		4	6	10	
Yandee	X						16		
Wheat	X						10		

G = Grazed UG = Ungrazed areas.
X = Cross strip received 200 kg N ha^{-1} in March.

3/7 (i) Yandee figures in brackets are for samples from the unharvested areas of the plots.

(ii) +50 N figures for sub plots which recieved 50 kg N ha^{-1} on 14/6/84 50 kg N ha^{-1} is equivalent to 30 ppm N on a 10 cm ha basis with a bulk density of 1.5 (i.e., 100% recovery of applied N).

(iii) Note the high mineral N levels following the abnormally moist summer conditions. Heavy rains in April and early May probably leached N and together with plant uptake caused the fall in N levels at 10/5. Cultivation and weed kill prior to seeding on 12/6 would allow a release of N from nitrogen rich materials and subsequent mineralisation without leaching rains after seeding could explain the relatively high mineral N figures on 3/7.

Table 5. 83WH29. ANTHESIS (24/9) and FINAL (26/11) YIELDS and YIELD COMPONENTS (mean of 4 replicates).

Treatment 1983 Species	Summer	1984	BY_A tha^{-1}	BY tha^{-1}	GY tha^{-1}	HI	Heads M^{-2}	Grain wt MGM	Machine Harvest 11/12 tha^{-1}
NORTHAM	UG	NIL	5.1	7.2	3.1	43	271	35.2	
Subclover	G	NIL	5.3	7.8	3.3	42	292	35.0	2.9
	G	50	6.7	7.7	3.1	40	315	32.6	(0.2)
	G	150	6.9	7.8	3.1	40	308	31.6	
	G	α	6.2	7.1	2.9	41	279	31.3	
BARE	UG	NIL	2.6	4.5	1.9	42	197	35.4	
FALLOW	G	NIL	2.3	3.8	1.7	45	174	34.3	1.6
	G	50	4.6	5.9	2.5	42	244	32.8	(0.4)
	G	100	5.0	6.2	2.6	42	250	33.1	
	G	150	4.9	6.2	2.5	40	268	31.8	
	G	300	5.2	5.6	2.3	41	251	31.7	
	G	α	5.5	6.4	2.6	41	239	31.6	
GAMENYA	H UG	NIL	1.8	3.8	1.7	45	174	35.8	
WHEAT	H G	NIL	1.6	3.8	1.8	47	178	35.0	1.7
	H G	50	5.1	7.3	3.0	41	284	35.1	(0.2)
	H G	150	6.9	7.1	2.9	41	305	31.9	
	H G	α	5.7	7.2	2.9	40	299	31.0	
YANDEE	UH UG	NIL	5.6	7.9	3.1	39	309	35.0	
LUPINS	H UG	NIL	3.8	6.3	2.7	43	240	36.7	
	UH G	NIL	3.9	6.5	2.7	42	253	36.3	2.7
	H G	NIL	3.6	6.0	2.5	42	217	35.1	2.4
	H G	50	5.9	8.3	3.3	40	319	34.2	(0.3)
	H G	150	6.2	7.5	3.0	40	321	31.8	
	H G	α	6.0	7.3	2.9	40	296	32.4	
EREGULLA	UH UG	NIL	4.3	6.4	2.6	41	254	35.2	
LUPINS	UH G	NIL	4.2	6.0	2.5	42	236	35.4	2.3
	UH G	50	6.3	8.0	3.2	40	308	33.8	(0.4)
	UH G	150	7.5	8.1	3.0	37	335	30.7	
	UH G	α	6.7	7.8	3.0	38	288	30.8	
PITMAN	UG	NIL	5.1	6.5	2.8	43	267	33.4	
SERRADELLA	G	NIL	4.5	6.5	2.7	42	252	34.4	2.8
	G	50	6.7	7.8	3.1	40	311	32.6	(0.2)
	G	150	6.1	7.3	2.9	40	338	31.8	
	G	α	6.0	6.5	2.6	40	267	32.2	
DUNDALE	UH UG	NIL	-	6.4	2.7	42	253	35.7	
PEA	H UG	NIL	3.3	5.0	2.2	44	217	36.1	
	H G	NIL	3.7	6.3	2.7	43	248	36.1	2.0*
	H G	50	5.5	7.1	3.0	42	263	34.8	(0.4)
	H G	150	5.5	6.3	2.6	41	269	32.4	
	H G	α	4.9	6.8	2.8	41	291	31.2	

Table 5. (Contd.) 83WH29. ANTHESIS (24/9) and FINAL (26/11) YIELDS and YIELD COMPONENTS (mean of 4 replicates).

