



1978

A. Take- all of cereals. B. Cereal seed dressings.

G C. MacNish

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DEPARTMENT OF AGRICULTURE
Western Australia

EXPERIMENTAL SUMMARY 1978

- A. TAKE-ALL OF CEREALS
- B. CEREAL SEED DRESSINGS

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(Preliminary reports of experiments conducted in
co-operation with other officers of the
Department of Agriculture)

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ABBREVIATIONS USED

- G.S. - Growth stage based on H Fisher's scale.
D - Drilled with seed.
TD - Topdressed.
NS - Not significant at $p = 0.05$.
NA - Not available.
N - Nitrogen

Take-all %

- Nil - No obvious infection.
L - Light, less than 25% of the root system discoloured.
M - Moderate, 25% to 75% of the root system discoloured.
S - Severe, more than 75% of root system discoloured, stem base usually discoloured.

Rhizoctonia % - Refers to only moderate and severe Rhizoctonia, i.e. more than 25% of roots (per plant) showing typical brown pinched-off root tips.

Fusarium % - Refers to those plants showing typical dark brown water soaked discolouration of crown and stem base.

TAKE-ALL SURVEY

Aim: To determine over a number of seasons the incidence and distribution within Western Australia of take-all of cereals.

Methods: Surveys have been carried out since 1973. Details of methods for 1973 to 1975 are given in last seasons summary.

In 1976 I decided to standardize the method of sampling. Roadside collections are to be made along a few strategical roads at a time as close as possible to when most crops would be flowering. In 1976 the roads were as follows:

Northern Zone (NZ) - Dongara to Morawa (approx. every 5 km); NCZ - Dandaragan West to Mollerin (5 km); CZ - Northam to Burracoppin (5 km); SCZ - Arthur River to Newdegate (10 km); CZ - Cranbrook to just east of Jerramungup and Gibson to Salmon Gums (20 km). In 1977 and 1978 the roads were:

NZ - Geraldton to Mullewa and Dongara to Morawa (10 km); NCZ - North of Badgingarra to Rabbit Proof Fence and Dandaragan West to Beacon (10 km); CZ - Clackline to Bodallin and Beverley to east Bruce Rock (10 km); SCZ - Williams to Hyden and Arthur River to Lake King (20 km); Cranbrook to Ravensthorpe and Gibson to Salmon Gums (20 km).

Results:

Year	Zone	Percentage of survey samples in Take-all categories (Plants infected)*					Number of Samples
		0	1-10%	11-20%	21-60%	61-100%	
1973	NZ	60	33	7	0	0	15
	NCZ	53	14	31	3	0	36
	CZ	74	19	5	2	0	43
	SCZ	30	20	20	10	20	9
	SZ	15	23	23	23	15	13
1974	NZ	79	7	3	3	7	29
	NCZ	85	4	0	11	0	53
	CZ	71	13	5	7	4	77
	SCZ	25	25	13	25	12	40
	SZ	38	21	15	21	6	48
1975	TS	42	6	8	25	19	36
	K	48	13	16	16	7	31
	LG	0	4	0	40	56	25
	F	7	0	7	40	47	15
1976	NZ	75	19	0	6	0	16
	NCZ	50	18	7	18	7	28
	CZ	50	31	11	8	0	26
	SCZ	24	23	12	35	6	17
	SZ	6	0	20	27	47	15
1977	NZ	89	0	0	11	0	19
	NCZ	79	3	5	13	0	38
	CZ	66	5	13	16	0	38
	SCZ	32	11	7	36	14	28
	SZ	13	12	19	31	25	16
1978	NZ	63	0	5	16	16	19
	NCZ	54	5	14	19	8	37
	CZ	50	13	13	10	15	40
	SCZ	24	4	12	36	24	25
	SZ	11	0	6	39	44	18

* 1-10% = Between 1 to 10% of the plants within a sample were infected.

SUMMARY OF NITROGEN SOURCES INVESTIGATIONS

Three seasons of investigations have established that the NH_4 form of nitrogen reduces severity of take-all and to some extent the incidence of take-all. The results of these investigations are summarised in figures 1, 2, 3 and 4.

There are now results from enough experiments comparing ammonium sulphate (drilled and topdressed) with no nitrogen to develop a series of models. In fig. 1 the relationships between severity of take-all (% of plants with moderate and severe) for ammonium sulphate and no nitrogen are compared for four rates (or groups of rates) of ammonium sulphate (expressed as kg/ha of N). The rates used are N = 10 to 20 kg/ha, N = 25 to 33, N = 45 to 50 and N = 60 to 75. Each point in the figure represents the result for the said comparison in one experiment. For the four rates a series of hand drawn curves have been established. (For N = 60 to 75, Agras No. 1 results have been included to increase the number of points). The curve for sodium nitrate (M + S%) is also shown in fig. 1. In fig. 1 only severity can be compared as different rates of nitrogen would influence yield.

In general the higher the rate of ammonium sulphate the more likelihood there is of there being a ' NH_4 -N effect' on take-all. However, as would be expected, at low levels of take-all there is little or no ' NH_4 -N effect'. At very high levels of take-all no rate of ammonium sulphate can cope. This gives the curves a bow-shaped configuration. (The use of high rates of ammonium sulphate should be treated with caution. High rates have caused significant reductions in emergence at some sites; but the most risky part of using high rates is the possibility of haying-off at the end of the season if soil moisture becomes limiting.)

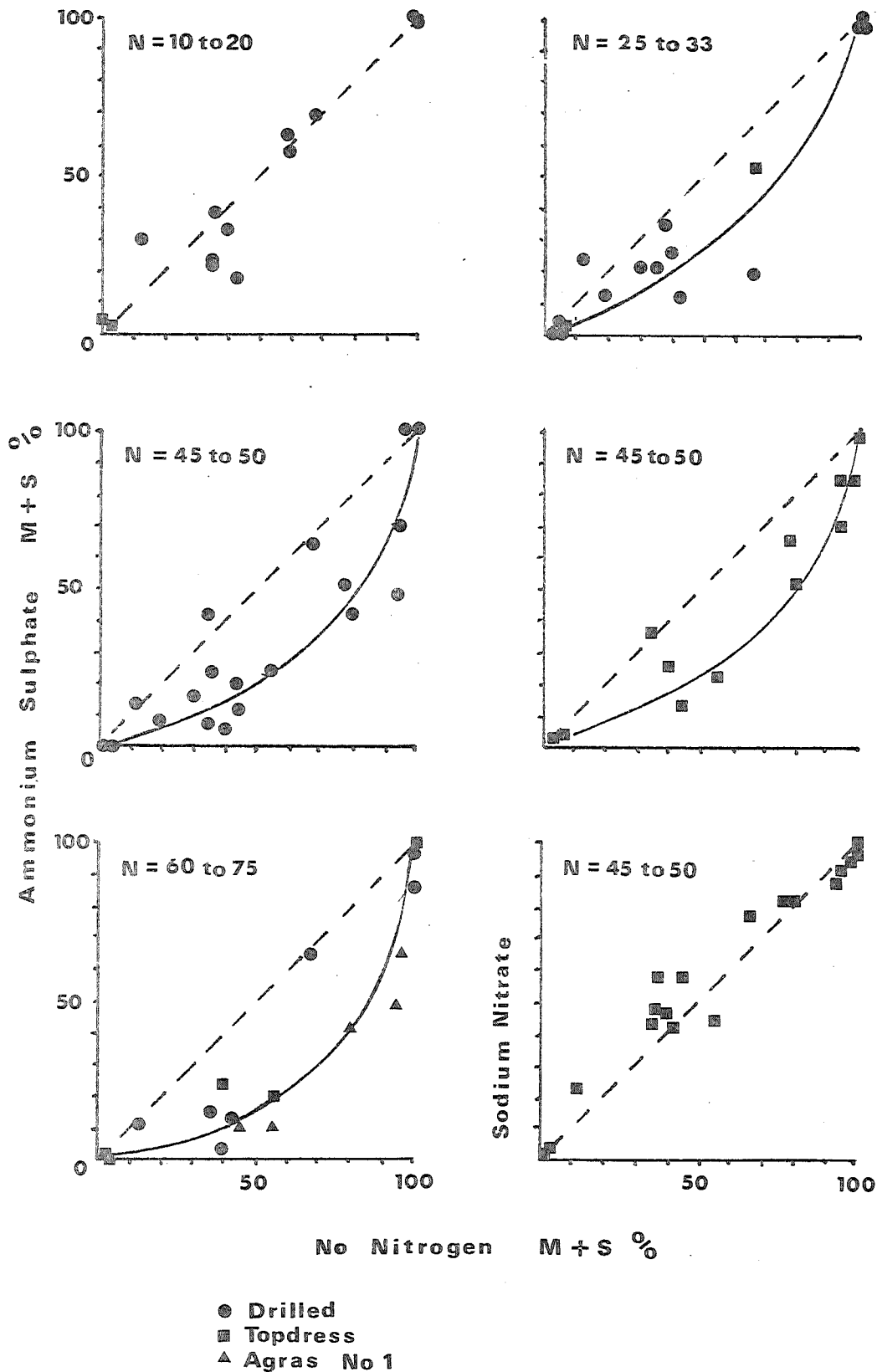
Sodium nitrate had little or no effect on take-all severity and has in a few instances caused small increases in severity.

In figures 2 and 3 different sources of nitrogen (N = 45 to 50, not enough points at other rates) are compared with sodium nitrate at 45 kg/ha of N. In these models the same rates of nitrogen allow yield results to be compared. Each point represents the relationship between % M + S for N source and sodium nitrate, while the shape of the point describes the yield difference. The yield comparisons shown are:-

- a) yield more than 200 kg/ha greater for the N source than the yield for sodium nitrate - solid square,
- b) yield less than 200 kg/ha greater - solid square,
- c) yield same or smaller - solid triangle.

In fig. 2 Agras 34 and ammonium sulphate (drilled) are compared with sodium nitrate while in fig. 3 ammonium sulphate (topdressed) and Agras No. 1 are compared with sodium nitrate.

Fig 1
TAKE-ALL INCIDENCE



Comparison between take-all infection using ammonium sulphate and no nitrogen fertilizer. If the ammonium sulphate had no effect on take-all the points would fall on the dotted line, points to the right of the dotted line indicate lower infection with ammonium sulphate.

