APPENDICES

A.1 APPENDIX 1 : EFFECTS OF HEAT TREATMENT ON ENDOPHYTE AND ON SOIL MICROFLORA

A.1.1 INTRODUCTION

The effects of 'steam-sterilization' of soil (Bayliss, 1967) on the availability of viable endophyte was investigated as a preliminary to the possible use of this technique, to obtain soil suitable for growing non-mycorrhizal seedlings. The method was found to be less reliable than gamma-irradiation, and therefore was not employed experimentally.

The results of five experiments are presented. (1)-(3) examined the effects on endophyte in soil. (4) examined the effect of temperature on endophyte in liquid culture. Experiment (5) looked at the results of heating soil on its microflora.

A.1.2 EXPERIMENT (1). The effects of steam sterilization on ericaceous endophyte in soil.

A.1.2.1 Method

Soil was collected from an acid heath/grassland site at Winterton Dunes, Norfolk. The soil was coarse sieved and air dried. It was then placed in poly-bags, each fastened by a rubber band.

The bags, containing 2kg of air-dried soil each, were placed in water-baths giving a range of temperatures of 60°C, 65°C and 70°C. The temperature was measured by mercury thermometers inserted into the centre of each bag of soil. This ensured that the temperature was achieved by the whole sample. The heating process took about 2 hours to raise the soil temperature from 18°C (room-temperature) to that required, using a pre-heated water-bath. The temperature having been reached throughout the soil sample, it was then removed from the bath and allowed to cool slowly to room temperature.

The soil was then placed in sterile crystallising dishes, watered with sterilized, distilled water and sown with R. ponticum seed (from Clumber, N.Notts.). 6 dishes were set up for each treatment and 6 with untreated soil as a control. Watering was then with sterilized, distilled water via a sterile pipette. The dishes were placed in a growth-room with a 20°C/16 hour day and a 15°C/8 hour night.

The seedlings were harvested after 4 months and examined for mycorrhizas.

A.1.2.2 Results

Germination was progressing well in all dishes after 2 weeks. There was no obvious growth stimulation or inhibition effect observed during the experiment related to the treatment.

Table A.1.2.2.1 Examination for mycorrhizas:

1.	Untreated soil	10 seedlings examined, all with heavily infected mycorrhizal roots.
2.	60°C soil	As above.
3.	65°C soil	As above.
4.	70°C soil	As above.

A.1.2.3 Discussion

Heating air-dried soil to a temperature of up to 70°C had no apparent effect on the germination and growth of R. ponticum seedlings subsequently sown on the soil.

Ericaceous endophyte was still present in the soil after treatment and all roots examined were heavily infected by mycorrhizas.

A.1.3 EXPERIMENT (2) The effects of 'steam sterlilization' on ericaceous endophyte in soil.

A.1.3.1 Method

The method and treatments were the same as for (1) except that the range of temperatures was increased. The time of exposure to the various temperatures was increased and varied.

Temperature range : No heating, 40°C, 50°C, 60°C, 70°C.
Time of exposure to the maximum temperature (in minutes) : 1,5,15,30,60.

1 dish was set up per treatment. All soils were moistened prior to heating, except for 2 additional bags which were filled with air-dried soil and treated at 70°C x 15 minutes and 70°C x 30 minutes.

R. ponticum seed (from Clumber, N.Notts.) was sown onto the soil and the dishes were treated as in (1). After 4 months, 4 seedlings per dish were harvested and the roots examined for mycorrhizas.

A.1.3.2 Results

Table A.1.3.2.1

Treatment	Mycorrhizal status of roots examined
Control, no heating.	4 heavily infected.
40°C x 1 min.	4 heavily infected.
x 5	" "
x 15	" "
x 30	3 heavily infected, 1 lightly infected.
x 60	4 heavily infected.
50°C x 1 min.	4 heavily infected.
x 5	2 heavily infected, 2 lightly infected.
x 15	1 heavily infected, 1 lightly infected, 1 slight infection.
x 30	4 heavily infected.
x 60	1 heavily infected, 2 lightly infected, 1 slight infection.
60°C x 1 min.	3 heavily infected, 1 lightly infected.
x 5	4 lightly infected.
x 15	2 heavily infected, 2 lightly infected.
x 30	" " " "
x 60	3 heavily infected, 1 lightly infected.
70°C x 1 min.	3 heavily infected, 1 lightly infected.
x 5	" " " "
x 15	" " " "
x 30	2 heavily infected, 2 lightly infected.
x 60	2 lightly infected, 2 very slight infection.

70°C x 15 min. (dry)	2 heavily infected, 2 lightly infected.
70°C x 30 min. (dry)	3 heavily infected, 1 slight infection.

Endophyte was still present and infective with heating of moistened soil up to 70°C for up to 60 minutes. Both air-dried and moistened soil still had viable, infective endophyte after treatment. Infection of roots in soil after the most drastic treatment (70°C x 60 min.) was rather light with little intracellular development of the fungus. (This was confirmed by the examination of further seedlings from the same treatment.)

A.1.3.3 Discussion

After 70°C for 60 minutes the amount of viable, infective endophyte may have been decreased by the treatment, or conditions in the treated soil could be adversely affecting the formation of mycorrhiza. This second possibility might be connected with the release of nutrients by the treatment. (Stribley and Read, 1976, have shown an increasing ammonium concentration to considerably reduce the intensity of mycorrhizal infection in seedlings of Vaccinium macrocarpon). However, such an effect might have been expected to increase gradually with more drastic treatments. This is not the case, so a direct effect of the treatment on the endophyte is implied. The heat treatment is perhaps decreasing the amount of available endophyte in the soil.

A.1.4 EXPERIMENT (3) The effects of 'steam sterilization' on ericaceous endophyte in soil.

A.1.4.1 Method

The method and treatments were the same as for (1) and (2) except that the temperatures were increased to 80°C and 90°C. In order to reach and maintain these temperatures a cover was constructed to enclose the water-baths and prevent excess evaporation and heat loss.

Temperature range : 80°C, 90°C.
Time of exposure to max. temperature (mins.) : 1, 5, 15, 30, 60.

2 dishes were set up per treatment. All samples were moistened prior to heating.

R. ponticum seed (from Clumber, N.Notts.) was sown onto the soil and the dishes were treated as in (1). After 4 months, 2 seedlings from each dish were harvested and examined for mycorrhizal infection.

A.1.4.2 Results

Table A.1.4.2.1

Treatment	Mycorrhizal status of roots examined	
	Dish (1)	Dish (2)
Control, no heating	2 heavily infected.	2 slightly infected.
80°C x 1 min.	2 slightly infected.	2 slightly infected.
x 5	" "	2 heavily infected.
x 15	" "	2 slightly infected.
x 30	" "	" "
x 60	No visible infection.	1 slightly infected, 1 no visible infection.

90°C x 1 min.	2 slightly infected.	2 very slightly infected
x 5	" "	" " "
x 15	No visible infection.	" " "
x 30	1 n.v.i., 1 s.i.	1 h.i., 1 v.s.i.
x 60	No visible infection.	No visible infection.

Only patchy development of mycorrhiza was observed in plants grown on soils heated to 80°C and 90°C. All the control seedlings were heavily mycorrhizal, but only two treatments (80°C x 5 min. and 90°C x 30 min.) produced any seedlings with heavily mycorrhizal roots. No mycorrhizal development was found in seedlings grown on soil heated to 80°C or 90°C for the full 60 minutes. Further seedlings from these treatments were examined and these confirmed the original observation.

A.1.4.3 Discussion

Endophyte was able to withstand heating up to 90°C for 30 minutes. Heating to 80°C or 90°C for 60 mins. however, apparently destroyed the endophyte or its viability for infection. Ericaceous endophyte in the soil is therefore quite resistant to even quite drastic heat treatment. Even high temperatures need to be maintained for between 30 and 60 minutes to remove viable endophyte.

A.1.5 EXPERIMENT (4) The effect of temperature on ericaceous endophyte grown in liquid culture.

A.1.5.1 Method

Endophyte was isolated from roots of R. ponticum (collected from Longshaw, North Derbyshire) and was cultured in Norkran's solution. 42 glass vials were prepared, each containing 2 ml of Norkran's solution. Under sterile conditions in a 'Microflow' cabinet, using a dissecting needle with a fine wire loop, two 'loop-fulls' of culture endophyte were transferred to each vial. The vials were then bunged and sealed with metal foil. They were then left at room temperature for 10 days.

The vials were subjected to a range of carefully controlled temperatures, with various times of exposure. After treatment, the vials were poured onto plates of 5% malt agar. The plates were then kept at room temperature for about 5 weeks when they were examined for culture development.

Treatments: Control (Room-temperature)
40°C x 1 min., 5 min., 10 min., 15 min., 30 min.
50°C "
60°C "
70°C "

2 vials per treatment.

Encophyte transferred from malt agar to Norkran's solution
2.2.79.. Cultures developing well by 20.3.79
Vials inoculated : 20.3.79
Vials treated : 30.3.79
Culture plated : 30.3.79
Plate cultures examined : periodically up until a final examination on 11.5.79.

A.1.5.2 Results

Table A.1.5.2.1

Temperature (°C)	Time of exposure to temperature									
	1 min.		5 min.		10 min.		15 min.		30 min.	
	A	B	A	B	A	B	A	B	A	B
40	+	+	+	+	+	+	+	+	+	+
50	+	+	-	-	-	-	-	-	-	-
60	+	+	-	-!	-	-	-	-	-	-
70	-	-	-!	-	-	-	-	-	-!	-

Control: A +; B +.

Key: A,B : duplicate vials.
+ : endophyte culture growing.
- : endophyte culture not growing by final examination.
! : some bacterial growth on plate.

The viability of ericaceous endophyte growing in liquid culture was unaffected by exposure to a temperature of 40°C for up to 30 minutes, or of 50°C and 60°C for 1 minute. All treatments more drastic than this led to no growth when the cultures were plated. Temperatures of 50°C and 60°C for 5 minutes or more prevented growth, as did all exposures to a temperature of 70°C.

A.1.5.3 Discussion

Endophyte in liquid culture was destroyed by lower temperatures and shorter exposure times than that in soil. These results suggest that soil contains some resistent form for the fungus. This might be some form of resting spore or hyphal fragment.

A.1.6 EXPERIMENT (5) The effects of 'steam sterilization' on soil microflora

A.1.6.1 Method

Winterton back-dune soil was treated in the same way as for Experiment (1). Examination of the affected soil microflora was by extraction into sterile water, followed by serial dilution and plating onto 5% malt agar.

Each treated soil was treated in the following way. 1g of soil was shaken vigorously in 10ml of sterile water on a shaker for 20 minutes. This extract was then serially diluted to give 1:10, 1:100 and 1:1000 dilutions. Three 1ml samples of each dilution were poured onto 5% malt agar plates and cultured at room temperature. Two samples of each treated soil were extracted in this way. All the operations were carried out under sterile conditions in a 'Microflow' cabinet.

The plates were periodically examined for the development of fungal or bacterial colonies. The final examination and colony count was 2 weeks after the heat treatment and extraction.

A.1.6.2 Results

Key:
- 1 : Room temperature only.
- 2 : 60°C
- 3 : 65°C
- 4 : 70°C
- A : 1:10 dilution.
- B : 1:100 "
- C : 1:1000 "
- a,b : Duplicate soil samples.
- 1,2,3 : Replicate plates.

Table A.1.6.2.1 Fungal and bacterial colonies on each plate

	1 A (a)			1 A (b)			1 B (a)			1 B (b)			1 C (a)			1 C (b)		
Treatment:	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Unidentified Yellow Bacteria		1	1		4		1											
Unidentified White Bacteria	5	2	5	2	3				1	10	6	1			2	2	5	2
Unid. White (Cloud) Bacteria			1								1						2	6
Bacterial Smear						+		+	+			+	+				+	+
Unid. Yellow Fungi			2					2	2			2					1	
Unid. Orange Fungi											1							
Unid. Slow-growing, dark Fungi			3															
Unid. Fast-growing, dark Fungi																		
Penicillium sp.	9	25	15	17	21		1	7	2	6	4	2		2	3	1		
Trichoderma sp.	42	90	3	60	65		90			1	1	62						
Fusarium sp.		1	2		2		1	2	1		1							1
Mucor sp.	3		2	1	2						6							
Aspergillus Sp.	5	15			2		1		1	2	2	1	1	1			2	1

Table A.1.6.2.2 Fungal and bacterial colonies on each plate

	2 A (a)			2 A (b)			2 B (a)			2 B (b)			2 C (a)			2 C (b)		
Treatment:	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Unidentified Yellow Bacteria														11				
Unidentified White Bacteria	3	13	1						1									1
Unid. White (Cloud) Bacteria						1								2	1	1	1	1
Bacterial Smear				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Unid. Yellow Fungi																		
Unid. Orange Fungi																		
Unid. Slow-growing, dark Fungi		1	1															
Unid. Fast-growing, dark Fungi	35	2	3		25	4												
Penicillium sp.	1						2											
Trichoderma sp.					1													
Fusarium sp.	2																	
Mucor sp.																		
Aspergillus Sp.			1															

Table A.1.6.2.3 Fungal and bacterial colonies on each plate

Treatment:	3 A (a)			3 A (b)			3 B (a)			3 B (b)			3 C (a)			3 C (b)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Unidentified Yellow Bacteria																		
Unidentified White Bacteria	13	22	18	20		51	10	11	11	7	17	16		28		2		
Unid. White (Cloud) Bacteria									7					2				
Bacterial Smear								+			+	+					+	+
Unid. Yellow Fungi																		
Unid. Orange Fungi											1							
Unid. Slow-growing, dark Fungi																		
Unid. Fast-growing, dark Fungi							9						1					
Penicillium sp.	21	23	9	108	35	25	14	13	22	20	11	21		1	2	1	2	5
Trichoderma sp.	5						1	1			1							
Fusarium sp.		1	2		2		1	2	1		1							1
Mucor sp.		1																
Aspergillus Sp.					5							2						1

Table A.1.6.2.4 Fungal and bacterial colonies on each plate

Treatment:	4 A (a)			4 A (b)			4 B (a)			4 B (b)			4 C (a)			4 C (b)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Unidentified Yellow Bacteria																		
Unidentified White Bacteria			8		2		9	19	24	17	16	30	1	1	7	3	3	6
Unid. White (Cloud) Bacteria																		
Bacterial Smear																		
Unid. Yellow Fungi																		
Unid. Orange Fungi									1									
Unid. Slow-growing, dark Fungi																		
Unid. Fast-growing, dark Fungi																		
Penicillium sp.							2	1	3	2	5	2	2	2	1			1
Trichoderma sp.	242	210	252	232	271	216	8	11	5	11	1	2					3	1
Fusarium sp.																		
Mucor sp.																		
Aspergillus Sp.		15					1		1		2		6					

Control: Plates of Malt Agar with added sterile water

1 : No colonies.

2 : "

3 : "

Table A.1.6.2.5 Summary of results

Treatment:	1			2			3			4		
	A	B	C	A	B	C	A	B	C	A	B	C
Unidentified Yellow Bacteria	6	1	-	-	-	11	-	-	-	-	-	-
Unidentified White Bacteria	17	18	11	17	1	1	124	72	30	10	30	21
Unid. White (Cloud) Bacteria	1	1	8	1	-	6	-	7	2	-	-	-
Bacterial Smear	1+	3+	3+	3+	6+	6+	-	3+	2+	-	-	-
Unid. Yellow Fungi	2	6	1	-	-	-	-	-	-	-	-	-
Unid. Orange Fungi	-	1	-	-	-	-	-	1	-	-	-	-
Unid. Slow-growing, dark Fungi	3	-	-	2	-	-	-	-	-	-	-	-
Unid. Fast-growing, dark Fungi	-	-	-	69	-	-	-	9	1	-	-	-
Penicillium sp.	87	22	6	1	2	-	221	101	11	-	15	6
Trichoderma sp.	260	154	-	1	-	-	154	3	-	1423	38	4
Fusarium sp.	5	5	1	2	-	-	5	3	-	-	-	-
Mucor sp.	8	6	-	-	-	-	1	-	-	-	-	-
Aspergillus Sp.	22	7	5	1	-	-	5	2	1	15	5	6

The heat treatment considerably modified the range and relative amounts of organisms in the soil microflora. Serial dilution also affected the outcome of culturing extracts. The effects of both treatment and dilution were not simple. Heating to 65°C greatly reduced the range of colony types found.

A.1.6.3 Discussion

These relatively mild soil treatments clearly had a drastic effect on the soil microbial population. The far more rigorous treatment necessary to remove endophyte from soil, combined with nutrient release expected from such treated soil would obviously produce a very much modified microbial community.

Heating the soil will have a range of effects on soil microbiology which may be difficult to quantify. The outcome of such treatment may depend on the death of a resistent form, the speed of recovery after treatment, the spread (perhpas by spores) from initial colonies, its ability to utilize nutrients released by the treatment and its competitive ability against other micro-organisms.

A.2 APPENDIX 2 : SOIL ANALYSIS

A.2.1 INTRODUCTION

At an early stage in this research it was apparent that the most important soil variables affecting the phenomena under study were pH, 'available' nitrogen content (and form), 'available' phosphorous content and organic matter content. The soil analysis carried out therefore included these factors, and in some cases, moisture content.

The methods used are presented here together with two experiments relating to the measurement of soil pH. The measurement of pH is highly relevant to this particular work. However, there is still considerable disagreement over techniques which most realistically and consistently represent the true soil conditions (Peech in Black (Ed.), 1965). The methods were therefore standardized early on in the work and strictly adhered to throughout.

A.2.2 METHOD

A.2.2.1 Soil acidity

(Methods based on Peech (in Black (Ed.), 1965) and 'Methods for the chemical analysis of soil, an internal document giving guidelines for the Natural Environment Research Council Unit, Department of Botany, University of Sheffield.)

A.2.2.1 (a) In water

20g of the soil sample were placed in a 50ml beaker. 10-20ml of distilled water were added and the sample stirred into a paste using a glass rod. The sample was then left and the pH measured (after stirring) after 2 hours and 24 hours, using a glass-calomel electrode pH meter.

A.2.2.1 (b) In calcium chloride solution

This technique is considered by some to give more realistic estimates of soil pH, though it may differ considerably from values in water.

10g of soil sample were placed in a 50ml beaker and 25ml of 0.01 M CaCl 2 (aq.) solution added. After stirring as before the pH was again measured after 2 hours and 24 hours, this time with the electrode placed in the supernatant.

A.2.2.2 'Available' nitrogen

A.2.2.2.1 Introduction

The inorganic combined nitrogen in most soils is in the form of ammonium (NH_4^+) and nitrate (NO_3^-). Nitrite may be detectable, but usually in relatively very small amounts. The degree to which the combined nitrogen is held in the soil varies considerably. It may be loosely held as 'available' or 'exchangeable' nitrogen. There is no generally accepted definition of the precise scope of these terms (Bremner in Black (Ed.), 1965).

In practice it is convenient to define 'fixed', combined, inorganic nitrogen as that not extractable by 1N Kcl(aq.) solution at 20°C. The fraction extracted may then be regarded as 'available' or 'exchangeable', combined, inorganic nitrogen.

A.2.2.2.2 Method

The method of extraction and analysis was based on that described by Bremner (in Black (Ed.), 1965). This is an extraction with KCl (aq), followed by steam-distillation with MgO and Devarda alloy, and then determination with boric acid indicator.

10g of fresh soil sample were extracted by shaking for 4 hours in 50ml of 2N KCl (aq) with 0.5g activated charcoal. The samples were then centrifuged at 4000 r.p.m. for 10 minutes, filtered on Whatman No. 1 paper and the filtrate collected in glass flasks.

5ml, 10ml or 15ml of filtrate were then steam-distilled on a Markham Still, using Pyrex Kjeldahl flasks with 0.2g dry MgO per sample. The distillation was complete in around 10 minutes or when around 35ml of distillate had been collected. The distillate was collected in flasks with 5ml of boric acid indicator solution. This was then titrated with standardized sulphuric acid on a micro-burette, the colour change being from blue-green to purple-red.

The filtrate remaining in the Kjeldahl flask was then re-distilled with 25-50mg of Devarda alloy. The titration of the sample was as before.

The whole process was repeated twice for each soil sample, two samples being used for each soil. Soil moisture content was determined by taking the fresh weight and oven dry weight of a sub-sample.

The first distillation and titration determines the ammonium nitrogen, the second determines nitrate nitrogen (reduced to ammonium and distilled by the mixture of Devarda alloy and MgO).

The amount of 'available' nitrogen present was then calculated according to:-

1ml of 0.01N H_2SO_4 (aq.) $\equiv$ 0.140 mgN
1ml of 0.001N H_2SO_4 (aq.) $\equiv$ 0.014 mgN

The extractant was also distilled and determined to give a background value subtracted from the sample values. The amounts of 'available' nitrogen as ammonium-N, nitrate-N and total-N were calculated and presented.

All glassware was 'acid-washed' in dilute HCl, then thoroughly rinsed in distilled, deionized water prior to use.

A.2.2.3 Available phosphorus

A.2.2.3.1 Introduction

As with nitrogen, phosphorus is held in the soil in a variety of forms. The particular form strongly affects its availability to plants. Much of the soil phosphorus may be organically bound. The extent of mineralization and fixing in inorganic forms is very important. The 'available' phosphorus extracted therefore depends very much on the extractant and technique employed. Problems such as the resorption of phosphorus during extraction, complicate any attempt to ascertain exact values of 'available' phosphorus in soil (Allen (Ed.), 1974). However, as an indication of the levels of phosphorus easily available to plants, the method described below is useful.

A.2.2.3.2 Method

The method chosen was extraction with 2.5% acetic acid (aq.) solution as used by Williams and Stewart, 1941 (in Allen (Ed.), 1974), followed by colorimetric determination with molybdenum blue, using stannons chloride (Kaila, 1955 in Allen (Ed.), 1974).

5g or 10g of air-dried soil were extracted in 50ml of 2.5% (v./v.) acetic acid (aq.), shaken on a rotary shaker for 1 hour. The samples were then centrifuged at 4000 r.p.m. for 10 minutes and filtered through Whatman No. 44 paper into borosilicate flasks. The first 20-30ml of each sample were rejected.

The level of phosphorus was then determined colorimetrically. Ammonium molybdate solution ($(NH_4)_6 Mo_7O_{24} . 4H_2O$ (aq.)) was made up in distilled water with concentrated sulphuric acid. Stannons chloride reagent ($SnCl_2 . 2H_2O$ with 2% v./v. HCl) was made up immediately prior to use.

The method relies on the formation of a heteropolyphosphomolybdate compound when an acid molybdate is added to a solution containing orthophosphate. Reduction of this complex gives a characteristic

molybdenum blue colour. Stannons chloride was used as the reductant. It is the most sensitive reductant used but has a very critical development time.

10ml of extractant were diluted to 35ml with distilled, deionized water. 2ml of acid ammonium molybdate solution were added, followed by 2ml of stannons chloride reagent. The solution was then left for 30 minutes to develop.

The optical density was measured on a spectrophotometer at 700 nm. with water as a reference. Blank determinations for the extractant were carried out and subtracted from the sample values. A calibration curve was produced using standard orthophosphate solutions against optical density.

All glassware was 'acid-washed' in dilute HCl (aq.) and then thoroughly rinsed in distilled deionized water before use.

A.2.2.4 Soil organic matter content

Soil samples were oven-dried at 80°C for 24 hours, then ignited in a crucible in a furnace at 375°C for 16 hours. The samples were weighed before and after ignition, the weight loss being taken as the organic matter content.

A.2.2.5 Soil moisture content

Either fresh or air-dried soil samples (depending on the analysis being done) were weighed and then oven-dried at 80°C for 24 hours. The samples were then reweighed and the percentage moisture calculated.

A.2.3

A.2.3.1 SOIL ACIDITY EXPERIMENT (1) Effects of dilution on the measurement in distilled water and in 0.01M calcium chloride (aq.) for an organic and for a sandy soil

A.2.3.1.1 Method

Samples of two soils were collected from Blacka Moor, S.Yorks.. One was an organic 'A' horizon from beneath mature R. ponticum and the other a sandy 'B' horizon from beneath mature C. vulgaris.

The pH of the samples was measured after dilution and mixing to a paste using a glass rod. Measurements were made with a glass-calomel electrode and pH meter, after 2 hours and 24 hours. A range of dilutions was used for both distilled water and calcium chloride solution. The moisture content of the soil was also measured.