Treatment 1983 Species	Summer	1984 kg N ha^{-1}	BY_A tha^{-1}	BY tha^{-1}	GY tha^{-1}	HI	Heads M^{-2}	Grain wt (mgm)	Machine Harvest 11/12 tha^{-1}
STIRLING	H UG	NIL	2.2	4.4	2.0	45	193	35.0	
BARLEY	H G	NIL	2.3	4.9	2.2	45	199	35.5	1.9
	H G	50	5.8	7.7	3.1	40	308	34.7	(0.3)
	H G	150	7.3	7.0	2.8	40	301	31.0	
	H G	α	6.1	8.0	3.2	40	250	32.2	
				ONE REP ONLY					
SERENA	UG	No		7.2	2.9	40	296	36	
MEDIC	G	No		8.1	3.4	42	269	36	2.7
	G	α		7.4	3.1	41	314	31	
COORONG	UG	No		3.8	1.5	41	181	36	
TRITICALE	G	No		4.7	2.0	43	194	37	1.9
	G	α		6.3	2.5	40	280	32	
RITSON	UG	No		5.1	2.1	41	203	36	
LUPINS	G	No		6.0	2.7	45	229	36	1.9
	G	α		6.4	2.5	39	260	34	

Notes: H = Harvested UH = Unharvested G = Grazed UG = Ungrazed
BY_A = Biological Yield at Anthesis. Standard error of Machine harvest in brackets.
* There is not explanation for the low harvester c.f. hand harvest yield on the pea plots and the Ritson plots.

Comments:

(i) There were no grain yield responses above 50 kg N ha^{-1}.

(ii) Grain yields on the bare plots plateaued well below (500 kg ha^{-1}) those on the other plots.

(iii) Ungrazed, unharvested yandee lupins had very high yields for nil nitrogen plots.

(iv) Head numbers increased and grain size decreased with increasing nitrogen status.

Table 6. Dry Matter Production (kg ha^{-1}) through time
(mean of 4 reps)

Treatment 1983 Species	1984 kg N ha^{-1}	Date and Days after seeding 9/7 29	16/7 35	23/7 42	30/7 49	6/8 56	13/8 63
NORTHAM	NIL	35	47	93	175	294	480
SUBCLOVER	50	38	52	110	225	389	700
	150	38	50	111	211	409	777
	α	33	50	95	224	354	682
BARE	NIL	24	41	49	96	93	184
FALLOW	50	30	44	79	166	227	416
	100	25	41	74	195	314	501
	150	24	36	55	124	279	419
	300	22	36	59	107	203	385
	α	27	46	75	144	237	354
GAMENYA	NIL	27	35	41	82	83	132
WHEAT	50	36	53	90	181	279	503
	150	36	52	103	189	358	546
	α	33	53	86	153	296	485
YANDEE	NIL	33	47	80	139	181	313
LUPINS	50	36	50	97	186	290	470
	150	38	57	80	211	392	708
	α	31	47	80	153	303	565
UG H	NIL						323
UG UH	NIL						547

Table 6. (contd.) Dry Matter Production (t ha^{-1}) through time (mean of 4 reps)

Treatment 1983 Species	1984 kg N ha^{-1}	Date and Days after seeding 27/9 77	11/9 91	25/9 105	9/10 119	24/10 134	6/11 147
NORTHAM	NIL	1.34	3.23	5.34	7.9	9.4	8.6
SUBCLOVER	50	1.77	4.06	6.74	8.3	10.0	10.0
	150	2.18	4.14	6.86	8.2	9.2	10.7
	$\underline{\alpha}$	1.57	4.26	6.20	8.3	9.8	10.5
BARE	NIL	0.37	0.89	2.34	3.1	3.8	4.3
	50	0.97	2.57	4.63	7.0	7.1	8.0
	100	1.39	3.20	5.03	7.4	7.8	8.6
	150	1.23	3.03	4.94	7.3	7.6	7.8
	300	1.15	2.97	5.20	6.7	7.6	7.5
	$\underline{\alpha}$	1.25	3.17	5.49	6.6	7.6	9.0
GAMENYA	NIL	0.30	0.80	1.60	3.2	4.1	4.7
WHEAT	50	1.12	2.74	5.14	7.1	8.2	9.0
	150	1.64	3.60	6.86	7.8	9.8	9.8
	$\underline{\alpha}$	1.32	3.03	5.71	8.8	8.2	9.5
YANDEE	NIL	0.71	2.46	3.73	5.4	6.6	6.8
LUPINS	50	1.12	3.40	5.94	8.7	9.7	9.5
	150	1.85	4.23	6.23	8.9	9.9	9.1
	$\underline{\alpha}$	1.43	3.54	6.00	9.1	9.4	9.6

