

---

## OVERSOWN CLOVERS ON PAKIHI LANDS

R. W. GOODALL

*Instructor in Agriculture, Department of Agriculture,  
Motueka*

### Introduction

G. DE S. BAYLIS, Fields Instructor with the Department of Agriculture, carried out the first experiment on pakihi soils in Golden Bay at Onekaka in 1910 and established pasture following cultivation. In 1912. Baylis stated, "The possibilities of this pakihi land have already been demonstrated and the rightly directed energy of the settlers is the one thing now needed to convert these barren lands into good pastures and farm lands". The settlers have converted small areas into reasonable pasture during intervening years. Further research into the requirements of these soils has been carried out by the Cawthron Institute.

### SOIL TYPE

This is of semi-podzolized Onahau soils, mostly sandy loams; alluvium from siliceous greywackes. The original vegetation was probably podocarp swamp forest (rimu and silver pine) and pakihi swamps. These soils are found on flat terraces and gently sloping fans. There are 10 in. of pale grey sandy loam on 12 in. greyish white sand with few mottles, on cemented gravels. Fertility is low. The soils are found in Golden Bay County and are moderate in area.

### VEGETATION COVER

Present vegetation consists of manuka (*Leptospermum* spp.), gorse (*Ulex europaeus*), fern (*Gleishenia circinata*), sedge (*Cladium teretifolium*), and *Lycopodium laterale*.

### PRELIMINARY WORK

In the autumn of 1960, a plot was treated with lime at 2 tons/acre, superphosphate at 10 cwt/acre and oversown with untreated white clover seed. Clover establishment was good. Though frequently grazed by roving bands of sheep, the clover plants persisted.

### Trial 1961

In 1961, a trial site with a gentle slope was chosen on an area that had been burnt the previous year. Young plants

of manuka, sedges, and fern were present. Analysis of a soil sample taken before treatment was as follows: pH 4.6; Ca 0.5; K 3.0; P 0.9. On February 8, 1961, lime at 0, 20, and 40 cwt/acre was applied to strips 25 × 60 links in area, each treatment being repeated four times. On March 6, 1961, all lime treatments were crossed with superphosphate at 0, 5, and 10 cwt/acre and seed mixture sown composed of: Montgomery red clover, 5 lb ; white clover, 5 lb ; strawberry clover, 5 lb ; cocksfoot, 5 lb ; crested dogstail, 2 lb per acre.

The clover seed was inoculated with Biolab (plus Adlife but not pelleted). Weather conditions following sowing favoured early germination, but seedling clover-s failed to survive a later dry period. On August 31, 1961, lime-coated inoculated Montgomery red clover and white clover seed was broadcast over the whole trial at 5 lb/acre of each variety. By this time young plants of cocksfoot and crested dogstail were noticeable.

At an inspection made on November 1, 1961, it was noted that white clover had established in the presence of superphosphate and establishment was best in lime-treated plots. Montgomery red clover had failed to germinate. The trials was mown on February 12, 1962, to remove natural vegetation. By this time clovers on the lower damper portion of the trial had reached 6 in. in height.

Potash applied on January 25, 1962, at 1 cwt/acre to two replicates was showing a response in increased clover growth by March 1, 1962. The trial was grazed during the winter of 1962. By October the white clover was making some growth but lacked vigour, cocksfoot and crested dogstail were more noticeable than previously, and Montgomery red clover plants were rare.

A soil and herbage sample taken in November, 1962, from plots receiving lime at 40 cwt/acre and superphosphate at 10 cwt/acre had been analysed and gave the following results :

<b>Soil analysis:</b>	pH .....	<b>5.6</b>
	Ca .....	4.0
	K .	2.0
	P -	7.0
	Mg . . . . .	6.3
	cu . . . . .	2.0
		%
<b>Herbage analysis:</b>	N .....	<b>3.37</b>
	P -	0.285
	K -	1.17

---

## DEVELOPMENT ON PAKIHI SOILS

Na .....	0.49
Mg .....	0.27
Ca .....	1.87
S .....	0.13
	<i>ppm</i>
Zn .....	18
Cu .....	2.6
B .....	48
Mn .....	30
Fe .....	128
Mo .....	0.1

Comments on these figures were that the P level appears to be below optimum and Mo possibly borderline; the low N level in the white clover suggests molybdenum or sulphur deficiency; molybdenum is low but not necessarily deficient; the S level, however, is very low and clearly deficient and is probably the main reason for the low N level.

The order of severity of deficiencies might be as follows (most acute first) : S, K, Cu, (N), P, Mo?

