Project Number No 2055

KEY POINTS FROM A TECHNICAL SESSION OF THE NATIONAL FOREST FERTILISING CO_OP ON MAGNESIUM FERTILISING RADIATA PINE HELD IN KAINGAROA AND TAUHARA FORESTS

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Report No 34 November 1988

Key points from a technical day on Magnesium fertilising held in Kaingaroa and Tauhara forest , November 1988

1. Nutrition on the pumice plateau

Soils on the pumice plateau are dominated by events of 2000 years ago when the last major eruption occured. Broadly as one travels south through Kaingaroa forest, the altitude increases, temperature drops and the depth of pumice increases. In Northern Kaingaroa the pumice is shallow enough for the trees to be able to get through it to the buried topsoils and the temperature is warm enough for some weathering of the new material to take place. In Southern Kaingaroa the trees cannot get through the up to 6 metres of rubbly pumice and the low temperatures and high rainfall mean that the soil is strongly leached and weakly weathered. If a manufacturer had produced it we would call it a "slag-heap".

This shallow rooting in recent, leached and unweathered material means that the nutrition of radiata pine in Southern Kaingaroa is very different from that in Northern Kaingaroa. (See the attached table which comes from NZ J of For 30 pages 102-114). Whereas Northern Kaingaroa can be described as adequate for all nutrients except for marginal concentrations in N and Mg, southern Kaingaroa is better for N but not nearly so well off for P,B, and is clearly very marginal for Mg. Concentrations of K are also lower.

The two soil samples analysed by the DSIR show the differences very clearly. Both have similar CEC but the base saturation of the southern sample is abnormally low. The soil has very low levels of exchangeable Mg,Ca and K. This fragility may go some way to explaining some of the other changes in tree nutrition when Mg is applied. Most of the available Mg is in the top soil so practices which remove topsoil, such as windrowing , generate one class of site which will be Mg deficient. There is some exploitable Mg deeper in the soil so sites with a shallow soil due to the presence of a pan are also likely to be deficient. Grass seems to be able to out-compete radiata pine for Mg so very grassy sites may also show Mg deficiency. These are the three types of site on which we currently expect Mg deficiency.

Radiata pine appears to be less able than some other species to take up Mg from such soils. The grass and clover in Tauhara had a concentration of 0.2% Mg and did not appear (to a forester) to be Mg deficient. Eucalypts also appear to be able to take up more Mg and radiata pine growing in mixture seems to be able to access some of the recycling Mg. We may be able to exploit this. The table from the project record by Peter Knight, which is based on some pot trial work, shows this clearly.

2. Correction of magnesium deficiency

Mg deficiency does not show up strongly until the trees are three or more years old. It begins with bright yellow tipping of the older needles, generally stem needles in these younger trees, which lasts only a few weeks until the needles drop. But as the trees age the yellowing becomes more pronounced , height growth is affected and basal area growth reduced. The trees must be relying on internal recycling of Mg for a major part of their annual needs because any interruption in recycling, such as occurs with pruning, has an unexpectedly large depressing effect on subsequent growth.

Mg fertiliser applied to young trees on one of the deficient site types will prevent Mg deficiency from occuring. However we cannot narrow down the range of sites affected sufficiently to be able to predict with a good level of accuracy where deficiency will occur. We lack a good soil test. All tested types of Mg fertiliser are slow to take effect. Experiments to date have gone through a protracted period of sub-optimal growth before the Mg fertiliser has taken effect.

There are some side-effects of Mg fertilising . Calcium levels are also low in these soils. At times radiata pine has Ca concentrations close to or below the expected deficiency level. The two major fertiliser sources for Mg either contain substantial Ca (dolomite) or none at all (calcined magnesite), so the need for calcium is important. Trials to date show that calcium deficiency is not a factor. Calcium, magnesium and potassium interact. Application of one tends to drive down concentrations of the others. So it is not suprising to find that K concentrations are sometimes reduced when dolomite (Ca,Mg fertiliser) is applied. What is perhaps suprising is that Mg concentrations do not increase at the same rate. It is almost as if the expected side effects of Mg fertilising occur but the main effect does not ! "Liming" is known to affect boron levels by making B less available. The expected decrease occured where dolomite was used but pure sources of Mg also appear to lock up B.

3. Suggested future work

3.1 Continue maintenance of existing trial series.

The existing trial series is continuing to produce results of interest. The three trials in the RO2002 series are just at the point where they are beginning to produce strong results.

3.2 Continue support of Tim Payn's PhD study of magnesium and grass interactions.

3.3 Put some effort into calibrating the soil model brought back from the USA by Malcolm Skinner. This model appears to have the necessary characteristics to handle the types of soil and the rooting environment experienced by radiata pine in Southern Kaingaroa. Working with Tim Payn, we can attempt to incorporate weed competition effects.

3.4 The trial at time of planting shows that results can be achieved on only one of the three main deficient site types. We really need to put out more simple step out trials to see if the result is obtainable generally.

The end point of this strategy , and one that it is adequate to achieve, is accurate prediction of and cost effective correction of Mg deficiency on pumice soils.

TABLE 2: FOLIAGE NUTRIENT CONCENTRATIONS FROM UNFERTILISED PLOTS

Trial	*Element* % d.w.					ppm			
	N	*P*	*K*	*Ca*	*Mg*	*B*	*Zn*	*Ca*	*Mn*
1. TRIALS ON NORTHERN AND CENTRAL PUMICE SOILS									
Kaingaroa									
RO 1063	1.46	0.14			0.09				
RO 1083/1	1.43	0.19	1.10	0.14	0.08				
RO 1818	1.35	0.20			0.10				
RO 1843	1.35	0.22							
Fletchers									
RO 1952	1.28	0.19	1.01	0.17	0.08	12			
Tasman									
RO 1844	1.43	0.17				25			
2. TRIALS IN SOUTHERN KAINGAROA									
RO 1083/2	1.48	0.14			0.07				
RO 1970	1.51	0.14	0.82	0.17	0.07	10	43	10	
RO 1814	1.65	0.12	0.70	0.09	0.04	13	28	8	311
Nutrient concentration Considered · —									
adequate	1.5	0.15	0.80		0.10			5	
marginal								3	
deficient	1.2	0.12	0.40	0.10	0.08	8	10	2	10

Northern Kaingaroa

SOIL CHEMISTRY

Depth (in.)	0–3	5–7	$7\frac{1}{2}$–10	14–17	17–20	20–27	34–42	44–47
Horizon	A	AB	(B)	C	C	C	C	uAB
pH (moist soil, H_2O)	5.5	6.1	6.2	6.3	6.6	6.5		6.6
(dried soil, H_2O)	4.9	5.9	5.9	6.1	6.0	6.1		6.4
(dried soil, N KCl)	4.3	4.8	4.9	5.0	5.1	4.9		5.0
$CaCO_3$ %								
Cation exchange								
CEC me. %	31.3	8.7	6.9	4.2	3.4	2.6		6.0
TEB me. %	9.6	2.1	1.9	1.8	1.9	2.6		2.5
BS %	30	24	28	43	56	100		42
Ca me. %	6.3	0.9	0.7	0.6	0.3	0.4		1.3
Mg me. %	2.0	0.4	0.3	0.3	0.3	0.2		0.4
K me. %	0.78	0.53	0.65	0.60	0.72	1.07		0.43
Na me. %	0.2	0.2	0.3	0.4	0.5	0.6		0.3
Organic matter								
C %	10.1	2.3	1.4	0.6	0.2	0.3		0.6
N %	0.52	0.14	0.10	0.05	0.02	0.02		0.05
C/N	19	16	14	12	10	15		12
Phosphorus (P)								
Total mg %	92			31		32		
Organic mg %	67			10		3		
Inorganic mg %	25			21		29		
N H_2SO_4 mg %	5			6		15		
Truog mg %	0.5			0.2		0.5		
Citric mg %	15			3		5		
P retention %	63			43		13		
N/Organic P	8			5		7		
Potassium (K)								
Total me. %	36.5			50.0		47.1		
Exch. (moist) me. %								
K_c	0.08							
Magnesium (Mg)								
Acid-sol. me. %	1.3	1.3						
Sulphur (S)								
Total mg %	63		22			7		14
Adsorbed mg %	2	3	0.5	0	0	0	0	0
Tamm oxalate								
Al %	0.60			0.78		0.24		
Fe %	0.30			0.22		0.36		
Horizon weights								
Thickness (in.)	5	2	7	3	3	7	8	
Weight, lb/ac × 10^6	0.6	0.3	1.0	0.6	0.6	1.6	0.9	

Southern Kaingaroa.

