5.4 PRODUCTION & PERSISTENCE OF COMMON PASTURE VARIETIES

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KEY MESSAGES

- Annual and Italian ryegrasses production dropped by 50 % in their second year and may not be worth maintaining unless additional species are over sowed.
- The winter active tall fescues showed they were more suited to Rokewood's climatic conditions, producing 28 % more feed on average than summer active tall fescues.
- With waterlogging events in the establishment year of 2022, the waterlogging tolerant varieties of sub clover have continued to perform the best.
- All cultivars of perennial ryegrass showed little growth in 2023 in comparison to the other pasture varieties which has been caused by nitrogen and moisture deficits.

Keywords: pasture, phalaris, tall fescue, ryegrass, sub clover

BACKGROUND

In 2022, pasture variety trials were established using phalaris, tall fescue, perennial ryegrass, annual and Italian ryegrass and sub clover cultivars. Most varieties in the trial were selected on their suitability to the local area and high rainfall zone, whilst some deemed not suitable were also included to show varietal differences within species and highlight the importance of pasture variety selection when improving pastures. In the year of establishment, unseasonally wet conditions occurred from October to November 2022. The production results of the first year are reported in the 2022 trial results book. In 2023 an unseasonal dry period occurred from late winter (August) to early spring (October) which finished with a wetter than normal December. This article reports on the second year of production and persistence results for the varieties tested.

METHOD

Trial Management

All varieties were sown in mid-May 2022. Table 1 shows the sowing rate used for each pasture species.

Table 1. Trial pasture species and their respective sowing rates.

Pasture Species	Sowing Rate/ha
Phalaris	4 kg
Tall Fescue	15 kg
Perennial Ryegrass	15 kg
Annual & Italian Ryegrass	21 kg (tetraploids) 15 kg (diploids)
Sub clover	10 kg

During the year there was no grazing by livestock, and biomass removal was undertaken mechanically using a catch-and-weigh mower for biomass data collection. After biomass cuts, urea fertiliser (46 % N) was applied depending on the amount of average DM removed per plot to replace lost nitrogen. Single superphosphate was applied at the autumn break with the rate based on dry matter removed in the previous year and soil test results.

Varieties

Phalaris

There are two types of phalaris: prostrate semi-winter dormant and summer dormant cultivars and newer varieties that are more erect, winter active (WA) and medium summer dormant. Winter active varieties were mainly used in the phalaris trial except for the traditional Australian phalaris which is semi-winter dormant. The varieties trialled are outlined in Table 2.

Tall Fescue

The tall fescue trial contained winter active (WA) and summer active (SA) cultivars. The summer active varieties are well suited to heavy soil types, summer rainfall or areas with above 600 mm annual rainfall. Although Rokewood has heavy clays, it may struggle to persist given it is generally not a summer wet environment. The varieties trialled are outlined in Table 3.

Perennial Ryegrass

All ryegrasses are identified as diploid or tetraploid. Diploids have two chromosomes per plant cell while tetraploids have four. Diploid plants have a lower water content per cell and therefore have a greater dry matter per kilogram of pasture than tetraploid plants. Leaves are generally smaller and thinner in diploids and tend to have more tillers per plant. In comparison, tetraploid grasses are more palatable, contain marginally higher metabolizable energy levels and have less ground cover, leaving room for clovers (DLF Seeds n.d).

In the perennial ryegrass trial, a variety of each ploidy was selected to show the difference in DM production between the two types. The varieties trialled are outlined in Table 4.

Annual & Italian Ryegrasses

Italian ryegrass varieties may persist into a second year under favourable moisture and temperature conditions over summer but have variable results as they need low summer temperatures. Annual ryegrasses may persist with the correct grazing management and climatic conditions (Launders et al. 2010). The varieties trialled are outlined in Table 5.

Table 2. Phalaris varieties, the marketer and growth period.

Variety	Marketer	Growth
Amplify	Valley Seeds	Winter active
Holdfast GT	Barenbrug (bred by CSIRO)	Winter active
Holdfast	AGF Seeds	Winter active
Stockman	Upper Murray Seeds	Winter active
Australian	AGF Seeds	Semi-winter dormant
Confederate	PGG Wrightson (DLF Seeds)	Winter active

Table 3. Tall fescue varieties, the marketer and growth period.

