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Hybrid and Perennial Tetraploid Ryegrasses Are at least as Productive and Persistent as Perennial Diploids in Dryland Conditions in Northern Tasmania

Pedro M. Evans
DLF Seeds, New Zealand

Eric J. Hall

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Hybrid and perennial tetraploid ryegrasses are at least as productive and persistent as perennial diploids in dryland conditions in northern Tasmania

Pedro M Evans [A] *and Eric J Hall* [B]

[A] DLF Seeds, 32 Sheffield Crescent, Burnside, Christchurch, New Zealand
[B] 210 Summit Drive, Devon Hills 7300, Tasmania, Australia
Contact email: pe@dlfseeds.co.nz

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Introduction

Perennial ryegrass *Lolium perenne* is the preferred grass for fertile conditions and high rainfall areas or those with irrigation. Persistence of ryegrass can become a problem in drier and warmer areas (Fraser 1994). Even in high rainfall areas of south eastern Australia receiving between 550 and 750 mm of annual rainfall, loss of perennial ryegrass within a few years from sowing is a common problem (Waller and Sale 2001).

This work aimed to examine the ability of a range of lines and cultivars of ryegrass to produce and persist under dryland conditions and rotational grazing by sheep in northern Tasmania, Australia.

Methods

21 diploid and 10 tetraploid perennial ryegrass lines and cultivars and 4 tetraploid hybrid ryegrasses were sown as monocultures on the 22nd April 2010 using a randomised complete block design with 4 replications, at Cressy, Tasmania (Table 1).

The site was sprayed twice prior to sowing with 2 L/ha of Roundup450 (active ingredient 450 g glyphosate/litre) + 100ml/100L Activator. All lines were direct drilled into 5 x 1.5m plots using an Oyjord cone seeder. The sowing rates for diploids and tetraploids were 20 and 25 kg/ha respectively. The site received 300 kg/ha of 0-6-17 NPK prior to sowing, with a maintenance dressing of 200 kg/ha of 4-6-7-12 NPKS applied in autumn 2011. Fifty kg/ha of N was applied in early spring 2011. Insecticide was applied annually to control the pasture pests *Oncopera intricata* (corbie) and *Aphodius* spp. (pasture cockchafers). Broadleaf weeds were controlled with herbicide, applied after the autumn break.

Table 1. Cressy site details.

Attribute	
Latitude	41° 43’ 57.76” S
Longitude	147° 03’ 58.8” E
Elevation (m)	147
Mean annual rainfall (mm)	628
mean maximum temperature (°C)	17.2
mean minimum temperature (°C)	5.1

Seedlings were counted in two quadrats (0.25 m^2) per replicate, 4 weeks after sowing to confirm establishment. Frequency assessments were made in April 2011 and April 2012 after the autumn break and again in February 2013. Two square quadrats of steel mesh with 100 cells (each 0.1 m x 0.1 m) were placed in fixed positions on the ground at each assessment time. For each plot, cells containing a portion of a live plant crown of the sown species were recorded and the total number of cells in the quadrat with live plant material was used to estimate frequency of occurrence. The mean of the two quadrats was used as the % frequency count. Dry matter production was assessed by randomly placing three 0.25m^2 quadrats per replicate and cutting one after removing the two extremes, and oven drying the samples at 100 °C. Cuts were only taken from the internal 3m x 1m area of each plot to eliminate any edge effect. The site was “crash” grazed with sheep after each herbage production assessment. Assessments were made every time enough biomass was present for a cut.

Results

The average production over the trial period for the hybrid tetraploids, perennial tetraploids and perennial diploids was 20.2, 18.4 and 16.5 tonnes of dry matter respectively. Their final frequency count in February 2013 was 40, 45 and 38 and the percentage of ground cover lost from their initial frequency count was 41, 36 and 47 for hybrid tetraploids, perennial tetraploids and diploids respectively. While there were reasonable numbers of perennial diploids and tetraploids, the results could be skewed towards the hybrids because of their low number (4) and an exceptionally productive line (px64-07).The annual rainfall for 2010, 2011 and 2012 at the site was 717, 655 and 571mm respectively. The result of a subset of the treatments is shown in Table 2.

There was general agreement between the total production and final frequency (r^2=0.44; P<0.001), however the most productive line, Px64-07, a tetraploid, had a final frequency of only 41% which was significantly less than the most persistent, Wintas2. Interestingly the loss of frequency of Px64-07 in relation with the first measurement was not significantly different to the most persistent treatments. The behaviour of Wintas 2 suggests a

Table 2. Frequency counts over the duration of the experiment and total dry matter (t/ha) for perennial and hybrid ryegrasses at Cressy, Tasmania. (* lpd: *Lolium perenne* diploid; lpt: *L. perenne* tetraploid; lht: *Lolium hybridum* tetraploid).

Line/cultivar/ploidy	Initial frequency	Final frequency	Frequency loss	Total dry matter
06px22a (lpd*)	87	44	44	17.1
06px22b (lpd)	88	34	54	19.4
06px43 (lpd)	81	22	60	14.2
06px45 (lpd)	85	24	61	13.8
Arrow (lpd)	85	38	46	16.0
Avalon (lpd)	85	39	46	14.8
Azer (lpd)	90	26	64	11.0
Banquet2 (lpt)	83	44	39	18.1
Bealey (lpt)	86	56	30	21.7
Expo (lpd)	85	46	38	18.0
Ohau (lht)	83	45	38	18.0
Px102 (lht)	83	34	48	20.1
Px27-07 (lpd)	83	43	40	18.5
Px47-07 (lpt)	83	46	37	17.6
Px56-07 (lpt)	85	54	31	20.8
Px56-07F5 (lpt)	86	51	35	19.5
Px64-07 (lht)	79	41	38	22.5
Wintas2 (lpd)	89	58	31	17.5
lsd (p=0.05)	ns	12.5	12.8	3.62

compromise between yield and persistence that has been observed by Hazard *et al.* (2001). However, there were productive treatments which maintained a frequency as high as Wintas2 such as Bealey and Px56-07 over the relatively short time of this experiment.

The results suggest that the productive plants continue to be productive under most conditions and that tetraploid cultivars, which generally have fewer, larger tillers than diploids, show a range of persistence and can be amongst the most persistent (Easton *et al*.2011).

Conclusion

Some hybrid tetraploid ryegrasses showed outstanding production and did not significantly lose frequency in relation to the most persistent treatments. Tetraploids produced and persisted at least as well as the diploids.

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