Fig 2

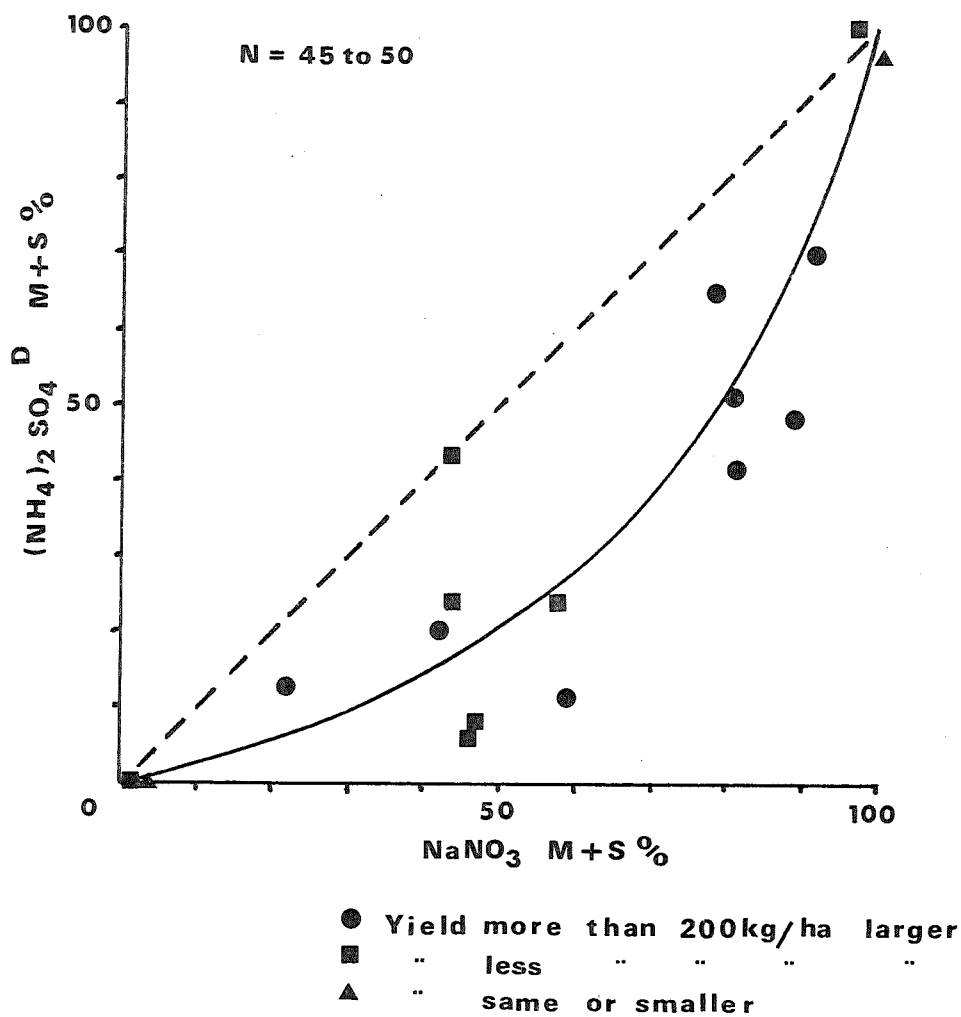
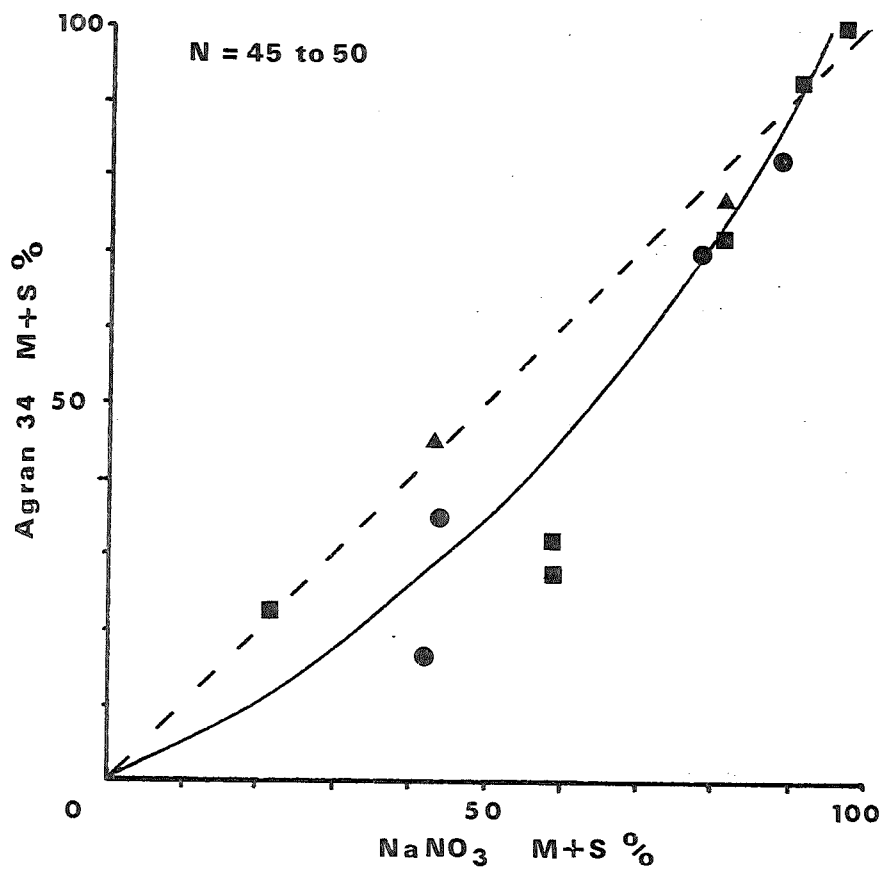
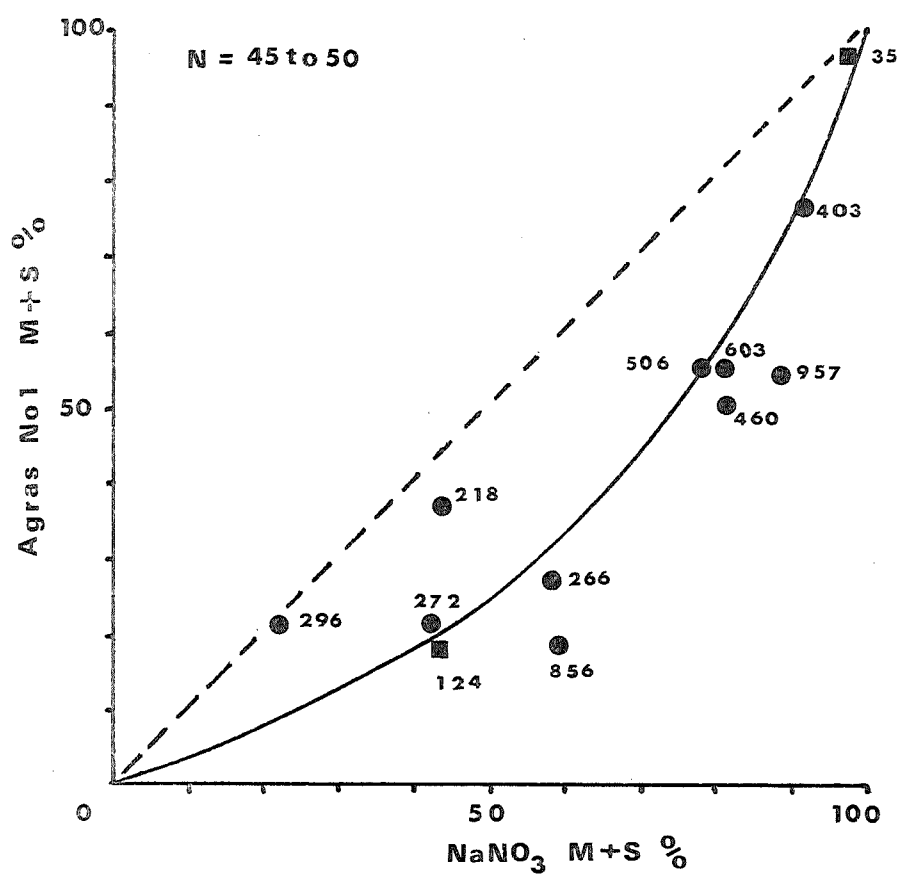
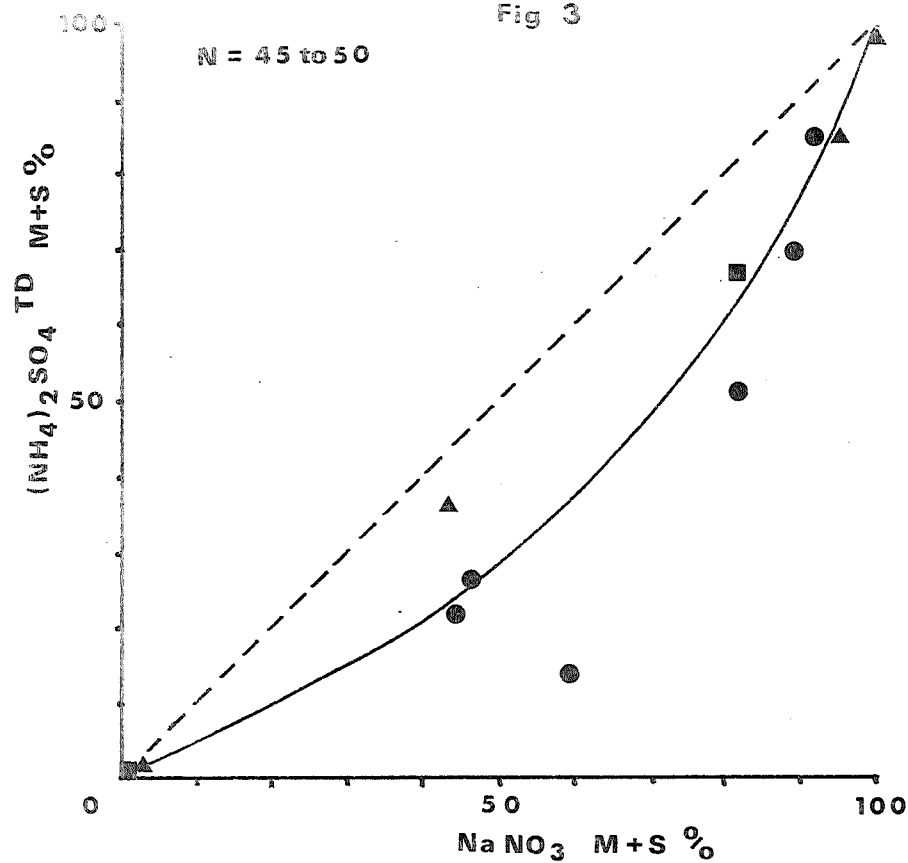


Fig 3



The numbers are the wheat yield increases in kg/ha with Agras No 1.

There are not enough points available to establish similar models for Agras No. 2, DAP or Urea. However what results there are indicate that the ' $\text{NH}_4\text{-N}$ effect' works in the following descending order of effectiveness:-

Ammonium sulphate^D > Agras No. 1^D and No. 2^D > Ammonium sulphate^{TD} > DAP^D > Agras 34^{TD} > Urea^{TD} > Nil and Sodium nitrate^{TD}.

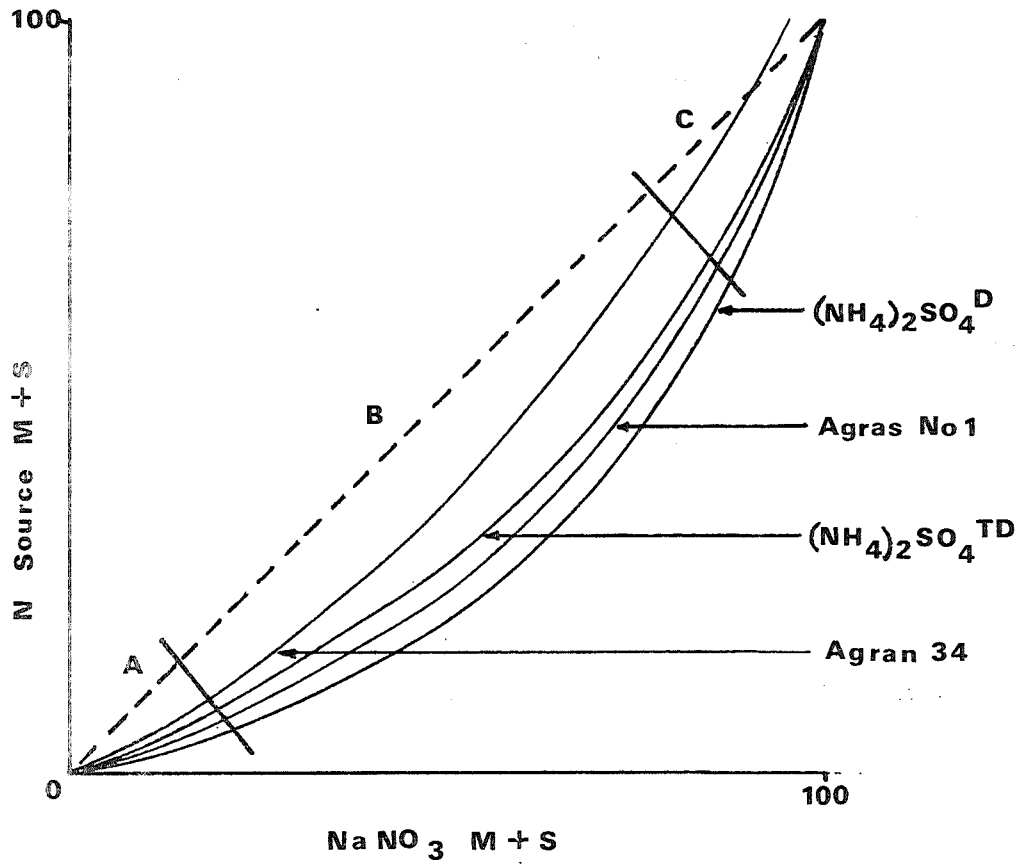
Unfortunately a high level of control by $\text{NH}_4\text{-N}$ is not always accompanied by a similar increase in yield. I have been unable to establish the reasons for these failures, but I suspect soil moisture may be involved. Agras No. 1 appears to give the most consistent increases in yield (fig. 3), with 10 out of 12 experiments giving yield increases of greater than 200 kg/ha (6 out of 12 > 400). In the remaining two experiments the increase was 124 and 35 kg/ha.

In fig. 4 the four curves described above have been reproduced. Using this model the following general recommendations can be made:-

- If take-all level likely to fall into section A - sources of nitrogen are of no consequence.
- If take-all level likely to fall into section B - then use Agras No. 1 or No. 2 (Agras not superior to ammonium sulphate but easier to use and appears to give more consistent yield increases). Any rate above 20 kg/ha of N likely to give some control. Below 20 kg/ha there maybe some marginal benefits from using Agras No. 1 or No. 2 rather than using DAP or Urea.
- If take-all level likely to be in section C - then any source of N is unlikely to help. The farmer would be well advised to either plant a cleaning crop to reduce take-all and return to wheat or barley the following season or if the area must be cropped use oats rather than wheat or barley.

Note: The above summary is based on results obtained using wheat, but there are indications that similar results could be expected with barley.

Fig 4



COST OF FERTILIZER 1979

Rate of N	Rate of Agras No.1 kg/ha	Equivalent rate of Super + Urea kg/ha	Cost* differential Cost of Agras No.1 - Cost of Super+Urea	
			Best bulk buying	Worst bag buying
20	111	91 43	\$ 4-09	\$ 4-50
33	183	150 72	\$ 6-60	\$ 7-26
45	250	205 99	\$ 8-93	\$ 9-81
60	333	272 130	\$10-17	\$13-41

* Costs at Works - does not include transport or cost of application.

EFFECT OF NITROGEN SOURCES ON TAKE-ALL

Experiment: 76LG25

Location: Newdegate Research Station (Paddock S3A)

Aim: To study the effect of repeated use of different nitrogen sources on the incidence of take-all.

Treatments: This experiment, which was commenced in 1976, was resown with the same treatments on the same plots in 1977 and 1978. Actual rates of application of fertilizers for some treatments varied slightly between seasons.

1. Nil
2. $(\text{NH}_4)_2 \text{SO}_4$ drilled with seed 237 kg/ha
3. $(\text{NH}_4)_2 \text{SO}_4$ topdressed 237 "
4. $\text{NH}_4 \text{NO}_3$ (Agran 34) topdressed 147 "
5. Na NO_3 topdressed 312 "
6. Agras No. 1 drilled 278 "
7. Agras No. 1 drilled 383 "

Methods: Experiment on white sand over gravel at depth. Area cropped to wheat in 1975, heavily infected with take-all. In 1978 the area sown to Camenya (50 kg/ha) on June 19. Super equivalent to 227 kg/ha. Sampled for take-all October 24 (growth stage 37 on H. Fisher scale). Bulk soil pH determined on soil taken from between rows (5 samples per plot). The root soil pH was determined as follows. Most of the soil was shaken from the root system of each plant and discarded. The remaining small amount of soil from each plant was gently shaken off, bulked with similar soil from other plants and the pH determined. All pH determinations are made in 0.01 M CaCl_2 . Results mean of 4 replications.

Results: Tables 1 to 4.

Investigations into the effects of the treatments on the soil/root microflora were undertaken in co-operation with Dr. Sivasithamparam. These results are reported in his summary.

Comments: Treatments had no effect on plant density. Yield results were similar to previous years except that yield from the topdressed ammonium sulphate treatment was higher (N.S.) than the ammonium sulphate drilled (Table 1). Take-all results were similar to previous years, except that

there was an overall drop in severity of about 34% (Table 2). The 1978 planting was the fourth successive wheat crop, but it is too early to determine whether this is a true "take-all decline".

In this experiment the root system of each plant was assessed as usual. The seminal root system was then removed and again assessed by the same method as that used for the whole root system. The effects of the treatment on the severity of take-all on the seminal root systems followed the same pattern as that shown on whole root systems (Table 3). This indicates that the $\text{NH}_4\text{-N}$ is protecting both the seminal and the nodal root systems. In dry seasons this could be of considerable importance to the plant.

The treatments caused highly significant differences in root soil pH (Table 4). The pH difference obtained in 1977 and 1978 were similar. There were also highly significant differences in bulk soil pH. The pH readings at anthesis in 1977 and 1978 (Oct. 6 and Oct. 24) were similar. A major drop in pH in the $\text{NH}_4\text{-N}$ plots has not yet occurred, but this will need to be monitored carefully. The buffering capacity of the soil is being determined. The rise in pH between October 24 and December 10 would be related to changes in soil moisture.