SOIL CHEMISTRY

	*				
Depth (in.)	1–0	0–3	5–8	8–9	9–15
Horizon	O_1	A_1	B_2	B_{hfe}	C_1
pH (moist soil, H_2O)	5.5	4.8	5.0	5.0	5.2
(dried soil, H_2O)	5.8	4.0	5.0	5.1	5.2
(dried soil, N KCl)	4.7	3.8	4.4	4.6	5.0
$CaCO_3$ %					
Cation exchange					
CEC me.%		27.1	11.7	13.0	3.2
TEB me.%		0.8	0.3	0.3	0.2
BS %		3	3	2	6
Ca me.%		0.4	0.2	0.2	0.1
Mg me.%		0.4	0.1	0.1	0.2
K me.%		0.27	0.12	0.09	0.14
Na me.%		0.2	0.2	0.3	0.3
Organic matter					
C %		10.1	3.6	3.4	0.5
N %		0.42	0.18	0.14	0.03
C/N		24	20	24	17
Phosphorus (P)					
Total mg%	94	62	45		28
Organic mg%		36	22		3
Inorganic mg%		26	23		25
N H_2SO_4 mg%		6	5		12
Truog mg%		0.7	0.2		0.2
Citric mg%		8	8		6
P retention %		70	80		45
N/Organic P		12	8		10
Potassium (K)					
Total me.%		33.2	40.6		44.7
Exch. (moist) me.%					
K_c		0.07	0.08		
Magnesium (Mg)					
Acid-sol. me.%		0.7	0.8		
Sulphur (S)					
Total mg%		67			12
Adsorbed mg%		2	2	7	4
Tamm oxalate					
Al %		0.61	1.09		0.83
Fe %		0.45	0.37		0.27
Horizon weights					
Thickness (in.)	1	4	4	1	9
Weight, lb ac $\times 10^6$		0.5	0.6	0.1	1.7

* See separate litter analyses

From a project record by Peter Knight.

TABLE 2: APPARENT RECOVERY OF APPLIED NUTRIENTS BY CONTROL SEEDLINGS OF THE FOUR TRIAL SPECIES

(A) Macronutrients

Treatment	N	P	K	Ca	Mg	S	Na
	- - - - -Apparent recovery of applied nutrient (%)- - - - -						
P. radiata	22.9	13.3	35.0	6.4	8.4	13.3	17.3
E. fastigata	62.4	50.3	75.1	56.0	67.8	64.5	119.3
E. regnans	62.8	46.4	75.7	69.5	79.4	52.3	142.2
E. saligna	59.9	52.9	83.1	72.5	82.3	58.2	124.8

STOP 1. Low Level Road

RADIATA PINE IN MIXTURE WITH EUCALYPT HAS A HIGHER Mg CONCENTRATION

FOREST RESEARCH INSTITUTE
Soils and Site Amendment
LABORATORY REPORT
Experiment Foliage Analysis Results

Trial : R00/0 Species : (EUFAS) Planted : 1975 Rotation : 2

Forest : KAINGAROA (KANG) Cpt : 265 Date Collected : 3/88 Date Analysed :

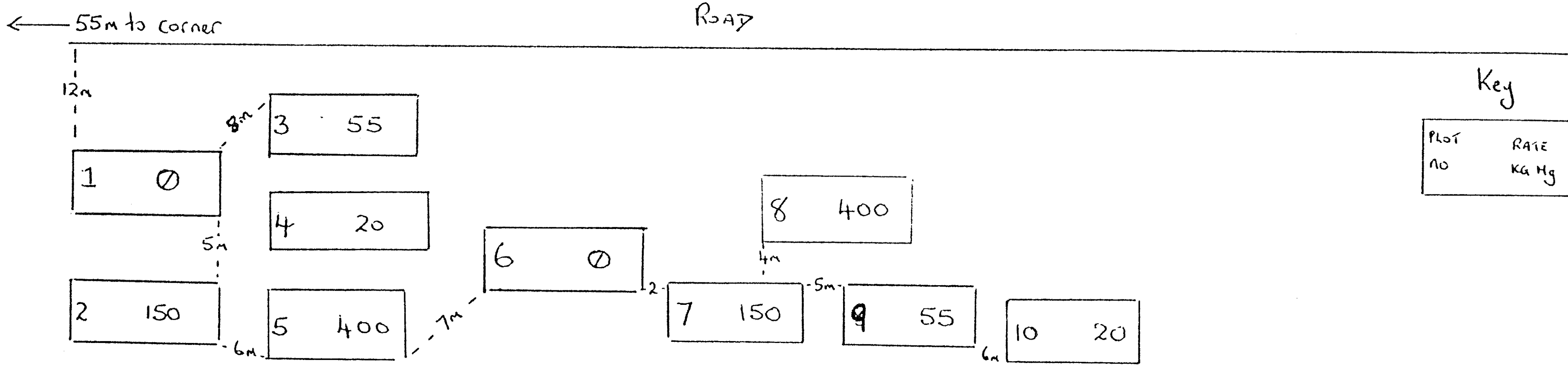
Land Preparation : +

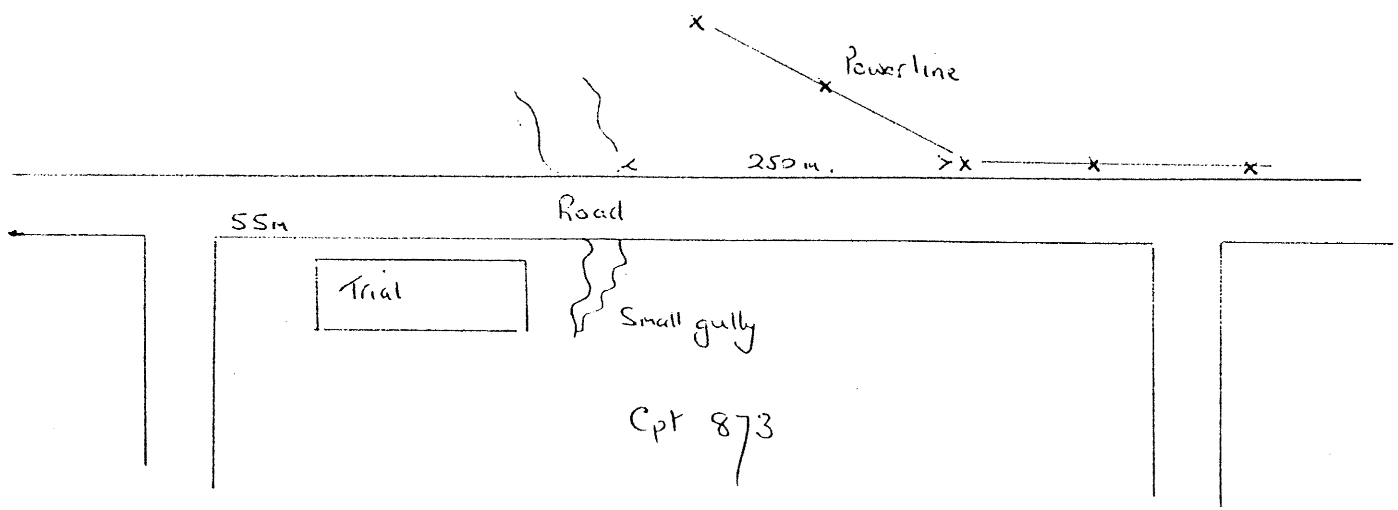
Log no.				Fertiliser history						N	P	K	Ca	Mg
				El.1	Yr	Cum.	El.2	Yr	Cum.					
F15739	EUFAS	1YRFOL	F	0000	00	0000	0000	00	0000	1.892	.122	.704	.501	.165
F15740	P.RAD	1YRFOL	F	0000	00	0000	0000	00	0000	1.657	.170	.911	.144	.080
F15741	P.RAD BESIDE EUFAS	1YRFOL	F	0000	00	0000	0000	00	0000	1.727	.185	.984	.178	.118
F15742	EUFAS	1YRFOL	F	0000	00	0000	0000	00	0000	1.781	.133	.858	.560	.159
F15743	P.RAD	1YRFOL	F	0000	00	0000	0000	00	0000	1.673	.187	1.089	.211	.101
F15744	P.RAD BESIDE EUFAS	1YRFOL	F	0000	00	0000	0000	00	0000	1.587	.186	1.151	.173	.11

STOP 2. Kiorenui Road

DOLOMITE FERTILISER APPLIED TO Mg DEFICIENT SITES AT TIME OF PLANTING CAN PREVENT Mg DEFICIENCY IN THE TREES

Magnesium (dolomite) trial in 1 yr old trees – Cpt 873 Kaingaroa. 17/1/84.





