Evaluating mixed species pastures in the Mid North

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Key findings

- Cereals were the most reliable and productive crop type in 2025, with barley varieties leading both early and later (post-grazing) season dry matter.
- Brassicas offered high dry matter potential but were more variable; tillage radish and forage brassicas performed well early, while Puna chicory consistently had low dry matter.
- Ryegrass varieties produced moderate early feed but increased later in the season. Pasture legumes were low yielding early and variable later; vetches, medics, clover and trigonella improved with time but generally remained lower than cereals and ryegrass in 2025.
- Mixed-species treatments provided consistent dry matter, often matching the best single species crops, highlighting their value for providing feed across the season.
- Feed quality and other benefits from pasture legumes and mixed-species (e.g. residual water and soil nitrogen) are still being assessed for 2025.

Introduction

Selecting and managing pastures effectively can be challenging, especially when trying to optimise production and livestock performance across different environments. In response to this challenge, two mixed-species pasture demonstration sites have been established in different environments in the Mid North of South Australia, at Hart and Farrell Flat. The specific objectives of the mixed-species pasture trials were to:

- Optimise pasture production across different environments and production zones.
- Evaluate pasture options for their ability to produce biomass and feed quality during key periods of the season when feed gaps occur.
- Demonstrate weed and disease management benefits, nitrogen fixation, and soil water conservation, which may improve crop yield in following seasons.

Methodology

Two trials were established at Hart and Farrell Flat, SA to evaluate a range of pasture systems for their suitability to the Mid North region (Table 1). The trials assessed a range of crop types standalone or in a mixture with other species, including cereals, ryegrass, brassicas and legumes (Table 2 and 3). Initial soil available nitrogen was 120 kg N/ha at Hart with -2.1 mm plant available water (PAW) and at Farrell Flat there was 146.1 mm of PAW and 132 kg N/ha. Urea (47 kg N/ha) was applied in July at each trial site to ensure pasture production was not limited by nitrogen.

Pasture species were assessed as sole crops to quantify their production potential and forage quality without the confounding effects of mixed-species competition. Pasture mixtures were developed from the individual species to balance dry matter production, seasonal feed supply, feed quality and herbicide options, with the aim of identifying the best pasture options for growers and advisers.

Table 1. Trial details for 2025 mixed-pasture species trial at Hart and Farrell Flat.

	Hart	Farrell Flat
Seeding date	June 20, 2025	June 18, 2025
Grazing date	September 1, 2025	September 2, 2025
2025 annual rainfall	263 mm	297 mm
Growing season rainfall	223 mm	253 mm
Soil available nitrogen	120.4 kg N/ha	132 kg N/ha
Plant available water (PAW)	-2.1 mm	146.1

Table 2. Crop type and specific varieties under evaluation in the Hart and Farrell Flat, 2025 trial.

Crop type	Variety	Farrell Flat seeding rates (kg/ha)	Hart seeding rates (kg/ha)
Cereal	Commodus CL barley		70
	Express forage oats	70	
	Forester oats	70	50
	Magnate forage barley	70	70
	Mowhawk wheat	100	100
	Neo CL barley	70	
	Newton barley	70	70
	Titan AX barley	70	
Ryegrass	Dazzler ryegrass	20	20
	Prodigy ryegrass	20	
Brassica	Blue Gorilla forage brassica	5	
	Captain CL canola	2	
	Greenland forage brassica	5	5
	RGT Hybra forage brassica	5	
	Puna chicory	6	6
	Retained winter canola	5	5
	Tillage radish	5	5
Pasture legume	AGF Balansa clover	4	4
	Benetas vetch	40	
	Jester SU barrel medic		5
	Timok vetch	40	40
	Trigonella	5	5

Table 3. Mixtures evaluated in the Hart and Farrell Flat, 2025 trials.