At the beginning of April, 1963, the following treatment was applied to the trial: Basal superphosphate at 2 cwt/acre plus copper sulphate at 3 lb/acre. In addition one replicate received sulphur at 25 lb/acre; a second, sulphur at 25 lb/acre and muriate of potash at 2 cwt/acre; while a third had muriate of potash at 2 cwt/acre, the remaining replicate being control. In June, clovers had a healthy appearance but growth differences were insignificant. It was recorded in October, 1963, that differences in favour of K and S over control had been observed. The trial was then closed.

### Trial 1962

In September, 1962, a second trial was commenced using lime at 0, 5, 10, 20 cwt/acre and superphosphate at 0, 2½, 5, and 10 cwt/acre. This was a 4 × 4 box design. Pelleted inoculated seed of Montgomery red clover and white clover was sown and both established, though establishment was too irregular to allow an accurate assessment of the various lime and superphosphate combinations. This irregularity of establishment was partly due to existing vegetative cover and partly to excessively wet areas on the trial site. However, the trial did confirm the possibility of oversowing this type of country.

---

**Trial 1963**

Early in 1963, a five-acre block was measured off and lime at 1 ton/acre and superphosphate 5 cwt/acre applied in March. In September, pelleted inoculated seed of white clover 5 lb/acre and cowgrass 5 lb/acre was broadcast. A preliminary soil analysis gave pH 4.4 ; Ca 0.5 ; K 3 ; P 1. Germination was most satisfactory and by the end of October clovers were in the 3 to 4 leaf stage. The area was fenced to exclude roving stock. Natural vegetation was mown in January, 1964, when clovers were 3 to 4 in. in height. Four acres of this block were topdressed with 33% potassic reverted superphosphate at 5 cwt/acre in early April. Late in May, when clover growth was 4 to 6 in. high, 12 sheep were placed on this block to control growth. They have not yet been removed. Both varieties of clover maintain a healthy appearance and have made some growth throughout a mild winter. The sheep have dealt severely with fern and rush regrowth and also regrowth on isolated gorse patches.

**Trial 1964**

In February, 1964, one acre of the 5-acre block was fenced off and a rates of sulphur trial laid down on part of the area. Analysis of a soil sample taken prior to treatment showed pH 5.2 ; Ca 3 ; K 2 ; P 2.5.

A basal dressing of the following was applied to all plots (rates per acre): Double superphosphate, 2½ cwt; **copper** sulphate, 10 lb ; molybdenum, 5 oz ; muriate of potash, 2 cwt.

- Treatments were :
1. Control
  2. Sulphur 30 lb/acre
  3. Sulphur 60 lb/acre
  4. Sulphur 90 lb/acre
  5. Sulphur 120 lb/acre
  6. Gypsum 350 lb/acre

An inspection was made at the end of **April when clover** was vigorous and 8 to 9 in. in height.

Plots were scored on O-5 scale.

<i>Treatment</i>	<i>Means</i>	<i>Rate of S</i>
1	3.3	nil
2	4.9	30 lb
3	5.0	60 lb
4	4.9	90 lb
5	4.9	120 lb
6	4.5	60 lb <b>as</b> gypsum

Basal potash may have influenced results slightly. It would be responsible for clover vigour.

Sulphur treatments were better than gypsum and gypsum was better than control. There was little difference between the rates of sulphur. It was also noted at this inspection that many clover leaves on all plots were bright red in colour. This condition was not observed outside the trial where clovers were less vigorous. The trial was then grazed.

At an inspection on September 15, 1964, when clovers were 4 to 6 in. high, plots were again scored on O-5 scale.

<i>Treatment</i>	<i>Means</i>	<i>Rate of S</i>
1	2.8	nil
2	4.1	30 lb
3	4.0	60 lb
4	3.8	90 lb
5	3.3	120 lb
6	4.0	60 lb as gypsum

Except for Treatments 1 and 5 which appear inferior, differences observed were negligible. Treatment 1 received no sulphur while Treatment 5 received 120 lb/acre which rate apparently depressed clover growth relative to intermediate rates. The other treatments suggested 30 lb/acre as the maximum required for vigorous clover growth.

### Conclusion

The possibility of oversowing this type of country has been adequately demonstrated. In the presence of lime and superphosphate, inoculated clovers establish satisfactorily. Potash is essential if the established plants are to maintain vigour, and it appears that additional sulphur is desirable. Some study of other elements may be necessary. Cocksfoot and crested dogstail established in the first trial but were not used in later work. Yorkshire fog and browntop should also establish when oversown.

The next step should be the establishment of an area sufficient to carry a small flock of sheep continually so that the economics of such a project can be obtained.

### Acknowledgements

Thanks are due to A. J. Healy, Botany Division, D.S.I.R., for plant identification and to K. J. McNaught, Ruakura Agricultural Research Centre, for soil and plant analyses.