A. .3.1. Results

Table A. .3.1.2.1

		ORGANIC		SANDY	
		2 hrs.	24 hrs.	2 hrs.	24 hrs.
1. Distilled water (mls.)	10	3.70	3.55	3.50	3.35
	20	3.75	3.45	3.45	3.40
	30	3.80	3.50	3.50	3.45
2 g soil (fw.)	40	3.80	3.45	3.55	3.45
	50	3.85	3.50	3.60	3.50
	100	3.80	3.70	3.80	3.75
2. Calcium chloride	10	3.30	2.90	3.20	2.75
solution (mls.)	20	3.30	2.90	3.20	2.75
	30	3.30	2.90	3.20	2.80
	40	3.25	2.85	3.20	2.80
10g soil (fw.)	50	3.30	2.90	3.25	2.85
	100	3.35	3.00	3.40	2.90

Measurement of pH for 20g soil in 10mls. of water was difficult due to the consistency of the samples at this dilution.

Moisture content : Organic soil : 58.7% of fresh sample.
Sandy soil : 16.5% " " "

pH generally rose with increasing dilution and fell during the period from 2 hours to 24 hours following mixing. Values in calcium chloride solution w re c. 0.30-0.40 pH units lower than those in distilled water.

Th effects of d'lution were stronger in distilled water, than in calcium chloride solution. Values with both treatments were fairly consistent thr ughout the range 10ml - 50ml addition.

The chang in pH measured from 2 hours to 24 hours was about the same in both s ils using calcium chloride solution. With distilled water, the chang was relatively slight in the sandy soil and greater in the organic s il.

A.2.3.1.3 D'scussion

T e ifferen es between the values in distilled water and in calcium l ride s lution were as expected. The variation with dilution suggests at until m re than 5 l solution was used per sample, the pH value would be c nstant. Ch nges in values measured from 2 hours to 24 hours highlight the need for standardization of this factor. The changes however, were not always great.

A.2.3.2 SOIL ACIDITY EXPERIMENT (2): Effects of time after mixing on the measurement in distilled water and in 0.01M calcium chloride (aq.) for an organic and for a sandy soil

A.2.3.2.1 Method

Soil samples were collected and treated in the same way as for the previous experiment (1). Soil pH was measured after a range of times following the mixing of the sample.

A.2.3. .2 R ults

T b e A. .3. .2.1

	Time after mixing.	Organic	Sandy
1. D still d w er	0 min.	3.50	3.55
2 mls.	30 min.	3.40	3.40
g s il (fw.)	60 min.	3.35	3.40
	90 min.	3.35	3.35
	120 min.	3.35	3.40
	24 hrs.	3.40	3.40
2. Cal um chloride	0 min.	2.80	2.70
solution	30 min.	2.80	2.75
5 mls.	60 min.	2.80	2.70
10g s il (fw.	90 min.	2.80	2.70
	120 min.	2.80	2.75
	24 hrs.	2.85	2.75

The changes in pH value measured at different times after mixing, were relatively slight. In distilled water the pH fell rapidly after initial mixing, but was then relatively constant. Similarly, the values in calcium hloride solution showed little variation.

A.2.3.2.3 Discussion

These results, together with those from Experiment (1) emphasise the variable nature of the phenomenon of soil pH. Changes with time and dilution clearly vary from sample to sample and with the type of soil and solution used.

A.3 APPENDIX 3 : BIOASSAY TESTS OF *RHODODENDRON* CANOPY THROUGHFALL

A.3.1 INTRODUCTION

Canopy throughfall and rainfall samples were collected from field sites as described in Chapter 5. The samples were then used wither modified or untreated in experiments to examine their effects on germination and growth of test species (Agrostis tenuis, Festuca ovina and Rhododendron ponticum).

A.3.2 METHOD

Five bioassays were carried out. The basic experimental procedure involved seeds sown or seedlings planted in glass crystallizing dishes with glass tops. The seeds or seedlings were placed on either field soil or filter paper. The dishes were placed in a growth-room with a 20°C/16 hour day and a 15°C/8 hour night. They were watered with Rhododendron canopy throughfall (Rh.T), rainfall collected in the open (O) or distilled water (W).

The individual experiments (1-5) are outlined below.

1. Samples collected : Strawberry Lee Plantation : 1.6.79.
   Dishes planted with 30 seedlings of Agnostis tenuis, Festuca ovina (both 2 weeks old) or Rhododendron ponticum (3 weeks old), or sown with 30 seeds of F. ovina, or R. ponticum. Sown or planted 4.6.79, harvested 17.7.79.

   Seeds or seedlings were on Winterton back-dune soil covering 20ml of 0.5% water agar, watered with Rhododendron canopy throughfall or rainfall.

2. Samples collected : Strawberry Lee Plantation : 26.6.79.
   Dishes with filter paper sown with seed of A. tenuis, F. ovina and R. ponticum, 29.6.79. They were watered with Rhododendron canopy througfall, rainfall or distilled water. Ten seedlings per treatment were harvested 24.7.79.

3. Samples collected : Strawberry Lee Plantation : 22.7.79.
Dishes with filter paper were sown with A. tenuis, F. ovina and R. ponticum 25.7.79.

6ml of throughfall or rainfall were added to each dish and the dishes were then sealed. 20 seedlings of each species per treatment were harvested 10.8.79.

4. Samples collected : Strawberry Lee Plantation : 31.7.79.
F. ovina seed was sown as in 3., 24.9.79 and 20 seedlings were harvested 8.10.79. They were watered with 12ml of throughfall concentrated (10X), throughfall or distilled water. After watering, dishes were sealed as in 3. The throughfall was concentrated on a rotary vacuum evaporator at 40°C.

5. Samples collected : Cardwell : 27.7.80.
F. ovina seed was sown (10 per dish, 20 per treatment) 4.8.80, and the seedlings were harvested 26.8.80.

The dishes were watered with distilled water or an aqueous residue of Rhododendron throughfall. Throughfall was evaporated to a solid on a rotary vacuum evaporator at 40°C. The methanol extractable fraction was then taken off for further analysis. The residue was taken up in the minimum possible amount of distilled water. This aqueous residue was used for the bioassay experiment. Its pH was 3.90 and its concentration was approximately 15X that of the original throughfall.

Following harvesting, seedlings from experiments 1-5 were taken and their root and shoot lengths carefully measured.

A.3.3 RESULTS

Germination. Quantitative assessments of germination success were carried out only for experiments 1 and 5.

1. :	F. ovina	: Rh.T	:	86.7%
		0	:	80.0%
	R. ponticum	: Rh.T	:	70.0%
		0	:	76.7%
5. :	F. ovina	: Rh.T (aq. residue concentrated)	:	85.0%
		W	:	75.0%

Experiment 1

Short lengths of the test seedlings were not significantly affected by application of throughfall. Root lengths of F. ovina (as seed and as seedlings) were significantly reduced in throughfall (Rh.T) compared to rainfall (0). R. ponticum root lengths were reduced but not significantly.

Experiment 2

Shoot lengths of F. ovina and A. tenuis, both plants as seeds were significantly reduced by both Rh.T and 0 compared to distilled water (W).

Root lengths were also significantly reduced, but those treated with 0 were also significantly less than those with Rh.T.

Experiment 3

Rh.T significantly reduced shoot length of A. tenuis and R. ponticum below those treated with O.

Root lengths of F. ovina and R. ponticum were similarly reduced.

Experiment 4

Throughfall had no significant effect on shoot or root length of F. ovina grown from seed. Concentrated throughfall significantly increased shoot length and decreased root length.

Experiment 5

The aquous residue of Rh.T significantly reduced shoot length of F. ovina and totally inhibited root development.

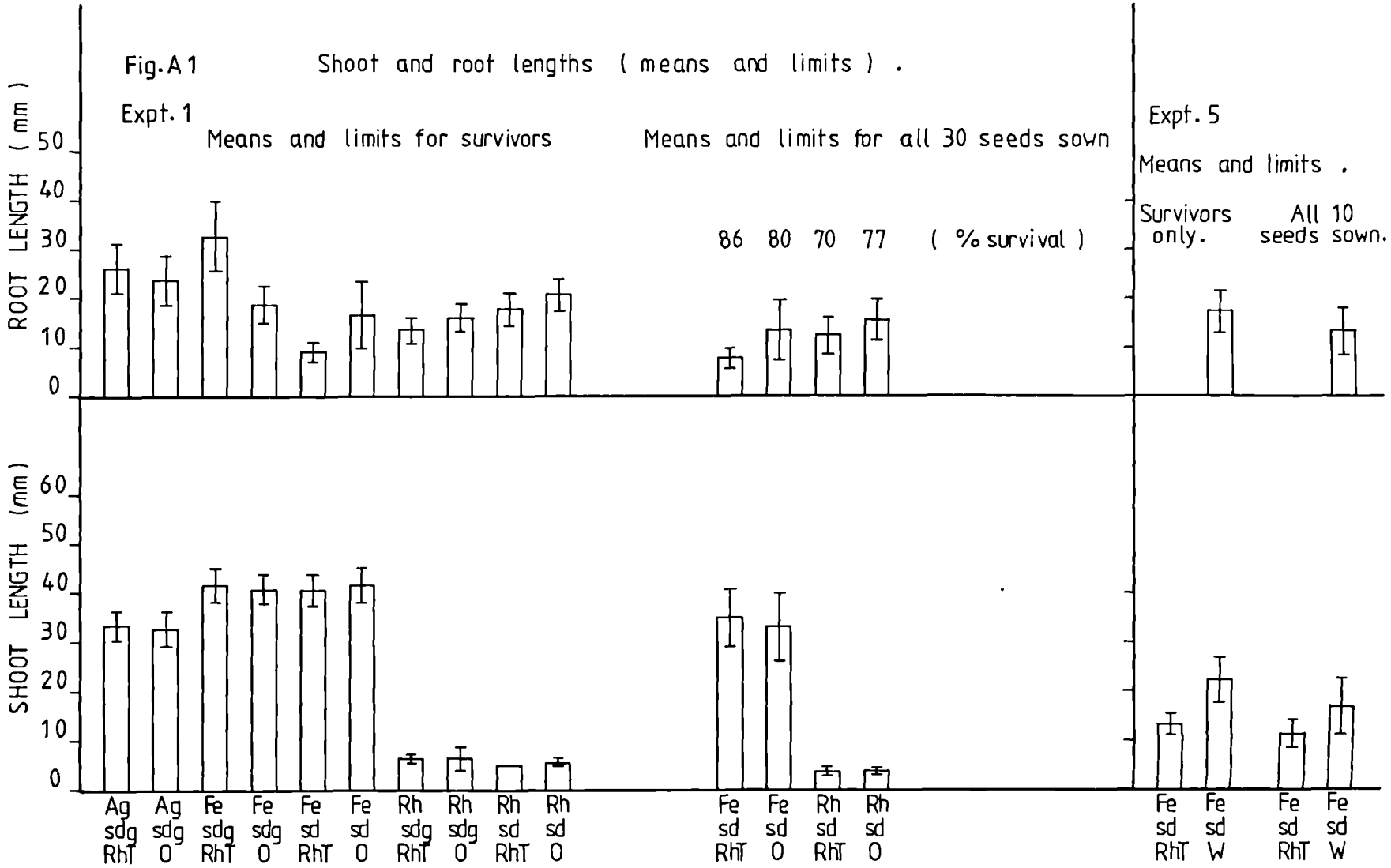
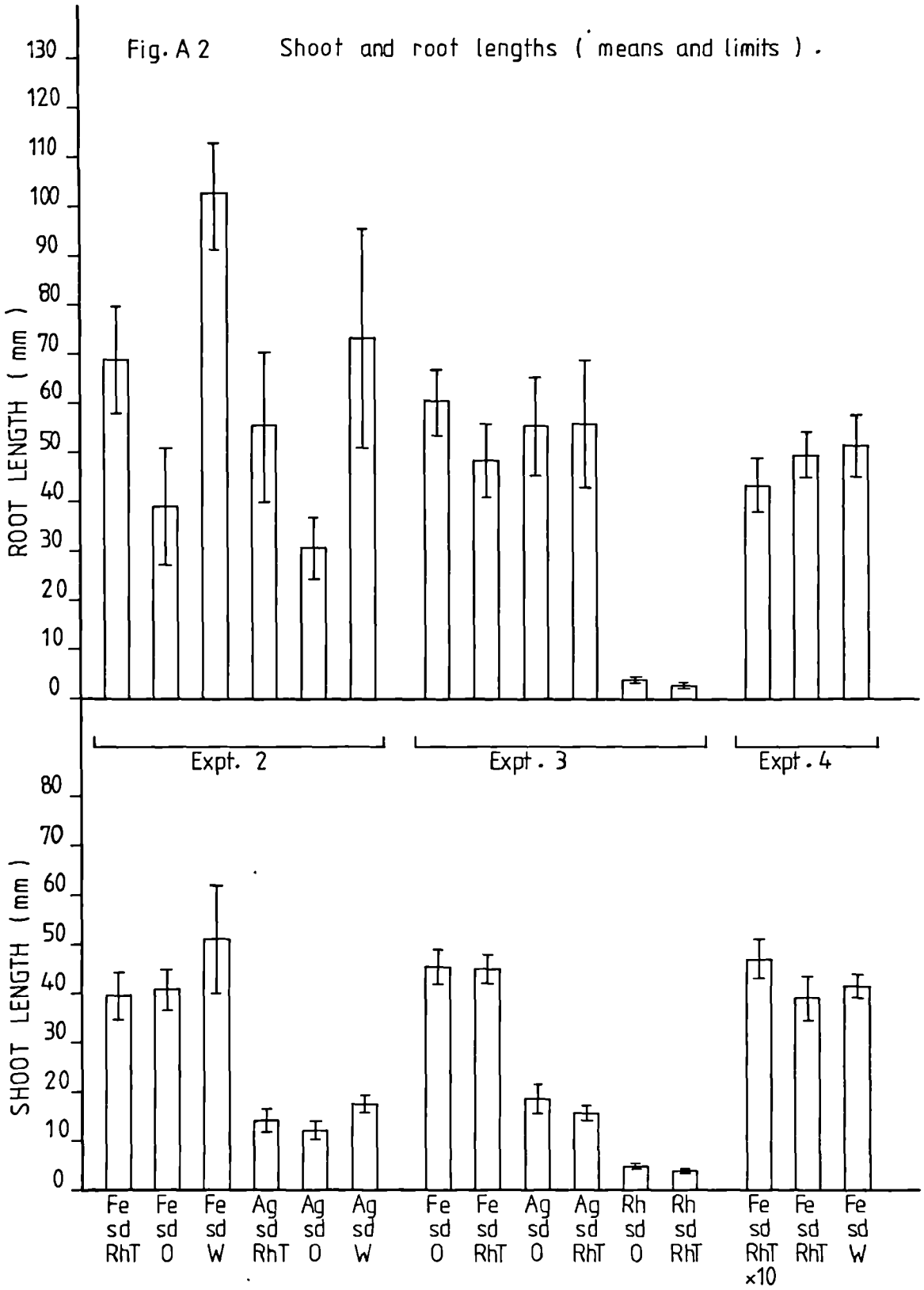


Fig. A 1
Shoot and root lengths (means and limits) .
Expt. 1
Means and limits for survivors
Means and limits for all 30 seeds sown
Expt. 5
Means and limits .
Survivors only.
All 10 seeds sown.
86 80 70 77 (% survival)
ROOT LENGTH (mm)
SHOOT LENGTH (mm)
0 10 20 30 40 50
0 10 20 30 40 50 60
Ag sdg RhT
Ag sdg 0
Fe sdg RhT
Fe sdg 0
Fe sd RhT
Fe sd 0
Rh sdg RhT
Rh sdg 0
Rh sd RhT
Rh sd 0
Fe sd RhT
Fe sd 0
Rh sd RhT
Rh sd 0
Fe sd RhT
Fe sd W
Fe sd RhT
Fe sd W

Fig. A 2 Shoot and root lengths (means and limits) .



A.4 APPENDIX 4: NUTRIENT SOLUTIONS OR MEDIA USED

Robbins Solution

- for culturing of seedlings in various media. Fairly low nutrient additive applied as solution.

- for culturing of seedlings in agar (in dishes or tubes), made up as 0.8% agar i.e. 8g agar per 1L solution.

Table A.4.1

Major Constituents:-

$Ca(NO_3)_2$	0.05g)	
$MgSO_4$	0.01g)	per 1L solution in distilled water.
KH_2PO_4	0.01g)	
$FeCl_3\ 6H_2O$	0.002g)	

Traces:-

$Na_2B_4O_7$)	each as 0.01g per 100ml H_2O.
$MnCl_2$)	1ml added per 1L of solution of major nutrients.
$ZnCl_2$)	

Norkran's Medium

- for liquid culture of endophyte.

Table A.4.2

$(NH_4)_2 H PO_4$	2.0g)	
$KH_2 PO_4$	0.6g)	
$K_2H PO_4$	0.4g)	
$MgSO_4 7H_2O$	0.5g)	
Ferricitiate	5.0mg)	per 1L aqueous solution in
$ZnSO_4 7H_2O$	4.4mg)	distilled water.
$MnSO_4 4H_2O$	5.0mg)	
$CaCl_2 2H_2O$	55.5mg)	
	)	
Yeast extract	50.0mg)	
Glucose	10.0g)	

pH of medium 5.6 - 5.8

A.5 APPENDIX 5 : PREPARATION OF ACID-WASHED SAND

The treated sand is sterile and without nutrients. It may be used as a base medium with the pH adjusted as required and nutrients added.

a) 1. Sand placed in 3% HCl in polythene bin (40L acid per 100Kg sand) and left for 15 hours.

2. Sand + acid transferred into poly bin with holes in base and allowed to drain.

3. (1) and (2) repeated.

4. Sand washed with distilled water until pH 4.

5. Nutrient solution added as required.

b) 1. Sand air-dried and then sieved through fine mesh.

2. Sand boiled for 2 hours in concentrated HCl.

3. Acid removed by washing the sand for 48 hours, first in running water and then several times in distilled water.

(Technique (b) suitable for small quantities of material.)

A.6 APPENDIX 6 : THE REGENERATION OF VEGETATION IN ARTIFICIAL GAPS WITHIN DENSE *RHODODENDRON* BUSHES

A.6.1 INTRODUCTION

The lack of colonization of areas of dense R. ponticum is an aspect of its ecology suggesting an allelopathic influence. In some cases the dense shade cast is clearly responsible for preventing the growth of seedlings. However, in other situations the R. ponticum canopy has fallen away to leave areas open to full daylight. Even when this has occurred, recolonization of the ground may not happen. One place where this has been observed is Strawberry Lee Plantation. It was therefore decided to investigate recolonization of open areas at this site, using artificially created gaps.

A.6.2 METHOD

Artificial gaps were cut in the canopy of dense R. ponticum bushes at Strawberry Lee Plantation, South Yorkshire (SK278805). Branch debris was cleared to ground level and plots (1m x 1m) were set up within the original gaps of 2m x 2m. Each plot was further divided into quarters (½m x ½m) which were then treated in the following ways:-

1. NPK. Fertilizer and Lime applied at a rate of 50g/sq.m each (1 quarter).

2. Rhododendron litter removed (1 quarter).

3. Both (1) and (2) (1 quarter).

4. No treatment (1 quarter).

Eight plots were set up. Four were 'trenched' to a depth of 0.3m by cutting around the perimeter of the plot with a spade and sinking heavy duty polythene sheet into the soil to this depth. This effectively removed living Rhododendron roots from these plots (R. ponticum being quite shallow rooted). Four plots were untrenched.

The plots were then periodically examined to follow the regeneration of vegetation, and the fate of developing seedlings with the various treatments. Fresh falls of litter etc. were removed as appropriate to maintain the required experimental conditions.

The plots were treated and monitored as below:-

Plots cut and set up July 1980.
Plots treated : 25.7.80., 4.5.81.
Seedlings counted : 8.9.80., 9.7.81., 17.9.81.

The main higher plant species in the plantation were identified and their status assessed very approximately to give an indication of the potential colonizers of the experimental plots.

A.6.3 RESULTS

The numbers of seedlings colonizing the experimental plots 12 months and 14 months after clearance are presented (Figures A3 and A4; Tables A.6.3.2 - A.6.3.10).

Far more dicotyledons than monocotyledons were found for all treatments. The numbers of seedlings declined strongly over the late summer period from 9.7.81 to 17.9.81.

With the untrenched plots the addition of F and L, or the removal of litter, each approximately doubled the number of seedlings compared with untreated controls. When litter was removed and F and L were added to the same area, the number of seedlings colonizing increased more than five-fold.

For the trenched plots, the addition of F and L had little effect. Removal of litter increased the number of seedlings nearly ten-fold. When F and L were added along with the removal of litter, numbers increased over the untreated controls by a factor of c.13.

The overall pattern found at the second count was similar to that in the first. However, a difference between untrenched and trenched plots was apparent. At the first count, the untrenched plots had very slightly more seedlings. The mortality over the summer period was considerably higher in the untrenched plots and the numbers at the second count, had fallen well below those for the trenched plots. This could be due to competition for moisture and nutrients, toxicity, or a combination of these.

The most common colonizing species were R. ponticum, Betula sp., Rumex acetosella and Deschampsia flexuosa. The most common higher plants in the plantation (and hence potential colonizers) are presented in Table A.6.3.1.

Table A.6.3.1

Main higher plant species found in Strawberry Lee Plantation in areas adjacent to the plots.

Agrostis tenuis : occasional.
Holcus lanatus : occasional.
Poa annua : occasional.
Poa pratensis : occasional.
Holcus mollis : frequent.
Deschampsia flexuosa : frequent.
Anthoxanthum odoratum : frequent.
Dactylis glomerata : frequent in peripheral areas of the plantation.
Juncus effusus : frequent in moist areas.
Rumex acetosa : frequent.
Rumex acetosella : occasional.
Oxalis acetosella : occasional.
Festuca ovina : occasional.
Galium saxatile : frequent.
Pteridium aquilinum : frequent.
Dryopteris dilatata : frequent.
Dryopteris felix-mas : occasional.

Rhododendron ponticum : frequent and dominant over large areas.
Calluna vulgaris : occasional.
Vaccinium myrtillus : occasional.
Erica tetralix : occasional.
Erica cinerea : occasional.
Alnus glutinosa : frequent.
Quercus petraea : frequent.
Betula pubescens : frequent.
Pinus sylvestris : frequent.
Acer pseudoplatanus : frequent.
Sorbus aucuparia : frequent.

Key to the tables

Monocots. or M.	: monocotyledons.
Dicots. or D.	: dicotyledons.
Total or T.	: total number of individual plants (M.+D.).
s	: seedling.
Unid.	: seedlings that it was not possible to identify with certainty.

Treatments:

F.	: fertilizer (total nitrogen 5.1%, total phosphorus 2.9%, water-soluble phosphorus 2.5%, total potassium 6.7%).
L.	: lime.
Lit.	: litter. 'No Lit.' means the litter was removed.
No Treat.	: no treatment i.e. litter was not removed and no fertilizer or lime was added.

Table A.6.3.2

Plot 1. Untrenched.

8.9.80. : no seedlings.

Experimental treatment (9.7.81)	Monocots. No.	Identification	Dicots. No.	Identification	Total No.	Other
1. F.+L.	3:	D. flexuosa (2,s) Unid. (1,s)	3:	Unid. (3,s)	6	-
2. No Lit.	2:	D. flexuosa (1,s) Unid. (1,s)	6:	R. ponticum (4,s) Unid. (2,s)	8	Moss
3. F.+L. No Lit.	6:	D. flexuosa (1,s) Unid. (5,s)	6:	R. ponticum (1,s) R. acetosella (1,s) Unid. (4,s)	12	Moss
4. No Treat.	1:	D. flexuosa (1,s)	4:	Unid. (4,s)	5	-
(17.9.81)						
1. F.+L.	0		0		0	-
2. No Lit.	1:	Unid. (1,s)	2:	R. acetosella (1,s)	3	-
3. F.+L. No Lit.	3:	D. flexuosa (2,s) A. tenuis (1)	1:	Unid. (1,s)	4	-
4. No Treat.	0		0		0	-

Notes: For No. 1 (9.7.81.) one D. flexuosa seedling was clearly suffering from drought and one of the unidentified dicots. was virtually moribund.

Table A.6.3.3

Plot 2 Untrenched.

8.9.80. : no seedlings.

	Monocots.	Dicots.	Total	Others
(9.7.81)				
1. F.+L.	1: Unid. (1,s)	8: Unid. (8,s)	9	-
2. No Lit.	0	8: Unid. (8,s)	8	-
3. F.+L. No Lit.	3: Unid. (3,s)	24: Unid. (24,s)	27	-
4. No Treat.	0	3: Unid. (3,s)	3	-
(17.9.81)				
1. F.+L.	1: A. tenuis (1)	4: R. ponticum (2,s) Unid. (2,s)	5	-
2. No Lit.	0	1: Unid. (1,s)	1	-
3. F.+ L. No Lit.	0	5: R. ponticum (2,s) Unid. (3,s)	5	-
4. No Treat.	0	0	0	-

Table A.6.3.4

Plot 3 Untrenched.