Variety	Marketer	Growth
Charlem	Upper Murray Seeds	Winter active
Temora	DLF Seeds	Winter active
Finesse-Q	RAGT	Summer active
Fortune	Barenbrug	Summer active
Prosper	Barenbrug	Winter active
Hummer	DLF Seeds	Summer active

Table 4. Perennial ryegrass varieties, the marketer, number of chromosomes and maturity notes.

Variety	Marketer	Ploidy (No. of Chromosomes)	Notes on Maturity
Victorian	AGF Seeds	Diploid	Mid-maturing
Avalon AR1	VicSeeds	Diploid	Mid-late maturing
Hustle AR1	RAGT	Diploid	Late maturing
Reason AR37	DLF Seeds	Diploid	Mid-maturing
Base AR37	DLF Seeds	Tetraploid	Late maturing
Maxsyn NEA4	DLF Seeds	Diploid	Mid-late maturing

Table 5. Annual and Italian ryegrass varieties, the marketer, number of chromosomes and maturity notes.

Variety	Marketer	Ploidy (No. of Chromosomes)	Notes on Maturity
Fuze	Barenbrug	Diploid	ARG - Late spring
New Tetila	Vic Seeds	Tetraploid	ARG - Late spring
SF Pinnacle	RAGT	Tetraploid	ARG - Late spring
Manta	DLF Seeds	Diploid	Italian ryegrass
Tempo	Barenbrug	Diploid	Italian ryegrass
Feast II	DLF Seeds	Tetraploid	Italian ryegrass

Subterranean (Sub) Clover

Subterranean cover has three subspecies (ssp). Ssp subterraneum sub clovers are suited to well-drained, neutral to moderately acid soils; Brachycalcinum sub clovers are suited to neutral to alkaline soils; Yannicum sub clovers are suited to poorly drained, waterlogged sandy loam and clay soils (Nichols 2021). A variety of the three subspecies were selected for comparison listed in Table 6.

Data Collection & Analysis

Pasture biomass was collected during the growing season based on the height and density of the plants. Sub-sample measurements were taken using a cordless handpiece and oven-dried to determine the moisture content of each variety. A ride-on mower with a built-in weighing system was used to mow and weigh the standing pasture in each plot to determine biomass. Cuts were taken throughout the year when the pasture reached 20 cm plus, as shown in Table 7. At each harvest, the pasture was cut to a residual height of 5 cm.

Persistence was measured by counting the number of 5 cm gaps in 4 crop rows x 1 m length. This is then subtracted from the 'base figure' which is the number of 5 cm units in the 400 cm assessed. This then produces a persistence 'score', with 80 the highest (no gaps). Sub clover was visually assessed for % of plot covered by clover. Trials were assessed in mid-July when pasture was short.

RESULTS & DISCUSSION

Phalaris

In 2022, there were no significant differences between varieties in the phalaris trial. They all produced between 7473 and 8296 kg DM/ha. In 2023, there were again no significant differences between varieties and DM production during the different seasons shown in Figure 1. However, Stockman produced the highest total amount of DM (5870 kg DM/ha) which was statistically different to Amplify which produced the lowest amount of DM (4895 kg DM/ha) (Table 8) with less growth occurring in autumn. Stockman is a cross between Holdfast and Australian phalaris. Australian phalaris is semi-winter dormant and prostrate growing, whereas the other varieties are winter active with more erect growth. There were no significant differences between the varieties' persistence scores that were taken in July with all varieties scoring above 75 out of a maximum score of 80 (Table 9).

Tall Fescue

In 2022, there were no significant differences between varieties in the tall fescue trial. They all produced between 7913 and 9519 kg DM/ha. Additionally, there were no significant differences between the summer and winter active types.

In 2023, the total production of the three winter active varieties (Charlem, Temora and Prosper) produced significantly more than the summer active species of Finesse-Q, Fortune and Hummer (Table 10).

