DEPARTMENT OF AGRICULTURE

Western Australia

EXPERIMENTAL SUMMARY 1986

PROJECT: Pasture Manipulation and Root Diseases of Cereals

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CONTENTS

1:1 rotation for wheat comparing pure clover ley with a pasture ley

Experiment - 79E15

Location: Esperance Downs Research Station (paddock C5).

Aim: To test the feasibility of growing wheat in a 1:1 rotation with a "pure" clover ley (maintained by use of herbicides) as a method of controlling take-all, and also providing nitrogen for the crop phase.

Treatments: This experiment is a long term rotation trial with one year of pasture followed by one year of wheat.

The main treatments are (1) Nil
(2) Roundup

Within each main treatment are four levels of nitrogen.

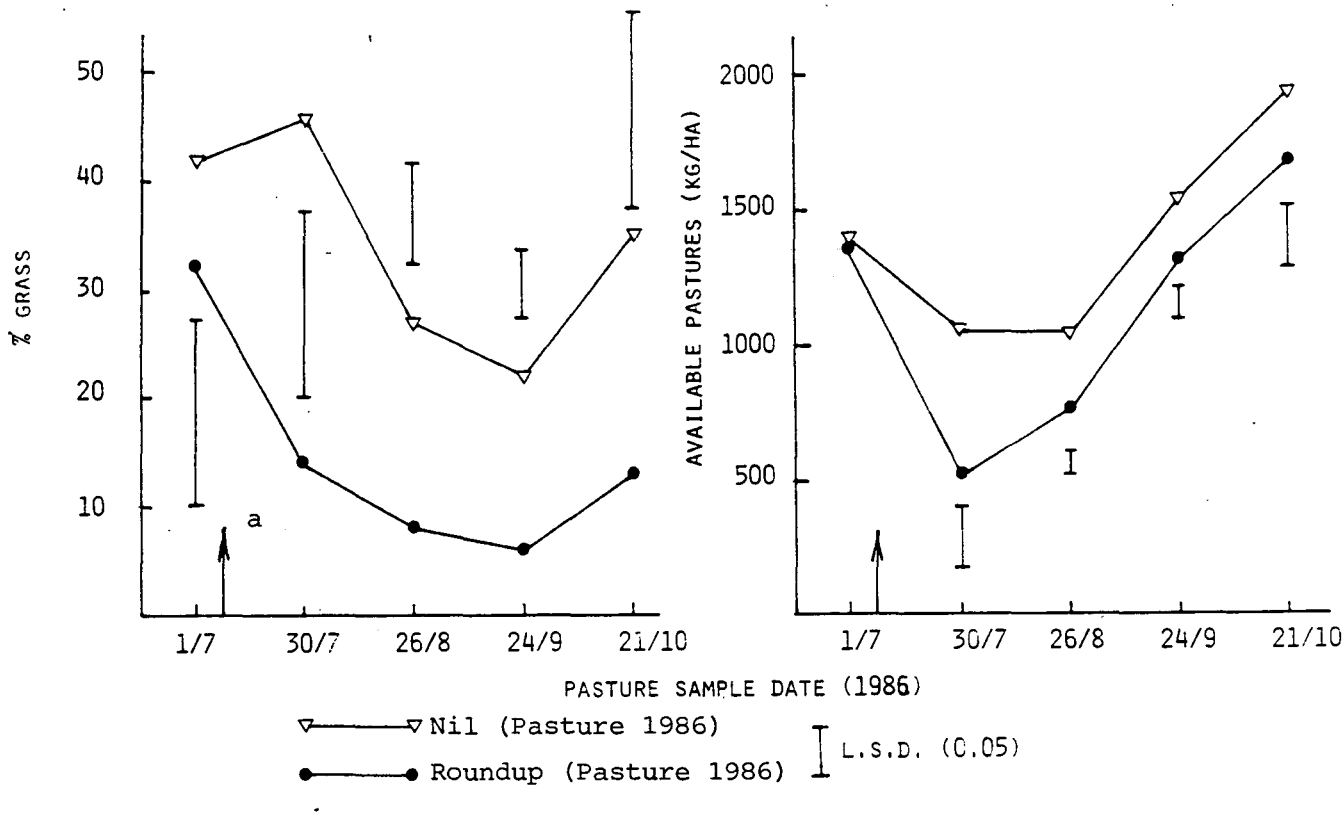
Methods: The experiment is on gravelly white sand, over gravel at depth. Treatment 1 (nil) is a control with no treatment in pasture years to manipulate pasture composition. In treatment 2 (Roundup) pasture composition is manipulated by post emergence herbicide application (Roundup® at 6 leaf stage of clover). Nitrogen treatments (0, 100, 200, 400 kg/ha Agran 34) was applied 3 weeks after sowing. Pasture composition was assessed at intervals throughout the growing season also a count was done in autumn of the number of plants that had germinated. Take-all was assessed at anthesis. Results are the means of 5 replicates.