NOTES:

The drop in dry matter production at the last harvest (29/11) is inexplicable. Sampling errors would not be so consistent. Loss of leaf material would only amount to 300 or 400 kg/ha. Checks were made that previous samples were oven dry. A mystery! Nitrogen uptake figures will be available to parallel these results. There was an obvious early depression of growth on the N$\underline{\alpha}$ plots and on N300 on the bare plots.

Table 7. Soil Nitrogen Profiles (NH_4 + NO_3 nitrogen, ppm) on 1983 fallow plots

(a) with 300 kg N ha^{-1} (as NH_4 NO_3) applied on 14/6/84.

Depth (cm)	Sampling Date 3/7	23/7	6/8	22/8	3/9	17/9	9/10
0-10	169	62	76	52	21 (36)	10 (42)	8
10-20	NS	33	37	38	14 (28)	9 (30)	8
20-30	NS	33	37	24	15 (24)	17 (33)	18
30-40	NS	14	34	28	23 (21)	14 (28)	18
40-50	NS	5	15	20	12 (12)	6 (11)	8
50-60	NS	2	4	8	3 (6)	2 (14)	4
60-70	NS	NS	1	3	1 NS	1 (2)	2
70-80	NS	NS	1	2	1 NS	1 (1)	1
Rain after seeding (mm)	11.8	18.7	58.5	98.9	102.3	128.9	138.1

(b) 50 kg N ha^{-1} as NH_4 NO_3 on 14/6/84 (C) NIL

Depth (cm)	3/7	6/8	22/8	3/9	21/6	23/7
0-10	34	10	7	2 (4)	8	4
10-20	NS	5	2	- (2)	2	3
20-30	NS	8	4	2 (2)	-	2
30-40	NS	7	6	2 (4)	-	2
40-50	NS	3	4	2 (2)	-	1
50-60	NS	1	2	1 (2)	-	1
60-70	NS	1	1	NS	NS	NS
70-80	NS	1	2	NS	NS	NS

Figures in brackets for areas from which plants had been removed on 27/8.
NS = Not sampled. Individual NH_4 N and NO_3 N figures are available.

Table 7 (d)

Soil nitrogen profiles on cross strip plots which received 148 kg N ha^{-1} in March, 74 kg N ha^{-1} on 14/6/84 and 113 kg N ha^{-1} again on 17/8/84.

Sampling Date	21/6		6/11			21/6		6/11	
Depth cm	NH_4	NO_3	NH_4	NO_3	Depth cm	NH_4	NO_3	NH_4	NO_3
0- 10	29	18	36	8	100-110	NS	NS	-	6
10- 20	6	4	14	7	110-120	NS	NS		6
20- 30	1	2	3	10	120-130	NS	NS	-	4
30- 40	-	2	2	14	130-140	NS	NS	-	4
40- 50	-	2	1	11	140-150	-	2	-	2
50- 60	NS	NS	-	6	150-160	NS	NS	-	2
60- 70	NS	NS	-	8	160-170	NS	NS	-	2
70- 80	NS	NS	-	8	170-180	NS	NS	-	2
80- 90	NS	NS	-	7	180-190	NS	NS	-	2
90-100	-	4	-	6	190-200	-	4	-	2