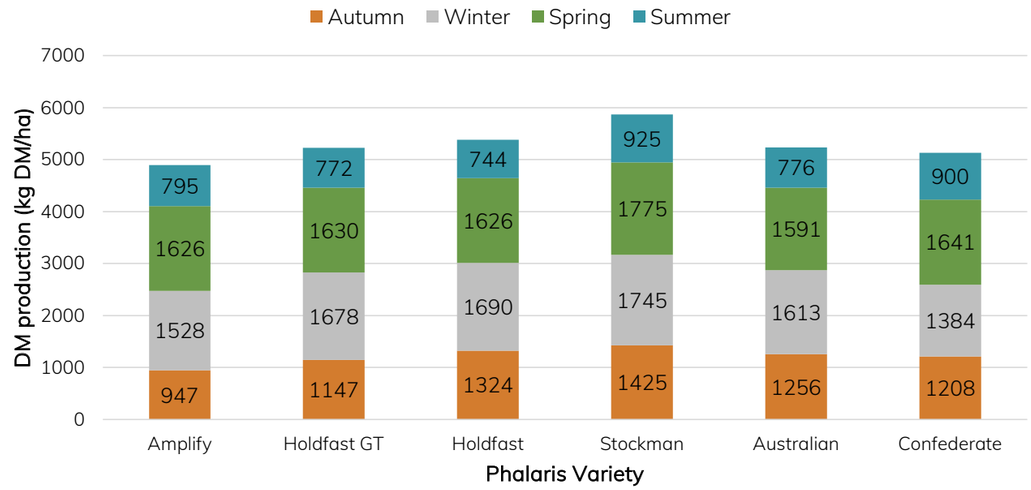

Figure 1. Phalaris varieties and their dry matter (DM) production (kg DM/ha) in 2023-24.

Table 6. Sub clover varieties, the marketer, sub clover type and maturity.

Variety	Marketer	Sub Species	Maturity
Yanco	RAGT	Yannicum	Mid
Trikkala	AGF Seeds	Yannicum	Mid
Narrikup	RAGT	Subterranean	Mid
Antas	Barenbrug	Brachy	Mid-late
Campeda	Barenbrug	Subterranean	Mid
Bindoon	DLF Seeds	Subterranean	Mid

Table 7. Cutting dates for each trial.

Season	Cutting Date	Species Cut
Autumn 2023	16-Jun-23	Phalaris, tall fescue
Winter 2023	13-Jul-23	Perennial ryegrass, Italian ryegrass, phalaris
	2-Aug-23	Tall fescue, sub clover
	29-Aug-23	Phalaris, tall fescue
Spring 2023	6-Sep-23	Italian ryegrass, sub clover
	11-Oct-23	All
	15-Nov-23	Perennial ryegrass, Italian ryegrass, phalaris, tall fescue
Summer 2023-24	22-Dec-23	Italian ryegrass
	5-Jan-24	Perennial ryegrass, phalaris, tall fescue

Table 8. Total biomass production (2023-24) for phalaris.

Variety	Total Biomass 2023-24 (kg DM/ha)	
Amplify	4895	b
Holdfast GT	5226	ab
Holdfast	5383	ab
Stockman	5870	a
Australian	5236	ab
Confederate	5133	ab
LSD P=0.05	563	
p-value	0.043	
CV (%)	7	

Means followed by the same letter do not significantly differ (p>0.05).

Table 9. Persistence score for phalaris varieties in 2023.

Variety	Persistence Score	
Amplify	75.88	-
Holdfast GT	76.13	-
Holdfast	76.63	-
Stockman	75.25	-
Australian	76	-
Confederate	75.31	-
LSD P=0.05	3.8	
p-value	0.99	
CV (%)	3.33	

Means followed by the same letter do not significantly differ (p>0.05).

Table 10. Dry matter production in winter, spring and summer, and total biomass production for tall fescue in 2023-24.

Variety	Autumn (kg DM/ha)		Winter (kg DM/ha)		Spring (kg DM/ha)		Summer (kg DM/ha)		Total Biomass 2023-24 (kg DM/ha)	
Charlem	1311	a	1811	a	1233	b	458	a	4845	a
Temora	1289	a	1692	a	1206	b	335	ab	4588	a
Prosper	1282	a	1969	a	1284	b	286	b	4867	a
Finesse-Q	606	b	769	b	1148	b	450	a	2898	b
Fortune	476	b	920	b	1903	a	430	a	3733	b
Hummer	451	b	999	b	1763	ab	424	a	3650	b
LSD (P=0.05)	209		484		425		91		717	
p-value	>0.001		>0.001		>0.001		>0.001		>0.001	
CV (%)	2		14		20		15		12	

Means followed by the same letter do not significantly differ (p>0.05).

