HNS/31

EVALUATION OF WEED CONTROL TREATMENTS IN TREE AND SHRUB SEED BEDS AND FIRST YEAR OUTDOOR TRANSPLANTS

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PROJECT TITLE:	Evaluation of weed control treatments in tree and shrub seed beds and first year outdoor transplants.
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CONTENTS

RELEVANCE TO GROWERS AND PRACTICAL APPLICATION

Application

The objective of the trial was to evaluate a range of weed control treatments for use on tree and shrub seed beds and transplants.

A number of herbicides and two rates of a soil sterilisation chemical (the recommended rate and a reduced rate) were examined in the seed bed trial. Both rates of the soil sterilisation chemical worked well. A number of the herbicides also gave good weed control, but unfortunately these herbicides also caused a certain amount of crop loss and damage.

The herbicides examined in the transplant trial worked very well in the second year of the trial and in most cases only caused the minimum of crop loss or damage.

From the results obtained in the trial several of the weed control treatments examined can be quickly adopted for use by growers. Other treatments however, will require further examination.

Summary

With the withdrawal of Enide 50W (diphenamid), very few herbicides now have a recommendation for use on seed beds, and the alternative, chemical soil sterilisation, is expensive.

Although a limited range of herbicides are recommended for weed control around field grown nursery stock not all of them are suitable for use around young transplants.

This experiment was therefore designed to evaluate a range of weed control treatments for use in seed beds and around transplants.

(i) SEED BED TRIAL

Both Dazomet (Basamid) treatments (recommended rate and reduced rate) worked well in terms of weed control, although weed control was better in the first year of the trial than in the second when perennial weeds were present. (Appendix 1). Both treatments also gave rise to improved seedling germination and vigour.

If weed control is the prime reason for using Dazomet, then the reduced rate of Dazomet examined, 100 kg/ha applied to the top 5 cm, of soil would provide a considerable financial saving of approximately £1,450/ha in terms of chemical cost on sandy soils (Appendix 2), over the higher rate.

The herbicide treatments which gave the best weed control in both years were Venzar applied pre and post emergence, Flexidor applied pre and post emergence and Ronstar Liquid applied pre emergence only. All three treatments did however, have deleterious effects on seedling germination (usually the Alnus glutinosa) and vigour, and they also gave rise to varying degrees of phytotoxicity.

However, if lower rates of the herbicides are used for the pre emergence treatment, (that is Venzar less than 1.5 kg/ha, Flexidor less than 200 ml/ha and Ronstar Liquid less than 4 l/ha), then perhaps the degree of crop loss and damage can be reduced whilst still maintaining good weed control.

Using herbicides in preference to the Dazomet soil sterilisation treatments for weed control will also lead to a considerable financial saving per hectare (Appendix 2).

(ii) TRANSPLANT TRIAL

Unlike the seed bed trial, the results from the two years of the transplant trial, in terms of weed control, were conflicting. In the first year of the trial due to a general lack of soil moisture (even though overhead irrigation was provided) weed control was very poor and only two treatments, Ronstar Liquid plus Kerb 50W and Kerb 50W plus Flexidor, achieved good weed control.

Because the second year of the trial was a continuation of the first, the herbicides were applied to the established transplants much earlier in the year when there was sufficent soil moisture and hence, all the treatments achieved at least 96% weed control.

Reductions in plant vigour as a result of the herbicides were less obvious in this trial, although the Ronstar Liquid plus Kerb 50W and Kerb 50 W plus Flexidor mixtures resulted in small reductions in plant vigour.

Phytotoxic damage as a direct result of the herbicides was limited to the first year of the trial when a number of treatments, Devrinol, Flexidor, Venzar and both Sinbar treatments resulted in low levels of chlorotic foliage mainly on the Sorbus aucuparia and Alnus glutinosa. Such damage, however, was not serious.

In the first year of the trial the herbicide treatment Diuron 80 plus Flexidor was associated with the poorest level of plant establishment when 40 of the plants failed to establish. Whether this was a direct result of the herbicide is not clear.

The treatment Ronstar Liquid plus Kerb 50W appeared to be the best herbicide treatment, as it gave very good levels of weed control in both years of the trial. However, a slight reduction in plant vigour, especially in the year of plant establishment, was noted with this herbicide.

EXPERIMENTAL SECTION

Introduction

Information on weed control in seed beds and seedling transplants is only available from related forestry work on a very limited range of species. With the recent withdrawal of diphenamid (Enide 50W) only simazine and paraquat (for use in the production of stale seed beds) now possess recommendations for use on `forestry nursery beds'.

Chemical soil sterilisation is often the chosen commercial treatment, however, the cost of this may be ten times that of a herbicide treatment.

A limited range of herbicides are recommended for weed control around field grown nursery stock, not all of them however are suitable for use around young transplants.

The two year trial was designed to assess the efficacy and potential phytotoxicity of a range of chemical treatments and to examine any effect the treatments may have on the final marketable yield and quality of the seedlings and transplants used in the trial.

Materials And Methods

(i) SEED BED TRIAL

The trial site (a different site to the one used previously) was initially prepared during October 1992 by staff from the nursery. Four seed beds were used in the trial, each seed bed being 47.4 m long and 1.2m wide. Soil samples were taken from the trial site to ensure the soil was not deficient in any of the major nutrients, the analysis results are given in Appendix 3.

Dazomet (Basamid) was applied by hand to the appropriate plots in the trial on 5 November 1992. In the case of the `low rate' treatment (100 kg/ha) the chemical was simply raked into the top 5 cm of soil. The `recommended rate' treatment (380 kg/ha) was forked into the top 15 - 20 cm of soil. The treated plots were then covered with polythene which remained over the plots until mid-March 1993.

During April and May any weeds which had emerged in the unsterilised plots were treated with paraquat. On 27 May 1993 further soil preparation by hand occurred to produce a fine surface tilth on the seed beds. Following this operation, on the same day, the various seeds were sown.

The seeds were sown according to the plan in Figure 1. Each plot was divided equally into six blocks, each block containing a particular plant species; Acer rubrum, Sorbus intermedia, Prunus padus, Alnus glutinosa, Gleditsia triacanthos and Fagus sylvatica. Each plot was separated from the next by guard rows of Fraxinus excelsior.

The same split plot layout was repeated for each plot throughout the entire trial.

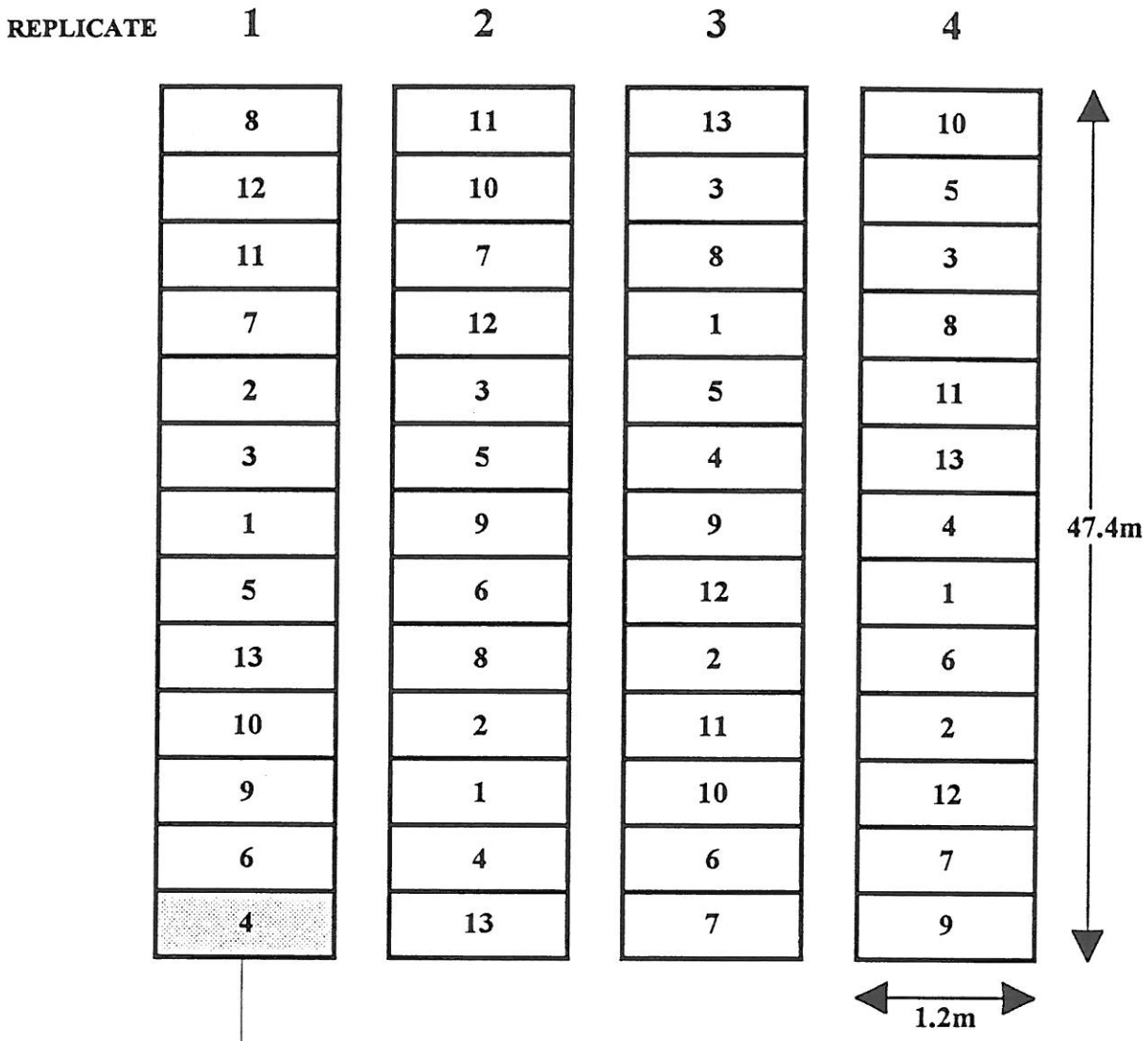
Each of the twelve treatments and the control were replicated four times in the trial.

The seeds were sown at varying rates according to seed size and plant species. The rates varied from approximately 200 seeds per m^2 for Gleditsia up to 800 seeds per m^2 for Alnus.

After the seeds were sown a suitable fertiliser top dressing was applied before the seeds were covered with approximately 0.5cm of grit. The trial was then irrigated via an overhead sprinkler system.

FIGURE 1

SEEDBED TRIAL LAYOUT



FRAXINUS EXCELSIOR		GUARD
ACER RUBRUM	SORBUS INTERMEDIA	
PRUNUS PADUS	ALNUS GLUTINOSA	
GLEDITSIA TRIACANTHOS	FAGUS SYLVATICA	
FRAXINUS EXCELSIOR		GUARD

REPEATING SPLIT PLOT

TREATMENT

1. CONTROL
2. ENIDE 50W PRE & POST EMERGENCE
3. ENIDE 50W + DACHTAL PRE-EMERGENCE & ENIDE 50W POST EMERGENCE
4. GOLTIX WG PRE & POST EMERGENCE
5. KERB 50W PRE & POST EMERGENCE
6. ATLAS GOLD PRE-EMERGENCE & ATLAS CIPC POST EMERGENCE
7. DEVRINOL PRE-EMERGENCE
8. VENZAR PRE & POST EMERGENCE
9. RONSTAR LIQUID PRE-EMERGENCE
10. BUTISAN S PRE & POST EMERGENCE
11. FLEXIDOR PRE & POST EMERGENCE
12. DAZOMET 'LOW RATE'
13. DAZOMET 'RECOMMENDED RATE'

The following herbicide treatments were then applied on 28 May 1992:-

Treatment No	Treatment
2.	Enide 50W (diphenamid) at 4.5 kg/ha and then at 4.5 kg/ha every five weeks post emergence.
3.	Enide 50W (diphenamid) plus Dacthal (chlorthal-dimethyl) at 4.5 kg/ha of each product, followed by 4.5 kg/ha of Enide 50W every five weeks post emergence.
4.	Goltix WG (metamitron) at 3 kg/ha, and then at 3 kg/ha every five weeks post emergence.
5.	Kerb 50W (propyzamide) at 1.5 kg/ha, and at 1.5 kg/ha ten weeks later post emergence.
6.	Atlas Gold (chlorpropham plus fenuron plus propham) at 5.5 l/ha, followed by 2.8 l/ha of Atlas CIPC 40 (chlorphopham) every five weeks post emergence.
7.	Devrinol (napropamide) at 5 l/ha.
8.	Venzar (lenacil) at 1.5 kg/ha, and then at 1.5 kg/ha. every five weeks post emergence.
9.	Ronstar liquid (oxadiazon) at 4 l/ha.
10.	Butisan S (metazachlor) at 1.5 l/ha, and then at 1.5 l/ha ten weeks later post emergence.
11.	Flexidor (isoxaben) at 200 ml/ha, and then at 200 ml/ha ten weeks later.

All the herbicides were applied in the equivalent of 400 litres of water per hectare. The control plots were left untreated. No herbicides were applied to the plots which had been previously sterilised with Dazomet (treatments 12 and 13).

Assessments of the trial were made on 15 June, 8 July and 16 August 1993 to record;

(a) weed number and weed species present

(b) plant vigour in terms of both plant height and overall quality

(c) possible phytotoxic damage

(d) comparative germination

A scoring system was adopted to record overall plant vigour, phytotoxicity and seed germination in each plot. Plots were examined on an individual basis and a score was given in the range of 0 - 9.

In the case of plant vigour, 0 represented a severe lack of vigour through to 9 which represented well developed vigorous seedlings. In the case of observed phytotoxic damage, 0 represented no damage whilst 9 represented severely stunted and abnormal seedlings. Finally, in the case of seedling germination, 0 represented no germination and 9 represented 80% plus germination. The results are presented in Table 1.

At the end of the trial, a sample of 390 seedlings was chosen at random from the trial and their stem heights measured. The average stem heights calculated from this sample are given in Table 2.

(ii) TRANSPLANT TRIAL

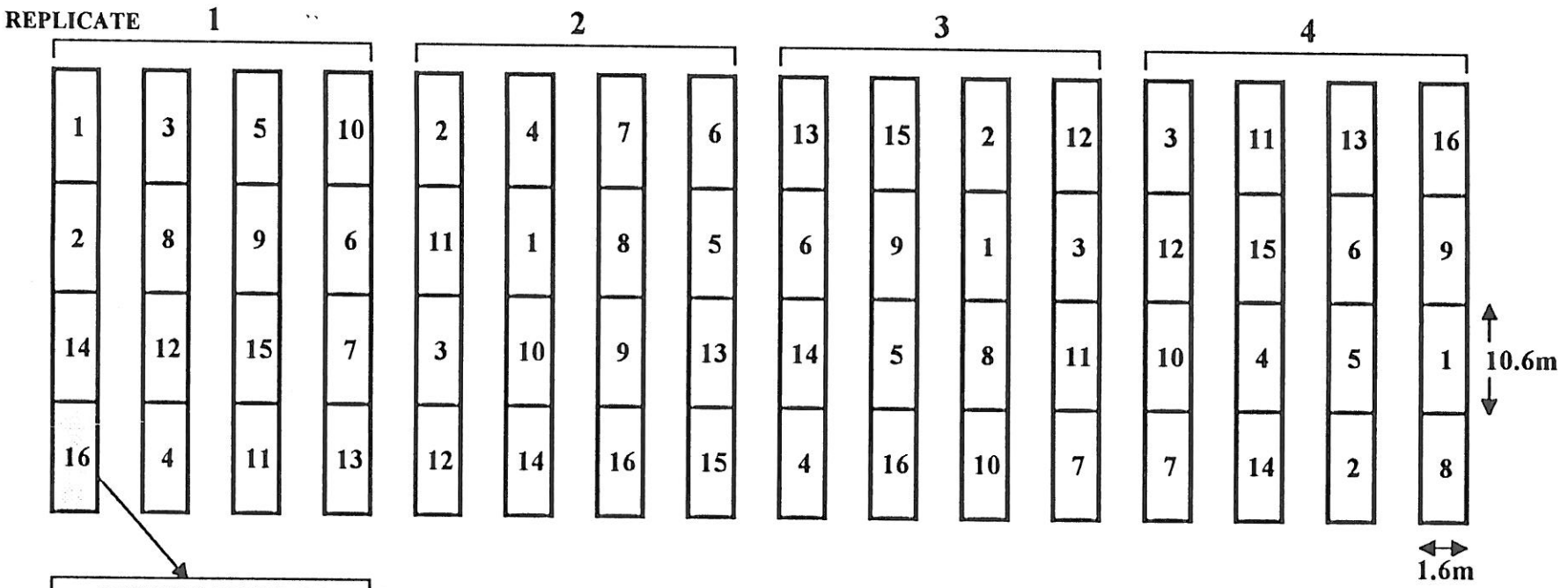
Unlike the seed bed trial where a fresh site was used, the herbicide treatments being examined in the transplant trial this year were reapplied to the same plants which were used last year. The reason for this was to examine any possible phytotoxicity which may arise from the continual use of the herbicides on the same area of land.

No alterations were made to the trial itself, the layout remained the same (Figure 2), but this year obviously the plants in the trial were established rather than recent transplants.

Soil samples were taken from the site for analysis to ensure the soil was not deficient in any of the major nutrients. The results of the analysis are presented in Appendix 3.

FIGURE 2

TRANSPLANT TRIAL LAYOUT



CORNUS SANGUINEA	GUARD
ACER PLATANOIDES	
ALNUS GLUTINOSA	
SORBUS AUCUPARIA	
QUERCUS PETREA	
CRATAEGUS MONOGYNA	
CORNUS SANGUINEA	GUARD

REPEATING SPLIT PLOT

TREATMENT

1. CONTROL
2. DEVRINOL
3. GESATOP 50WP
4. FLEXIDOR
5. BUTISAN S
6. BUTISAN S + KERB 50W
7. STOMP 400 + FLEXIDOR
8. SINBAR 0.5 KG/HA
9. SINBAR 0.25 KG/HA
10. DIURON 80 + FLEXIDOR
11. VENZAR
12. KERB 50W + GESATOP 50WP
13. KERB 50W + FLEXIDOR
14. DEVRINOL + GESATOP 50WP
15. RONSTAR LIQUID + KERB 50W
16. GOLTIX WG + KERB 50W

Any weeds which remained in the trial from the first year or developed over winter were treated with paraquat during January 1993 to ensure the entire trial was weed free prior to applying the treatments.

The following herbicides were applied on 16 February 1993:-

Treatment No	Treatments
2.	Devrinol (napropamide) at 9 l/ha.
3.	Gesatop 50 WP (simazine) at 2 kg/ha
4.	Flexidor (isoxaben) at 500 ml/ha
5.	Butisan S (metazachlor) at 2.5 l/ha
6.	Butisan S (metazachlor) at 2.5 l/ha plus Kerb 50W (propyzamide) at 1 kg/ha.
7.	Stomp 400 (pendimethalin) at 4 l/ha plus Flexidor (isoxaben) at 300 ml/ha.
8.	Sinbar (terbacil) at 0.5 kg/ha.
9.	Sinbar (terbacil) at 0.25 kg/ha
10.	Diuron 80 at 0.5 kg/ha plus Flexidor (isoxaben) at 300 ml/ha
11.	Venzar (lenacil) at 2.2 kg/ha.
12.	Kerb 50W (propyzamide) at 1.5 kg/ha plus Gesatop 50 WP (simazine) at 1.5 kg/ha.