8.9.80 : no seedlings.

	Monocots.	Dicots.	Total	Others
(9.7.81)				
1. F.+L.	1: *D. flexuosa* (1,s)*	0	1	-
2. No Lit.	0	1: Unid. (1,s)	1	-
3. F.+L. No Lit.	1: *D. flexuosa* (1,s)	1: Unid. (1,s)	2	-
4. No Treat.	0	0	0	-
(17.9.81)				
1. F.+L.	0	0	0	-
2. No Lit.	0	0	0	-
3. F.+L. No Lit.	1: *D. flexuosa* (1,s)	3: *R. ponticum* (1,s) Unid. (2,s)	4	-
4. No Treat.	0	0	0	-

* This seedling had about 5 cm of shoot growth but no root development at all. The seedling was lying fully exposed on the surface of large fragments of leaf litter.

Table A.6.3.5

Plot 4 Untrenched.

8.9.80 : no seedlings.

	Monocots.	Dicots.	Total	Other
(9.7.81)				
1. F.+L.	0	1: Unid. (1,s)	1	-
2. No Lit.	0	4: Unid. (4,s)	4	-
3. F.+L. No Lit.	1: D. flexuosa (1,s)	9: Unid. (9,s)	10	-
4. No Treat.	0	1: Unid. (1,s)	1	-
(17.9.81)				
1. F.+L.	0	0	0	-
2. No Lit.	0	6: R. ponticum (6,s)	6	-
3. F.+L. No Lit.	0	3: R. ponticum (2,s) Betula sp. (1,s)	3	-
4. No Treat.	1: D. flexuosa (1,s)	4: R. ponticum (4,s)	5	-

Table A.6.3.6

Plot 5 Trenched

8.9.80 : no seedlings.

	Monocots.	Dicots.	Total	Other
(9.7.81)				
1. F.+L.	0	3: Unid. (3,s)	3	-
2. No Lit.	0	13: R. ponticum (1,s)	13	Moss
		Unid. (12,s)		Liverwort
3. F.+L. No Lit.	2: D. flexuosa (1,s)	16: R. ponticum (1,s)	18	Liverwort
	H. lanatus (1,s)	C. angustifolium (1,s)		Moss
		Unid. (14,s)		
4. No Treat.	0	2: Unid. (2,s)	2	-
(17.9.81)				
1. F.+L.	0	0	0	-
2. No Lit.	0	19: R. ponticum (13,s)	19	Moss several patches.
		Betula sp.		
3. F.+L. No Lit.	2: D. flexuosa (1,s)	17: R. ponticum (16,s)	19	Fern (10)
	A. tenuis	Betula sp. (1,s)		Moss several patches.
4. No Treat.	0	0	0	-

Notes: The Agrostis tenuis in Treatment No. 3 (17.9.81) was a well established plant. The 'Fern' referred to in Treatment No. 3 (17.7.81) was not identified with certainty, but may have been Dryopteris dilatata.

Table A.6.3.7

Plot 6 Trenched

8.9.80 : no seedlings

	Monocots.	Dicots.	Total	Other
(9.7.81)				
1. F.+L.	0	0	0	-
2. No Lit.	0	9: Unid. (9,s)	9	-
3. F.+L. No Lit.	0	18: Unid. (18,s)	18	-
4. No Treat.	0	0	0	-
(17.9.81)				
1. F.+L.	0	0	0	-
2. No Lit.	0	0	0	-
3. F.+L. No Lit.	0	0	0	-
4. No Treat.	0	0	0	-

Table A.6.3.8

Plot 7 Trenched

8.9.80 : *no seedlings*

	Monocots.	Dicots.	Total	Other
(9.7.81)				
1. F.+L.	1: *D. flexuosa* (1,s)	0	1	-
2. No Lit.	0	3: *R. ponticum* (3,s) Unid. (2,s)	3	-
3. F.+L. No Lit.	0	4: Unid. (4,s)	4	-
4. No Treat.	0	0	0	-
(17.9.81)				
1. F.+L.	0	0	0	-
2. No Lit.	0	3: *R. ponticum* (3,s)	3	-
3. F.+L. No Lit.	1: *D. flexuosa* (1,s)	4: *R. ponticum* (4,s)	5	-
4. No Treat.	0	0	0	-

Table A.6.3.9

Plot 8 Trenched

8.9.80 : no seedlings

	Monocots.	Dicots.	Total	Other
(9.7.81)				
1. F.+L.	2: H. lanatus (2,s)	1: Unid. (1,s)	3	-
. No Lit.	0	12: Unid. (12,s)	12	Moss
. F.+L. No Lit.	0	12: Unid. (12,s)	12	Moss
4. No Treat.	0	2: Unid. (2,s)	2	-
17.9.81)				
1. F.+L.	0	2: R. ponticum (1,s) Unid. (1,s)	2	Fern (3
2. No Lit.	0	5: Betula sp. (1,s) V. myrtillus (1,s) Unid. (3,s)	5	-
3. F.+L. No Lit.	1: A. tenuis (1)	1: R. ponticum (1,s)	2	Moss
4. No Treat.	0	2: R. ponticum (1,s) Betula sp. (1,s)	2	-

Notes: There had been some inundation of the plot by litter when examined in September 1981.

The Agrostis tenuis noted for 17.9.81 Treatment No. 3 was a well-established plant, but it had been grazed.

Table A.6.3.10 Summary of data

U trenched Plots

F.+L.			No Lit.			F.+L.No Lit.			No Treat.			Date & Plot
M.	D.	T.	M.	D.	T.	M.	D.	T.	M.	D.	T.	
0	0	0	0	0	0	0	0	0	0	0	0	8.9.80
												9.7.81
	3	6	2	6	8	6	6	12	1	4	5	Plot 1
1	8	9	0	8	8	3	24	27	0	3	3	2
1	0	1	0	1	1	1	1	2	0	0	0	3
0	1	1	0	4	4	1	9	10	0	1	1	4
5	12	17	2	19	21	11	40	51	1	8	9	1 - 4
												17.9.81
0	0	0	1	2	3	3	1	4	0	0	0	Plot 1
1	4	5	0	1	1	0	5	5	0	0	0	2
0	0	0	0	0	0	1	3	4	0	0	0	3
0	0	0	0	6	6	0	3	3	1	4	5	4
1	4	5	1	9	10	4	12	16	1	4	5	1 - 4

Trenched Plots

0	0	0	0	0	0	0	0	0	0	0	0	8.9.80
												9.7.81
0	3	3	0	13	13	2	16	18	0	2	2	Plot 5
0	0	0	0	9	9	0	18	18	0	0	0	6
1	0	1	0	3	3	0	4	4	0	0	0	7
2	1	3	0	12	12	0	12	12	0	2	2	8
3	4	7	0	37	37	2	50	52	0	4	4	5 - 8

F.+L.			No Lit.			F.+L.No Lit.			No Treat.			Date & Plot
M.	D.	T.	M.	D.	T.	M.	D.	T.	M.	D.	T.	
												17.9.81
0	0	0	0	19	19	2	17	19	0	0	0	Plot 5
0	0	0	0	0	0	0	0	0	0	0	0	6
0	0	0	0	3	3	1	4	5	0	0	0	7
0	2	2	0	5	5	1	1	2	0	2	2	8
0	2	2	0	27	27	4	22	26	0	2	2	5 - 8

Untrenched Plots : 9.7.81.: M.19, D.79, T. 98; 17.9.81.: M.7, D.29, T.36

Trenched Plots : 9.7.81.: M.5, D.95, T.100; 17.9.81.: M.4, D.53, T.57.

A.6.4 DISCUS ION

The ess of colonization by seedlings was strongly affected by the removal of l er and by the addition of fertilizer and lime. Of these treatments, litte removed had the most effect, but colonization was best when both treat nts were combined.

The re oval of live R. ponticum roots by trenching the plots had a marked effe on the survival of seedlings over the summer. This might have b en due to r val of competition, toxicity or both. The results of laboratory exper ents suggest that the killing of R. ponticum roots would remo e the competition effect but toxicity would remain unless the dead roots were extracted from the soil.

One of the most frequent colonizers of the plots was R. ponticum i self. This would be expected due to the abundant seed readily available. Relat ve y few other species were recorded.

Some seedlings were found either dead or almost moribund and without ro t development. They were very similar to those suffering from the 'ınt erence' effect noted in laboratory experiments and in field trials with R. ponticum bare-zones at Winterton in Norfolk.

A.7 APPENDIX 7

A.7.1 STATISTICAL ANALYSIS

The experimental data gathered were subject to the appropriate statistical tests and comparison, to establish whether treatments had produced significant effects. The parameters calculated were $\bar{x}$ (the sample mean) and s (the sample standard deviation). From these, confidence limits were fitted to data where appropriate and the significance of results was tested using Student's t-test. (Refs. Heath, 1970; Bailey, 1959.)

A.7.1.2 Confidence limits

$\bar{x} \pm$ 95% confidence limits.

$\bar{x} \pm t \times \frac{s}{n}$, where n = sample size

degrees of freedom (v = n-1).

A.7.1.3 Student's t-test

To test whether two samples belong to the same population, variance assumed equal, sample sizes equal.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\frac{1}{n}(S_1^2 + S_2^2)}$$, degrees of freedom (v = 2 (n-1)).

ANALYSIS OF VARIATION USED

(Basic approach the same for all experiments analysed, details given for analysis of variation done for Expt. 1a. Chapter 4.)

Experimental design:-

POTS			
1	2		
10 plants per pot	10 plants per pot	1	SOIL
"	"	2	TYPES
"	"	3	

The objective of the experiment was to determine whether variation between 'Soil types' is significant.

Basically the experimental unit in this experiment is the pot. However, more than one observation per experimental unit is made, i.e. 10 plants per pot. These are not strictly statistically independent of each other, but the individual plants within pots can be treated as subsamples within experimental units.

Sources of variation:-

	degrees of freedom
1. Variation between soil treatments :	2 - main treatment variation.
2. " " pots within treatments :	3 - experimental error.
3. " " all 6 pots :	5
4. " " plants within all 6 pots:	9x6 = 54 - sampling error.
5. Total variance of all 60 plants : (total sum of squares).	59

Formal analysis:-

Pots : $j = 1, j = 2$ $(j = 1,2.)$

Treatments : $i = 1, i = 2, i = 3$ $(i = 1,2,3)$

Plants per pot : $K = 1, 2, 3 \ldots\ldots 10.$

Individual observations are therefore : Y_{ijK}.

Total SS $= \sum_{ijk} Y^2_{ijk} - C$ where $C = \frac{G^2}{n}$ (G = grand total of all observations)

(n = number of observations = 60)

Pots SS $= \sum_{ij} \frac{Y^2_{ij} - C}{10}$

Among plants:-

Within pots SS = Total SS - Pots SS.
(Sampling error)

Treatments SS = $\sum_i \frac{Y^2 i - C}{20}$

Among pots within treatments SS = Pots SS - treatments SS.
(Experimental error).

This gives:-

	degrees of freedom			MS	F
Treatments	3-1	=	2	A	Variance Ratio
Experimental Error			3	B	
Sub total (pots SS)	6-1	=	5		
Sampling error	9x2x3	=	54	C	
Total SS			59		

The appropriate F-test is $F = \frac{\text{treatment mean square}}{\text{experimental mean square}}$

i.e. $\frac{A}{B}$ = Variance Ratio.

Experimental error may or may not contain variation in addition to that among subsamples. This depends on differences that exist from unit to unit (pot to pot) and whether or not they are greater than those within the unit (pot). An appropriate F-test for this is:-

$F = \frac{\text{experimental error mean square}}{\text{sampling error mean square}}$ i.e. $\frac{B}{C}$ = Variance Ratio

Key o symbols - abbreviations used (statistical significance and trends)

95% mits = 95% confidence limits.
n = number of observations.

NS not significant.
d value decreased relative to control.
i value increased relative to control.
- value unchanged relative to control.

0.1
0.2 level of significance indicated by p = 0.1%, 0.2%, 1%, 2% or 5%.
1
2
5

RESULTS OF THE ANALYSIS OF VARIANCE

3.3.4. Expt. II

Harvest 2 : Nutrients : significant effect (p 0.01 or 0.05) for all data R, S, & T, both untransformed and ln.-transformed.
Mycorrhizas : no significant effect.

Harvest 3 : Nutrients : significant effect for S & T.
Mycorrhizas : significant effect for R, S & T.

Harvest 4 : Nutrients : significant effect for all data (R, S & T).
Mycorrhizas : significant effect only for ln-transformed S & T.

Comparison with t-test :

Harvest 2 : analysis of variance supports the t-tests.

Harvest 3 : analysis of variance supports the t-tests which indicated a nutrient effect for S & T (but not R) and a significant mycorrhizas effect on S & T. The analysis of variance also indicates an effect which is just significant for mycorrhizas on R. This was not shown by the t-test.

Harvest 4 : Again the analysis of variance supports the t-test results. The lesser significance of mycorrhizas is due to the nutrient effect as previously discussed. This is highlighted more by this more rigorous analysis.

Some effects of mycorrhizas are probably not showing with analysis of variance because this is considering all mycorrhizal seedlings vs. all non-mycorrhizal, regardless of nutrient treatment. The strength of the nutrient effect (shown by both analysis of variance and t-tests) is enough to mask some of the mycorrhizal effects.

HARVEST 2

Root wgt. TITLE Expt. 2, Chap. 3 Myc. & N.

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	1.352	13.41	1.352	12.055	0.01
Mycorrhizas	1	0.190	1.89	0.190	1.695	NS
Nutrient Mycorrhizas	1	0.018	0.18	0.018	0.160	NS
Residual	76	8.524	84.53	0.112		
Total	79	10.084	100.00	0.128		
Grand Total	79	10.084	100.00			

Grand Mean 0.316

Total No. Obs. 80

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	8.530	15.03	8.530	13.755	0.01
Mycorrhizas	1	0.955	1.68	0.955	1.539	NS
Nutrient Mycorrhizas	1	0.151	0.27	0.151	0.244	NS
Residual	76	47.128	83.03	0.620		
Total	79	56.764	100.00	0.719		
Grand Total	79	56.764	100.00			

Grand Mean - 1.546

Total No. Obs. 80

HARVEST 2

Shoot wgt. TITLE Expt. 2, Chap. 3 Myc. & N.

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	1.176	10.40	1.176	8.835	0.01
Mycorrhizas	1	0.0001	0.00	0.0001	0.001	NS
Nutrient Mycorrhizas	1	0.010	0.09	0.010	0.076	NS
Residual	76	10.118	89.50	0.133		
Total	79	11.304	100.00	0.143		
Grand Total	79	11.304	100.00			

Grand Mean 0.629

Total No. Obs. 80

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	2.099	7.52	2.099	6.191	0.05
Mycorrhizas	1	0.044	0.16	0.044	0.131	NS
Nutrient Mycorrhizas	1	0.007	0.02	0.007	0.019	NS
Residual	76	25.764	92.30	0.339		
Total	79	27.913	100.00	0.353		
Grand Total	79	27.913	100.00			

Grand Mean - 0.628

Total No. Obs. 80

HARVEST 2

Total wgt. TITLE Expt. 2, Chap. 3 Myc. & N.

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	5.050	12.95	5.050	11.372	0.01
Mycorrhizas	1	0.200	0.51	0.200	0.450	NS
Nutrient Mycorrhizas	1	0.001	0.00	0.001	0.003	NS
Residual	76	33.752	86.54	0.444		
Total	79	39.003	100.00	0.494		
Grand Total	79	39.003	100.00			

Grand Mean 0.945

Total No. Obs. 80

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	3.607	11.49	3.607	9.880	0.01
Mycorrhizas	1	0.014	0.05	0.014	0.040	NS
Nutrient Mycorrhizas	1	0.021	0.07	0.021	0.057	NS
Residual	76	27.744	88.40	0.365		
Total	79	31.385	100.00	0.397		
Grand Total	79	31.385	100.00			

Grand Mean - 0.258

Total No. Obs. 80

HARVEST 3

Root wgt. TITLE Expt. 2, Chap. 3 Myc. & N.

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	0.666	2.31	0.666	1.934	NS
Mycorrhizas	1	1.378	4.79	1.378	4.002	0.05
Nutrient Mycorrhizas	1	0.561	1.95	0.561	1.629	NS
Residual	76	26.175	90.95	0.344		
Total	79	28.780	100.00	0.364		
Grand Total	79	28.780	100.00			

Grand Mean 0.789

Total No. Obs. 80

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	0.801	2.28	0.801	1.831	NS
Mycorrhizas	1	1.072	3.04	1.072	2.450	NS
Nutrient Mycorrhizas	1	0.080	0.23	0.080	0.182	NS
Residual	76	33.243	94.45	0.437		
Total	79	35.195	100.00	0.446		
Grand Total	79	35.195	100.00			

Grand Mean - 0.461

Total No. Obs. 80

HARVEST 3

Shoot wgt. TITLE Expt. 2, Chap. 3 Myc. & N.

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	98.568	16.01	98.568	16.154	0.01
Mycorrhizas	1	47.432	7.70	47.432	7.773	0.01
Nutrient Mycorrhizas	1	5.940	0.96	5.940	0.974	NS
Residual	76	463.747	75.32	6.102		
Total	79	615.688	100.00	7.794		
Grand Total	79	615.688	100.00			

Grand Mean 2.59

Total No. Obs. 80

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	13.293	23.34	13.293	26.753	0.01
Mycorrhizas	1	5.638	9.90	5.638	11.347	0.01
Nutrient Mycorrhizas	1	0.2651	0.47	0.265	0.534	NS
Residual	76	37.762	66.30	0.497		
Total	79	56.957	100.00	0.721		
Grand Total	79	56.957	100.00			

Grand Mean 0.576

Total No. Obs. 80

HARVEST 3

Total wgt. TITLE Expt. 2, Chap. 3 Myc. & N.

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	115.440	14.04	115.440	13.887	0.01
Mycorrhizas	1	64.980	7.90	64.980	7.817	0.01
Nutrient Mycorrhizas	1	10.153	1.23	10.153	1.221	NS
Residual	76	631.792	76.83	8.313		
Total	79	822.365	100.00	10.410		
Grand Total	79	822.365	100.00			

Grand Mean 3.38

Total No. Obs. 80

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	8.449	19.45	8.449	20.636	0.01
Mycorrhizas	1	3.743	8.62	3.743	9.143	0.01
Nutrient Mycorrhizas	1	0.1279	0.29	0.128	0.312	NS
Residual	76	31.118	71.64	0.409		
Total	79	43.438	100.00	0.550		
Grand Total	79	43.438	100.00			

Grand Mean 0.928

Total No. Obs. 80

HARVEST 4

Root wgt. TITLE Expt. 2, Chap. 3 Myc. & N.

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	111.392	27.03	111.392	28.971	0.01
Mycorrhizas	1	0.450	0.11	0.450	0.117	NS
Nutrient Mycorrhizas	1	8.065	1.96	8.065	2.097	NS
Residual	76	292.213	70.90	3.845		
Total	79	412.120	100.00	5.217		
Grand Total	79	412.120	100.00			

Grand Mean 2.28

Total No. Obs. 80

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	25.407	32.17	25.407	37.029	0.01
Mycorrhizas	1	0.106	0.13	0.106	0.154	NS
Nutrient Mycorrhizas	1	1.312	1.66	1.312	1.913	NS
Residual	76	52.146	66.03	0.686		
Total	79	78.971	100.00	1.000		
Grand Total	79	78.971	100.00			

Grand Mean 0.374

Total No. Obs. 80

HARVEST 4

Shoot wgt. TITLE Expt. 2, Chap. 3 Myc. & N.

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	4228.23	35.90	4228.23	43.865	0.01
Mycorrhizas	1	198.45	1.68	198.45	2.059	NS
Nutrient Mycorrhizas	1	25.09	0.21	25.09	0.260	NS
Residual	76	7325.86	62.20	96.39		
Total	79	11777.63	100.00	149.08		
Grand Total	79	11777.63	100.00			

Grand Mean 11.1

Total No. Obs. 80

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	68.629	49.65	68.629	84.225	0.01
Mycorrhizas	1	5.312	3.84	5.312	6.519	0.05
Nutrient Mycorrhizas	1	2.370	1.71	2.370	2.909	NS
Residual	76	61.9267	44.80	0.815		
Total	79	138.238	100.00	1.750		
Grand Total	79	138.238	100.00			

Grand Mean 1.70

Total No. Obs. 80

HARVEST 4

Total wgt. TITLE Expt. 2, Chap. 3 Myc. & N.

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	5712.2	35.67	5712.2	43.152	0.01
Mycorrhizas	1	180.0	1.12	180.0	1.360	NS
Nutrient Mycorrhizas	1	61.6	0.38	61.6	0.465	NS
Residual	76	10060.4	62.82	132.4		
Total	79	16014.2	100.00	202.7		
Grand Total	79	16014.2	100.00			

Grand Mean 13.4

Total No. Obs. 80

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrient	1	55.627	48.31	55.627	77.404	0.01
Mycorrhizas	1	3.328	2.89	3.328	4.631	0.05
Nutrient Mycorrhizas	1	1.582	1.37	1.582	2.202	NS
Residual	76	54.618	47.43	0.719		
Total	79	115.155	100.00	1.458		
Grand Total	79	115.155	100.00			

Grand Mean 1.976

Total No. Obs. 80

A.7.2.1 4.3 Experiment 1 (Dry weights)

4.3.3.1.1. (Experiment 1a, Strawberry Lee Plantation)

Dry weight (mg), (mean of 20 seedlings)
standard deviation () and 95% confidence limits.

	Root	95% Limits	Shoot	95% Limits	Total	95% Limits
Ru						
GR	2.86(2.01)	0.94	4.59(1.73)	0.81	7.44(3.40)	1.59
Rh.S	0.60(0.34)	0.16	2.32(0.96)	0.45	2.91(1.22)	0.57
Rh.L	3.10(2.11)	0.99	4.92(2.30)	1.08	8.02(3.99)	1.87
Fe						
GR	1.65(0.78)	0.37	3.62(1.54)	0.72	5.27(1.92)	0.90
Rh.S	0.29(0.23)	0.11	2.06(0.64)	0.30	2.35(0.78)	0.37
Rh.L	3.89(2.32)	1.09	7.04(4.52)	2.12	10.92(6.65)	3.11
Rh.						
GR	0.59(0.20)	0.09	0.43(0.13)	0.06	1.01(0.22)	0.10
Rh.S	0.29(0.18)	0.08	0.55(0.27)	0.13	0.84(0.38)	0.39
Rh.L	0.41(0.20)	0.09	0.55(0.22)	0.10	0.95(0.28)	0.13

4.3.3.1.2 (Experiment 1b, Stand Wood)

Ru						
GR	0.39(0.17)	0.08	0.98(0.42)	0.20	1.37(0.53)	0.25
Rh.S	0.47(0.24)	0.11	1.28(0.52)	0.24	1.75(0.69)	0.32
Fe						
GR	0.11(0.01)	0.005	1.21(0.47)	0.22	1.32(0.49)	0.23
Rh.S	0.14(0.09)	0.04	1.18(0.67)	0.31	1.32(0.72)	0.34
Rh.						
GR	0.27(0.14)	0.07	0.54(0.40)	0.19	0.81(0.48)	0.23
Rh.S	0.26(0.15)	0.07	0.42(0.23)	0.11	0.68(0.32)	0.15

A.7.2.2 4.3 Experiment 1 (Statistical significance)

4.3.3.1.1 (Experiment 1a, Strawberry Lee Plantation)

		R	S	T
Ru	GR	CONTROL		
	Rh.S	d 0.1	d 0.1	d 0.1
	Rh.L	i ns	i ns	ı ns
Fe	GR	CONTROL		
	Rh.S	d 0.1	d 0.1	d 0.1
	Rh.L	i 0.1	i 1	ı 1
Rh.	GR	CONTROL		
	Rh.S	d 0.1	d ns	d ns
	Rh.L	d 1	i 5	d ns

4.3.3.1.2 (Experiment 1b, Stand Wood

Ru	GR	CONTROL		
	Rh.S	i ns	i ns	ı ns
Fe	GR	CONTROL		
	Rh.S	i ns	d ns	-
Rh.	GR	CONTROL		
	Rh.S	d ns	d ns	d ns

Chapter 4 Expt. 1a

Rumex — Data show significant effects for the ln-transformed data of R and very nearly significant effect for the untransformed data for R and ln-transformed data for T.

