

THE PERFORMANCE OF GRASSLANDS KOPU WHITE CLOVER ON TWO DAIRY FARMS

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Abstract

The performance of **Kopu** white clover was compared with that of **Huia** and Pitau under intensive dairy grazing management at **Taupo** and the **Manawatu**. Sampling included both dry matter production and detailed white clover **stolon** and leaf measurements.

These trials have shown that there are significant advantages to be gained from the use of **Kopu** over both **Huia** and Pitau. in **rotationally** grazed cattle wards, particularly during autumn and winter. At the **Taupo** site where **Kopu** was sown with high endophyte perennial ryegrass, seasonal white clover yields from **Kopu** were 120% greater than **from Huia** in autumn and 160% in winter. At the **Manawatu** site with **Matua** prairie grass as the grass component, the advantage of **Kopu** over Pitau was 105% in autumn, increasing to 150% by winter.

These results are discussed in relation to the significance of **Kopu** to dairy farming in the central and southern **North Island** region.

Keywords: rotationally grazed wards. cool season activity, erect habit, dairy pasture. intensive dairying

INTRODUCTION

Grasslands **Kopu** white clover, previously known as **G18**, has very large leaves, long petioles, thick fleshy stolons. an open erect growth habit and stem nematode resistance, suggesting a potential for use in intensive dairying in the North island (van den Bosch et al. 1986).

This paper reports the performance of **Kopu** in mixed grass/clover swards under intensive dairy grazing management at two sites.

SITES, METHODS AND MEASUREMENTS

Site 1 (**Taupo**) is at Tirohanga 40 km NW of **Taupo** at 430 m **asl**, on medium to high fertility **Taupo** sandy silt soil, (**pH=5.9**, **Olsen P=22**, **S=16**). The farm is on a 50 ha seasonal factory supply dairy unit, with **milkfat** production of 500 kg/ha. The climate is extremely variable, with hot summers, cool dry autumns and prolonged cold winters with a high incidence of frost. Rainfall is 1250 mm pa.

Site 2 (**Manawatu**) is 16 km south of **Palmerston North** at **Linton**, and is a good example of an intensive, high fertility, seasonal factory supply dairy unit. Soils are fine silty loams (**pH=5.8-6.4**, **Olsen P=13-35**), and range from the more developed **Rangitikei** series to the very recent **Manawatu** series on which the trial is located. **Milkfat** production is 540 kg/ha with total farm area 40 ha. Rainfall is 850-900 mm, with summer and autumn being critical for feed supply.

At the **Taupo** site in the autumn of 1983, two mixtures (0.8 ha each) were established in a 1.6 ha paddock, both based on high endophyte perennial **ryegrass** sown at 20 kg/ha, and either **Huia** or **Kopu** sown at 3 kg/ha. **DM** production measurements began in June 1984, although estimation of annual **DM** production is possible only from January 1986. Four (0.5 **m**²) pasture frames were sited at representative areas within each mixture, and cut to a height of 2 cm at each sampling.

Detailed measurement of the white clover populations commenced in January 1987. From each of three transects, 30 50 mm diameter cores were taken for detailed measurement of growing point (**GP**) density, stolon dry weight (**SDW**), stolon length (**SL**), leaf dry weight (**LDW**) and leaf area index (**LAI**), the ratio of leaf area to ground area occupied.

At the Manawatu site, a 3.6 ha paddock was sown in the autumn of 1986 with two mixtures (1.6 ha each): Matua at 40 kg/ha and either Pitau or Kopu at 3 kg/ha. After establishment the paddock was subdivided where the mixtures met, to give effective grazing control. Sampling methods were the same as used at the Taupo site and commenced in December 1986.

The trial paddock mixtures at both sites were placed into the normal paddock rotation, thus receiving intensive rotational grazing management under commercial conditions, from establishment.