Most of the additional growth was during autumn and winter, with an additional ~600 kg in autumn and ~1000 kg in winter (Figure 2). In spring, the summer actives, Fortune produced the most amount of DM (1903 kg DM/ha) and Hummer, produced the second highest amount of DM (1763 kg DM/ha). However, after good summer rainfall, the winter active variety Charlem produced the most amount of DM, along with Finesse-Q, Fortune and Hummer. Prosper expressed its summer dormancy trait by producing little growth. The summer active varieties are not expected to survive at Rokewood as they are best suited to annual rainfall areas above 600 mm, however, all the varieties had good persistence measurements of about 75 out of 80 or greater (Table 11).

Table 11. *Persistence scores for tall fescue varieties in 2023.*

Variety	Persistence Score	
Charlem	74.5	b
Temora	77	ab
Prosper	78.8	a
Finesse-Q	77	ab
Fortune	77.8	a
Hummer	76.5	ab
LSD P=0.05	2.1	
p-value	0.016	
CV (%)	2	

Means followed by the same letter do not significantly differ (p>0.05).

Perennial Ryegrass

In 2022, Base AR37 produced the most DM overall at 12486 kg DM/ha. All other varieties produced between 7413 and 8646 kg DM/ha.

In 2023-24, the total DM production was not significantly different between varieties. They all produced between 1468 and 1754 kg DM/ha. This is much lower than what was grown in the previous year. Tissue tests in late September indicated nitrogen levels of 1.7% where above 3.2% is optimal, suggesting there was an N deficiency in the trial. It appeared varieties that had high production in the previous year were possibly hindered the most in 2023. Production was lower than expected across all variety trials, generally at least 10 t DM/ha should be grown per year, but the drier winter and spring has also curtailed production and possibly reduced the amount of mineralised N. Perennial ryegrass is shallower rooted than phalaris and tall fescue, and perhaps unable to access the deeper moisture.

There were many significant differences between each perennial ryegrass variety in each season for DM production. Victorian produced the least amount of DM in winter (275 kg DM/ha) whilst all other varieties produced between 465 and 583 kg DM/ha (Figure 3, Table 12). However, in spring, Victorian produced the most amount of DM (1466 kg DM/ha), statistically higher than all other varieties. In summer, there were significant differences between varieties, but Victorian produced the least (20 kg DM/ha) and Base AR37 produced the most (243 kg DM/ha). Despite the poor growth of perennial ryegrass, the persistence scores indicate most sown plants are still present with scores greater than 72 out of 80 (Table 13). Interestingly, Victorian perennial ryegrass showed the highest persistence, which is often reported by producers.

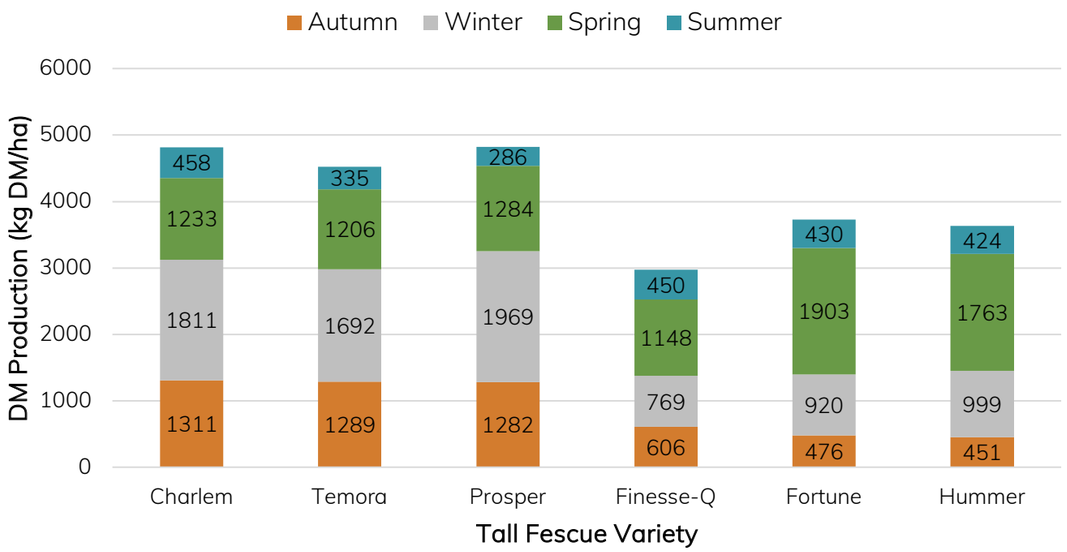

Figure 2. *Tall fescue varieties and their dry matter (DM) production (kg DM/ha) in 2023-24.*