13. Kerb 50w (propyzamide) at 1.5 kg/ha plus Flexidor (isoxaben) at 300 ml/ha.

14. Devrinol (napropamide) at 9 l/ha plus Gesatop 50 WP (simazine) at 1 kg/ha.

15. Ronstar liquid (oxadiazon) at 4 l/ha plus Kerb 50w (propyzamide) at 1 kg/ha.

16. Goltix WG (metamitron) at 5 kg/ha plus Kerb 50w (propyzamide) at 1 kg/ha.

All the herbicides were applied in the equivalent of 400 litres of water per hectare.

The control plots were left untreated.

On 18 June 1993 all the herbicide treatments were followed up with an application of Butisan S (metazachlor) at 2.5 l/ha applied in 400 l/ha of water.

Assessments of the trial were made on 27 April, 7 June and 20 July 1993 to record;

(a) weed number and weed species present

(b) plant vigour in terms of shoot development

(c) possible phytotoxic damage

A scoring system similar to the one adopted for the seed bed trial was used to record overall plant vigour and observed phytotoxic damage. The results are presented in Table 3.

A standard fertiliser programme and pest and disease control programme was applied to the trial.

At the end of the first year of the trial, 400 plants were chosen at random from the trial and their stem heights measured. The average stem heights calculated from this sample are given in Table 4.

Results

(i) SEED BED TRIAL

(a) *Summary of last year's results*

The best weed control was achieved by the Venzar pre and post emergence treatment. Other treatments which also performed well included the Dazomet soil sterilisation treatments (both rates) and the Flexidor pre and post emergence treatment. The remaining treatments performed relatively poorly in terms of weed control. The main weed problem noted in the trial was volunteer oil seed rape.

In terms of plant vigour and germination, both the Venzar and Flexidor treatments had a deleterious effect on a number of the plant species used in the trial, especially the Alnus glutinosa and Cotoneaster franchetii. No such problems were associated with the Dazomet treatments.

Direct phytotoxic plant damage was noted with the following treatments (usually as a result of the pre emergence application); Enide 50w plus Dacthal, Butisan S and Ronstar Liquid.

(b) *Results obtained this year*

1. Weed Control

The main difference between the site used this year for the seed bed trial and that used last year was the higher weed pressure. As well as a wide range of annual weed seed present in the soil (Groundsel, Willowherb, Annual meadow grass, Nightshade, Fat hen etc) a range of perennial weeds (Dock, Creeping buttercup, Sorrel, Couch and Creeping thistle) were also noted. The site proved more of a test for the various treatments under examination, and as can be seen from Figure 3 and the statistical data in Appendix 4 the levels of weed control attained by the treatments decreased with time.

As with the results obtained in the previous year the pre and post emergence Venzar treatment produced the highest level of weed control (Table 1 and Figure 3). This high level of weed control was maintained throughout the trial.

TABLE 1

SUMMARY OF THE PLANT ASSESSMENT FROM THE SEED BED TRIAL (TOTAL OF ALL FOUR REPLICATES)

TREATMENT	15 JUNE 1993				8 JULY 1993				16 AUGUST 1993			
	Percentage Weed Control	Vigour Score	Phytotoxicity Score	Germination Score	Percentage Weed Control	Vigour Score	Phytotoxicity Score	Germination Score	Percentage Weed Control	Vigour Score	Phytoxicity Score	Germination Score
Control	-	32	0	31	-	33	0	35	-	25	0	29
Enide 50 W pre emergence and every 5 weeks post emergence	91	28	3	30	56	28	1	32	14	28	0	34
Enide 50W + Dacthal pre emergence and Enide 50W every 5 weeks post emergence	95	27	3	30	83	28	11	32	65	30	4	33
Goltix WG pre emergence and every 5 weeks post emergence	98	25	7	27	60	27	0	31	17	26	0	31
Kerb 50W pre emergence and 10 weeks later post emergence	91	27	0	27	90	29	0	28	61	29	0	31
Atlas Gold pre emergence and Atlas CIPC 40 every 5 weeks post emergence	58	30	1	32	13	32	1	33	10	26	0	31
Devrinol pre emergence	81	30	0	27	72	31	0	29	52	28	0	31
Venzar pre emergence and every 5 weeks post emergence	100	27	3	26	99	27	4	28	90	28	3	27
Ronstar Liquid pre emergence	91	24	5	26	82	28	0	27	65	31	0	31

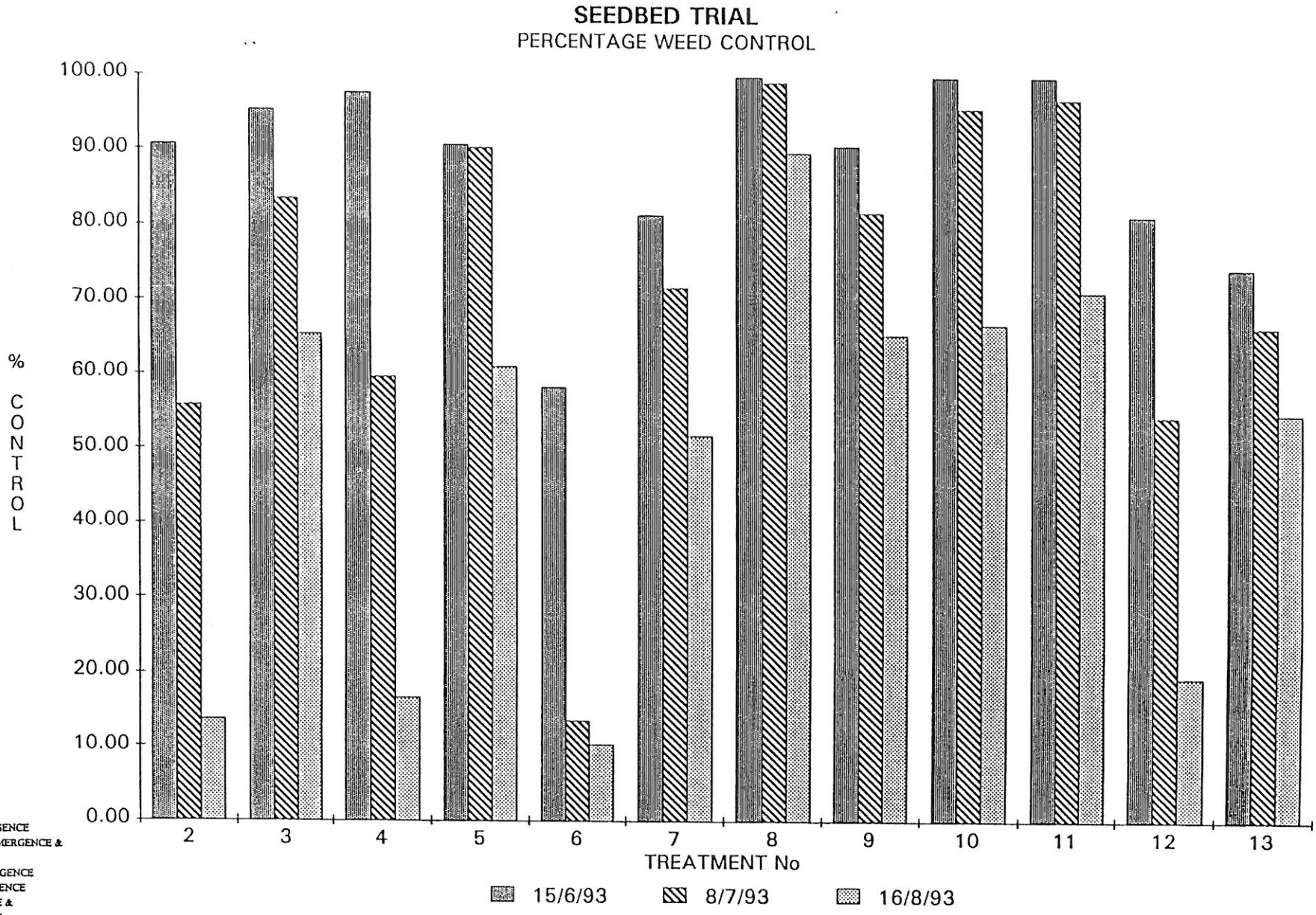
TREATMENT	15 JUNE 1993				8 JULY 1993				16 AUGUST 1993			
	Percentage Weed Control	Vigour Score	Phytotoxicity Score	Germination Score	Percentage Weed Control	Vigour Score	Phytotoxicity Score	Germination Score	Percentage Weed Control	Vigour Score	Phytoxicity Score	Germination Score
Butisan S pre emergence and 10 weeks later post emergence	100	22	5	21	96	22	12	19	67	29	0	24
Flexidor pre emergence and 10 weeks later post emergence	100	25	3	25	97	23	10	24	71	31	0	30
Dazomet `low rate'	81	33	0	34	54	34	0	35	19	32	0	32
Dazomet `recommended rate'	74	32	0	32	66	36	0	35	55	36	0	36

Key: Vigour score - a high figure represents good vigour, a low figure represents poor vigour
Phytotoxicity score - a high figure represents damage to the seedlings, a low figure represents little damage
Germination score - a high figure represents good germination, a low figure represents poor germination.

TABLE 2

AVERAGE FINAL STEM HEIGHTS OF SPECIES IN THE SEED BED TRIAL

TREATMENT	SPECIES	AVERAGE STEM HEIGHT (CM)	TREATMENT	SPECIES	AVERAGE STEM HEIGHT (CM)
Control	Acer rubrum	14.4	Venzar pre and post emergence	Acer rubrum	18.4
	Prunus padus	35.8		Prunus padus	22.4
	Gleditsia triacanthos	27.2		Gleditisia triacanthos	39.6
	Sorbus intermedia	17.4		Sorbus intermedia	9.2
	Alnus glutinosa	11.2		Alnus glutinosa	5.2
	Fagus sylvatica	20.2		Fagus sylvatica	20.4
Enide 50W pre and post emergence	Acer rubrum	13.2	Ronstar Liquid pre emergence	Acer rubrum	16.4
	Prunus padus	31.2		Prunus padus	32.8
	Gleditisia triacanthos	36.0		Gleditisia triacanthos	28.2
	Sorbus intermedia	10.2		Sorbus intermedia	11.4
	Alnus glutinsoa	8.2		Alnus glutinsoa	13.0
	Fagus sylvatica	20.2		Fagus sylvatica	24.4
Enide 50W + Dacthal pre emergence, Enide 50 W post emergence	Acer rubrum	12.6	Butisan S pre and post emergence	Acer rubrum	15.0
	Prunus padus	26.8		Prunus padus	18.2
	Gleditisia triacanthos	29.8		Gleditisia triacanthos	30.2
	Sorbus intermedia	12.6		Sorbus intermedia	11.2
	Alnus glutinosa	15.0		Alnus glutinosa	8.2
	Fagus sylvatica	20.4		Fagus sylvatica	21.2
Goltix WG pre and post emergence	Acer rubrum	17.6	Flexidor pre and post emergence	Acer rubrum	21.0
	Prunus padus	30.8		Prunus padus	48.4
	Gleditisia triacanthos	35.8		Gleditisia triacanthos	37.2
	Sorbus intermedia	7.0		Sorbus intermedia	14.2
	Alnus glutinsoa	9.6		Alnus glutinsoa	13.6
	Fagus sylvatica	24.6		Fagus sylvatica	21.8
Kerb 50W pre and post emergence	Acer rubrum	20.2	Dazomet 'low rate'	Acer rubrum	24.8
	Prunus padus	24.0		Prunus padus	29.4
	Gleditisia triacanthos	27.4		Gleditisia triacanthos	33.4
	Sorbus intermedia	9.8		Sorbus intermedia	16.2
	Alnus glutinosa	7.0		Alnus glutinosa	12.8
	Fagus sylvatica	21.6		Fagus sylvatica	25.6
Atlas Gold pre emergence and Atlas CIPC post emergence	Acer rubrum	8.4	Dazomet 'recommended rate'	Acer rubrum	29.4
	Prunus padus	28.6		Prunus padus	54.0
	Gleditisia triacanthos	22.2		Gleditisia triacanthos	46.0
	Sorbus intermedia	11.8		Sorbus intermedia	20.6
	Alnus glutinosa	6.2		Alnus glutinosa	24.6
	Fagus sylvatica	21.6		Fagus sylvatica	29.4
Devrinol pre emergence	Acer rubrum	12.4			
	Prunus padus	21.4			
	Gleditisia triacanthos	21.8			
	Sorbus intermedia	8.0			
	Alnus glutinosa	7.0			
	Fagus sylvatica	19.6			



REATMENT

ONTROL
NIDE 50W PRE & POST EMERGENCE
NIDE 50W + DACHTAL PRE-EMERGENCE &
NIDE 50W POST EMERGENCE
OLTEX WG PRE & POST EMERGENCE
ERB 50W PRE & POST EMERGENCE
TLAS GOLD PRE-EMERGENCE &
TLAS CIPC POST EMERGENCE
EVRINOL PRE-EMERGENCE
ENZAR PRE & POST EMERGENCE
ONSTAR LIQUID PRE-EMERGENCE
UTISAN S PRE & POST EMERGENCE
LEXIDOR PRE & POST EMERGENCE
AZOMET 'LOW RATE'
AZOMET 'RECOMMENDED RATE'

The Flexidor pre and post emergence and Butisan S pre and post emergence treatments also produced good initial levels of weed control, but the level of control decreased with time (Figure 3).

Both the Dazomet treatments performed relatively poorly, but in the main it was perennial weeds rather than annual weeds which were a problem with these treatments.

The poorest weed control was attained by the Atlas Gold pre-emergence and Atlas CIPC 40 post emergence treatment. This treatment gave significantly poorer weed control than the majority of the other treatments on the last two assessment dates. (Appendix 4). It specifically gave poor control of both Nightshade and Willowherb.

2. **Vigour**

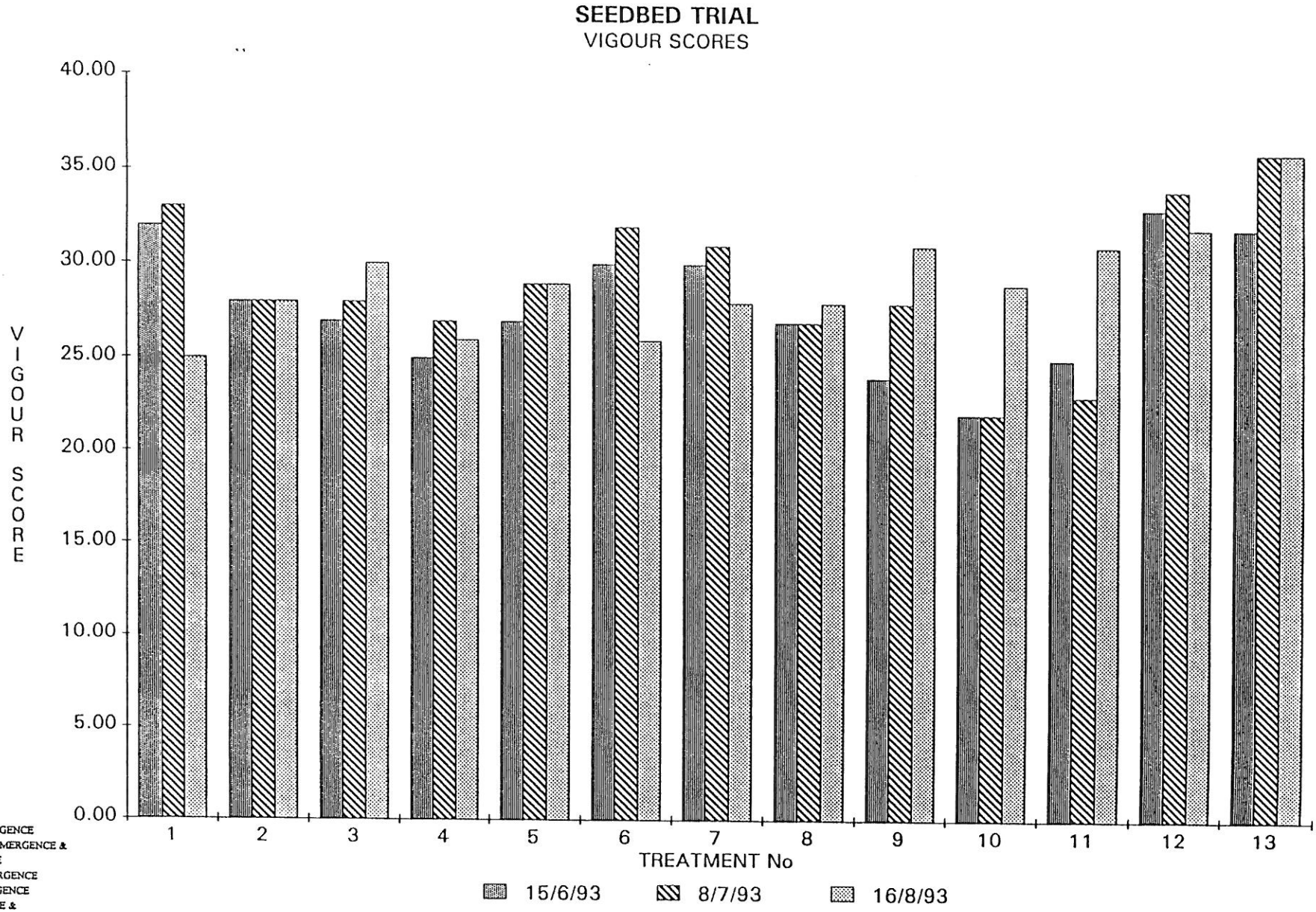
Two systems were used to assess vigour, these were direct measurement of the stem height and a scoring system, which assessed the seedling's `overall vigour'. The results of the assessments are given in Tables 1 and 2 and Figure 4. The degree of vigour in the seedlings throughout the trial was fairly uniform as can be seen from Figure 4, although differences occurred in response to a few of the treatments.

The results from the 'overall vigour' assessment show that both the Dazomet treatments gave rise to the most vigorous seedlings. The seedlings treated with these two treatments were the only ones which were consistently more vigourous than the seedlings in the control plots.

Herbicides which performed well in terms of not reducing seedling vigour included Atlas Gold pre-emergence followed by Atlas CIPC 40 post emergence treatment and the Devrinol pre-emergence treatment.

The Flexidor, Butisan S and Goltix WG treatments reduced the initial vigour of the seedlings, mainly the Alnus glutinosa, Sorbus aucuparia, and Prunus padus (Appendix 5). In fact the seedlings treated with Butisan S were significantly less vigorous than the majority of the other seedlings in the trial over the first few months (Appendix 4).

The vigour scores for several of the treatments decreased with time, this was most likely due to an increase in direct weed competition.



TREATMENT

. CONTROL
. ENIDE 50W PRE & POST EMERGENCE
. ENIDE 50W + DACHTAL PRE-EMERGENCE & ENIDE 50W POST EMERGENCE
. GOLTIX WG PRE & POST EMERGENCE
KERB 50W PRE & POST EMERGENCE
ATLAS GOLD PRE-EMERGENCE & ATLAS CIPC POST EMERGENCE
. DEVRINOL PRE-EMERGENCE
. VENZAR PRE & POST EMERGENCE
. RONSTAR LIQUID PRE-EMERGENCE
. BUTISAN S PRE & POST EMERGENCE
. FLEXIDOR PRE & POST EMERGENCE
. DAZOMET 'LOW RATE'
DAZOMET 'RECOMMENDED RATE'

The results from the average stem height analysis (Table 2) suggest that as with the `overall vigour' scoring system, the most vigorous seedlings occurred in the Dazomet treated plots (both rates) and the plots treated with Flexidor.

In direct contradiction to the results obtained using the scoring system, the least vigorous seedlings occurred in the plots treated with Devrinol and Atlas Gold pre-emergence followed by Atlas CIPC 40 post emergence.

3. **Phytotoxicity**

Eight of the thirteen treatments caused direct phytotoxic damage to one or more of the plant species used in the trial (Table 1 and Figure 5). Generally this was a result of the initial pre-emergence treatment and usually the symptoms were transitory. However, in the case of four treatments seedling death was noted.

