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DEPARTMENT OF AGRICULTURE
STUDIES ON THE EFFECTS OF NUTRITION
AND TILLAGE ON CEREAL ROOT DISEASES

EXPERIMENTAL RESULTS 1986

R.F. BRENNAN
PLANT RESEARCH DIVISION
ESPERANCE

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DISEASE CATEGORIES

Take-all

1. Nil - no obvious infection
2. Light - less than 25% of the root system discoloured
3. Moderate - 25% to 75% of the root system discoloured
4. Severe - more than 75% of the root system discoloured

TAKE-ALL AND MANGANESE/AMMONIUM INTERACTION IN CONTINUOUS CROPPING

84E7/4504 EX

Aim: To test the hypothesis that the control of take-all by the NH_4^+ form of N is actually an effect on plant health stimulated by the removal of marginal manganese deficiency rather than any direct effect on take-all.

Location: Esperance Downs Research Station

Soil: Gray gravelly sand

Sown: June 9, 1986

Harvested: December 19, 1986

Basals: Aroona at 47 kg/ha
P at 14 kg/ha

Table 1. Grain yields (kg/ha)

N sources	Manganese sulphate (kg/ha)				
	0	25	50	100	200
Nil	298	452	263	536	363
Sodium Nitrate TD	798	607	798	786	607
Ammonium Sulphate TD	489	933	880	804	969
Ammonium Sulphate DR	638	566	536	559	554
Ammonium Chloride DR	768	670	750	804	773

TD = Topdressed

DR = Drilled

Table 2. Dry matter production sampled 21/10/86 (kg/ha)

N sources	Manganese sulphate (kg/ha)				
	0	25	50	100	200
Nil	1,170	1,504	1,611	1,672	1,753
Sodium Nitrate TD	2,710	3,112	2,928	2,957	3,030
Ammonium Sulphate TD	3,542	3,554	3,690	3,635	3,707
Ammonium Sulphate DR	3,578	3,794	3,655	3,608	3,773
Ammonium Chloride DR	3,735	3,697	3,706	3,752	3,760

Table 3. Take-all severity (mod. + sev.) (Arcsin √%)

N sources	Manganese sulphate (kg/ha)				
	0	25	50	100	200
Nil	44.71	39.99	38.82	36.99	37.23
Sodium Nitrate TD	43.39	39.47	41.15	37.17	35.43
Ammonium Sulphate TD	26.35	25.18	26.13	29.47	22.79
Ammonium Sulphate DR	23.42	24.95	28.86	28.73	28.32
Ammonium Chloride DR	22.79	22.71	23.19	30.33	31.05

Table 4. Grain weights (g/1000 seeds)

N sources	Manganese sulphate				
	0	25	50	100	200
Nil	44.41	45.52	43.40	46.21	42.41
Sodium Nitrate TD	43.57	44.58	46.61	43.73	40.44
Ammonium Sulphate TD	42.32	41.83	41.97	42.47	40.44
Ammonium Sulphate DR	43.77	41.99	42.09	44.31	43.96
Ammonium Chloride DR	43.52	42.83	45.54	41.98	44.59

THE EFFECTS OF SPLIT APPLICATIONS OF NITROGEN SOURCES ON TAKE-ALL

84E2/4504EX

Aim: To test the effects of nitrogen sources at sowing as well as sources applied 4 weeks after on the incidence and severity of Take-all in a continuous cropped situation.

Location: Esperance Downs Research Station

Soil: Gray sand/gravel

Sown: June 9, 1986

Harvested: December 19, 1986

Basals: Aroona at 47 kg/ha
P at 30 kg/ha

Nitrogen topdress 4 weeks after seeding.

Table 5. Dry matter production (kg/ha) sampled 21/10/86

NP source	0	Nitrogen source TD (4 weeks)	
		Urea (33 kg/ha)	Am Sul* (71 kg/ha)
Super	1,722	2,154	2,083
18:5	3,651	3,891	3,637
DAP	3,275	3,504	3,459
Agras No. 1	3,186	3,922	3,946
Am Sul*	3,665	3,643	3,867

* Granulated ammonium sulphate

Table 6. Grain yield (kg/ha)

NP source	0	Nitrogen source TD (4 weeks)	
		Urea (33 kg/ha)	Am Sul (71 kg/ha)
Super	684	827	857
18:5	1,023	1,000	1,027
DAP	1,000	970	1,140
Agras No. 1	934	1,005	1,084
Am Sul	911	988	1,066

Table 7. Grain weight (g/1000 seeds)

NP source	0	Nitrogen source TD (4 weeks)	
		Urea (33 kg/ha)	Am Sul (71 kg/ha)
Super	42.13	42.77	37.72
18:5	41.33	39.41	39.73
DAP	39.42	39.60	38.01
Agras No. 1	40.12	39.30	38.98
Am Sul	41.56	38.88	39.71

Table 8. Effect of split applications of different sources of nitrogen on take-all. Percentage transformed to Arcsin $\sqrt{\%}$

NP source	0	Nitrogen source TD (4 weeks)	
		Urea (31)	Am Sul (71)
Super	34.57	33.89	39.17
18:5	33.52	25.62	22.22
DAP	21.13	22.30	21.47
Agras No. 1	23.50	25.48	21.22
Am Sul	25.55	26.28	20.44

TAKE-ALL AND MANGANESE/AMMONIUM INTERACTION IN CONTINUOUS CROPPING

84LG2/4504EX

Aim: To test the hypothesis that the control of take-all by NH_4^+ form of N is actually an effect on plant health stimulated by the removal of marginal manganese deficiency rather than any direct effect on take-all.