Table 12. *Winter, spring, summer and total biomass production for perennial ryegrass in 2023-24.*

Variety	Winter (kg DM/ha)		Spring (kg DM/ha)		Summer (kg DM/ha)		Total Biomass (2023-24)	
Victorian	275	b	1466	a	20	d	1753	-
Avalon AR1	533	a	1137	b	51	cd	1716	-
SF Hustle AR1	483	a	965	b	157	ab	1599	-
Reason AR37	465	a	907	b	96	bc	1468	-
Base AR37	583	a	779	b	243	a	1575	-
Maxsyn NEA4	561	a	1014	b	185	ab	1754	-
LSD P=0.05	124		273		63		318	
p-value	0.032		0.002		<0.001		0.362	
CV (%)	3		17		20		2	

Means followed by the same letter do not significantly differ (p>0.05).

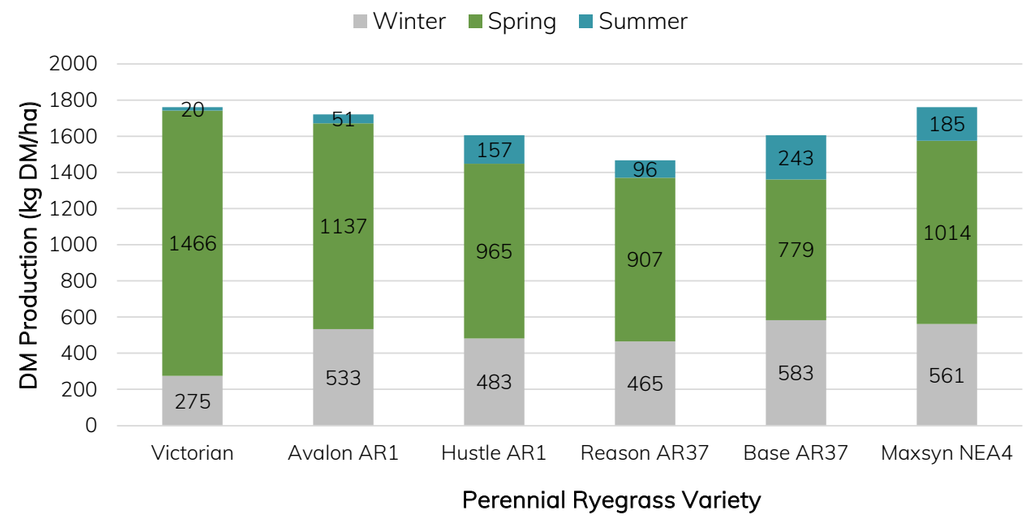

Figure 3. *Perennial ryegrass varieties and their dry matter (DM) production (kg DM/ha) in 2023-24.*

Table 13. *Persistence scores for perennial ryegrass varieties in 2023.*

Variety	Persistence Score	
Victorian	77.38	a
Avalon AR1	76	ab
Hustle AR1	72.88	b
Reason AR37	75.25	ab
Base AR37	72.75	b
Maxsyn NEA4	75.5	ab
LSD P=0.05	3.01	
p-value	0.03	
CV (%)	3	

Means followed by the same letter do not significantly differ (p>0.05).

Table 14. *Spring, summer and total biomass production for annual and Italian ryegrass in 2023-24.*

Variety	Spring (kg DM/ha)		Summer (kg DM/ha)		Total Biomass (2023-24) (kg DM/ha)	
Fuze	2266	a	694	a	3790	a
New Tetila	2225	a	674	a	3737	a
SF Pinnacle	1849	bc	720	a	3277	ab
Manta	1532	c	585	ab	2839	b
Tempo	2007	ab	446	b	3181	ab
Feast II	1628	c	393	b	2855	b
LSD P=0.05	285		158		521	
p-value	<0.001		0.002		0.004	
CV (%)	10		18		11	

Means followed by the same letter do not significantly differ (p>0.05).