The Enide 50 w plus Dacthal mixture and the Butisan S treatment produced a dieback of the young Acer rubrum and Prunus padus seedlings. (Appendix 5). The Flexidor treatment caused a distortion and slight dieback in the young Prunus padus seedlings, whilst the Venzar treatment produced a dieback in the Prunus padus and then later in the Sorbus aucuparia.

The damage caused by the first three herbicide treatments was significantly worse than the other treatments (Appendix 4).

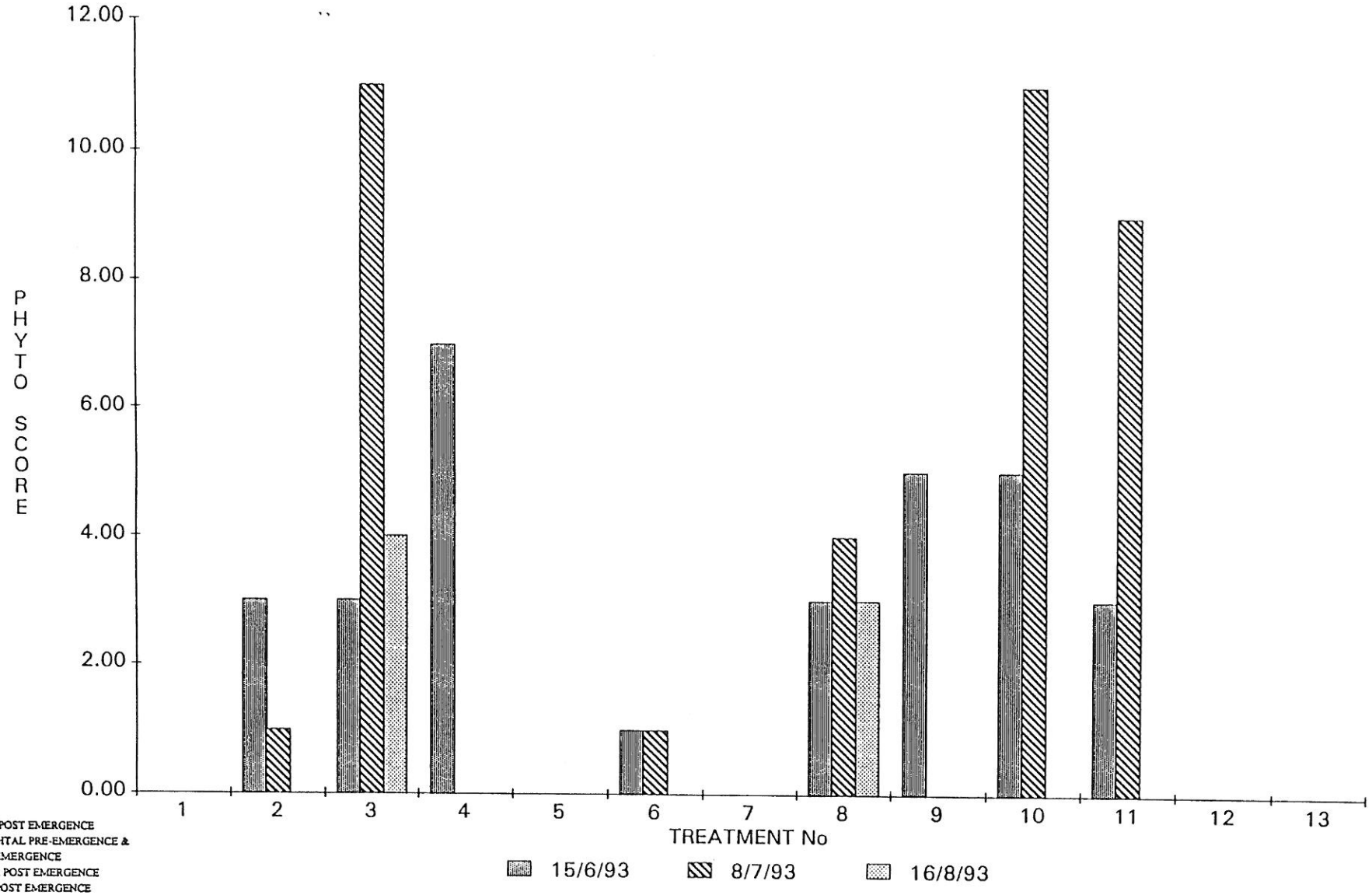
4. **Germination**

Overall the germination level was reasonable, but herbicide activity inhibited germination in certain species (Table 1 and Figure 6).

The germination of Alnus glutinosa appeared to be reduced by most of the herbicide treatments to varying degrees. Good germination of Alnus was only noted in the control plots and the plots treated with the two Dazomet treatments.

The two treatments which gave rise to the lowest level of germination were the Butisan S and Flexidor treatments. Both treatments considerably reduced the germination level of the Alnus and Prunus species (Appendix 5). The Butisan S treatment reduced germination significantly when compared to the other treatments (Appendix 4).

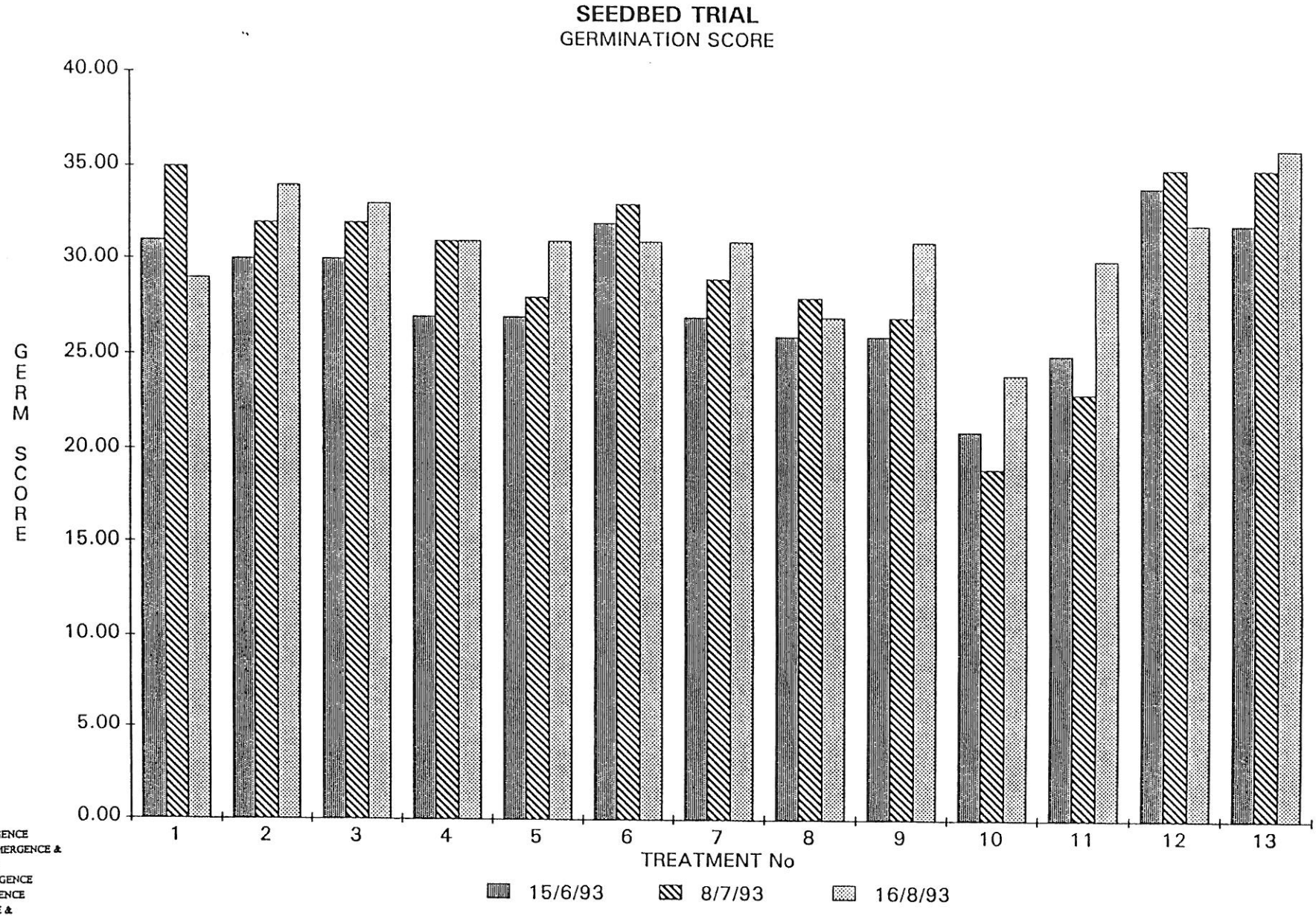
SEEDBED TRIAL
PHYTOTOXICITY SCORES



TREATMENT

CONTROL
ENIDE 50W PRE & POST EMERGENCE
ENIDE 50W + DACHTAL PRE-EMERGENCE &
ENIDE 50W POST EMERGENCE
OLTIX WG PRE & POST EMERGENCE
ERB 50W PRE & POST EMERGENCE
TLAS GOLD PRE-EMERGENCE &
TLAS CIPC POST EMERGENCE
EVRINOL PRE-EMERGENCE
ENZAR PRE & POST EMERGENCE
ONSTAR LIQUID PRE-EMERGENCE
UTISAN S PRE & POST EMERGENCE
LEXIDOR PRE & POST EMERGENCE
AZOMET 'LOW RATE'
AZOMET 'RECOMMENDED RATE'

FIGURE 6



TREATMENT

CONTROL
NIDE 50W PRE & POST EMERGENCE
NIDE 50W + DACHTAL PRE-EMERGENCE &
NIDE 50W POST EMERGENCE
OLTIX WG PRE & POST EMERGENCE
ERB 50W PRE & POST EMERGENCE
TLAS GOLD PRE-EMERGENCE &
TLAS CIPC POST EMERGENCE
EVRINOL PRE-EMERGENCE
ENZAR PRE & POST EMERGENCE
ONSTAR LIQUID PRE-EMERGENCE
UTISAN S PRE & POST EMERGENCE
LEXIDOR PRE & POST EMERGENCE
AZOMET 'LOW RATE'

(ii) **TRANSPLANT TRIAL**

(a) *Summary of last year's results*

Weed control was particularly poor overall, due to a lack of moisture in the soil at the time of herbicide application. The best weed control was attained by the Ronstar Liquid plus Kerb 50W and the Kerb 50W plus Flexidor mixture. Both the above treatments did however, cause a slight reduction in plant vigour.

The Butisan S treatment applied as a follow up treatment ten weeks later to all the previously treated plots, prevented the vast majority of the Groundsel seed present in the trial from germinating.

No plant damage was noted as a result of this treatment.

(b) *Results obtained this year*

1. **Weed Control**

All the treatments gave excellent weed control throughout the trial (Table 3 and Figure 7).

2. **Vigour**

As with the vigour assessment for the seedlings in the seed bed trial, two methods were used to assess vigour, these were direct stem height measurement and a scoring system which assessed the plant's `overall vigour'.

Generally no major differences in overall plant vigour were noticed between the various treatments (Table 3 and 4 and Figure 8).

From the 'overall vigour' assessment the most vigorous plants occurred in the plots treated with Venzar and Butisan S. A slight reduction in vigour was associated with the plants treated with the Ronstar Liquid plus Kerb 50 W mixture and the Goltix WG plus Kerb 50W mixture. However, in the case of the plants treated with the Ronstar Liquid plus Kerb 50W mixture the reduction in vigour noted probably resulted the year before as a result of the herbicide application post planting.

TABLE 3

SUMMARY OF THE PLANT ASSESSMENTS FROM THE TRANSPLANT TRIAL (TOTAL OF ALL FOUR REPLICATES)

TREATMENT	27 April 1993		7 June 1993		20 July 1993	
	Percentage weed control	Vigour Score	Percentage weed control	Vigour Score	Percentage weed control	Vigour Score
Control	-	-	-	34	-	34
Devrinol	99	-	98	32	98	33
Gesatop 50 WP	100	-	100	32	100	32
Flexidor	99	-	96	34	98	33
Butisan S	99	-	99	34	99	34
Butisan S + Kerb 50W	100	-	99	32	98	34
Stomp 400 + Flexidor	100	-	99	31	98	31
Sinbar 0.5 kgha	100	-	99	33	100	31
Sinbar 0.25 kgha	99	-	98	30	98	32
Diuron 80 + Flexidor	99	-	99	32	99	31
Venzar	99	-	99	35	99	35
Kerb 50 W + Gesatop 50 WP	100	-	100	34	100	31
Kerb 50W + Flexidor	100	-	99	31	98	33
Devrinol + Gesatop 50 WP	100	-	100	32	99	33
Ronstar Liquid + Kerb 50W	100	-	100	30	97	30
Goltix WG + Kerb 50W	99	-	97	30	98	31

KEY Vigour score - a high figure represents good vigour, a low figure represents poor vigour.

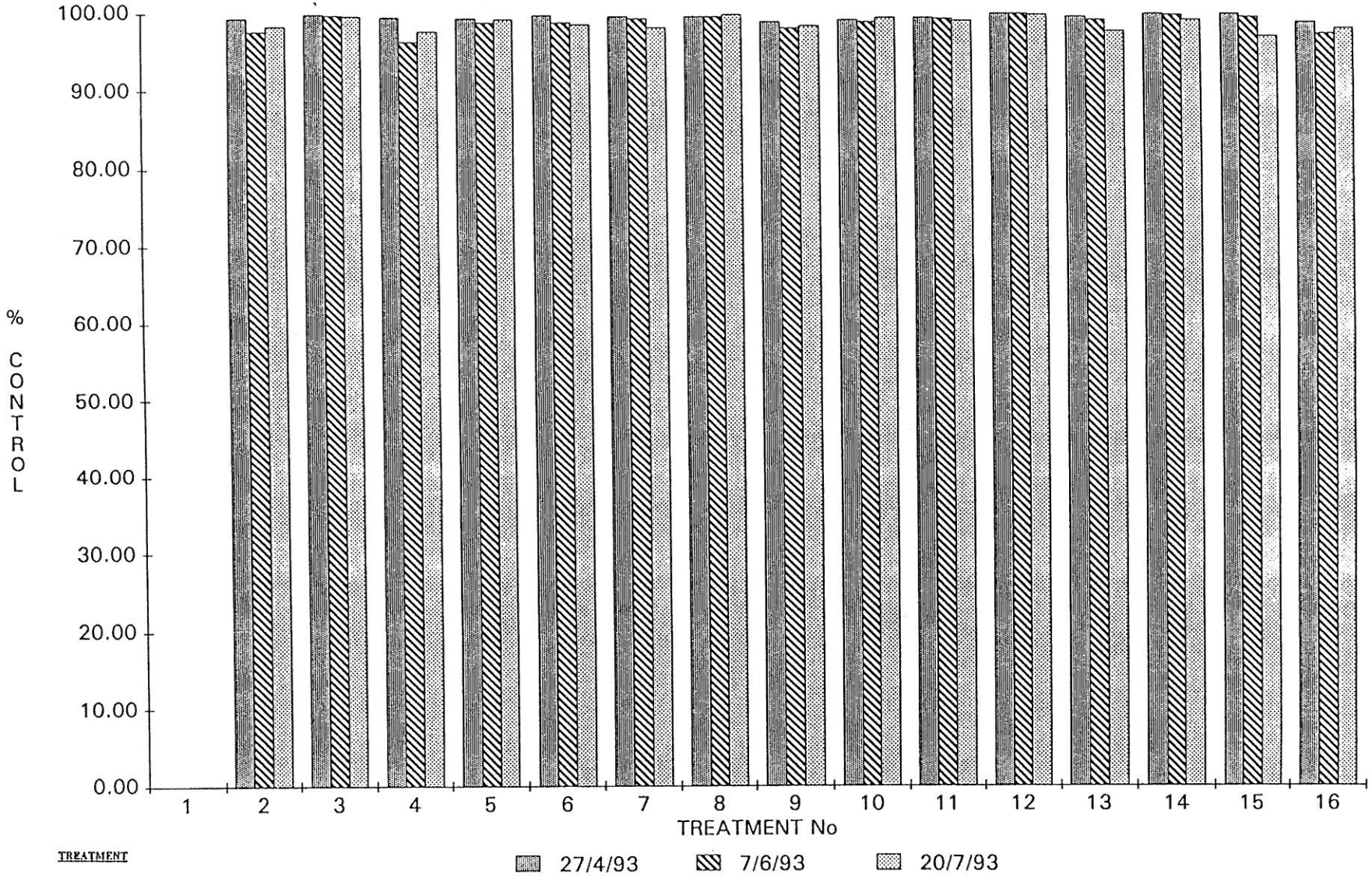
TABLE 4

AVERAGE FINAL STEM HEIGHTS OF SPECIES IN THE TRANSPLANT TRIAL

TREATMENT	SPECIES	AVERAGE STEM HEIGHT (CM)
Control	Crataegus monogyna	107
	Quercus petrea	76
	Sorbus aucuparia	147
	Alnus glutinosa	195
	Acer platanoides	147
Devrinol	Crataegus monogyna	130
	Quercus petrea	74
	Sorbus aucuparia	154
	Alnus glutinosa	193
	Acer platanoides	176
Gesatop 50 WP	Crataegus monogyna	123
	Quercus petrea	63
	Sorbus aucuparia	150
	Alnus glutinosa	204
	Acer platanoides	151
Flexidor	Crataegus monogyna	136
	Quercus petrea	88
	Sorbus aucuparia	152
	Alnus glutinosa	218
	Acer platanoides	167
Butisan S	Crataegus monogyna	104
	Quercus petrea	73
	Sorbus aucuparia	163
	Alnus glutinosa	192
	Acer platanoides	128
Butisan S + Kerb 50W	Crataegus monogyna	104
	Quercus petrea	92
	Sorbus aucuparia	140
	Alnus glutinosa	208
	Acer platanoides	139
Stomp 400 + Flexidor	Crataegus monogyna	110
	Quercus petrea	80
	Sorbus aucuparia	174
	Alnus glutinosa	208
	Acer platanoides	170
Sinbar 0.5 kg/ha	Crataegus monogyna	114
	Quercus petrea	73
	Sorbus aucuparia	149
	Alnus glutinosa	190
	Acer platanoides	152
Sinbar 0.25 kg/ha	Crataegus monogyna	99
	Quercus petrea	80
	Sorbus aucuparia	153
	Alnus glutinosa	204
	Acer platanoides	159
Diuron 80 + Flexidor	Crataegus monogyna	110
	Quercus petrea	78
	Sorbus aucuparia	136
	Alnus glutinosa	192
	Acer platanoides	167
Venzar	Crataegus monogyna	120
	Quercus petrea	72
	Sorbus aucuparia	147
	Alnus glutinosa	206
	Acer platanoides	166
Kerb 50W Gesatop 50 WP	Crataegus monogyna	122
	Quercus petrea	83
	Sorbus aucuparia	146
	Alnus glutinosa	190
	Acer platanoides	157
Kerb 50W + Flexidor	Crataegus monogyna	117
	Quercus petrea	71
	Sorbus aucuparia	164
	Alnus glutinosa	204
	Acer platanoides	166
Devrinol + Gesatop 50WP	Crataegus monogyna	130
	Quercus petrea	90
	Sorbus aucuparia	168
	Alnus glutinosa	208
	Acer platanoides	153
Ronstar Liquid + Kerb 50W	Crataegus monogyna	138
	Quercus petrea	82
	Sorbus aucuparia	140
	Alnus glutinosa	210
	Acer platanoides	166
Goltix WG + Kerb 50W	Crataegus monogyna	106
	Quercus petrea	72
	Sorbus aucuparia	150
	Alnus glutinosa	190
	Acer platanoides	132