Location: G. Cugley. Newdegate

Soil: Brown gravelly sandy loam

Sown: June 10, 1986

Harvested: December 4, 1986

Basals: Aroona at 50 kg/ha
P at 14 kg/ha

Table 9. Grain yield (kg/ha)

N sources	Manganese sulphate (kg/ha)				
	0	25	50	100	200
Nil	278	433	470	555	595
Sodium Nitrate TD	354	563	780	873	1,012
Ammonium Sulphate TD	910	1,012	817	984	933
Ammonium Sulphate DR	880	1,104	995	942	942
Ammonium Chloride DR	1,000	1,035	1,081	1,104	1,080

TD = Topdressed

DR = Drilled

Table 10. Dry matter production (kg/ha) 30/9/86

N sources	Manganese sulphate (kg/ha)				
	0	25	50	100	200
Nil	522	636	674	771	809
Sodium Nitrate TD	822	1,155	1,306	1,572	1,528
Ammonium Sulphate TD	1,741	1,790	1,811	1,825	1,836
Ammonium Sulphate DR	1,769	1,874	2,014	2,123	2,047
Ammonium Chloride DR	1,888	2,174	2,282	2,329	2,347

Table 11. Incidence of take-all (% plants) *

N sources	Manganese sulphate (kg/ha)				
	0	25	50	100	200
Nil	39.82	37.35	30.79	33.21	33.09
Sodium Nitrate TD	37.60	38.41	30.20	37.64	31.18
Ammonium Sulphate TD	40.80	34.45	39.00	39.00	34.02
Ammonium Sulphate DR	45.11	36.51	42.13	36.33	32.77
Ammonium Chloride DR	47.18	41.67	35.55	29.73	30.66

* Data: Transformed Arcsin $\sqrt{\%}$

Table 12. Severity of take-all (% plants) *

N sources	Manganese sulphate (kg/ha)				
	0	25	50	100	200
Nil	37.76	34.82	30.33	30.13	32.20
Sodium Nitrate TD	36.45	37.17	29.73	36.57	31.18
Ammonium Sulphate TD	39.99	30.92	38.59	36.99	33.58
Ammonium Sulphate DR	41.67	33.96	41.00	36.33	30.98
Ammonium Chloride DR	44.43	41.27	33.27	28.79	29.73

* Data: Transformed Arcsin $\sqrt{\%}$

Table 13. Grain weight (g/1000 seeds)

N sources	Manganese sulphate (kg/ha)				
	0	25	50	100	200
Nil	37.01	39.00	39.46	39.61	40.08
Sodium Nitrate TD	34.64	36.81	36.59	36.27	35.29
Ammonium Sulphate TD	38.71	38.23	37.17	37.35	38.14
Ammonium Sulphate DR	35.83	38.96	38.28	37.19	37.37
Ammonium Chloride DR	38.01	37.43	38.40	38.55	38.00

COPPER AND ZINC/TAKE-ALL

83ES40/4504EX

Aim: To study the nutritional and fungicidal effects of copper and zinc on take-all in wheat.

Location: G. Tyrrell, Mt. Ridley

Soil: Brown sandy/loam (alkaline)

Sown: May 27, 1986

Harvested: November 25, 1986

Basals: Cranbrook at 62 kg/ha
P at 20 kg/ha
N at 37.6 kg/ha T.D.

Table 14. Grain yield (GY), grain weight and dry matter production (DMP)

TRS	DMP (2/10/86)	GY (kg/ha)	Grain wt. (g/1000)
1. Nil Cu Zn	2,400	828	37.53
2. ZnO (2 kg/ha)	2,500	832	35.53
3. CuSO ₄ (5), Nil Zn	2,520	840	35.93
4. CuSO ₄ (5), ZnO (2)	2,472	824	32.71
5. CuSO ₄ (10), ZnO (2)	2,540	848	35.25
6. CuSO ₄ (15), ZnO (2)	2,560	855	35.12
7. CuSO ₄ (20), ZnO (2)	2,550	851	30.95
8. CuSO ₄ (5), ZnO (4)	2,710	905	34.72
9. CuSO ₄ (5), ZnO (8)	2,530	844	35.62
10. CuSO ₄ (5), ZnO (16)	2,700	901	36.17

Table 15. Take-all incidence and severity (mod. + sev.). Data transformed Arcsin √%

TR	Incidence	Severity (M + S)
1. Nil Cu Zn	75.23	58.89
2. ZnO (2 kg/ha)	74.44	61.41
3. CuSO ₄ (5), Nil Zn	73.57	62.24
4. CuSO ₄ (5), ZnO (2)	74.00	61.48
5. CuSO ₄ (10), ZnO (2)	72.44	62.17
6. CuSO ₄ (15), ZnO (2)	72.44	55.80
7. CuSO ₄ (20), ZnO (2)	73.26	61.55
8. CuSO ₄ (5), ZnO (4)	75.23	61.82
9. CuSO ₄ (5), ZnO (8)	75.50	64.82
10. CuSO ₄ (5), ZnO (16)	69.73	60.13

TAKE-ALL/PP450 FUNGICIDE

83ES42/4504EX

Aim: To measure the effects of a fungicide PP450 on Take-all incidence and severity and plant growth and yield.