RO2002/0: Magnesium fertiliser trial in young trees

SITE: A scalped firebreak on flow tephra

TREES: Planted in 1982

FERTILISER: Applied late 1984 as dolomite (10% Mg)

RESULTS:

Fertiliser rate	1985 Foliar Mg	1988 Foliar Mg	1988 Basal area	Mean Height
	%		m**2	m
0	0.069	0.066	4.9	3.3
200	0.077	0.070	6.1	3.5
550	0.085	0.074	6.5	3.5
1500	0.072	0.111	5.8	3.5
4000	0.097	0.130	5.9	3.4
Sign.	NS	**	**	NS

CONCLUSION:

In the circumstances tested an early application of Mg fertiliser will prevent Mg deficiency from occuring. The desirable rate appears to be approximately 1 tonne of dolomite

STOP 3. Dry Fly Road

DOLOMITE FERTILISER APPLIED TO Mg DEFICIENT TREES WILL EVENTUALLY CORRECT DEFICIENCY

BORON CONCENTRATIONS ARE DILUTED

POTASSIUM CONCENTRATIONS ARE ALSO REDUCED

THE CALCIUM IN DOLOMITE IS PROBABLY NOT IMPORTANT

DRY FLY ROAD MAGNESIUM TRIAL

SITE: An old forest boundary area, on rough flow tephra soil

TREES: Planted in 1974

PLOTS 1 -12 were fertilised in 1980 when 6 years old.
****

Tree height averaged 2.2 m at age 6.

TREATMENTS:

1. No fertiliser
2. Mg (called ED in the paper) 100 kg/ha of Mg as 25% Epsom salts, and 75% dolomite
3. Mg+ (called ED+ in the paper) as above but also including N,P,K, Zn,Mn and B. The inclusion of K and B was important to the result.

The trial was run unthinned to age 11 then thinned. It has not been remeasured since.

PLOTS 13 - 24 were established in 1983 in an area that had been thinned
****

and pruned. The TREATMENTS were Mg and Ca as pure carbonates at 100 k

elemental.

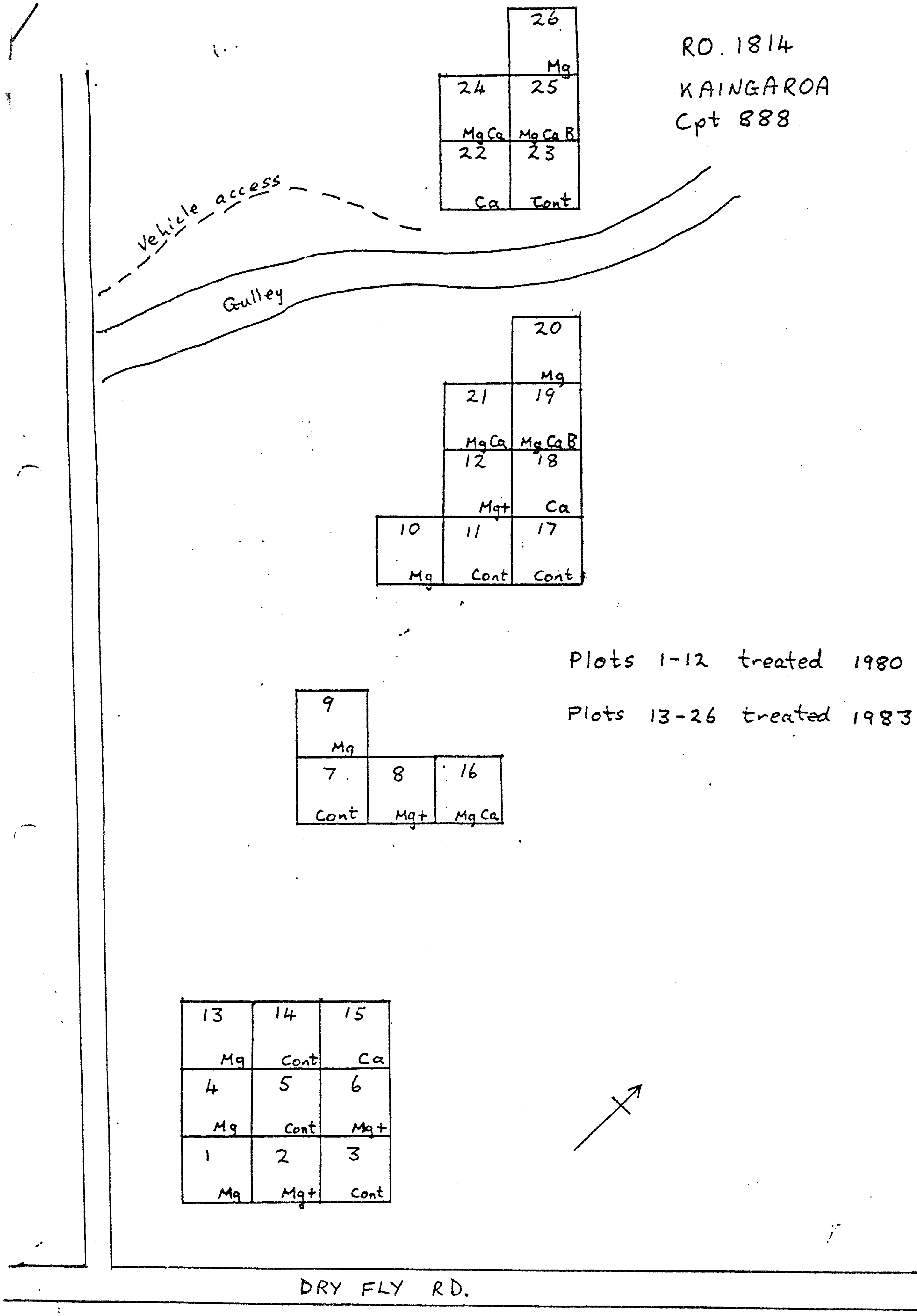

RO. 1814
KAINGAROA
Cpt 888
26 Mg
24 Mg Ca
25 Mg Ca B
22 Ca
23 Cont
Vehicle access
Gulley
20 Mg
21 Mg Ca
19 Mg Ca B
12 Mg+
18 Ca
10 Mg
11 Cont
17 Cont
Plots 1-12 treated 1980
Plots 13-26 treated 1983
9 Mg
7 Cont
8 Mg+
16 Mg Ca
13 Mg
14 Cont
15 Ca
4 Mg
5 Cont
6 Mg+
1 Mg
2 Mg+
3 Cont
DRY FLY RD.