Results:

Table 1. (79E15) Mean number of plants per square metre at 2 to 6 leaf stage of clover (assessed 20/5/86)

Treatment	1986 Phase	Clover	Grass	Broadleaf weeds
Nil	Pasture	1,320	1,120	920
Roundup	Pasture	2,120	480	690
Nil	Wheat*	260	1,980	460
Roundup	Wheat*	200	1,320	770
Significance		0.01	0.01	NS
LSD (5%)		465	361	-

* Sown 6/6/86



a - Date of application of herbicide treatment.

Figure 1 (79E15) - Percentage of grass in pastures and available pasture through the growing season of 1986.

Table 2. (79E15) Mean number of plants per square metre within the 1986 crop (25 days after sowing)

Treatment applied to 1985 pasture	N level (kg/ha Agran 34)	Germination counts (plants/m^2)		
		Wheat	Grass	Broad leaf
Nil	0	110	35	3
	100	106	135 (83)[a]	4 (5)
	200	110	88	4
	400	10	75	7
Roundup	0	109	53	6
	100	109	57 (45)	3 (4)
	200	116	35	1
	400	114	30	3
Significance		NS	NS (0.05)	NS (NS)
LSD (0.05)			(27)	

[a] Means of main treatment

Table 3. (79E15) The incidence[a] and severity[b] of take-all and yield of the 1986 wheat crop

Treatment applied to 1985 pasture	N level (kg/ha Agran 34)	Take-all		Yield (kg/ha)
		Incidence %	Severity %	
Nil	0	73	68	540
	100	61 (61)[c]	34 (38)	500 (715)
	200	58	29	720
	400	54	23	1,100
Roundup	0	48	22	580
	100	41	18	940
	200	33 (38)	12 (15)	1,310 (1,143)
	400	29	9	1,750
Significance		0.01 (0.01)	0.01 (0.01)	0.05 (0.01)
LSD (0.05)		10 (9)	10 (7)	322 (161)

[a] Take-all incidence is the percentage of plants that show take-all lession on their roots.

[b] Take-all severity is the percentage of plants which have more than 25% of their root length discoloured.

[c] Means of main treatments.

Comments:

The two phases of this rotation experiment (i.e. that cropped in 1985 and cropped in 1986) differ in both the numbers of clover and grass plants observed on 20//5/86. In both phases of the rotation fewer grass plants germinated in the Roundup treatment than in untreated pasture. In the rotation cropped in 1985, but not that cropped in 1986, more clover plants germinated in the Roundup treatment (Table 1).

Application of Roundup resulted in a decrease in both the grass in the pasture and total pasture production, these differences persisted through the remainder of the growing season. At the end of the growing season dry matter was approximately 90% of that in untreated pasture (Figure 1).

Fewer grass weeds germinated in the crop after Roundup treatment pasture than untreated. There was no difference in numbers of wheat or broadleaf weeds emerging in the crop. Nitrogen supply had no effect on the numbers of plants emerging (Table 2).

Take-all incidence and severity were lower after Roundup treated pasture than after untreated. A close direct relationshhip between the amount of grass (kg/ha) in the 1985 pasture and the incidence of take-all in the 1986 crop ($r = 0.6898$, $P < 0.05$) further illustrates the value of decreasing the grass content of pastures before cropping as a take-all control measure. In the 1986 crop, the decrease in take-all from untreated pasture (severity = 38%) to

Roundup treated pasture (Severity = 15%) explains an increase in yield of about 320 kg/ha (1% severity = 14 kg/ha yield loss) (Table 3). A further yield difference of about 100 kg/ha may have resulted from lower grass weed numbers in the crop following Roundup treated pasture (Table 2).