TABLE 1 (76IG25)

EFFECT OF NITROGEN SOURCES ON TAKE-ALL OF WHEAT

Treatments	Rate of N † kg/ha	Plant Parameters				Av. 100 Grain weight (g)	
		Plants per m	Yield kg/ha			1976	1977
7. Agran No. 1 (D)	70	22.0	1999	1322	1571	2.98	3.12
2. $(\text{NH}_4)_2\text{SO}_4$ (D)	50	23.6	1723	1214	1302	2.85	2.86
6. Agran No. 1 (D)	50	22.6	1712	1233	1488	2.80	2.82
3. $(\text{NH}_4)_2\text{SO}_4$ (TD)	50	23.9	1376	1187	1512	2.60	2.61
4. Agran 34 (TD)	50	22.5	997	858	1097	2.68	2.25
5. Na NO_3 (TD)	50	22.2	755	773	632	2.52	2.31
1. Nil	0	21.1	432	595	723	2.53	2.48
LSD Significance P = 0.05		NS	*** 182	*** 154	*** 287	** 0.22	*** 0.28
							NS

† Rates of nitrogen have varied slightly from these rates during the three years of the experiment.

TABLE 2 (761G25)

EFFECT OF NITROGEN SOURCES ON TAKE-ALL OF WHEAT

Take-all incidence 1976 to 1978

Treatments	Rate of N kg/ha	Take-all Incidence %									
		Nil		L		M		S		M + S	
		1976	1977	1976	1977	1976	1977	1976	1977	1976	1977
7 Agrads No. 1 (D)	70	1	4	50 ^A	54 ^A	41	32	8 ^A	10 ^A	49 ^A	42 ^A
2 (NH ₄) ₂ SO ₄ (D)	50	2	2	51 ^A	56 ^A	38	31	10 ^A	11 ^A	48 ^A	42 ^A
6 Agrads No. 1 (D)	50	3	2	43 ^{AB}	48 ^A	38	36	16 ^A	14 ^{AB}	54 ^{AB}	50 ^A
3 (NH ₄) ₂ SO ₄ (TD)	50	2	0	28 ^{BC}	49 ^A	51	30	19 ^{AB}	21 ^{ABC}	70 ^{BC}	51 ^A
4 Agrads 34 (TD)	50	1	0	16 ^{CD}	28 ^B	54	42	29 ^B	30 ^{BC}	83 ^{CD}	72 ^B
5 Na NO ₃ (TD)	50	1	0	11 ^D	19 ^B	36	42	52 ^C	39 ^{CD}	88 ^D	81 ^B
1 Nil	0	0	1	7 ^D	19 ^B	37	30	56 ^C	50 ^D	93 ^D	80 ^B
LSD						NS	NS	***	***	***	***

TABLE 3 (761G25)

EFFECT OF NITROGEN SOURCES ON TAKE-ALL OF WHEAT

Comparison of seminal root and whole root systems

Treatments	Rate of N kg/ha	Take-all Incidence %							
		Nil		L		M		S	
		Sem.	Whole	Sem.	Whole	Sem.	Whole	Sem.	Whole
7. Agras No. 1 (D)	70	25 ^A	9 ^{AB}	48 ^{AB}	81 ^A	24	9 ^A	3 ^A	1 ^A
2. (NH ₄) ₂ SO ₄ (D)	50	9 ^B	5 ^B	58 ^A	84 ^A	29	10 ^A	4 ^A	1 ^A
6. Agras No. 1 (D)	50	13 ^B	6 ^B	48 ^{AB}	76 ^{AB}	31	16 ^A	8 ^{AB}	2 ^A
3. (NH ₄) ₂ SO ₄ (TD)	50	28 ^A	17 ^A	30 ^{BC}	69 ^{AB}	31	12 ^A	11 ^B	2 ^A
4. Agras 34 (TD)	50	2 ^C	1 ^C	34 ^B	72 ^{AB}	43	20 ^A	21 ^{BC}	7 ^{AB}
5. Na NO ₃ (TD)	50	0 ^C	1 ^C	14 ^C	40 ^C	35	42 ^B	51 ^D	17 ^B
1. Nil	0	0 ^C	0 ^C	15 ^C	56 ^{BC}	49	35 ^B	36 ^{CD}	9 ^B
LSD		***	***	**	**	NS	***	***	*
		***	***	**	**	NS	***	***	***

EFFECT OF NITROGEN SOURCES ON TAKE-ALL OF WHEAT

pH (in 0.01 m CaCl_2)

Treatments	Rate of N kg/ha	Root Soil pH		Bulk Soil pH				Dec. 10 1978
		Oct. 6 1977	Oct. 24 1978	Oct. 6 1977	June 12 [†] 1978	July 31 1978	Oct. 24 1978	
7. Agras No. 1 (D)	70	4.76	4.90	4.54	4.87	4.31	4.37	5.18
2. (NH ₄) ₂ SO ₄ (D)	50	4.72	5.09	4.60	4.91	4.46	4.59	5.33
6. Agras No. 1 (D)	50	4.64	5.02	4.52	4.92	4.33	4.54	5.34
3. (NH ₄) ₂ SO ₄ (TD)	50	4.79	4.92	4.58	4.76	4.48	4.38	5.03
4. Agras 34 (TD)	50	5.00	5.21	4.78	5.06	4.72	4.65	5.32
5. NaNO ₃ (TD)	50	5.46	5.38	5.08	5.29	5.00	4.98	5.75
1. Nil	0	5.23	5.31	4.88	5.20	4.99	4.95	5.56
LSD Significance		***	***	***	***	***	***	***
P = 0.05		0.25	0.12	0.17	0.15	0.10	0.12	0.12

† Pre planting

Post harvest

EFFECT OF NITROGEN SOURCES ON TAKE-ALL

Experiment: 77E4

Location: Esperance Downs Research Station (CW17)

Aim: To study the effect of two years of the same nitrogen treatment on the incidence and build up of take-all in wheat.

Treatment: This experiment was resown in 1978. Actual rates of application of fertilizers for some treatments varied slightly between seasons. Nitrogen equivalent to 25 kg/ha.

1. Nil
2. Na NO_3 topdressed 156 kg/ha
3. Agran 34 topdressed 74 "
4. Urea topdressed 54 "
5. $(\text{NH}_4)_2 \text{SO}_4$ drilled with seed 119 "
6. Agras No. 1 drilled with seed 139 "
7. Agras No. 2 drilled with seed 208 "
8. D.A.P. 18:46 drilled with seed 139 "

For T.1, 2, 3 and 4 super drilled with seed (290 kg/ha); T.5, 6 and 7 as mixture (290, 177, 64).

Methods: Sandy gravel over clay at about 40 cm. Area virgin 1965, sown to Kondinin Rose clover in 1966, clover nearly disappeared in 1968 leaving grass pasture (predominantly silver grass with some barley grass) until 1976. The level of take-all in 1977 was low and the treatments had no effect (Table 1). In 1978 area combined June 16, Sprayseed July 4, sown Egret (128 kg/ha - incorrect rate) on July 6. Sampled for take-all at G.S. 36. Results mean of four replications.

Results: Table 1.

Comments: The take-all level was moderate to high. The treatments caused significant differences in yield and take-all incidence. The $\text{NH}_4\text{-N}$ effect on take-all was evident in this experiment.

TABLE 1 (77E4)
EFFECT OF NITROGEN SOURCES ON TAKE-ALL

Results 1977 and 1978

Treatment	Plants per m		Yield kg/ha		Av. 100 Grain Weight (g)	
	1977	1978	1977	1978	1977	1978
1. Nil	20.1	55.8	2556	1441	3.84	3.32
2. Na NO ₃	18.7	60.2	2611	1746	3.63	3.42
3. Agran 34	21.6	70.5	2692	1928	3.76	3.54
4. Urea	19.0	70.0	2570	1570	3.82	3.34
5. (NH ₄) ₂ SO ₄	14.1	52.9	2621	2390	3.98	3.59
6. Agras No. 1	17.7	61.3	2642	2112	3.78	3.42
7. Agras No. 2	15.8	63.2	2681	2041	3.77	3.32
8. D.A.P.	18.2	70.5	2634	2116	3.73	3.38
LSD Significance P = 0.05	NS	* 11.6	NS	** 430	NS	NS

Treat	Take-all Incidence %									
	Nil		L		M		S		M & S	
	1977	1978	1977	1978	1977	1978	1977	1978	1977	1978
1	72	6 ^A	27	28	1	19	0	47 ^C	1	66 ^C
2	77	9 ^{AB}	21	32	2	19	0	40 ^C	2	59 ^C
3	77	10 ^{AB}	22	37	1	22	0	31 ^{BC}	1	53 ^{BC}
4	80	17 ^{ABC}	20	33	0	18	0	32 ^{BC}	0	50 ^{BC}
5	82	39 ^D	18	41	0	16	0	4 ^A	0	20 ^A
6	82	26 ^{BC}	17	43	1	17	0	14 ^{AB}	1	31 ^{AB}
7	86	29 ^{CD}	14	38	0	15	0	18 ^B	0	33 ^{AB}
8	79	27 ^{CD}	20	40	1	16	0	17 ^B	1	33 ^{AB}
LSD	NS	*	NS	NS	-	NS	-	***	-	**

EFFECT OF NITROGEN SOURCES ON TAKE-ALL (WHEAT)

Experiment: 77MT19

Location: Mt. Barker Research Station (N1B)

Aim: To study the effect of two years of the same nitrogen treatment on the incidence and build-up of take-all in wheat.

Treatment: This experiment was resown in 1978. Actual rates of application of fertilizers for some treatments varied slightly between seasons. Nitrogen equivalent to 45 kg/ha.

1. Nil
2. Na NO_3 topdressed 281 kg/ha
3. Agran 34 topdressed 132 "
4. Urea topdressed 98 "
5. $(\text{NH}_4)_2 \text{SO}_4$ topdressed 214 "
6. " " drilled with seed 214 "
7. Agras No. 1 drilled with seed 250 "

For T1, 2, 3, 4 and 5, super drilled with seed (205 kg/ha); T6 as mixture (205 kg/ha).

Method: Site loamy gravel over clay. Grass dominant pasture in 1976. The level of take-all in 1977 was moderate to high and the treatments had significant effects on take-all incidence and yield (Table 1). In 1978 sown to Egret (50 kg/ha) on June 13. Sampled for take-all at G.S. 37. Results mean of 4 replications.

Results: Table 1.

Comments: Treatments had no significant effect on take-all incidence or yield. The level of take-all was moderate with a general small drop in overall level compared to 1977. The reason for the ineffectiveness of the treatments in this experiment remain unknown. This may mean that under the wet conditions of Mt. Barker, the $\text{NH}_4\text{-N}$ effective is inoperative in some years. Yields were considerably lower than in 1977 although grain size was larger in 1978.

TABLE 1 (77MT19)
EFFECT OF NITROGEN SOURCES ON TAKE-ALL

Results 1977 and 1978

Treatment	Plants per m		Yield kg/ha		Av. 100 Grain Weight (g)	
	1977	1978	1977	1978	1977	1978
6. $(\text{NH}_4)_2 \text{SO}_4^{\text{D}}$	21.6	24.7	4266	2703	2.18	2.98
7. Agras No. 1	20.6	22.6	3959	2636	2.46	3.01
5. $(\text{NH}_4)_2 \text{SO}_4^{\text{TD}}$	23.2	24.7	3497	2392	1.98	2.85
3. Agras 34	23.6	31.7	3267	2364	1.86	2.83
4. Urea	24.6	28.6	3300	2495	2.00	2.87
2. Na NO_3	23.6	27.1	3356	2418	1.85	2.93
1. Nil	27.2	25.4	2988	2412	2.02	3.00
LSD Significance P = 0.05	NS	*	***	NS	NS	NS
		4.5	405			

Treat	Take-all Incidence %									
	Nil		L		M		S		M + S	
	1977	1978	1977	1978	1977	1978	1977	1978	1977	1978
6.	6	9	43 ^A	48	36	31	15 ^A	12	51 ^A	43
7.	6	10	39 ^{AB}	53	34	26	21 ^{AB}	11	55 ^{AB}	37
5.	5	15	28 ^{BC}	49	43	28	24 ^{AB}	8	67 ^{BC}	36
3.	2	11	21 ^C	44	49	35	28 ^{BC}	10	77 ^C	45
4.	1	5	18 ^C	40	37	38	44 ^D	17	81 ^C	55
2.	1	7	18 ^C	50	38	30	43 ^D	13	81 ^C	43
1.	1	13	21 ^C	53	38	27	40 ^{CD}	7	78 ^C	34
LSD	NS	NS	**	NS	NS	NS	***	NS	**	NS

EFFECT OF NITROGEN SOURCES ON TAKE-ALL

Experiment: 77LG20

Location: Newdegate Research Station (S3A)

Aim: 1977 - To study the effect of various nitrogen sources on the incidence of take-all in oats (N = 45 kg/ha).
1978 - To determine whether there was any carry-over effects of 1977 treatments in 1978.

Treatments (1977):

1.	Nil		
2.	Na NO ₃	topdressed	280 kg/ha
3.	Agran 34	topdressed	128 "
4.	Urea	topdressed	96 "
5.	(NH ₄) ₂ SO ₄	topdressed	212 "
6.	" "	drilled with seed	212 "
7.	Agras No. 1	drilled with seed	258 "

No treatments in 1978.

Methods (1977): Sandy loam over gravel. Cropped to oats 1976. The oats showed evidence of take-all. Stubble burnt. Sown to West (45 kg/ha) on June 2. Super (205 kg/ha) drilled with seed for T.1, 2, 3, 4 and 5. Super (205 kg/ha) mixed with (NH₄)₂ SO₄ for T.6.

(1978): Area topdressed across plots with urea (50 kg/ha) prior to sowing Gamenya (50 kg/ha) without super on last seasons plots. Sampled for take-all G.S.? Results mean of four replications.

Results: Samples from 1977 were inadvertently destroyed and no take-all results are available. Results for 1978 given in table.