Hart	
Mixture and seeding rate	**Total (kg/ha)**
Timok vetch 40 kg/ha + Magnate barley 40 kg/ha + Trigonella 2 kg/ha	82
Retained winter canola 3 kg/ha + Commodus barley 40 kg/ha	43
Timok vetch 40 kg/ha + Greenland forage brassica 3 kg/ha	43
AGF WinterMax - Vampire ryecorn 30%, oats 36%, tillage radish 10%, Crimson clover 8% and tetraploid annual Italian ryegrass 16%	50
Farrell Flat	
Mixture and seeding rate	**Total (kg/ha)**
Titan barley 40 kg/ha + Benetas vetch 40 kg/ha + retained winter canola 2 kg/ha	82
Greenland Forage Brassica 3 kg/ha + Benetas vetch 40 kg/ha	43
Prodigy ryegrass 40 kg/ha + AGF balansa clover 40 kg/ha + Forester oats 2 kg/ha	82
AGF WinterMax - Vampire ryecorn 30%, oats 36%, tillage radish 10%, Crimson clover 8% and tetraploid annual Italian ryegrass 16%	50

During the season dry matter and feed quality was assessed at two times; early September (pre-grazing and mid-October (post-grazing). Grazing was simulated by mowing half of the plot area while, still allowing sufficient leaf area for crop recovery. Residual soil moisture and soil available nitrogen on selected treatments were analysed at the end of the season to identify additional rotational benefits of the different crop species. However, only dry matter results were available at the time this report was prepared.

The results were analysed using ASREML and Biometry Assist (Nielsen et al. 2026) Tukey's Honest Significant Difference (HSD) test which compares all possible pairs of means and identifies any difference between two means that is greater than the expected standard error.

Results and discussion

Early dry matter production – single species

At Hart, early September dry matter production was highest in cereal and brassica species (Table 4). Commodus CL and Magnate barley, along with tillage radish, produced the greatest early biomass. Greenland forage brassica also performed strongly (2107 kg DM/ha), as did the retained winter canola. Forester oats, Newton barley, Mowhawk wheat and Dazzler ryegrass produced moderate dry matter relative to the full range of treatments (ranging 1409-1935 kg DM/ha).

At Farrell Flat, dry matter production at the first sampling was generally lower than at Hart, and differences were observed in the relative performance of standalone species (Table 4). Cereals again provided the most reliable early biomass, with Magnate barley, an awnless forage variety, producing 2012 kg DM/ha. Both spring barley varieties Titan AX and Neo CL and the winter barley Newton were also high yielding, producing between 1500 and 1700 kg DM/ha. Consistent across both sites, Mowhawk wheat and Forester oats produced significantly lower dry matter than the best-performing cereal treatments. Mowhawk wheat is a quick-maturing winter variety with a vernalisation requirement, and early season dry matter can be lower compared with spring varieties when all sown in mid to late June. However, this reduced early growth is generally offset by the longer vegetative growth period of winter wheats, which allows more time for dry matter accumulation before stem elongation (GS30). In contrast, a reduction in early dry matter production was not observed for the winter barley variety Newton.

Brassica dry matter production at Farrell Flat was more variable compared to Hart. Forage varieties RGT Hybra, Greenland and Blue Gorilla and tillage radish all performed well, producing approximately 1600 kg DM/ha. In comparison, both winter canola treatments (retained seed and Captain) produced lower dry matter. Ryegrass varieties produced dry matter levels comparable to the cereal and brassica treatments at this site.

Pasture legumes produced low early dry matter at both sites (<963 kg DM/ha at Hart and <556 kg DM/ha at Farrell Flat). Chicory (brassica) also produced very low dry matter at both sites (89–395 kg DM/ha), indicating limited contribution to early feed supply. There were no significant differences in dry matter production among the legume pasture species or chicory at this sampling time. This is consistent with outcomes from previous trials (Nietschke and Smith, 2024) at Farrell Flat and Giles Corner which showed pasture legume species produced low early dry matter.

Early dry matter production – species mixtures

All species mixtures produced high early dry matter at Hart, averaging 2758 kg/ha (Table 4). There were no significant differences among the mixtures, and dry matter production was comparable to that of the highest yielding cereal treatments. At Farrell Flat, AGF WinterMax was the highest yielding mixture, producing 2149 kg DM/ha which was comparable to the best performing cereal and brassica treatments. All remaining mixtures were competitive with the 'mid to lower range' single-species treatments.

