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Pasture management and pasture species for improved dry matter production in south Taranaki

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ABSTRACT Dry matter (DM) production and seasonal distribution of old ryegrass/white clover pasture defoliated at 14- and 28-day intervals, and new sowings of 'Grasslands Maru' phalaris (*Phalaris aquatica* L.), 'Grasslands Roa' tall fescue *(Festuca arundinacea* Schreb.), and 'Grasslands Kara' cocksfoot (*Dactylis glomerata* L.) at 28-day defoliation intervals were evaluated in an environment prone to grass grub damage and dry summer/autumn periods. Under a 28-day defoliation interval old ryegrass produced 20% more DM that the 14-day defoliation interval, the difference occuring mainly in spring. Annual production, in the initial 4 years, of phalaris and tall fescue was respectively 17 % and 20 % more than that of old ryegrass. Phalaris was superior to old ryegrass in all seasons. Cocksfoot annual production was similar to that of old ryegrass, producing more in summer (9%) and autumn (19%) but 15% less in spring. Results from year 5 and 6 suggest that phalaris may not be as persistent as tall fescue. A 28-day rotation in spring is recommended to maximise production of old ryegrasslclover pasture. Phalaris and tall fescue are recommended as alternative species to old ryegrass in a grass grub prone and/or summer dry environment. Cocksfoot is not recommended.

Keywords pasture production, seasonal distribution, cow requirements, old ryegrass, phalaris, tall fescue, cocksfoot

INTRODUCTION

Productive pastoral farming is best achieved by growing high producing pastures and matching pasture growth with animal requirements. Knowledge of the dynamics of pasture production in the local environment is, then, essential to the planning of an efficient plant/animal system.

To achieve optimal animal performance, precise knowledge of pasture growth and the possible benefits of new species and cultivars is necessary. It may be possible to modify the seasonality of pasture growth and the total production of pasture by changing management or introducing new pasture species and cultivars more suited to the particular environment.

The south Taranaki environment is characterised by warm dry summers with frequent grass grub damage and mild wet winters (Roberts & Thomson 1984). Tall fescue, phalaris and cocksfoot can tolerate grass grub and drought (Kain et *al.* 1979) and were, therefore, considered to be suitable for this environment.

The data presented, collected from the Taranaki Agricultural Research Station, describe production and distribution of old ryegrasslwhite clover pasture and three new pasture species in a dairying area. The information shows the comparative advantage in dry matter (DM) production, over the establishment years, through cultivation and sowing new pastures compared with not cultivating and retaining old ryegrass-dominant pasture.

METHOD

The Taranaki Agricultural Research Station is situated 120 m a.s.l on the volcanic yellow-brown loam Egmont brown loam (Lands and Survey Department (1970), which has an average to above average soil fertility status (Olsen P 25-30, K 8, S 30+, pH 5.6-6.0). The mean annual rainfall is 1058 mm (1978-1988), the highest rainfall occurring in mid-winter and the lowest in mid-summer. The mean annual air temperature is 12.4°C and the mean annual soil temperature (10 cm) 11.9°C (Judd 1988).

The growth of old ryegrass and three drought- and grass grub-tolerant species was studied in two trials.

Trial 1

A 7-year study of the effect of 2 defoliation intervals (14 and 28 days) on production of old (30-year plus) ryegrasslwhite clover pasture.

Trial 2

A 6-year study of seasonal and annual production of 'Grasslands Roa' tall fescue *(Festuca arundinacea* Schreb.), 'Grasslands Maru' phalaris (*Phalaris aquatica* L.) and 'Grasslands Kara' cocksfoot (*Dactylis glomerata* L.). (Cocksfoot recorded 4 years only).

Trial technique and pasture management were similar in both trials. All pastures were rotationally grazed with dairy cows at 3.7-4.0 cows/ha. Pasture production was measured from one l-ha paddock of each species using 3 enclosure cages per paddock and the 'trim technique' as descibred by Lynch (1966). The cages were placed on areas trimmed to 4 cm above ground level with a rotary mower, and the pasture within was harvested at 14- and 28-day intervals in

Trial 1 and 28 days only in Trial 2. Additional pasture samples were collected with handshears from all pastures on harvest day, for separation into sown species, clover, other grasses, weeds and dead matter.

Comparisons for all the new pasture species began in 1982 and continued for 4 years (Figure 1). In 1986 the cocksfoot paddocks were resown for another trial, but the old ryegrass, tall fescue and phalaris comparison continued through to 1988. Measurements began 5 months after establishment for each of the new species.

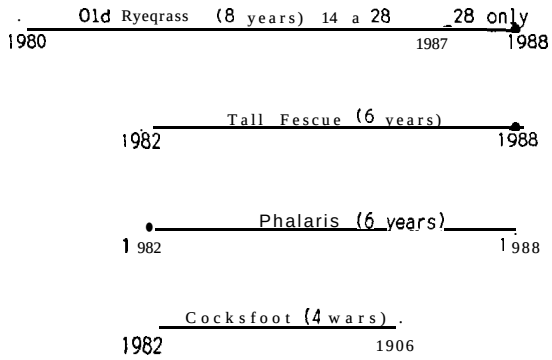

Figure 1 Periods of measurement for each species.