TABLE 1—Chemical analysis of needle sections

Section	N	P	K	Ca	Mg	B	Mn	Zn	Cu
	(% d.w.)					(ppm d.w.)			
Green base	1.37	0.13	0.94	0.05	0.03	9	180	38	26
Yellow middle	1.39	0.12	0.75	0.03	0.02	12	137	23	9
Brown tip	1.83	0.15	0.71	0.04	0.02	15	164	26	11

TABLE 2—Mean tree height (m)

Treatment	Year					
	1980	1981	1982	1983	1984	1985
Control	2.18	2.68	3.29	3.58	4.05	4.44
ED	2.18	2.73	3.68	4.36	5.09	5.94
ED+	2.18	2.69	3.59	4.31	5.03	5.68
Significance	Covariate	ns	*	**	*	*

ns Not significant
* Difference significant at $p < 0.05$
** Difference significant at $p < 0.01$

TABLE 3—Basal area (m^2/ha)

Treatment	Root collar						Breast height
	1980	1981	1982	1983	1984	1985	1985
Control	6.6	10.0	14.0	17.7	21.8	24.2	9.7
ED	6.6	10.0	15.3	22.5	28.9	32.2	14.4
ED+	6.6	10.3	15.9	22.9	29.9	33.4	14.9
Significance	Covariate	ns	<0.1	*	*	*	*

ns Not significant
* Difference significant at $p < 0.05$

TABLE 4—Dry weight (kg/ha) by tree biomass component

Component	Treatment: Control		Treatment: ED		Probability of significant difference
Immature foliage	910		1 725		0.04
1 yr foliage	1 099		3 647		0.01
2+ yr foliage	173		1 732		0.09
Total live		2 182		7 104	
Live branches	5 516		15 848		0.02
Stem wood	10 695		15 782		0.16
Stem bark	2 018		3 325		0.08
Total live		18 229		34 955	
Dead foliage	854		689		0.55
Dead branches	3 216		1 199		0.06
Total		4 070		1 888	
Stump	3 040		5 119		0.14
Roots	2 646		4 247		0.08
Total		5 686		9 366	
Total biomass		23 915		44 321	

FIGURE 2A: MAGNESIUM CONTENT OF COMPONENTS - CONTROL PLOTS (kg Mg / ha)

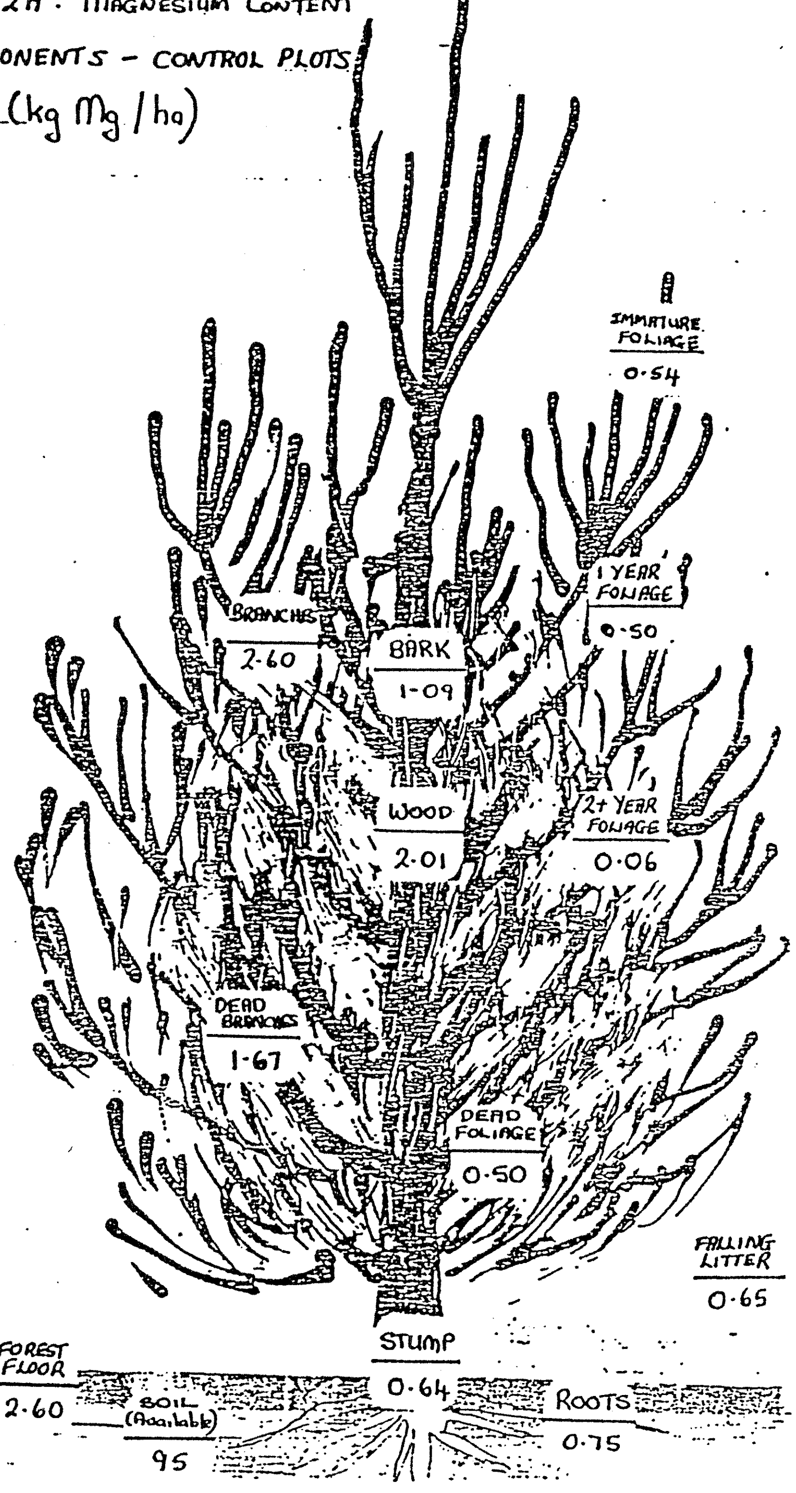
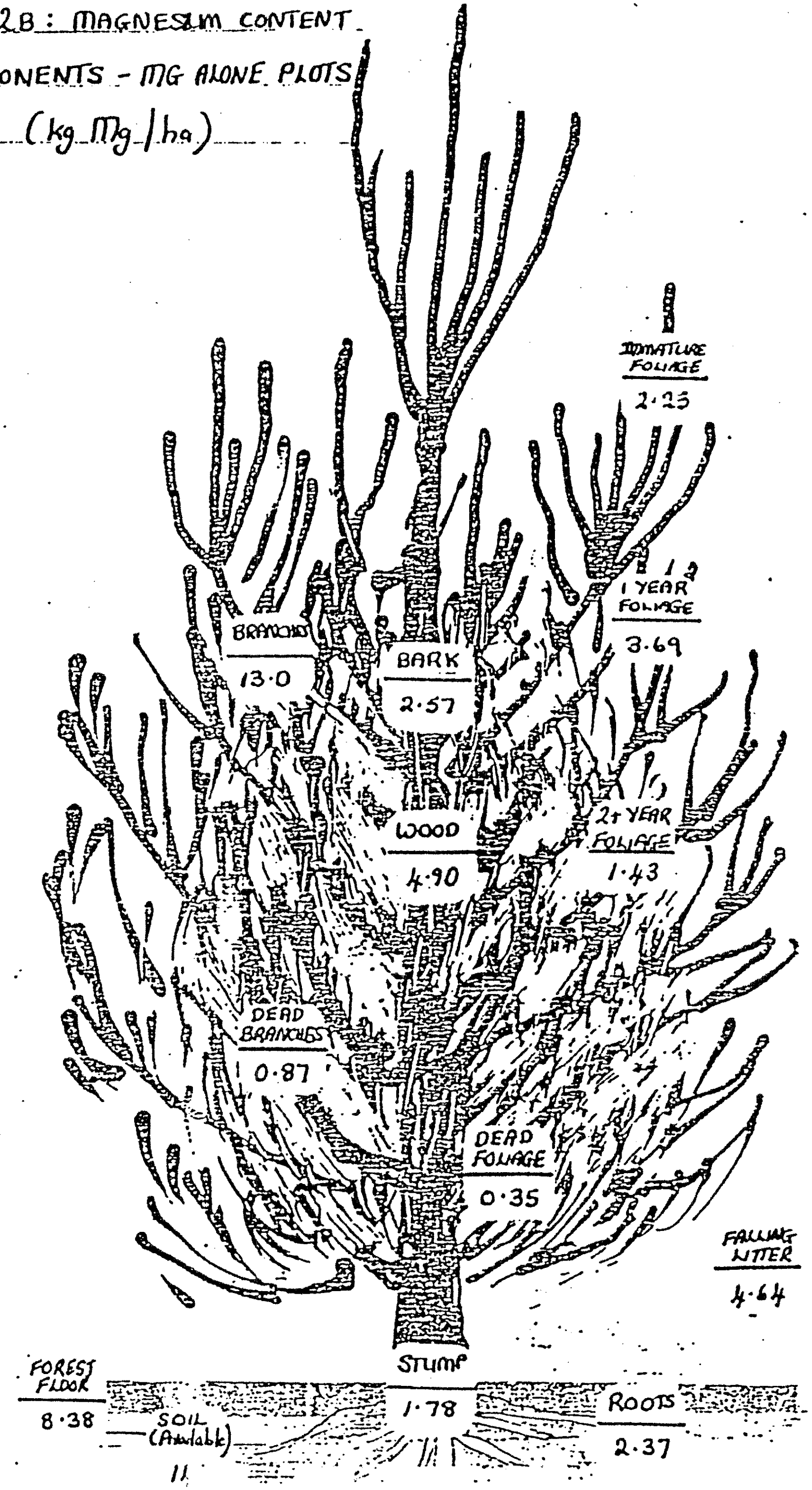