Festuca — Data shows a significant effect of 'Soil type' for R, S, T.

Rhododendron — No significant effect of 'Soil type'.

Comparison with t-test

The analysis of variance supports the t-test results. The effects of 'Soil type' on Rhododendron are not significant, on Festuca they are.

For Rumex there is a consistently lower yield in RhS which is not quite significant using analysis of variance, except for ln root weight. The data is not generally significant due to the high variability of plant yield within pots. The t-test gave significant results here because it treated each plant as a replicate, the analysis of variance does not do this.

Root wgt. TITLE Expt. 1a, Chap. 4 SLP Soils

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	76.284	31.83	38.142	7.680	NS
Residual	3	14.899	6.22	4.966		
Total	5	91.183	38.04	18.237		
Residual						
Units	54	148.500	61.96	2.750		
Grand Total	59	239.683	100.00			

Grand Mean 2.18

Total No. Obs. 60

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	32.431	56.64	16.216	18.442	0.05
Residual	3	2.638	4.61	0.879		
Total	5	35.069	61.24	7.014		
Residual						
Units	54	22.192	38.76	0.411		
Grand Total	59	57.261	100.00			

Grand Mean 0.353

Total No. Obs. 60

Shoot wgt. TITLE Expt. 1a, Chap. 4 SLP Soils

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	80.145	31.43	40.073	3.497	NS
Residual	3	34.373	13.48	11.458		
Total	5	114.519	44.91	22.904		
Residual						
Units	54	140.503	55.09	2.602		
Grand Total	59	255.022	100.00			

Grand Mean 3.94

Total No. Obs. 60

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	6.524	36.89	3.262	4.161	NS
Residual	3	2.32	13.30	0.784		
Total	5	8.876	50.19	1.775		
Residual						
Units	54	8.807	49.81	0.163		
Grand Total	59	17.682	100.00			

Grand Mean 1.230

Total No. Obs. 60

Total wgt. TITLE Expt. 1a, Chap. 4 SLP Soils

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	315.750	36.25	156.375	5.229	NS
Residual	3	89.723	10.40	29.908		
Total	5	402.473	46.66	80.495		
Residual						
Units	54	460.169	53.34	8.522		
Grand Total	59	862.642	100.00			

Grand Mean 6.12

Total No. Obs. 60

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	11.707	48.22	5.854	7.711	NS
Residual	3	2.278	9.38	0.759		
Total	5	13.985	57.60	2.797		
Residual						
Units	54	10.296	42.40	0.191		
Grand Total	59	24.280	100.00			

Grand Mean 1.618

Total No. Obs. 60

Root wgt. TITLE Expt. 1a, Chap. 4 SLP Soils

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	132.123	53.49	66.061	82.749	0.01
Residual	3	2.395	0.97	0.798		
Total	5	134.518	54.46	26.904		
Residual						
Units	54	112.466	45.54	2.083		
Grand Total	59	246.984	100.00			

Grand Mean 1.94

Total No. Obs. 60

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	178.557	38.21	89.278	5.452	NS
Residual	3	49.126	10.51	16.375		
Total	5	227.683	48.73	45.537		
Residual						
Units	54	239.597	51.27	4.437		
Grand Total	59	467.280	100.00			

Grand Mean -0.43

Total No. Obs. 60

Shoot wgt. TITLE Expt. 1a, Chap. 4 SLP Soils

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	264.545	38.49	132.273	33.101	0.01
Residual	3	11.988	1.74	3.996		
Total	5	276.533	40.23	55.307		
Residual						
Units	54	410.786	59.77	7.607		
Grand Total	59	687.319	100.00			

Grand Mean 4.30

Total No. Obs. 60

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	11.648	44.59	5.824	15.435	0.05
Residual	3	1.132	4.33	0.377		
Total	5	12.780	48.93	2.556		
Residual						
Units	54	13.340	51.07	0.247		
Grand Total	59	26.120	100.00			

Grand Mean 1.224

Total No. Obs. 60

Total wgt. TITLE Expt. 1a, Chap. 4 SLP Soils

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	770.07	46.35	385.04	53.624	0.01
Residual	3	21.54	1.30	7.18		
Total	5	791.61	47.65	158.32		
Residual						
Units		54	869.64	52.35	16.10	
Grand Total		59	1661.25	100.00		

Grand Mean 6.24

Total No. Obs. 60

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	20.062	59.58	10.031	26.946	0.05
Residual	3	1.117	3.32	0.372		
Total	5	21.179	62.90	4.236		
Residual						
Units		54	12.491	37.10	0.231	
Grand Total		59	33.670	100.00		

Grand Mean 1.541

Total No. Obs. 60

Root wgt. TITLE Expt. 1a, Chap. 4 SLP Soils

Rhododendron

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	0.912	29.88	0.456	2.889	NS
Residual	3	0.474	15.51	0.158		
Total	5	1.386	45.39	0.277		
Residual						
Units	54	1.667	54.61	0.031		
Grand Total	59	3.053	100.00			

Grand Mean 0.425

Total No. Obs. 60

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	7.081	27.78	3.541	3.036	NS
Residual	3	3.499	13.73	1.166		
Total	5	10.580	41.51	2.116		
Residual						
Units	54	14.908	58.49	0.276		
Grand Total	59	25.488	100.00			

Grand Mean -1.036

Total No. Obs. 60

Shoot wgt. TITLE Expt. 1a, Chap. 4 SLP Soils

Rhododendron

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	0.200	7.21	0.100	3.035	NS
Residual	3	0.099	3.56	0.033		
Total	5	0.299	10.78	0.050		
Residual						
Units	54	2.478	89.22	0.046		
Grand Total	59	2.777	100.00			

Grand Mean 0.507

Total No. Obs. 60

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	0.506	4.20	0.253	1.342	NS
Residual	3	0.565	4.69	0.188		
Total	5	1.071	8.88	0.214		
Residual						
Units	54	10.987	91.12	0.204		
Grand Total	59	12.058	100.00			

Grand Mean -0.773

Total No. Obs. 60

A.7.3.1 4.3 Experiment 2 (Dry weights)

4.3.3.2.1 (F. ovina)

Dry weight (mg), (mean of 20 seedlings)
standard deviation () and 95% confidence limits.

	Root	95% Limits	Shoot	95% Limits	Total	95% Limits
Expt. 2a (Winterton)						
GR	0.36(0.16)	0.08	0.93(0.35)	0.16	1.28(0.33)	0.15
GR+N	0.28(0.19)	0.09	1.11(0.29)	0.14	1.39(0.36)	0.17
Rh.L	1.12(0.48)	0.23	1.17(0.50)	0.23	2.29(0.68)	0.32
Rh.L+N	0.99(0.42)	0.20	1.55(0.89)	0.42	2.54(1.16)	0.54
Rh.S	0.22(0.18)	0.08	1.20(0.48)	0.23	1.42(0.52)	0 24
Rh.S+N	0.29(0.20)	0.09	1.06(0.43)	0.20	1.36(0.52)	0.24
Rh.Ss	0.47(0.17)	0.08	1.14(0.42)	0.20	1.61(0.43)	0.20
Rh.Ss+N	0.41(0.14)	0.07	1.19(0.44)	0.21	1.60(0.47)	0 22
Rh.bz	0.25(0.18)	0.08	0.86(0.36)	0.17	1.10(0.42)	0.20
Rh.bz+N	0.34(0.15)	0.07	0.85(0.31)	0.15	1.17(0.34)	0.16
CaS	0.34(0.14)	0.07	0.93(0.38)	0.18	1.27(0.44)	0.21
CaS+N	0.09(0.07)	0.03	1.10(0.33)	0.15	1.19(0.31)	0.15
CaSs	0.27(0.12)	0.06	0.97(0.37)	0.17	1.23(0.39)	0.18
CaSs+N	0.30(0.17)	0.08	1.33(0.35)	0.16	1.63(0.41)	0.19
Cabz	0.38(0.12)	0.06	0.99(0.32)	0.15	1.37(0.38)	0.18
Cabz+N	0.36(0.14)	0.07	0.97(0.41)	0.19	1.34(0.47)	0.22

	Root	95% Limits	Shoot	95% Limits	Total	95% Limits
Expt. 2b (Strawberry Lee Plantation)						
GR	0.86(0.35)	0.16	1.61(0.54)	0.25	2.47(0.76)	0.36
GR+N	1.04(0.53)	0.25	2.19(0.79)	0.37	3.23(1.16)	0.54
Rh.L	0.46(0.16)	0.08	1.58(0.53)	0.25	2.04(0.56)	0.26
Rh.L+N	0.47(0.22)	0.10	1.53(0.69)	0.32	2.00(0.81)	0.38
Rh.Ls	0.50(0.30)	0.14	1.62(0.74)	0.35	2.12(0.86)	0.40
Rh.Ls+N	0.15(0.17)	0.08	1.38(0.70)	0.33	1.53(0.72)	0.34
Rh.S	0.73(0.26)	0.12	1.10(0.42)	0.20	1.82(0.56)	0.26
Rh.S+N	0.34(0.15)	0.07	1.55(0.69)	0.32	1.89(0.75)	0.35
Rh.Ss	0.34(0.11)	0.05	1.23(0.44)	0.21	1.56(0.44)	0.21
Rh.Ss+N	0.71(0.23)	0.11	1.55(0.47)	0.22	2.25(0.59)	0.28
Expt. 2c (Stand Wood)						
GR1	0.85(0.32)	0.15	2.15(0.68)	0.32	2.99(0.84)	0.39
GR1+N	1.06(0.31)	0.15	1.68(0.68)	0.32	2.75(0.91)	0.43
GR1 1	0.73(0.33)	0.15	1.43(0.63)	0.30	2.16(0.85)	0.40
GR1 1+N	0.64(0.19)	0.09	1.23(0.40)	0.19	1.87(0.51)	0.24
GR2	0.83(0.40)	0.19	1.93(0.85)	0.40	2.76(1.14)	0.53
GR2+N	1.08(0.50)	0.23	2.73(0.97)	0.45	3.79(1.29)	0.60
GR2 1	0.73(0.24)	0.11	1.32(0.46)	0.22	2.04(0.61)	0.29
GR2 1+N	0.69(0.37)	0.17	1.37(0.54)	0.25	2.11(0.85)	0.40
Rh.L	0.03(0.04)	0.02	1.01(0.41)	0.19	1.04(0.41)	0.59
Rh.L+N	0.06(0.09)	0.04	0.94(0.32)	0.15	0.99(0.35)	0.16
Rh.Ls	0.09(0.09)	0.04	1.24(0.46)	0.22	1.34(0.45)	0.21
Rh.Ls+N	0.08(0.07)	0.03	1.42(0.55)	0.26	1.50(0.58)	0.27
Rh.S	0.05(0.05)	0.02	1.19(0.36)	0.17	1.24(0.38)	0.18
Rh.S+N	0.22(0.12)	0.06	1.40(0.34)	0.16	1.62(0.42)	0.20

	Root	95% Limits	Shoot	95% Limits	Total	95% Limits
Expt. 2d (Clumber)						
GR	0.58(0.26)	0.12	1.60(0.67)	0.31	2.18(0.68)	0.32
GR+N	0.59(0.18)	0.08	1.73(0.54)	0.25	2.32(0.63)	0.30
GR1	1.10(0.65)	0.30	1.47(0.66)	0.31	2.56(1.08)	0.51
GR1+N	0.74(0.31)	0.15	1.35(0.48)	0.23	2.08(0.67)	0.31
Rh.S	0.12(0.17)	0.08	0.90(0.39)	0.18	1.02(0.53)	0.25
Rh.S+N	0.12(0.16)	0.08	1.06(0.31)	0.15	1.18(0.37)	0.17
Rh.S1	0.31(0.20)	0.09	1.14(0.38)	0.18	1.45(0.38)	0.18
Rh.S1+N	0.16(0.09)	0.04	1.07(0.28)	0.13	1.23(0.28)	0.13
Expt. 2e (Cordwell)						
GRs	0.29(0.20)	0.09	1.01(0.43)	0.20	1.31(0.55)	0.26
GRs+N	0.32(0.15)	0.07	1.34(0.44)	0.21	1.65(0.49)	0.23
GR1	0.06(0.07)	0.03	0.85(0.36)	0.17	0.91(0.37)	0.17
GR1+N	0.03(0.03)	0.01	0.93(0.34)	0.16	0.96(0.33)	0.15
PtS	0.02(0.03)	0.01	0.82(0.30)	0.14	0.84(0.30)	0.14
PtS+N	0.02(0.07)	0.03	0.82(0.27)	0.13	0.84(0.28)	0.13
PtSs	0.02(0.03)	0.01	0.85(0.24)	0.11	0.86(0.24)	0.12
PtSs+N	0.03(0.05)	0.02	0.84(0.39)	0.18	0.87(0.39)	0.18
PtLs	0.17(0.12)	0.06	1.31(0.52)	0.24	1.48(0.54)	0.25
PtLs+N	0.29(0.13)	0.06	1.03(0.29)	0.14	1.32(0.28)	0.13
Rh.S1	0.06(0.06)	0.03	1.22(0.53)	0.25	1.28(0.54)	0.25
Rh.S1+N	0.04(0.04)	0.02	0.88(0.23)	0.11	0.92(0.24)	0.11
Rh.S1s	0.02(0.05)	0.02	1.07(0.44)	0.21	1.09(0.45)	0.21
Rh.S1s+N	0.06(0.09)	0.04	0.91(0.26)	0.12	0.97(0.32)	0.15
Rh.S11s	0.06(0.11)	0.05	0.77(0.27)	0.13	0.84(0.35)	0.16
Rh.S11s+N	0.08(0.07)	0.03	0.61(0.25)	0.12	0.67(0.30)	0.14
Rh.L1	0.64(0.51)	0.24	1.35(0.74)	0.35	2.00(1.11)	0.52
Rh.L1+N	1.10(0.87)	0.41	1.34(0.78)	0.37	2.44(1.45)	0.68
Rh.S2s	0.60(0.34)	0.16	1.44(0.44)	0.21	2.03(0.61)	0.29
Rh.S2s+N	0.51(0.19)	0.09	1.16(0.47)	0.22	1.67(0.56)	0.26
Rh.S21s	0.25(0.18)	0.08	1.15(0.32)	0.15	1.40(0.39)	0.18
Rh.S21s+N	0.34(0.19)	0.09	1.02(0.28)	0.13	1.36(0.36)	0.17
Rh.L2s	0.24(0.18)	0.08	1.34(0.58)	0.27	1.58(0.64)	0.30
Rh.L2s+N	0.39(0.15)	0.07	1.51(0.38)	0.18	1.91(0.39)	0.18

4.3.3.2.1 (R. acetosa)

Dry weight (mg), (mean of 20 seedlings)
standard deviation () and 95% confidence limits.

	Root	95% Limits	Shoot	95% Limits	Total	95% Limits
Expt. 2a (Winterton)						
GR	0.73(0.36)	0.17	1.76(0.84)	0.39	2.48(1.14)	0.53
GR+N	0.73(0.41)	0.19	1.71(0.73)	0.34	2.44(0.97)	0.45
Rh.L	0.97(0.60)	0.28	2.60(1.89)	0.89	3.57(2.35)	1.10
Rh.L+N	3.18(1.37)	0.65	4.53(2.37)	1.13	7.73(3.47)	1.61
Rh.S	0.26(0.13)	0.06	0.95(0.53)	0.25	1.20(0.59)	0.28
Rh.S+N	0.39(0.28)	0.13	1.49(0.72)	0.34	1.88(0.92)	0.43
Rh.Ss	0.34(0.15)	0.07	1.46(0.51)	0.24	1.79(0.58)	0.27
Rh.Ss+N	0.64(0.37)	0.17	1.61(0.69)	0.32	2.25(0.91)	0.43
Rh.bz	0.14(0.10)	0.05	1.06(0.34)	0.16	1.20(0.38)	0.18
Rh.bz+N	0.40(0.21)	0.10	1.30(0.49)	0.23	1.69(0.60)	0.28
CaS	0.61(0.36)	0.17	1.74(0.77)	0.36	2.35(0.96)	0.45
CaS+N	0.50(0.27)	0.13	1.62(0.72)	0.34	2.12(0.88)	0.41
CaSs	0.32(0.18)	0.08	1.32(0.38)	0.18	1.63(0.49)	0.23
CaSs+N	0.43(0.17)	0.08	1.79(0.83)	0.39	2.21(0.89)	0.42
Cabz	0.56(0.23)	0.11	1.89(0.70)	0.33	2.45(0.88)	0.41
Cabz+N	0.78(0.34)	0.16	2.01(0.86)	0.40	2.79(0.99)	0.46
Expt. 2b (Strawberry Lee Plantation)						
GR	2.29(0.79)	0.37	4.76(2.75)	1.29	7.09(3.10)	1.45
GR+N	3.02(1.66)	0.78	7.04(2.67)	1.25	10.08(3.82)	1.79
Rh.L	1.46(1.09)	0.51	3.86(2.45)	1.15	5.39(3.42)	1.60
Rh.L+N	1.09(0.59)	0.28	2.68(1.34)	0.63	3.77(1.75)	0.82
Rh.Ls	1.12(0.53)	0.25	2.96(1.11)	0.52	4.07(1.54)	0.72
Rh.Ls+N	0.94(0.31)	0.15	2.77(1.04)	0.49	3.69(1.19)	0.56
Rh.S	0.93(0.40)	0.19	2.70(1.15)	0.54	3.63(1.45)	0.68
Rh.S+N	0.83(0.38)	0.18	3.16(1.21)	0.57	3.99(1.45)	0.68
Rh.Ss	0.75(0.32)	0.15	2.33(0.94)	0.44	3.08(1.09)	0.51
Rh.Ss+N	0.93(0.47)	0.22	2.43(0.91)	0.43	3.36(1.27)	0.59

	Root	95% Limits	Shoot	95% Limits	Total	95% Limits
Expt. 2c (Stand Wood)						
GR1	1.23(0.60)	0.28	6.00(3.21)	1.50	7.22(3.61)	1.69
GR1+N	3.62(1.12)	0.52	6.92(2.78)	1.30	10.54(3.55)	1.66
GR1 1	1.47(1.01)	0.47	4.15(2.31)	1.08	5.62(2.93)	1.37
GR1 1+N	2.16(1.30)	0.61	5.82(2.90)	1.36	7.98(3.99)	1.87
GR2	1.63(0.94)	0.44	5.73(2.83)	1.33	7.36(3.49)	1.63
GR2+N	4.72(3.16)	1.48	9.08(5.05)	2.36	13.79(7.71)	3.61
GR21	1.41(0.95)	0.45	3.65(1.68)	0.79	5.06(2.37)	1.11
GR21+N	2.21(0.99)	0.46	5.49(2.68)	1.25	7.68(3.34)	1.56
Rh.L	0.18(0.14)	0.07	0.85(0.35)	0.16	1.03(0.37)	0.17
Rh.L+N	0.29(0.17)	0.08	1.01(0.42)	0.20	1.29(0.50)	0.23
Rh.Ls	0.62(0.26)	0.12	2.05(1.08)	0.51	2.66(1.15)	0.54
Rh.Ls+N	0.45(0.21)	0.10	1.44(0.68)	0.32	1.89(0.82)	0.38
Rh.S	0.48(0.28)	0.13	2.02(1.79)	0.84	2.50(1.94)	0.91
Rh.S+N	0.50(0.29)	0.14	2.07(0.96)	0.45	2.57(1.02)	0.48
Expt. 2d (Clumber)						
GR	1.20(0.51)	0.24	4.08(1.82)	0.85	5.28(2.18)	1.02
GR+N	1.02(0.48)	0.23	3.21(1.21)	0.57	4.23(1.38)	0.65
GR1	1.57(0.85)	0.40	3.36(1.02)	0.48	4.93(1.78)	0.83
GR1+N	2.15(1.66)	0.78	3.41(1.82)	0.85	5.56(3.29)	1.54
Rh.S	0.67(0.34)	0.16	1.96(0.71)	0.33	2.63(0.93)	0.44
Rh.S+N	0.58(0.35)	0.16	2.02(0.96)	0.45	2.60(1.23)	0.58
Rh.S1	0.66(0.35)	0.16	2.11(0.83)	0.39	2.76(1.09)	0.51
Rh.S1+N	0.68(0.38)	0.18	1.79(0.72)	0.34	2.46(0.99)	0.46

	Root	95% Limits	Shoot	95% Limits	Total	95% Limits
Expt. 2e (Cordwell)						
GRs	1.44(0.72)	0.34	2.38(0.85)	0.40	3.82(1.35)	0.63
GRs+N	1.50(0.70)	0.33	2.48(0.75)	0.35	3.97(1.32)	0.62
GR1	0.53(0.23)	0.11	2.08(0.48)	0.23	2.61(0.55)	0.26
GR1+N	0.29(0.19)	0.09	1.49(0.59)	0.28	1.78(0.77)	0.36
PtS	0.15(0.15)	0.07	0.78(0.27)	0.13	0.94(0.30)	0.14
PtS+N	0.16(0.14)	0.07	0.80(0.37)	0.17	0.95(0.40)	0.19
PtSs	0.10(0.08)	0.04	0.58(0.24)	0.11	0.67(0.29)	0.14
PtSs+N	0.22(0.22)	0.10	1.06(0.50)	0.23	1.28(0.65)	0.30
PtLs	0.38(0.29)	0.14	1.12(0.55)	0.26	1.50(0.78)	0.37
PtLs+N	0.59(0.35)	0.16	1.30(0.55)	0.26	1.89(0.84)	0.39
Rh.S1	0.42(0.30)	0.14	1.41(0.85)	0.40	1.81(0.96)	0.45
Rh.S1+N	0.16(0.08)	0.04	0.79(0.23)	0.11	0.97(0.26)	0.12
Rh.S1s	0.41(0.17)	0.08	1.29(0.52)	0.24	1.69(0.64)	0.30
Rh.S1s+N	0.36(0.16)	0.08	1.18(0.85)	0.40	1.54(0.92)	0.43
Rh.S11s	0.53(0.29)	0.14	1.63(0.75)	0.35	2.16(0.84)	0.39
Rh.S11s+N	0.84(0.35)	0.16	1.89(0.77)	0.36	2.76(0.94)	0.44
Rh.L1	1.14(0.59)	0.28	1.85(0.78)	0.37	2.99(1.14)	0.53
Rh.L1+N	1.79(1.41)	0.66	3.18(1.30)	0.61	4.97(2.55)	1.19
Rh.S2s	0.57(0.27)	0.13	2.15(0.47)	0.22	2.71(0.50)	0.23
Rh.S2s+N	0.71(0.42)	0.20	1.94(0.99)	0.46	2.65(1.27)	0.59
Rh.S21s	0.64(0.34)	0.16	2.27(1.13)	0.53	2.90(1.34)	0.63
Rh.S21s+N	0.82(0.40)	0.19	2.01(0.70)	0.33	2.83(0.87)	0.41
Rh.L2s	0.38(0.17)	0.08	1.47(0.58)	0.27	1.85(0.66)	0.31
Rh.L2s+N	0.70(0.37)	0.17	1.42(0.60)	0.28	2.12(0.83)	0.39

A.7.3.2 4.3 Experiment 2 (Statistical significance)

4.3.3.2.1 (F. ovina)

Expt. 2a (Winterton)

	R	S	T
GR	CONTROL		
GR+N	d ns	i ns	i ns
Rh.L	i 0.1	i ns	i 0.1
Rh.L+N	i o.1	i 1	i 0.1
Rh.S	d 2	i ns	i ns
Rh.S+N	d ns	i ns	i ns
Rh.Ss	i 5	i ns	i 2
Rh.Ss+N	i ns	i 5	i 5
Rh.bz	d ns	d ns	d ns
Rh.bz+N	d ns	d ns	d ns
CaS	d ns	-	d ns
CaS+N	d 0.1	i ns	d ns
CaSs	d ns	i ns	d ns
CaSs+N	d ns	i 0.2	i 1
Cabz	i ns	i ns	i ns
Cabz+N	-	i ns	i ns

Expt. 2b (Strawberry Lee Plantation)

GR	CONTROL		
GR+N	i ns	i 2	i 5
Rh.L	d 0.1	d ns	d ns
Rh.L+N	d 0.1	d ns	d ns
Rh.Ls	d 0.1	i ns	d ns
Rh.Ls+N	d 0.1	d ns	d 0.1
Rh.S	d ns	d 1	d 1
Rh.S+N	d 0.1	d ns	d 5
Rh.Ss	d 0.2	d 5	d ns
Rh.Ss+N	d ns	d ns	d 0.1

