PROGRESS REPORT ON 'GRASSLANDS 4700' WHITE CLOVER

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Summary

A progress report on 'Grasslands 4700' white clover shows differences in its relative performance at the Northland, Canterbury and Southland stations of Grasslands Division, DSIR. Indications are that it has a higher potential growth than 'Grasslands Huia' white clover at Kaikohe. At Lincoln its herbage production has not been significantly different from that of Huia. At Gore clover herbage production from 4700 was poorer in the first year, but better in winter and equal in the other seasons of the second year compared with Huia. While associated ryegrass production tended to be better with 4700 than with Huia at Kaikohe. it was variable at Lincoln and poorer at Gore.

KAIKOHE EXPERIMENT

A TRIAL was sown on Wharekohe silt loam, newly cultivated from scrub, in autumn 1966. This gumland soil is of extremely low natural fertility, and has a low pH, but adequate lime and fertilizer for establishment and maintenance were applied. Quarter-acre plots, replicated four times, were sown with either 'Grasslands 4700' or 'Grasslands Huia' white clover at 2 lb per acre. Ariki ryegrass was sown at 10 lb per acre in all plots.

There was no grazing in the first winter but in the following spring the plots were grazed at intervals with sheep to assist optimum establishment. In the first summer, grazing was harder than normal to prevent reseeding, so that the finally established pastures contained clover. plants directly derived from sown seed.

The grazing technique used, after establishment, was one of continuous grazing with sheep, generally wethers, but with ewes and lambs in the spring, and lambs in summer and autumn. Sheep numbers were adjusted at intervals so that pasture height did not exceed 3 in. or fall below 1 in.

Pasture yield measurement was by a rate of growth technique in which two 7 ft x 3 ft frames, placed at random one in each half plot each period, were mown at 3-weekly intervals.

The yields were grouped in 3-monthly seasonal periods, from March 1967, which was taken as the beginning of autumn.

In July 1966, twenty seedlings from each half plot were harvested at ground level, dried and weighed.

RESULTS

The total dry weight of 160 seedlings was 12.82 g for Huia, and 17.03 g for 4700, but the difference was not significant at 5 % probability level.

Seasonal herbage yields from the two clovers and Ariki ryegrass are shown in Table 1.

The yield from 4700 white clover constituent was significantly greater than that from Huia in the annual total and the first three seasons of the first year, and in winter of the second year. In the second summer the clover yield from Huia plots was significantly greater than that from 4700.

There was a significant difference in ryegrass yield, in favour of 4700, in the winter of 1967. In each of the other seven seasons, yields of ryegrass in the 4700 plots were higher than those from Huia, though not significantly.

Total herbage yields from 4700 plots were significantly higher in autumn, winter and for the year in 1967-8, and in autumn in the second year.

TABLE 1: SEASONAL AND ANNUAL HERBAGE YIELDS FROM WHITE CLOVER VARIETIES AT KAIKOHE

(lb D.M. per acre)

		1967-8			1968-9		
Season	*Variety*	*Clover*	*Grass*	*Total*	*Clover*	*Grass*	*Total*
--	Huia	1,230	830	2,080	390	920	1,350
Autumn	4700	2,050	990	3,050	810	970	1,800
	*d*0.05	390	NS	380	NS	NS	240
	Huia	170	350	520	180	550	840
Winter	4700	510	560	1,070	340	610	1,040
	*d*0.05	160	90	110	160	NS	NS
	Huia	1,370	870	2,290	1,380	1,180	2,270
Spring	4700	1,610	1,030	2,660	1,280	1,250	2,720
	do.05	220	NS	NS	NS	NS	NS
	Huia	1,730	600	2,370	1,870	1,700	3,690
Summer	4700	1,950	650	2,640	1,360	1,870	3,320
	*d*0.05	NS	NS	NS	220	NS	NS
	Huia	4,500	2,650	7,260	3,820	4,350	8,650
Year	4700	6,130	3,210	9,420	3,790	4,700	8,880
	*d*0.05	1,340	NS	1,600	NS	NS	NS

Stocking rates, ignoring sheep classes, averaged 9.9 for Huia and 11.3 for 4700 in-the first year, with 10.2 and 10.0, respectively, in the second.

In this experiment 4700 clover growth was superior throughout the first year and as good as Huia in the second, except in summer. Further data (not presented) show that 4700 clover production was equal to that of Huia in autumn 1969 and significantly higher in the succeeding winter, with no significant differences in ryegrass production in either season. Palatability of 4700 and its associated grass appeared to be better than the constituents of the Huia pastures, and the 4700 pastures seemed to be more readily and closely grazed. This, together with its more erect habit, may make 4700 more vulnerable than Huia to the effects of hard grazing. In the trial and in some local farm sowings, it is evident that 4700 has larger leaves, is taller, and less dense than Huia. In all these situations it was apparently more vigorous in the cool season.

LINCOLN EXPERIMENTS.