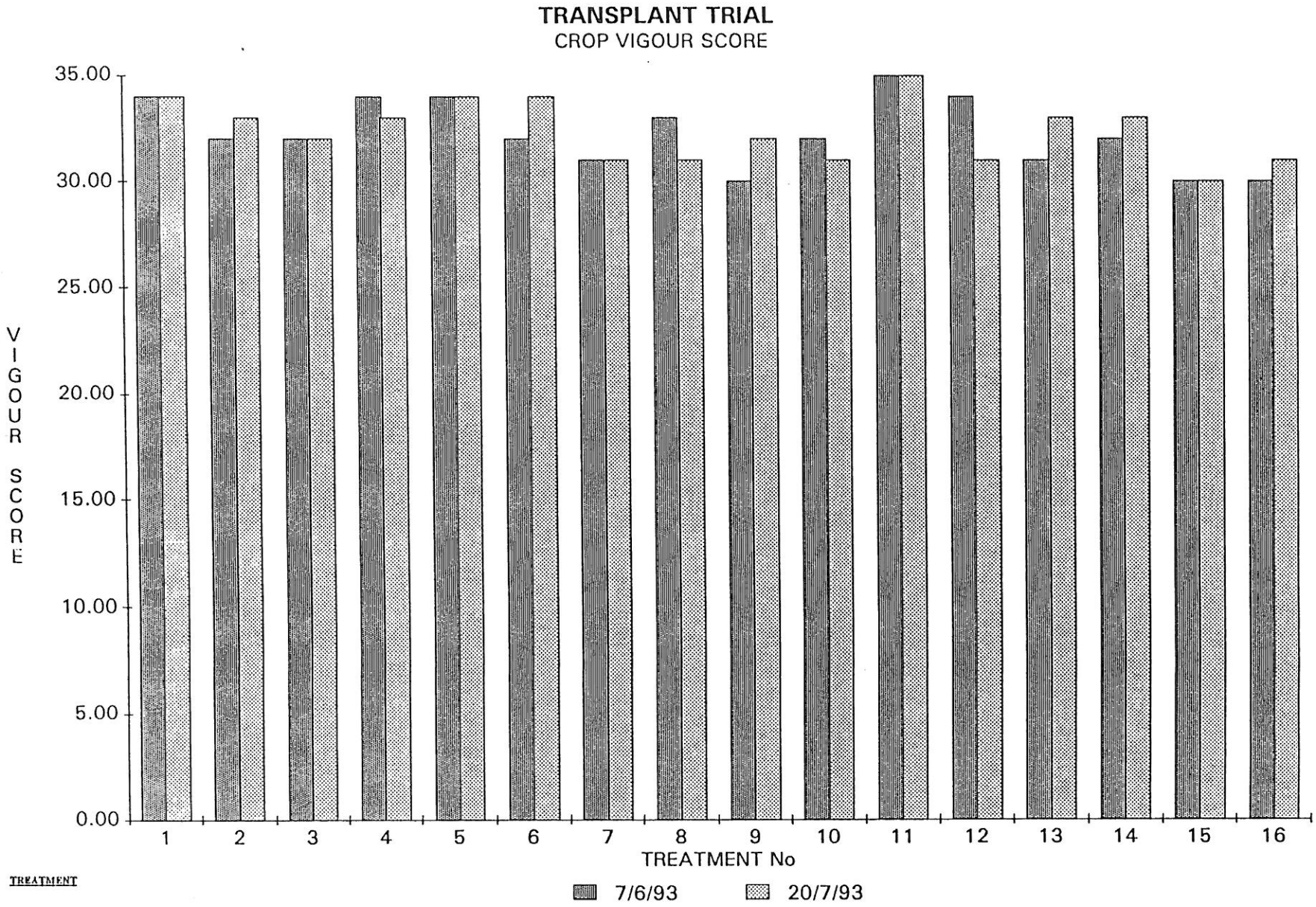
TRANSPLANT TRIAL

PERCENTAGE WEED CONTROL



TREATMENT

1. CONTROL
2. DEVRINOL
3. GESATOP 50WP
4. FLEXIDOR
5. BUTISAN S
6. BUTISAN S + KERB 50W
7. STOMP 400 + FLEXIDOR
8. SINBAR 0.5 KG/HA
9. SINBAR 0.25 KG/HA
10. DIURON 80 + FLEXIDOR
11. VENZAR
12. KERB 50W + GESATOP 50WP
13. KERB 50W + FLEXIDOR
14. DEVRINOL + GESATOP 50WP
15. RONSTAR LIQUID + KERB 50W
16. GOLTIX WG + KERB 50W



TREATMENT

1. CONTROL
2. DEVRINOL
3. GESATOP 50WP
4. FLEXIDOR
5. BUTISAN S
6. BUTISAN S + KERB 50W
7. STOMP 400 + FLEXIDOR
8. SINBAR 0 5 KG/HA
9. SINBAR 0.25 KG/HA
10. DIURON 80 + FLEXIDOR
11. VENZAR
12. KERB 50W + GESATOP 50WP
13. KERB 50W + FLEXIDOR
14. DEVRINOL + GESATOP 50WP
15. RONSTAR LIQUID + KERB 50W
16. GOLTIX WG + KERB 50W

The average stem height measurements suggest that overall the most vigorous plants occurred in the plots treated with Flexidor, whilst the least vigorous plants were associated with treatments of Goltix WG plus Kerb 50W (Table 4).

3. Phytotoxicity

No phytotoxic damage was noted after the first set of herbicides were applied. One or two patches of scorched foliage on the Sorbus aucuparia were noted after the follow up application of Butisan S (Appendix 5). Whether the scorch was a direct effect of the Butisan S is not clear.

No further plant losses were noted in the second year of the trial.

Conclusions

(i) SEED BED TRIAL

Most of the herbicide treatments produced a higher level of weed control in the second year of the trial than in the first, however a general decline in weed control with time was noted in the second year of the trial.

Similar levels of seedling germination, seedling vigour and seedling phytotoxicity levels occurred in response to the various treatments over both the years.

The Venzar pre and post emergence treatment produced the highest level of weed control over the two years. However, the pre-emergence treatment:-

(i) reduced the initial level of seedling germination, especially of the Alnus glutinosa.

(ii) reduced the general level of seedling vigour.

(iii) produced a dieback in the Prunus padus and Sorbus intermedia seedlings.

The Flexidor pre and post emergence treatment also worked well in terms of weed control, but again the treatment gave rise to a reduction in seedling germination, an initial loss of seedling vigour and a high level of seedling phytotoxicity.

The Ronstar Liquid pre-emergence treatment produced a reasonable level of weed control, but again had deleterious effects on seedling germination and vigour.

Herbicide treatments which caused no or very little phytotoxic damage and had the minimal deleterious effects on seedling germination and vigour included; Devrinol, applied pre-emergence only, Atlas Gold applied pre-emergence followed by Atlas CIPC 40 applied post emergence and to a lesser extent Kerb 50 W applied pre and post emergence. However, these treatments did not produce high levels of weed control. In the case of the Devrinol and Kerb 50W treatments this maybe because the herbicides were simply applied too late in the year.

Good levels of seed bed weed control with the minimum of crop losses or damage may be attainable through the use of herbicides like Venzar, Flexidor, Butisan S and Ronstar Liquid. However, the rates of these herbicides applied pre-emergence (and to a lesser degree, where applicable, post emergence) will have to be further reduced.

Therefore, on sandy soils Venzar will need to be applied below 1½ kg/ha pre-emergence, Flexidor below 200 ml/ha pre-emergence, Butisan S below 1½ 1 /ha pre-emergence and Ronstar Liquid below 4 l/ha pre-emergence.

Both the Dazomet treatments examined in the trial produced lower levels of weed control in the second year of the trial, but again both treatments gave rise to improved seedling germination and vigour. If weed control is the only reason for using Dazomet in the seed bed situation, it would be worthwhile considering the use of the lower rate Dazomet because of the considerable financial savings achievable (Appendix 2).

Note that the 100 kg/ha rate of Dazomet applied to the top 5 cm of soil was the rate chosen for the sandy soils at the trial site, heavier soils will probably require a higher rate. No soil cultivations deeper than 5 cm must be carried out after the soil has been sterilised, using the 100 kg/ha rate of Dazomet.

(ii) TRANSPLANT TRIAL

Because of a general lack of moisture in the soil at the time of planting the majority of the herbicides gave very poor weed control in the first year of the trial. This year because the herbicides were applied earlier in the year, when the soil was still moist, excellent weed control was achieved by all the treatments.

Because of such widely differing results it is difficult to draw any positive conclusions. However, the higher levels of weed control which were attained by two of the treatments (Ronstar Liquid plus Kerb 50W and Kerb 50W plus Flexidor) in the first year of the trial can still be highlighted.

In general the herbicides used in the transplant trial had much less of an effect on the transplants themselves. Reductions in plant vigour were noticed as a result of the Ronstar Liquid plus Kerb 50W, Goltix WG and Kerb 50W and Sinbar treatments, but such reductions were small.

Phytotoxic damage was limited to chlorosis of the foliage in the first year of the trial by the Devrinol, Venzar, Flexidor and two Sinbar treatments. Once the plants had become established no further phytotoxicity was noted.

In the first year of the trial one treatment, the Diuron 80 plus Flexidor mixture, was associated with over 40 plants failing to establish. Whether this was a direct result of the herbicide is not clear.

With regard to the range of herbicides examined in the trial, it appears from the results that they can all give good levels of weed control if sufficient moisture is provided, whilst causing the minimum of crop loss or damage.

APPENDIX 1

THE MOST PROMINENT WEEDS NOTED IN EACH TREATMENT IN THE SEED BED TRIAL

Treatment	Prominent Weeds Noted (16 August 1993)
Control	Perennial weeds (Clover, Creeping buttercup) Nightshade and Willowherb
Enide 50W pre-emergence and every 5 weeks post emergence	Nightshade and Willowherb
Enide 50W + Dacthal pre emergence and Enide 50W every 5 weeks post emergence	Willowherb
Goltix WG pre emergence and every 5 weeks post emergence	Creeping buttercup and Willowherb
Kerb 50W pre emergence and 10 weeks later post emergence	Willowherb
Atlas Gold pre emergence and Atlas CIPC 40 every 5 weeks post emergence	Nightshade and Willowherb
Devrinol pre emergence	Nightshade
Venzar pre emergence and every 5 weeks post emergence	-
Ronstar Liquid pre emergence	-
Butisan S pre emergence and 10 weeks later post emergence	-
Flexidor pre emergence and 10 weeks later post emergence	Willowherb
Dazomet `low rate'	Perennial weeds (Creeping buttercup, Dock), Groundsel and Willowherb
Dazomet `recommended rate'	Willowherb

APPENDIX 2

APPROXIMATE COST OF THE VARIOUS CHEMICAL TREATMENTS USED IN THE SEED BED AND TRANSPLANT TRIAL

SEED BED TRIAL

	TREATMENT	COST PER TREATED HECTARE £
2.	Enide 50W pre and post-emergence	360
3.	Enide 50W + Dacthal pre-emergence and Enide 50W post-emergence	433
4.	Goltix WG pre and post-emergence	177
5.	Kerb 50W pre and post-emergence	130
6.	Atlas Gold pre-emergence and Atlas CIPC post-emergence	48
7.	Devrinol pre-emergence	153
8.	Venzar pre and post-emergence	186
9.	Ronstar Liquid pre-emergence	104
10.	Butisan S pre and post-emergence	90
11.	Flexidor pre and post-emergence	52
12.	Dazomet 'low rate'	518
13.	Dazomet 'recommended rate'	1968

Costs relate to the pre-emergence treatment and two post-emergence treatments where the interval between applications is five weeks, and one post-emergence treatment where the interval between applications is ten weeks.

APPENDIX 3

SOIL ANALYSES OF THE TWO TRIAL SITES

Lab sample No and Identification	pH	Lime g/m2 (oz/sq.yd)	Phosphorus mg/l (index)	Potassium mg/l (index)	Magnesium mg/l (index)	Conduct µS (index)	Nitrate mg/l N (index)
93243499 Oakover Seedbed	6.5	0	35 (3)	177 (2)	88 (2)	2070 (0)	7 (0)
93243500 Oakover Transplant	6.5	0	23 (2)	110 (1)	51 (2)	2060 (0)	5 (0)

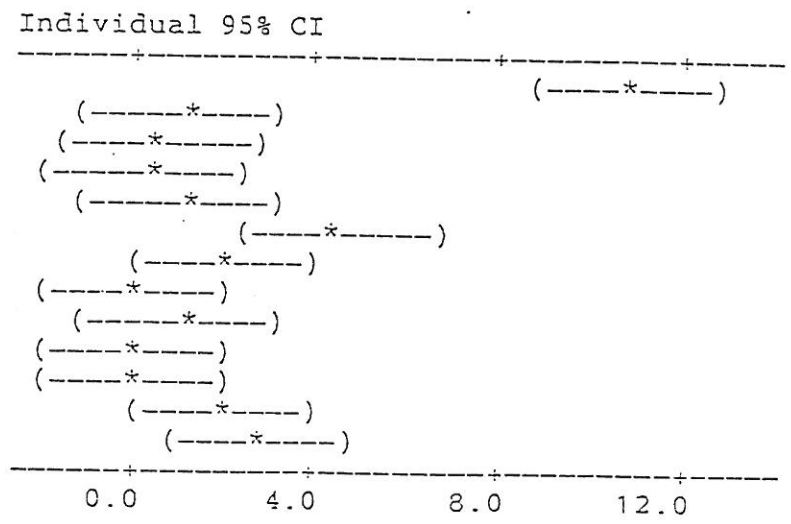
SEED BED TRIAL - WEED COUNT ANALYSIS JUNE 15

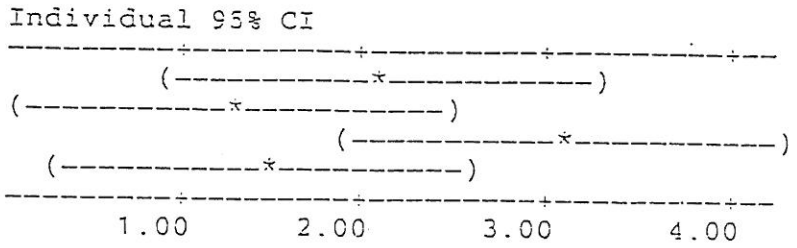
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	11.0000	8.0000	19.0000	5.0000	10.7500
2	3.0000	1.0000	0.0000	0.0000	1.0000
3	1.0000	1.0000	0.0000	0.0000	0.5000
4	1.0000	0.0000	0.0000	0.0000	0.2500
5	1.0000	0.0000	3.0000	0.0000	1.0000
6	3.0000	3.0000	9.0000	3.0000	4.5000
7	4.0000	1.0000	2.0000	1.0000	2.0000
8	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0000	2.0000	2.0000	0.0000	1.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000	0.0000	0.0000
12	1.0000	1.0000	2.0000	4.0000	2.0000
13	2.0000	0.0000	3.0000	6.0000	2.7500
ALL	2.0769	1.3077	3.0769	1.4615	1.9808

ANALYSIS OF VARIANCE WEEDS1

SOURCE	DF	SS	MS
TRT	12	414.73	34.56
REP	3	25.13	8.38
ERROR	36	159.12	4.42
TOTAL	51	598.98	





Treatments (or replicates) are significantly different if the dotted lines on the above charts do not overlap. For example, in the above chart treatment 1 (in this case the control) gave rise to significantly more weeds than any other treatment

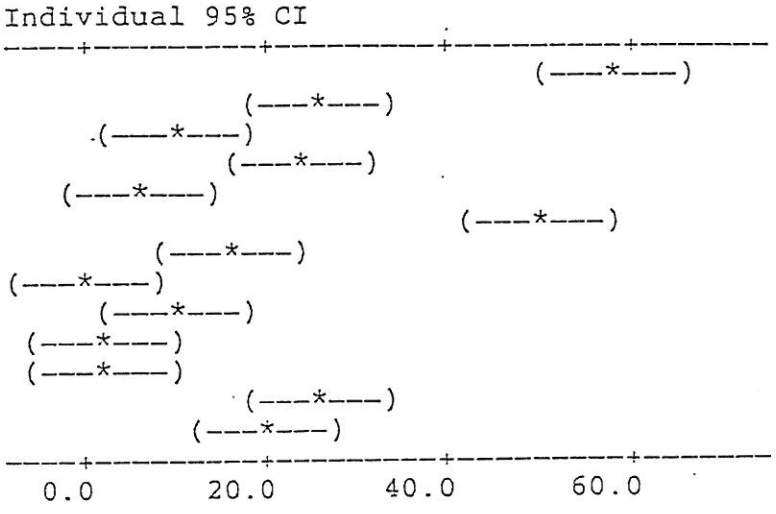
SEED BED TRIAL - WEED COUNT ANALYSIS JULY 8

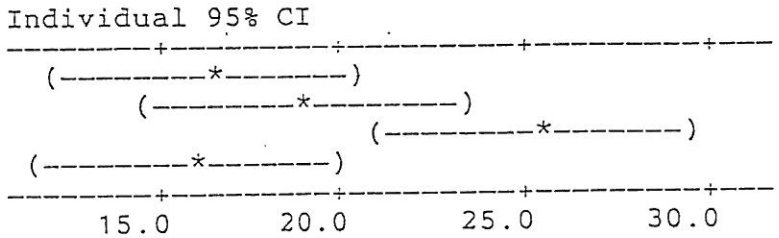
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	51.000	54.000	70.000	55.000	57.500
2	18.000	9.000	56.000	19.000	25.500
3	13.000	4.000	9.000	12.000	9.500
4	16.000	37.000	20.000	20.000	23.250
5	2.000	2.000	17.000	2.000	5.750
6	39.000	60.000	65.000	35.000	49.750
7	16.000	19.000	17.000	13.000	16.250
8	0.000	1.000	0.000	1.000	0.500
9	12.000	9.000	17.000	4.000	10.500
10	2.000	3.000	4.000	1.000	2.500
11	1.000	0.000	3.000	3.000	1.750
12	23.000	29.000	34.000	19.000	26.250
13	19.000	19.000	18.000	21.000	19.250
ALL	16.308	18.923	25.385	15.769	19.096

ANALYSIS OF VARIANCE WEEDS2

SOURCE	DF	SS	MS
TRT	12	15193.3	1266.1
REP	3	759.4	253.1
ERROR	36	2165.8	60.2
TOTAL	51	18118.5	





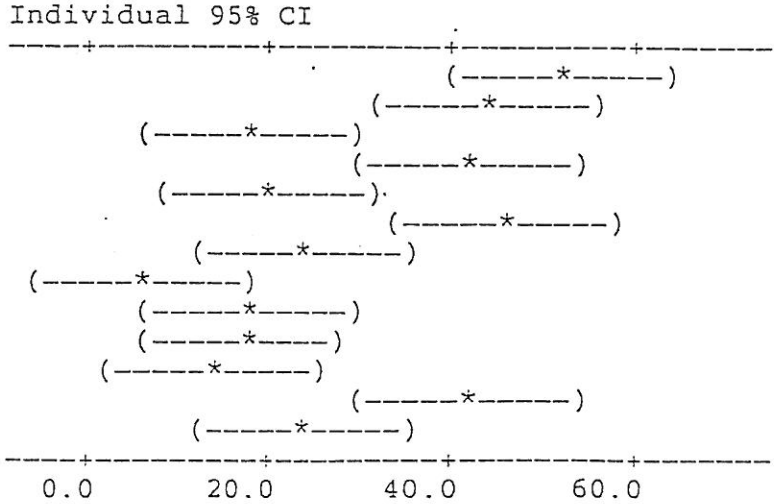
SEED BED TRIAL - WEED COUNT ANALYSIS AUGUST 16

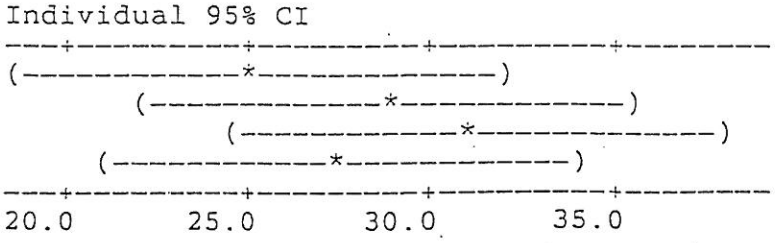
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	52.000	54.000	62.000	37.000	51.250
2	37.000	23.000	80.000	37.000	44.250
3	15.000	12.000	17.000	27.000	17.750
4	17.000	68.000	34.000	52.000	42.750
5	25.000	14.000	21.000	20.000	20.000
6	48.000	26.000	57.000	53.000	46.000
7	25.000	35.000	24.000	15.000	24.750
8	0.000	7.000	5.000	9.000	5.250
9	13.000	27.000	20.000	11.000	17.750
10	12.000	16.000	13.000	27.000	17.000
11	18.000	14.000	13.000	14.000	14.750
12	45.000	43.000	40.000	37.000	41.250
13	20.000	36.000	19.000	18.000	23.250
ALL	25.154	28.846	31.154	27.462	28.154

