NEW ZEALAND PERENNIAL RYEGRASS CULTIVARS IN MID-CANTERBURY

J. M. HAYMAN*

Winchmore Irrigation Research Station, MAF, Ashburton

Abstract

The perennial ryegrass cultivars 'Grasslands Ruanui', 'Grasslands Ariki' and 'Grasslands Nui' were sown with clover and compared at three levels of irrigation under rotational grazing with sheep.

Ryegrass cultivar had little effect on total annual pasture production, although Nui pastures produced more total DM in autumn and winter. Nui was the most persistent cultivar and produced substantially more ryegrass than the others (6.1 t/ha, compared with 4.1 t/ha for Ruanui and 3.3 t/ha for Ariki) . Nui pastures produced less white clover, volunteer grasses and weeds. When grazed at the same stocking rate, sheep liveweight gain was similar regardless of ryegrass cultivar.

INTRODUCTION

PERENNIAL ryegrass forms the basis of most pastures sown in Mid-Canterbury under both irrigated and dryland conditions. The cultivar most frequently used is 'Grasslands Ruanui' *(Lolium perenne* L.) , but the hybrid 'Grasslands Ariki' *(Lolium (multiflorum x perenne)* **x** *perenne)* is also sown, usually in high rainfall areas or under irrigation.

Two disadvantages of these cultivars are their poor persistence under dry conditions (Sheath et *al.*, 1976; Vartha, 1978) and their relatively low production in summer, even with irrigation (Rickard and Radcliffe, 1976; S. D. Walker, pers. comm.).

'Grassland Nui' ryegrass *(Lolium perenne* L.), which was introduced in 1975 (Armstrong, 1977), was claimed to be more persistent under dry conditions and more productive in summer and autumn than either Ruanui or Ariki (I. M. Ritchie and J. A. Douglas, unpublished). If these claims were substantiated, Nui would be attractive to Mid-Canterbury farmers.

The trial reported here was designed to establish whether the reputed advantages of Nui could be realized with and without irrigation on the light stony soils of Mid-Canterbury under sheep grazing.

---

*Present address: Templeton Agricultural Research Station, MAF, P.O. Box 33, Templeton.

EXPERIMENTAL

The trial was established in April 1975 at Winchmore on a Lismore stony silt loam which had been in irrigated pasture for 25 years before being cultivated and rebordered for the trial.

A split plot design was used with three levels of irrigation as main plots (none, irrigated at nil available soil moisture (asm) in the top 100 mm, and 50% asm) , and three pasture types as subplots (based on Ruanui, Ariki and Nui ryegrasses). The seeding rate was 18 kg/ha of viable ryegrass, 3 kg/ha of 'Grasslands Huia' white clover (*Trifolium repens* L.), and 3 kg/ha of Mount Barker subterranean clover (*Trifolium subterranean* L.) . Each plot consisted of a single border strip (90 m x 9 m) fenced into a separate paddock. There were four replicates.

Superphosphate was broadcast at 375 kg/ha before drilling the seed and a similar amount topdressed each winter. Lindane (11 kg/ha) was applied in autumn 1976 to control grass grub. The pastures were irrigated or left dry according to the designated treatments, from the time of sowing.

GRAZING

The trial wasgrazed rotationally, one replicate at a time, with the same number of sheep on each cultivar within each irrigation level. Stocking rates were adjusted to ensure that each replicate was grazed down in 5 to 7 days. Hoggets were used in the first 2 years and dry mixed-age ewes in the third year.

PASTURE DM MEASUREMENT

Pasture herbage was harvested with a reel mower using exclosure cages (3.6 m × 1.4 m) and the "Trim" technique (Lynch, 1966).

SHEEP LIVEWEIGHT

The liveweight gains of hoggets (unfasted) were recorded for four grazing rotations in 1976-7, and ewe liveweight gains (12-hour fast) were recorded for three grazing rotations in 1978-9.

STATISTICAL ANALYSES

In the analyses of variance the irrigation x cultivar interaction was broken into two independent terms, corresponding to the breakup of irrigation comparisons into "dry versus mean

irrigated", and "nil asm versus 50% asm". In the tables presented all these interactions were nonsignificant, with the exception of a 5% significant (dry vs. irrig.) x cultivar interaction for mean ryegrass production (Tables 3 and 4).

In Table 5 the percentage reduction in ryegrass yield was defined for each plot as:

$$\% \text{ reduction} = \frac{(\text{1978-9 ryegrass yield} - \text{1976-7 ryegrass yield}) \times 100}{\text{1976-7 ryegrass yield.}}$$

In Table 7 the analyses were performed on the mean weight gains for the irrigated treatments, treating grazing periods as replicates.

'RESULTS

RYEGRASS CONTENT OF PASTURE

Five weeks after sowing there were significantly fewer Ariki ryegrass seedlings (580/m²) than Ruanui (780/m²) or Nui (730/m*). Three years later, point analysis revealed significantly more Nui ryegrass than either Ruanui or Ariki (Table 1) .