FIGURE 2B: MAGNESIUM CONTENT OF COMPONENTS - MG ALONE PLOTS (kg Mg / ha)



SIDE EFFECTS OF Mg FERTILISING: Effects on foliar K and B

1. Effect on foliar K

Foliar K was clearly reduced by Mg fertilising for the first few years

Treatment	Year			
	1983	1984	1987	1988
Control	0.75	0.82	0.88	0.81
Mg	0.52	0.52	0.71	0.74
Mg+ (contains K)	0.64	0.67	0.74	0.88

2. Effect on foliar B

We analysed for B only twice, in 1981 and 1988. Foliar B was immediately affected and appears to be more strongly affected as time goes on.

Treatment	Year	
	1981	1988
Control	13	12
Mg	9.5	6.5
Mg+ (contains B)	21	16

IS CALCIUM REALLY NECESSARY?

1. Common fertilisers vary greatly in the amount of calcium they contain. for example:

Fertiliser	% Ca
Single Super	20
Triple Super	13.3
PAPR	24.2
Rock	36
DAP	0
Dolomite	20
Calcined magnesite	0

2. Common fertilisers also vary greatly in the solubility of their calcium contents. The Ca in rock P is not very soluble, whereas the gypsum in single super is soluble.
3. So, we accidentally vary the Ca nutrition of the trees when we switch fertilisers.
4. Calcium deficiency leads to resin bleeding, tip death and finally collapse of the tree. It has been seen in pot trials but never unequivocally in the field. It is thought to occur when foliar Ca falls below 0.1%. Many areas of NZ have trees with Ca concs below 0.1%, particularly in areas that are P and Mg deficient. Some nutritionists have believed that the leader death associated with extreme Mg and P deficiency is IN FACT CA DEFICIENCY .
5. We have established two trials: one in Riverhead using pure sources of Ca and P fertiliser and the other in Kaingaroa using pure sources of Mg and Ca. The Riverhead site was certainly P deficient and had the beginnings of severe leader death. The Kaingaroa site was certainly Mg deficient and most of the trees had leader death.

6. RESULTS:

6.1 At Riverhead

P: Foliar P in 1987 averaged 0.077% in plots fertilised with Ca or left unfertilised.
Foliar P in 1987 averaged 0.136% in P fertilised plots.

Ca: In unfertilised plots foliar Ca averaged 0.134%
In Ca fertilised plots foliar Ca averaged 0.155%
However in P only fertilised plots foliar Ca averaged 0.217%
and in P * Ca fertilised plots 0.202%

Growth:

Average height has increased only slowly since 1985

1985	11.34m
1986	11.79
1987	12.26
1988	13.24

Treatment effects are not strongly significant, however trees fertilised with P alone have grown 1 metre a year, while those fertilised with Ca alone have grown very little.

TENTATIVE CONCLUSION: Ca deficiency is not responsible for the tip die-back of P deficient trees.

6.2 At Kaingaroa

Mg: Mg concentrations of unfertilised or Ca fertilised trees averaged 0.044% in 1988

Mg concentrations of Mg fertilised trees averaged 0.111%

Ca: Ca concentrations of unfertilised trees averaged 0.089%

Ca concentrations of Mg fertilised trees averaged 0.078%

Ca concentrations of Ca fertilised trees averaged 0.104%

Growth:

Between 1983 and 1988 Mg fertilised trees grew 4 metres in height,and 7.4 cms in diameter, unfertilised ones grew 2 metres in height and 4 cms in diameter. The Mg effect was strongly significant, the Ca effect was not at all.

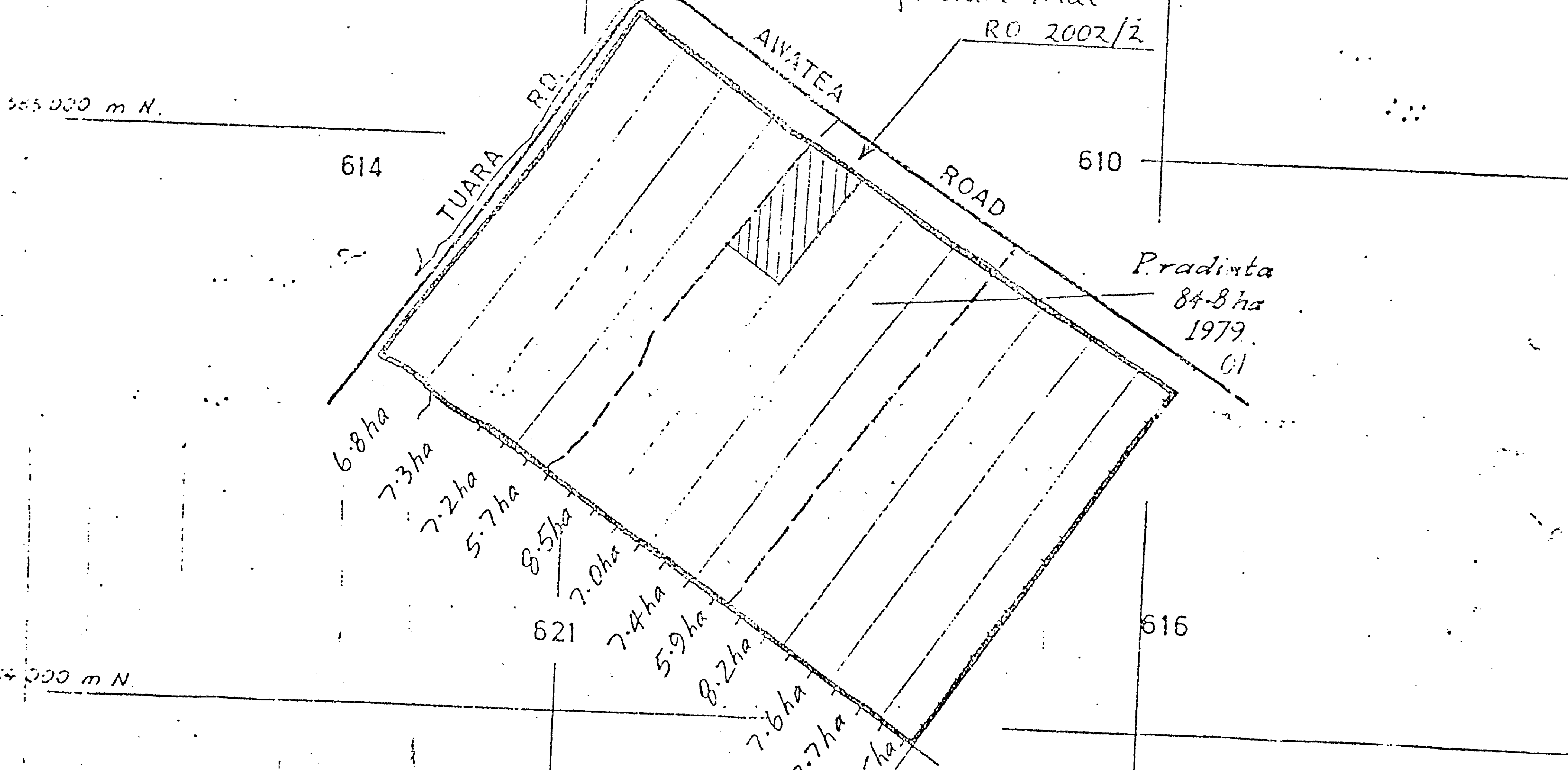
CONCLUSION: Ca is not yet shown to be necessary, the deficiency level is lower than 0.1%

STOP FOUR: THE MAGNESIUM AND PRUNING TRIALS.

