

'Grasslands Pacific' perennial ryegrass: performance at several sites

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Abstract

'Grasslands Pacific' perennial ryegrass (*Lolium perenne* L.) was compared in the field with available cultivars in plot trials at 6 sites and as sown rows at 7 sites. Pacific showed consistently good performance, particularly in summer and winter when it was superior to other perennial ryegrass cultivars.

Keywords perennial ryegrass, 'Grasslands Pacific', cultivars, 'Grasslands Marsden'

Introduction

'Grasslands Pacific' perennial ryegrass (*Lolium perenne* L.) was bred by C.M.S. Armstrong, DSIR Grasslands, incorporating source material from Spain, Italy and an old Canterbury pasture. It is an erect large-tillered cultivar, similar in appearance to 'Grasslands Nui', Ellett and Yatsyn-1. Its breeding will be described more fully elsewhere.

Pacific was evaluated in a number of trials under the code G28.

Also present in some of the trials was the new long rotation cultivar 'Grasslands Marsden', selected from within 'Grasslands Ariki', and evaluated under the code G33.

This paper summarises data from mowing and grazing trials at 6 sites, and sown rows scored subjectively for vigour and disease infection at 7 sites.

Methods

Trial design is summarised in Table 1.

Gore

Ryegrass was sown at 18 kg/ha with 3 kg/ha Huia white clover in 300 m² plots in October 1986. The trial area was grazed by ewes once in the winter, and every 4 to 6 weeks through the rest of the year. Fertiliser applied was 250 kg/ha per annum 22%

sulphur superphosphate. Before each grazing quadrats were cut to 10 mm. Samples were weighed for yield and dissected for botanical composition.

Lincoln

Perennial ryegrass was sown in October 1986 at 15 kg/ha in a split plot design with white clover cultivars Huia and 'Grasslands Tahora' (3 kg/ha) as main plots. Superphosphate was applied at sowing (150 kg/ha) and annually (100 kg/ha). Dasinit was applied as necessary for control of grass grub and porina. Herbage mass was estimated by capacitance probe when pastures reached 1500-2000 kg/ha dry weight, and then herbage was removed by mob stocking, with subsequent trimming if necessary.

Palmerston North — Mown

Ryegrass was sown in October 1983 at 30 kg/ha into 2 x 1 m plots in a randomised block design with 3 replicates. Dry matter (DM) yields were determined by cutting the whole plot to 3 cm; and botanical composition was determined before cutting when required.

Nitrogen was applied as nitrolime after each cut to replace 3% of the highest total DM yield, and 400 kg/ha of 30% potassic superphosphate was applied annually.

Palmerston North — Grazed

Ryegrass was sown in spring 1986 at 30 kg/ha into 4.5 x 1.25 m plots in a randomised block design with 4 replicates. Before grazing by wethers, DM was determined by cutting 4.5 x 0.09 m strips to 3 cm. Appropriate herbicide was applied in spring each year to keep plots free of white clover and dicotyledonous weeds.

Nitrogen was applied as nitrolime after each cut to replace 3% of the highest total DM yield, and 200 kg/ha of 30% potassic superphosphate was applied in spring and autumn.

Normanby — Mown

Pure ryegrass swards (20 kg/ha) were sown into cultivated ground in April 1985. Nitrogen was

Table 1 Details of plot trials.

Site	Year of sowing	Number of years data	Soil type	Range annual rainfall mm	Cultivars present
Gore	1986	3	Hororata stony silt loam	650-950	Pacific, Nui, Ellett, Yatsyn-1 DM ¹
Lincoln	1986	3	Templeton silt loam	300-750	Pacific, Nui, Ellett, Yatsyn-1, DM¹, TP²
Palmerston Nth — mown	1983	5	Manawatu silt loam	800-1100	Pacific, Nui, Ellett, Ariki, Marsden, Ruanui
Palmerston Nth — grazed	1986	3	Manawatu silt loam	800-1 100	Pacific, Nui, Ellett, Yatsyn-1, Marsden, Marathon, DM¹, TP²
Normanby — mown	1985	2	Egmont brown loam	760-1200	Pacific, Nui, Ellett, Ariki, Ruanui, DM¹
Normanby — grazed	1983	2	Egmont brown loam	760-1200	Pacific, Nui, Ellett
Rukuhia	1989	1	Horotiu sandy loam	1300-1500	Pacific, Nui, Ellett, Yatsyn-1, Marsden, Marathon, DM¹
Kaikohe	1988	1	Waiotu friable clay	1600-1700	Pacific, Nui, Ellett, Yatsyn-1, Marsden, Marathon, DM¹, TP²

¹ DM Droughtmaster² TP Takapau Persistor

applied after each cut, phosphorus and potassium every 2 months, and magnesium and lime as indicated by soil tests. The trial was sprayed as necessary with Nortron, MCPA and dicamba for weed control.