Ariki ryegrass was sown with either 4700 or Huia varieties of white clover in autumn 1967, grass being drilled and clover broadcast. The land had been summer fallowed after greenfeed after old grass so that fertility was high. Grass growth was vigorous from the outset. Three grazings were carried out prior to spring to control grass growth. From September 1967, pastures were grazed wherever herbage was three inches in height down to a short stubble. Each grazing was of two days' duration. Herbage yields were measured prior to each grazing.

In another experiment, Ariki ryegrass was overdrilled in autumn 1965 into a 4700 white clover base. This was established from spaced plants of clover set out in the previous autumn and intercultivated until the stolons "ran" in early summer. The pasture was grazed wherever herbage was three inches in height down to a short stubble. Each grazing was of two days' duration. Herbage yields were measured by a "rate of growth" technique, cutting cage-protected areas at monthly intervals. Records were taken for only the two years in which clover production was considered to be from the 4700 variety.

RESULTS

The establishment of both varieties of clover in the first mentioned experiment was poor, so that, for a 12-month period in

TABLE 2: PERFORMANCE OF ARIKI RYEGRASS-WHITE CLOVER PASTURES AT LINCOLN

(lb D.M. per acre)

		1967-8				1968-9			
Season	Variety	Clover	Grass	Herbage	Total Clover (%)	Clover	Grass	Herbage	Total Clover (%)
Spring	Huia	80	3,830	4,630	2	540	2,150	2,740	20
	4700	60	4,580	5,380	1	430	1,990	2,520	17
Summer	Huia	490	2,990	3,520	14	890	2,090	3,000	30
	4700	420	4,450	4,930	9	810	1,990	3,070	27
Autumn	Huia	460	1,780	2,240	20	190	330	530	37
	4700	310	2,360	2,680	12	340	380	730	47
Winter	Huia	120	1,210	1,350	9	270	450	720	38
	47oc	160	1,500	1,680	10	230	340	570	40
Year	Huia	1,150	9,810	11,740	10	1,890	5,020	6,990	27
	4700	950	12,890	14,670	6	1,810	4,700	6,890	26

1967-8, 4700 clover yielded only 950 lb dry matter per acre and Huia clover 1,1 SO lb dry matter per acre. As shown in Table 2, the maximum seasonal contribution of clover to total herbage yields was 20%. For the succeeding 12 months period in 1968-9, 4700 clover yielded 1,810 lb dry matter per acre and Huia clover 1,890 lb dry matter per acre. None of the yield differences shown in the table was significant. Initially, there was strong competition from the ryegrass under high fertility conditions. In early summer of the first year from sowing, the frequency of occurrence of clover plants in 100 cm^2 quadrats was: 4700 variety 38%, and Huia variety 51%. Subsequent development of the clover was restricted by dry weather in that summer and the

TABLE 3: PERFORMANCE OF GRASS OVERDRILLED CLOVER PASTURE AT LINCOLN

(lb D.M. per acre)

	1965-6			1966-7		
Season	Ariki Ryegrass	4700 Clover	Total Herbage	Ariki Ryegrass	4700 Clover	Total Herbage
Spring	2,820	3,000	6,590	7,360	1,900	9,530
Summer	2,890	1,800	4,950	1,990	1,630	3,840
Autumn	1,560	1,710	3,300	150	850	1,140
Winter	950	350	1,330	270	1,330	1,770
Year	8,220	6,860	16,170	9,770	5,710	16,280

following summer and autumn. At the end of the third winter from sowing, frequency of occurrence of rooted clover in 20 cm^2 plugs was: 4700 variety 65%, and Huia variety 77%. Because of the difficulties in establishment, the productive performance of neither variety of clover showed to advantage in the data presented from this experiment.

Data from the other experiment (Table 3) showed higher levels of herbage production from Ariki ryegrass/4700 white clover pasture than had previously been recorded from pastures of Ruanui perennial ryegrass/Huia white clover at this locality (O'Connor *et al.*, 1968) . Clover yields alone in the present experiment exceeded or were similar to maximum yields that had been obtained at this locality from mixed stands of Turoa red and Huia white clovers, sown without grass (O'Connor *et al., loc. cit.).* Higher yield of clover than of grass in the first spring would be expected where grass had been overdrilled in the previous autumn. The first winter was colder than normal and the low yield of clover in that season does not indicate any marked degree of cool season activity from the 4700 variety. The high yield of clover in the following winter may have reflected not only the effects of both the unusually mild winter in that year, but also minimal competition from ryegrass which had been attacked by porina caterpillar in the autumn.

With satisfactory establishment, the 4700 variety of white clover may give higher yield of clover from pasture than the Huia variety. On the evidence of the first experiment, the 4700 variety of white clover may be more difficult to establish in adequate amount to express its potential. Interactions between clover variety and management systems require more investigation to better assess the merit of the 4700 clover in this environment.

GORE EXPERIMENT

This trial was sown in spring 1966, on Mataura silt loam, previously under a ryegrass/white clover pasture for 5½ years, and ploughed in April 1966. Following cultivations through winter and spring, there was no evidence of volunteer clover seedlings at sowing.

The design was a 3 X 2 factorial, with five replications of 1/20 acre plots. Manawa, Ariki or Ruanui ryegrasses were sown at 15 lb per acre, with either Huia or 4700 white clover at 3¾ lb, the clover seed being inoculated before sowing.