RESULTS

Taupo site

Dry Matter. Although total DM yields were similar for both mixtures (eg in 1986 **Kopu/ryegrass** 17.9 t, cf **Huia/ryegrass** 17.7 t DM/ha pa), differences occurred between the two clovers in their relative contribution to the totals. Kopu yields were greater than those of Huia (Figure 1). Further, at the autumn sampling of May 1987, ryegrass yield was higher with Kopu than with Huia ($P < 0.05$, Figure 2), leading to greater accumulated means for the January-August period for ryegrass of 7100 kg DM/ha with Kopu compared with 5300 kg DM/ha with Huia.

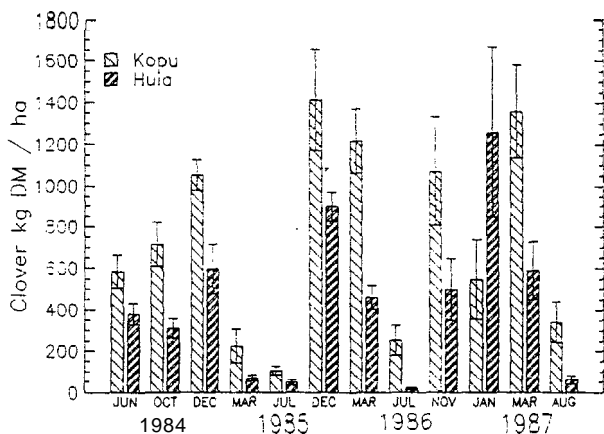


Figure 1: White clover yields (kg DM/ha) from comparative samplings between 1984 and 1987 at Site 1 (error bars denote SEM).

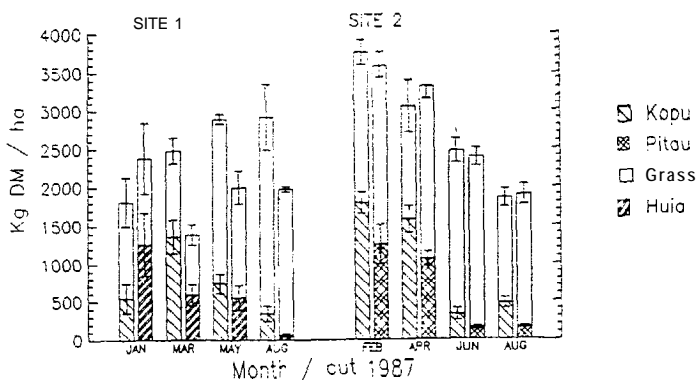


Figure 2: Sown grass and white clover yields (kg DM/ha), from the the 1987 samplings at site 1 and site 2 (error bars denote SEM).

On a seasonal basis, for the samplings between 1984 and 1987, the white clover DM advantage to Kopu over Huia in the autumn was 120% increasing to 160% in winter, and was significant ($P<0.05$) in all four winters sampled (Figure 1). The advantage of Kopu over Huia was reduced in spring and summer.

Stolon and Leaf Measurements. Table 1 shows both cultivars doubling the number of growing points between the dry 1987 summer and the moist autumn. In autumn, Kopu showed a clear superiority to Huia in stolon mass and by winter this difference still favoured Kopu.

Manawatu site

Dry matter. At this site, total accumulated DM yields from December 1986 to August 1987 were the same for both mixtures, at 12.1 t DM/ha. Nor was there a difference in the grass component (Matua) between mixtures, however the white clover DM yield of Kopu was greater than that of Pitau ($P<0.05$, Figure 2). The accumulated means from these four samplings were Kopu 4200 and Pitau 2600 kg DM/ha.

As at Taupo, this site suffered a severe drought from late spring to early summer 1987, (November-mid January 53 mm cf 212 mm mean) followed by a wet autumn (mid January-April 341 mm cf 257 mm mean). Recovery of white clover following the drought was rapid, with Kopu contributing 45% and Pitau 30% DM to the total yield by the March sampling (Figure 2). By June and August, the proportional DM yield advantage of Kopu over Pitau was substantial (Figure 2).

Stolon and Leaf Measurements. SDW, LDW and LAI for Kopu were greater than for Pitau at the autumn and winter samplings (Table 2). These results closely follow the DM yield differences expressed by Kopu for the same periods (Figure 2).