Normanby — Grazed

Ryegrass (20 kg/ha) and 'Grasslands Pitau' white clover (3 kg/ha) were sown in plots 6 x 3 m into cultivated ground in September 1983. **Quadrats** were mown immediately before plots were grazed by dairy cows, and plots were trimmed after grazing. Samples were dissected into **herbage** components once each season. Data were taken for 2 full years from autumn 1984.

Rukuhia

Perennial **ryegrass** was sown in pure **swards** in April 1989 at 15 kg/ha into 5 x 2 m plots with 4 replicates. **Captan** fungicide was applied to the seed and 350 kg/ha serpentine superphosphate was sown with it. Lime was applied after sowing at 2 t/ha. Nitrolime was applied at 30 kg/N/ha after the first cut, and after each subsequent cut was applied at 4 g N per

100 g DM of the top yielding plot. Potassium chloride was also applied as appropriate. Yields for the first two cuts are available on request. One full year's data are presented from 13 cuts from September 1989 until August 1990 (5 cuts in spring, 3 each in summer and autumn and two in winter).

Kaikohe

A randomised block design with 4 replicates was sown in June 1988 in 4 x 3 m plots to 16 kg/ha **ryegrass** with 1 kg/ha each of Huia and 'Grasslands Kopu' white **clovers**. Thirteen **ryegrass** cultivars were included. Herbicide was applied as required. Lime (2 t/ha), superphosphate (425 kg/ha) and potassium chloride (75 kg/ha) were applied at sowing, and phosphate, potash, magnesium and urea were applied at intervals subsequently. Initial clover establishment was poor so 4 kg/ha Kopu was sown in September. Yield assessments were not begun until the following April. Pasture probe and mown strips were used to assess **herbage**, before grazing with sheep and cattle, at **10- to 12-week** intervals in summer and autumn and 6-weekly the rest of the year.

Table 2 Endophyte levels of seed lots (%)¹

	Lincoln	P.N. (mown)	P.N. (grazed)	Normanby (grazed)	Rukuhia	Kaikohe
Pacific	81	94	81	94	63	65
Nui	67	75	84 ²	93	93	86
Ellett		76	85²		90	93
Droughtmaster					80	100
Yatsyn-1					90	94
Ariki			89	89		
Marsden		92	100		93	100

¹ Seed squash inspection of 15-20 seeds² Mean of two seed lots

Table 3 % tillers infected with **ryegrass** endophyte at Palmerston North.

Mowing trial: samples February 1985			Grazing trial: sampled June 1989				
Nui	Ellett	Ariki	Drought- master	Yatsyn-1	Takapau Persistor	Marathon	Marsden
100	85	60					
88	83	85	80	53	85	93	43

Sown rows

Up to 210 **ryegrass** breeding lines were sown in 1 m rows at Kaikohe, Wairakei, Palmerston North, Aorangi research farm (west of Palmerston North), Lincoln and Gore in autumn and spring 1987, and at Te Poi (Waikato) in autumn 1988. Currently available **ryegrass** cultivars and Pacific were included as controls. The areas were grazed by sheep, and 50 kg/ha nitrogen as urea was broadcast after grazing in autumn and spring each year. Growth was noted by eye at different times through the year on a scale of 1-5, or 1-10. On one occasion, plots at Palmerston North were cut to 20 mm and fresh weights were recorded. Rust infection of the control cultivars was reported by Easton et al. (1989).

Results

Table 2 gives levels of endophyte infection in seed lots and Table 3 gives infection levels in plots for the two Palmerston North trials, 16 months after sowing for the mowing trial, and nearly 3 years after sowing for the grazing trial. Except for Rukuhia, the seedlot data are determined from seed squashes, and therefore indicate the level of infection at seed harvest. As the seedlot ages, the level of live endophyte declines. **Ryegrass annual mean yields are given in Table 4, and seasonal data for Pacific and Marsden relative to controls in Table 5.**

Gore

There were no year x cultivar interactions and few comparisons were significant. Pacific had the highest yield in summer and winter, and Yatsyn-1 was highest yielding in the autumn. Summer clover yield was poor in Pacific plots. For all plots white clover yield was less than 10% of the total.

Lincoln

Uneven establishment and subsequent high variability reduced the value of this trial, but precision was enhanced by covariance analysis correcting for the depth of soil above a layer of stones.