Table 4. Dry matter weights for all treatments in early September at Hart and Farrell Flat, 2025. Results were analysed using Tukey's test, and single-species treatments and mixtures were analysed separately at each site. Shaded values indicate best performing treatments.

Crop type	Variety	Farrell Flat Dry matter Sept 1 (kg/ha)	Hart Dry matter Sept 2 (kg/ha)
Cereal	Commodus CL barley		2512^{ef}
	Express forage oats	1308^{def}	
	Forester oats	1351^{def}	1935de
	Magnate forage barley	2012^{g}	2573^{ef}
	Mowhawk wheat	966^{bcd}	1540^{cd}
	Neo CL barley	1721^{fg}	
	Newton barley	1497^{d-g}	1626^{d}
	Titan AX barley	1504^{d-g}	
Ryegrass	Dazzler ryegrass	1352^{def}	1409^{bcd}
	Prodigy ryegrass	1568^{efg}	
Brassica	Blue Gorilla forage brassica	1584^{efg}	
	Captain CL canola	1095^{cde}	
	Greenland forage brassica	1482^{d-g}	2107de
	RGT Hybra forage brassica	1722^{fg}	
	Puna chicory	89^{a}	395^{a}
	Retained winter canola	1167^{def}	1440^{cd}
	Tillage radish	1680^{fg}	3105^{f}
Pasture legume	AGF Balansa clover	400^{ab}	466^{a}
	Benetas vetch	427^{ab}	
	Jester SU barrel medic		963^{abc}
	Timok vetch	556^{abc}	818^{abc}
	Trigonella	176^{a}	546^{ab}
		P<0.01	**P<0.01**
Mixtures	Benetas vetch + Greenland Forage brassica	825^{a}	
	Prodigy ryegrass + AGF Balansa clover + Forester oats	1190^{a}	
	Timok vetch + Greenland forage brassica		2851
	Timok vetch + Magnate barley + Trigonella		2690
	AGF WinterMax	2149^{b}	2866
	Retained winter canola + Commodus barley		2625
	Titan barley + Benetas vetch + retained winter canola	941^{a}	
		P<0.01	**NS**

Late season (post-grazing) dry matter production – single species

By the second sampling time, crops at Farrell Flat had produced higher dry matter than Hart across all treatments (Table 5). Drought stress had started to impact the Hart trial by this sampling time. This was not observed to the same extent at Farrell Flat, where higher rainfall was received during the growing season. While total dry matter production differed between sites, similar patterns were observed across crop types. Cereals (wheat and barley) consistently provided the most reliable biomass of all crops trialed. Oat varieties were more variable, at times matching the yields of wheat and barley but in other cases producing slightly lower dry matter. Ryegrass varieties also produced comparatively high dry matter at this sampling time, ranging from 2792 to 3976 kg/ha.

At the later sampling time, brassicas generally produced moderate dry matter at both sites, with little variation observed among the varieties trialed. The only exception was Puna chicory which consistently had very low dry matter at around 400 kg DM/ha. Pasture legumes showed a clear improvement at the later sampling time for both sites. At Hart, a number of pasture legumes were as high yielding as cereal and ryegrass options.

Late season (post-grazing) dry matter production – species mixtures

All mixtures at Hart and Farrell Flat produced moderate to high dry matter, averaging 3608 kg/ha and 1984 kg/ha, respectively. There were no or only minor differences between the mixtures at each site. The results show that in many cases, mixing the sole species assessed in these trials is a viable strategy to maximise fodder production across the season, while also improving pasture quality and livestock performance. While the feed quality results from this season are pending, this approach has been demonstrated in previous trial seasons (Nietschke and Smith, 2024) and helps fill key feed gaps, with cereals and brassicas providing early-season feed and other species, such as legumes (and brassicas), contributing higher-quality forage later in the season as some cereal species/varieties mature and decline in feed quality.

When creating species mixtures, it is important to balance the seeding rates of the individual components, as there is the risk of one or more species outcompeting the others. The current trials, together with previous field research (Nietschke and Smith, 2024), provide guidance on appropriate seeding rates that can form the basis of discussions for individual farms. Commercially available seed blends, such as AGF WinterMax, also offer a pre-mixed option with comparable dry matter production. In this blend, species ratios have been optimised, which was evident in the plots where all species were present and none appeared to outcompete. This approach allows growers to sow mixed-pastures without the added complexity of blending seed or adjusting individual seeding rates.