Location: N. Condingup, J. Lays

Soil: Grey sand/gravel/clay

Sown: June 4, 1986

Harvested: December 2, 1986

Basals: Cranbrook wheat at 62 kg/ha
29.9 kg N/ha at seeding (topdressed)
27.6 kg N/ha at 4 weeks (topdressed)

Table 16. Dry matter production (kg/ha) 27/8/86

Super (kg/ha)	PP450 (g/ha)			
	0	50	100	200
0	342	406	364	370
50	698	875	838	849
100	902	1,008	1,049	1,112
150	999	1,236	1,227	1,176
200	1,070	1,348	1,324	1,298

LSD = 91

Table 17. Dry matter production (t/ha) 15/10/86

Super (kg/ha)	PP450 (g/ha)			
	0	50	100	200
0	1.32	1.47	1.48	1.47
50	2.45	3.18	3.06	3.23
100	2.98	3.69	3.60	3.71
150	3.23	3.96	3.92	3.91
200	3.45	4.13	4.26	4.23

LSD = 0.15

Table 23. Grain weight (g/1000)

Super (kg/ha)	PP450 (g/ha)			
	0	50	100	200
0	NG	NG	NG	17.31
50	15.70	29.12	28.22	29.17
100	26.13	29.71	30.12	34.55
150	29.56	31.00	28.19	28.12
200	28.75	29.56	27.20	26.88

N.G. No grain produced

Table 24. Grain yield (kg/ha)

Super (kg/ha)	PP450 (g/ha)			
	0	50	100	200
0	0 ^A	0 ^A	0 ^A	0 ^A
50	300	378	384	391
100	468	583	577	592
150	569	695	669	710
200	579	738	747	772

^A No machine harvestable yield

Table 25. Take-all severity (% mod. + sev.). Data transformed Arcsin $\sqrt{\%}$

Super (kg/ha)	PP450 (g/ha)			
	0	50	100	200
0	83.28	75.35	70.88	70.10
50	82.29	74.19	69.79	73.61
100	78.46	71.00	68.79	66.97
150	78.40	67.86	63.85	62.00
200	70.81	64.24	60.43	58.05

TAKE-ALL/PP450 FUNGICIDE

83ES41/4504EX

Aim: To measure the effects of a fungicide PP450 on Take-all incidence and severity as well as plant growth and yield.

Location: High school block, Neridup

Soil: Grey sand/gravel

Sown: May 30, 1986

Harvested: December 3, 1986

Basals: Cranbrook wheat at 62 kg/ha
27.6 kg N/ha topdressed at seeding
32 kg/ha N topdressed 4 weeks after seeding

Table 26. Dry matter production (kg/ha) 26/8/86

Super (kg/ha)	PP450 (g/ha)			
	0	50	100	200
0	803	938	970	963
50	949	1,062	1,124	1,020
100	1,196	1,259	1,516	1,357
150	1,376	1,584	1,664	1,705
200	1,529	1,695	1,706	1,704

Table 27. Dry matter production (kg/ha) 16/10/86

Super (kg/ha)	PP450 (g/ha)			
	0	50	100	200
0	1,936	2,165	2,141	2,166
50	2,169	2,410	2,418	2,411
100	2,305	2,563	2,601	2,616
150	2,395	2,661	2,662	2,677
200	2,495	2,703	2,737	2,739

Table 28. Grain weight (g/1000 seeds)

Super (kg/ha)	PP450 (g/ha)			
	0	50	100	200
0	18.61	19.89	20.92	21.69
50	18.86	19.91	19.62	23.80
100	20.23	21.57	22.19	22.35
150	20.72	22.98	19.56	23.57
200	19.33	20.67	23.36	22.73

Table 29. Grain yield (kg/ha)

Super (kg/ha)	PP450 (g/ha)			
	0	50	100	200
0	195	267	257	257
50	521	632	645	645
100	678	834	834	794
150	756	964	949	939
200	777	980	1,005	992

Table 30. Take-all severity (mod. + sev.). Data transformed Arcsin $\sqrt{\%}$

Super (kg/ha)	PP450 (g/ha)			
	0	50	100	200
0	84.00	76.54	72.24	79.76
50	76.96	74.81	73.61	78.77
100	82.37	64.58	69.48	70.16
150	79.16	64.76	68.53	66.29
200	84.88	64.09	64.23	62.06