Increasing nitrogen supply decreased take-all incidence and severity after both pasture treatments. Also large increases in yield in both treatments resulted from the increase in nitrogen supply. The yield response is mostly a direct effect of the nitrogen however some part of it may be via the effect of nitrogen in decreasing take-all (Table 3).

Pasture renovation techniques and crop and livestock production in a 1:2 rotation

Experiment 81E35

Location: Esperance Downs Research Station (paddocks CW10 to 13, CW2, CW4)

Aim: To assess the advantage of using existing methods of herbicide renovation of pastures with respect to their effects on levels of root disease in a subsequent crop and the yield of that crop.

Treatments: This experiment is a long term rotation trial with two years of pasture followed by one year of crop. Pasture renovation/manipulation treatments are applied to pastures in the first year after crop, the treatments being:-

(1) Nil
(2) Fusilade® (at 6 leaf stage of clover)
(3) Gramoxone® (spraytopped)
(4) Sprayseed® (at 6 leaf stage of clover)

Method:

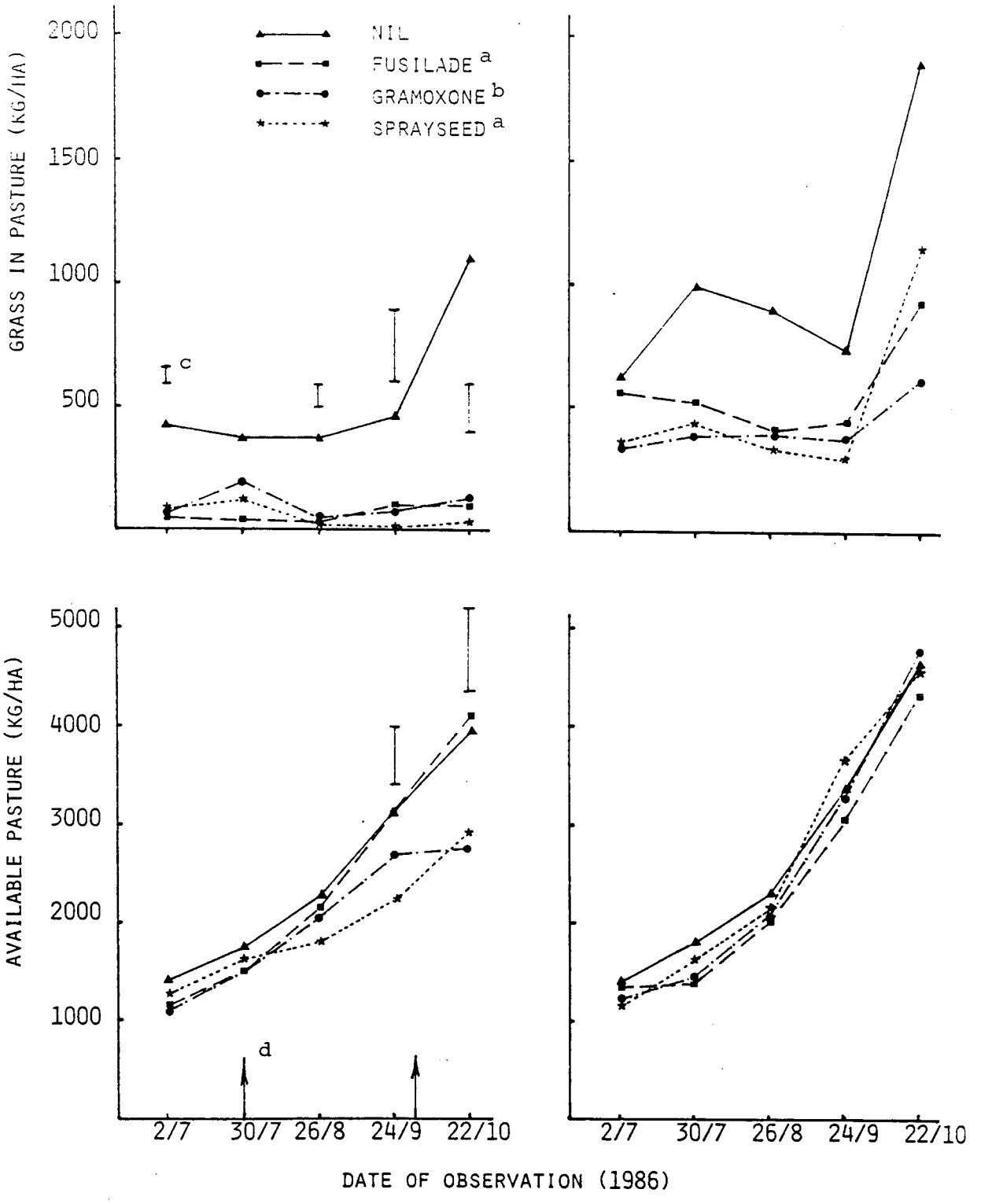
The experimental site is gravelly white sand over gravel at depth. All herbicides are applied at the recommended rates for pasture manipulation. Spraytopping treatments are applied at the soft dough stage of seed of the major pasture grass. Pasture availability and composition, as well as root disease levels, were assessed at intervals throughout the growing season.