Treatments	Take-all Incidence %					Yield kg/ha	
	Nil	L	M	S	M + S	1977 Oats	1978 Wheat
1	29	64	5	1	6	656	689
2	25	61	12	2	14	1280	914
3	23	69	7	0	7	1397	1059
4	27	66	6	1	7	1148	773
5	37	58	5	0	5	1120	754
6	35	61	4	0	4	1110	848
7	39	55	6	1	7	1162	572
LSD	NS	NS	NS	NS	NS	189	NS

Comments: No carry-over effect from 1977 could be detected. This experiment is directly north of 76LG25. It has a similar site history to 76LG25, except it had oats 1976 without nitrogen sources and oats 1977 as above. The level of take-all in nil treatments were 76LG25 - M + S = 44%, 77LG20 - M + S = 6%. Two seasons of oats has controlled take-all but has not eliminated it.

TAKE-ALL, NITROGEN SOURCES AND RATES

Experiment: 78BR2

Location: W.R. White & Son, Dinninup

Aim: To continue the investigation into the effect of various N sources on take-all.

Treatments:

1.	Nil					
2.	(NH ₄) ₂ SO ₄	drilled with seed	71 kg/ha	(N = 15)		
3.	"	"	"	143	"	(N = 30)
4.	"	"	"	214	"	(N = 45)
5.	"	"	"	286	"	(N = 60)
6.	Agras No 1	"	"	250	"	(N = 45)
7.	Agras No 2	"	"	375	"	(")
8.	DAP	"	"	250	"	(")
9.	Agran 34 top	dressed		132	"	(")
10.	NaNO ₃	"		281	"	(")
11.	Urea	"		98	"	(")

Actual rates of application for some treatments may vary slightly from the quoted rates. For T1, 2, 3, 4 and 5 double-super drilled with seed (280 kg/ha); T6 and 7 double-super drilled (171 & 61); T8 no super; T9, 10 and 11 as mixture (280).

Methods: Site loamy gravel. Grass dominant pasture 1977. Egret wheat 1978. No other details available. Sampled for take-all at G.S.37. Results mean of 3 replications.

Results: Table 1.

Comments: Although there were significant differences in level of take-all((NH₄)₂SO₄ at 60 kg/ha of N had lowest level of take-all while NaNO₃ had the highest level) the difference were not great enough to significantly influence yield.

The experimental site was heavily infested with weeds; these may have complicated the yield results.

TABLE 1 (78BR2)

EFFECT OF NITROGEN SOURCES ON TAKE-ALL

Treatment	Rate of N kg/ha	Plants per m	Take-all incidence %				Yield kg/ha	Av. 100 grain weight (g)
			Nil + L [†]	M	S	M + S		
1 Nil	0	21.6	63 ^B	26	11	37 ^B	1350	3.64
2 (NH ₄) ₂ SO ₄	15	19.7	62 ^{AB}	23	15	38 ^{BC}	1219	3.49
3 "	30	19.7	65 ^B	27	8	35 ^B	1359	3.43
4 "	45	19.6	76 ^{BC}	17	7	24 ^{AB}	1550	3.50
5 "	60	19.7	84 ^C	12	4	16 ^A	1659	3.44
6. Agras 1	45	17.5	73 ^{BC}	20	7	27 ^{AB}	1553	3.48
7. Agras 2	"	23.7	79 ^{BC}	14	7	21 ^{AB}	1647	3.54
8. DAP	"	20.8	74 ^{BC}	15	11	26 ^{AB}	1193	3.47
9. Agras 34	"	20.7	68 ^{BC}	21	11	32 ^{AB}	1306	3.42
10. NaNO ₃	"	22.9	42 ^A	28	30	58 ^C	1287	3.37
11. Urea	"	20.5	64 ^B	26	10	36 ^B	1553	3.44
LSD Significance		NS	*	NS	NS	*	NS	NS

[†] Because the soil was black and difficult to wash off, nil and light categories were combined to save time during assessing.

TAKE-ALL, NITROGEN SOURCES AND RATES

Experiment: 78ES 8

Location: H. Oesterhuis, East of Scadden (PO Box 628 Esperance)

Aim: To continue the investigation into the effect of various N sources on take-all.

Treatment:

1.	Nil					
2.	(NH ₄) ₂ SO ₄	drilled with seed	71 kg/ha	(N = 15)		
3.	"	"	"	143	"	(N = 30)
4.	"	"	"	214	"	(N = 45)
5.	"	"	"	286	"	(N = 60)
6.	Agras No 1	"	"	250	"	(N = 45)
7.	Agras No 2	"	"	375	"	(")
8.	DAP	"	"	250	"	(")
9.	Agran 34 top	dressed		132	"	(")
10.	NaNO ₃	"		281	"	(")
11.	Urea	"		98	"	(")

Actual rates of application for some treatments may vary slightly from the quoted rates. For T1, 2, 3, 4 and 5 double-super drilled with seed (280 kg/ha); T6 and 7 double-super drilled (171 & 61); T8 no super; T9, 10 and 11 as mixture (280).

Methods: Circle Valley sandy loam. Cleared 1975. Wheat 1976 with 102 kg/ha of Agras No 1 (18N) and 1977 with 190 kg/ha of Agras No 2 (23N). Sown to Egret (50 kg/ha) on June 8. Sampled for take-all at G.S.41. Results mean of 3 replications.

Results: Table 1.

Comments: The level of take-all at this site was extremely high. As this was the third consecutive crop on new land, a high level of take-all could be expected. The use of low levels of Agras No 1 and Agras No 2 in 1976 and 1977 respectively failed to prevent a major take-all problem in 1978. There were highly significant differences in yield between treatments, but most of these differences could be accounted for by differences in rates of N.

TABLE 1 (78ES8)
EFFECT OF NITROGEN SOURCES ON TAKE-ALL

Treatment	Rate of N kg/ha	Plants per m	Take-all Incidence %					Yield kg/ha	Av. 100 grain weight (g)
			Nil	L	M	S	M & S		
1. Nil	0	14.7	0	0	1 ^A	99 ^E	100	75	2.16
2. (NH ₄) ₂ SO ₄	15	17.3	0	0	0 ^A	100 ^E	100	131	2.35
3. "	30	16.0	0	0	2 ^{AB}	98 ^{BCDE}	100	265	2.53
4. "	45	18.9	0	0	9 ^{BC}	91 ^{ABC}	100	428	2.51
5. "	60	16.1	1	3	4 ^{ABC}	92 ^{ABC}	96	575	2.40
6. Agras 1	45	18.2	2	2	6 ^{BC}	90 ^{AB}	96	391	2.40
7. Agras 2	"	17.7	1	3	11 ^C	85 ^A	96	418	2.39
8. DAP	"	17.8	0	3	3 ^{ABC}	94 ^{ABCD}	97	163	2.41
9. Agras 34	"	17.9	0	0	1 ^A	99 ^{DE}	100	419	2.40
10. NaNO ₃	"	18.3	0	3	4 ^{ABC}	93 ^{ABCD}	97	356	2.41
11. Urea	"	19.9	1	1	6 ^{ABC}	92 ^{ABCD}	98	262	2.61
LSD Significance p = 0.05		NS	-	-	**	**	-	*** 160	NS

TAKE-ALL, NITROGEN SOURCES AND RATES

Experiment: 78LG4

Location: G. Cugley, South Newdegate

Aim: To continue the investigation into the effect of various N sources on take-all.

Treatments:

1.	Nil					
2.	(NH ₄) ₂ SO ₄	drilled with seed	71 kg/ha	(N = 15)		
3.	"	"	"	143	"	(N = 30)
4.	"	"	"	214	"	(N = 45)
5.	"	"	"	286	"	(N = 60)
6.	Agras No 1	"	"	250	"	(N = 45)
7.	Agras No 2	"	"	375	"	(")
8.	DAP	"	"	250	"	(")
9.	Agran 34	top dressed		132	"	(")
10.	NaNO ₃	"		281	"	(")
11.	Urea	"		98	"	(")

Actual rates of application for some treatments may vary slightly from the quoted rates. For T1, 2, 3, 4 and 5 double-super drilled with seed (280 kg/ha); T6 and 7 double-super drilled (171 & 61); T8 no super; T9, 10 and 11 as mixture (280).

Methods: Area mallee, white sand over clay. Pasture clover and silver grass 1977. Sown with Gamenya (50 kg/ha) on June 15. Sampled for take-all G.S.37. Results mean of 3 replications.

Results: Table 1

Comments: There was a low to moderate level of take-all. Treatments significantly affected incidence only in the moderate category. Although there were significant differences in yield, these do not appear to be related to take-all incidence.

TABLE 1 (78LG4)

EFFECT OF NITROGEN SOURCES ON TAKE-ALL

Treatment	Rate of N kg/ha	Plants per m	Take-all Incidence %				Yield kg/ha
			Nil	L	M	S	
1. Nil	0	21.7	67	21	8 ^{ABC}	4	1834
2. (NH ₄) ₂ SO ₄	15	21.6	62	8	15 ^D	15	1650
3. "	30	21.3	57	18	13 ^{CD}	12	1769
4. "	45	18.0	70	17	4 ^A	9	1859
5. "	60	20.4	74	15	5 ^A	6	1949
6. Agras 1	45	22.8	58	21	10 ^{BCD}	11	1871
7. Agras 2	"	23.0	76	12	5 ^A	7	1852
8. DAP	"	18.1	58	23	11 ^{BCD}	8	1784
9. Agras 34	"	19.1	60	17	15 ^D	8	1703
10. NaNO ₃	"	24.3	55	23	11 ^{BCD}	11	1575
11. Urea	"	21.7	71	15	7 ^{AB}	7	1793
LSD Significance p = 0.05		* 3.8	NS	NS	**	NS	* 199

TAKE-ALL, NITROGEN SOURCES AND RATES

Experiment: 78KA6

Location: F. Berger, Nyabing

Aim: To continue the investigation into the effect of various N sources on take-all.

Treatments: As 78BR2 except 250 kg/ha of triple super used rather than 280 kg/ha of double super.

Methods: Site grey sand over clay. Newland crop 1975. Pasture 1976 & 1977. Sown with Egret (50 kg/ha) on June 7. Sampled for take-all at G.S.37. Results mean of 3 replications.

Results: Table 1

Comments: Level of take-all low to moderate. Treatments caused some significant differences in incidence of take-all and yield.

TABLE 1 (78KA6)
EFFECT OF NITROGEN SOURCES ON TAKE-ALL

Treatment	Rate of N kg/ha	Plants per m	Take-all Incidence %				M & S	Yeild kg/ha
			Nil	L	M	S		
1. Nil	0	19.9	16	42	34 ^C	8	42 ^B	800
2. (NH ₄) ₂ SO ₄	15	18.3	22	59	16 ^{AB}	3	19 ^A	1275
3. "	30	15.1	32	56	10 ^A	2	12 ^A	1006
4. "	45	13.3	23	57	16 ^{AB}	4	20 ^A	1250
5. "	60	12.9	27	60	9 ^A	4	13 ^A	1400
6. Agras 1	45	18.3	28	51	15 ^{AB}	6	21 ^A	1159
7. Agras 2	"	16.3	22	63	13 ^{AB}	2	15 ^A	1337
8. DAP	"	16.1	43	45	8 ^A	4	12 ^A	1156
9. Agras 34	"	22.7	30	54	10 ^A	6	16 ^A	1650
10. NaNO ₃	"	20.4	10	48	26 ^{BC}	16	42 ^B	887
11. Urea	"	19.1	20	61	14 ^{AB}	5	19 ^A	1116
LSD Significance p = 0.05		** 4.9	NS	NS	*	NS	**	* 426

TAKE-ALL, NITROGEN SOURCES AND RATES

Experiment: 78NA5

Location: Beattie Bros, Yealering

Aim: To continue the investigation into the effect of various N sources on take-all.

Treatments:

1.	Nil					
2.	(NH ₄) ₂ SO ₄	drilled with seed	71 kg/ha	(N = 15)		
3.	"	"	"	143	"	(N = 30)
4.	"	"	"	214	"	(N = 45)
5.	"	"	"	286	"	(N = 60)
6.	Agras No 1	"	"	144	"	(N = 26)
7.	Agras No 2	"	"	300	"	(" 36)
8.	DAP	"	"	250	"	(" 45)
9.	Agran 34 top	dressed		132	"	(")
10.	NaNO ₃	"		281	"	(")
11.	Urea	"		98	"	(")

Actual rates of application for some treatments may vary slightly from the quoted rates. For T1, 2, 3, 4 and 5 double-super drilled with seed (280 kg/ha); T6 and 7 double-super drilled (171 & 61); T8 no super; T9, 10 and 11 as mixture (280).

Due to an error treatments 6 and 7 received less than the planned level of N.

Methods: Site red/brown loamy sand and gravel over red/brown loamy clay at 18 cm. Cleared 1963. Sown clover-1965. Rotation 1 year crop, 2 year pasture. Area cropped to wheat 1977 with 100 kg/ha of Agras No 1. (Note latter fact unknown when site selected). Sown with Egret (50 kg/ha) on June 13. Sampled for take-all at G.S.37. Results mean of 3 replications.

Results: Table 1.

Comments: In this experiment there was a high level of take-all but no treatment differences were significant. Although take-all incidence tended to follow an expected pattern (eg. NaNO₃ - 78% M + S, Nil - 67% and Agras No 1 - 55%) the results were disappointing. The 100 kg/ha of Agras No 1 in 1977 may have masked the effects of NH₄ - N or take-all in 1978. Yield results were significantly different and followed an expected pattern.

Note:- Interesting relationship between take-all incidence in 78NA4 and 78NA5 discussed in summary of 78NA4.

TABLE 1 (78NA5)
EFFECT OF NITROGEN SOURCES ON TAKE-ALL

Treatment	Rate of N kg/ha	Plants per m	Take-all Incidence %					Yield kg/ha	Av 100 grain weight (g)
			Nil	L	M	S	M & S		
1 Nil	0	20.8	8	25	29	38	67	894	3.37
2 (NH ₄) ₂ SO ₄	15	23.3	6	26	26	42	68	878	3.29
3 "	30	21.5	8	30	23	39	52	1050	3.44
4 "	45	25.9	10	25	36	29	65	1084	3.47
5 "	60	18.0	4	31	31	34	65	1175	3.41
6 Agras 1	26	23.6	12	33	28	27	55	1284	3.31
7 Agras 2	36	23.0	11	33	26	30	56	1312	3.36
8 DAP	"	21.5	7	36	27	30	57	1266	3.32
9 Agras 34	"	28.6	6	24	29	41	70	1256	3.42
10. NaNO ₃	"	20.7	3	19	32	46	78	778	3.39
11. Urea	"	23.2	12	31	21	36	57	1262	3.31
LSD Significance p = 0.05		NS	NS	NS	NS	NS	NS	*** 230	NS

TAKE-ALL, NITROGEN SOURCES AND RATES OF SOWING

Experiment: 78ES9

Location: D. Reichstein, East of Scadden (Box 429 Esperance)

Aim: To determine whether higher than normal rates of sowing can overcome the problem of poor emergence in wheat sown with high rates of N and also to examine the possible interaction of seed rates x rates N on take-all incidence.