ANALYSIS OF VARIANCE WEEDS3

SOURCE	DF	SS	MS
TRT	12	10571	881
REP	3	246	82
ERROR	36	4957	138
TOTAL	51	15775	





SEED BED TRIAL - WEED VIGOUR ANALYSIS JUNE 15

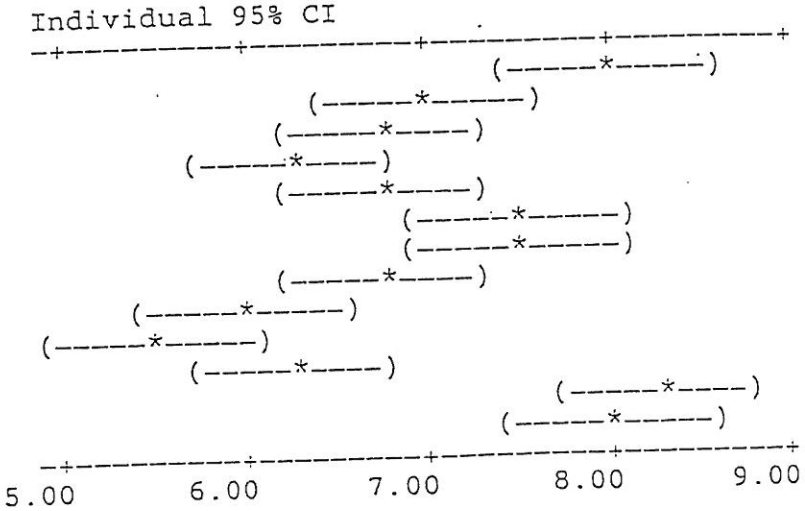
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	8.0000	8.0000	8.0000	8.0000	8.0000
2	7.0000	7.0000	7.0000	7.0000	7.0000
3	7.0000	6.0000	7.0000	7.0000	6.7500
4	6.0000	6.0000	7.0000	6.0000	6.2500
5	6.0000	7.0000	7.0000	7.0000	6.7500
6	7.0000	8.0000	7.0000	8.0000	7.5000
7	8.0000	8.0000	7.0000	7.0000	7.5000
8	6.0000	7.0000	7.0000	7.0000	6.7500
9	5.0000	7.0000	7.0000	5.0000	6.0000
10	5.0000	6.0000	6.0000	5.0000	5.5000
11	5.0000	7.0000	6.0000	7.0000	6.2500
12	8.0000	8.0000	9.0000	8.0000	8.2500
13	8.0000	8.0000	8.0000	8.0000	8.0000
ALL	6.6154	7.1538	7.1538	6.9231	6.9615

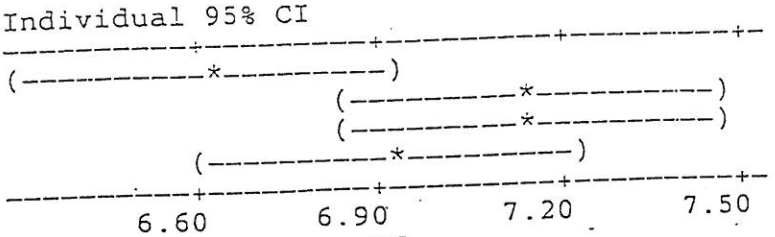
ANALYSIS OF VARIANCE VIG1

SOURCE	DF	SS	MS
TRT	12	34.423	2.869
REP	3	2.538	0.846
ERROR	36	10.962	0.304
TOTAL	51	47.923	

TRT	Mean
1	8.00
2	7.00
3	6.75
4	6.25
5	6.75
6	7.50
7	7.50
8	6.75
9	6.00
10	5.50
11	6.25
12	8.25
13	8.00



REP	Mean
1	6.62
2	7.15
3	7.15
4	6.92



SEED BED TRIAL - VIGOUR ANALYSIS JULY 8

ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	8.0000	9.0000	8.0000	8.0000	8.2500
2	8.0000	7.0000	6.0000	7.0000	7.0000
3	7.0000	7.0000	7.0000	7.0000	7.0000
4	6.0000	7.0000	7.0000	7.0000	6.7500
5	7.0000	7.0000	7.0000	8.0000	7.2500
6	9.0000	8.0000	8.0000	7.0000	8.0000
7	8.0000	7.0000	8.0000	8.0000	7.7500
8	7.0000	6.0000	7.0000	7.0000	6.7500
9	7.0000	7.0000	7.0000	7.0000	7.0000
10	6.0000	5.0000	5.0000	6.0000	5.5000
11	6.0000	6.0000	5.0000	6.0000	5.7500
12	9.0000	9.0000	8.0000	8.0000	8.5000
13	9.0000	9.0000	9.0000	9.0000	9.0000
ALL	7.4615	7.2308	7.0769	7.3077	7.2692

ANALYSIS OF VARIANCE VIG2

SOURCE	DF	SS	MS
TRT	12	49.731	4.144
REP	3	1.000	0.333
ERROR	36	9.500	0.264
TOTAL	51	60.231	

TRT	Mean	Individual 95% CI
1	8.25	(----*---)
2	7.00	(---*----)
3	7.00	(---*----)
4	6.75	(---*----)
5	7.25	(---*----)
6	8.00	(----*---)
7	7.75	(----*---)
8	6.75	(---*----)
9	7.00	(---*----)
10	5.50	(----*---)
11	5.75	(---*---)
12	8.50	(----*---)
13	9.00	(---*---)

6.00 7.20 8.40 9.60

REP	Mean	Individual 95% CI
1	7.46	(---------*---------)
2	7.23	(---------*---------)
3	7.08	(---------*---------)
4	7.31	(---------*---------)

7.00 7.25 7.50 7.75

SEED BED TRIAL - VIGOUR ANALYSIS AUGUST 16

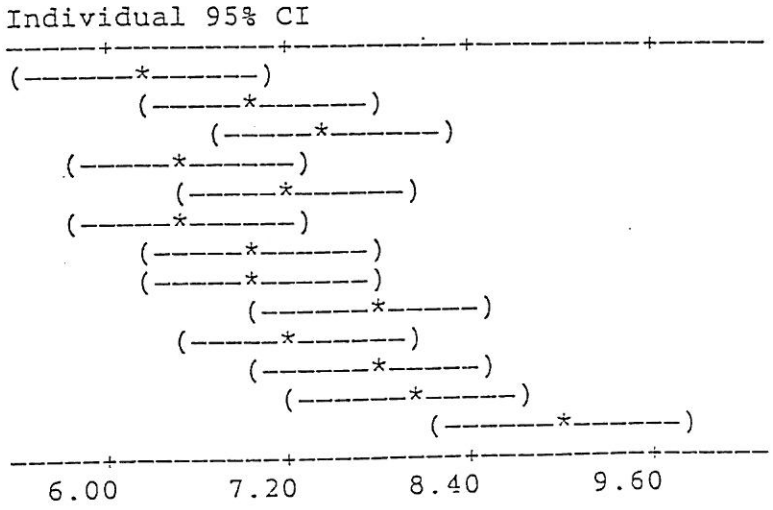
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	5.0000	8.0000	5.0000	7.0000	6.2500
2	7.0000	8.0000	6.0000	7.0000	7.0000
3	7.0000	7.0000	8.0000	8.0000	7.5000
4	6.0000	7.0000	6.0000	7.0000	6.5000
5	8.0000	7.0000	6.0000	8.0000	7.2500
6	8.0000	7.0000	5.0000	6.0000	6.5000
7	7.0000	7.0000	7.0000	7.0000	7.0000
8	7.0000	6.0000	7.0000	8.0000	7.0000
9	9.0000	7.0000	7.0000	8.0000	7.7500
10	8.0000	7.0000	6.0000	8.0000	7.2500
11	7.0000	9.0000	7.0000	8.0000	7.7500
12	8.0000	8.0000	8.0000	8.0000	8.0000
13	9.0000	9.0000	9.0000	9.0000	9.0000
ALL	7.3846	7.4615	6.6923	7.6154	7.2885

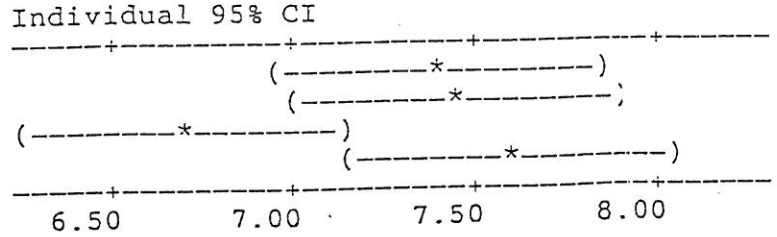
ANALYSIS OF VARIANCE VIG3

SOURCE	DF	SS	MS
TRT	12	25.923	2.160
REP	3	6.519	2.173
ERROR	36	22.231	0.618
TOTAL	51	54.673	

TRT	Mean
1	6.25
2	7.00
3	7.50
4	6.50
5	7.25
6	6.50
7	7.00
8	7.00
9	7.75
10	7.25
11	7.75
12	8.00
13	9.00



REP	Mean
1	7.38
2	7.46
3	6.69
4	7.62



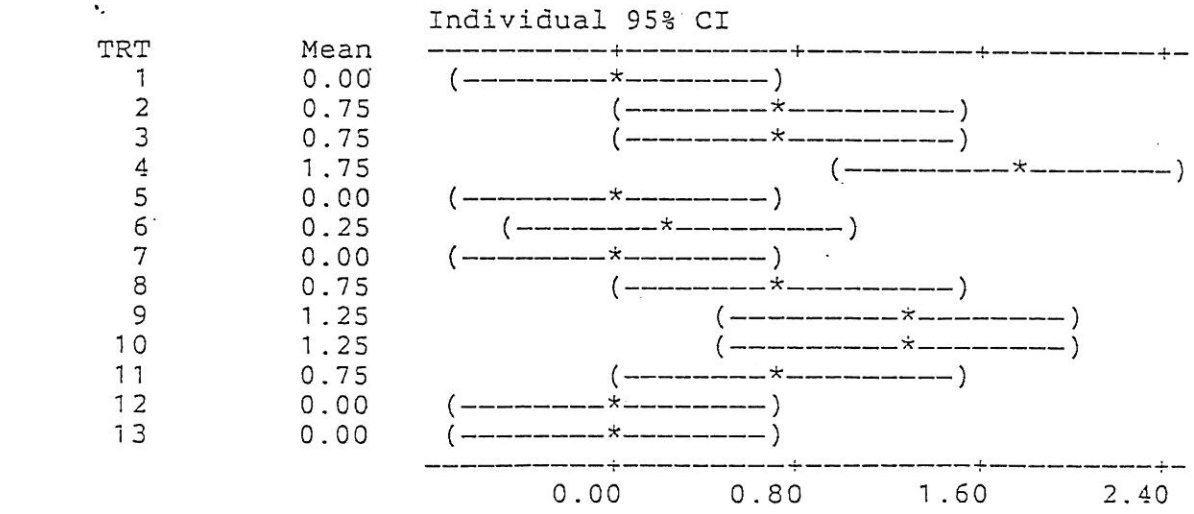
SEED BED TRIAL - PHYTOTOXICITY ANALYSIS JUNE 15

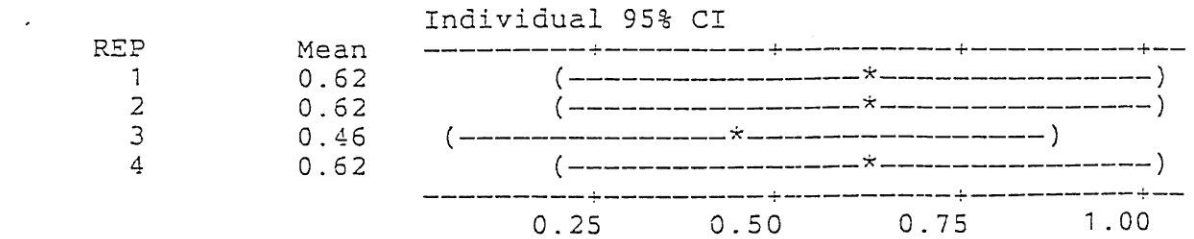
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	1.0000	1.0000	0.0000	1.0000	0.7500
3	1.0000	0.0000	1.0000	1.0000	0.7500
4	1.0000	3.0000	1.0000	2.0000	1.7500
5	0.0000	0.0000	0.0000	0.0000	0.0000
6	1.0000	0.0000	0.0000	0.0000	0.2500
7	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.0000	3.0000	0.0000	0.0000	0.7500
9	2.0000	0.0000	1.0000	2.0000	1.2500
10	0.0000	1.0000	2.0000	2.0000	1.2500
11	2.0000	0.0000	1.0000	0.0000	0.7500
12	0.0000	0.0000	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000	0.0000	0.0000
ALL	0.6154	0.6154	0.4615	0.6154	0.5769

ANALYSIS OF VARIANCE PHYTO1

SOURCE	DF	SS	MS
TRT	12	16.692	1.391
REP	3	0.231	0.077
ERROR	36	19.769	0.549
TOTAL	51	36.692	





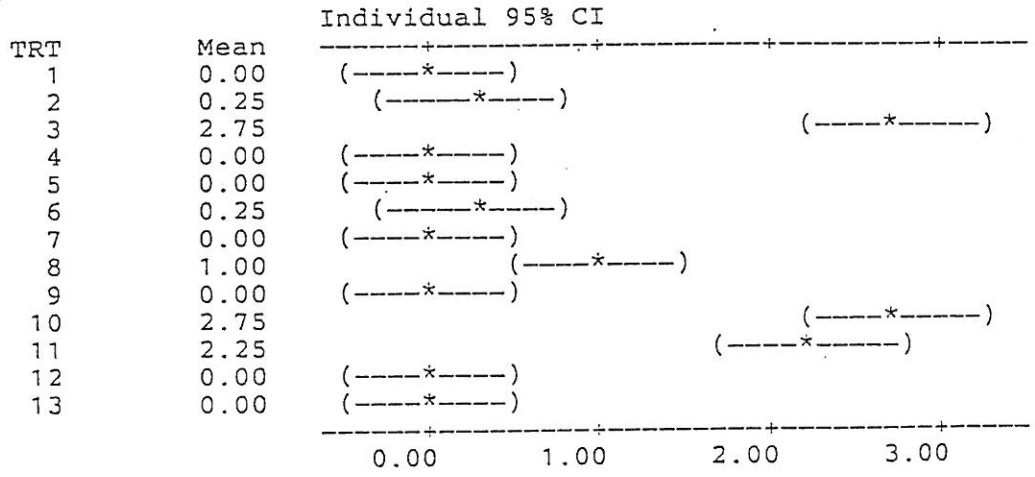
SEED BED TRIAL - PHYTOTOXICITY ANALYSIS JULY 8

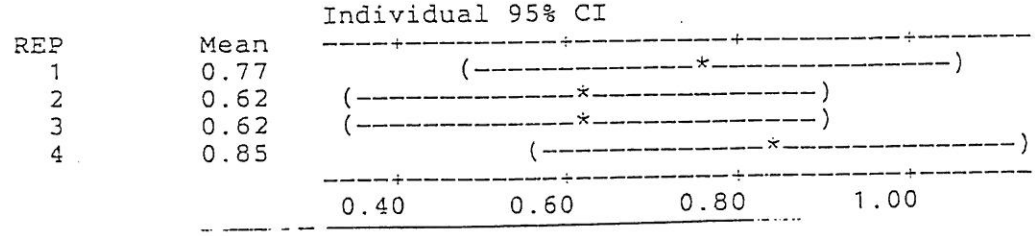
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000	1.0000	0.2500
3	2.0000	3.0000	2.0000	4.0000	2.7500
4	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	1.0000	0.2500
7	0.0000	0.0000	0.0000	0.0000	0.0000
8	2.0000	1.0000	0.0000	1.0000	1.0000
9	0.0000	0.0000	0.0000	0.0000	0.0000
10	4.0000	2.0000	3.0000	2.0000	2.7500
11	2.0000	2.0000	3.0000	2.0000	2.2500
12	0.0000	0.0000	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000	0.0000	0.0000
ALL	0.7692	0.6154	0.6154	0.8462	0.7115

ANALYSIS OF VARIANCE PHYTO2

SOURCE	DF	SS	MS
TRT	12	58.923	4.910
REP	3	0.519	0.173
ERROR	36	9.231	0.256
TOTAL	51	68.673	





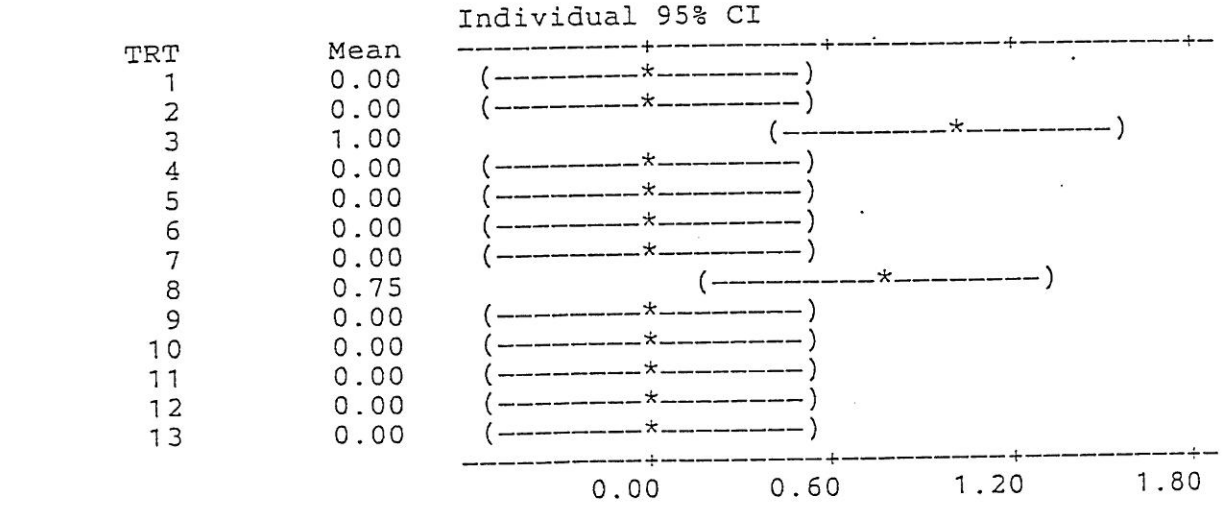
SEED BED TRIAL - PHYTOTOXICITY ANALYSIS AUGUST 16

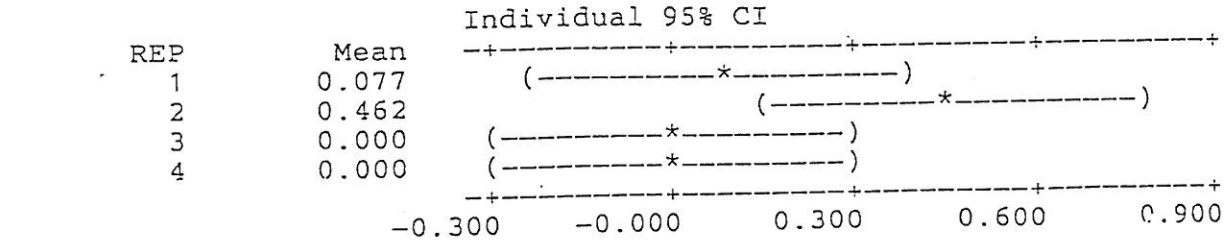
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	0.00000	0.00000	0.00000	0.00000	0.00000
2	0.00000	0.00000	0.00000	0.00000	0.00000
3	1.00000	3.00000	0.00000	0.00000	1.00000
4	0.00000	0.00000	0.00000	0.00000	0.00000
5	0.00000	0.00000	0.00000	0.00000	0.00000
6	0.00000	0.00000	0.00000	0.00000	0.00000
7	0.00000	0.00000	0.00000	0.00000	0.00000
8	0.00000	3.00000	0.00000	0.00000	0.75000
9	0.00000	0.00000	0.00000	0.00000	0.00000
10	0.00000	0.00000	0.00000	0.00000	0.00000
11	0.00000	0.00000	0.00000	0.00000	0.00000
12	0.00000	0.00000	0.00000	0.00000	0.00000
13	0.00000	0.00000	0.00000	0.00000	0.00000
ALL	0.07692	0.46154	0.00000	0.00000	0.13462