Results:

Table 1. (81E35) Mean number of plants per square metre (2 to 6 leaf stage of clover) prior to 1986 crop and pasture treatments.

Treatment	Plants per m^2 clover	grass	broadleaf weeds
First year pastures (CW12 and 13) (Sprayed 1986)			
Nil	1,100	2,180	330
Fusilade[a]	1,400	160	430
Gramoxone[b]	1,330	90	280
Sprayseed[a]	1,680	1,340	180
Significance	NS	0.01	NS
LSD (0.05)	-	201	-
Second year pasture (CW2 and 4) (Sprayed 1985)			
Nil	1,160	3,510	460
Fusilade[a]	1,160	1,410	890
Gramoxone[b]	520	360	850
Sprayseed[a]	1,530	1,280	630
Significance	NS	NS	NS
LSD (0.05)	-	-	-
Crop (CW10 and 11) (Sprayed 1984)			
Nil	2,840	5,370	170
Fusilade[a]	3,150	940	150
Gramoxone[b]	2,010	1,790	420
Sprayseed[a]	2,650	40	210
Significance	NS	0.05	NS
LSD (0.05)	-	2,330	-

[a] applied at 6 leaf stage of clover
[b] spraytopped (at soft dough stage of grass seeds)



a - Applied at 6 leaf stage of clover.
b - Applied at soft dough stage of grass seeds.
c - L.S.D. (0.05) where differences occur (P > 0.05).
d - Date of application of herbicide treatments.

Figure 1 (81E35)- Grass in pastures and available pasture through the growing season of 1986.

Table 2. (81E35) Mean number of plants per square metre within the wheat crop (21 days after sowing - paddocks CW10 and 11)

Treatment	Plants per m^2		
	clover	grass	broadleaf weeds
Nil	11	11	44
Fusilade[a]	10	18	2
Gramoxone[b]	12	12	1
Sprayseed[a]	12	30	6
Significance	NS	NS	0.05
LSD (0.05)	-	-	24

[a] sprayed at 6 leaf stage of clover (1984)
[b] spray topped at soft dough stage of grass seed (1984)

Table 3. (81E35) Grass content of 1985 pasture, take-all incidence and severity and yield for 1986 wheat crop (paddocks CW 10 and 11)

1984 treatment applied to pasture	1985 pasture (% grass)	1986 crop		
		Take-all		Yield
		Incidence %[c]	Severity %[d]	(kg/ha)
1. Nil	53	89	58	330
2. Fusilade[a]	11	13	6	2,000
3. Gramoxone[b]	33	38	22	1,260
4. Sprayseed[a]	1	1	0	2,250
Significance	0.05	0.01	0.05	0.05
LSD (0.05)	24	33	35	750

[a] applied at 6 leaf stage of clover plants (July)
[b] applied at soft dough stage of grass seeds (October)
[c] take-all incidence is the percentage of plants that show take-all lesions on their roots
[d] take-all severity is the percentage of plants that have more than 25% of their root length discoloured

Comments:

A greater number of grass plants emerged in the nil treatment than in any herbicide treatment in all three phases of the rotation. However this difference was not significant in the second year pastures though it was large. There were no differences in the number of clover plants and broad leaf weeds emerging (Table 1).