Treatments:

1.	Nil N - Wheat 40 kg/ha
2.	" - " 60 "
3.	" - " 80 "
4.	" - " 100 "
5. to 8.	Urea drilled 54 kg/ha (N = 25) x 40, 60, 80 or 100.
9. to 12.	(NH ₄) ₂ SO ₄ drilled 119 kg/ha (N = 25) x 40, 60, 80 or 100.
13. to 16.	(NH ₄) ₂ SO ₄ drilled 238 kg/ha (N = 50) x 40, 60, 80 or 100.

Actual rates of application of some treatments may vary slightly from the quoted rates. Experimental area topdressed with super (158 kg/ha) prior to sowing.

Methods: Circle Valley sand. Cleared 1973, fallow 1974, wheat 1975, pasture 1976 and 1977. Egret sown June 14, 1978. Sampled for take-all at G.S.38. Results mean of 3 replications.

Results: Table 1

Comments: The rate of sowing had a highly significant effect on plant density but no effect on yield or take-all incidence. There was a low level of take-all, but the NH₄-N reduced take-all significantly. Only in the M + S category was the Urea treatment significantly different from Nil. There was a considerable amount of Rhizoctonia at this site. Urea and (NH₄)₂SO₄ (50 N) caused a significant increase in Rhizoctonia. Under the low incidence of take-all differences in yield were probably mainly related to levels of N.

TABLE 1 (78ES9)
TAKE-ALL, NITROGEN SOURCES AND RATES OF SOWING

Type	N Seed Rate	Nil	UREA 25	(NH ₄) ₂ SO ₄ 25	(NH ₄) ₂ SO ₄ 50	Seed rate means	Sign. of treatment means
Plts/m	40	17.5	8.5	11.8	9.3	11.8	*** (3.8)
	60	28.2	14.5	17.5	12.8	18.2 (§)	
	80	40.5	15.2	29.8	20.1	26.4	
	100	48.1	21.9	32.5	26.1	32.1	
	Mean	33.6	15.0	22.9	17.1	*** (§)	
Take- all Nil %	40	63	72	71	74	70	NS NS
	60	59	76	80	78	73	
	80	49	78	82	72	70	
	100	61	57	86	81	71	
	Mean ⁺	58 ^A	71 ^{AB}	80 ^B	76 ^B	*	
L %	40	18	18	16	17	17	NS NS
	60	19	11	8	16	14	
	80	21	10	8	19	14	
	100	15	22	11	11	15	
	Mean	18	15	11	16	NS	
M %	40	11	6	7	6	8	NS NS
	60	10	7	5	4	6	
	80	15	4	6	8	8	
	100	11	13	6	5	9	
	Mean	12 ^B	8 ^{AB}	6 ^A	6 ^A	*	
S %	40	8	3	6	2	5	NS NS
	60	13	6	6	3	7	
	80	16	8	5	1	8	
	100	13	8	1	3	6	
	Mean	12 ^B	6 ^{AB}	4 ^A	2 ^A	**	
M + S %	40	19	9	13	9	12	NS NS
	60	19	14	11	7	13	
	80	31	12	10	9	16	
	100	24	21	4	8	14	
	Mean	23 ^B	14 ^A	10 ^A	8 ^A	**	
Rhiz- octonia %	40	1.1	13.1	3.5	11.5	5.7	NS ***
	60	0.5	14.1	2.6	11.4	5.3	
	80	0.5	11.2	0.6	18.6	5.0	
	100	0	16.9	6.6	5.2	5.1	
	Mean	0.4 ^A	13.1 ^B	2.5 ^A	10.6 ^B	***	
Yield kg/ha	40	247	884	681	956	692	NS *** (359)
	60	506	693	834	968	750	
	80	487	806	678	1178	787	
	100	397	740	1046	975	790	
	Mean	409 ^A	781 ^B	810 ^B	1019 ^C	*** (180)	

() = LSD for p = 0.05

§ As there was a significant (***) interaction between Rates X N sources no LSD values can be provided

TAKE-ALL, NITROGEN SOURCES AND RATES OF SOWING

Experiment : 78KA5

Location : T Wilcox, Woodanilling

Aim : As 78ES 9

Treatments : As 78ES9 except that the Urea treatments (T5 to T8) were not included. Area topdressed with super (200 kg/ha) prior to sowing.

Methods : Loamy soil with gravel. Crop 1975. Pasture 1976 and 1977. No other details provided. Egret sown June 12. Sampled for take-all at G.S. 37. Results mean of 3 replications.

Results : Table 1.

Comments : Rate of sowing had highly significant effect on plant density but no effect on yield or take-all incidence. There was a low level of take-all. Both rates of $\text{NH}_4\text{-N}$ reduced take-all incidence compared to nil N, but there was no significant differences between 25 and 50 N. The low levels of take-all failed to influence yield.

TABLE 1 (78KA5)

TAKE-ALL, NITROGEN SOURCES AND RATES OF SOWING

Type	Seed Rate	N	(NH ₄) ₂ SO ₄	(NH ₄) ₂ SO ₄	Seed Rate Means	Sign. of Treatment Means
		Nil	25	50		
Plts/m	40	20.5	16.1	12.0	16.2	*** (8.7)
	60	24.0	22.1	17.2	21.1 (**)	
	80	28.7	26.3	24.5	26.5 (4.3)	
	100	36.5	39.1	28.8	34.8	
	Mean	27.4	25.9	20.6	*** (5.0)	
Take-all Nil + L %	40	70	78	83	77	* NS
	60	68	78	84	77	
	80	71	85	88	81	
	100	66	88	85	80	
	Mean	69 ^A	82 ^B	85 ^B	***	
M %	40	23	20	16	20	NS NS
	60	24	20	15	20	
	80	25	12	10	16	
	100	29	10	14	18	
	Mean	25 ^A	16 ^B	14 ^B	**	
S %	40	7	2	1	3	NS ***
	60	8	2	1	4	
	80	4	3	2	3	
	100	5	2	1	3	
	Mean	6 ^A	2 ^B	1 ^B	***	
M + S %	40	30	22	17	23	NS *
	60	32	22	16	23	
	80	29	15	12	19	
	100	34	12	15	20	
	Mean	31 ^A	18 ^B	15 ^B	***	
Yield kg/ha	40	3046	2890	2468	2802	NS NS
	60	2546	3031	2593	2724	
	80	2359	2905	2937	2734	
	100	2484	2821	2719	2675	
	Mean	2609	2912	2679	NS	

() = LSD for $p = 0.05$

TAKE-ALL, NITROGEN SOURCES AND RATES OF SOWING

Experiment: 78NA4

Location: Beattie Bros, Yealering

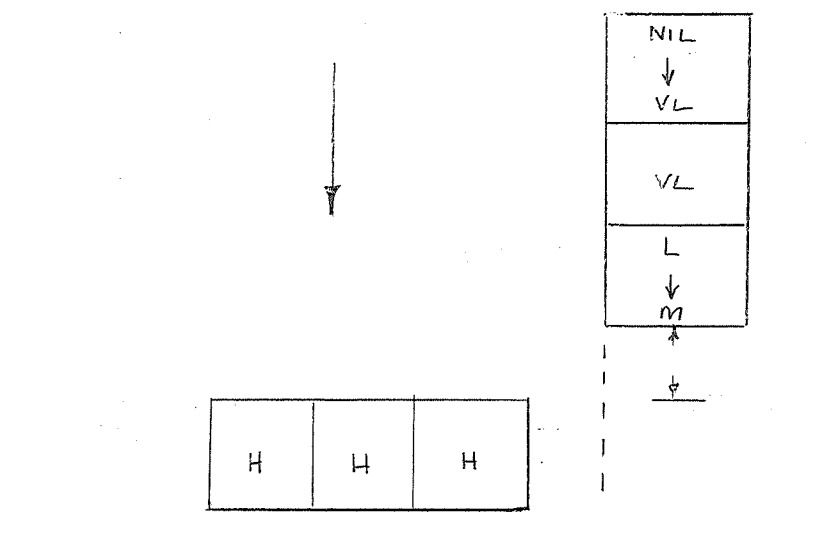
Aim: as 78ES9

Treatments: As 78ES9 except that the Urea treatments (T5 to 8) were not included. Treatment 11 ((NH₄)₂SO₄ at 50N) was sown at 90 kg/ha rather than 80. Area top-dressed with super (195 kg/ha) prior to sowing.

Methods: Yellow loamy sand over yellow/red clay loam at 20cms. Other details as 78NA5. Egret sown June 13. Sampled for take-all at GS37. Results mean of 3 replications.

Results: Tables 1 and 2.

Comments: Rates of sowing had highly significant effects on plant density (analyses for seed rate and N sources not completed but figures for plant numbers similar to 78KA5), but no effect on yield. The take-all situation in this experiment was most interesting. The experiment was in the same paddock as 78NA5 (see map)



In 78NA4 replications 1 and 2 had very low levels of take all (Table 2). Plots 1 to 19 were all nils or very low incidence. From plot 20 onwards take-all incidence increased to where more than half the plants were infected in plot 36. In contrast, incidence in 78NA5 ranged from 80 to 100% of plants infected per plot (Rep 1-87 to 100%, Rep 2-80 to 96% 82 to 100%). The reason for this marked change in incidence over such a short distance within the same paddock is unknown. It maybe related to a change in soil type. There is a major change in soil type across replication 3 from yellow sand to red/brown loamy sand with gravel. It may also be related to slope of land, moisture differences,

changes in grass content or some farmer practice unknown to us when the experimental sites were chosen. Discussions with the farmer appears to have ruled out the latter possibility.

No analyses of take-all results was attempted.

TABLE 1 (78NA4)

TAKE-ALL NITROGEN SOURCES AND RATES OF SOWING

Type	Seed N Rate	NIL	(NH ₄) ₂ SO ₄ 25	(NH ₄) ₂ SO ₄ 50	Seed Rate means	Sign. of treatment means
Plts/m	40	21.1	17.7	13.1	17.3	*** (7.5)
	60	30.1	25.5	19.4	25.0	
	80	36.7	35.8	23.7	32.1	
	100	44.4	40.2	31.7	38.8	
	Mean	33.1	29.8	22.0	NA	
Yield Kg/ha	40	1337	1556	1150	1348	NS
	60	1428	1397	1337	1387	
	80	1390	1269	1497	1385	
	100	1156	1359	1415	1310	
	Mean	1328	1395	1350	NS	

() = LSD for p = 0.05

TABLE 2 (78NA4)

TAKE-ALL NITROGEN SOURCES AND RATES OF SOWING

Plot results for Nil take-all

Plot No	% Nil	Plot No	% Nil	Plot No	% Nil
1	100	13	99	25	70
2	100	14	97	26	78
3	100	15	95	27	87
4	100	16	100	28	72
5	100	17	100	29	81
6	98	18	99	30	85
7	98	19	100	31	72
8	100	20	93	32	81
9	99	21	97	33	71
10	100	22	96	34	55
11	93	23	96	35	55
12	100	24	85	36	49

TAKE-ALL, ROW SPACING AND RATES OF NITROGEN

Experiment: 78ES10

Location: R. Curby, Salmon Gums

Aim: To test the following hypothesis :- Drilling the $\text{NH}_4\text{-N}$ fertilizer with the seed at 36 cm row spacing rather than 18 cm spacing should double the concentration of $\text{NH}_4\text{-N}$ around the roots. Take-all control should be maintained but with half the rate of application of $\text{NH}_4\text{-N}$ per unit area.

Treatments:

1.	Nil x 18 cm spacing	(N = 0)
2.	$(\text{NH}_4)_2\text{SO}_4$ (24 kg/ha) drilled x 18cm	(N = 5)
3.	" " (48 kg/ha) " x "	(N = 10)
4.	" " (95 kg/ha) " x "	(N = 20)
5.	" " (190 ") " x "	(N = 40)
6.	" " (381 ") " x "	(N = 80)
7.	" " (190 ") " x "	(N = 40)
8.	Nil x 36 cm spacing	(N = 0)
9.	$(\text{NH}_4)_2\text{SO}_4$ (24 kg/ha) drilled x 36cm	(N = 5)
10.	" " (48 ") " x "	(N = 10)
11.	" " (95 ") " x "	(N = 20)
12.	" " (190 ") " x 36cm	(N = 40)
13.	" " (381 ") " x "	(N = 80)
14.	" " (190 ") " x "	(N = 40)

Actual rates of application for some treatments may vary slightly from the quoted rates.

Methods: Site wheat 1975, volunteer pasture 1976 and 1977. Area cropped twice. No clover history. Rest of history unknown. Site topdressed (243 kg/ha) prior to sowing. Egret (50 kg/ha) sown June 23. Fertilizers and wheat sown in 36 cm plots by placing two tubes in one boot (i.e. every second boot no tube). Sampled for take-all at G.S.39.

Mean of three replications.

Results: Table 1

Comments:

The treatments had very little effect on plant parameters although wide-spacing significantly reduced yield. The incidence of take all in this experiment was extremely low. Of the 4722 plants assessed only five had any visible infection by G. graminis. However there ~~was~~ a widespread incidence of Rhizoctonia but no significant relationship between Rhizoctonia incidence and the treatments.