	R	S	T
Expt. 2c (Stand Wood)			
GR1	CONTROL		
GR1+N	i 5	d 5	d ns
Rh.L	d 0.1	d 0.1	d 0.1
Rh.L+N	d 0.1	d 0.1	d 0.1
Rh.Ls	d 0.1	d 0.1	d 0.1
Rh.Ls+N	d 0.1	d 0.1	d 0.1
Rh.S	d 0.1	d 0.1	d 0.1
Rh.S+N	d 0.1	d 0.1	d 0.1
Expt. 2d (Clumber)			
GR	CONTROL		
GR+N	i ns	i ns	i ns
Rh.S	d 0.1	d 0.1	d 0.1
Rh.S+N	d 0.1	d 1	d 0.1
GR1	CONTROL		
GR1+N	d 5	d ns	d ns
Rh.S1	d 0.1	d ns	d 0.1
Rh.S1+N	d 0.1	d 2	d 0.1

	R	S	T
Expt. 2e (Cordwell)			
GRs	CONTROL		
GRs+N	i ns	i 5	i 5
PtS	d 0.1	d ns	d 1
PtS+N	d 0.1	d ns	d 0.2
PtSs	d 0.1	d ns	d 1
PtSs+N	d 0.1	d ns	d 1
PtLs	d 5	i ns	i ns
PtLs+N	-	i ns	i ns
Rh.S1	d 0.1	i ns	d ns
Rh.S1+N	d 0.1	d ns	d 1
Rh.S1s	d 0.1	i ns	d ns
Rh.S1s+N	d 0.1	d ns	d 5
Rh.L1	i 0.2	i ns	i 2
Rh.L1+N	i 0.1	i 1	i 0.1
Rh.S2s	i 0.2	i 1	i 0.1
Rh.S2s+N	i 0.2	i ns	i 5
Rh.L2s	d ns	i 5	i ns
Rh.L2s+N	i ns	i 0.1	i 0.1

4.3 Experiment 2 (Statistical significance)

4.3.3.2.2 (R. acetosa)

	R	S	T
Expt. 2a (Winterton)			
GR	CONTROL		
GR+N	-	d ns	d ns
Rh.L	i ns	i ns	i ns
Rh.L+N	i 0.1	i 0.1	i 0.1
Rh.S	d 0.1	d 0.1	d 0.1
Rh.S+N	d 1	d ns	d ns
Rh.Ss	d 0.1	d ns	d 5
Rh.Ss+N	d ns	d ns	d ns
Rh.bz	d 0.1	d 0.2	d 0.1
Rh.bz+N	d 0.2	d 5	d 2
CaS	d ns	d ns	d ns
CaS+N	d 5	d ns	d ns
CaSs	d 0.1	d 5	d 1
CaSs+N	d 1	i ns	d ns
Cabz	d ns	i ns	d ns
Cabz+N	i ns	i ns	i ns
Expt. 2b (Strawberry Lee Plantation)			
GR	CONTROL		
GR+N	i ns	i 2	i 2
Rh.L	d 1	d ns	d n
Rh.L+N	d 0.1	d 2	d 0.1
Rh.Ls	d 0.1	d 5	d 0.1
Rh.Ls+N	d 0.1	d 2	d 0.1
Rh.S	d 0.1	d 2	d 0.1
Rh.S+N	d 0.1	d 5	d 0.1
Rh.Ss	d 0.1	d 0.1	d 0.1
Rh.Ss+N	d 0.1	d 0.2	d 0.1

	R	S	T
Expt. 2c (Stand Wood)			
GR1	CONTROL		
GR1+N	i 0.1	i ns	i 1
Rh.L	d 0.1	d 0.1	d 0.1
Rh.L+N	d 0.1	d 0.1	d 0.1
Rh.Ls	d 0.1	d 0.1	d 0.1
Rh.Ls+N	d 0.1	d 0.1	d 0.1
Rh.S	d 0.1	d 0.1	d 0.1
Rh.S+N	d 0.1	d 0.1	d 0.1
Expt. 2d (Clumber)			
GR	CONTROL		
GR+N	d ns	d ns	d ns
Rh.S	d 0.1	d 0.1	d 0.1
Rh.S+N	d 0.1	d 0.1	d 0.1
GR1	CONTROL		
GR1+N	i ns	i ns	i ns
Rh.S1	d 0.1	d 0.1	d 0.1
Rh.S1+N	d 5	d 0.1	d 0.1

	R	S	T
Expt. 2e (Cordwell)			
GRs	CONTROL		
GRs+N	i ns	i ns	i ns
PtS	d 0.1	d 0.1	d 0.1
PtS+N	d 0.1	d 0.1	d 0.1
PtSs	d 0.1	d 0.1	d 0.1
PtSs+N	d 0.1	d 0.1	d 0.1
PtLs	d 0.1	d 0.1	d 0.1
PtLs+N	d 0.1	d 0.1	d 0.1
Rh.S1	d 0.1	d 0.2	d 0.1
Rh.S1+N	d 0.1	d 0.1	d 0.1
Rh.S1s	d 0.1	d 0.1	d 0.1
Rh.S1s+N	d 0.1	d 0.1	d 0.1
Rh.L1	d ns	d 5	d 5
Rh.L1+N	i ns	i 5	i ns
Rh.S2s	d 0.1	d ns	d 0.2
Rh.S2s+N	d 0.1	d ns	d 1
Rh.L2s	d 0.1	d 0.1	d 0.1
Rh.L2s+N	d 0.1	d 0.1	d 0.1

2a Festuca

Nutrients : no significant effect.

Soil type : highly significant effect for R & T, both untransformed and ln-transformed data.

Effects on S not significant.

This agrees with the t-tests except that the latter also suggested a significant effect of 'Soil type' on S with added nutrients. This is presumably lost in combining the 'with' and 'without added nutrients' data and the more rigorous analysis.

2a Rumex

Both 'Nutrients' and 'Soil type' gave highly significant effects (mostly at P 0.001).

This is generally supportive of the t-test results which suggested a number of significant effects.

Total wgt. TITLE Expt. 1a, Chap. 4 SLP Soils

Rhododendron

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	0.316	5.80	0.158	0.571	NS
Residual	3	0.831	15.24	0.277		
Total	5	1.147	21.04	0.229		
Residual						
Units	54	4.303	78.96	0.080		
Grand Total	59	5.450	100.00			

Grand Mean 0.932

Total No. Obs. 60

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Soil type	2	0.793	9.95	0.396	1.165	NS
Residual	3	1.021	12.81	0.340		
Total	5	1.814	22.76	0.363		
Residual						
Units	54	6.156	77.24	0.114		
Grand Total	59	7.969	100.00			

Grand Mean -0.130

Total No. Obs. 60

Root wgt. TITLE Expt. 2a, Chap. 4 Wint.

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.015	0.64	0.015	1.646	NS
Soil type	7	2.071	89.32	0.296	32.722	0.001
Nutrients - Soil type	7	0.088	3.80	0.013	1.391	NS
Residual	16	0.145	6.24	0.009		
Total	31	2.318	100.00	0.075		
Grand Total	31	2.318	100.00			

Grand Mean 0.404

Total No. Obs. 32

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.218	1.94	0.218	2.943	NS
Soil type	7	8.007	71.40	1.144	15.464	0.001
Nutrients - Soil type	7	1.805	16.10	0.258	3.487	0.05
Residual	16	1.184	10.55	0.074		
Total	31	11.213	100.00	0.362		
Grand Total	31	11.213	100.00			

Grand Mean -1.084

Total No. Obs. 32

Shoot wgt. TITLE Expt. 2a, Chap. 4 Wint.

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.070	4.43	0.070	1.582	NS
Soil type	7	0.626	39.43	0.090	2.013	NS
Nutrients - Soil type	7	0.181	11.36	0.026	0.580	NS
Residual	16	0.711	44.78	0.045		
Total	31	1.589	100.00	0.051		
Grand Total	31	1.589	100.00			

Grand Mean 1.069

Total No. Obs. 32

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.046	3.42	0.046	1.127	NS
Soil type	7	0.513	37.87	0.073	1.781	NS
Nutrients - Soil type	7	0.137	10.11	0.020	0.475	NS
Residual	16	0.659	48.60	0.041		
Total	31	1.355	100.00	0.044		
Grand Total	31	1.355	100.00			

Grand Mean 0.046

Total No. Obs. 32

Total wgt. TITLE Expt. 2a, Chap. 4 Wint.

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.021	0.35	0.021	0.284	NS
Soil type	7	4.515	77.96	0.645	8.943	0.001
Nutrients - Soil type	7	0.102	1.75	0.015	0.201	NS
Residual	16	1.154	19.93	0.072		
Total	31	5.791	100.00	0.187		
Grand Total	31	5.791	100.00			

Grand Mean 1.473

Total No. Obs. 32

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.003	0.12	0.003	0.070	NS
Soil type	7	1.509	71.27	0.216	6.092	0.01
Nutrients - Soil type	7	0.040	1.88	0.006	0.161	NS
Residual	16	0.566	26.74	0.035		
Total	31	2.118	100.00	0.068		
Grand Total	31	2.118	100.00			

Grand Mean 0.352

Total No. Obs. 32

Root wgt. TITLE Expt. 2a, Chap. 4 Wint.

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	1.217	8.21	1.217	131.268	0.001
Soil type	7	9.549	64.40	1.364	147.272	0.001
Nutrients - Soil type	7	3.914	26.40	0.559	60.372	0.001
Residual	16	0.148	1.00	0.009		
Total	31	14.828	100.00	0.478		
Grand Total	31	14.828	100.00			

Grand Mean 0.686

Total No. Obs. 32

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	1.747	12.27	1.747	71.629	0.001
Soil type	7	10.543	74.06	1.506	61.742	0.001
Nutrients - Soil type	7	1.555	10.92	0.222	9.106	0.001
Residual	16	0.390	2.74	0.024		
Total	31	14.235	100.00	0.459		
Grand Total	31	14.235	100.00			

Grand Mean -0.643

Total No. Obs. 32

Shoot wgt. TITLE Expt. 2a, Chap. 4 Wint.

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	1.345	6.39	1.345	33.001	0.001
Soil type	7	16.029	76.22	2.290	56.194	0.001
Nutrients - Soil type	7	3.004	14.28	0.429	10.531	0.001
Residual	16	0.652	3.10	0.041		
Total	31	21.030	100.00	0.678		
Grand Total	31	21.030	100.00			

Grand Mean 1.803

Total No. Obs. 32

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.311	7.65	0.311	23.076	0.001
Soil type	7	3.191	78.44	0.456	33.802	0.001
Nutrients - Soil type	7	0.350	8.61	0.050	3.710	0.005
Residual	16	0.216	5.30	0.014		
Total	31	4.068	100.00	0.131		
Grand Total	31	4.068	100.00			

Grand Mean 0.517

Total No. Obs. 32

Total wgt. TITLE Expt. 2a, Chap. 4 Wint.

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	5.120	7.35	5.120	75.586	0.001
Soil type	7	50.038	71.82	7.148	105.529	0.001
Nutrients - Soil type	7	13.428	19.27	1.918	28.320	0.001
Residual	16	1.084	1.56	0.068		
Total	31	69.670	100.00	2.247		
Grand Total	31	69.670	100.00			

Grand Mean 2.489

Total No. Obs. 32

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.551	9.35	0.551	44.193	0.001
Soil type	7	4.616	78.39	0.659	52.903	0.001
Nutrients - Soil type	7	0.522	8.87	0.075	5.984	0.01
Residual	16	0.199	3.39	0.012		
Total	31	5.888	100.00	0.190		
Grand Total	31	5.888	100.00			

Grand Mean 0.801

Total No. Obs. 32

2b Festuca Nutrients : Effects not significant except for ln-transformed data for R (significant at P 0.05).

Soil type : Significant effects for R & T with both untransformed and ln-transformed data.

This is generally supportive of the results of t-tests on the effects of Soil type.

2b Rumex Nutrients : Effects not significant.

Soil type : Effects all significant (at P 0.01 or 0.001) for both untransformed and ln-transformed data.

This strongly supports the results of the t-tests on the data for 'Soil type' effects.

Root wgt. TITLE Expt. 2b, Chap. 4 SLP

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.010	0.79	0.010	1.003	NS
Soil type	4	0.863	70.34	0.216	22.346	0.001
Nutrients - Soil type	4	0.258	21.00	0.064	6.673	0.01
Residual	10	0.097	7.87	0.010		
Total	19	1.226	100.00	0.065		
Grand Total	19	1.226	100.00			

Grand Mean 0.588

Total No. Obs. 20

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.241	4.53	0.241	8.638	0.05
Soil type	4	3.289	61.86	0.822	29.478	0.001
Nutrients - Soil type	4	1.508	28.37	0.377	13.518	0.001
Residual	10	0.279	5.25	0.028		
Total	19	5.316	100.00	0.280		
Grand Total	19	5.316	100.00			

Grand Mean -0.643

Total No. Obs. 20

Shoot wgt. TITLE Expt. 2b, Chap. 4 SLP

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.085	4.45	0.085	1.420	NS
Soil type	4	0.717	37.76	0.179	3.010	NS
Nutrients - Soil type	4	0.502	26.44	0.126	2.108	NS
Residual	10	0.595	31.35	0.060		
Total	19	1.898	100.00	0.100		
Grand Total	19	1.898	100.00			

Grand Mean 1.570

Total No. Obs. 20

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.036	4.72	0.036	1.460	NS
Soil type	4	0.291	38.28	0.073	2.96	NS
Nutrients - Soil type	4	0.187	24.66	0.047	1.906	NS
Residual	10	0.246	32.34	0.025		
Total	19	0.760	100.00	0.040		
Grand Total	19	0.760	100.00			

Grand Mean 0.432

Total No. Obs. 20

Total wgt. TITLE Expt. 2b, Chap. 4 SLP

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.037	0.84	0.037	0.479	NS
Soil type	4	2.679	60.57	0.670	8.682	0.01
Nutrients - Soil type	4	0.936	21.16	0.234	3.033	NS
Residual	10	0.771	17.44	0.077		
Total	19	4.423	100.00	0.233		
Grand Total	19	4.423	100.00			

Grand Mean 2.158

Total No. Obs. 20

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.002	0.24	0.002	0.112	NS
Soil type	4	0.514	58.48	0.129	6.833	0.001
Nutrients - Soil type	4	0.175	19.89	0.044	2.324	NS
Residual	10	0.188	21.39	0.019		
Total	19	0.879	100.00	0.046		
Grand Total	19	0.879	100.00			

Grand Mean 0.747

Total No. Obs. 20

Root wgt. TITLE Expt. 2b, Chap. 4 SLP

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.039	0.36	0.039	0.729	NS
Soil type	4	9.411	88.33	2.353	44.322	0.001
Nutrients - Soil type	4	0.674	6.32	0.168	3.172	NS
Residual	10	0.531	4.98	0.053		
Total	19	10.654	100.00	0.561		
Grand Total	19	10.654	100.00			

Grand Mean 1.318

Total No. Obs. 20

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.002	0.05	0.002	0.041	NS
Soil type	4	3.697	82.27	0.924	16.885	0.001
Nutrients - Soil type	4	0.247	5.51	0.062	1.130	NS
Residual	10	0.547	12.18	0.055		
Total	19	4.493	100.00	0.237		
Grand Total	19	4.493	100.00			

Grand Mean 0.152

Total No. Obs. 20

Shoot wgt. TITLE Expt. 2b, Chap. 4 SLP

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.551	1.22	0.551	0.808	NS
Soil type	4	31.650	69.90	7.913	11.604	0.01
Nutrients - Soil type	4	6.261	13.83	1.565	2.296	NS
Residual	10	6.819	15.06	0.682		
Total	19	45.282	100.00	2.383		
Grand Total	19	45.282	100.00			

Grand Mean 3.45

Total No. Obs. 20

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.014	0.54	0.014	0.290	NS
Soil type	4	1.801	68.08	0.450	9.182	0.01
Nutrients - Soil type	4	0.340	12.85	0.085	1.733	NS
Residual	10	0.490	18.54	0.049		
Total	19	2.646	100.00	0.139		
Grand Total	19	2.646	100.00			

Grand Mean 1.164

Total No. Obs. 20

Total wgt. TITLE Expt. 2b, Chap. 4 SLP

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.882	0.92	0.882	0.970	NS
Soil type	4	75.298	78.39	18.825	20.710	0.001
Nutrients - Soil type	4	10.789	11.23	2.697	2.967	NS
Residual	10	9.089	9.46	0.910		
Total	19	96.058	100.00	5.056		
Grand Total	19	96.058	100.00			

Grand Mean 4.77

Total No. Obs. 20

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.009	0.32	0.009	0.234	NS
Soil type	4	2.266	76.73	0.566	14.161	0.001
Nutrients - Soil type	4	0.278	9.40	0.069	1.735	NS
Residual	10	0.400	13.55	0.040		
Total	19	2.953	100.00	0.155		
Grand Total	19	2.953	100.00			

Grand Mean 1.479

Total No. Obs. 20

2c Festuca Nutrients : not significant.

Soil type : all significant.

This strongly supports the t-tests on the data which indicated significant differences between the soils, unrelieved by nutrient addition.

2c Rumex Nutrients : not significant.

Soil type : all significant.

Root wgt. TITLE Expt. 2c, Chap. 4 CLUM

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.063	3.37	0.063	3.846	NS
Soil type	3	1.573	84.79	0.525	32.275	0.001
Nutrients - Soil type	3	0.090	4.83	0.030	1.840	NS
Residual	8	0.130	7.01	0.016		
Total	15	1.856	100.00	0.124		
Grand Total	15	1.856	100.00			

Grand Mean 0.465

Total No. Obs. 16

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.131	0.49	0.131	0.133	NS
Soil type	3	17.992	67.62	5.997	6.063	0.05
Nutrients - Soil type	3	0.573	2.15	0.191	0.193	NS
Residual	8	7.913	29.74	0.989		
Total	15	26.610	100.00	1.774		
Grand Total	15	26.610	100.00			

Grand Mean -1.26

Total No. Obs. 16

Shoot wgt. TITLE Expt. 2c, Chap. 4 CLUM

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.003	0.17	0.003	0.081	NS
Soil type	3	1.141	78.66	0.381	12.283	0.01
Nutrients - Soil type	3	0.059	4.09	0.020	0.638	NS
Residual	8	0.248	17.08	0.031		
Total	15	1.451	100.00	0.097		
Grand Total	15	1.451	100.00			

Grand Mean 1.290

Total No. Obs. 16

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.004	0.41	0.004	0.161	NS
Soil type	3	0.711	74.30	0.237	9.869	0.05
Nutrients - Soil type	3	0.050	5.21	0.017	0.692	NS
Residual	8	0.192	20.08	0.024		
Total	15	0.957	100.00	0.064		
Grand Total	15	0.957	100.00			

Grand Mean 0.226

Total No. Obs. 16

Total wgt. TITLE Expt. 2c, Chap. 4 CLUM

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.040	0.71	0.040	0.541	NS
Soil type	3	4.708	83.73	1.569	21.241	0.001
Nutrients - Soil type	3	0.284	5.05	0.095	1.281	NS
Residual	8	0.591	10.51	0.074		
Total	15	15.623	100.00	0.375		
Grand Total	15	5.623	100.00			

Grand Mean 1.755

Total No. Obs. 16

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.003	0.14	0.003	0.077	NS
Soil type	3	1.777	80.83	0.592	15.163	0.05
Nutrients - Soil type	3	0.106	4.82	0.035	0.904	NS
Residual	8	0.313	14.22	0.039		
Total	15	2.199	100.00	0.147		
Grand Total	15	2.199	100.00			

Grand Mean 0.499

Total No. Obs. 16

Root wgt. TITLE Expt. 2c, Chap. 4 CLUM

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.027	0.54	0.027	0.296	NS
Soil type	3	3.935	77.93	1.312	14.241	0.01
Nutrients - Soil type	3	0.350	6.93	0.117	1.267	NS
Residual	8	0.737	14.59	0.092		
Total	15	5.049	100.00	0.337		
Grand Total	15	5.049	100.00			

Grand Mean 1.066

Total No. Obs. 16

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.0003	0.01	0.0003	0.003	NS
Soil type	3	3.107	75.71	1.036	10.255	0.05
Nutrients - Soil type	3	0.188	4.59	0.063	0.622	NS
Residual	8	0.808	19.69	0.101		
Total	15	4.104	100.00	0.274		
Grand Total	15	4.104	100.00			

Grand Mean -0.066

Total No. Obs. 16

Shoot wgt. TITLE Expt. 2c, Chap. 4 CLUM

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.292	2.20	0.292	0.863	NS
Soil type	3	9.687	73.07	3.229	9.551	0.01
Nutrients - Soil type	3	0.574	4.33	0.191	0.566	NS
Residual	8	2.705	20.40	0.338		
Total	15	13.257	100.00	0.884		
Grand Total	15	13.257	100.00			

Grand Mean 2.74

Total No. Obs. 16

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.028	1.67	0.028	0.786	NS
Soil type	3	1.336	78.61	0.445	12.315	0.05
Nutrients - Soil type	3	0.046	2.69	0.015	0.421	NS
Residual	8	0.289	17.02	0.036		
Total	15	1.699	100.00	0.113		
Grand Total	15	1.699	100.00			

Grand Mean 0.956

Total No. Obs. 16

Total wgt. TITLE Expt. 2c, Chap. 4 CLUM

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.141	0.47	0.141	0.230	NS
Soil type	3	23.186	78.18	7.729	12.665	0.01
Nutrients - Soil type	3	1.450	4.89	0.483	0.792	NS
Residual	8	4.882	16.46	0.610		
Total	15	29.658	100.00	1.977		
Grand Total	15	29.658	100.00			

Grand Mean 3.81

Total No. Obs. 16

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.010	0.48	0.010	0.239	NS
Soil type	3	1.698	80.60	0.566	13.396	0.05
Nutrients - Soil type	3	0.061	2.88	0.020	0.478	NS
Residual	8	0.338	16.04	0.042		
Total	15	2.106	100.00	0.140		
Grand Total	15	2.106	100.00			

Grand Mean 1.272

Total No. Obs. 16

2d Festuca Nutrients : not significant except for untransformed R data.

Soil type : all highly significant at P 0.001

This is highly supportive of the significant effect suggested by t-tests.

2d Rumex Nutrients :) all significant
Soil type :)

This supports the t-test results on the effects of soil type. It additionally suggests a nutrient effect on some of the data.