To highlight the value of each species for dairying, pasture production is compared with the requirements of 4 Jersey x Fresian cows/ha, starting to calve on 1 August and drying off 1 May (annual DM requirement = 14.6 t/ha) (Scott et al. 1980).

RESULTS

Trial 1: Ryegrass at 14- and 28-day defoliation intervals

Annual DM production of ryegrass at the 28-day interval was 13.7 t/ha (Table 1) compared with 11.3 t/ha at the 14-day interval. The difference in production occurred in spring and summer when the 28-day interval produced respectively 1.6 t/ha and 0.8 t/ha more than the 14-day interval. Defoliation interval had no effect in autumn and winter.

A 28-day defoliation interval better matched cow requirements than a 14-day defoliation interval (Figure 2).

Table 1 Average annual and seasonal DM production (kg DM/ha) of old ryegrass at 14- and 28-day defoliation intervals.

	W-Day 7 Year $\bar{x}$	SEE	28 Day 7 Year $\bar{x}$	SE$\bar{x}$
		(217)		
Winter	1500	(183)	1500	(166)
Spring	3800	(333)	5220	(294)
Summer	3470	(189)	4320	(429)
Autumn	2480		2460	(281)
Total annual	11300	(580)	13500	(652)

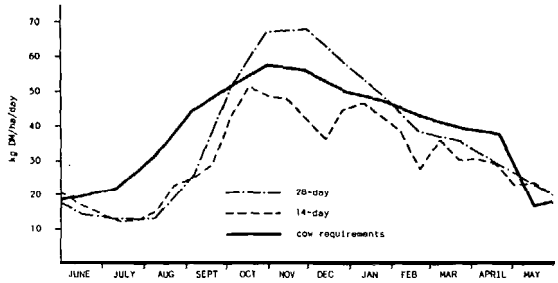

Figure 2 Comparison of 14- and 28-day defoliation intervals of old ryegrass in relation to cow requirements.

Trial 2: Phalaris, tall fescue and cocksfoot (cultivated and sown) vs retaining old ryegrass

Average annual DM production of phalaris and tall fescue (Table 2) was 17.0 t/ha and 17.5 t/ha respectively compared with 14.5 t/ha for old ryegrass. Phalaris produced more than old ryegrass in winter (16%), summer (40%), and autumn (48%) but produced 10% less in spring. Tall fescue produced more than old ryegrass in winter (10 %) , spring (8 %), summer (30%), and autumn (37%).

Table 2 Average seasonal production (kg DM/ha) of old ryegrass, phalaris, tall fescue and cocksfoot (1982-1986).

	Old ryegrass	(SE$\bar{x}$)	Maru phalaris	(SE$\bar{x}$)	Roa tall fescue	(SE$\bar{x}$)	Kara cocksfoot	(SE$\bar{x}$)
Winter	1790	(105)	2080	(91)	1970	(120)	1700	(101)
Spring	5700	(201)	5180	(310)	6170	(61)	4950	(158)
Summer	4820	(291)	6410	(620)	6160	(320)	5250	(409)
Autumn	2240	(459)	3310	(485)	3060	(619)	2660	(477)
Annual	14550	(228)	16980	(625)	17460	(455)	14560	(483)

Average annual DM production for cocksfoot of 14.6 t/ha was similar to that of old ryegrass, but its distribution differed. Cocksfoot produced 15% less in spring, 9% more in summer, 19% more in autumn and was similar to winter to the old ryegrass.

All three species showed a growth surplus over late spring/summer (Figure 3). Phalaris and cocksfoot were slower to get away in spring than tall fescue. Phalaris grew more than tall fescue and cocksfoot in winter. Tall fescue and phalaris performed exceptionally well in the establishment years while cocksfoot produced poorly (Table 3). Tall fescue maintained its productivity over time and produced 17 % more than

Table 3 Effect of time from sowing on average annual DM production (t DM/ha) of old ryegrass, tall fescue, phalaris and cocksfoot.

	Year 1 & 2	Year 3 & 4	Year 5 & 6
Old ryegrass	14.6	14.5	12.0
Tall fescue	17.3	17.7	14.0
Phalaris	17.7	16.3	13.0
Cocksfoot	14.0	15.2	

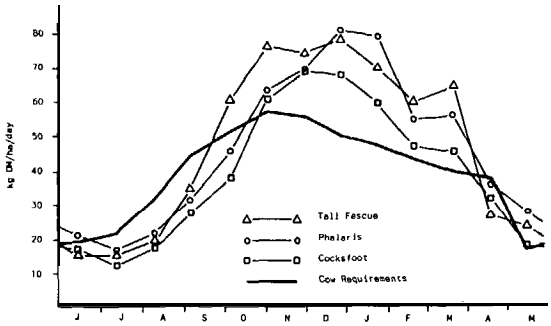

Figure 3 Seasonal growth pattern of phalaris, tall fescue and cocksfoot in relation to cow requirements.

old ryegrass in the final 2 years of measurement. The productivity of phalaris declined over time and was only 8% higher than that of old ryegrass in Years 5 and 6. The productivity of cocksfoot improved over time but at the end of the trial was only 5% higher than that of old ryegrass.