ANALYSIS OF VARIANCE PHYTO3

SOURCE	DF	SS	MS
TRT	12	5.308	0.442
REP	3	1.904	0.635
ERROR	36	10.846	0.301
TOTAL	51	18.058	





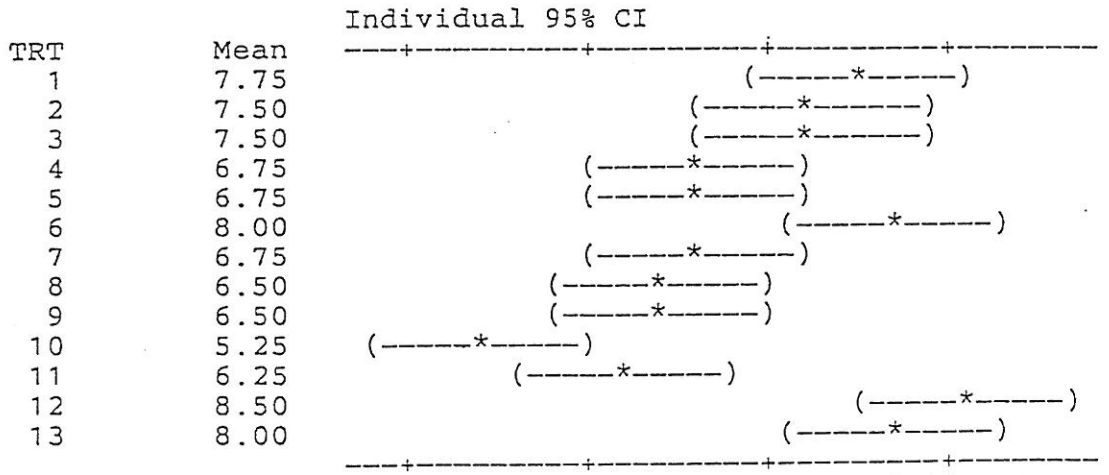
SEED BED TRIAL - GERMINATION ANALYSIS JUNE 15

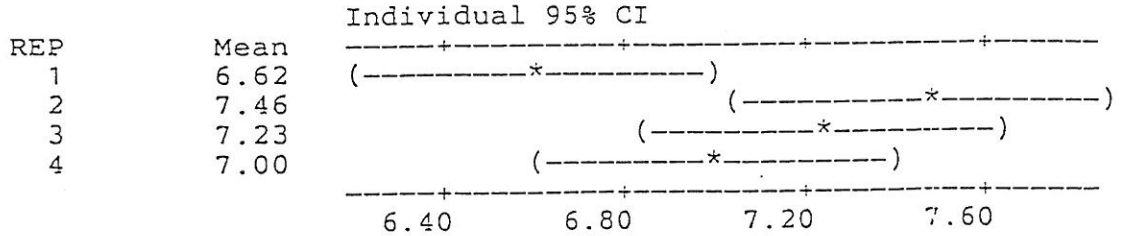
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	8.0000	8.0000	8.0000	7.0000	7.7500
2	7.0000	8.0000	8.0000	7.0000	7.5000
3	7.0000	7.0000	8.0000	8.0000	7.5000
4	6.0000	6.0000	8.0000	7.0000	6.7500
5	6.0000	7.0000	7.0000	7.0000	6.7500
6	8.0000	8.0000	8.0000	8.0000	8.0000
7	8.0000	7.0000	6.0000	6.0000	6.7500
8	6.0000	7.0000	6.0000	7.0000	6.5000
9	5.0000	8.0000	7.0000	6.0000	6.5000
10	4.0000	6.0000	5.0000	6.0000	5.2500
11	5.0000	7.0000	6.0000	7.0000	6.2500
12	8.0000	9.0000	9.0000	8.0000	8.5000
13	8.0000	9.0000	8.0000	7.0000	8.0000
ALL	6.6154	7.4615	7.2308	7.0000	7.0769

ANALYSIS OF VARIANCE GERM1

SOURCE	DF	SS	MS
TRT	12	38.192	3.183
REP	3	5.077	1.692
ERROR	36	18.423	0.512
TOTAL	51	61.692	





SEED BED TRIAL - GERMINATION ANALYSIS JULY 8

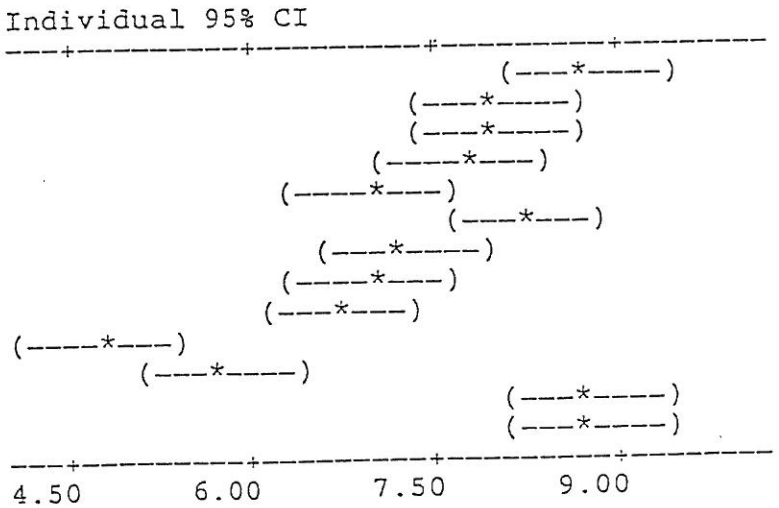
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	9.0000	9.0000	8.0000	9.0000	8.7500
2	7.0000	9.0000	8.0000	8.0000	8.0000
3	8.0000	8.0000	8.0000	8.0000	8.0000
4	7.0000	7.0000	8.0000	9.0000	7.7500
5	7.0000	7.0000	7.0000	7.0000	7.0000
6	8.0000	9.0000	7.0000	9.0000	8.2500
7	7.0000	8.0000	7.0000	7.0000	7.2500
8	7.0000	7.0000	7.0000	7.0000	7.0000
9	6.0000	7.0000	7.0000	7.0000	6.7500
10	3.0000	5.0000	6.0000	5.0000	4.7500
11	4.0000	6.0000	6.0000	7.0000	5.7500
12	9.0000	9.0000	8.0000	9.0000	8.7500
13	9.0000	9.0000	8.0000	9.0000	8.7500
ALL	7.0000	7.6923	7.3077	7.7692	7.4423

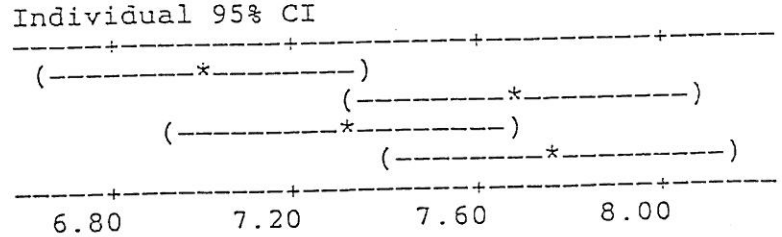
ANALYSIS OF VARIANCE GERM2

SOURCE	DF	SS	MS
TRT	12	70.077	5.840
REP	3	4.981	1.660
ERROR	36	15.769	0.438
TOTAL	51	90.827	

TRT	Mean
1	8.75
2	8.00
3	8.00
4	7.75
5	7.00
6	8.25
7	7.25
8	7.00
9	6.75
10	4.75
11	5.75
12	8.75
13	8.75



REP	Mean
1	7.00
2	7.69
3	7.31
4	7.77



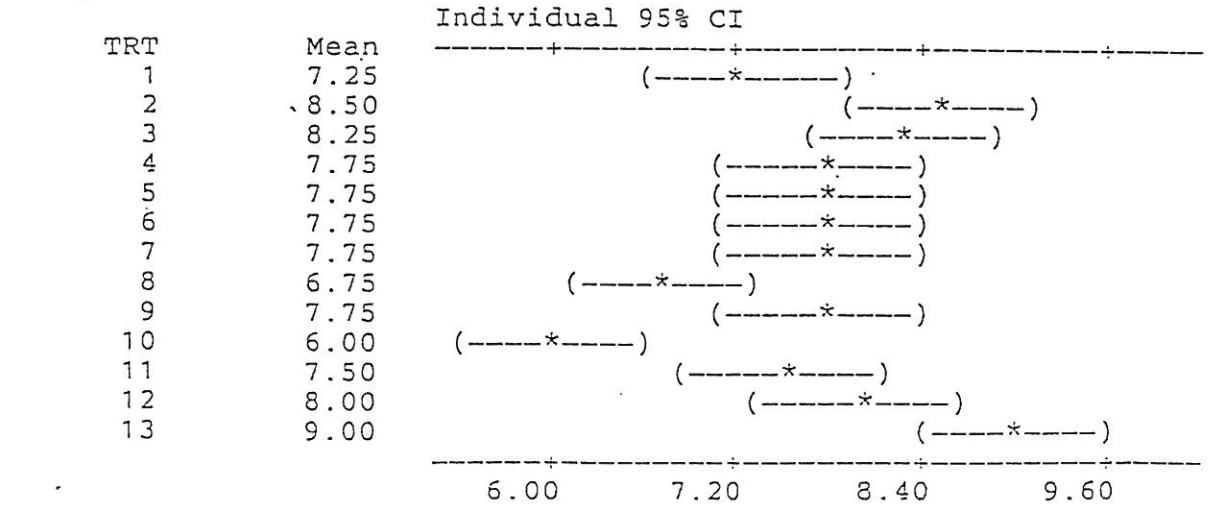
SEED BED TRIAL - GERMINATION ANALYSIS AUGUST 16

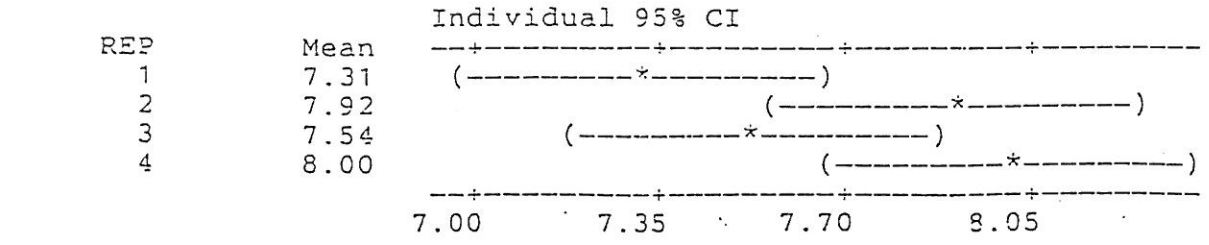
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	8.0000	7.0000	6.0000	8.0000	7.2500
2	8.0000	9.0000	8.0000	9.0000	8.5000
3	8.0000	8.0000	8.0000	9.0000	8.2500
4	7.0000	8.0000	8.0000	8.0000	7.7500
5	7.0000	8.0000	8.0000	8.0000	7.7500
6	7.0000	8.0000	8.0000	8.0000	7.7500
7	8.0000	8.0000	7.0000	8.0000	7.7500
8	6.0000	7.0000	7.0000	7.0000	6.7500
9	8.0000	9.0000	7.0000	7.0000	7.7500
10	5.0000	6.0000	7.0000	6.0000	6.0000
11	6.0000	8.0000	7.0000	9.0000	7.5000
12	8.0000	8.0000	8.0000	8.0000	8.0000
13	9.0000	9.0000	9.0000	9.0000	9.0000
ALL	7.3077	7.9231	7.5385	8.0000	7.6923

ANALYSIS OF VARIANCE GERM3

SOURCE	DF	SS	MS
TRT	12	27.077	2.256
REP	3	4.154	1.385
ERROR	36	13.846	0.385
TOTAL	51	45.077	





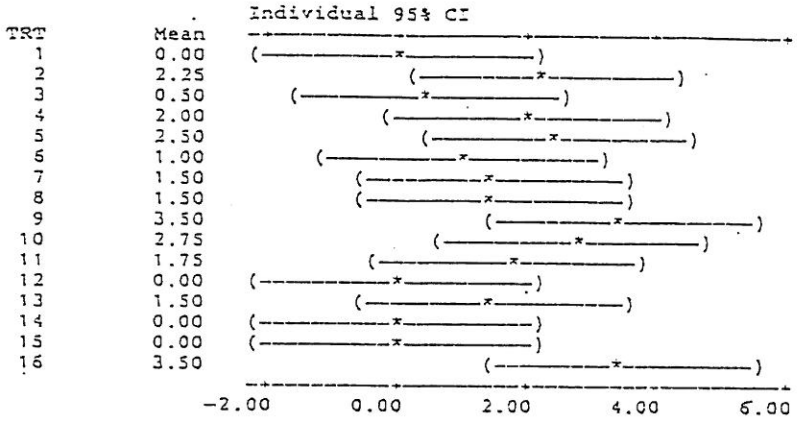
TRANSPLANT TRIAL - WEED COUNT ANALYSIS APRIL 27

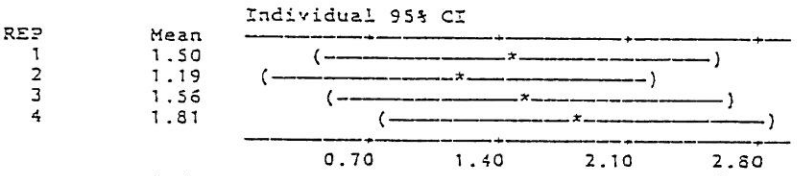
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	383.00	263.00	458.00	259.00	340.75
2	2.00	4.00	3.00	0.00	2.25
3	1.00	0.00	1.00	0.00	0.50
4	0.00	2.00	2.00	4.00	2.00
5	10.00	0.00	0.00	0.00	2.50
6	2.00	1.00	1.00	0.00	1.00
7	1.00	0.00	0.00	5.00	1.50
8	1.00	3.00	2.00	0.00	1.50
9	3.00	1.00	3.00	7.00	3.50
10	1.00	2.00	4.00	4.00	2.75
11	2.00	1.00	0.00	4.00	1.75
12	0.00	0.00	0.00	0.00	0.00
13	0.00	2.00	0.00	4.00	1.50
14	0.00	0.00	0.00	0.00	0.00
	1	2	3	4	ALL
15	0.00	0.00	0.00	0.00	0.00
16	1.00	3.00	9.00	1.00	3.50
ALL	25.44	17.63	30.19	18.00	22.81

ANALYSIS OF VARIANCE WEEDS1

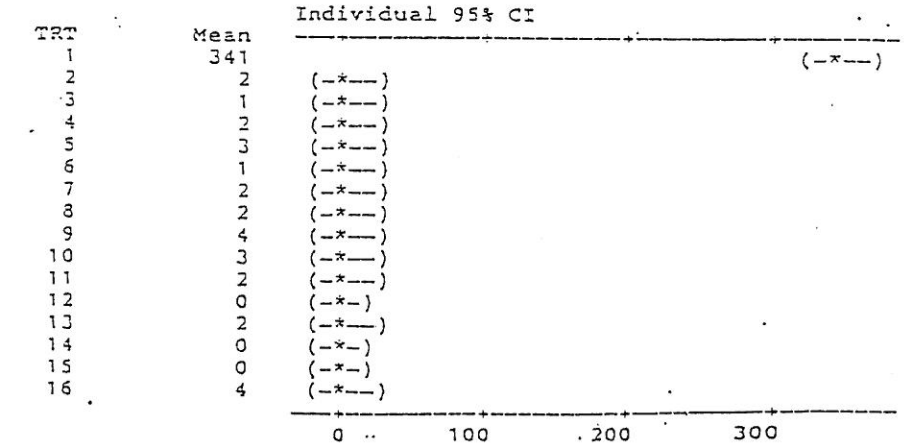
SOURCE	DF	SS	MS
TRT	15	86.73	5.78
REP	3	3.17	1.06
ERROR	45	202.08	4.49
TOTAL	63	291.98	

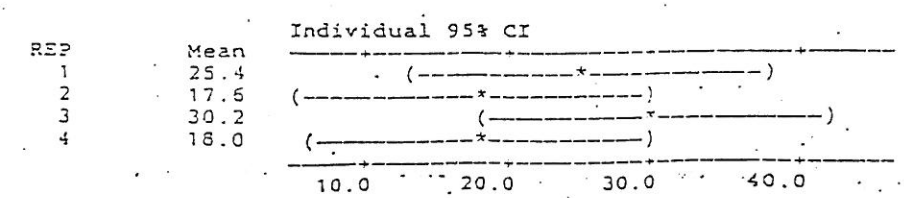




ANALYSIS OF VARIANCE WEEDS1

SOURCE	DF	SS	MS
TRT	15	431370	28758
REP	3	1782	594
ERROR	45	26684	593
TOTAL	63	459836	





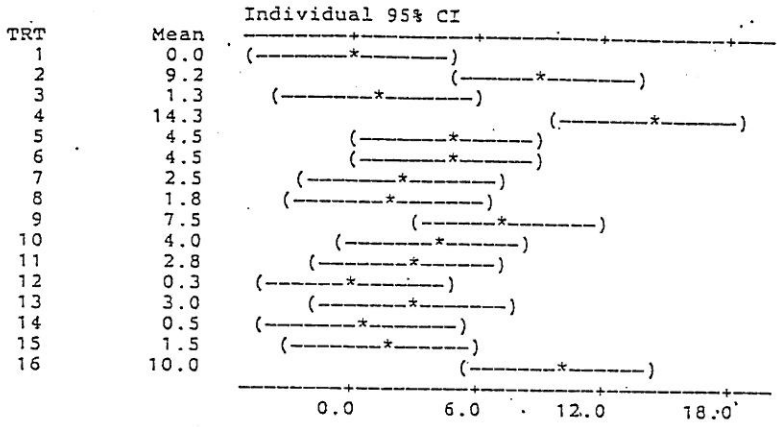
TRANSPLANT TRIAL - WEED COUNT ANALYSIS JUNE 7

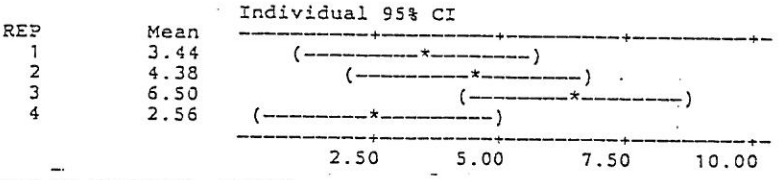
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	412.00	333.00	562.00	278.00	396.25
2	18.00	4.00	9.00	6.00	9.25
3	0.00	0.00	1.00	4.00	1.25
4	0.00	16.00	35.00	6.00	14.25
5	8.00	3.00	6.00	1.00	4.50
6	3.00	9.00	6.00	0.00	4.50
7	1.00	4.00	3.00	2.00	2.50
8	1.00	3.00	1.00	2.00	1.75
9	10.00	6.00	9.00	5.00	7.50
10	1.00	6.00	6.00	3.00	4.00
11	2.00	3.00	1.00	5.00	2.75
12	0.00	1.00	0.00	0.00	0.25
13	1.00	2.00	5.00	4.00	3.00
14	0.00	0.00	1.00	1.00	0.50
	1	2	3	4	ALL
15	0.00	2.00	4.00	0.00	1.50
16	10.00	11.00	17.00	2.00	10.00
ALL	29.19	25.19	41.63	19.94	28.98