TABLE 1 (78ES10)
TAKE-ALL, ROW SPACING AND RATES OF NITROGEN
RESULTS 1978

Type	Row Rates	Spacing cms 18 36		Rates of N means		Sign of treatment means	
pHs per quad- rat 50 x 36 cm	0	22.5	22.1	22.3	NS	NS	Drilled vs Topdressed ⁺ 24.1 23.4 NS
	5	22.5	22.4	22.5			
	10	24.7	22.7	23.7			
	20	22.3	22.5	22.4			
	40	26.6	21.5	24.1			
	80	24.9	20.7	22.8			
	Mean	24.0	23.4	*			
Yield kg/ha	0	1650	1659	1654	NS	* (97)	Drilled vs Topdressed 1646 1709 NS
	5	1740	1643	1692			
	10	1734	1631	1682			
	20	1740	1678	1709			
	40	1700	1593	1646			
	80	1693	1606	1650			
	Mean	1710	1635	***			
Rhiz- oct- onia %	0	9	17	13	NS	NS	Drilled vs Topdressed 22 22 NS
	5	2	16	9			
	10	33	20	27			
	20	21	7	14			
	40	23	21	22			
	80	19	22	21			
	Mean	18	17	NS			

* Treatments 5 and 12 vs Treatments 7 and 14
() = LSD for p = 0.05

TAKE-ALL, ROW SPACING AND RATES OF NITROGEN

Experiment: 78LG 6

Location: B. Eyres, Kulin

Aim: As 78ES10

Treatments: As 78ES10. Two extra treatments added.
15. $(\text{NH}_4)_2\text{SO}_4$ (95 kg/ha + N-serve 2% w/w)
drilled \times 18⁴ cm (N = 20)
16. $(\text{NH}_4)_2\text{SO}_4$ (190 kg/ha + N-serve 2% w/w)
drilled \times 18⁴ cm (N = 40)

Methods: Site grey-brown sandy loam. Wheat 1977.
Area topdressed with double super (130 kg/ha)
prior to sowing. N-serve sprayed on to $(\text{NH}_4)_2\text{SO}_4$
 SO_4 immediately prior to drilling. Madden
(50 kg/ha) sown June 13. Fertilizers and wheat
sown in 36 cm plots by placing two tubes in one
boot. Sampled for take-all at G.S.38. Results
mean of three replications.

Results: Table 1 and Table 2.

Comments: Row spacing had no significant effect on any
parameter. Increasing the rate of $(\text{NH}_4)_2\text{SO}_4$
reduced plant density, grain yield and take-all
incidence and severity. Plots with the high
rates of nitrogen looked excellent in early
September but hayed off towards the end of the
season. This indicates moisture stress toward
the end of the growing season.

There is some evidence (Table 2) that the
principle being investigated may have worked.
Before any definite statement could be made
analyses of the regression will be necessary.

TABLE 1. (78LG6)
TAKE-ALL, ROW SPACING AND RATES OF NITROGEN

Type	Row Rates	Spacing (cm)		Rates of N Means	Sign of Treatment means	
Plants per quadrat (50 x 36 cm)	0	24.7	25.5	25.1		Drilled vs Topdressed †
	5	25.9	25.1	25.5		19.9 22.7
	10	22.1	22.1	22.1 ***	***	NS
	20	21.7	21.3	21.5 (2.8)	(4.0)	- N-serve + §
	40	21.5	18.3	19.9		21.6 23.7
	80	19.3	16.3	17.8		NS
	MEAN	22.5	21.4	NS		
Yield kg/ha	0	959	862	911		Drilled vs Topdressed
	5	790	669	730 *		652 738
	10	959	740	850 (203)	NS	NS
	20	897	703	800		- N-serve +
	40	641	663	652		769 726
	80	575	584	580		NS
	MEAN	804	704	NS		
Take all Nil %	0	6	3	5A		Drilled vs Topdressed
	5	3	7	5A		9 13
	10	11	5	8AB		NS
	20	13	15	14B ***	**	- N-serve +
	40	7	11	9AB		10 7
	80	28	30	29C		NS
	MEAN	11	12	NS		
L %	0	59	49	54A		Drilled vs Topdressed
	5	53	54	53A		74 57
	10	66	59	63AB	NS	**
	20	65	71	68B **		- N-serve +
	40	68	78	73B		67 62
	80	51	58	54A		NS
	MEAN	60	62	NS		
M %	0	27	41	34C		Drilled vs Topdressed
	5	32	33	33C		14 23
	10	21	28	25BC ***	**	NS
	20	19	12	16AB		- N-serve +
	40	21	9	15A		19 23
	80	17	9	13A		NS
	MEAN	23	22	NS		
S %	0	8	7	7B		Drilled vs Topdressed
	5	12	6	8B		2 5
	10	2	8	5AB	*	NS
	20	3	2	2A ***		- N-serve +
	40	4	2	3A		3 6
	80	4	3	3A		NS
	MEAN	6	5	NS		
M+S %	0	35	48	42C		Drilled vs Topdressed
	5	44	39	42C		16 28
	10	23	36	30BC	**	NS
	20	22	14	18AB ***		- N-serve +
	40	25	11	18A		23 28
	80	21	12	17A		NS
	MEAN	28	27	NS		

† Treatments 5 & 12 vs Treatments 7 & 14 () = LSD for p = 0.05
§ " 4 & 5 vs Treatments 15 & 16

TABLE 2 (78LG6)

TAKE-ALL, ROW SPACING AND RATES OF NITROGEN

Rate of $(\text{NH}_4)_2\text{SO}_4$ per unit of drill row (kg)	Take-all incidence % M + S	
	18cm	36cm
0	35	48
5	44	-
10	23	39
20	22	36
40	25	14
80	21	11
160	-	12

TAKE-ALL, ROW SPACING AND RATES OF NITROGEN

Experiment: 78MT8

Location: Mount Barker Research Station (S5)

Aim: As 78ES10

Treatments: As 78ES10

Methods: Site gravelly loam. Grassy pasture 1977. Area topdressed with super (200 kg/ha) prior to sowing. Egret (50 kg/ha) sown June 19. Fertilizer and wheat sown in 36 cm plots by placing two tubes in one boot. Sampled for take-all at G.S. 36. Results mean of three replications.

Results: Table 1.

Comments: Rates of application of $(\text{NH}_4)_2\text{SO}_4$ had no effect on any of the parameters assessed. Row spacing had no effect on any parameter other than yield, which was reduced by wide-spacing. There was a high level of take-all. In both experiments (See also 77MT19) conducted at Mt Barker Research Station in 1978, there was a moderate to high level of take-all, but in neither instance was any control effected by $\text{NH}_4\text{-N}$. The reasons for this ineffectiveness at Mount Barker in 1978 is unknown.

TABLE 1. (78MT8)
TAKE-ALL, ROW SPACING AND RATES OF NITROGEN

Type	Row	Spacing (cm)		Rates of N		Sign of Treatment Means	
	Rates	18	36	Means			
Plants per quadrat (50 x 36cm)	0	25.0	27.7	26.3	NS	NS	† Drilled vs Topdressed 25.9 23.0
	5	23.3	26.4	24.8			
	10	28.7	20.5	24.6			
	20	24.8	25.5	25.1			
	40	28.1	23.7	25.9			
	80	24.8	19.2	22.0			
	MEAN	25.8	23.8	NS			
Yield kg/ha	0	1609	928	1268	NS	** PO.05 = 398	Drilled vs Topdressed 1443 1342
	5	1462	1065	1264			
	10	1749	1072	1410			
	20	1718	1037	1378			
	40	1598	1287	1443			
	80	1632	1409	1521			
	MEAN	1628	1133	***			
Take all Nil %	0	3	1	2	NS	NS	Drilled vs Topdressed 4 5
	5	4	1	3			
	10	7	0	4			
	20	5	3	4			
	40	2	6	4			
	80	1	2	2			
	MEAN	4	7	NS			
L %	0	38	41	40	NS	NS	Drilled vs Topdressed 44 29
	5	38	26	32			
	10	29	32	31			
	20	37	29	33			
	40	37	50	44			
	80	24	42	33			
	MEAN	34	37	NS			
M %	0	32	31	32	NS	NS	Drilled vs Topdressed 29 26
	5	27	36	32			
	10	30	25	28			
	20	30	21	26			
	40	34	24	29			
	80	36	32	34			
	MEAN	32	28	NS			
S %	0	27	27	27	NS	NS	Drilled vs Topdressed 24 39
	5	31	37	34			
	10	34	43	39			
	20	28	48	38			
	40	27	20	24			
	80	39	24	32			
	MEAN	31	33	NS			
M+S %	0	59	58	59	NS	NS	Drilled vs Topdressed 53 65
	5	58	73	66			
	10	64	68	66			
	20	58	69	64			
	40	61	44	53			
	80	75	56	66			
	MEAN	63	61	NS			

† Treatments 5 and 12 vs treatments 7 and 14.

TAKE-ALL AND N-SERVE

Experiment: 78E16

Location: Esperance Downs Research Station (CW2).

Aim: To study the effect of N-serve on the effectiveness of ammonium sulphate as a controlling agent for take-all.

<u>Treatments:</u>	<u>Rate of $(\text{NH}_4)_2\text{SO}_4$</u>	<u>Placement depth</u>	<u>N-serve</u>
1.	119 kg/ha (N=25)	5cm	-
2.	" " "	10cm	-
3.	" " "	5cm	+
4.	" " "	10cm	+
5.	238 kg/ha (N=50)	5cm	-
6.	" " "	10cm	-
7.	" " "	5cm	+
8.	" " "	10cm	+

Methods: This experiment was placed on the site of replications 1 and 2 of 76E6. Plots were exactly at right angles to 76E6. I hoped to achieve a ranges of take-all levels (see page 36, 1977 summary) by this arrangement.

Stubble raked and burnt April 4. Combined May 16, June 9 and June 16 in the direction of the 76E6 plots. Fertilizer placed in position at right angles to 76E6 plot with combine June 20. N-serve sprayed on to $(\text{NH}_4)_2\text{SO}_4$ at 2% w/w of N immediately prior to drilling. Egret (50 kg/ha) sown with super (150 kg/ha) at 4 cms June 20. Samples for pH and microbiological studies were taken across the experiment on the position of the former plot 6 (treat 2 rep 2) of 76E6. For other assessments samples were taken across the experiment at 9 sites (plots 1 to 10 except 5).

Results: Table 1 and 2.

Investigations into the effects of the treatments on the bacteria involved in N transformation were undertaken in cooperation with Dr Sivasithamparam. These results are reported in his summary.

Comments: My original aim of providing a range of take-all levels did not work. It appears from the results (table 1) that the two cross workings (Fertilizer and Seeding) was sufficient to even out the 1977 differences in incidence and severity.

The results (table 2) of this experiment were disappointing. Factorial analysis of variance revealed no significant difference for any parameters. The manufacturers of N-serve recommended that the N-serve treated fertilizer

be placed at 10 cms. As this is rather impractical for on farm use I decided to include the recommended depth and the more practical 5 cm depth. As there was room for only 24 plots I was confined to three replications of eight treatments. In hind-sight it appears the plots were too close together and there may have been cross contamination of the plots by the volitile N-serve. It may have been wise to have buffers between plots. At this stage I consider the experiment is not worth repeating unless it is possible to obtain the granulated form of N-serve which can be mixed with the fertilizer rather than sprayed on.

Table 1 (78E16)

TAKE-ALL AND N-SERVE

Comparison of incidence and severity of take-all on wheat sown in 1977 (76E6) and 1978 (78E16).

Plot	Crop on 76E6		Crop on 78E16 1978	Take-all incidence %			
	1976	1977		76E6		78E16†	
				Total	M+S	Total	M+S
1	Lupins	Wheat	Wheat	41	0	72	33
2	Pasture	"	"	100	32	92	49
3	Oats	"	"	81	16	83	13
4	Spray-fallow	"	"	44	11	75	44
5	Wheat	"	"	100	73	NA	NA
6	Oats	"	"	85	18	99	50
7	Spray-fellow	"	"	40	7	94	52
8	Wheat	"	"	100	92	93	54
9	Lupins	"	"	100	11	97	55
10	Pasture	"	"	100	56	97	68
11	Oats	"	Nil	90	35	-	-
12	Pasture	"	"	96	51	-	-

† Crop sown in 78E16 at right angles to plots in 76E6, but sampling for take-all made across 78E16 on site of former 76E6 plots.

* In 1978 direction of working was always across plots from 12 towards 1.

TABLE 2 (78E16)
TAKE-ALL AND N-SERVE
Results 1978

Treatments				Plants per m.	Take-all incidence %				Yield kg/ha	Av. 100 grain wt. (mg)	pH*Oct.18	
N	Depth	N-serve			Nil	L	M	S			Bulk Soil	Root Soil
1.	25	5	-	17.1	8	35	34	23	1731	3.59	4.85	5.20
2.	25	10	-	17.0	7	30	37	26	1944	3.42	4.91	5.27
3.	25	5	+	18.7	7	36	34	23	1912	3.40	4.95	5.25
4.	25	10	+	18.6	7	43	33	17	1656	3.48	4.92	5.22
5.	50	5	-	17.5	16	40	30	14	2116	3.37	4.83	5.26
6.	50	10	-	16.2	13	42	30	15	2025	3.41	4.86	5.18
7.	50	5	+	18.3	12	43	25	20	2078	3.32	4.88	5.31
8.	50	10	+	18.2	6	39	29	26	1903	3.25	5.00	5.32
LSD Significance p = 0.05				NS	NS	NS	NS	NS	NS	NS	NS	NS

* pH determinations in 0.01M CaCl₂. Bulk soil pH also determined on June 20, July 4, July 18 and August 22 while root soil pH determined on July 18 and August 22. Results on these dates were also not significant. Root soil pH was always about .2 to .3 higher than bulk soil pH.

TAKE-ALL AND ROOT-SOIL pH

- Experiment: 78LG3
- Location: N. Dunham, Lake Grace
- Aim: To study the effectiveness of various chemicals for the lowering of root soil pH and their effects on take-all in wheat.
- Treatments:
1. Nil
 2. Urea (105 kg/ha) top dressed
 3. Iron sulphate (37 kg/ha) drilled and Urea (105 kg/ha) top dressed
 4. Iron sulphate (60 kg/ha) drilled and Urea (105 kg/ha) top dressed
 5. Iron sulphate (100 kg/ha) drilled and Urea (105 kg/ha) top dressed
 6. Iron sulphate (1100 kg/ha) top dressed and Urea (105 kg/ha) top dressed
 7. Ammonium sulphate (240 kg/ha) drilled
 8. Ammonium chloride (186 kg/ha) drilled
 9. Sodium nitrate (309 kg/ha) top dressed.
- Note: All top dressed treatments applied before seeding. Area top dressed with super (260 kg/ha) before seeding.
- Methods: Mallee. Sand over clay. Grassy pasture 1977. Sown to Gamenya (50 kg/ha) on June 8. Sampled August 1, September 9 and October 10 (G.S. 36). The pH determinations as described in 76LG25. All pH determinations are measured in 0.01 M CaCl₂. Results mean of three replications.
- Results: Tables 1 to 3
- Investigations into the effects of the treatments on the soil/root microflora were undertaken in cooperation with Dr. Sivasithamparam. These results are reported in his summary.
- Comments: The results from this experiment were disappointing. The treatments had significant effects on plant dry weight, plant density, root and bulk soil pH, take-all incidence but no effect on yield. Plant dry weight differences appear to be related mainly to plant density and not take-all incidence. The highest rate of FeSO₄, the (NH₄)₂ SO₄ and the NH₄ Cl all consistently reduced root-soil pH, although only (NH₄)₂ SO₄ was still

significantly different from nil by October 10. Similarly these chemicals reduced bulk-soil pH although only the first two were significantly different from nil by October 10.