Mg fertiliser eventually improves foliar Mg
Pruning Mg deficient trees leads to a big decrease in height growth

METRIC 1 : 10,000.

PRESCRIPTION MAP



TREATMENT AREA 84·8 ha

G.C.A. 93.3ha

	BONUS	CONTRA	WAGES
DATE COMM			
DATE COMPL			
S.P.H.			
AREA			
TOTAL COST			
T/H			

RO 2002/2 WAIMIHIA Cpt 615

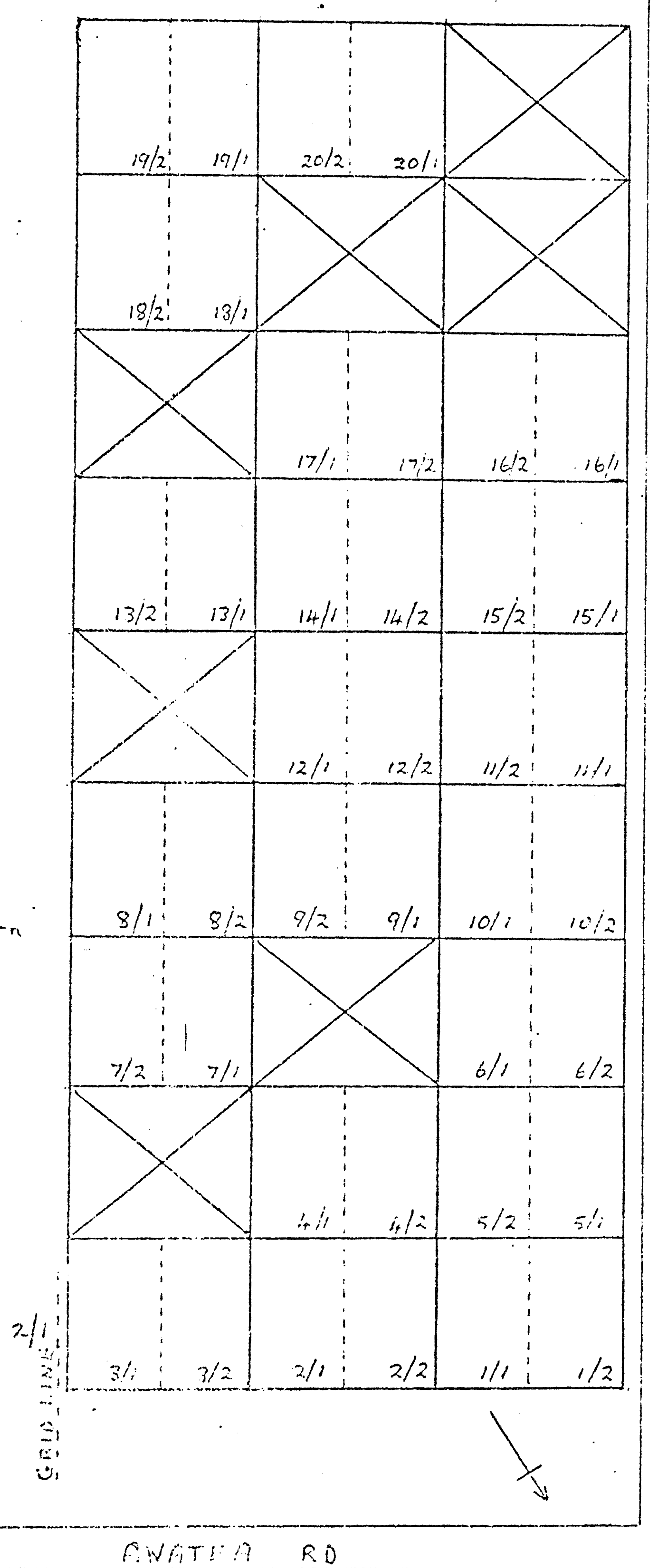
Planted 1979

Established 1/84

Treatment	Plots
Mg 0	5, 8
Mg 20	2, 6
Mg 55	1, 9
Mg 150	3, 7
Mg 400	4, 10
Calcined Magnesite	
Fine	11, 18
Coarse	13, 17
Epsom Salts	15, 20
Kieserite	14, 16
Serpentine	12, 19

Measurements start at numbered peg in Northern Corner.

Subplot 1 = Unpruned
2 = Pruned



RESULTS OF THE TWO MAGNESIUM TRIALS : RO2002/1&2

There are two sites: 1. Waimahia - a second rotation forestry site
2. Tauhara - first rotation over grass

The trials have a common design:

1. Pruning compared with no pruning

2. Several rates of Mg as dolomite (200, 550, 1500, 4000 kg)

3. Several types of Mg applied at 55 kg elemental -
   serpentine
   epsom salts
   keiserite
   coarse calcined magnesite
   fine calcined magnesite

4. In 1988 , four years after fertilising , foliar Mg was:

rate	At Waimahia	At Tauhara
0	.08	.06
20	.08	.07
55	.09	.08
150	.10	.08
400	.12	.08

Tauhara is the more Mg deficient. At both sites fertiliser is having a small effect on foliar Mg.

5. Boron concentrations are also affected:

rate	at Waimahia	at Tauhara
0	7.5	8
20	6.8	8.3
55	6.8	7
150	7.0	7.5
400	5.3	6.8

6. Effect of different types of Mg:

The different types of Mg have had an effect on foliar Mg as expected from their rate and degree of solubility

7. Effect of fertiliser on tree growth

So far no type or rate of fertiliser has had a marked effect or significant effect on tree growth. This is the first year however in which a significant foliar Mg effect has appeared. There is a trend in the data for rates up to 55 kg to improve growth and for the 400 kg rate to decrease growth below the control - probably a by-product of the liming effect.

8. Effect of pruning on tree growth.

Pruning markedly and significantly reduced both height and basal area growth. The reduction was more severe at the more deficient site.