Table 8 Wheat Root Length per volume of Soil (Lv, cm^{-2})
(a) fallow/wheat NIL

DATE	16/7	23/7	30/7	13/8	27/8	11/9	24/9
DAS	35	42	49	63	77	91	104
0- 10	0.50	0.53	0.60	0.79	1.22	2.21	1.72
10- 30	0.02	0.01	0.01	0.01	0.29	0.43	0.52
30- 50	0.01	0.00	0.00	0.01	0.22	0.59	0.61
50- 70		0.00	0.01	0.00	0.12	0.37	0.62
70- 90				0.00	0.03	0.24	0.33
90-100				0.00	0.00	0.05	0.19
110-130					0.00	0.03	0.15
130-150					0.00	0.03	0.06
150-170						0.01	0.00
LA cm^{-1}	5.3	5.5	6.4	8.3	24.8	57.1	66.8

fallow/wheat 50 kg N ha^{-1}

DAS	35	42	49	63	77	91	104
0- 10	0.44	NS	0.64	1.36	1.60	2.28	2.74
10- 30	0.02	NS	0.03	0.08	0.30	0.47	0.81
30- 50	0.00	NS	0.00	0.00	0.18	0.65	0.75
50- 70			0.00	0.00	0.06	0.29	0.51
70- 90				0.01	0.01	0.19	0.47
90-110				0.00	0.02	0.03	0.28
110-130					0.03	0.02	0.14
130-150					0.01	0.01	0.02
150-170						0.01	0.00
LA cm^{-1}	4.8	NS	7.0	15.4	28.2	56.2	87.0

fallow/wheat 300 kg N ha^{-1}

DAS	35	42	49	63	77	91	104
0- 10	0.20	0.20	NS	NS	1.52	2.86	2.58
10- 30	0.01	0.02	NS	NS	0.41	0.47	0.56
30- 50	0.00	0.01	NS	NS	0.26	0.42	0.55
50- 70					0.02	0.22	0.38
70- 90					0.00	0.04	0.46
90-110					0.00	0.02	0.39
110-130					0.00	0.00	0.15
130-150					0.00	0.01	0.04
150-170						0.00	0.00
LA cm^{-1}	2.2	2.6	NS	NS	29.0	52.2	76.4

Table 8 (Contd). Wheat Root Length per volume of Soil (Lv, cm^{-2}) as a function of time and depth in soil.

(b) Yandee/Wheat N, NIL						(c) Wheat/Wheat N, NIL					
DATE	16/7	30/7	13/8	27/8	11/9	24/9	30/7	13/8	27/8	11/9	24/9
DAS	35	49	63	77	91	104	49	63	77	99	104
0- 10	0.35	0.97	1.41	1.50	2.87	2.70	1.09	0.83	1.40	2.06	2.35
10- 30	0.02	0.03	0.13	0.36	0.49	0.53	0.03	0.15	0.35	0.20	0.37
30- 50	0.00	0.01	0.04	0.33	0.59	0.72	0.00	0.05	0.29	0.42	0.57
50- 70		0.00	0.01	0.29	0.46	0.55	0.00	0.01	0.21	0.09	0.42
70- 90			0.00	0.05	0.55	0.61		0.00	0.18	0.13	0.53
90-110			0.01	0.02	0.31	0.64		0.00	0.07	0.16	0.38
110-130				0.01		0.31			0.01		0.38
130-150				0.02		0.17			0.00		0.25
150-170						0.05					0.12
LA(cm^{-1}											
	3.9	11.3	17.9	37.6	76.7+	98.6	11.5	12.5	36.6	40.6+	83.9

	Yandee/Wheat N50					Wheat/Wheat N50					
DAS	35	49	63	77	91	104	49	63	77	99	104
0- 10	0.24	0.64	1.09	2.48	3.44	2.93	0.68	1.25	2.02	2.10	2.52
10- 30	0.01	0.02	0.19	0.61	0.75	0.59	0.04	0.10	0.43	0.39	0.64
30- 50	0.00	0.00	0.06	0.51	0.77	0.62	0.01	0.01	0.25	0.58	0.82
50- 70		0.00	0.01	0.22	0.29	0.28	0.00	0.01	0.07	0.31	0.54
70- 90			0.00	0.06	0.43	0.16		0.00	0.01	0.20	0.47
90-110			0.00	0.01	0.31	0.11		0.00	0.00	0.14	0.39
110-130				0.01		0.19			0.02		0.33
130-150				0.01		0.20			0.01		0.07
150-170						0.03					0.03
LA cm^{-1}											
	2.6	6.8	16.1	53.4	85.4+	72.9	7.8	14.9	36.0	53.4+	91.0

DAS is days after seeding. + means greater root density per unit area (LA) possible.