Fewer grass weeds emerged within the crop following manipulated pastures, however there were no differences in the numbers of wheat or clover plants emerging (Table 2). Take-all incidence and severity were lower in the crop following manipulated pastures. Also the incidence of take-all in the 1986 crop has a close positive relationship to the percentage grass in the 1985 pasture (Table 3). The yield of wheat following manipulated pastures was much higher than that following untreated pasture. Take-all severity measured in the nil treatment would have caused a yield loss of about 800 kg/ha (14 kg/ha yield loss for each 1% severity). Additional increase in the yield of crop following herbicide treatments is the result of less weed competition and higher soil nitrogen fixed by pasture legumes (Table 3).

In both first and second year pastures, the nil treatment consistently had more grass than herbicide treatments. Total pasture production was decreased by Gramoxone and Sprayseed in the first year but only late in the season. The expected drop in total pasture production early in the season on second year pastures under these treatments did not occur (Figure 1).

Pasture manipulation - effects on take-all

Experiment 85E32

Location: Esperance Downs Research Station (paddock CW3)

Aim: To determine the effect of different timing of herbicide application for grass removal on take-all levels in subsequent crops. The hypothesis is that take-all in a crop is a function of grass level in pasture the year prior to cropping.

Treatments: The experiment is designed to run for three years with herbicide treatments in the first two years (1985 and 1986) followed by a wheat crop in the third year (1987) to determine the take-all level.

Treatment No.	1985	Date of application	1986	Date of application	1987
1	Pasture		Post emergence (Sprayseed)	29/7/86	Wheat
2	Pasture		Spraytop (Gramoxone)	6/11/86	Wheat
3	Pasture		Spraytop (Fusilade)	6/11/86	Wheat
4	Pasture		Pasture		Wheat
5	Post emergence (Sprayseed)	7/8/85	Pasture		Wheat
6	Spraytop (Gramoxone)	1/11/85	Pasture		Wheat
7	Spraytop (Fusilade)	1/11/85	Pasture		Wheat
8	Wheat		Pasture		Wheat
9	Wheat		Post emergence (Sprayseed)	29/7/86	Wheat
10	Wheat		Spraytop (Gramoxone)	6/11/86	Wheat
11	Wheat		Spraytop (Fusilade)	6/11/86	Wheat

Method:

The experiment is on gravelly white sand over gravel at depth. The area was a grassy pasture (predominantly annual rye grass) for a number of years. All herbicides are applied at the recommended rates for pasture manipulation. Post emergence treatments are applied at the 6 leaf stage of clover plants. Spraytopping treatments are applied at the soft dough stage of the seed of the major pasture grass. Broad leaf weeds have been at very low levels in this pasture and have not required treatment. Pasture composition has been assessed at intervals throughout the growing season. Results are means of five replicates.

Results:

Table 1. (85E32) Mean number of plants per square metre at 2 to 6 leaf stage of clover

Treatment	Year applied	Clover	Grass	Weeds
1 Sprayseed[a]	1986	1,630	3,700	890
2 Gramoxone[b]	1986	2,045	3,890	630
3 Fusilade[b]	1986	2,280	3,480	700
4 Nil		1,760	3,230	540
5 Sprayseed[a]	1985	1,760	2,750	610
6 Gramoxone[b]	1985	1,685	1,480	810
7 Fusilade[b]	1985	2,310	1,810	720
8 Wheat		1,005	1,620	220
9 Sprayseed[a]	1986	1,210	1,650	310
10 Gramoxone[b]	1986	1,120	1,560	240
11 Fusilade[b]	1986	1,050	1,490	100
Significance		0.001	0.001	0.001
LSD (0.05)		650	804	229

a applied at 6 leaf stage of clover
b applied at soft dough stage of grass seeds

Table 2. (85E32) Pasture assessments for two dates in the 1986 growing season showing percentage grass, weight of grass and total pasture.