The **ryegrass** cultivar mean square was not significant at the 5% probability level. Ellett and Yatsyn-1 were generally the highest yielding **ryegrass**

Table 5 Seasonal yield of Pacific and Marsden relative to mean of controls (= 100).

	Spring	Summer	Autumn	Winter
Pacific				
Gore'	105	110	95	119
Lincoln'	91	88	96	108
Palmerston Nth — mown'	94	102	100	108
Palmerston Nth — grazed'	110	132	112	97
Normanby — mown ²	100	114	102	105
Normanby — grazed'	115	132	141	141
Kaikohe'	97	106	104	101
Rukuhia'	93	102	89	98
Marsden				
Palmerston Nth — mown ³	89	105	99	97
Palmerston Nth — grazed'	105	115	103	94
Kaikohe'	105	99	105	120
Rukuhia ¹	95	106	88	103

Controls: Nui, Ellett, Droughtmaster, Yatsyn-1

*Controls: Nui, Ellett, Droughtmaster

¹Controls: Nui, Ellett

Table 4 Mean annual **ryegrass** yield for plot trials (t/ha).

	Pacific	Nui	Ellett	Drought- master	Yatsyn-1	Marathon	Ariki	Marsden	lsd
Gore	9.7	8.5	9.1	9.2	9.8				0.9
Lincoln	6.3	6.5	1.3	5.9	7.0				0.8
Palmerston Nth — mown	11.6	11.7	11.8				10.5	11.2	1.2
Palmerston Nth — grazed	13.1	11.9	12.2	11.2	11.8	10.4		12.3	0.8
Normanby — mown	15.4	14.8	14.2	15.0			13.7		0.6
Normanby — grazed	5.9	5.1	4.6						0.7
Rukuhia	13.3	14.2	14.1	13.4	14.1			13.5	0.9
Kaikohe'	8.4	8.6	8.5	8.4	7.4	8.0		8.7	1.4

Kaikohe data are for total **herbage**, elsewhere **ryegrass** atone.

Table 6 Sown rows seasonal and annual indices over all sites.

	Pacific	Nui	Ellett	Drought- master	Yatsyn-1	Marathon	Ariki	Marsden	lsd (5%)
Spring	5.38	4.70	5.02	5.48	4.82	4.56	4.59	4.47	0.48
Summer	5.05	4.32	4.47	4.19	4.12	4.01	3.80	3.90	0.63
Autumn	4.46	4.29	4.38	4.00	4.14	3.93	3.55	3.68	0.41
Winter	4.92	4.16	4.22	4.43	3.90	4.12	3.85	3.92	0.59
Annual	4.95	4.31	4.52	4.52	4.25	4.17	3.95	3.99	0.26

cultivars. Pacific grew very well during and after the difficult summer of 1987/88. Nui plots had significantly more clover than Pacific, Ellett or Yatsyn-1. Clover was less than 10% total annual yield.

Palmerston North — Mown

Significant differences between annual totals in each of the 5 years distinguished only the poor lines (nil endophyte) from the others. In 3 of the 5 springs, Pacific was lower yielding than Ellett and Nui, but in 2 of these years it showed compensatory greater production in the following summer. Pacific was the highest yielding cultivar in the poorest year, 1986-7.

Another comparison of interest is between the long rotation cultivars Ariki and Marsden. Marsden consistently outperformed Ariki. Marsden was the highest yielding cultivar of the trial (not significantly so) in the second, third and fourth autumns, in the third, fourth and sixth summers, and in the fourth winter. It performed very well in the difficult year of 1986-7. However, it was always outyielded in the spring.

Palmerston North — Grazed

The most consistent effect was that Pacific, Nui, Marsden, Ellett and Yatsyn-1 outyielded Takapau Persistor and Marathon, with Droughtmaster between these two groups. Pacific had the highest yield in the first 2 full years, particularly the second when its summer performance was significantly higher than that of any other cultivar. However, it yielded relatively poorly in the third spring (differences not significant at the 5% probability level) and this carried into the third summer. In the fourth autumn (1990), Pacific again yielded as well as any other cultivar.

As in the mowing trial at Palmerston North, Marsden performed very well. The trend for relatively weak spring performance was not repeated in the grazing trial.

The contribution of volunteer species to the total yield was inconsistent for the first 2 years, with no significant effects. It tended to be relatively low for Pacific in all seasons in the third year, and in the fourth autumn, but this result was not statistically significant. Ryegrass yields were over 90% of sward totals.