The above three chemicals also caused significant reductions in the severity of take-all on the whole root system. This suggests that the take-all control is either a direct or indirect effect of pH rather than a NH_4 or SO_4 ion effect. The Fe SO_4 and $(\text{NH}_4)_2 \text{SO}_4$ when compared to Nil or NaNO_3 reduced the severity of take-all on the seminal roots on September 5 but not on October 10. Although there were differences on October 10 the use of only 6 degrees of freedom for error meant the differences were not enough for significance at the $p = 0.05$ level.

TABLE 1 (78LG3)

TAKE-ALL AND ROOT-SOIL pH

Plant Parameters

Treatment	Average dry weight/plant mg			Plants per m Oct. 10	Yield kg/ha	Av. 100 grain wt. (g)
	Aug. 1	Sept. 5	Oct. 10			
1. Nil	222	1,543	2,577	25.3	1,497	3.343
2. Urea	236	1,953	3,890	24.7	1,677	3.273
3. $\text{FeSO}_4(37)+\text{U}$	223	2,227	4,333	20.3	1,657	3.203
4. " (60)+U	284	1,863	4,067	20.0	1,641	3.303
5. " (100)+U	190	2,183	4,923	20.4	1,528	3.293
6. " (1100)TD+U	304	2,617	4,967	17.4	1,450	3.313
7. $(\text{NH}_4)_2 \text{SO}_4$	240	2,180	3,663	21.2	1,656	3.373
8. $\text{NH}_4 \text{Cl}$	218	1,777	4,177	16.8	1,646	3.250
9. NaNO_3	231	1,660	3,323	22.8	1,532	3.230
LSD Significance p = 0.05	*	**	***	*	NS	NS
	75	429	817	4.9		

TABLE 2 (78LG3)

TAKE-ALL AND ROOT-SOIL H

pH (0.01M CaCl_2)

Treatment	Root Soil PH			Bulk Soil PH		
	Aug. 1	Sept. 5	Oct. 10	Aug. 1	Sept. 5	Oct. 10
1. Nil	5.34	5.28	5.57	5.33	5.25	5.05
2. Urea	5.32	5.20	5.65	5.31	5.11	5.11
3. $\text{FeSO}_4(37)+\text{U}$	5.37	5.17	5.61	5.16	5.06	5.08
4. " (60)+U	5.30	5.12	5.61	5.10	5.05	5.00
5. " (100)+U	5.35	5.18	5.53	5.16	5.07	5.12
6. " (1100)TD+U	5.02	5.01	5.47	4.93	4.69	4.76
7. $(\text{NH}_4)_2 \text{SO}_4$	5.08	5.04	5.37	4.95	4.97	4.85
8. $\text{NH}_4 \text{Cl}$	5.13	5.04	5.46	4.98	4.94	4.92
9. NaNO_3	5.37	5.22	5.63	5.28	5.15	5.10
LSD Significance p = 0.05	***	**	*	**	***	**
	0.12	0.13	0.15	0.20	0.16	0.18

TABLE 3 (78LG3)
TAKE-ALL AND ROOT-SOIL pH
Take-all incidence %

W H O L E R O O T S Y S T E M											
Treatment	Aug. 1			September 5			October 10 (G.S.36)				
	Nil	L		Nil	L	M	Nil	L	M	S	M + S
1. Nil	75	25 AB		16 A	78 D	6 C	7	58	22 CD	13 CD	35 D
2. Urea	65	35B		40 BCD	53 ABC	5 C(+2s)	11	49	27 D	13 BCD	40 D
3. FeSO ₄ (37)+U	76	24 AB		36 ABC	62 BCD	2 BC	21	55	21 BCD	3 ABC	24 BCD
4. " (60)+U	90	10 A		52 CD	47 AB	1 AB	9	59	18 BCD	14 BCD	32 CD
5. " (100)+U	85	15 A		45 CD	55 ABC	1 A	6	59	28 D	7 ABCD	35 CD
6. " (1100)TD+U	89	11 A		62 D	37 A	1 AB	26	70	4 A	0 A	4 A
7. (NH ₄) ₂ SO ₄	81	19 AB		42 CD	52 ABC	6 C	17	75	6 A	2 AB	8 AB
8. NH ₄ Cl	89	11 A		53 CD	46 AB	1 AB	23	67	8 ABC	2 AB	10 ABC
9. NaNO ₃	77	23 AB		20 AB	73 CD	7 C	5	48	30 D	17 D	47 D
LSD Significance	*	*		**	*	**	NS	NS	*	*	**

S E M I N A L R O O T S Y S T E M O N L Y											
Treatment	September 5					October 10					
	Nil	L	M	S	M & S	Nil	L	M	S	M & S	
1. Nil	15 A	61 B	20 B	4	24 B	7	32	43	18	61	
6. FeSO ₄ (1100)TD+U	55 C	40 A	4 A	1	5 A	21	37	40	2	42	
7. (NH ₄) ₂ SO ₄	36 B	53 AB	8 AB	3	11 AB	12	51	33	4	37	
9. NaNO ₃	16 A	64 B	16 B	4	20 B	4	34	38	24	62	
	**	*	*	NS	*	NS	NS	NS	NS	NS	NS

TAKE-ALL AND COPPER SULPHATE

Experiment: 78JE6

Location: R. Christie, Jacup.

Aim: To study the nutritional and fungicidal effects of Cu SO_4 on take-all in wheat.

Treatments:

1. Wheat only
2. Wheat + Cu SO_4 (5 kg/ha) drilled with seed
3. " + " (10 kg/ha) " " "
4. " + " (15 kg/ha) " " "
5. " + " (2 kg/ha) spray 5 weeks after sowing
6. " + CuO (3.3 kg/ha) drilled with seed.

Entire area topdressed with super (200 kg/ha) prior to sowing.

Method: Grey sand (with some gravel) over clay at about 30 cm. Virgin 1976, Wheat 1977 with high incidence of take-all. Madden (53 kg/ha) sown August 21, 1978. Sampled for take-all G.S. 39. Results mean of 3 replications.

Results:

Treatment	Plants per m	Take-all incidence*		Yield \pm kg/ha
		Nil + L	M + S	
1	18.8	40	60	39
2	21.7	38	62	80
3	16.4	49	51	43
4	18.3	48	52	36
5	18.9	51	49	41
6	16.9	43	57	36
LSD	NS	NS	NS	NS

*Damage to root system during sampling made it difficult to separate incidence into more than 2 categories.

*Plants stunted - ? weather condition and lack of Nitrogen.

Comments: High level of take-all. No treatment effects.

TAKE-ALL AND COPPER SULPHATE

Experiment: 78LG5

Location: G. Cugley, South Newdegate.

Aim: To study the nutritional and fungicidal effects of Cu SO_4 on take-all in wheat.

Treatments:

1. Wheat only.
2. Wheat + Cu SO_4 (5 kg/ha) drilled with seed
3. " + " (10 kg/ha) " " "
4. " + " (15 kg/ha) " " "
5. " + " (2 kg/ha) spray 5 weeks after sowing.
6. " + CuO (3.3 kg/ha) drilled with seed. Also received CuSO_4 (2 kg/ha) spray in error.

Methods: Area mallee, white sand over clay. Pasture clover and silver grass 1977. Sown with Gamanya (50 kg/ha) on June 15. Sampled for take-all G.S. 37. Results mean of 3 replications.

Results:

Treatment	Plants per m	Take-all incidence %					Yield kg/ha
		Nil	L	M	S	M + S	
1	21.8	63	20	9	8 B	17	1,706
2	21.3	65	21	6	8 B	14	1,669
3	19.5	84	13	3	0 A	3	1,532
4	16.0	82	14	3	1 A	4	1,495
5	21.8	62	22	10	6 B	16	1,730
6	20.8	75	15	4	6 B	10	1,682
LSD Sign P= 0.05	** 3.0	NS	NS	NS	*	NS	*** 91

Comments: Low to moderate level of take-all. High rates of Cu SO_4 caused small reductions in take-all. Reduction in plant density and yield probably due to some toxicity from such high rate of Cu SO_4 .

RESULT 1977

CLEANING CROPS AND TAKE-ALL CONTROL

Experiment : 76M47

Location : Merredin Research Station (T3)

Aim : To study the effect of cleaning crops and 'Spray-seed' fallow on the incidence of take-all in wheat in the following season.

Treatments : Tables below

Methods : 1975 - Grassy pasture; 1976 - Cultivated June 28, cereals sown July 6, T4 sprayed with 'spray-seed' July 6; 1977 - Sampled for take-all at G.S. 46. Results mean of 5 replications.

Results :

Treatments 1976	Take-all incidence %				Grass density+	
	Nil	L	M	S	ARG	Barley grass
4. Sprayfallow	-	-	-	-	1.4	1.1
3. Pasture	-	-	-	-	1.5	3.2
2. Oats	100	0	0	0	-	-
1. Wheat	92	8	0	0	-	-

+ Grass density rating Nil (0) to dense stand (5)

Treatments 1977	Take-all incidence %				Yield
	Nil	L	M	S	kg/ha
4. Wheat	84	16	0	0	1 331
3. "	80	20	0	0	992
2. "	79	21	0	0	834
1. "	78	22	0	0	611
LSD Sign. p=0.05	NS	NS	-	-	*** 101

Comments : Grass control on spray-fallow (1976) only moderately effective. There was a low level of take-all in 1977. The treatments had no effect on take-all incidence, but the poor grass control in 3 and 4 could account for the infection in these treatments. High yield on T4 in 1977 may be due to moisture conservation or nitrogen release in 1976.

RESULTS 1977

CLEANING CROPS AND TAKE-ALL CONTROL

Experiment : 76N5

Location : Newdegate Research Station (N2)

Aim : As 76M47

Treatments : Tables below

Methods : 1975 - Grassy pasture; 1976 - cultivated June 17, cereals sown June 19, T.4 sprayed with 'Spray-seed' June 11, 1977. Sampled for take-all at G.S. 39. Results mean of 5 replications.

Results : 1976

Treatments 1976	Take-all incidence %					Grass numbers+				
	Nil	L	M	S	Bd ^{\$}	Vm	Pd	ARG	others	
4. Sprayfallow	-	-	-	-	3	70(4)*	2	3	10	
3. Pasture	-	-	-	-	2	254	3	5	0	
2. Oats	95.8	3.6	0.6	0	2	1	0	10	0	
1. Wheat	79.6	14.4	5.6	0.4	1	16	0	50	2	

+ For T4 and T3, total number of plants from 5 quadrats (1 per replication) each 1 m x $\frac{1}{2}$ m. T4 - av. dry weight of clover and grass per quadrat was 14 g and 47 g resp.; T3 - 251 g and 21 g resp.

+ For T2, total number of plants from 7.5 m of drill row.

+ For T1, total number of plants from 15 m of drill row.

§ Bd = Bromus diandrus; Vm = Vulpia myuros; Pd = Pentaschistis diroides; ARG = annual rye grass.

* Grasses from T4 and T3 bioassayed for presence of G. graminis, only 4 B. myuros infected.

: 1976 (All Treatments Wheat)

Treatments	Take-all infection %				Yield kg/ha
	Nil	L	M	S	
4.	96.7 AB	1.3 A	1.0	1.0	2 422
3.	99.8 A	0.2 A	0	0	2 381
2.	83.5 C	9.8 B	3.0	3.7	1 980
1.	91.8 BC	4.2 AB	3.3	0.6	2 089
LSD Sign: p=0.05	**	*	-	-	** 258

Comments : Grass control on spray-fallow in 1976 was only moderately effective, but the incidence of G. graminis was very low. No G. graminis found on grasses from pasture plots and a low incidence in oat and wheat plots. In 1977 the level of take-all was low, but incidence in the oats treatment was significantly higher than the incidence in treatments 3 and 4.

TAKE-ALL FOLLOWING CLEANING CROPS

Experiment : 78JE5

Location : R Christie, Jacup

Aim : To study the effect of various cleaning crops on take-all incidence in subsequent wheat crop.

Treatments : 1978 1979

1. Pasture	Wheat
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2. Lupins 11

3. Rape seed "

4. Wheat "

All treatments received Manganese super (221 kg/ha), T3 urea (63 kg/ha), T4 urea (76 kg/ha).

Methods : Grey sand (with some gravel) over clay at about 30 cm. Virgin 1976, wheat 1977 with high incidence of take-all. 1978 Unicrop 121 kg/ha, Wesro 6 kg/ha, Egret 53 kg/ha all sown August 22. Sampled for take-all at G.S. 37. Results mean of 4 replications.

Results :

Treatment	Details 1978	Yield kg/ha
1.	Patchy self-sown wheat - otherwise weed free.	169
2.	Poor crop - weed free - few self-sown wheat - few ARG.	63
3.	Poor crop - weed free - few self-sown wheat - few ARG.	Nil-shed
4.	Poor crop - weed free - Take-all, Nil-41%, L-39%, M-16%, S-4%.	494

Comments : District weather problems may have spoilt this experiment.

EFFECT OF GRASS CONTROL ON TAKE-ALL

Experiment : 77JE4

Location : C Parsons, Fitzgerald

Aim : To determine the effect of grass control in the year preceding or the two years preceding wheat.

<u>Treatments</u> :	1977	1978	1979
	1. Pasture	Pasture	Wheat
	2. Pasture	Surflan	"
	3. Surflan	Surflan	"
	4. Surflan	Wheat	"
	5. Spray-fallow	Spray-fallow	"
	6. Spray-fallow	Wheat	"

Methods : Sand plain cropped to wheat 1976. Infected with take-all. 1977 Surflan (1.3 kg/ha) applied May 13. Spray-seed July 6. Very poor control of vegetation in T 5 and 6. Re-sprayed August 2. 1978 Surflan (1.3 kg/ha). Area topdressed with super (195 kg/ha) on June 21. T4 and T6 sown to Egret (48 kg/ha) June 22. Due to flood damage T4 and T6 resown July 31 after spray-seed. Failed to produce harvestable yield. Sampled for take-all G.S. 37.