Adequate fertilizer and lime applications were made, and DDT and fenitrothion were applied for grass grub and porina caterpillar control.

For each set of five 1/20 acre measurement paddocks, a ¼ acre "conditioning" area was sown with the same pasture seed mixture. Sheep were depastured on these for 24 hours prior to entering the measurement paddocks. Mature Romney wethers were used to graze the pasture from 3 to 4 in. height to ½ in. During December and January this pressure was relaxed to limits from 6 to 7 in. to 1 in, to give a better environment for Manawa ryegrass (Brougham, 1959; A. J. Harris and J. D. Turner, unpublished data) and Ariki ryegrass (Harris and Turner, *loc. cit.*). The number of animals required to defoliate pastures in 48 hours was calculated from yield measurements and maintenance requirements for sheep of varying body weight (McMeekan, 1943). Uneaten material was cut with a rotary mower.

Yield measurements were made by cutting the herbage in a 7 ft x 3 ft frame, placed on a representative site, while the sheep were in the conditioning area.

Clover bud counts were made at intervals of four months commencing May 1967, using the technique of Mitchell and Glenday (1958), and counting 15 plugs per plot.

All yield measurements were grouped in 4-monthly periods, commencing May 1967.

TABLE 4. MAIN EFFECT OF CLOVER VARIETY ON HERBAGE YIELD AT GORE

(lb D.M. per acre)

Period		1967-8 Clover	1967-8 Grass	1967-8 Total Herbage	1968-9 Clover	1968-9 Grass	1968-9 Total Herbage
May-Aug.	Huia	59.5	1,850	2,010	130	1,070	1,240
	4700	67.5	1,625	1,765	230	940	1,250
	*d*0.05	NS	170	180	60	90	NS
Sep.-Jan.	Huia	1,460	3,820	5,740	1,040	4,410	6,260
	4700	990	3,660	4,980	1,070	3,660	5,560
	*d*0.05	220	NS	230	NS	310	260
Feb.-Apr.	Huia	1,790	2,260	4,180	1,190	2,680	4,380
	4700	1,710	1,830	3,640	1,360	2,100	3,960
	*d*0.05	NS	310	NS	NS	410	NS
Year	Huia	3,300	7,950	11,930	2,370	8,090	11,870
	4700	2,760	7,110	10,370	2,670	6,680	10,760
	*d*0.05	430	630	820	NS	450	690

TABLE 5: MEAN CLOVER BUD DENSITY (BUDS PER SQ. FT) IN PLUGS CONTAINING CLOVER AND PERCENTAGE OF PLUGS IN WHICH CLOVER IS PRESENT. GORE.

		May 1967	*May 1968*	*May 1969*
Density	Huia	252	635	1,425
	4700	172	557	1,395
	do.05	66	NS	NS
% Presence	Huia	40.9	92.0	97.3
	4700	32.0	90.2	90.7
	do.05	6.6	NS	4.7

RESULTS

The salient feature of Table 4 is the consistent inferiority of pastures containing 4700 white clover, for only in the clover constituent during the cold period of the second year of measurement is it superior to Huia.

Table 5 shows that the density of Huia was higher initially, as was its spread through the sward. By the end of the first year differences had disappeared, and both clovers were well distributed through the sward. At the end of the second year there was still no difference between varieties but Huia appeared to continue to fill bare ground while 4700 plots still contained no clover buds in 9% of the area sampled.

Visual assessment of plants of different growth habits can be misleading. K. R. Brown (pers. comm.) states that the leaf size of 4700 is significantly bigger than that of Huia. When grown with Ariki ryegrass, Huia had 279 leaves per sq. ft of leaf tissue, while 4700 had 247. Probably it is this difference that accounts for the anomaly between density counts for May 1967 and the lack of detectable difference in vigour between clover varieties from an eye estimation in February 1967.

While 4700 eventually produced at the same annual level as Huia, and had higher cold weather productivity, the yields from associated grasses were lower, as were the total herbage yields. The difference in annual total herbage production (1,500 and 1,100 lb D.M. per acre for 1967-S and 1968-9, respectively) is approximately the yearly feed requirement of one ewe under fat lamb conditions.

It is possible that productivity could be increased by a more lenient grazing management, and this aspect is under consideration.

CONCLUSIONS

Kaikohe evidence suggests that 'Grasslands 4700' white clover has a higher potential production in Northland than has Huia. There are indications that ryegrass growth may be increased in association with 4700, which could be due to better nitrogen fixation and transfer. Seedling vigour appears to be greater, but, since the difference measured was not significant, further investigation is needed.

Lincoln work shows that 4700 has not proved superior in growth when sown simultaneously with grass. Comparison with earlier records of Huia production suggests that, if the clover is well established, 4700 might yield higher than Huia, and that management systems may interact with variety.

Gore results show no reason, under the existing grazing technique, in the environment of the trial for recommending substitution of 4700 white clover for Huia. The establishment of 4700, measured by spread through the sward, is slower than that of Huia. It is recognized that production of 4700 might be improved under a more lenient grazing system.

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