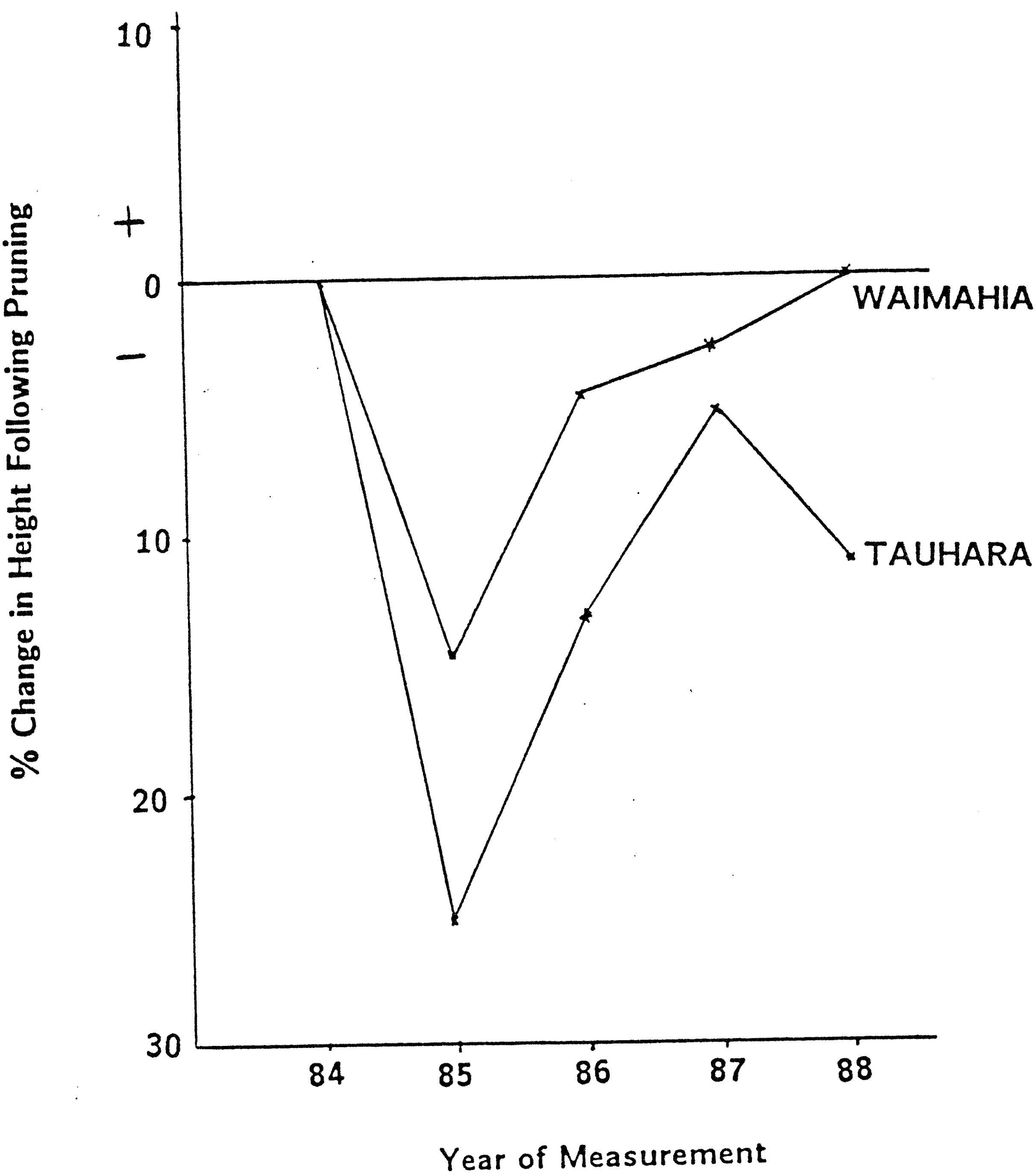
EFFECT OF GRASS REMOVAL INTERACTED WITH MAGNESIUM FERTILISE

BASAL AREA IN 1987 (adjusted for covariance on b.a 1984)

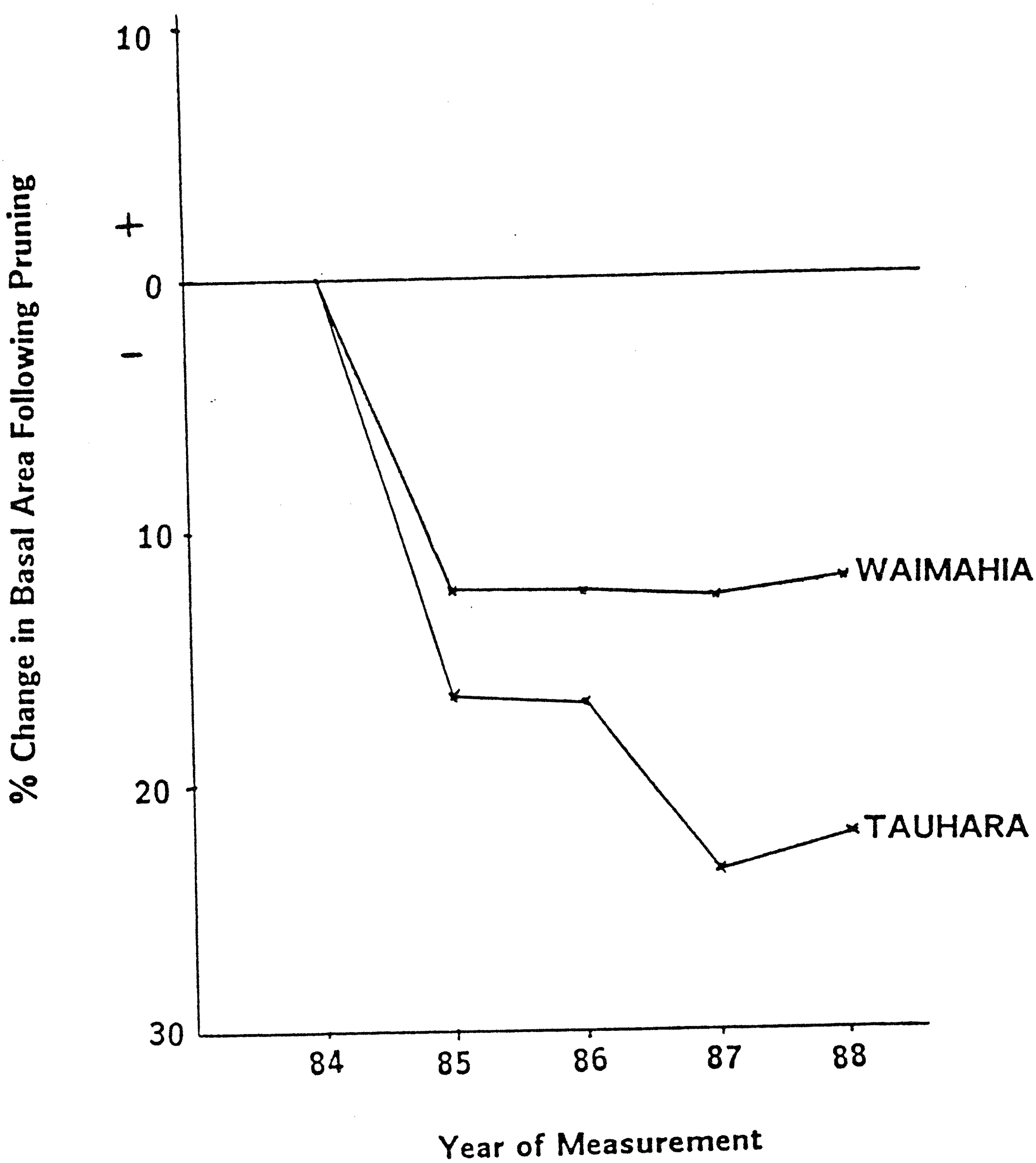
MG FERTILISER	NONE	+MG
	15.24	15.03
GRASS REMOVE	PRESENT	REMOVED
	13.99	16.29
PRUNE	NOT	PRUNED
	16.56	13.71

The unpruned grass free trees have grown 50% faster than pruned grassy ones. (B.a. in 1984 was 3 m2/ha. Best growth in 87 was 18, worst 12). What is really interesting is that the differences seem to be increasing. In 1986 the difference due to grass was only 1.3 m2/ha. This despite the fact that grass spraying has not been done for some time.