Treatment	Date sprayed	July 30, 1986		October 20, 1986	
		grass[c]	pasture (kg/ha)	grass	pasture (kg/ha)
1 Sprayseed[a]	21.07.86	25 (240)	960	28 (250)	3,500
2 Gramoxone[b]	6.11.86	26 (400)	1,580	36 (390)	3,670
3 Fusilade[b]	6.11.86	30 (470)	1,580	28 (360)	3,740
4 Nil		29 (450)	1,550	43 (430	3,790
5 Sprayseed[a]	7.08.85	27 (410)	1,540	36 (440	3,800
6 Gramoxone[b]	1.11.85	22 (320)	1,440	32 (300)	3,740
7 Fusilade[b]	1.11.85	20 (320)	1,560	33 (280)	3,800
8 Crop		42 (580)	1,360	31 (360)	3,860
9 Sprayseed[a]	21.07.86	29 (220)	750	31 (330)	3,640
10 Gramoxone[b]	6.11.86	40 (550)	1,400	35 (360)	4,040
11 Fusilade[b]	6.11.86	50 (650)	1,330	31 (400)	3,810
Significance		0.01 (0.01)	0.01	NS (0.1)	0.01
LSD (0.05)		7 (101)	124	- (124)	289

a applied at 6 leaf stage of clover
b applied at soft dough stage of grass seeds
c % grass followed by grass kg/ha in brackets

Comments:

This experiment is in the second year of its planned three year duration.

Both the spray topping treatments (Gramoxone and Fusilade) applied in 1985 decreased the number of grass plants emerging (Table 1) and also the amount of grass in the pasture at both observations in 1986 (Table 2). However, at neither observation was the total pasture production decreased, while the percentage of grass in the pasture was only decreased at the first time of observation (Table 2). The Sprayseed treatment applied in 1985 did not affect the numbers of plants emerging nor the pasture production and composition during 1986 (Tables 1 and 2).

Both Sprayseed treatments applied in 1986 (Treatment 1 after pasture and Treatment 9 after crop) resulted in a decrease in grass and total pasture at the first time of observation (Table 2). However at the second observation the amount of grass was lower only in Treatment 1, and the total pasture was unaffected in both Treatment 1 and Treatment 9 (Table 2).

Observations will need to be taken in 1987, both prior to and after sowing a crop, to determine the effects of the treatments on number of plants emerging and the level of take-all in the crop.

Spray topping herbicides and take-all

Experiment 85MT58

Location: Mount Barker Research Station (paddock E5)

Aim: To determine whether spray topping increases the level of take-all inoculum for infection of subsequent crops, and whether this effect may be modified by the herbicide used.

Treatments: This experiment was designed to run over two years, in 1985 spray topping treatment were applied and in 1986 all plots were sown to wheat

(1) Nil
(2) Gramoxone W. (spraytopped at 500 ml/ha)
(3) Roundup C.T. (spraytopped at 240 ml/ha)
(4) Fusilade (spraytopped at 500 ml/ha)

Method:

The experiment site is a sandy gravel soil. All herbicides were applied at the recommended rate for spraytopping. Spraytopping treatments were applied in 1985 at the late dough stage of the major grass in the pasture. Pasture germination counts and in crop weed counts were taken, and root disease levels have been assessed at intervals throughout the growing season.

Results:

Table 1. (85MT58) Mean number of plants per square metre in pasture prior to sowing and in crop after sowing and grain yield for the 1986 crop

Treatment	1986 pasture (plants/m^2)		1986 crop (plants/m^2)		Grain yield (kg/ha)
	grass	clover	grass	clover	
Nil	590	190	630	70	1,570
Gramoxone W	940	180	370	60	1,690
Roundup C.T	560	180	390	60	1,500
Fusilade	890	180	360	60	1,680
Significance	NS	NS	NS	NS	NS

Comments:

The spray topping treatments were applied too late in 1985, and consequently had no effect on the number of plants emerging in the pasture in 1986. Similarly, the treatements had no significant effect on the numbers of grass and clover weeds emerging in the wheat crop sown in 1986 (Table 1).

Sampling for take-all during the 1986 growing season, showed at the second date of sampling (18.8.86) that spraytopping with Gramoxone and Roundup had resulted in an increase in take-all incidence. However, at anthesis there was no difference between treatments (Figure 1).