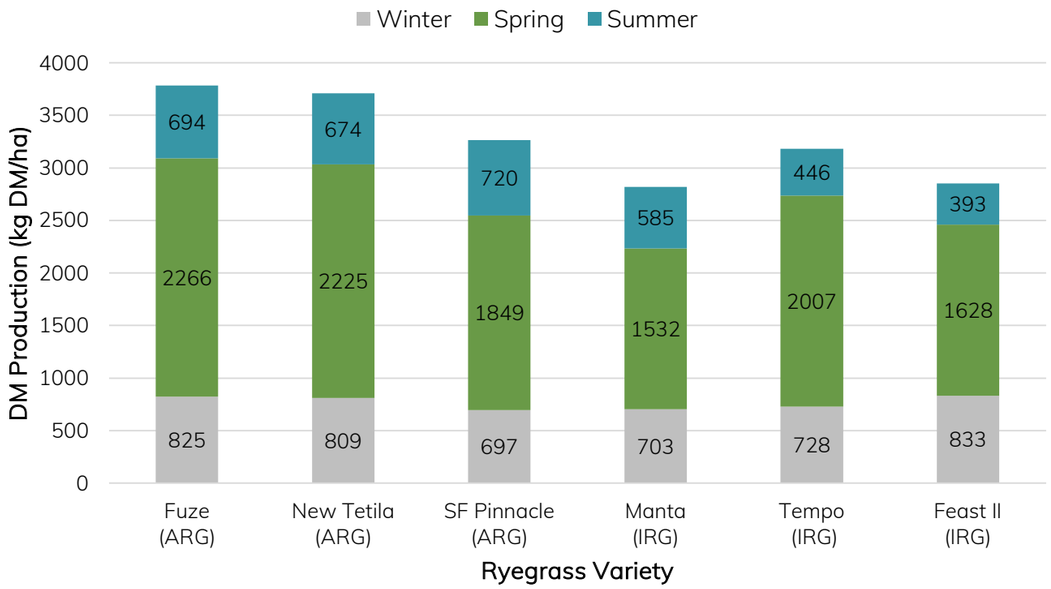

Figure 4. *Annual and Italian ryegrass varieties and their dry matter production (kg DM/ha) in 2023-24.*

Figure 5. *Bare ground observed in annual and Italian ryegrass trial 6 September 2023.*

Annual & Italian Ryegrass

In 2022, there were no significant differences between varieties in the annual and Italian ryegrass trial for any of the cuts. All varieties produced between 6984 and 7711 kg DM/ha. The varieties were encouraged to set seed and recruit, to see how much production could occur in the second year.

In 2023, there was a significant difference between annual and Italian ryegrass varieties and DM production in spring, summer and for total dry matter production (Table 14). Figure 4 shows that Fuze and New Tetila produced the highest amount of DM in 2023. They are both annual ryegrass varieties and interestingly had some of the lowest persistence scores out of all varieties (Table 15). Understandably, the persistence scores were much lower than the other species trials and, in some plots, it was mostly bare ground observed (Figure 5). Italian ryegrass can often survive into the second year, but persistence scores show 40 to 58 scores indicating numbers had fallen by up to 50%. It begs the question – is it worth keeping these varieties for a second year when they produced around half the dry matter in 2023 compared to 2022?

Sub Clover

In 2022, the trial was only cut once to encourage seed set and burr formation, making it hard to compare to 2023. However, in 2022 Bindoon was the highest-performing variety producing 1970 kg DM/ha. Campeda and Narrikup produced the lowest DM ~1300 kg DM/ha.

In 2023, Yanco produced the highest amount of DM in both August (1605 kg DM/ha) and September (2157 kg DM/ha) (Figure 6).

Table 15. *Persistence score for annual and Italian ryegrass varieties in 2023.*

Variety	Persistence Score	
Fuze (ARG)	13.63	b
New Tetila (ARG)	13.88	b
SF Pinnacle (ARG)	5.88	b
Manta (IRG)	43.63	a
Tempo (IRG)	40.88	a
Feast II (IRG)	58.13	a
LSD P=0.05	17.83	
p-value	<0.001	
CV (%)	40	

Means followed by the same letter do not significantly differ (p>0.05).