EFFECT OF IRRIGATION ON PASTURE PRODUCTION

The number of irrigations required on the irrigated treatments and the DM yield of the non-irrigated treatments (Table 2) were more closely related to the number of "drought days" *(i.e.,* the days in which the O-100 mm layer of soil under non-irrigated pasture was at or below zero asm) than to the October-March rainfall.

Irrigation increased the yield of ryegrass and white clover, but 'it had little effect on the yield of the other grasses and weeds (Table 3). Irrigation at 50% asm was superior to irrigation at nil asm.

TABLE 1: EFFECT OF RYEGRASS CULTIVAR ON GROUND COVER, AUTUMN 1978
(Point analysis: Cover hits per 100 points)

Ryegrass Cultivar	*Pasture Species*				
	Ryegrass	*Browntop*	*White Clover*	*Weeds*	*Bare Ground*
Ruanui	11.1	9.8	15.7	11.3	42.7
Ariki	a.3	15.6	14.4	11.8	44.4
Nui	**19.0**	8.8	13.4	7.9	44.6
LSD (5%)	3.3	3.4	1.9	3.3	4.5

TABLE 2: RAINFALL, DROUGHT DAYS, IRRIGATIONS AND NON-IRRIGATED PASTURE YIELD

Year	*Rainfall Oct.-Mar. (mm)*	Drought *Days*	*No. of* Irrigations *Nil asm*	*50% asm*	*Yield Non-irrig. Pasture (t DM/ha)*
1976-7	277	24	1	3	8.4
1977-S	227	68	4	8	4.2
1978-9	505	2s	2	5	7.4

TABLE 3: MEAN EFFECTS OF IRRIGATION AND RYEGRASS CULTIVAR ON ANNUAL PRODUCTION OF PASTURE COMPONENT SPECIES OVER 3 YEARS (t DM/ha)

Main Effect	*Ryegrass*	*White Clover*	*Other Grasses*	*Weeds*	*Total*
irrigation					
None	2.8	2.0	1.1	0.6	6.6
Nil asm	4.4	3 . 9	1.4	0.7	10.6
50% asm	6.2	4.2	1.3	0.7	12.6
LSD (5%)	0.9	0.6	0.2	0.2	1.1
Cultivar					
Ruanui	4.1	3.3	1.3	0.8	9.6
Ariki	3.3	3.9	1.8	0.8	9.9
Nui	6.1	2.9	0.8	0.5	10.4
LSD (5%)	0.4	0.4	0.3	0.1	0.6

EFFECT OF RYEGRASS CULTIVAR ON PASTURE PRODUCTION

The ryegrass cultivar had a highly significant effect on annual DM production of the component species of the pasture (Table 3). Nui pastures produced significantly more ryegrass, less "other grasses" (mostly browntop — *Agrostis tenuis* Sibth.), less white clover, and fewer weeds than Ruanui and Ariki pastures.

Overall mean annual production of Nui pastures tended to be higher than the others (Table 3). Most of this advantage occurred on the 50% asm irrigation treatment (Table 4), although the interaction between cultivars and irrigation level was not significant.

PERSISTENCE OF RYEGRASS CULTIVARS

Nui ryegrass was more persistent than the other cultivars (Table 5) at all levels of irrigation. On the irrigated treatments, Nui production declined by an average of 3%, while Ruanui and Ariki declined by 39 and 48%, respectively (Table 5 and Fig. 1).

TABLE 4: EFFECT OF IRRIGATION AND RYEGRASS CULTIVAR ON TOTAL PASTURE AND RYEGRASS YIELD (t DM/ha), 3-Y EAR MEAN

Ryegrass Cultivar	*Non-irrig.*	*Irrigated at:* *Nil asm*	50% *asm*
	Total pasture production		
Ruanui	6.2	10.6	12.0
Ariki	6.9	10.4	12.4
Nui	6.8	10.7	13.5
	Ryegrass production		
Ruanui	2.6	4.2	5.5
Ariki	1.Y	3.3	4.8
Nui	3.9	5.9	8.4

The (dry vs. irrig.) x cultivar interaction was 5% sig.

TABLE 5: PERCENTAGE REDUCTION IN RYEGRASS YIELD FROM 1976-7 TO 1978-Y

Ryegrass Cultivar	*Non-irrig.*	*Irrigated at:* *Nil asm*	50% *asm*	*Ryegrass Main Effect*
Ruanui	65	39	39	48
Ariki	79	51	46	59
Nui	46	6	1	12
LSD 5% (ryegrass main effect)				12
Main effect of irrigation	63	32	29	
LSD 5% (irrigation main effect) 14				

TABLE 6: EFFECT OF CULTIVAR ON SEASONAL PASTURE PRODUCTION OVER 3 YEARS (t DM/ha)

Ryegrass Cultivar	*Winter*	*Spring*	*Summer*	*Autumn*
	Total pasture production			
Ruanui	i.43	3.51	3.18	1.48
Ariki	1.35	3.73	3.35	1.45
Nui	1.60	3.66	3.28	1.84
LSD (5%)	0.10	0.20	0.24	0.19
	Ryegrass production			
Ruanui	0.85	1.51	1.10	0.63
Ariki	0.68	1.18	0.94	0.52
Nui	1.16	1.91.	1.69	1.30
LSD (5%)	0.11	0.17	0.15	0.12

SEASONAL PRODUCTION

Nui pasture produced more total DM than the others in autumn and winter (Table 6). Nui produced the most ryegrass in all seasons.

