Effects of sowing date on ryegrass and tall fescue establishment by direct-drilling

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Abstract

The effects of sowing date on tall fescue (*Festuca arundinacea* Schreb) and perennial ryegrass (*Lolium perenne L.*) establishment by no-tillage were assessed in the autumn of 1993. Establishment began on 1 March 1993 and continued at 21 day intervals through to 24 June 1993. Tall fescue emergence (mean = 19% of sown seed) and ensuing plant populations (362 plants/m^2) was significantly lower than that for ryegrass (65% emergence and 559 plants/m^2 respectively). Emergence declined as sowing dates progressed through autumn into winter, and weed ingression was greater in the tall fescue plots. Time of sowing significantly affected yield, with herbage mass from the first three sowing dates being 42% greater than herbage mass from the latter three sowing dates. Yield declined by 559 kgDM/ha with every 21 days between sowings. At this site, plant performance characteristics rapidly diminished at sowings later than 14 April. Plant performance was consistently better for the 1 March sowing.

Additional key words: *date of sowing, perennial ryegrass, tall fescue, direct-drilling, pasture establishment.*

Introduction

Optimum pasture sowing time in New Zealand is determined by temperature and moisture constraints, and autumn is traditionally favoured for pasture establishment because of the suitability of these factors. Timeliness of sowing is particularly important when slower establishing temperature sensitive species such as tall fescue (*Festuca arundinacea* Schreb) are used (Charlton *et al.*, 1986). Late sowing dates are however widely used, often resulting in reduced total yield, increased weed ingression and fewer grazing days (Ritchie and Empson, 1993).

Pasture establishment has undergone a distinct change from traditional cultivation based around the mouldboard plough (Baker, 1969) to the technique of no-tillage (Baker, 1982; Ritchie, 1986) as both management techniques and machinery development have evolved conjointly. The latter has become a popular method for both establishing new pastures and renovating existing swards. In addition to the more general advantages of no-tillage as reviewed by Baker (1985), no-tillage provides significant time savings, time flexibility and an opportunity to graze new pastures within a short time of sowing when compared with conventional cultivation.

No-tillage does not necessarily result in pastures being established early in the autumn. Empson (1992) reported that most farmers currently practising no-tillage pasture establishment did not begin doing so until late April or early May. Ritchie and Empson (1993) stated that such "late" sowing dates could well result in reduced total pasture yield and increased weed ingression into the newly-sown sward, and added that while the decision to undertake pasture renewal is influenced by a number of factors, the gross returns for many farmers from new pastures could be improved by sowing earlier.

Materials and Methods

Both perennial ryegrass and tall fescue were direct-drilled at six dates from February to June 1993 (Table 1). There were therefore twelve treatments with four replicates per treatment, contained within a randomised complete block design located on a Manawatu fine sandy loam soil. The site was flat and had been previously cropped with wheat (*Triticum aestivum* L.). The vegetation was mown to a residual height of 1.5 cm. Preparation and sowing dates are described in Table 1. The last sowing (sowing 6) was destroyed by slugs (*Deroceras* spp.) and hence the results are for only five sowing dates.

Plots were sprayed with 5 L/ha Roundup® (360 g/L glyphosate as active ingredient) in 200 L/ha of water 7

Table 1. Spraying and drilling dates with elapsed time between operations.

Treatment	Spraying	Drilling	Elapsed Time (days)
1	23 February	1 March	6
2	17 March	23 March	7
3	8 April	14 April	6
4	28 April	4 May	6
5	21 May	1 June	9
6	14 June	24 June	10

days before drilling. To increase penetration and plant herbicide uptake a surfactant (Triton® X-45) was used at 250 ml/100 L of water (1000 g/L alkyl aryl polyether alcohol as active ingredient).

An Aitchison Seedmatic™ 1112 direct-drill featuring the inverted-T groove described by Baker (1976) was used because of its characteristic features which retain high levels of in-groove vapour moisture, even in relatively dry soils (Choudhary and Baker, 1981). All plots were drilled at a constant ground speed of 5 km/h, while groove depth was set at 20-30 mm. Tall fescue (cv. Grasslands Roa) was sown at 35 kg/ha and perennial ryegrass (cv. Grasslands Nui) was sown at 16.5 kg/ha. Plot size was 3.6 m by 8 m.

Thimet® 20G (200 g/kg phorate as active ingredient) was sown with the seed at 5 kg/ha and a slow-release nitrogenous fertiliser (27:0:0:0) was applied at 50 kg/ha in the drill rows. Harrowing was performed immediately post-drilling to achieve a slot cover approximating Grade III (intermittent sod or mulch cover) (Baker, 1976) thus promoting seed germination. Five kg/ha of Blitzem® (27 g/kg metaldehyde as active ingredient) was broadcast immediately following drilling.