EFFECT OF PRUNING ON HEIGHT GROWTH ON MAGNESIUM DEFICIENT SOILS



EFFECT OF PRUNING ON BASAL AREA GROWTH ON MAGNESIUM DEFICIENT SOILS



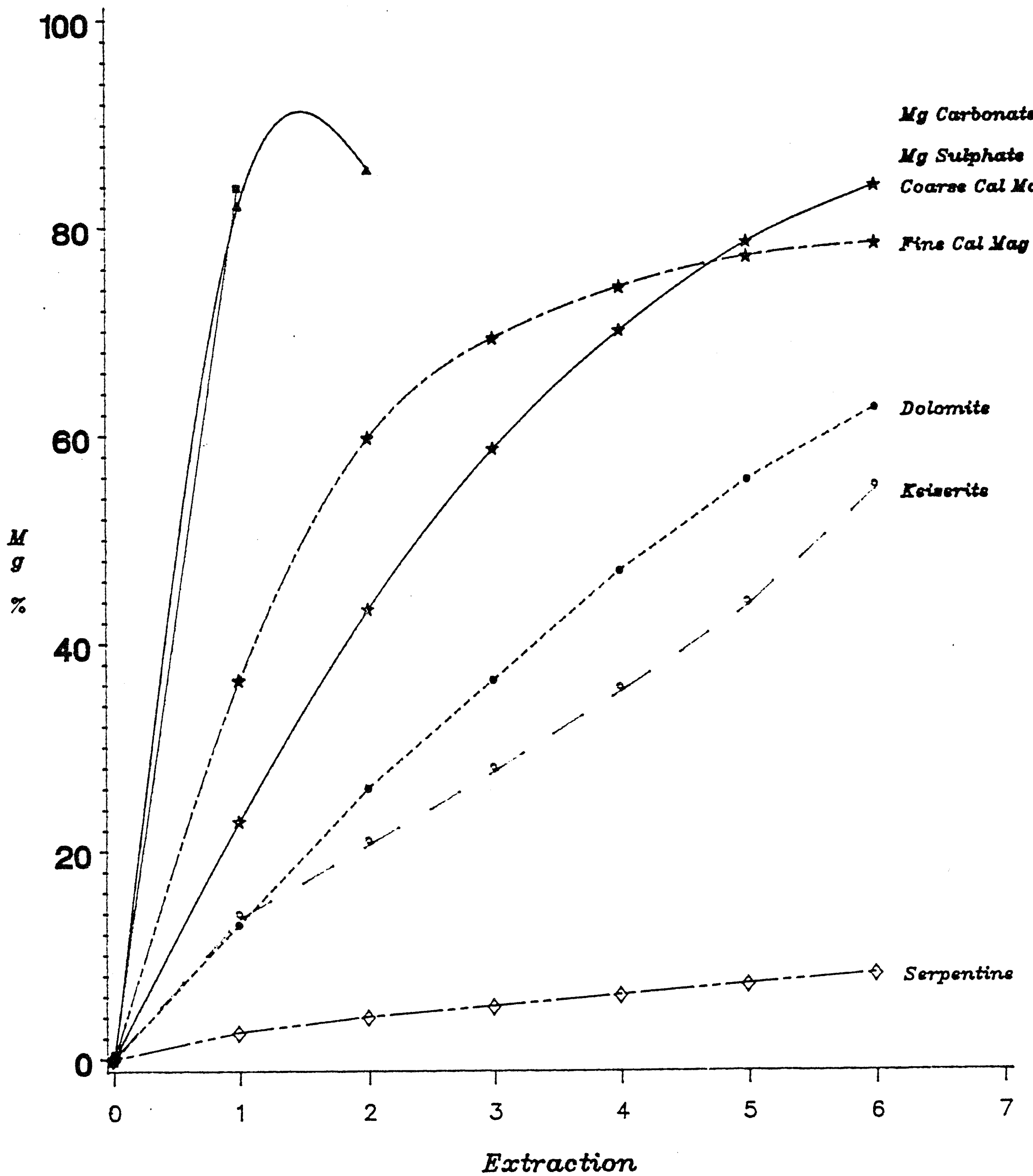
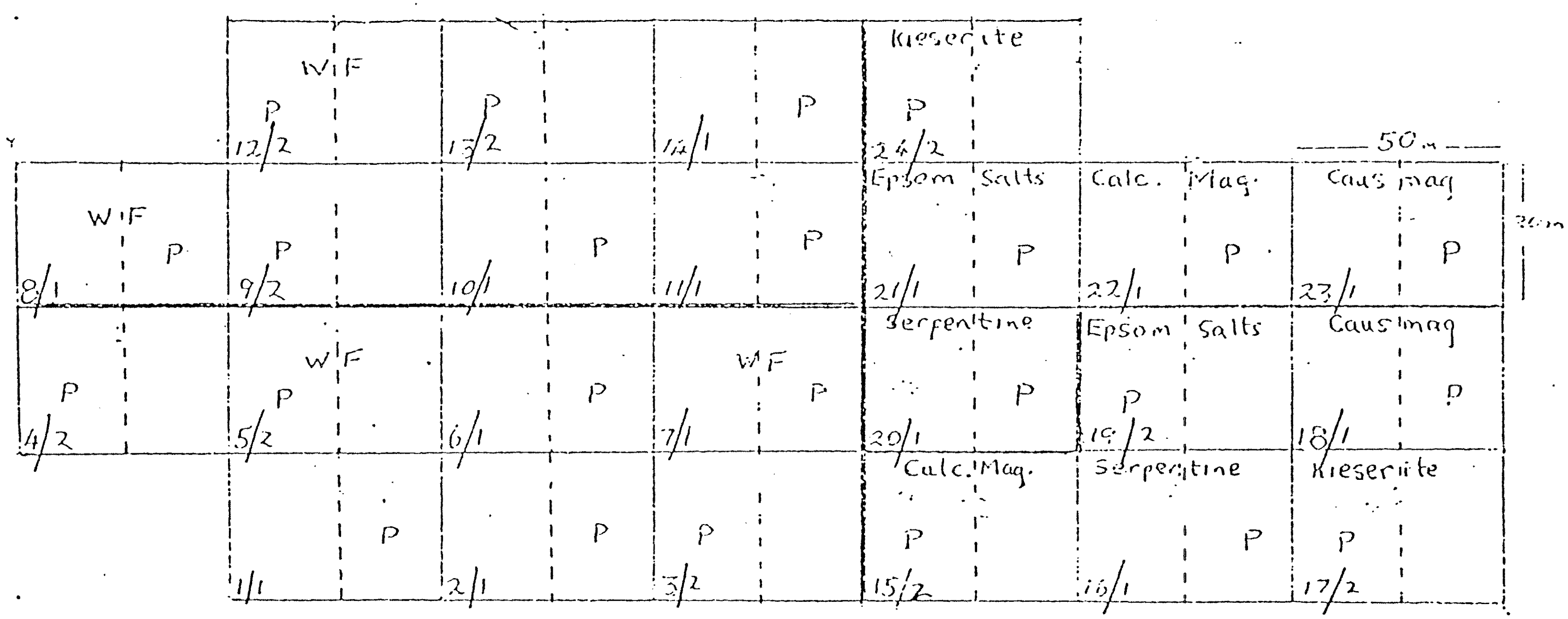


Figure 2: Accumulated Mg release as a % of the total present in fertilisers extracted with citric acid

SOIL ANALYSES ON THE TWO MG FERT BY PRUNING TRIALS

ANALYSIS		TRIAL			COMMENT
		WAIMAHIA		TAUHARA	
Total N	top10	0.36	%	0.34	High
"	10-20	0.22		0.15	"
"	20 +	0.03		0.04	Normal
Bray P	top10	23	ppm	98	High, the Ag soil at Tauhara very high
	10-20	14		37	
	20 +	20		18	
Bray Ca	top10	2.6		2.3	Interpretation not at all clear, except that no clear residual from Ag super.
	10-20	0.8		0.8	
	20 +	0.4		0.4	
Bray Mg	top10	0.4		0.4	See attached graph; these values not closely related to pine Mg.
	10-20	0.1		0.1	
	20 +	0.0		0.0	
Bray K	top10	0.02		0.03	Low but not deficient
	10-20	0.03		0.16	
	20 +	0.04		0.23	Tauhara shows some evidence of surface depletion



Planted 1979 Established 11/84

RILEY ROAD

Tmnt	Plots
Mg 0	3 7 8 11
Mg 20	1 10
Mg 55	5 6 12 14
Mg 150	4 13
Mg 400	2 9

Subplot size 15 x 20 m
" labelling 1 = No prune
2 = Prune

WF = grass control

Measurements start at numbered peg in Eastern corner

RO 2002/1 TAUHARA Cpt. 49

Relationship of foliar Mg and soil Mg.