Root wgt. TITLE Expt. 2d, Chap. 4 SW

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.034	0.79	0.034	5.429	0.05
Soil type	6	4.030	94.45	0.672	108.527	0.001
Nutrients - Soil type	6	0.117	2.73	0.019	3.138	0.05
Residual	14	0.087	2.03	0.006		
Total	27	4.267	100.00	0.158		
Grand Total	27	4.267	100.00			

Grand Mean 0.508

Total No. Obs. 28

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.473	0.86	0.473	3.320	NS
Soil type	6	50.718	91.85	8.453	59.340	0.001
Nutrients - Soil type	6	2.031	3.68	0.339	2.377	NS
Residual	14	1.994	3.61	0.143		
Total	27	55.216	100.00	2.045		
Grand Total	27	55.216	100.00			

Grand Mean -1.317

Total No. Obs. 28

Shoot wgt. TITLE Expt. 2d, Chap. 4 SW

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.037	0.57	0.037	1.090	NS
Soil type	6	5.037	77.54	0.840	24.636	0.001
Nutrients - Soil type	6	0.945	14.54	0.158	4.621	0.01
Residual	14	0.477	7.34	0.034		
Total	27	6.497	100.00	0.241		
Grand Total	27	6.497	100.00			

Grand Mean 1.502

Total No. Obs. 28

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.010	0.40	0.010	0.611	NS
Soil type	6	1.914	80.09	0.319	20.305	0.001
Nutrients - Soil type	6	0.246	10.30	0.041	2.612	NS
Residual	14	0.220	9.20	0.016		
Total	27	2.390	100.00	0.089		
Grand Total	27	2.390	100.00			

Grand Mean 0.362

Total No. Obs. 28

Total wgt. TITLE Expt. 2d, Chap. 4 SW

Festuca

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.141	0.77	0.141	2.647	NS
Soil type	6	16.196	88.19	2.699	50.518	0.001
Nutrients - Soil type	6	1.280	6.97	0.213	3.993	0.05
Residual	14	0.748	4.07	0.053		
Total	27	18.366	100.00	0.680		
Grand Total	27	18.366	100.00			

Grand Mean 2.010

Total No. Obs. 28

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.027	0.59	0.027	1.996	NS
Soil type	6	4.158	90.91	0.693	50.957	0.001
Nutrients - Soil type	6	0.199	4.34	0.033	2.432	NS
Residual	14	0.190	4.16	0.014		
Total	27	4.574	100.00	0.169		
Grand Total	27	4.574	100.00			

Grand Mean 0.618

Total No. Obs. 28

Root wgt. TITLE Expt. 2d, Chap. 4 SW

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	6.861	14.06	6.861	35.152	0.001
Soil type	6	29.632	60.74	4.939	25.305	0.001
Nutrients - Soil type	6	9.557	19.59	1.593	8.161	0.001
Residual	14	2.732	5.60	0.195		
Total	27	48.783	100.00	1.807		
Grand Total	27	48.783	100.00			

Grand Mean 1.498

Total No. Obs. 28

In.Root wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	1.352	5.47	1.352	30.719	0.001
Soil type	6	21.217	85.87	3.536	80.349	0.001
Nutrients - Soil type	6	1.523	6.16	0.254	5.767	0.01
Residual	14	0.616	2.49	0.044		
Total	27	24.707	100.00	0.915		
Grand Total	27	24.707	100.00			

Grand Mean 0.001

Total No. Obs. 28

Shoot wgt. TITLE Expt. 2d, Chap. 4 SW

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	7.781	4.30	7.781	8.169	0.05
Soil type	6	149.080	82.34	24.847	26.088	0.001
Nutrients - Soil type	6	10.863	6.00	1.811	1.901	NS
Residual	14	13.334	7.36	0.952		
Total	27	181.057	100.00	6.706		
Grand Total	27	181.057	100.00			

Grand Mean 4.02

Total No. Obs. 28

In.Shoot wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.215	1.38	0.215	4.619	0.05
Soil type	6	14.268	91.46	2.378	51.150	0.001
Nutrients - Soil type	6	0.467	2.99	0.078	1.675	NS
Residual	14	0.651	4.17	0.047		
Total	27	15.651	100.00	0.578		
Grand Total	27	15.601	100.00			

Grand Mean 1.147

Total No. Obs. 28

Total wgt. TITLE Expt. 2d, Chap. 4 SW

Rumex

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	29.254	7.31	29.254	17.189	0.01
Soil type	6	310.715	77.64	51.786	30.429	0.001
Nutrients - Soil type	6	36.401	9.10	6.067	3.565	0.05
Residual	14	23.826	5.95	1.702		
Total	27	400.196	100.00	14.822		
Grand Total	27	400.196	100.00			

Grand Mean 5.52

Total No. Obs. 28

In.Total wgt. TITLE

SOURCE OF VARIATION	DF	SS	SS%	MS	VR	SIG
Nutrients	1	0.403	2.31	0.403	10.498	0.01
Soil type	6	15.862	91.12	2.644	68.893	0.001
Nutrients - Soil type	6	0.606	3.48	0.101	2.630	NS
Residual	14	0.531	3.09	0.038		
Total	27	17.408	100.00	0.645		
Grand Total	27	17.408	100.00			

Grand Mean 1.433

Total No. Obs. 28

A.7.4 4.4 Experiments (3 - 6)

A.7.4.1 4.4.3.1 (Experiment 3)

A.7.4.1.1 Root and shoot lengths

	Mean length (mm) with 95% confidence limits	
	R	S
Fe sdg (mean of 20 planted)	27.8 ± 9.3	36.3 ± 3.6
Fe sd (" " ")	0.8 ± 0.5	22.5 ± 6.7
Ag sdg (" " ")	32.5 ± 6.5	11.0 ± 1.6
Fe sd (mean of survivors only)	1.1 ± 0.7	30.0 ± 3.2 (n=15)

A.7.4.1.2 Root and shoot dry weights

Mean dry weight (mg), standard deviation)
and 95% confidence limits.
n=20 unless otherwise stated.

	R	95% cd's	S	95% cd's	T	95% cd's
Fe sdg (mean of 20 planted)	0.37(0.23)	0.11	1.13(0.46)	0.22	1.49(0.57)	0.27
Fe sd (mean of 20 planted)	0.03(0.03)	0.01	1.14(0.87)	0.41	1.17(0.89)	0.42
Ag sdg (mean of 20 planted)	0.27(0.13)	0.06	0.19(0.09)	0.04	0.46(0.18)	0.08
Fe sd (mean of survivors only)	0.04(0.03)	0.02	1.51(0.64)	0.36	1.56(0.66) (n=15)	0.37

A.7.4.1.3/4 4.4.3.1 (Experiment 3) Statistical significance

A.7.4.1.3 Root and shoot lengths

	Mean length	
	R	S
Fe sdg (mean of 20 planted)	CONTROL	
Fe sd (mean of 20 planted)	d *	d *
Fe sd (mean of survivors)	d *	d * (n=15)

A.7.4.1.4 Root and shoot dry weights

	Mean dry weight		
	R	S	T
Fe sdg (mean of 20 planted)	CONTROL		
Fe sd (" " ")	d *	ns	ns
Fe sd (mean of survivors)	d *	i *	ns (n-15)

* : difference significant at p=95% or more.

A.7.4.2 4.4.3.2 (Experiment 4) (Dry weights)

A.7.4.2.1 Mean dry weight (mg) of surviving seedlings standard deviation in () and 95% confidence limits.

	Root	95% cd's	Shoot	95% cd's	Total	95% cd's	n
1. +N							
Rh.Myc	0	-	0.09(0.03)	0.05	0.09(0.03)	0.05	4
Rh.NMyc	0	-	0.12(0.08)	0.20	0.12(0.08)	0.20	3
Rh.MycH	0	-	0.21(0.14)	0.15	0.21(0.14)	0.15	6
Rh.NMycH	0	-	0.26(0.13)	0.11	0.26(0.13)	0.11	8
NRh.+E	0.78(0.44)	0.15	5.50(3.78)	1.32	6.28(4.07)	1.43	34
NRh.	0.75(0.48)	0.17	6.78(4.66)	1.61	7.53(4.95)	1.71	35
2. -N							
Rh.Myc	0	-	0.10(0)	-	0.10(0)	-	2
Rh.NMyc	0.01(0.02)	0.02	0.18(0.11)	0.12	0.18(0.12)	0.13	6
Rh.MycH	0	-	0.15(0.07)	0.63	0.15(0.07)	0.63	2
Rh.NMycH	0	-	0.24(0.15)	0.24	0.24(0.15)	0.24	4
NRh.+E	0.67(0.30)	0.11	7.94(5.16)	1.89	8.60(5.30)	1.94	31
NRh.	0.54(0.29)	0.10	5.24(3.10)	1.07	5.78(3.29)	1.14	35

	Root	95% Limits	Shoot	95% Limits	Total	95% Limits
			Mean dry weight (mg) of seedlings for the 10 seeds sown per dish. Standard deviation in (). n = 40 for each treatment.			
1. +N						
Rh.Myc	0	-	0.01(0.03)	0.01	0.01(0.03)	0.01
Rh.NMyc	0	-	0.01(0.04)	0.01	0.01(0.04)	0.01
Rh.MycH	0	-	0.03(0.09)	0.03	0.03(0.09)	0.03
Rh.NMycH	0	-	0.05(0.12)	0.04	0.05(0.12)	0.04
NRh.+E	0.66(0.49)	0.16	4.68(4.00)	1.29	5.34(4.38)	1.41
NRh.	0.66(0.51)	0.17	.5.93(4.91)	1.59	6.59(5.27)	1 7
2. -N						
Rh.Myc	0	-	0.01(0.02)	0.01	0.01(0.02)	.01
Rh.NMyc	0.001(0.008)	0.003	0.03(0.07)	0.02	0.03(0.08)	03
Rh.MycH	0	-	0.01(0.04)	0.01	0.01(0.08	0.01
Rh.NMycH	0	-	0.02(0.08)	0.03	0.02(0.08)	
NRh.+E	0.52(0.38)	0.12	6.15(5.63)	1.82	6.67(5.90)	1.91
NRh	0.47(0.33)	0.11	4.59(3.38)	1.09	5.06(3.63)	1.17

4.4.3.2 (Experiment 4)

A.7.4.2.2 Statistical significance of the data

The results were treated using Student's t-test. The data are for all the seeds sown (n=40).

CONTROL : No Rhododendron (NRh.)

Conditions	Root	Shoot	Total
Rh.Myc	d 1%	d 0.1%	d 0.1%
Rh.NMyc	d 2%	d 0.1%	d 0.1%
Rh.MycH	d 1%	d 0.1%	d 0.1%
Rh.NMycH	d 1%	d 0.1%	d 0.1%
NRh.+E	i ns	i ns	i ns
NRh.+N	i ns	i ns	i ns

CONTROL : No Rhododendron + N (NRh.+N)

Rh.Myc +N	d 0.1%	d 0.2%	d 0.1%
Rh.NMyc+N	d 0.1%	d 0.2%	d 0.1%
Rh.MycH+N	d 0.1%	d 0.2%	d 0.1%
Rh.NMycH+N	d 0.1%	d 0.2%	d 0.1%
NRh.+E+N	-	d ns	d ns

All Rhododendron (Rh.) and Rhododendron harvested (Rh.H) soils showed no significant increase with nutrient addition.

A.7.4.3 4.4.3.3 (Experiment 5)

A.7.4.3.1 Survival of F. ovina seedlings

Treatment and Pot		No. seedlings still alive at time of harvest + Robbins' soln.	+ Distilled water
Rh.	1:	3	2
	2:	0	0
	3:	4	0
	4:	4 T=11,55%	3 T=5,25%
Rh.+R	1:	3	4
	2:	2	3
	3:	2	1
	4:	4 T=11,55%	3 T=11,55%
Rh.-R	1:	3	5
	2:	4	4
	3:	2	5
	4:	1 T=10,50%	5 T=19,95%
NRh.	1:	2	5
	2:	4	5
	3:	2	4
	4:	3 T=11,55%	4 T=18,90%

'T' = total number of survivors for that treatment, for all pots presented as the number of individuals and as the percentage of those planted (5 per pot, 20 per treatment).

A.7.4.3.2 Bioassay results : dry weights

Treatment	Mean dry weight (mg) of surviving seedlings. Standard deviation in ().						
	Root	95% limits	Shoot	95% limits	Total	95% limits	n
Rh.	0.31(0.27)	0.34	0.66(0.32)	0.40	0.97(0.44)	0.55	(5)
Rh.H+R	2.68(2.56)	1.72	8.57(10.68)	7.18	11.26(12.99)	8.73	(11)
Rh.H-R	10.08(10.19)	4.91	42.61(36.22)	17.46	52.68(45.96)	22.15	(19)
NRh.	1.42(1.56)	0.78	4.06(4.57)	2.27	5.48(6.02)	2.99	(18)
Rh.+N	0.99(0.39)	0.26	2.25(0.84)	0.56	3.24(0.96)	0.65	(11)
Rh.H+R+N	17.06(24.02)	16.14	30.40(27.25)	18.31	47.46(46.73)	31.39	(11)
Rh.H-R+N	52.03(45.90)	32.83	133.52(93.45)	95.51	185.55(128.25)	91.74	(10)
NRh.+N	10.45(10.34)	6.95	28.52(26.38)	17.72	38.97(35.52)	23.86	(11)

	Mean dry weight (mg) of all seedlings planted Standard deviation in (). n=20					
Rh.	0.08(0.19)	0.09	0.17(0.33)	0.15	0.24(0.48)	0.23
Rh.H+R	1.48(2.31)	1.08	4.72(8.90)	4.17	6.19(11.04)	5.17
Rh.H-R	9.58(10.16)	4.76	40.48(36.52)	17.09	50.05(46.26)	21.65
NRh.	1.21(1.52)	0.71	3.45(4.45)	2.08	4.66(5.88)	2.75
Rh.+N	0.55(0.58)	0.27	1.24(1.30)	0.61	1.78(1.79)	0.84
Rh.H+R+N	9.39(19.48)	9.12	16.71(25.14)	11.77	26.11(41.67)	19.50
Rh.H-R+N	26.02(41.36)	19.36	66.76(93.96)	43.97	92.78(129.81)	60.50
NRh.+N	6.27(9.46)	4.43	17.11(24.66)	11.54	23.38(33.38)	15.62

A.7.4.3.3 4.4.3.3 (Experiment 5)

Statistical significance of the results

Data for total number of seedlings planted, tested with Student's t-test.

Control : Rh.H-R

Conditions	Root	Shoot	Total
Rh.	d 0.1%	d 0.1%	d 0.1%
Rh.H+R	d 0.2%	d 0.1%	d 0.1%
Rh.H-R+N	i ns	i ns	i ns
Rh. vs Rh.H+R	d 2%	d 1%	d 1%
Rh. vs Rh.+N	d 0.2%	d 0.2%	d 0.2%
Rh.H+R vs Rh.H+R+N	d ns	d ns	d 5%

Control : Rh.H-R+N

Rh.+N	d 1%	d 1%	d %
Rh.H+R+N	d ns	d 5%	d 5%
NRh. vs NRh.+N	d 5%	d 5%	d 5%

A.7.4.4 4.4.3.4 (Experiment 6a)

A.7.4.4.1 Dry weight (mg) : mean, standard deviation, 95% limits

Conditions	*	Root	Shoot	Total
Festuca				
NRh.-N	15	3.49,1.75,0.97;	7.97,3.63,2.01;	11.46,4.98,2.76
	20	2.62,2.16,1.01;	5.98,4.71,2.20;	8.60,6.65,3.11
NRh.+1N	16	1.86,1.26,0.68;	6.65,3.64,1.94;	8.51,4.84,2.58
	20	1.49,1.37,0.64;	5.32,4.23,1.98;	6.81,5.54,2.59
NRh.+2N	18	2.98,1.95,0.97;	8.98,3.97,1.97;	11.96,5.73,2.85
	20	2.68,2.06,0.96;	8.09,4.66,2.18;	10.77,6.55,3.07
Rh.NMyc-N	17	0.66,0.37,0.19;	0.85,0.43,0.22;	1.50,0.74,0.38
	20	0.56,0.42,0.20;	0.72,0.50,0.23;	1.28,0.88,0.41
Rh.NMyc+1N	15	0.70,0.51,0.28;	1.00,0.58,0.32;	1.70,1.07,0.59
	20	0.52,0.54,0.25;	0.75,0.67,0.31;	1.27,1.19,0.56
Rh.NMyc+2N	17	0.90,0.53,0.27;	1.56,0.58,0.30;	2.46,0.96,0.49
	20	0.77,0.59,0.28;	1.33,0.78,0.37;	2.09,1.26,0.59
Rh.Myc-N	10	0.66,0.47,0.34;	0.99,0.62,0.44;	1.65,0.75,0.54
	20	0.33,0.47,0.22;	0.50,0.67,0.31;	0.83,0.99,0.46
Rh.Myc+1N	17	0.80,0.56,0.29;	1.18,0.79,0.41;	1.98,1.21,0.62
	20	0.68,0.59,0.28;	1.00,0.84,0.39;	1.68,1.33,0.62
Rh.Myc+2N	16	1.25,0.88,0.47;	1.65,0.71,0.38;	2.90,1.52,0.81
	20	1.00,0.94,0.44;	1.32,0.92,0.43;	2.32,1.80,0.84

* : Number of seedlings surviving (upper figure)
Number of seedlings planted (lower figure)

A.7.4.4 4.4.3.4 (Experiment 6a)

A.7.4.4.2 Dry weight (mg) : mean, standard deviation, 95% limits.

Conditions	*	Root	Shoot	Total
Rumex				
NRh.-N	20	3.16,1.59,0.74;	2.40,1.44,0.67;	5.56,2.66,1.25
NRh.+1N	20	19.06,9.77,4.57;	17.14,8.86,4.15;	36.20,18.05,8.45
NRh.+2N	17	15.34,13.91,7.15;	17.94,15.78,8.11;	33.31,29.19,15.01
	20	13.04,13.95,6.53;	15.25,15.90,7.44;	28.31,29.43,13.77
Rh.NMyc-N	17	2.05,1.29,0.66;	2.63,1.34,0.69;	4.68,2.40,1.23
	20	1.75,1.40,0.66;	2.24,1.56,0.73;	3.98,2.79,1.31
Rh.NMyc+1N	20	2.50,0.97,0.45;	2.35,0.88,0.41;	4.84,1.48,0.69
Rh.NMyc+2N	20	2.79,1.94,0.91;	3.79,1.95,0.91;	6.58,3.13,1.47
Rh.Myc-N	19	1.99,1.21,0.58;	1.78,1.00,0.48;	3.78,1.85,0.89
	20	1.90,1.26,0.59;	1.70,1.05,0.49;	3.59,1.99,0.93
Rh.Myc+1N	20	2.68,1.41,0.66;	2.28,1.15,0.54;	4.96,2.26,1.06
Rh.Myc+2N	19	2.44,1.65,0.80;	2.15,1.17,0.56;	4.60,2.54,1.22
	20	2.32,1.70,0.80;	2.05,1.23,0.58;	4.37,2.68,1.25

* : Number of seedlings surviving (upper figure)
Number of seedlings planted (lower figure)

A.7.4.4 4.4.3.4 (Experiment 6a)

A.7.4.4.3 Dry weight (mg) : mean, standard deviation, 95% limits.

Conditions	*	Root	Shoot	Total
Trifolium				
NRh.-N	2	0.70,0.28,2.52;	1.95,0.07,0.63;	2.65,0.35,3.15
	20	0.07,0.23,0.11;	0.20,0.60,0.28;	0.27,0.82,0.38
NRh.+1N	10	0.70,0.48,0.34;	1.54,1.07,0.77;	2.24,1.32,0.94
	20	0.35,0.49,0.23;	0.77,1.08,0.51;	1.12,1.47,0.69
NRh.+2N	17	3.02,1.56,0.80;	5.65,2.10,1.08;	8.68,3.32,1.71
	20	2.57,1.81,0.85;	4.81,2.83,1.33;	7.38,4.40,2.06
Rh.NMyc-N	10	0.08,0.05,0.04;	0.86,0.46,0.33;	0.94,0.45,0.32
	20	0.04,0.06,0.03;	0.43,0.54,0.25;	0.47,0.57,0.27
Rh.NMyc+1N	13	0.05,0.05,0.03;	0.47,0.38,0.23;	0.52,0.38,0.23
	20	0.03,0.04,0.02;	0.31,0.38,0.18;	0.34,0.40,0.19
Rh.NMyc+2N	13	0.13,0.15,0.09;	0.91,0.54,0.33;	1.04,0.59,0.36
	20	0.09,0.14,0.07;	0.59,0.62,0.29;	0.68,0.69,0.32
Rh.Myc-N	9	0.17,0.15,0.12;	0.60,0.33,0.25;	0.77,0.39,0.30
	20	0.08,0.13,0.06;	0.27,0.37,0.17;	0.35,0.47,0.22
Rh.Myc+1N	10	0.08,0.07,0.05;	0.29,0.17,0.12;	0.37,0.23,0.17
	20	0.04,0.06,0.03;	0.15,0.19,0.09;	0.19,0.25,0.12
Rh.Myc+2N	13	0.49,0.31,0.19;	0.86,0.42,0.25;	1.35,0.62,0.38
	20	0.32,0.34,0.16;	0.56,0.54,0.25;	0.88,0.82,0.38

* : Number of seedlings surviving (upper figure)
Number of seedlings planted (lower figure)

A.7.4.4 4.4.3.4 (Experiment 6b)

A.7.4.4.4 Dry weight (mg) : mean, standard deviation, 95% limits

Conditions	*	Root	Shoot	Total
NRh.-N	9	1.79,1.61,1.24;	4.83,2.99,2.30	6.62,3.69,2.84
	10	1.61,1.62,1.16;	4.35,3.20,2.29;	5.96,4.06,2.90
NRh.+N	9	1.91,1.61,1.24;	5.01,3.85,2.96;	6.92,5.43,4.17
	10	1.72,1.63,1.17;	4.51,3.96,2.83;	6.23,5.56,3.98
NRh.+2N	8	2.88,2.09,1.75;	11.84,4.51,3.77;	14.71,6.38,5.34
	10	2.30,2.21,1.58;	9.47,6.38,4.56;	11.77,8.38,5.99
NRh.+10N	10	6.52,3.08,2.20;	22.41,15.29,10.94	28.93,18.19,13.01
Rh.-R-N	8	1.43,1.12,0.94;	5.71,5.48,4.58;	7.14,6.55,5.48
	10	1.14,1.15,0.82;	4.57,5.40,3.86;	5.71,6.51,4.66
Rh.-R+N	9	2.66,1.05,0.81;	5.91,2.66,2.05;	8.57,3.45,2.65
	10	2.39,1.30,0.93;	5.32,3.13,2.24;	7.71,4.24,3.03
Rh.-R+2N	7	2.51,1.50,1.39;	8.17,4.47,4.13;	10.69,5.81,5.37
	10	1.76,1.72,1.23;	5.72,5.38,3.85;	7.48,7.01,5.01
Rh.-R+10N	8	4.30,2.20,1.84;	15.45,6.30,5.27;	19.75,7.45,6.23
	10	3.44,2.65,1.90;	12.36,8.56,6.12;	15.80,10.61,7.59

* : Number of seedlings surviving (upper figure)
Number of seedlings planted (lower figure)

Conditions	*	Root	Shoot	Total
Festuca				
Rh.+R-N	10	0.60,0.40,0.29;	0.66,0.49,0.35;	1.26,0.79,0.57
Rh.+R+1N	8	0.83,0.87,0.73;	1.30,0.80,0.67;	2.13,1.61,1.35
	10	0.66,0.84,0.60;	1.04,0.89,0.64;	1.70,1.68,1.20
Rh.+R+2N	8	1.79,0.86,0.72;	2.48,0.87,0.73;	4.23,1.39,1.16
	10	1.43,1.07,0.77;	1.98,1.29,0.92;	3.38,2.16,1.55
Rh.+R+10N	10	5.22,1.94,1.39;	9.35,3.90,2.79;	14.57,5.35,3.83
Rh.-N	10	0.56,0.47,0.34;	0.62,0.43,0.31;	1.18,0.76,0.54

* : Number of seedlings surviving (upper figure)
Number of seedlings planted (lower figure)

A.7.4.4 4.4.3.4 (Experiment 6b)

A.7.4.4.5 Dry weight (mg) : mean, standard deviation, 95% limits

Conditions	*	Root	Shoot	Total
Rumex				
NRh.-N	10	7.44,4.86,3.48;	10.48,7.44,5.32;	17.92,12.18,8.71
NRh.+1N	10	7.64,3.15,2.25;	11.47,6.06,4.34;	19.11,8.51,6.09
NRh.+2N	10	11.40,7.56,5.41;	14.06,6.45,4.61;	25.46,13.21,9.45
NRh.+10N	10	41.93,12.94,9.26;	55.04,16.26,11.63;	96.97,28.38,20.30
Rh.-R-N	10	5.11,2.35,1.68;	8.50,5.23,3.74;	13.61,7.13,5.10
Rh.-R+1N	10	2.95,1.67,1.20;	3.83,2.27,1.62;	6.78,3.63,2.60
Rh.-R+2N	10	3.21,2.07,1.48;	4.20,2.33,1.67;	7.41,4.30,3.08
Rh.-R+10N	10	15.78,12.01,8.59;	19.98,13.89,9.94;	35.76,25.13,17.98
Rh.+R-N	10	1.87,0.90,0.64;	3.18,1.10,0.79;	5.05,1.84,1.32
Rh.+R+1N	10	3.48,1.34,0.96;	3.99,2.55,1.82;	7.47,3.51,2.51
Rh.+R+2N	10	1.77,1.08,0.77;	2.76,1.72,1.23;	4.53,2.50,1.79
Rh.+R+10N	9	24.86,13.60,10.45;	22.00,12.86,9.89;	46.81,26.06,20.03
	10	22.37,15.04,10.76;	19.76,13.97,9.99;	42.13,28.68,20.52
Rh.-N	9	1.81,1.08,0.83;	2.41,1.01,0.78;	4.22,1.72,1.32
	10	1.63,1.17,0.84;	2.17,1.22,0.87;	3.80,2.10,1.50

* : Number of seedlings surviving (upper figure)
Number of seedlings planted (lower figure)

A.7.4.4 4.4.3.4 (Experiment 6c)

A.7.4.4.6 Dry weight (mg) : mean, standard deviation, 95% limits

Conditions	*	Root	Shoot	Total
Festuca				
NRh.-N	9	0.85,0.70,0.54;	4.39,2.62,2.01;	5.24,3.22,2.48
	10	0.77,0.71,0.55;	3.95,2.83,2.02;	4.72,3.46,2.48
NRh.+1N	9	0.38,0.34,0.26;	1.58,1.30,1.00;	1.96,1.52,1.17
	10	0.34,0.34,0.24;	1.42,1.32,0.94;	1.76,1.56,1.12
NRh.+2N	3	2.73,1.17,2.91;	11.13,5.37,13.34;	13.87,5.41,16.17
	10	9.82,1.43,1.02;	3.34,5.94,4.25;	4.16,7.37,5.27
NRh.+10N	9	4.94,2.96,2.28;	19.86,11.29,8.68;	24.80,13.99,10.75
	10	4.45,3.20,2.29;	17.87,12.36,8.84;	22.32,15.34,10.97
Rh.-R-N	9	0.27,0.29,0.22;	1.16,0.69,0.53;	1.43,0.93,0.72
	10	0.25,0.28,0.20;	1.04,0.75,0.54;	1.29,0.98,0.70
Rh.-R+1N	10	0.68,0.83,0.59;	3.33,2.94,2.10;	4.01,3.74,2.68
Rh.-R+2N	10	0.62,0.43,0.31;	5.55,3.08,2.20;	6.37,3.46,2.48
Rh.-R+10N	6	2.00,0.66,0.69;	12.72,3.74,3.93;	14.72,4.23,4.44
	10	1.20,1.15,0.82;	7.63,7.14,5.11;	8.83,8.23,5.89
Rh.+R-N	8	0.24,0.13,0.11;	0.46,0.33,0.28;	0.70,0.39,0.33
	10	0.19,0.15,0.11;	0.37,0.35,0.25;	0.56,0.45,0.32

* : Number of seedlings surviving (upper figure)
Number of seedlings planted (lower figure)

Conditions	*	Root	Shoot	Total
Rh.+R+1N	9	0.27,0.19,0.15;	0.59,0.37,0.28;	0.86,0.44,0.34
	10	0.24,0.20,0.14;	0.53,0.39,0.28;	0.77,0.49,0.35
Rh.+R+2N	7	0.70,0.55,0.51;	0.80,0.49,0.45;	1.50,1.03,0.95
	10	0.49,0.56,0.40;	0.56,0.56,0.40;	1.05,1.11,0.79
Rh.+R+10N	9	2.68,2.26,1.74;	10.74,10.28,7.90;	13.42,12.36,9.50
	10	2.41,2.30,1.65;	9.67,10.27,7.35;	12.08,12.40,8.87
Rh.-N	6	0.55,0.20,0.21;	0.30,0.17,0.18;	0.85,0.30,0.32
	10	0.33,0.32,0.23;	0.18,0.20,0.14;	0.51,0.49,0.35

* : Number of seedlings surviving (upper figure)
Number of seedlings planted (lower figure)

A.7.4.4.7 4.4.3.4 (Experiment 6c)

Dry weight (mg) : mean, standard deviation, 95% limits.