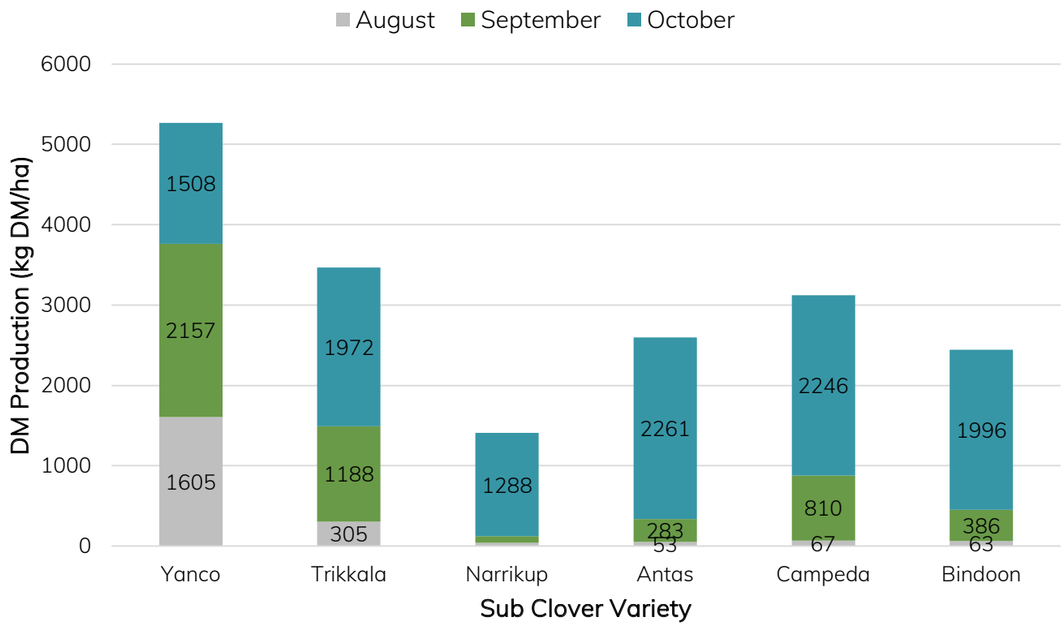

Figure 6. *Sub clover varieties and dry matter (DM) production (kg DM/ha) in 2023.*

Table 16. Dry matter production in August, September and October, and total biomass production for sub clover in 2023.

Variety	August (kg DM/ha)		September (kg DM/ha)		October (kg DM/ha)		Total Biomass 2023-24 (kg DM/ha)	
Yanco	1605	a	2157	a	1508	bc	5313	a
Trikkala	305	b	1188	ab	1972	ab	3831	b
Narrikup	39	b	82	d	1288	c	1460	d
Antas	53	b	283	c	2261	a	2831	bc
Campeda	67	b	810	b	2246	a	3226	bc
Bindoon	63	b	386	c	1996	ab	2551	c
LSD P=0.05	421		600		466		878	
p-value	<0.001		<0.001		0.002		<0.001	
CV (%)	42		8		2		18	

Means followed by the same letter do not significantly differ (p>0.05).

In October, Antas and Campeda produced the most amount of DM, 2261 and 2264 kg DM/ha, respectively. Overall, Yanco produced the most amount of DM, 5313 kg DM/ha, significantly higher than all other varieties (Table 16). Yanco is a yannicum sub species, cream seeded and is tolerant of waterlogging (RAGT 2023). It persisted the best out of all varieties (Table 17) after the wet year experienced in 2022.

Table 17. Persistence (%) for sub clover varieties in 2023.

Variety	Persistence (%)	
Yanco	95	a
Trikkala	94	a
Narrikup	51	c
Antas	74	b
Campeda	91	a
Bindoon	80	ab
LSD P=0.05	11	
p-value	<0.001	
CV (%)	2	

Means followed by the same letter do not significantly differ (p>0.05).

CONCLUSION

Although this trial has only been run for two years so far, it highlights the importance of selecting the right variety when renovating pastures, particularly with the very wet spring in 2022 and then the very dry spring in 2023. All species trials had significant differences in total dry matter production, with some having stand-out varieties such as Yanco in the sub clover trial with its suitability for waterlogging. The perennial ryegrass failed to produce much growth in comparison to phalaris and tall fescue which is likely to do with dry spring conditions and poor nitrogen availability in 2023.

The annual and Italian ryegrass trial as expected showed poor persistence scores compared to other trials and produced half the dry matter in their second year compared to the first year, despite the wet mild summers.

In 2022, the varieties in the tall fescue trial were establishing and it wasn't until the second year, 2023, that we saw the difference in production between the summer and winter active varieties. Producers should pick varieties based on what time of the year they need feed the most, not just what variety produces the most. This is evident in the sub clover trial, where Yanco produced most of its dry matter in August and September and was one of the lowest producers in October. Also, varieties like Temora, a tall fescue, which goes dormant over summer are not able to take advantage of out-of-season rainfall.

ACKNOWLEDGMENTS

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