ANALYSIS OF VARIANCE WEEDS2

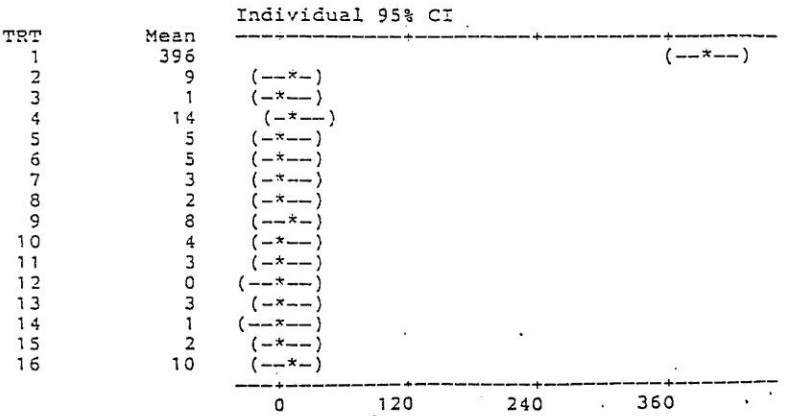
SOURCE	DF	SS	MS
TRT	15	986.4	65.8
REP	3	137.3	45.8
ERROR	45	955.2	21.2
TOTAL	63	2078.9	

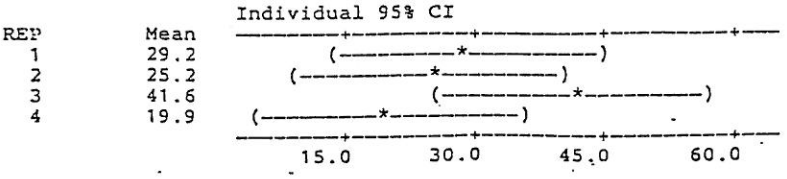




ANALYSIS OF VARIANCE WEEDS2

SOURCE	DF	SS	MS
TRT	15	576416	38428
REP	3	4097	1366
ERROR	45	42700	949
TOTAL	63	623213	





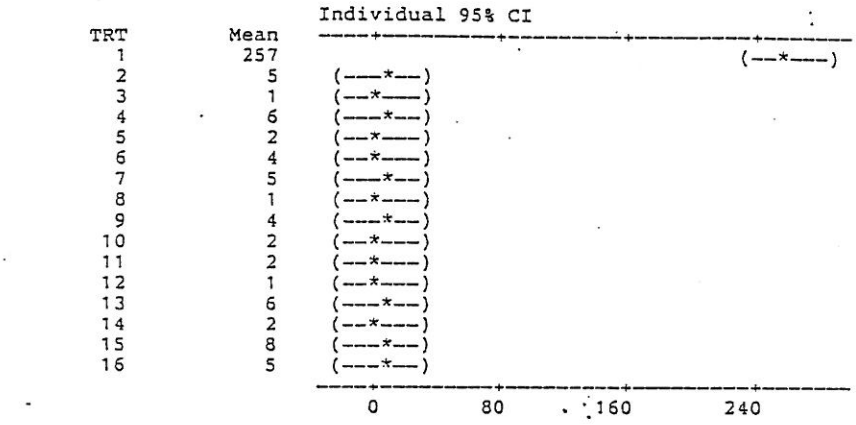
TRANSPLANT TRIAL - WEED COUNT ANALYSIS JULY 20

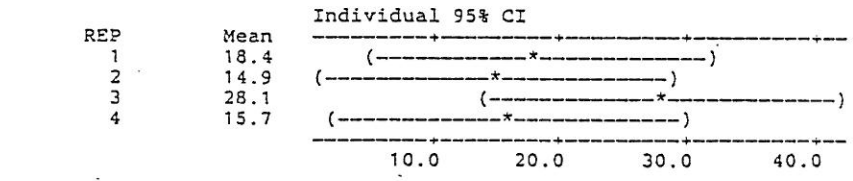
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	257.000	153.000	405.000	215.000	257.500
2	8.000	4.000	3.000	3.000	4.500
3	0.000	0.000	1.000	3.000	1.000
4	2.000	9.000	8.000	5.000	6.000
5	2.000	2.000	4.000	0.000	2.000
6	2.000	8.000	3.000	2.000	3.750
7	1.000	12.000	6.000	0.000	4.750
8	0.000	0.000	0.000	2.000	0.500
9	3.000	4.000	6.000	3.000	4.000
10	2.000	0.000	2.000	2.000	1.500
11	4.000	3.000	0.000	2.000	2.250
12	0.000	2.000	0.000	0.000	0.500
13	3.000	6.000	7.000	7.000	5.750
14	0.000	3.000	1.000	4.000	2.000
	1	2	3	4	ALL
15	0.000	30.000	0.000	0.000	7.500
16	10.000	2.000	3.000	4.000	4.750
ALL	18.375	14.875	28.062	15.750	19.266

ANALYSIS OF VARIANCE WEEDS3

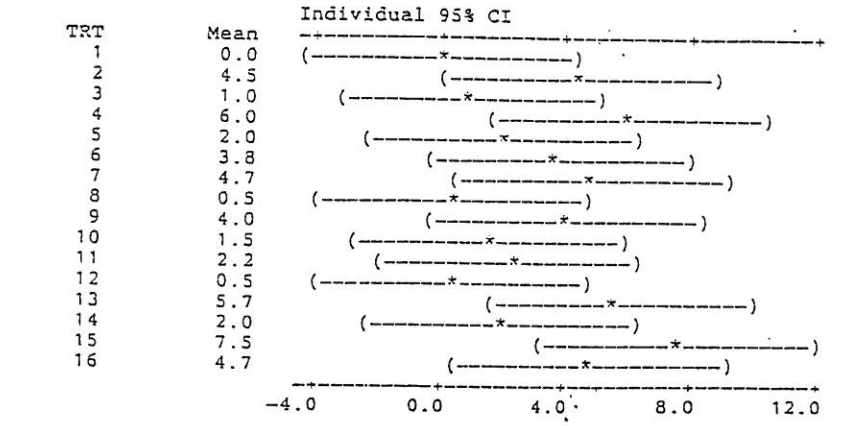
SOURCE	DF	SS	MS
TRT	15	242421	16161
REP	3	1757	586
ERROR	45	33661	748
TOTAL	63	277838	

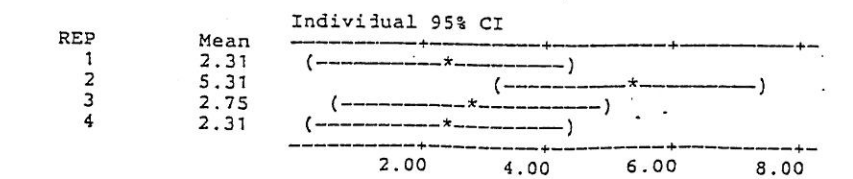




ANALYSIS OF VARIANCE WEEDS3

SOURCE	DF	SS	MS
TRT	15	306.4	20.4
REP	3	99.8	33.3
ERROR	45	835.0	18.6
TOTAL	63	1241.1	





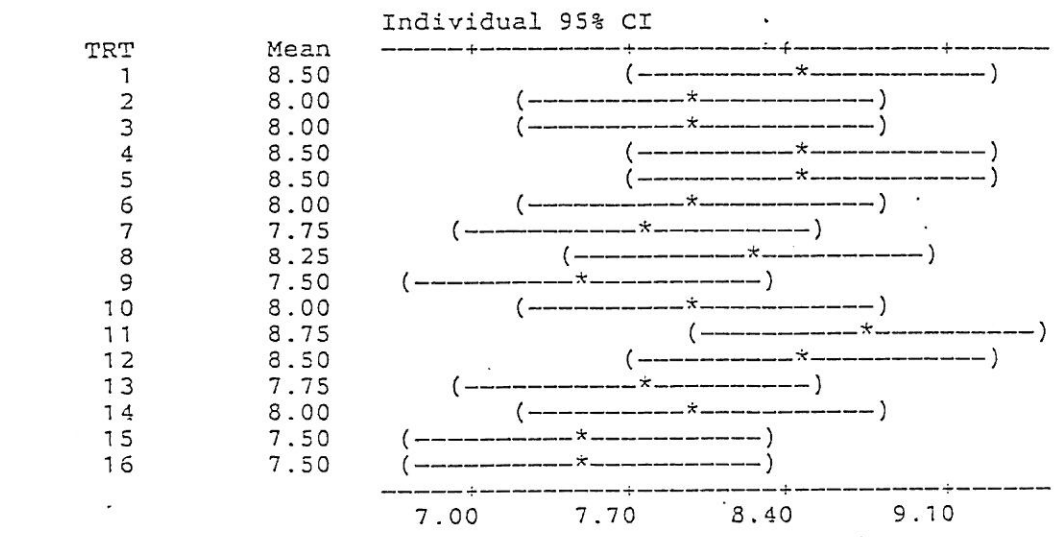
TRANSPLANT TRIAL - VICCUR ANALYSIS JUNE 7

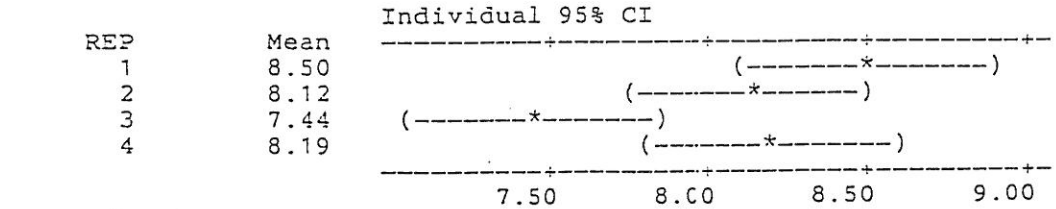
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	9.0000	9.0000	7.0000	9.0000	8.5000
2	8.0000	9.0000	8.0000	7.0000	8.0000
3	8.0000	8.0000	8.0000	8.0000	8.0000
4	9.0000	9.0000	7.0000	9.0000	8.5000
5	9.0000	9.0000	7.0000	9.0000	8.5000
6	9.0000	8.0000	7.0000	8.0000	8.0000
7	8.0000	9.0000	7.0000	7.0000	7.7500
8	8.0000	9.0000	8.0000	8.0000	8.2500
9	9.0000	7.0000	6.0000	8.0000	7.5000
10	8.0000	7.0000	8.0000	9.0000	8.0000
11	8.0000	9.0000	9.0000	9.0000	8.7500
12	9.0000	9.0000	8.0000	8.0000	8.5000
13	8.0000	8.0000	6.0000	9.0000	7.7500
14	9.0000	7.0000	8.0000	8.0000	8.0000
	1	2	3	4	ALL
15	9.0000	6.0000	7.0000	8.0000	7.5000
16	8.0000	7.0000	8.0000	7.0000	7.5000
ALL	8.5000	8.1250	7.4375	8.1875	8.0625

ANALYSIS OF VARIANCE VIG1

SOURCE	DF	SS	MS
TRT	15	9.750	0.650
REP	3	9.625	3.208
ERROR	45	28.375	0.631
TOTAL	63	47.750	





TRANSPLANT TRIAL - VIGOUR ANALYSIS JULY 20

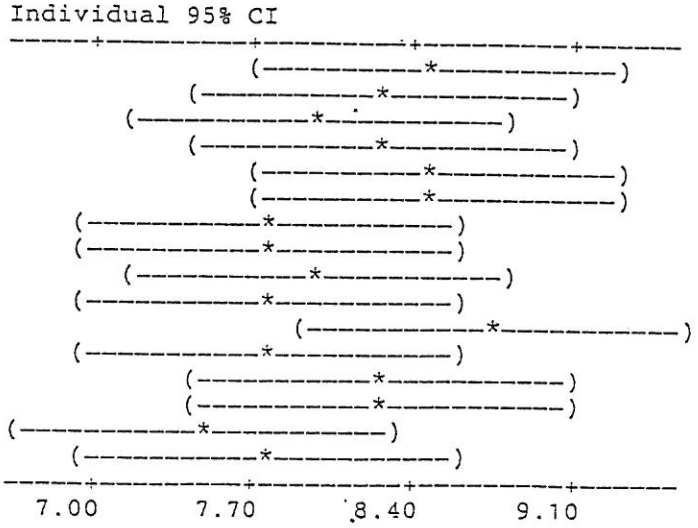
ROWS: TRT COLUMNS: REP

	1	2	3	4	ALL
1	9.0000	9.0000	7.0000	9.0000	8.5000
2	8.0000	8.0000	9.0000	8.0000	8.2500
3	9.0000	9.0000	7.0000	7.0000	8.0000
4	8.0000	9.0000	7.0000	9.0000	8.2500
5	9.0000	8.0000	8.0000	9.0000	8.5000
6	9.0000	9.0000	7.0000	9.0000	8.5000
7	8.0000	9.0000	7.0000	7.0000	7.7500
8	8.0000	8.0000	7.0000	8.0000	7.7500
9	9.0000	8.0000	6.0000	9.0000	8.0000
10	9.0000	7.0000	7.0000	8.0000	7.7500
11	9.0000	9.0000	8.0000	9.0000	8.7500
12	9.0000	7.0000	7.0000	8.0000	7.7500
13	7.0000	9.0000	8.0000	9.0000	8.2500
14	9.0000	7.0000	9.0000	8.0000	8.2500
	1	2	3	4	ALL
15	8.0000	6.0000	8.0000	8.0000	7.5000
16	9.0000	7.0000	7.0000	8.0000	7.7500
ALL	8.5625	8.0625	7.4375	8.3125	8.0937

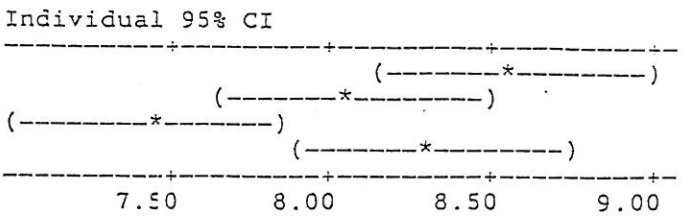
ANALYSIS OF VARIANCE VIG2

SOURCE	DF	SS	MS
TRT	15	7.938	0.529
REP	3	11.188	3.729
ERROR	45	30.312	0.674
TOTAL	63	49.437	

TRT	Mean
1	8.50
2	8.25
3	8.00
4	8.25
5	8.50
6	8.50
7	7.75
8	7.75
9	8.00
10	7.75
11	8.75
12	7.75
13	8.25
14	8.25
15	7.50
16	7.75