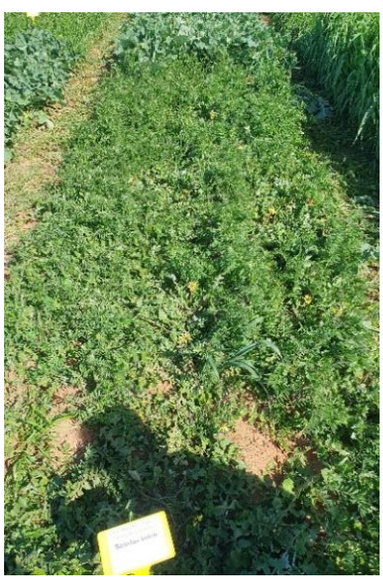
Table 5. Dry matter weights for all treatments at Hart and Farrell Flat, October 2025 in the 'grazed' plots. Results were analysed using Tukey's test, and single-species treatments and mixtures were analysed separately at each site. Shaded values indicate best performing treatments.

Crop type	Variety	Farrell Flat Dry matter Oct 14 (kg/ha)	Hart Dry matter Oct 9 (kg/ha)
Cereal	Commodus CL barley		2288^{b-f}
	Express forage oats	3321^{cde}	
	Forester oats	3609^{def}	1660^{bcd}
	Magnate forage barley	5273^{ef}	2201^{b-f}
	Mowhawk wheat	4585^{def}	2573^{c-f}
	Neo CL barley	5449^{f}	
	Newton barley	5628^{f}	2997^{f}
	Titan AX barley	5378^{ef}	
Ryegrass	Dazzler ryegrass	3973^{c-f}	2792^{ef}
	Prodigy ryegrass	3616^{c-f}	
Brassica	Blue Gorilla forage brassica	3325^{cde}	
	Captain CL canola	2948^{bcd}	
	Greenland forage brassica	2960^{bcd}	1740^{b-e}
	RGT Hybra forage brassica	2948^{bcd}	
	Puna chicory	428^{a}	399^{a}
	Retained winter canola	2637^{a-d}	1495^{abc}
	Tillage radish	2636^{a-d}	1873^{b-f}
Pasture legume	AGF Balansa clover	2128^{abc}	1350^{ab}
	Benetas vetch	2285^{abc}	
	Jester SU barrel medic		2776^{def}
	Timok vetch	2583^{bcd}	2419^{b-f}
	Trigonella	1061^{ab}	1828^{b-e}
		P<0.01	**P<0.01**
Mixtures	Benetas vetch + Greenland Forage brassica	2924^{a}	
	Prodigy ryegrass + AGF Balansa clover + Forester oats	3125^{ab}	
	Timok vetch + Greenland forage brassica		1822
	Timok vetch + Magnate barley + Trigonella		2279
	AGF WinterMax	3892^{ab}	1700
	Retained winter canola + Commodus barley		2134
	Titan barley + Benetas vetch + retained winter canola	4489^{b}	
		P<0.01	**NS**

Trigonella

Prodigy ryegrass + Balansa clover + Forester oats

Magnate barley



Benetas vetch

Prodigy ryegrass

Retained winter canola

Figure 1. Photos of selected treatments at Farrell Flat taken on September 26, 2025. The rear half of each plot shown had been 'grazed' in early September.

Summary

Overall, while drought reduced yields in 2025, especially at Hart, the relative performance of species and mixtures remained consistent. Across both Farrell Flat and Hart, cereals consistently provided the most reliable source of early and later season dry matter, with barley varieties generally outperforming wheat and oats. Brassicas offered competitive early feed but were more variable, while ryegrass and legumes contributed less early-on but improved later in the season, particularly ryegrass and vetch.

A range of species mixtures performed well, often matching single-species options and providing consistent feed across varying seasonal conditions. Looking at research from 2022–2025, mixtures are most effective when cereals and brassicas supply reliable early-season feed, while legumes and some brassicas deliver higher-quality forage later as cereals mature and feed quality declines.

References

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