* All 4 replicates for this sampling were low compared with the previous sampling. Other treatments do not show this drop and so I can only conclude that our sampling was inadequate.

The above results are the medians of 4 replicates with one deep hole over the plants and one shallow hole (to 50cm) between the rows for each replicate. On row and off row information is available for examination of lateral proliferation of roots. A hard pan reduced root densities in the 10-30 cm layer.

Table 9 Zadok Development Score (10 plants/plot - 4 replicate plots)

DATE			10/7	24/7	7/8	20/8	3/9	17/9	2/10	15/10
DAS			30	43	57	70	84	98	112	125
1983 treatment							Flag	Boot	Anth	Grain
SUBCLOVER	No	(1)	2.0	3.4	4.6	6.0	37	46,50	62	0.69*
		(2)		2	2	2	2	2	2	
		(3)				1	2	3	4	
	N α	(1)	2.0	3.3	4.9	6.2	39	48,51	63	0.76
		(2)		1	2	2	3	2	2	
		(3)				1	2	4	4	
BARE	N	(1)	1.8	3.2	4.3	5.6	37	44,50	62	0.64
		(2)		0	2	1	2	2	1	
		(3)				0	1	3	4	
	N α	(1)	1.9	3.2	4.4	6.1	38	48,52	62	0.74
		(2)		1	2	2	3	2	2	
		(3)				1	2	4	4	
WHEAT	N	(1)	2.0	3.1	4.4	6.0	7.0	42,50	61	0.60
		(2)		0	1	2	1	1	1	
		(3)				0	1	2	3	
	N α	(1)	2.1	3.4	4.9	5.7	38	47,50	64	0.76
		(2)		1	2	2	3	2	2	
		(3)				0	2	4	4	
YANDEE	No	(1)	2.0	3.3	4.6	6.0	38	45,50	62	0.74
		(2)		1	2	2	2	2	2	
		(3)				0	0	3	4	
	N α	(1)	2.1	3.4	4.6	6.3	38	47,50	63	0.79
		(2)		1	2	3	3	3	2	
		(3)				1	2	4	4	

NOTE: * FRACTION of SEED DEVELOPED
ANTH = ANTHESIS SCORE
BOOT = DEGREE of BOOTING SCORE
FLAG = FLAG LEAF DEVELOPMENT SCORE
(1) = LEAF SCORE
(2) = TILLER SCORE
(3) = NODE SCORE

Table 10. Water use (mm) to 2 metres (Rain + WCT_1-WCT_2)

1983 Crop	1984	T1	PRE ANTHESIS 6/8	20/8	3/9	17/9	POST ANTHESIS 28/6	2/10	15/10	28/6	Post
	kg Nha^{-1}	T2	20/8	3/9	17/9	2/10	2/10	15/10	29/10	13/12	TOTAL
NORTHAM	NIL		24	23	42	44	196	25	14	252	22
SUBCLOVER	α		24	21	38	36	183	24	12	231	21
BARE	NIL		31*	0*	34	25	153	29	20	224	32
FALLOW	50		21	21	39	33	179	27	13	236	24
	100		21	21	40	34	177	24	14	232	24
	150		20	21	41	28	172	30	12	230	25
	300		23	17	38	29	168	28	17	228	26
	α		22	21	39	34	179	26	14	233	23
GAMENYA	NIL		18	14	30	38	160	21	23	228	30
WHEAT	α		20	19	43	46	192	21	13	242	21
YANDEE	NIL		20	19	38	43	186	25	15	244	24
LUPINS	α		23	25	42	42	193	21	12	240	20
SERRADELLA	NIL		-	-	-	-	180	-	-	242	26
PEA	NIL		-	-	-	-	180	-	-	241	25
BARLEY	NIL		-	-	-	-	170	-	-	235	28
EREGULLA	NIL		-	-	-	-	186	-	-	240	23
RAIN	(mm)		18	5	27	4	116	5	NIL	138	

NOTES:

* Possibly error in readings on 20/8/84. Water use is actually evaporation + transportation + drainage + runoff. About 61 mm of water was used to 6/8/84. These would be mainly drainage and evaporative losses because top growth was low (< 400 kg ha^{-1}) to that date.