Conditions	*	Root	Shoot	Total
Rumex				
NRh.-N	9	5.11,2.17,1.67;	7.93,2.09,1.61;	13.04,3.23,2.48
	10	4.60,2.61,1.87;	7.14,3.19,2.28;	11.74,5.16,3.69
NRh.+1N	9	2.81,1.51,1.16;	10.35,2.99,2.30;	13.17,2.69,2.07
	10	2.53,1.68,1.20;	9.32,4.32,3.09;	11.85,4.88,3.49
NRh.+2N	10	1.88,0.83,0.59;	4.87,2.71,1.94;	6.75,2.96,2.12
NRh.+10N	10	7.04,2.49,1.78;	32.51,9.02,6.45;	39.55,8.53,6.10
Rh.-R-N	7	5.10,2.76,2.55;	11.74,6.88,6.36;	16.84,9.25,8.56
	10	3.57,3.34,2.39;	8.22,7.98,5.71;	11.79,11.10,7.94
Rh.-R+1N	10	2.01,0.76,0.54;	4.28,1.05,0.75;	6.29,1.53,1.09
Rh.-R+2N	7	4.04,1.45,1.34;	7.54,3.91,3.62;	11.59,5.13,4.75
	10	2.83,2.28,1.63;	5.28,4.84,3.46;	8.11,6.99,5.00
Rh.-R+10N	9	2.26,0.69,0.53;	11.66,2.48,1.91;	13.91,3.01,2.31
	10	2.03,0.96,0.69;	10.49,4.37,3.13;	12.52,5.23,3.74
Rh.+R-N	10	1.70,1.06,0.76;	2.16,0.62,0.44;	3.76,1.41,1.01

Conditions	*	Root	Shoot	Total
Rh.+R+1N	9	2.02,0.85,0.65;	4.62,2.08,1.60;	6.64,2.78,2.14
	10	1.82,1.03,0.74;	4.16,2.44,1.75;	5.98,3.36,2.40
Rh.+R+2N	9	3.44,1.70,1.31;	6.38,2.60,2.00;	9.81,2.94,2.26
	10	3.10,1.94,1.39;	5.74,3.18,2.28;	8.83,4.16,2.98
Rh.+R+10N	8	1.80,0.37,0.31;	8.66,3.75,3.14;	10.46,3.80,3.18
	10	1.44,0.83,0.59;	6.93,4.93,3.53;	8.37,5.54,3.96
Rh.-N	10	1.81,0.40,0.29;	2.70,0.70,0.50;	4.41,0.76,0.54

4.4.3.4 (Experiment 6)

A.7.4.4.2 Statistical significance of data

Results from the different conditions were tested by Student's t-test. (not significant at 5% = ns.)

A.7.4.4.2.1 Festuca

	Significance at % level, i or d		
	Root	Shoot	Total
NRh.+1N vs NRh.-N	d ns	d ns	d ns
NRh.+2N vs NRh.-N	i ns	i ns	i ns
Rh.NMyc+1N vs Rh.NMyc-N	d ns	i ns	d ns
Rh.NMyc+2N vs Rh.NMyc-N	i ns	i 1%	i 5%
Rh.Myc+1N vs Rh.Myc-N	i 5%	i 5%	i 5%
Rh.Myc+2N vs Rh.Myc-N	i 1%	i 1%	i 1%
Rh.NMyc-N vs NRh.-N	d 0.1%	d 0.1%	d 0.1%
Rh.Myc-N vs NRh.-N	d 0.1%	d 0.1%	d 0.1%
Rh.NMyc+1N vs NRh.+1N	d 1%	d 0.1%	d 0.1%
Rh.Myc+1N vs NRh.+1N	d 5%	d 0.1%	d 0.1%
Rh.NMyc+2N vs NRh.+2N	d 0.1%	d 0.1%	d 0.1%
Rh.Myc+2N vs NRh.+2N	d 0.1%	d 0.1%	d 0.1%
Rh.Myc-N vs Rh.NMyc-N	d ns	d ns	d ns
Rh.Myc+1N vs Rh.NMyc+1N	d ns	i ns	i ns
Rh.Myc+2N vs Rh.NMyc+2N	i ns	d ns	i ns

A.7.4.4.2.2 Rumex

	Significance at % level, i or d		
	Root	Shoot	Total
NRh.+1N vs NRh.-N	i 0.1%	i 0.1%	i 0.1%
NRh.+2N vs NRh.-N	i 1%	i 1%	i 1%
Rh.NMyc+1N vs Rh.NMyc-N	i ns	i ns	i ns
Rh.NMyc+2N vs Rh.NMyc-N	i ns	i 1%	i 1%
Rh.Myc+1N vs Rh.Myc-N	i ns	i ns	i ns
Rh.Myc+2N vs Rh.Myc-N	i ns	i ns	i ns
Rh.NMyc-N vs NRh.-N	d 1%	d ns	d ns
Rh.Myc-N vs NRh.-N	d 1%	d ns	d 2%
Rh.NMyc+1N vs NRh.+1N	d 0.1%	d 0.1%	d 0.1%
Rh.Myc+1N vs NRh.+1N	d 0.1%	d 0.1%	d 0.1%
Rh.NMyc+2N vs NRh.+2N	d 1%	d 1%	d 1%
Rh.Myc+2N vs NRh.+2N	d 0.2%	d 0.2%	d 0.2%
Rh.Myc-N vs Rh.NMyc-N	i ns	d ns	d ns
Rh.Myc+1N vs Rh.NMyc+1N	i ns	d ns	i ns
Rh.Myc+2N vs Rh.NMyc+2N	d ns	d ns	d 5%

A.7.4.4.2.3 Trifolium

	Significance at % level, i or d		
	Root	Shoot	Total
NRh.+1N vs NRh.-N	i 5%	i 5%	i 5%
NRh.+2N vs NRh.-N	i 0.1%	i 0.1%	i 0.1%
Rh.NMyc+1N vs Rh.NMyc-N	d ns	d ns	d ns
Rh.NMyc+2N vs Rh.NMyc-N	i ns	i ns	i ns
Rh.Myc+1N vs Rh.Myc-N	d ns	d ns	d ns
Rh.Myc+2N vs Rh.Myc-N	i 1%	i ns	i 2%
Rh.NMyc-N vs NRh.-N	d ns	i ns	i ns
Rh.Myc-N vs NRh.-N	i ns	i ns	i ns
Rh.NMyc+1N vs NRh.+1N	d 1%	d ns	d 5%
Rh.Myc+1N vs NRh.+1N	d 1%	d 2%	d 1%
Rh.NMyc+2N vs NRh.+2N	d 0.1%	d 0.1%	d 0.1%
Rh.Myc+2N vs NRh.+2N	d 0.1%	d 0.1%	d 0.1%
Rh.Myc-N vs Rh.NMyc-N	i ns	d ns	d ns
Rh.Myc+1N vs Rh.NMyc+1N	i ns	d ns	d ns
Rh.Myc+2N vs Rh.NMyc+2N	i ns	i ns	i ns

A.7.4.4.2.4 Festuca

	Root	Shoot	Total
NRh.+1N vs NRh.-N	i ns	i ns	i ns
NRh.+2N vs NRh.-N	i ns	i 5%	i ns
NRh.+10N vs NRh.-N	i 0.1%	i 2%	i 2%
Rh.-R+1N vs Rh.-R-N	i 2%	i ns	i ns
Rh.-R+2N vs Rh.-R-N	i ns	i ns	i ns
Rh.-R+10N vs Rh.-R-N	i 5%	i 5%	i 5%
Rh.+R+1N vs Rh.+R-N	i ns	i ns	i ns
Rh.+R+2N vs Rh.+R-N	i 5%	i 1%	i 1%
Rh.+R+10N vs Rh.+R-N	i 0.1%	i 0.1%	i 0.1%
Rh.-R-N vs NRh.-N	d ns	i ns	d ns
Rh.+R-N vs NRh.-N	d ns	d 0.2%	d 1%
Rh.-N vs NRh.-N	d ns	d 0.2%	d 1%
Rh.-R+1N vs NRh.+1N	i ns	i ns	i ns
Rh.+R+1N vs NRh.+1N	d ns	d 2%	d 5%
Rh.-R+2N vs NRh.+2N	d ns	d ns	d ns
Rh.+R+2N vs NRh.+2N	d ns	d 0.2%	d 1%
Rh.-R+10N vs NRh.+10N	d 5%	d ns	d ns
Rh.+R+10N vs NRh.+10N	d ns	d 2%	d 5%
Rh.-R-N vs Rh.-N	i ns	i 5%	i 5%
Rh.+R-N vs Rh.-N	i ns	i ns	i ns
Rh.-R-N vs Rh.+R-N	i ns	i 5%	i 5%
Rh.-R+1N vs Rh.+R+1N	i 1%	i 0.1%	i 0.1%
Rh.-R+2N vs Rh.+R+2N	i ns	i 5%	i ns
Rh.-R+10N vs Rh.+R+10N	d ns	i ns	i ns

A.7.4.4.2.5 Rumex

	Root	Shoot	Total
NRh.+1N vs NRh.-N	i ns	i ns	i ns
NRh.+2N vs NRh.-N	i ns	i ns	i ns
NRh.+10N vs NRh.-N	i 0.1%	i 0.1%	i 0.1%
Rh.-R+1N vs Rh.-R-N	d 5%	d 2%	d 2%
Rh.-R+2N vs Rh.-R-N	d ns	d 5%	d 5%
Rh.-R+10N vs Rh.-R-N	d 2%	i 5%	i 2%
Rh.+R+1N vs Rh.+R-N	i 1%	i ns	i ns
Rh.+R+2N vs Rh.+R-N	d ns	d ns	d ns
Rh.+R+10N vs Rh.+R-N	i 0.1%	i 0.2%	i 0.1%
Rh.-R-N vs NRh.-N	d ns	d ns	d ns
Rh.+R-N vs NRh.-N	d 1%	d 1%	d 1%
Rh.-N vs NRh.-N	d 0.2%	d 1%	d 0.2%
Rh.-R+1N vs NRh.+1N	d 0.1%	d 0.2%	d 0.1%
Rh.+R+1N vs NRh.+1N	d 0.2%	d 1%	d 0 1%
Rh.-R+2N vs NRh.+2N	d 1%	d 0.1%	d 0.1%
Rh.+R+2N vs NRh.+2N	d 0.1%	d 0.1%	d 0.1%
Rh.-R+10N vs NRh.+10N	d 0.1%	d 0.1%	d 0.1
Rh.+R+10N vs NRh.+10N	d 1%	d 0.1%	d 0.1%
Rh.-R-N vs Rh.-N	i 0.1%	i 0.2%	i 0.1%
Rh.+R-N vs Rh.-N	i ns	i ns	i ns
Rh.-R-N vs Rh.+R-N	i 0.1%	i 1%	i 0.2%
Rh.-R+1N vs Rh.+R+1N	d ns	d ns	d ns
Rh.-R+2N vs Rh.+R+2N	i ns	i ns	i ns
Rh.-R+10N vs Rh.+R+10N	d ns	i ns	d ns

A.7.4.4.2.6 Festuca

	Root	Shoot	Total
NRh.+1N vs NRh.-N	d ns	d 2%	d 5%
NRh.+2N vs NRh.-N	i ns	d ns	d ns
NRh.+10N vs NRh.-N	i 1%	i 1%	i 1%
Rh.-R+1N vs Rh.-R-N	i ns	i 5%	i 5%
Rh.-R+2N vs Rh.-R-N	i 5%	i 0.1%	i 0.1%
Rh.-R+10N vs Rh.-R-N	i 5%	i 1%	i 2%
Rh.+R+1N vs Rh.+R-N	i ns	i ns	i ns
Rh.+R+2N vs Rh.+R-N	i ns	i ns	i ns
Rh.+R+10N vs Rh.+R-N	i 1%	i 2%	i 1%
Rh.-R-N vs NRh.-N	d 5%	d 1%	d 1%
Rh.+R-N vs NRh.-N	d 5%	d 0.1%	d 0.2/
Rh.-N vs NRh.-N	d ns	d 0.1%	d 0.2°
Rh.-R+1N vs NRh.+1N	i ns	i ns	i ns
Rh.+R+1N vs NRh.+1N	d ns	d ns	d ns
Rh.-R+2N vs NRh.+2N	i ns	i ns	i ns
Rh.+R+2N vs NRh.+2N	d ns	d ns	d ns
Rh.-R+10N vs NRh.+10N	d 1%	d 5%	d 5%
Rh.+R+10N vs NRh.+10N	d ns	d ns	d ns
Rh.-R-N vs Rh.-N	d ns	i 1%	i 5%
Rh.+R-N vs Rh.-N	d ns	i ns	i ns
Rh.-R-N vs Rh.+R-N	i ns	i 2%	i 5%
Rh.-R+1N vs Rh.+R+1N	i ns	i 1%	i 2%
Rh.-R+2N vs Rh.+R+2N	i ns	i 0.1%	i 0.1%
Rh.-R+10N vs Rh.+R+10N	d ns	d ns	d ns

A.7.4.4.2.7 Rumex

	Root	Shoot	Total
NRh.+1N vs NRh.-N	d 5%	i ns	i ns
NRh.+2N vs NRh.-N	d 1%	i ns	d 2%
NRh.+10N vs NRh.-N	i 5%	i 0.1%	i 0.1%
Rh.-R+1N vs Rh.-R-N	d ns	d ns	d ns
Rh.-R+2N vs Rh.-R-N	d ns	d ns	d ns
Rh.-R+10N vs Rh.-R-N	d ns	i ns	i ns
Rh.+R+1N vs Rh.+R-N	i ns	i 5%	i ns
Rh.+R+2N vs Rh.+R-N	i ns	i 1%	i 0.2%
Rh.+R+10N vs Rh.+R-N	d ns	i 1%	i 5%
Rh.-R-N vs NRh.-N	d ns	i ns	i ns
Rh.+R-N vs NRh.-N	d 1%	d 0.1%	d 0.1%
Rh.-N vs NRh.-N	d 1%	d 0.1%	d 0. %
Rh.-R+1N vs NRh.+1N	d ns	d 1%	d 1°
Rh.+R+1N vs NRh.+1N	d ns	d 1%	d 1%
Rh.-R+2N vs NRh.+2N	i ns	i ns	i ns
Rh.+R+2N vs NRh.+2N	i ns	i ns	i ns
Rh.-R+10N vs NRh.+10N	d 0.1%	d 0.1%	d 0.1%
Rh.+R+10N vs NRh.+10N	d 0.1%	d 0.1%	d 0.1%
Rh.-R-N vs Rh.-N	i ns	i 5%	i ns
Rh.+R-N vs Rh.-N	d ns	d ns	d ns
Rh.-R-N vs Rh.+R-N	i ns	i 5%	i 5%
Rh.-R+1N vs Rh.+R+1N	i ns	i ns	i ns
Rh.-R+2N vs Rh.+R+2N	d ns	d ns	d ns
Rh.-R+10N vs Rh.+R+10N	i ns	i ns	i ns

A.7.4.5 4.5.3 (Investigation into the interference phenomenon in the field)

A.7.4.5.1 Bioassay results, seedling dry weights (F. ovina)

Treatment	Mean dry weight (mg) of surviving seedlings Standard deviation in () and 95% confidence limits						
	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s	n
1 A Rh.US	0.10(0.04)	0.03	0.38(0.23)	0.17	0.48(0.25)	0.18	10
1 A Rh.S	0.06(0.05)	0.04	0.35(0.19)	0.14	0.41(0.19)	0.14	10
1 A Rh.US+L	0.14(0.11)	0.08	0.20(0.23)	0.17	0.34(0.32)	0.23	10
1 A Rh.S+L	0.11(0.09)	0.08	0.21(0.21)	0.19	0.32(0.24)	0.22	7
1 A Rh.US+F	0.06(0.07)	0.05	0.22(0.17)	0.13	0.28(0.23)	0.18	9
1 A Rh.S+F	0.13(0.12)	0.09	0.18(0.11)	0.08	0.31(0.22)	0.16	10
1 A Rh.	0.08(0.03)	0.03	0.18(0.07)	0.06	0.26(0.08)	0.07	8
1 A Rh.+L	0 (-)	-	0.40(-)	-	0.40(-)	-	1
1 A Rh.+F	0.14(0.08)	0.13	0.43(0.10)	0.16	0.56(0.15)	0.24	4
1 A NRh.US	0.31(0.19)	0.14	0.38(0.19)	0.14	0.69(0.36)	0.26	10
1 A NRh.S	0.32(0.30)	0.22	0.36(0.29)	0.21	0.68(0.58)	0.42	10
2 A Rh.US	0.21(0.09)	0.06	0.36(0.20)	0.14	0.51(0.27)	0.19	10
2 A Rh.S	0.18(0.09)	0.08	0.23(0.046)	0.04	0.39(0.08)	0.07	8
2 A Rh.US+l	0.36(0.14)	0.10	0.45(0.24)	0.17	0.81(0.30)	0.22	10
2 A Rh.S+L	0.22(0.13)	0.09	0.25(0.10)	0.07	0.44(0.21)	0.15	10
2 A Rh.US+F	0.20(0.16)	0.12	0.28(0.20)	0.14	0.48(0.35)	0.25	10
2 A Rh.S+F	0.17(0.08)	0.06	0.33(0.20)	0.14	0.50(0.24)	0.17	10
2 A Rh.	0.09(0.08)	0.07	0.14(0.05)	0.05	0.24(0.13)	0.12	7
2 A Rh.+L	0.23(0.11)	0.08	0.24(0.07)	0.05	0.47(0.12)	0.09	10
2 A Rh.+F	0.13(0.05)	0.08	0.15(0.06)	0.10	0.28(0.10)	0.16	4
2 A NRh.US	0.21(0.16)	0.13	0.38(0.27)	0.23	0.59(0.42)	0.35	8
2 A NRh.S	0.23(0.07)	0.05	0.31(0.10)	0.07	0.54(0.14)	0.10	10

Treatment	Mean dry weight (mg) of surviving seedlings Standard deviation in () and 95% confidence limits						
	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s	n
3 A Rh. S	0.03(0.03)	0.02	0.10(0.04)	0.03	0.13(0.04)	0.03	10
3 A Rh.S	0.01(0.0)	0.01	0.16(0.07)	0.05	0.17(0.07)	0.05	10
3 A Rh.US+L	0.08(0.07)	0.05	0.13(0.08)	0.06	0.20(0.14)	0.10	10
A Rh.S+L	0.1 (-)	-	0.10(-)	-	0.20(-)	-	1
A R .U +F	0. 3 0. 4)	0.03	0.09(0.05)	0.04	0.12(0.05)	0.05	10
3 A Rh.S+F	0. 6(0.05)	0.04	0.13(0.06)	0.05	0.19(0.09)	0.08	8
3 A Rh.	. 7(. 4)	0.03	0.15(0.05)	0.04	0.22(0.08)	0.06	10
A Rh.+L	.1 (. 8)	0.06	0.19(0.14)	0.10	0.30(0.22)	0.16	10
A .+F	. 7 .)	0.06	0.15(0.06)	0.04	0.22(0.13)	0.09	10
A NRh.US	0. 5 . 3	0.02	0.15(0.08)	0.06	0.20(0.09)	0.06	10
A N h.S	. .)	0.02	0.16 0.07	0.05	0.22(0.09)	0.06	10
4 A R .U	.19 . 9)	0.06	0.34 0.14	0.10	0.53(0.19)	0.14	10
4 A R .	. . 1	0.08	0.44 0.21	0.15	0.70(0.24)	0.17	10
A h. +L	.19 .11	0.08	0.29 0.12)	0.09	0.51(0.19)	0.14	10
4 A . +L	.19 .13)	.09	0.37 .12)	0.09	0.56(0.17)	0.12	10
4 A h.US+F	.54 . 7	0.19	0.56(0.20	0.14	1.10(0.42)	0.30	10
.S+F	. 7 .1	0. 9	0.53 0.13	0.09	0.80(0.17)	0.12	10
4 A .	0.2 .1	0.09	0.55(0.22)	0.16	0.80(0.29)	0.21	10
4 A I .+L	. .12	0.09	0.51(0. 3)	0.23	0.79(0.37)	0.27	10
4 A h.+F	0.2 .09)	0. 6	0.43 0.19)	0.14	0.63(0.21)	0.15	10
4 A N . S	.4 0.18	0.13	0.55 0.27)	0.19	0.97(0.36)	0.26	10
4 A N .S	0.35 0.1	0.09	0. 2(0.26)	0.19	0.87(0.35)	0.25	10

Treatment	Mean dry weight (mg) of surviving seedlings Standard deviation in () and 95% confidence limits						
	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s	n
1 B Rh.US	0.06(0.03)	0.02	0.08(0.03)	0.02	0.15(0.04)	0.03	9
1 B h.S	0.05(0.03)	0.02	0.08(0.03)	0.02	0.13(0.05)	0.04	10
1 B Rh.US L	0.11(0.10)	0.08	0.19(0.06)	0.05	0.29(0.15)	0.13	8
1 B h.S+L	0.08(0.03)	0.04	0.17(0.14)	0.17	0.25(0.15)	0.19	5
1 B Rh.US+F	0.08(0.05)	0.04	0.10(0.04)	0.03	0.17(0.08)	0.06	10
B Rh.S+F	0. .09)	0.06	0.12(0.06)	0.04	0.18(0.13)	0.09	10
1 B Rh.	0.02 0. 3)	0.02	0.13(0.08)	0.06	0.16(0.09)	0.06	10
1 B h.+L	0.03 0.0?)	0.05	0.14(0.08)	0.13	0.16(0.05)	0.08	4
1 B h.+F	. 4(. 3)	0.03	0.16 0.12)	0.10	0.21(0.13)	0.11	8
1 B N h.	.1 (.1)	0.12	0.18(0.13)	0.16	0.31(0.23)	0.29	5
N .S	.13 . 5	0.08	0.18(0.10)	0.16	0.30(0.14)	0.22	4
2 .US	.07 . 4	0.03	0.17(0.07)	0.05	0.24(0.09)	0.06	10
.S	0. 5 . 5	.05	0.15(0.06)	0.06	0.20(0.06)	0.06	6
R .U +L	0. . 4	0.36	.1 (0)	-	0.18(0.04)	0.36	2
B . +L	. 5 .05	0.12	0.10 0)	-	0.15(0.05)	0.12	3
B Rh.US	. 4 .04	0.03	0.11(0.04)	0.03	0.14(0.06)	0.05	8
B .S+F	. 6 . 5)	0. 5	0.17(0.05)	0.05	0.23(0.08)	0.08	6
h.	. 3 0.	0.0	0.11(0.04)	0.03	0.14(0.05)	0.04	10
B h.+	. 5 . 6	0.05	0.09 0.05	0.04	0.13(0.08)	0.07	8
Rh. F	0. 4 0.0	0.02	0.12 0.04)	0.03	0.17(0.07)	0.05	9
B N h.US	0.15 .12)	0.09	0.19 0.06)	0.05	0.34(0.16)	0.12	9
N h.S	0. 8 .03)	0.02	0.17(0.05)	0.04	0.26(0.06)	0.04	10