Sown species and clover components

The content of tall fescue and cocksfoot in pastures declined over time, while the content of phalaris remained constant over the 6 years (Table 4). The clover component of all species remained relatively constant throughout the trial, at approximately 20%.

Table 4 Changes in composition of old ryegrass, tall fescue, phalaris and cocksfoot pastures over the trial period.

	Year 1 & 2		Year 3 & 4		Year 5 & 6	
	Sown	Clover	Sown	Clover	Sown	Clover
Old ryegrass	63	17	53	20	49	23
Tall fescue	71	19	55	21	51	22
Phalaris	68	20	57	19	60	22
Cocksfoot	60		55	18		

DISCUSSION

Trial 1

The results show that both production and seasonal distribution of growth of old ryegrass can be modified by defoliation interval (Figure 2). This was highlighted by a marked increase in DM production over spring at the 28-day defoliation compared with the 14-day defoliation interval. Over spring the grass component of pasture begins its reproductive phase of growth where stem, sheath, and seedhead development increase. This change results in an increase in the rate of DM accumulation (Kays & Harper 1974, Browse *et* al. 1981). Under a 28-day defoliation, reproductive growth is allowed to proceed, but under a 14-day defoliation reproductive growth is possibly inhibited, resulting in lower yields. Similar conclusions were drawn with old ryegrass in Taranaki by Roberts & Thomson (1984) and Kerrisk ***et al.*** (1989). Growth rates under the 28-day interval may have been higher due to increased sward length (Brougham 1956). However, our results showed that growth in summer, autumn and winter was little affected by the longer defoliation interval.

These results suggest that a longer grazing rotation, especially in spring, would meet cow requirements better than a shorter rotation (Figure 2). Similar conclusions were drawn by Bryant (1986) under grazing conditions.

Trial 2

Comparisons between old ryegrass and phalaris, tall fescue and cocksfoot were possibly influenced by the age of pastures and cultivation. Cultivation will affect in particular the soil nitrogen levels and soil structure. No work, to our knowledge, has compared the productivity of new cultivated pastures and old pastures of the same species or cultivar. However, in a study comparing a full cultivation programme with direct drilling for establishing wheat, Carran (1989) showed that enhanced nitrogen mineralisation was evident for 100 days only. In another study comparing the effect on soil structure of cultivation and direct drilling, Francis ***et al.*** (1987) showed that while there were advantages to cultivation through increased micropores in the topsoil, cultivation reduced earthworm populations and the amount of continuous macropores in the soil, suggesting that the beneficial effects on soil structure through cultivation are unlikely to affect pasture growth in the longer term.

Therefore, cultivation and resowing a new pasture may influence production in the first year. Information obtained on production after this period is likely to represent a true species effect.

Cocksfoot Annual production of cocksfoot was similar to that of old ryegrass and only in summer did it outproduce old ryegrass (Table 2). Therefore it is not considered a suitable species for dairying (Figure 3) in south Taranaki.

Phalaris The average annual production of phalaris was 17 % higher than that of ryegrass (Table 2) owing to superior winter, summer and autumn production (Figure 3). Over time, the productivity of phalaris declined, suggesting that it may not persist as well as cocksfoot or tall fescue. However, the sown species content of phalaris was maintained at 60 % throughout the study (Table 4).

Tall fescue The average annual production of tall fescue was 20% higher than that of the ryegrass because of superior growth in all seasons (Figure 3). The content of tall fescue declined over the study (Table 4) but overall productivity was maintained (Table 3). Tall fescue was the superior species at meeting cow requirements in early spring (Figure 3).

Phalaris and tall fescue have also been identified as grass grub-tolerant pasture species (Kain ***et al.*** 1979).

This study has shown that phalaris and tall fescue could be recommended as alternatives to old ryegrass in the grass grub-prone, summer-dry environment of south Taranaki. Thomson *et al.* (1988) also reported superior DM production from phalaris and tall fescue in a farmlet study measuring milk production from a combination of these pasture species. The real benefits of phalaris and tall fescue may be realised when sown as a mixture, and evaluation work in this area is recommended.

CONCLUSIONS

Trial 1

A 28-day defoliation interval:

- increases annual DM production of old ryegrass by 20% compared with a 14-day defoliation interval.
- has a major production advantage in spring, and
- meets cow requirements better than a 14-day defoliation interval.

Trial 2

In the south Taranaki environment, characterised by mild, wet winters, summer dry periods, and frequent grass grub damage, cocksfoot is not recommended.

Phalaris and tall fescue would both be recommended for dairying because of:

- superior annual production,
- better distribution of growth in relation to cow requirements, and
- superior summer/autumn growth.

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