Plant counts were made in 1m of five rows per plot at 35 and 98 days after sowing (das). Pasture samples were initially harvested 70 das and every 28 days thereafter until the trial ceased on November 16, by cutting to ground level with hand shears from within three 0.1 m quadrats within the plots. Plots were then mown to a 2.5 cm sward height with the herbage removed at each harvest. Each pasture cut was botanically analysed to determine the proportion of weeds and sown species within the established sward. Tiller numbers and plant leaves were measured before oven-drying at 80°C for 12 hours and weighing.

Table 2. Plant emergence and establishment characteristics among five sowing dates for perennial ryegrass (PR) and tall fescue (TF)

	Sowing Date					
Characteristic and species	23/2	17/3	8/4	28/4	21/5	LSD P<0.05
Pre-mowing herbage mass at 70 das[1] (kg DM/ha)						
PR	1165	1213	757	1377	635	334
TF	1100	967	585	1071	483	296
Accumulated herbage mass at 16 Nov. (kg DM/ha)						
PR	7393	6266	6028	4351	5196	731
TF	6160	5907	7042	4051	4644	782
Other species at 70 das (% total DM)						
PR	4.5	4.8	3.4	0.6	1.1	2.7
TF	10.7	4.9	3.6	2.0	1.8	4.1
Emergence at 35 das (%)						
PR	85	54	93	47	44	11
TF	28	18	22	12	14	4
Plant population at 98 das (plants/m^2)						
PR	733	469	801	409	381	120
TF	540	346	418	237	269	96

[1] das = days after sowing

Results and Discussion

Emergence ranged from 44 to 93% in perennial ryegrass and from 12-28% in tall fescue (Table 2). The mean emergence was 65% for the former and 19% for the latter. The mean emergence was 65% for the former and 19% for the latter. The greatest emergence (93%) was achieved for the 8 April sowing of perennial ryegrass, while for tall fescue the greatest emergence (28%) was for the March sowing (Table 2). For both species, emergence was significantly reduced at the last two sowings. Hill *et al.* (1985) concluded that tall fescue required soil temperatures in the range of 18-21°C to achieve successful establishment. In this experiment however, soil temperature at 10cm peaked at only 14.6°C (March) and it became progressively colder as sowing was delayed reaching a minimum of 7.1°C in July. Seedling emergence may also have been affected by varying depth as a function of machine design which may have resulted in seed being placed beyond the ideal 5-15 mm band (Southwood *et al.*, 1982) (especially important for tall fescue).

Plant populations measured at 98 das were greater for ryegrass over all sowing dates than for tall fescue (Table 2). Plant populations for both species declined significantly at the last two sowings, and this was also reflected in the accumulated herbage mass (Table 2).

Species had no significant effect on total accumulated herbage mass throughout the experiment. Ryegrass plots yielded a mean total of 5787 kgDM/ha while tall fescue plots produced 5621 kgDM/ha (LSD = 275; $P \leq 0.05$) through to November 16 when the last harvest was made.

Time of sowing however, produced significant effects ($P \leq 0.001$) on yield. The first three sowing dates, on average, yielded 42% more than the last two sowing dates, reflecting the declining autumn and winter temperatures. Total yield declined by 559 kgDM/ha ($r=0.80$) every 21 days between sowings. Earlier sowings allowed three additional harvests over those established later. This has obvious practical implications for winter grazing rotations on farms in this country. Earlier sown pastures enjoyed the obvious benefits of warmer soil temperatures and longer sunshine hours, resulting in greater seedling emergence and significantly greater plant populations. This experiment validated the suggestion by Ritchie and Empson (1992) that "late" sowing dates could well result in reduced total pasture yield and increased weed ingression. With the time-saving benefits of no-tillage, pastoral farmers have the means to establish pastures as early as possible and realise the benefits of increased grazing days, greater pasture growth rates and weed-free pastures.

Tall fescue swards contained 1.5 times more weeds at 70 das than ryegrass (mean = 4.6%, cf 2.2%, $P \leq 0.001$, Table 2), possibly due to the competition effect of vigorously establishing ryegrass seedlings compared with the slower establishing tall fescue seeds. Date of sowing had a significant ($P \leq 0.001$) bearing on percentage weed ingression into both ryegrass and tall fescue plots, as the presence of weed species steadily declined with time from 7.6% in sowing 1 to 1.4% at the last sowing date, (Table 2) a further possible reflection of declining soil temperatures.

Conclusions

In this study tall fescue emergence and ensuing plant populations were disadvantaged when compared to perennial ryegrass. As sowing dates progressed through autumn into winter emergence rapidly declined and weed ingression was greater in the tall fescue pastures. Time of sowing produced significant effects on yield, the first three sowing dates producing 42% more herbage mass than the latter sowing dates. Yield declined by 559 kgDM/ha with every 21 days between sowings.

It was clearly beneficial, in the Manawatu autumn of 1993, to have sown pastures as early as possible. In this experiment plant performance characteristics rapidly diminished when sown later than 14 April. Earlier sowing dates allowed three extra harvests over later dates. Sowing 1 showed consistently greater plant performance across most measurements.

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