Results :

Treatment	1977	1978
1.	Very grassy	Very grassy
2.	Very grassy	Good grass control, but some poor patches.
3.	Good grass control, but some ARG and Broome grass	As T2
4.	As T3	Poor crop but grass free-some cape weed. 45% plants with light take-all
5.	Good vegetation control at end of season	Very patchy
6.	As T5	As T4. 34% plants with light take-all.

Comments : Level of take-all less than expected.

LONG-TERM ROTATION AND TAKE-ALL

Experiment : 77ES8

Location : E Starcevich, Circle Valley

Aim : To investigate effect of various rotations on the incidence of take-all in wheat.

Treatments : Table 1 for details of rotation.

Methods : 1978 - T1 and T3 topdressed with super (50 kg/ha) on May 22. T2 sown with Harbinger medic (5 kg/ha) and super (160 kg/ha) on May 19. T4 ploughed May 15. Madden (50 kg/ha) sown with super (160 kg/ha) and Urea topdressed (65 kg/ha) on May 19. T4 sampled for take-all at G.S. 38.

Results : Table 1.

Comments : In 1977 no take-all was detected at this site. In 1978 5.7% of plants were infected (all light and detected by bioassay). In 1977 only one (0.2%) plant from the 405 examined from T4 showed Fusarium root rot. In 1978 31% of the plants in T4 showed Fusarium root rot.

TABLE 1 (77ES8)

LONG TERM ROTATION AND TAKE-ALL

1975	1976	1977	1978	1979	1980	Total numbers from 5 replications			Yield
						Number Plants examined	Infected by G. graminis No %	Infected by Fusarium roseum No %	kg/ha
Virgin	Fallow	Wheat	Medic(P)	Medic(P)	Wheat	-	-	-	-
"	"	"	Medic(G)	Medic(G)	"	-	-	-	-
"	"	"	Medic(P)	Wheat	Medic(P)	-	-	-	-
"	"	"	Wheat	Wheat	Wheat	245	14 5.7	76 31.0	1 396

P = poor medic - undersown with Harbinger (3 kg/ha) in cropping year.

G = good medic.

TAKE-ALL BUILD-UP ON NEW LAND ROTATION

Experiment: 78JE4

Location: P. Bell, Fitzgerald

Aim: To study the rate of build-up of take-all in crops grown on virgin soil which formerly carried native grasses infected with G. graminis.

<u>Treatments:</u>	1978	1979
1.	Fallow + super (220 kg/ha)	Wheat
2.	Egret + Agras No. 1 (139 kg/ha) + super (114 kg/ha)	Wheat
3.	Egret + Agras No. 1 (278 kg/ha)	Wheat
4.	Clipper + Agras No. 1 (139 kg/ha) + super (114 kg/ha)	Wheat
5.	Clipper + Agras No. 1 (278 kg/ha)	Wheat
6.	West + Agras No. 1 (129 kg/ha) + super (114 kg/ha)	Wheat
7.	West + Agras No. 1 (278 kg/ha)	Wheat

Area topdressed with Super A (144 kg/ha) prior to sowing.

Methods: Grey sand over clay. Virgin bush burnt 1977. Ploughed September 1977. Grasses in area infected with G. graminis (See pages 54 & 55 1977 Summary). Above crops sown June 20, 1978. Sampled for take-all at the following G. Stages - Wheat 43, Barley 46, Oats 41. Results mean of 4 replications.

Results:

Treatment	Plants Per m	Take-all incidence % plants infected				Yield kg/ha
		Rep 1	Rep 2	Rep 3	Rep 4	
1	-	-	-	-	-	-
2	13.6	0	0	20	0	874
3	15.1	0	2	28	0	1 466
4	5.7	3	0	11	0	232
5	9.7	0	0	0	0	222
6	9.1	0	0	7	0	319
7	6.9	0	0	0	0	406

Comments: A few grass plants on fallow. Other crops well grown. Yield on barley and oats reduced by emus and late harvesting.

TAKE-ALL BUILD-UP AND RATES OF PHOSPHORUS ON WHEAT

Experiment: 78ES30

Location: E. Starcervich, Circle Valley

Aim: To follow the build-up of take-all on virgin soil with various rates of phosphorus (Note - Originally used by Dr Bowden to observe response curve characteristics of wheat to applied Phosphorus 77ES2).

<u>Treatments:</u>	<u>1977</u>	<u>Subsequent years</u>
1.	P = 0	P = 0
2.	P = 10	P = 11
3.	P = 20	P = 22
4.	P = 32 All N = 32	P = 33 All N = 33
5.	P = 46	P = 44
6.	P = 88	P = 88
7.	P = 106	P = 0
8.	P = 212	P = 0
9.	P = 37	P = 33 (As Agras No. 1)
10.	P = 37	P = 33 (As Agras No. 1)

In 1977 all super except T9 (Triple super) and T10 (Triple super + Gypsum (150 kg/ha)). In subsequent years all super (except 1, 7, 8, 9 & 10) and urea. In 1978 the rate of N for T1 to 8 was actually 27 kg/ha and for T9 & 10 29 kg/ha.

Method: Cleared 1976. Burnt 1977. First crop 1977. Disc ploughed May 15, 1978. Sown to Madden (50kg/ha) May 22. Sampled for take-all at G.S. 38.

Results: Table 1

Comments: Both infection by G. graminis and Fusarium very patchy (Table 1). The pattern of infection by G. graminis suggest that there are now a number of nuclei of infection. These could have come either mechanically (e.g. on machinery) or by wind. Wind seems a strong possibility. Most infection nuclei are on the southern end of the experiment; there is about 150 m of bush between the experimental site and the nearest established farm on the southern side of the site.

TABLE 1 (78ES30)
TAKE-ALL BUILD-UP AND RATES OF PHOSPHORUS ON WHEAT
RESULTS 1978

Treat	Rate of P kg/ha	Take-all incidence % infected			Fusarium incidence % infected			Yield kg/ha
		Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	
1	0	0	0	64	0	0	0	140
2	11	0	16	0	0	5	0	1 022
3	22	0	15	0	0	10	0	1 466
4	33	4	0	0	0	10	0	1 803
5	44	0	0	0	0	0	0	1 906
6	88	0	0	0	0	5	0	1 831
7	0 ⁺	0	0	4	0	0	17	1 606
8	0 ⁺	0	0	0	4	0	0	1 881
9	33	0	0	0	0	14	5	1 759
10	33	0	0	0	0	0	11	1 775
LSD Sign. p = 0.05								*** 136

+ See treatments

CONTINUOUS WHEAT AND TAKE-ALL

Experiment: 74SG16

Location: Salmon Gums Research Station (Circle Valley Lease)

Aim: To provide an area of continuous wheat for the study of take-all decline and to study the effect on take-all of two cultivation methods.

Treatments:

Year	Northern Site (0.47 ha) Minimum Tillage	Southern Site (0.47 ha) Normal Cultivation
1972	Wheat	Wheat
1973	Natural medic	Natural medic
1974	Wheat - spray seed, ploughed, harrowed, Agran 24:24 (100 kg/ha)	Wheat - as Northern site
1975	Wheat - scratch for ARG, spray-seed, super (200 kg/ha)	Wheat - scratch for ARG, ploughed super (200 gk/ha)
1976	Wheat - scratch for ARG, spray-seed, Agras 18.18 (142.5 kg/ha)	Wheat - scratch for ARG, ploughed, Agras 18:18 (142.5 kg/ha)
1977	Wheat - sprayseed, Agran 34 (70 kg/ha)	Wheat - ploughed, Agran 34 (70 kg/ha)
1978	Wheat - sprayseed June 10, Urea June 12, Sown with super (90 kg/ha) June 13.	Wheat - Cultivated May 1, scarified June 6, Urea (50kg/ha) June 12, Sown with super (90 kg/ha) June 13.

Results

Year	Take-all incidence % (plant infected)		Yield kg/ha	
	Northern	Southern	Northern	Southern
1974	NA ⁺	NA ⁺	426	389
1975	NA	NA	1 357	1 261
1976	31.0	26.3	No yield - drought	
1977	50.2	18.9	217	217
1978			1 754	2 230

⁺ In 1974 and 1975 take-all assessed in small mapping experiments only. In 1976 the area assessed was increased to 60 x 10m.

Comments:

In 1977 the overall level of take-all was low, but the incidence and severity of take-all was higher in the minimum tillage section.

Northern site:-

Nil = 49.8%, Light = 45.0%, Moderate = 5.2%

Southern site:-

Nil = 81.1%, Light = 18.7%, Moderate = 0.2%.

There was a considerable amount of Rhizoctonia at both sites.

TAKE-ALL, MINI-FALLOW AND TIME OF SOWING

Experiment: 78E6

Location: Esperance Downs Research Station (C6B)

Aim: To study the effect of a short fallow after the break of season on the incidence of take-all in wheat sown with a range of planting dates. The results from last seasons experiments 76E6 and 77E4 (page 17, 1977) summary gave the impetus for this investigation.

Treatments: Planned treatments were as follows:

1. Break Spray Sow
I-----I-----I
About 19 days

2. Spray Fallow (35) Sow
I-----I-----I
About 49 days

3. Pasture Spray Sow
I-----I-----I
About 49 days

4. Spray Fallow (65) Sow
I-----I-----I
About 79 days

5. Pasture Spray Fallow (35) Sow
I-----I-----I
About 79 days

6. Pasture Spray Sow
I-----I-----I
About 79 days

Actual treatment dates and periods of fallow were as follows:-

Treatment No.	Sprayseed + Dicamba		Scarify and Combine		Length of 'Fallow' Days
	Date Applied	Days from Break of Season	Date Applied	Days from Break of Season	
1	30/5	14	2/6	17	3
2	30/5	14	5/7	50	36
3	4/7	49	7/7	52	3
4	30/5	14	4/8	80	66
5	4/7	49	4/8	80	31
6	28/7	73	4/8	80	7

Method: Sand plain. Pasture 1977. Spray-seed (31/ha) and Dicamba (500 ml/ha). Cultivation by scarifier. Sown to Egret (50 kg/ha) except treatment 2 and replication 4 of treatment 3 accidentally sown at 128 kg/ha. Treatment 1 was severely damaged by red-legged earth mite and webworm and reached anthesis at the same date as treatments 2 and 3. In treatments 3 and 6 a lack of breakdown of plant material led to cloddy conditions which interfered with the combine during sowing. Sampled for take-all at GS37. Results mean of 4 replications.

Results:

Treatment	Plants per m	Take-all incidence %					Yield kg/ha
		Nil	L	M	S	M+S	
1	9.1	19 ^{AB}	64	13	4 ^{AB}	17 ^{BC}	1751
2	63.7	19 ^{AB}	49	23	9 ^{BC}	32 ^{CD}	2299
3	27.2	7 ^A	52	27	14 ^C	41 ^D	1917
4	22.3	56 ^C	38	6	0 ^A	6 ^A	1910
5	14.1	38 ^{BC}	49	12	1 ^A	13 ^{AB}	1776
6	14.7	39 ^{BC}	47	12	2 ^A	14 ^{AB}	1448
LSD Sign. p = 0.05	*** 12.1	*	NS	NS	**	***	NS

Comments: As expected there were highly significant differences in plant density. Differences in plant density in conjunction with different sowing dates and webworm damage to treatment 1 may have complicated the yield and take-all results. On first principles I would have expected the level of take-all in the treatments to have been in approximately the following descending order of severity:- T1 & T6 > T3 > T5 > T2 > T4. The actual order achieved was T3 > T2 > T1 > T5 & T6 > T4. Although this experiment had problems I believe the results are interesting enough to make it worth while to repeat this experiment.

TAKE-ALL AND HYPO-VIRULENT STRAINS

Experiment: 78LG30

Location: Newdegate Research Station (S3A)

Aim: To test the effectiveness of hypo-virulent strains as a means of minimising take-all.

Treatments:

1. Dead oat kernels
2. Culture C114 (G. Mac Nish)
3. " 75181 (L. Parker)
4. " 76A7/35 (G. Mac Nish)
5. " *Phialophora hoffmanii*
(K. Sivasithamparam)
6. " 75181 (G. Mac Nish)
7. " C114 (L. Parker))
8. " WUF127 (L. Parker)) One rep only.

This experiment is designed to run for several years. Inoculum was prepared from oat kernels colonized by hypo-virulent strains of *G. graminis*. Area topdressed with Agran 34 (60 kg/ha). Gamenya plus inoculum (50:50 mixture) (90 kg/ha) sown with super (65 kg/ha) on August 30. Sampled for take-all G.S. 45. Results mean of 3 replications.

Results:

Treatment	Plants per m	Take-all incidence ⁺ %		Av. plant dry weight (mg)
		Nils & Doubtfulls	Light	
1	22.4	75	25	1242
2	21.2	80	20	1290
3	24.4	70	30	1390
4	19.3	65	35	1361
5	20.1	67	31	1268
6	23.1	68	32	1472
7	(22.7)\$	(53)	(47)	(1135)
8	(16.7)	(60)	(40)	(1368)
LSD				

⁺ plants dry and difficult to assess

\$ One rep only for T7 & T8

Comments: Because of problems with the preparation of inoculum, the experiment was planted too late to obtain any yield.

CONTROL OF BARLEY COVERED SMUT WITH FUNGICIDE

Experiment : 78WH38

Location : Wongan Hills Research Station (2ED)

Aim : To test the effectiveness of seed dressings for the control of barley covered smut.

Treatments : Table below.

Method : Infested seed obtained from Mr V H F Lane and Sons of Three Springs. Seed pickled June 29 and sown July 7. Incidence assessed at maturity. Results mean of 2 replications (insufficient seed for any more reps.).

Results :

	Rate g/100 kg	Plants per m	Yield kg/ha	Covered Smut % plants infected
1. Nil		17.0	1 886	1.76
2. Pano Ram 25	150	16.3	2 010	0
3. M.B.C. 10%	100	17.7	2 010	0.06
4. M.B.C. 7.5%	100	17.0	2 052	0.08
5. Bravo Flowable	100 ml	18.3	2 042	0.33
6. Furavax 7.5%	100	17.0	1 980	0
7. KWG 0519	100	16.2	2 136	0
8. KWG 0519	150	15.4	2 094	0
9. RH-2161 12%	150 ml	18.6	2 084	0.07
10. RH-2161 24%	150 ml	14.8	1 854	0.01
LSD	p = 0.05	NS	NS	

Comments : Incidence low. All products performed well but not placed under much disease pressure.