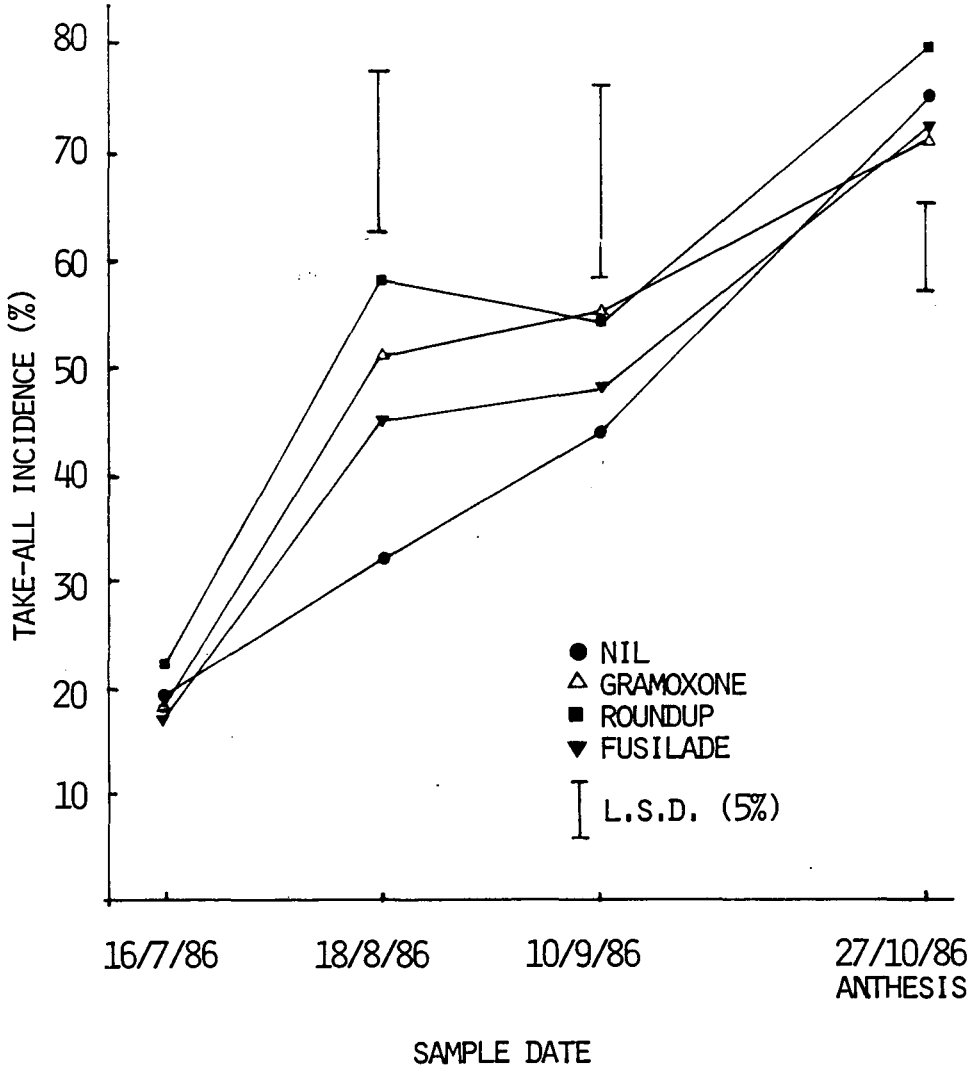


Figure 1. (85MT58). The affect of "spraytopping" with the herbicides Gramoxone, Roundup and Fusilade on the incidence of take-all in a following wheat crop.

In spite of the increase in take-all early in the season in Gramoxone and Roundup treatments, there were no differences in yield (Table 1).

Timing of spray topping and herbicides

Experiments 86MT64 and 86E55

Location: 86MT64 at Mount Barker Research Station (paddock E11)
86E55 at Esperance Downs Research Station (paddock CW3)

Aim: To determine the effect of different times of spray topping on the carryover of take-all and the possible mechanisms by which this may occur.

Treatments: This experiment was designed to run for two years with spraytopping treatments applied to pastures in 1986 then wheat sown in 1987

(1) Gramoxone (spraytopped September)
(2) Fusilade (spraytopped September)
(3) Gramoxone (spraytopped October)
(4) Fusilade (spraytopped October)
(5) Gramoxone (spraytopped late dough stage of grass)
(6) Fusilade (spraytopped late dough stage of grass)
(7) Nil

Method:

The experiment site at Mount Barker Research Station is clayey gravel and the site at Esperance Downs Research Station is gravelly sand over gravel at depth. Gramoxone and Fusilade were both applied at 500 ml/ha (the recommended rate for spraytopping). At Mount Barker Research Station (86MT64) the treatments were applied on September 16, 1986, October 20, 1986 and November 18, 1986 (late dough stage of grass) while at Esperance Downs Research Station the dates were Setpember 9, 1986, October 7, 1986 and November 6, 1986 (late dough stage of grass).