Treatment	Mean dry weight (mg) of surviving seedlings Standard deviation in () and 95% confidence limits						
	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s	n
3 B Rh.US	0.08(0.06)	0.04	0.15(0.05)	0.04	0.23(0.09)	0.06	10
3 B Rh.S	0.04(0.04)	0.03	0.13(0.05)	0.04	0.18(0.07)	0.05	10
3 B Rh.US+L	0.03(0.05)	0.04	0.16(0.06)	0.05	0.18(0.09)	0.08	8
3 B Rh.S+L	0.05(0.04)	0.03	0.17(0.08)	0.06	0.22(0.08)	0.06	10
3 B Rh.US+F	0.11(0.14)	0.10	0.29(0.19)	0.14	0.40(0.28)	0.20	10
3 B Rh.S+F	0.09(0.08)	0.06	0.18(0.10)	0.07	0.27(0.17)	0.12	10
3 B Rh.	0.07(0.08)	0.06	0.14(0.07)	0.05	0.22(0.13)	0.09	10
3 B Rh.+L	0.04(0.05)	0.05	0.17(0.05)	0.05	0.21(0.09)	0.10	6
3 B Rh.+F	0.04(0.07)	0.05	0.20(0.08)	0.06	0.24(0.09)	0.06	10
3 NRh.US	0.05(0.05)	0.04	0.21(0.06)	0.05	0.26(0.08)	0.07	8
3 NRh.S	0.10(0.06)	0.04	0.19(0.09)	0.06	0.29(0.10)	0.07	10
4 B Rh.US	0.06(0.08)	0.07	0.37(0.10)	0.09	0.43(0.13)	0.12	7
4 B Rh.S	0.10(0.09)	0.08	0.24(0.11)	0.09	0.34(0.13)	0.11	8
4 B Rh.US+L	0.09(0.16)	0.17	0.23(0.10)	0.11	0.33(0.18)	0.19	6
4 B Rh.S+L	0.07(0.12)	0.30	0.13(0.06)	0.15	0.20(0.17)	0.42	3
4 B Rh.US+F	0.08(0.10)	0.07	0.35(0.14)	0.10	0.43(0.18)	0.13	10
4 B Rh.S+F	0.11(0.09)	0.09	0.47(0.18)	0.17	0.59(0.20)	0.19	7
4 B Rh.	-		-		-		
4 B Rh.+L	0.04(0.05)	0.04	0.14(0.05)	0.04	0.18(0.10)	0.08	9
4 B Rh.+F	0.04(0.05)	0.05	0.16(0.22)	0.23	0.20(0.26)	0.27	6
4 B NRh.US	0.04(0.07)	0.05	0.20(0.07)	0.05	0.24(0.12)	0.09	10
4 B NRh.S	0.05(0.09)	0.07	0.32(0.17)	0.13	0.37(0.15)	0.12	9

(R.acetosa)

Treatment	Mean dry weight (mg) of surviving seedlings Standard deviation in () and 95% confidence limits						
	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s	n
1 A Rh.US	0.31(0.19)	0.14	0.93(0.35)	0.25	1.24(0.47)	0.34	10
1 A Rh.S	0.11(0.06)	0.04	0.32(0.12)	0.09	0.43(0.13)	0.09	10
1 A Rh.US+L	0.34(0.20)	0.14	1.16(0.47)	0.34	1.50(0.56)	0.40	10
1 A Rh.S+L	0.52(0.16)	0.12	1.45(0.50)	0.35	1.97(0.51)	0.37	10
1 A Rh.US+F	0.42(0.16)	0.12	1.14(0.32)	0.23	1.56(0.46)	0.33	10
1 A Rh.S+F	0.35(0.12)	0.09	1.53(0.48)	0.34	1.88(0.55)	0.39	10
1 A Rh.	0.13(0.05)	0.04	0.34(0.21)	0.15	0.47(0.20)	0.14	10
1 A Rh.+L	0.23(0.12)	0.09	0.68(0.37)	0.28	0.91(0.47)	0.36	9
1 Rh.+F	0.13(0.07)	0.05	0.42(0.32)	0.23	0.55(0.33)	0.24	10
1 A NRh.US	0.38(0.17)	0.12	1.31(0.61)	0.44	1.67(0.77)	0.55	10
1 A NRh.S	0.62(0.33)	0.24	1.02(0.37)	0.27	1.64(0.68)	0.49	10
2 A Rh.US	0.38(0.18)	0.13	1.59(0.72)	0.52	1.97(0.86)	0.62	10
2 A Rh.S	0.41(0.18)	0.13	1.18(0.46)	0.33	1.59(0.61)	0.44	10
2 A Rh.US+L	0.48(0.19)	0.14	1.15(0.54)	0.39	1.63(0.55)	0.39	10
2 A Rh.S+L	0.72(0.17)	0.12	2.07(0.91)	0.65	2.79(0.99)	0.71	10
2 A Rh.US+F	0.47(0.16)	0.12	1.94(0.87)	0.62	2.41(0.96)	0.60	10
2 A Rh.S+F	0.52(0.22)	0.16	1.94(0.87)	0.62	2.46(0.92)	0.66	10
2 A Rh.	0.45(0.18)	0.13	0.73(0.31)	0.22	1.15(0.45)	0.32	10
2 A Rh.+L	0.34(0.15)	0.11	0.67(0.55)	0.39	0.98(0.59)	0.42	10
2 A Rh.+F	0.42(0.20)	0.07	1.43(0.57)	0.41	1.76(0.59)	0.42	10
2 A NRh.US	0.46(0.18)	0.13	2.06(0.63)	0.45	2.52(0.64)	0.46	10
2 A NRh.S	0.51(0.28)	0.20	1.61(0.72)	0.52	2.12(0.87)	0.62	10

(R. acetosa)

Treatment	Mean dry weight (mg) of surviving seedlings Standard deviation in () and 95% confidence limits						
	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s	n
3 A Rh.US	0.18(0.10)	0.07	0.60(0.15)	0.11	0.77(0.16)	0.12	10
3 A Rh.S	0.20(0.13)	0.09	0.48(0.14)	0.10	0.68(0.22)	0.16	10
3 A Rh.US+L	0.14(0.08)	0.06	0.33(0.16)	0.12	0.47(0.20)	0.14	10
3 A Rh.S+L	0.08(0.03)	0.03	0.50(0.34)	0.28	0.59(0.35)	0.29	8
3 A Rh.US+F	0.21(0.09)	0.06	0.55(0.23)	0.17	0.76(0.30)	0.22	10
3 A Rh.S+F	0.10(0)	-	0.55(0.21)	0.15	0.65(0.21)	0.15	10
3 A Rh.	0.14(0.07)	0.05	0.52(0.25)	0.18	0.66(0.26)	0.19	10
3 A Rh.+L	0.34(0.12)	0.09	0.83(0.36)	0.26	1.14(0.35)	0.25	10
3 A Rh.+F	0.17(0.13)	0.09	0.56(0.15)	0.11	0.73(0.14)	0.10	10
3 A NRh.US	0.27(0.11)	0.08	0.78(0.59)	0.42	1.08(0.62)	0.44	10
3 A NRh.S	0.27(0.18)	0.13	0.90(0.33)	0.24	1.17(0.37)	0.27	10
4 A Rh.US	0.31(0.15)	0.11	0.67(0.16)	0.12	0.98(0.20)	0.14	10
4 A Rh.S	0.24(0.08)	0.06	0.71(0.31)	0.22	0.95(0.30)	0.22	10
4 A Rh.US+L	0.53(0.21)	0.15	1.14(0.46)	0.33	1.67(0.59)	0.42	10
4 A Rh.S+L	0.32(0.14)	0.10	1.27(0.36)	0.26	1.59(0.40)	0.29	10
4 A Rh.US+F	0.45(0.10)	0.07	1.15(0.45)	0.32	1.60(0.48)	0.34	10
4 A Rh.S+F	0.46(0.18)	0.13	1.00(0.32)	0.23	1.46(0.36)	0.26	10
4 A Rh.	0.18(0.09)	0.06	0.73(0.24)	0.17	0.91(0.25)	0.18	10
4 A Rh.+L	0.44(0.13)	0.09	1.19(0.38)	0.27	1.63(0.40)	0.29	10
4 A Rh.+F	0.27(0.16)	0.12	1.09(0.23)	0.17	1.36(0.38)	0.27	10
4 A NRh.US	0.81(0.39)	0.28	1.42(0.36)	0.26	2.23(0.58)	0.42	10
4 A NRh.S	0.43(0.32)	0.23	1.05(0.48)	0.34	1.48(0.52)	0.37	10

Treatment	Mean dry weight (mg) of surviving seedlings Standard deviation in () and 95% confidence limits						
	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s	n
1 B Rh.US	0.17(0.08)	0.06	0.35(0.29)	0.21	0.52(0.33)	0.24	10
1 B Rh.S	0.12(0.04)	0.03	0.49(0.33)	0.24	0.61(0.34)	0.24	10
1 B Rh.US+L	0.18(0.09)	0.06	0.36(0.12)	0.09	0.54(0.12)	0.09	10
1 B Rh.S+L	0.21(0.12)	0.11	0.23(0.05)	0.05	0.44(0.13)	0.12	7
1 B Rh.US+F	0.25(0.07)	0.05	0.37(0.16)	0.12	0.62(0.21)	0.15	10
1 B Rh.S+F	0.24(0.11)	0.08	0.47(0.18)	0.13	0.71(0.24)	0.17	10
1 B Rh.	0.16 0.10)	0.08	0.33(0.16)	0.12	0.49(0.21)	0.16	9
1 B Rh.+L	.11(0.04)	0.04	0.27(0.14)	0.13	0.39(0.14)	0.13	7
1 B Rh.+F	.09(0. 5)	0.04	0.16(0.09)	0.07	0.25(0.13)	0.10	9
1 B N h.US	0.19(0.07)	0.05	0.36(0.11)	0.08	0.55(0.16)	0.12	10
1 B N h.S	0.17 0.08)	0.06	0.42(0.28)	0.20	0.59(0.27)	0.19	10
B Rh.US	.18 0.14)	0.11	0.36(0.24)	0.19	0.54(0.34)	0.26	9
B Rh.S	.14 0.07)	0.05	0.32(0.2)	0.14	0.46(0.23)	0.17	10
B Rh.US+L	. 1 .12)	0.09	0.24 0.05)	0.04	0.45(0.14)	0.11	9
B Rh.S+L	0.1 . 7)	0.06	0.13 0.08)	0.07	0.23(0.14)	0.12	8
2 B .US+F	.13 .05)	0.05	0.17 0.05)	0.05	0.30(0.09)	0.10	6
B h.S+F	.2 .09)	0.06	0.31 0.21)	0.15	0.51(0.29)	0.21	10
2 B Rh.	.11(0.07)	0.05	0.18 0.09)	0.06	0.29(0.15)	0.11	10
B Rh.+L	0. 9 0. 5	.05	0.18 0.10)	0.09	0.27(0.14)	0.13	7
2 B Rh.+F	.2 0.11)	0.09	0.22(0.19)	0.15	0.44(0.17)	0.13	9
B N h.US	0.14 . 8)	0.06	0.42 0.17)	0.12	0.56(0.23)	0.17	10
2 B NRh.S	.29 .15)	0.11	0.42 0.15	0.11	0.71(0.21)	0.15	10

Treatment	Mean dry weight (mg) of surviving seedlings Standard deviation in () and 95% confidence limits						
	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s	n
3 B Rh.US	0.12(0.06)	0.04	0.30(0.18)	0.13	0.42(0.22)	0.16	10
3 B Rh.S	0.18(0.08)	0.06	0.35(0.11)	0.08	0.53(0.17)	0.12	10
3 B Rh.US+L	0.22(0.11)	0.08	0.37(0.16)	0.12	0.59(0.25)	0.18	10
3 B Rh.S+L	0.12(0.04)	0.03	0.41(0.20)	0.14	0.53(0.20)	0.14	10
3 B Rh.US+F	0.13(0.05)	0.04	0.32(0.09)	0.06	0.46(0.17)	0.12	10
3 B Rh.S+F	0.14(0.05)	0.04	0.32(0.17)	0.12	0.46(0.20)	0.14	10
3 B Rh.	0.08(0.03)	0.02	0.25(0.09)	0.06	0.33(0.20)	0.14	10
3 B Rh.+L	0.20(0.09)	0.07	0.42(0.22)	0.17	0.62(0.28)	0.22	9
3 B Rh.+F	0.19(0.10)	0.07	0.34(0.17)	0.12	0.53(0.18)	0.13	10
3 B NRh.US	0.12(0.08)	0.06	0.40(0.15)	0.11	0.52(0.19)	0.14	10
3 B NRh.S	0.16(0.08)	0.06	0.50(0.34)	0.24	0.66(0.32)	0.23	10
4 B Rh.US	0.17(0.10)	0.07	0.48(0.17)	0.12	0.65(0.14)	0.10	10
4 B Rh.S	0.13(0.05)	0.04	0.45(0.11)	0.08	0.58(0.12)	0.09	10
4 B Rh.US+L	0.16(0.05)	0.04	0.45(0.11)	0.08	0.60(0.13)	0.09	10
4 B Rh.S+L	0.14(0.13)	0.09	0.48(0.09)	0.06	0.62(0.10)	0.07	10
4 B Rh.US+F	0.10(0.08)	0.06	0.61(0.21)	0.15	0.71(0.23)	0.17	10
4 B Rh.S+F	0.18(0.06)	0.04	0.35(0.11)	0.08	0.53(0.12)	0.09	10
4 B Rh.	0.19(0.15)	0.11	0.37(0.15)	0.11	0.56(0.19)	0.14	10
4 B Rh.+L	0.17(0.13)	0.09	0.36(0.17)	0.12	0.53(0.23)	0.17	10
4 B Rh.+F	0.14(0.10)	0.07	0.48(0.08)	0.06	0.62(0.12)	0.09	10
4 B NRh.US	0.19(0.15)	0.11	0.56(0.50)	0.36	0.78(0.61)	0.44	10
4 B NRh.S	0.19(0.12)	0.09	0.48(0.19)	0.14	0.67(0.23)	0.17	10

A.7.4.5.2 Bioassay results as means of seedlings planted

(Only results given are those for which the mean or standard deviation differ from the values for 'surviving seedlings')

Treatment	Mean dry weight (mg) of seedlings planted Standard deviation in () and 95% confidence limits n = 10					
	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s
(F. ovina)						
1 A Rh.S+L	0.08(0.09)	0.06	0.15(0.20)	0.14	0.23(0.25)	0.18
1 A Rh.US+F	0.06(0.06)	0.04	0.20(0.18)	0.13	0.26(0.24)	0.17
1 A Rh.	0.07(0.04)	0.03	0.14(0.10)	0.07	0.21(0.13)	0.09
1 A Rh.+L	0	-	0.04(0.13)	0.09	0.05(0.13)	0.09
1 A Rh.+F	0.06(0.08)	0.06	0.17(0.23)	0.17	0.23(0.30)	0.22
2 A Rh.S	0.14(0.11)	0.08	0.18(0.10)	0.07	0.31(0.18)	0.13
2 A Rh.	0.07(0.08)	0.06	0.10(0.08)	0.06	0.17(0.16)	0.12
2 A Rh.+F	0.05(0.07)	0.05	0.06(0.08)	0.06	0.11(0.15)	0.11
2 A NRh.US	0.17(0.16)	0.12	0.30(0.29)	0.21	0.47(0.45)	0.32
3 A Rh.S+L	0.01(0.03)	0.02	0.01(0.03)	0.02	0.02(0.06)	0.04
3 A Rh.S+F	0.05(0.05)	0.04	0.11(0.08)	0.06	0.16(0.11)	0.08
4 A	No change					

	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s
1 B Rh.US	0.06(0.03)	0.02	0.08(0.04)	0.03	0.14(0.06)	0.04
1 B Rh.US+L	0.09(0.10)	0.07	0.15(0.10)	0.07	0.24(0.18)	0.13
1 B Rh.S+L	0.04(0.05)	0.04	0.09(0.13)	0.09	0.13(0.17)	0.12
1 B Rh.+L	0.01(0.02)	0.01	0.06(0.08)	0.06	0.07(0.09)	0.06
1 B Rh.+F	0.04(0.03)	0.02	0.13(0.12)	0.09	0.17(0.14)	0.10
1 B NRh.US	0.06(0.10)	0.07	0.09(0.13)	0.09	0.16(0.22)	0.16
1 B NRh.S	0.05(0.07)	0.05	0.07(0.11)	0.08	0.12(0.18)	0.13
2 B Rh.S	0.03(0.04)	0.03	0.09(0.09)	0.06	0.12(0.11)	0.08
2 B Rh.US+L	0.02(0.03)	0.02	0.02(0.04)	0.03	0.04(0.08)	0.06
2 B Rh.S+L	0.02(0.03)	0.02	0.03(0.05)	0.04	0.05(0.08)	0.06
2 B Rh.US+F	0.03(0.04)	0.03	0.09(0.05)	0.04	0.12(0.08)	0.06
2 B Rh.S+F	0.04(0.05)	0.04	0.10(0.09)	0.06	0.14(0.13)	0.09
2 B Rh.+L	0.04(0.06)	0.04	0.08(0.06)	0.04	0.11(0.09)	0.06
2 B Rh.+F	0.04(0.03)	0.02	0.11(0.06)	0.04	0.15(0.08)	0.06
2 B NRh.US	0.14(0.12)	0.09	0.17(0.08)	0.06	0.31(0.19)	0.14
3 B Rh.US+L	0.02(0.04)	0.03	0.13(0.09)	0.06	0.15(0.11)	0.08
3 B Rh.+L	0.03(0.04)	0.03	0.10(0.09)	0.06	0.13(0.13)	0.09
3 B NRh.US	0.04(0.05)	0.04	0.17(0.11)	0.08	0.21(0.13)	0.09
4 B Rh.US	0.04(0.07)	0.05	0.26(0.20)	0.14	0.27(0.22)	0.16
4 B Rh.S	0.08(0.09)	0.06	0.19(0.14)	0.10	0.27(0.18)	0.13
4 B Rh.US+L	0.06(0.13)	0.09	0.14(0.14)	0.10	0.20(0.21)	0.15
4 B Rh.S+L	0.02(0.06)	0.04	0.04(0.07)	0.05	0.06(0.13)	0.09
4 B Rh.US+F	0.08(0.10)	0.07	0.35(0.14)	0.10	0.43(0.18)	0.13
4 B Rh.S+F	0.08(0.09)	0.06	0.33(0.27)	0.19	0.41(0.33)	0.24
4 B Rh.+L	0.04(0.05)	0.04	0.13(0.07)	0.05	0.16(0.11)	0.08
4 B Rh.+F	0.03(0.04)	0.03	0.10(0.18)	0.13	0.12(0.22)	0.16
4 B NRh.S	0.05(0.08)	0.06	0.29(0.19)	0.14	0.34(0.19)	0.14

	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s
1 B Rh.US	0.06(0.03)	0.02	0.08(0.04)	0.03	0.14(0.06)	0.04
1 B Rh.US+L	0.09(0.10)	0.07	0.15(0.10)	0.07	0.24(0.18)	0.13
1 B Rh.S+L	0.04(0.05)	0.04	0.09(0.13)	0.09	0.13(0.17)	0.12
1 B Rh.+L	0.01(0.02)	0.01	0.06(0.08)	0.06	0.07(0.09)	0.06
1 B Rh.+F	0.04(0.03)	0.02	0.13(0.12)	0.09	0.17(0.14)	0.10
1 B NRh.US	0.06(0.10)	0.07	0.09(0.13)	0.09	0.16(0.22)	0.16
1 B NRh.S	0.05(0.07)	0.05	0.07(0.11)	0.08	0.12(0.18)	0.13
2 B Rh.S	0.03(0.04)	0.03	0.09(0.09)	0.06	0.12(0.11)	0.08
2 B Rh.US+L	0.02(0.03)	0.02	0.02(0.04)	0.03	0.04(0.08)	0.06
2 B Rh.S+L	0.02(0.03)	0.02	0.03(0.05)	0.04	0.05(0.08)	0.06
2 B Rh.US+F	0.03(0.04)	0.03	0.09(0.05)	0.04	0.12(0.08)	0.06
2 B Rh.S+F	0.04(0.05)	0.04	0.10(0.09)	0.06	0.14(0.13)	0.09
2 B Rh.+L	0.04(0.06)	0.04	0.08(0.06)	0.04	0.11(0.09)	0.06
2 B Rh.+F	0.04(0.03)	0.02	0.11(0.06)	0.04	0.15(0.08)	0.06
2 B NRh.US	0.14(0.12)	0.09	0.17(0.08)	0.06	0.31(0.19)	0.14
3 B Rh.US+L	0.02(0.04)	0.03	0.13(0.09)	0.06	0.15(0.11)	0.08
3 B Rh.+L	0.03(0.04)	0.03	0.10(0.09)	0.06	0.13(0.13)	0.09
3 B NRh.US	0.04(0.05)	0.04	0.17(0.11)	0.08	0.21(0.13)	0.09
4 B Rh.US	0.04(0.07)	0.05	0.26(0.20)	0.14	0.27(0.22)	0.16
4 B Rh.S	0.08(0.09)	0.06	0.19(0.14)	0.10	0.27(0.18)	0.13
4 B Rh.US+L	0.06(0.13)	0.09	0.14(0.14)	0.10	0.20(0.21)	0.15
4 B Rh.S+L	0.02(0.06)	0.04	0.04(0.07)	0.05	0.06(0.13)	0.09
4 B Rh.US+F	0.08(0.10)	0.07	0.35(0.14)	0.10	0.43(0.18)	0.13
4 B Rh.S+F	0.08(0.09)	0.06	0.33(0.27)	0.19	0.41(0.33)	0.24
4 B Rh.+L	0.04(0.05)	0.04	0.13(0.07)	0.05	0.16(0.11)	0.08
4 B Rh.+F	0.03(0.04)	0.03	0.10(0.18)	0.13	0.12(0.22)	0.16
4 B NRh.S	0.05(0.08)	0.06	0.29(0.19)	0.14	0.34(0.19)	0.14

	Root	95% cd.'s	Shoot	95% cd.'s	Total	95% cd.'s
(R. acetosa)						
1 A Rh.+L	0.21(0.14)	0.10	0.61(0.41)	0.29	0.82(0.53)	0.38
2 A	No change					
3 A Rh.S+L	0.07(0.05)	0.04	0.50(0.34)	0.24	0.59(0.35)	0.25
4 A	No change					
1 B Rh.S+L	0.15(0.14)	0.10	0.16(0.12)	0.09	0.31(0.24)	0.17
1 B Rh.	0.14(0.11)	0.09	0.30(0.18)	0.13	0.44(0.25)	0.18
1 B Rh.+L	0.08(0.06)	0.05	0.19(0.17)	0.12	0.27(0.22)	0.16
1 B Rh.+F	0.08(0.05)	0.04	0.15(0.10)	0.07	0.23(0.14)	0.10
2 B Rh.US	0.17(0.15)	0.11	0.32(0.25)	0.18	0.49(0.36)	0.26
2 B Rh.US+L	0.19(0.13)	0.09	0.22(0.09)	0.06	0.41(0.20)	0.14
2 B Rh.S+L	0.08(0.07)	0.05	0.11(0.09)	0.06	0.19(0.16)	0.12
2 B Rh.US+F	0.08(0.08)	0.06	0.10(0.09)	0.06	0.18(0.17)	0.12
2 B Rh.+L	0.07(0.06)	0.04	0.13(0.12)	0.09	0.19(0.17)	0.12
2 B Rh.+F	0.20(0.13)	0.09	0.20(0.12)	0.09	0.40(0.22)	0.16
3 B Rh.+L	0.18(0.10)	0.07	0.38(0.25)	0.18	0.56(0.33)	0.24
4 B	No change					