POST/TOTAL is post anthesis water use as a percentage of total water use. These figures should correlate with grain size and harvest index.

Table 11. Water use (mm) as a function of depth in soil.
(20/8 to 2/10 - 36.4 mm rain fell in this period)

1983 1984 N DEPTH (cm)	N NIL	N α	B NIL	B 50	B 300	B α	G NIL	G α	Y NIL	Y α
0- 20	15.2	13.5	9.6	12.8	13.4	12.6	13.4	14.6	17.0	13.2
20- 40	9.2	9.2	5.4	9.0	8.2	9.9	6.8	10.6	9.0	10.6
40- 60	7.8	9.0	4.2	8.8	7.4	9.4	5.8	9.8	8.4	9.6
60- 80	8.8	9.0	3.4	7.8	6.4	8.6	4.4	9.4	6.8	9.8
80-100	9.4	7.0	2.2	7.4	5.6	6.9	4.0	8.8	7.2	10.0
Σ(0-100)	50.4	47.7	24.8	45.8	41.0	47.4	34.4	53.2	48.4	53.2
% (0-200)	70	80	105	81	85	81	74	73	73	72
100-120	7.6	5.3	0.8	5.0	3.4	4.8	3.8	7.2	6.4	8.0
120-140	6.8	3.4	0.6	2.4	2.2	2.6	3.2	4.6	4.6	5.4
140-160	2.8	1.1	-0.4	1.4	1.2	1.8	2.0	3.8	2.8	3.4
160-180	2.4	1.0	-0.6	1.2	0.6	1.1	1.6	2.8	2.0	1.8
180-200	2.0	1.0	-1.6	1.0	-0.2	0.5	1.0	1.8	2.0	1.2
Σ(100-200)	21.6	11.8	-1.2	11.0	7.2	10.8	11.6	20.2	17.8	19.8
Σ(0-200)	72.0	59.5	23.6	56.8	48.2	58.2	46.2	73.4	66.2	73.0

1983 treats : N = Northam B = Bare G = Gamenya Y = Yandee.
% (0-200) is the water use (0-100)cm expressed as a percent of water use (0-200)cm WATER USE is here defined as (Water Content 20/8 - Water Content 2/10).

Table 12. Post Anthesis. Water use (mm) as a function of depth in soil. 2/10 to 29/10 - only 5 mm rain fell in this period).

1983 1984 N DEPTH (cm)	N NIL	N α	B NIL	B 50	B 300	B α	G NIL	G α	Y NIL	Y α
0- 20	2.0	2.4	6.6	3.4	3.8	2.2	7.0	2.4	2.8	2.2
20- 40	0.6	0.6	4.0	1.2	2.8	1.0	4.4	0.2	1.0	0.2
40- 60	1.0	0.6	4.4	1.4	2.6	0.8	3.2	0.6	1.0	0.4
60- 80	1.2	1.2	4.6	2.4	3.2	2.0	4.2	1.4	2.4	0.4
80-100	1.2	3.4	5.4	3.4	4.6	4.6	4.6	3.0	2.8	2.0
Σ (0-100)	6.0	8.2	25.0	11.4	17.0	10.6	23.4	7.6	10.0	5.2
% (0-200)	18	28	57	32	43	31	60	26	27	17
100-120	2.2	4.0	5.6	4.8	5.6	5.6	4.2	4.0	4.0	2.6
120-140	3.8	4.6	3.8	6.2	4.8	5.6	3.6	4.8	4.8	4.6
140-160	7.0	4.4	3.8	6.2	4.6	4.8	3.6	5.2	6.2	6.4
160-180	8.2	4.5	3.0	3.6	4.2	4.8	2.2	4.2	6.4	5.8
180-200	6.6	3.6	3.0	3.0	3.2	3.0	2.0	3.4	5.0	6.2
Σ 100-200	27.8	21.1	19.2	23.8	22.4	23.8	15.6	21.6	26.4	25.6
Σ 0-200	33.8	29.3	44.2	35.2	39.4	34.4	39.0	29.2	36.4	30.8

WATER USE is here defined as (Water Content 2/10 - Water Content 29/10).