Pasture production and composition measurements have been taken at both sites during the treatment period. Soil samples have also been taken for bioassays of take-all inoculum levels.

At Mount Barker, only one measurement of pasture production and composition has been made as heavy grazing after October 14, 1986 resulted in any differences caused by herbicide application being greatly diminished, also the pastures were very difficult to assess.

Results:

Table 1. (86MT64, 86E55) Available pasture and percent grass measured at various dates during treatment period

(A) 86MT64

Treatment	October 14	
	pasture (kg/ha)	grass %
1 Gramoxone (Sept)	3,120	26
2 Fusilade (Sept)	3,250	19
3 Gramoxone (Oct)	3,160	25
4 Fusilade (Oct)	3,160	20
5 Gramoxone (Nov)	3,100	21
6 Fusilade (Nov)	3,170	25
7 Nil	3,230	31
Significance	NS	NS
LSD	-	-

(B) 86E55

Treatment	September 25		October 23	
	pasture (kg/ha)	grass %	pasture (kg/ha)	grass %
1 Gramoxone (Sept)	2,380	18	3,220	55
2 Fusilade (Sept)	2,540	7	3,560	14
3 Gramoxone (Oct)	2,450	16	3,350	51
4 Fusilade (Oct)	2,770	15	3,610	28
5 Gramoxone (Nov)	2,430	18	3,640	35
6 Fusilade (Nov)	2,660	18	3,480	38
7 Nil	2,430	17	3,410	41
Significance	0.1	0.01	0.01	0.01
LSD	-	4	210	10

Table 2. (86MT64, 86E55) Soil moisture in top 10 cm of soil (percentage of less than 2 mm fraction) measured at various dates during treatment period

Treatment	84MT64	86E55	
	October 14	October 23	November 20
1 Gramoxone (September)	12.8	3.0	1.5
2 Fusilade (September)	12.5	2.9	1.6
3 Gramoxone (October)	13.8	4.4	1.6
4 Fusilade (October)	13.5	2.7	1.4
5 Gramoxone (November)	13.8	2.8	1.2
6 Fusilade (November)	12.9	2.8	1.7
7 Nil	13.3	2.8	1.4
Significance	NS	0.01	NS
LSD	-	0.45	-

Table 3. (86MT64, 86E58) The effect of spray topping on take-all inoculum level (assess by bioassay) and measured at various dates during treatment period

Treatment	% bioassay roots lesioned (experiment 86MT64)		
	September 16	October 14	October 27
1 Gramoxone (Sept)	-	20	32
2 Fusilade (Sept)	-	14	25
3 Gramoxone (Oct)	-	16	28
4 Fusilade (Oct)	-	19	44
5 Gramoxone (Nov)	-	23	32
6 Fusilade (Nov)	-	22	37
7 Nil	14	15	43
Significance		NS	NS

Comments:

Gramoxone proved to be more toxic to clover than Fusilade at the September and October application times. This resulted in a decrease in the total pasture production as clover was less able to recover and replace grass in Gramoxone than in Fusilade treatments.

At the first observation, the September treatments had not affected pasture production but Fusilade had decreased the grass content of pasture. However at the second observation September and October applications of Gramoxone had decreased total pasture production while Fusilade had only decreased the grass content (Table 1).

Soil moisture was unaffected by treatment at Mount Barker on October 14, and at Esperance on November 20. Soil moisture measurements at Esperance on October 23 show no effect of Fusilade treatment whereas Gamoxone applied in October resulted in an increase in soil moisture on (Table 2).

Soil bioassays to determine the effect of spray topping on take-all inoculum did not reveal any differences, however this is likely to be a result of inadequaces in the bioassay technique (Table 3). Therefore it will be necessary to do emergence counts and sample the crop, in 1987 to determine whether the treatments have had any effect on weed populations and take-all levels in the crop.