Normanby — Mown

Pacific grew very well in the first year so that annual yield was significantly greater than all other cultivars

except Droughtmaster. Pacific outyielded Droughtmaster in all seasons except spring. The superiority of Pacific was particularly evident in summer. In the second year cultivar yields were essentially the same, except that Ruanui and Ariki were poorer than the rest, probably reflecting the low levels of endophyte infection.

Normanby — Grazed

Pacific was significantly better than Ellett and Nui in both springs, in the second autumn and in the second annual total. It outyielded Ellett alone in both summers. All other ryegrass comparisons were non-significant, and compensating clover growth rendered all comparisons of total growth non-significant. Pacific tended to have a higher ryegrass component (52%) than Nui (45%) or Ellett (40%). Most of the herbage other than ryegrass was white clover.

Rukuhia

The cultivar mean square for annual yield in the first year of this trial was not significant. Pacific yielded less than Nui, Ellett and Yatsyn-1 and the difference was just significant at 5%. Performance in summer and winter was better than in spring and autumn.

There was no significant difference in annual yield between Marsden and the control cultivars, and again in summer and winter growth was stronger than in spring and autumn.

Kaikohe

Botanical composition was analysed only once, in February, when plots contained up to 50% *Digitaria sanguinalis*, so data in Table 4 are total yields for this site.

Cultivars of interest did not differ significantly in total yield. Marsden grew very well in the second winter of the trial, but Marsden and Yatsyn-1 plots were very severely invaded by *Digitaria sanguinalis* in February 1990, with only 18 and 10% respectively of the herbage being ryegrass. They were both significantly poorer at the autumn recovery cut than Ellett, Nui and Pacific which were 35% ryegrass in February.

Sown rows

Notes from different occasions and sites were combined into indices by dividing the cultivar mean for a note by the root error mean square for that note. Overall and seasonal indices are given in Table 6.

Differences between cultivars were significant at all seasons and at all sites except Te Poi, which was very variable, and Lincoln. Pacific had the highest mean note overall, the highest mean at all sites except Te Poi and the highest mean in each season except spring. Droughtmaster performed unusually well in spring but was not significantly better than Pacific.

Marsden persisted well and was noted as well as Ariki, but its mean growth note was consistently poorer than those of most of the commonly used cultivars. Possibly, visual noting penalises dense finer **tillered** varieties relative to more open erect types. The Ariki seed used had a high level of endophyte infection, but such seed lots are now not common in commerce. Farmers can expect **Marsden** to outperform Ariki in situations of moisture or stem weevil stress.

General discussion

Where possible, all plots were sown to seedlines with high levels of endophyte infection. There were inevitably, however, differences in the **actual** levels (Table 2), and these were still evident in sward levels some years after sowing (Table 3). With current seed storage technology, commercial seedlines for any one variety can be expected to show these levels of variation, except for the first few years of the cultivar's commercial life.

Neither the sown grass rows, nor the 5 sward trials which included Yatsyn-1 supported the report by Kerr (1987) of consistently outstanding performance by that cultivar. The location of trial sites was different, but our results cover a wide area of New Zealand.

Pacific has performed as well as any cultivar in all trials, except for **being marginally poorer** than controls in Rukuhia, and has shown superior performance in some. The lower than expected performance of Pacific at Rukuhia can be explained by the lower endophyte infection level of this cultivar, compared with the others at this site. Further, 2 of the 4 trials in which it did not **outyield** Nui and Ellett, the only controls present in all trials,

were those at Kaikohe and Lincoln which were the least successful trials in terms of controlling the error variation.

There is evidence of a general interaction with season (Table 5). Except for the Lincoln trial, where cultivar comparisons were generally not significant, Pacific has performed better in the summer than in spring. Only the grazing trials at Palmerston North and **Normanby** gave any indication of superior performance in spring and autumn, whereas summer performance was consistently good. Winter performance was also good except for the grazing trial at Palmerston North. The sown rows, noted at 7 sites, gave no evidence of interaction with season.

At several sites there was a trend of less clover in the Pacific plots than with other ryegrasses. This may reflect stronger competition from Pacific over the summer, and this aspect is under further study (Hay pers. **comm.**). However, in some cases where this trend was evident, the clover levels were generally very high (Normanby), or very low. All mowing trials were conducted on pure **ryegrass** swards.

Pacific shows up then as a good general purpose cultivar which can be sown with confidence in all **ryegrass** areas of New Zealand. Its especially good summer and winter growth, relative to spring, and its low level of infection with crown rust (**Easton et al.** 1989) mean that it will supply **quality herbage** throughout the year.

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