SHEEP PRODUCTION

The cultivars had no significant effect on hogget or ewe liveweight gain (Table 7).

TABLE 7: MEAN EFFECT OF CULTIVARS ON LIVEWEIGHT GAINS OF HOGGETS AND EWES GRAZING IRRIGATED TREATMENTS (kg/head)

	Hoggets 19767	*Ewes 1978-9*
Ruanui	4.5	4.7
Ariki	4.5	4.7
Nui	4.8	4.0
LSD (5%)	0.5	1.3

DISCUSSION

Despite good fertility and rotational grazing management designed to favour ryegrass, Ariki and Ruanui failed to maintain an acceptable level of ryegrass production (Fig. 1). For instance, in the absence of irrigation Ariki ryegrass constituted less than 10% of the total pasture DM yield in 1978-9, compared with Ruanui (22%) and Nui (43%).

However, drought cannot be the only problem, because Ariki and Ruanui ryegrass production declined almost as much on the

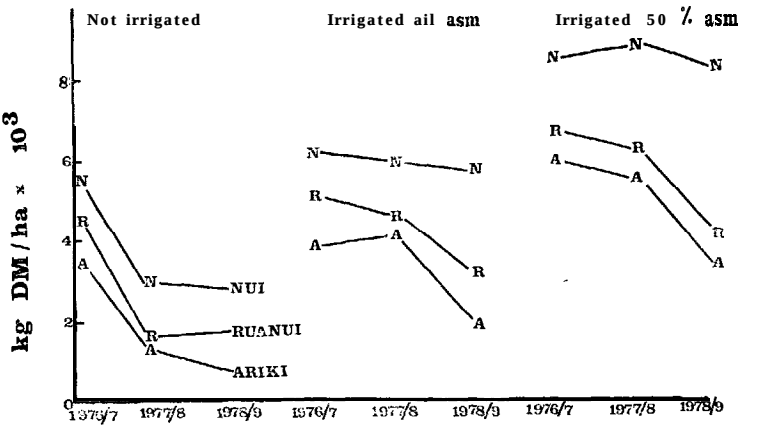

FIG. 1: *Ryegrass production at three levels of irrigation.*

irrigated treatments over the 3 years of the trial (Fig. 1). Lancashire *ef* al. (1976). have suggested that Ariki is susceptible to Argentine stem weevil (*Hyperodes bonariensis* Kuschel) , but it is not known if that insect caused the decline observed in this trial. In contrast, Nui maintained a consistent level of production on the irrigated treatments and is clearly a more persistent cultivar than Ruanui or Ariki under both irrigated and dryland conditions.

Nui-based pastures were more productive than Ariki *or* Ruanui in autumn and winter but failed to realize the expectation of higher summer production. This is probably a reflection of the lower proportion of white clover (a vigorous summer producer) in the Nui pastures. However, Nui pastures did produce more ryegrass in summer, as in all other seasons.

Throughout the trial the sheep were moved together when the shortest pasture was judged to require a spell. Usually they had to be moved because the Ariki pasture required it, and usually the Nui pasture needed further grazing. Each year it was necessary to bring extra sheep in to "clean up" the Nui pastures, especially at 50% asm, and these pastures also required "topping" to remove uneaten seed stalks. It is probable that this was simply because the Nui pastures contained a higher proportion of ryegrasses in the sward.

It seems that the Nui pastures were capable of carying a higher stocking rate than the others: indeed, a higher stocking rate would appear to be necessary to maintain them in a palatable state and prevent undue suppression of clover. Nui pastures may prove most valuable when managed under high stocking rates. Their ability to produce at higher levels in autumn and winter suggests that they will be particularly valuable for all grass wintering management.

ACKNOWLEDGEMENTS

To J. H. Baird for technical work; D. J. Saville, J. R. Proffitt and S. D. McBride for statistical arialysis; and P. C. Carter and D. A. Thomson for herbage dissection and point analysis.

REFERENCES

Armstrong, C. S., 1977. *N.Z. Jl exp. Agric., 5:* 381-4.
Lancashire, J. A., et *al., 1977. N.Z. Jl agric. Res., 20: 63-7.*
Lynch, P. B., 1966. Conduct of field experiments. N.Z. *Dept. Agric. Bull. No. 399.*
Rickard, D. S.; Radcliffe, J. E., 1976. *N.Z. Jl exp. Agric., 4: 329-35.*
Sheath, G. W.; Galletly, W. S.; Greenwood, P., 1976. *Proc. N.Z. Grassld Ass., 38:* 140-50.
Vartha, E. W.,' 1978. *N.Z. Jl exp. Agric., 6:* 157-60.