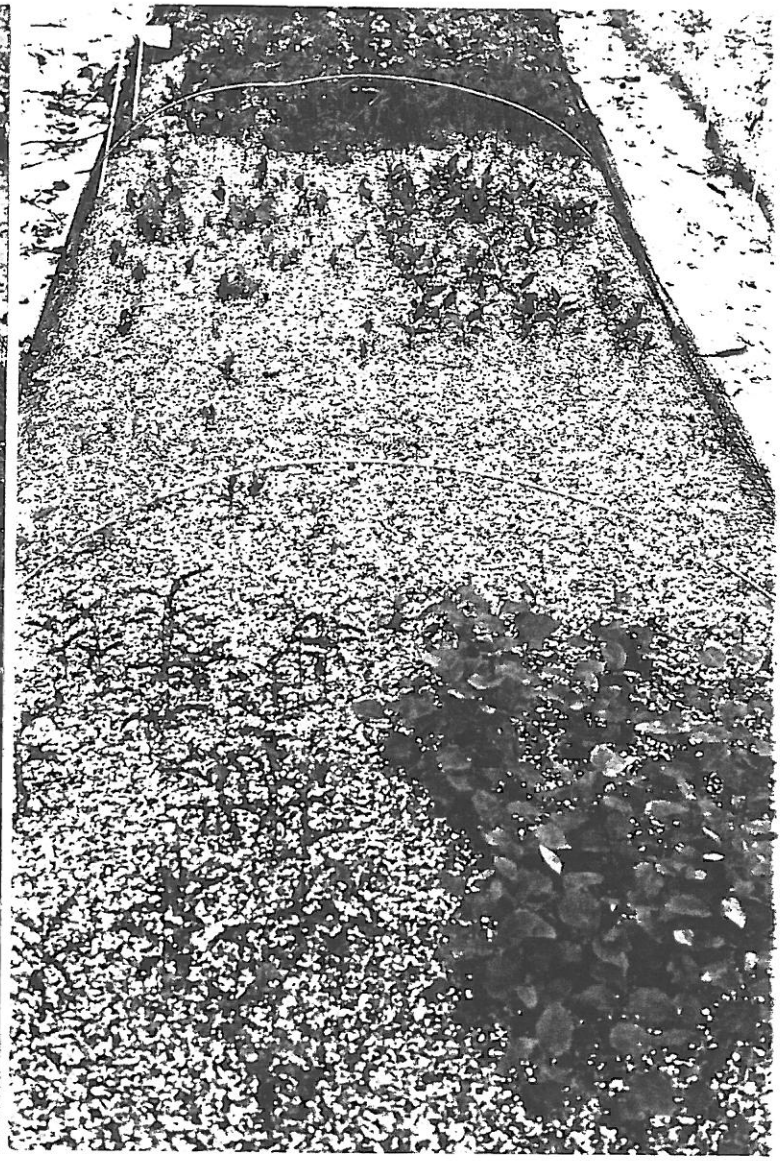
REP	Mean
1	8.56
2	8.06
3	7.44
4	8.31



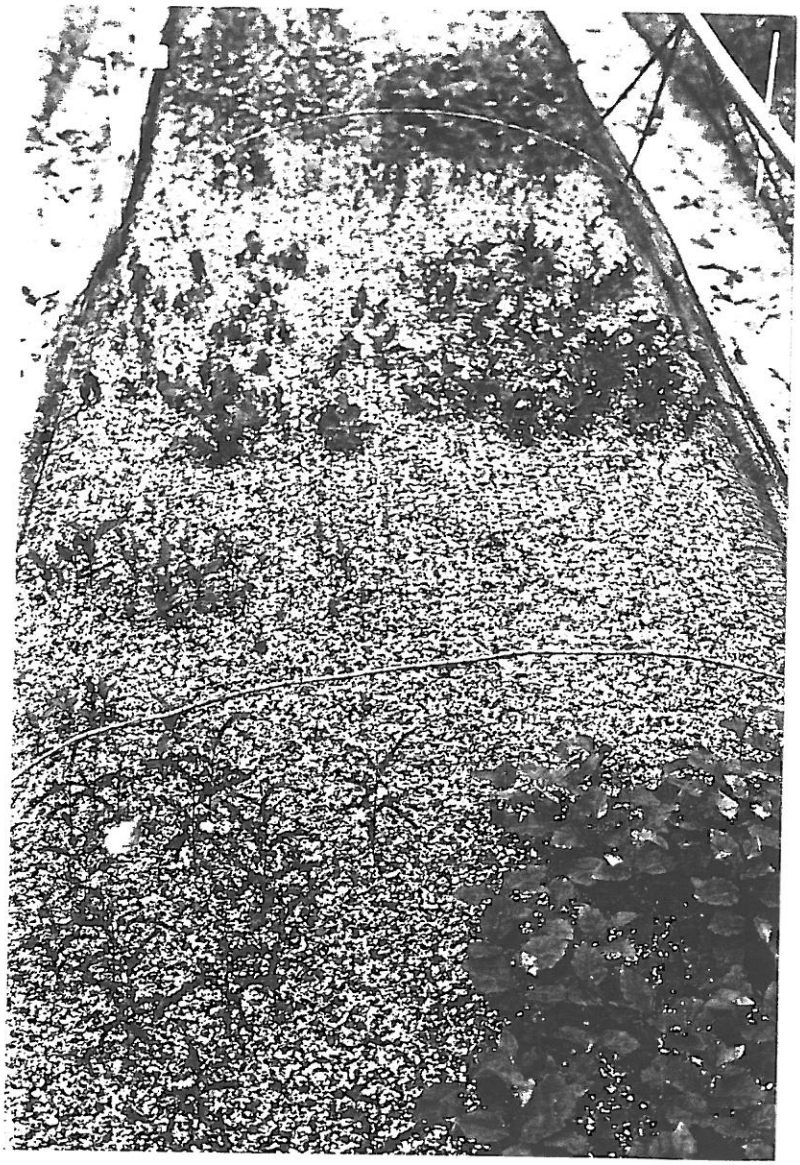
APPENDIX 5

EFFECT OF FLEXIDOR AND BUTISAN S UPON SEEDLING GERMINATION

1. Control

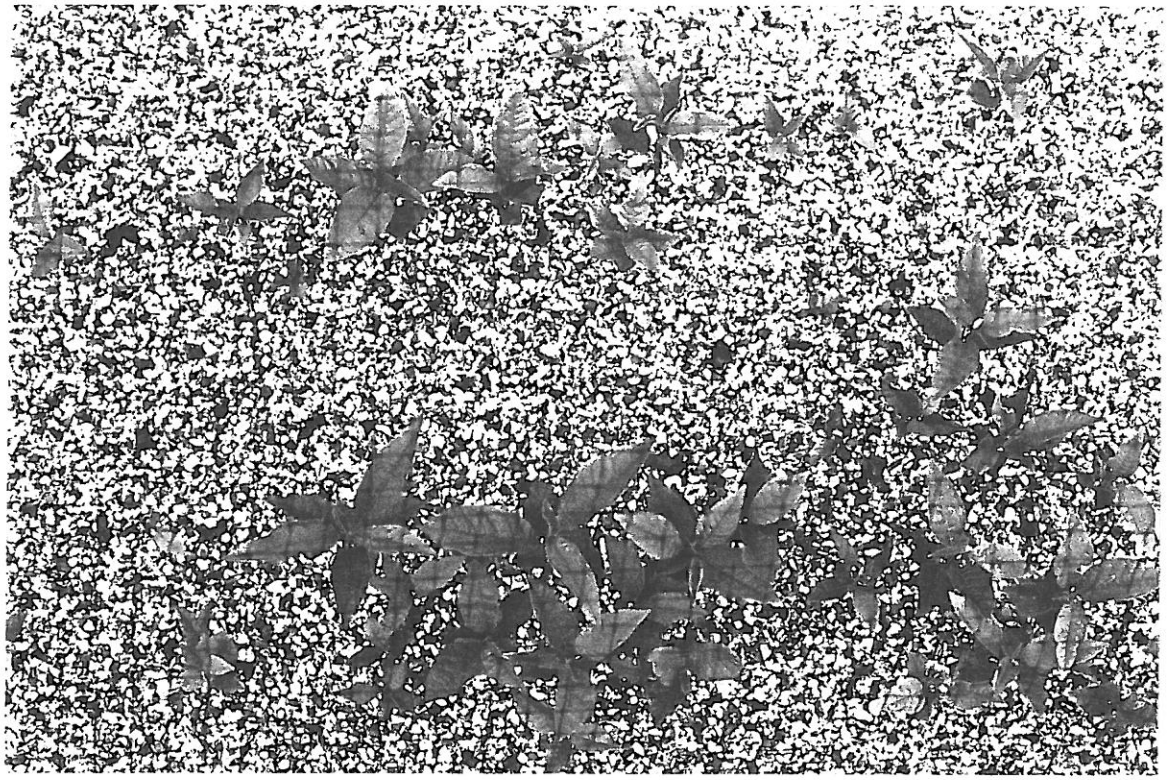


2. Flexidor

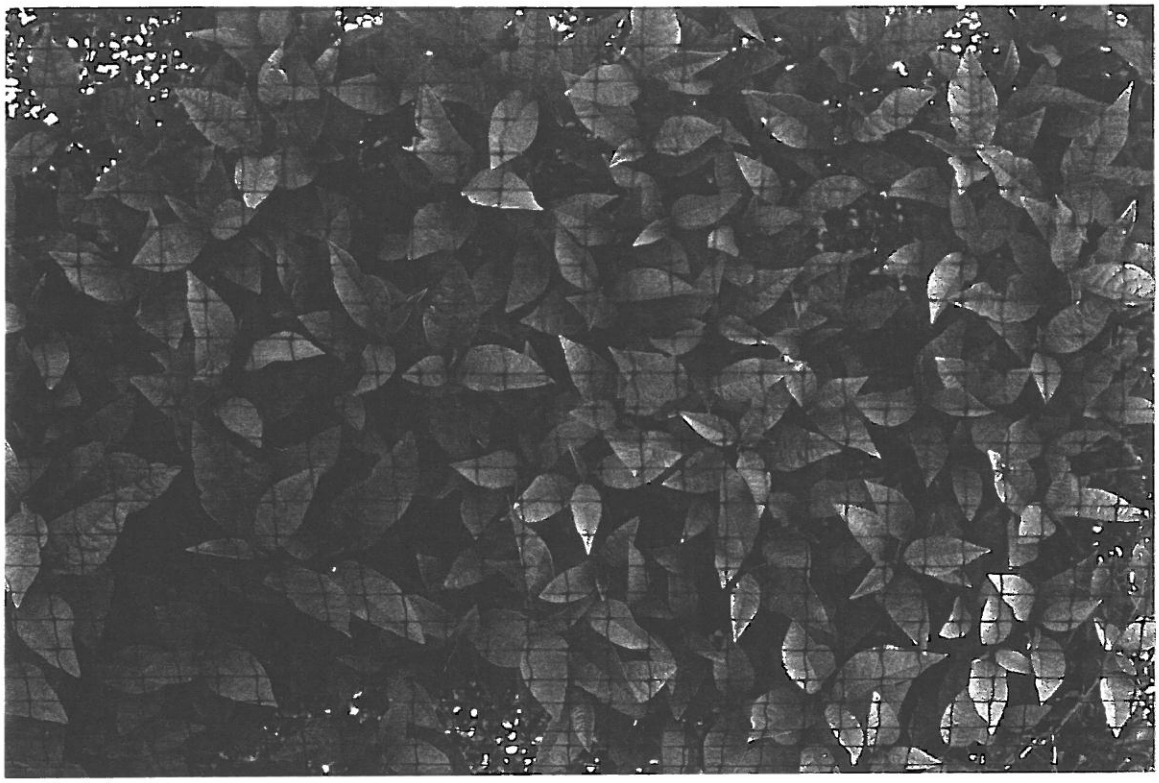


3. Butisan S

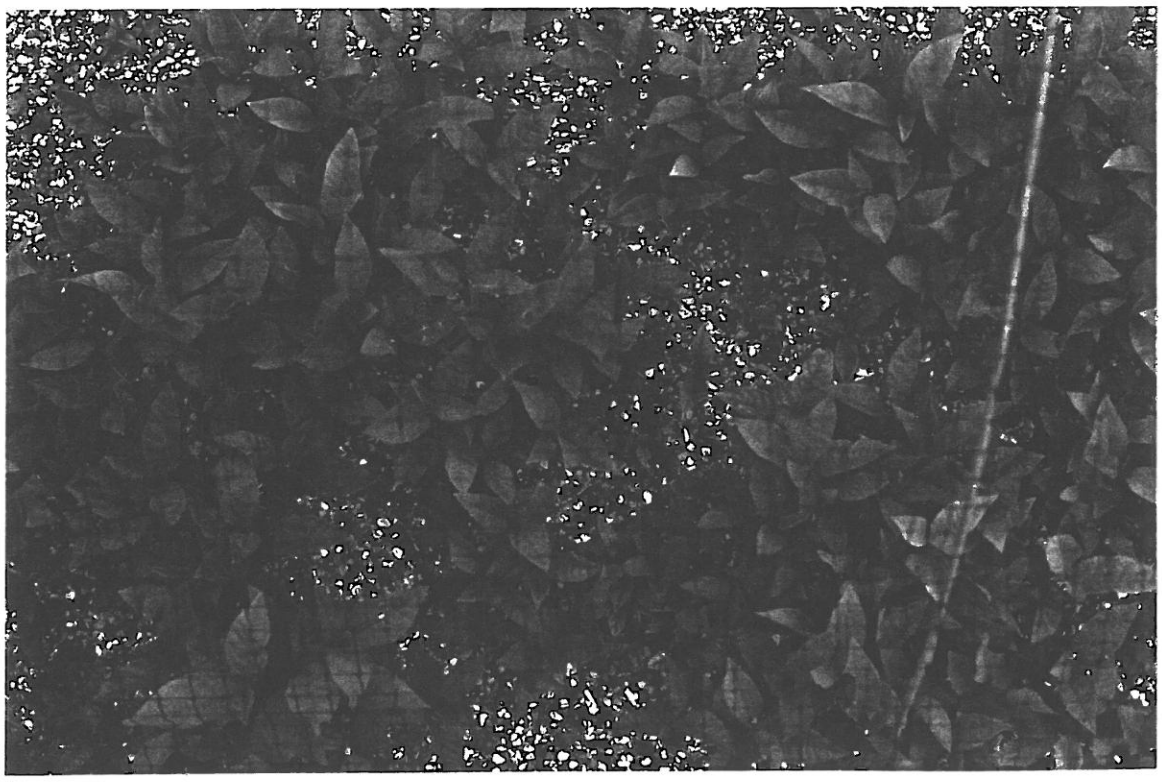
PRUNUS PADUS SEEDLING DIEBACK, NOTED IN RESPONSE TO BUTISAN S, FLEXIDOR, ENIDE 50W + DACTHAL AND VENZAR.



REDUCTION IN VIGOUR OF PRUNUS PADUS SEEDLINGS DUE TO APPLICATIONS OF GOLTIX WG.



Control



Goltix WG

SCORCH ON SORBUS AUCUPARIA TRANSPLANT POSSIBLY AS A RESULT OF BUTISAN S BEING SPRAYED OVER THE PLANT.

Contract between ADAS (hereinafter called the "Contractor") and the Horticultural Development Council (hereinafter called the "Council") for a research/development project.

PROPOSAL

1. TITLE OF PROJECT

Contract No: HNS/31

EVALUATION OF WEED CONTROL TREATMENTS IN TREE AND SHRUB SEEDBEDS AND FIRST OUTDOOR TRANSPLANTS

2. BACKGROUND AND COMMERCIAL OBJECTIVES

Information is available on seedbed weed control for hardy ornamental nursery stock only from related forestry work on a very limited range of species.

Of the range of commercially available herbicides for HONS only one is recommended for seedbeds, Enide 50W. Soil sterilisation is often the chosen commercial treatment. The cost of this treatment however, may exceed by 10 times the cost of a herbicide treatment. Because of the continuing need to protect seedling transplants from severe weed competition in the early stages, it is necessary to evaluate a range of weed control systems during this period of sensitive growth. Much of the planting material at the seedling and first transplant stage is imported, mainly from Europe. There is a need to ensure that the UK industry is able to compete successfully in the production of young plant material, which is the starting point for the majority of trees and shrubs produced in the UK.

The industry requires that further work be carried out to investigate the range of possible treatments resulting in safe and reliable weed control systems.

3. POTENTIAL FINANCIAL BENEFITS TO THE INDUSTRY

Results would enable optimum weed control systems to be identified, particularly those with environmental advantages.

Previous research has shown a 50% reduction in crop yield can occur when weed control is poor. Weed competition can also seriously reduce crop quality.

These results should enable the industry to compete more effectively with imports.

4. SCIENTIFIC/TECHNICAL TARGET OF THE WORK

To assess:-

(a) The efficiency of weed control of a range of herbicide treatments.

(b) The phytotoxicity of a range of herbicide treatments on limited range of plant species in seedbed and first

transplant stage.

(c) The marketable yield and quality of plants from all treatments.

5. CLOSELY RELATED WORK - COMPLETED OR IN PROGRESS

Work by the Forestry Commission on seed bed herbicides has been ongoing for some years, but has concentrated on a range of coniferous species and a narrow range of broad leaved forest trees. The results of this work have been taken into consideration in the planning of this proposal.

At Luddington EHS between the years 1976 - 1981 herbicide trials investigated a small range of treatments which were limited in their commercial application.

A literature search has revealed little of value from overseas to support the commercial uptake of results in the UK, due for example, to unavailability of chemicals, and different range of weeds and crop species.

6. DESCRIPTION OF THE WORK

The following treatments are proposed:-

(a) Seedbed crop

Treatments

1. Handweed/control weeds removed by hand after 5 and 10 weeks.

2. Diphenamid (Enide 50w) at 4.5kg/ha pre-emergence and 4.5kg/ha every 5 weeks post emergence.

3. Diphenamid and chlorthal-dimethyl (Enide 50w & Dacthal) at 4.5kg/ha of each product pre-emergence and 4.5kg/ha of Enide 50w only every 5 weeks post emergence.

4. Metamitron (Goltix WG) at 3kg/ha pre-emergence and 3kg/ha every 5 weeks post emergence.

5. Propyzamide (Kerb 50w) at 1.5kg/ha pre-emergence and 1.5kg 10 weeks later, post emergence.

6. Chlorpropham + fenuron + propham (Atlas Gold) at 5.5 l/ha pre-emergence followed by Chlorpropham (Atlas CIPC 40) at 2.8 l/ha after and every 5 weeks post emergence.

7. Napropamide (Devrinol) at 5 l/ha pre-emergence only.

8. Lenacil (Venzar) at 1.5kg/ha pre-emergence and 1.5kg/ha every 5 weeks post emergence.

9. Oxadiazon (Ronstar liquid) at 4 l/ha pre-emergence only.

10. Metazachlor (Butisan S) at 1.5 l/ha pre-emergence and 1.5 l/ha 10 weeks later, post emergence.

11. Isoxaben (Flexidor) at 200ml/ha pre-emergence and 200ml/ha 10 weeks later, post emergence.

12. Dazomet (Basamid) 100kg/ha soil incorporation to a depth of 5 cm.

13. Dazomet (Basamid) 400 kg/ha soil incorporation to a depth of 15 cm.

Plant Species

1. Prunus avium

2. Sorbus aucuparia

3. Fagus sylvatica

4. Laburnum vulgare

5. Alnus glutinosa

6. Acer campestre

Notes

1. A bed system is to be used.

2. Chitted seed will be broadcast onto the beds.

3. All beds have a grit covering.

4. Irrigation applied when required.

5. Herbicide top up treatments applied at stated intervals.

6. 12 treatments each replicated 4 times, each plot is split and contains the 6 different tree species.

Basamid to be applied November 1991, herbicides to be applied mid-late April 1992 onwards. Modifications to the treatment list for the second year of the trial will be based on the results from year 1.

(b) Transplant crop

Treatments

1. Handweed/control. Weeds removed by hand.

2. Napropamide (Devrinol) at 9 l/ha at planting.

3. Simazine (various products) at 2kg/ha at planting.

4. Isoxaben (Flexidor) at 500ml/ha at planting.

5. Metazachlor (Butisan S) at 2.5 l/ha at planting.

6. Metazachlor (Butisan S) at 2.5 l/ha and propyzamide (Kerb 50w) at 1kg/ha at planting.

7. Pendimethalin (Stomp 400) at 4 l/ha and Isoxaben (Flexidor) at 300ml/ha at planting.

8. Terbacil (Sinbar) at 0.5kg/ha at planting.

9. Terbacil (Sinbar) at 0.25kg/ha at planting.

10. Diuron (Diuron 80) at 0.5kg/ha and Isoxaben (Flexidor) at 300ml/ha at planting.

11. Lenacil (Venzar) at 2.2 kg/ha at planting.

12. Propyzamide (Kerb 50w) at 1.5kg/ha and Simazine (various products) at 1.5kg at planting.

13. Propyzamide (Kerb 50w) at 1.5kg/ha and Isoxaben (Flexidor) at 300ml/ha at planting.

14. Napropamide (Devrinol) at 9 l/ha and Simazine (various products) at 1kg/ha at planting.

15. Oxadiazon (Ronstar liquid) at 4 l/ha and propyzamide (Kerb 50w) at 1kg/ha at planting.

16. Metamitron (Goltix WG) at 5kg/ha and propyzamide (Kerb 50w) at 1kg/ha at planting.

All herbicide treatments will be followed up after 10 weeks with an application of metazachlor (Butisan S) at 2.5 l/ha.

Plant species

1. Sorbus aucuparia

2. Acer platanoides

3. Quercus robur

4. Alnus glutinosa

5. Crataegus monogyna

Notes

1. A bed system is to be used.

2. Irrigation applied when required.

3. Blanket top up treatment applied when stated.

4. 16 treatments each replicated 4 times, each plot is split and contains the 5 different tree species.

Herbicides to be applied from April 1992 onwards. Modifications to the treatment list for the second year of the trial will be based on the results from year 1.

7. COMMENCEMENT DATE AND DURATION

The trial will start on 1.11.91 and will continue for 2 seasons. An interim report will be produced in autumn 1992 and a final report will be produced by the end of 1993.

8. STAFF RESPONSIBILITIES

Project leader: W Brough, Horticultural Consultant, ADAS, Crown House, Sittingbourne Road, Maidstone, Kent ME14 5EY

Key collaborative staff: D Savours, Scientific Officer, ADAS, Olantigh Road, Wye, Ashford, Kent, TN25 5EL.

Other staff: A J Greenfield, ADAS, Horticultural Herbicide Liaison Officer, Oxford Divisional Office.

B J Morgan, ADAS Regional Nursery Stock Consultant, Reading Regional Office.

J Llewellin, ADAS Divisional Head, Maidstone Divisional Office.

D H Gilbert, ADAS National Adviser, Ornamental Crops, Cambridge Regional Office.

9. LOCATION

Oakover Nurseries Ltd, Calehill Stables, The Leacon, Charing, Ashford, Kent, TN27 OET.

Contract No: HNS/31

TERMS AND CONDITIONS

The Council's standard terms and conditions of contract shall apply.

Signed for the Contractor(s)

Signature.....

Position.....R. & D. MANAGER.....

Date.....17/2/92.....

Signed for the Contractor(s)

Signature.....

Position.....

Date.....

Signed for the Council

Signature.....

Position.....CHIEF EXECUTIVE.....

Date.....11.2.92.....