Table 1: Stolon and leaf parameter means for Taupo, site 1

Sample Date ¹	Cultivar	GP No./m ²	SDW kg/ha	SL km/ha	LDW kg/ha	LAI
Jan a7	Kopu	2089	a25	547	634	NA ¹
	Huia	2056	679	659	481	NA
May a7	Kopu	4063	868**	793	1008	4.2
	Huia	4095	498	646	539	2.3
Jul a7	Kopu	3354	741 ¹	774	644	1.5
	Huia	4131	487	611	473	1.0

¹ Not available

^{*} ($P<0.05$)

^{**} ($P<0.01$)

Table 2: Stolon and leaf parameter means for Manawatu, site 2.

Sample Date	Cultivar	GP No./m ²	SDW kg/ha	SL km/ha	LDW kg/ha	LAI
Feb a7	Kopu	4457	1137	1205	1201	3.3
	Pitau	5296	928	994	782	1.9
Apr	Kopu	3207	1905	1466	1993	7.7
	Pitau	3438	937	901	1066 ^{***}	4.2 ^{**}
Jul a7	Kopu	2373	1639 [*]	903	a77	1.9 [*]
	Pitau	1721	516	126	310 ^{**}	0.5

^{*} ($P<0.05$)

^{**} ($P<0.01$)

^{***} ($P<0.001$)

DISCUSSION

The ability of Kopu to persist was well demonstrated by its performance at Taupo. This site is typical of the region's extensive pumice derived soils, which are characterised by low water-holding capacity, high phosphate retention and large populations of grass grub. These

features, combined with the region's extremely variable climate, have all placed considerable stress on clover and grass species alike.

At site 1, Kopu gave a significantly greater white clover DM contribution to the total yield (28%), than did Huia (19%). This contribution was particularly evident in the two cool seasons, autumn and winter.

During dry periods of the year, mineralisation of soil organic matter (OM) results in an accumulation of available N (Hoglund and Brock 1978), with the result that a stimulation in growth can be expected when soil moisture and temperature are no longer limiting. At the Taupo site, autumn 1987, the significant response by ryegrass in DM and Kopu in SDW, compared with the ryegrass (Huia) mixture, was a direct result of this mechanism, for it followed the severe drought of November to January 1987, and was initiated by wet and mild autumn weather.

At the Manawatu site, Kopu had both seasonal and annual DM production advantages over Pitau. These results showed that the erect habit and larger leaves of Kopu compared with Pitau enabled Kopu to compete more successfully with the vigorous tall growth habit of Matua. Thus Kopu was able to maintain a better grass to clover ratio, particularly during autumn and spring when Matua is most vigorous.

The advantages of a high clover content (30-35% of annual yield) in intensively grazed dairy swards are in increased pasture quality and soil fertility. Increased pasture quality increases animal production: cows offered pure white clover (*ad lib*), consumed 33% more DM and produced 25% more milk, containing 33% more fat and 38% more protein, than cows offered pure ryegrass (Rogers *et al.* 1982). Thompson (1978) found similar increases in both sheep and cattle production in clover grazing trials. Nitrogen (N) loss from intensively grazed North Island dairy swards is extremely high, upwards of 350 kg N/ha pa (Field and Ball 1981). For optimum DM production, these must be replaced either by clover N fixation, or costly artificial N inputs. In general N fixation is directly related to clover growth (Hoglund and Brock 1978). It is therefore, reasonable to assume that Kopu, with its superior DM production demonstrated throughout the year, but particularly in autumn, will contribute a greater proportion of N to the total N economy of the system than other white clover cultivars. The result from this increase in soil organic N may be expected in a grass DM response, as seen at Taupo in autumn 1987.

These factors highlight the importance of a large and vigorous white clover which is able to cope with intensive rotational grazing by dairy cows, and compete with tall aggressive grass species such as Matua. Kopu, with its excellent cool season production, vigorous erect habit and large leaves, and stem nematode resistance, make it well suited to the demands of such a system.

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