WA Seed Performance Trial 2020

Final Report by Dr Peter Hutton

Statistical analysis Andrew VanBurgel

INTRODUCTION

Two sites were selected for the 2020 WA Seed Performance (WASP) trial - the first at the Brett family's dairy platform at Dardanup (for the third year), and a second site further south at the Brennen family's Forest Grove support block near Witchcliffe. This second site would determine if the growing season extended further and how might each seed line perform when there was potentially a tough but sustainable tail to the season.

SUMMARY

- The two control treatments had the highest cumulative yields at both sites.
- At both sites, one of the control treatments was highest yielding in the first three or four harvests, however was lowest yielding in the final harvest.
- Fuze had significantly lower cumulative yields to both control treatments at both sites, while Ascend was significantly lower to at-least one control treatment at each site. Three treatments that were only present at Forest Grove (Finefeed, Concord II and Hogan) also had significantly lower cumulative yields than both controls.
- Attain was the non-Control treatment with the highest cumulative yield at both sites. Together with Amass, Abundant and Exp line 1, these treatments were not significantly different in cumulative yield to both controls at both sites. Three treatments that were only present at Dardanup (Exp line 2, Astro and Vortex) also did not have significantly different cumulative yield to both control treatments.
- The growing season extended further at the Forest Grove site which resulted in higher dry matter (DM) production of mid and late seed lines versus early flowering seed lines, at the final harvest.

DESIGN & METHOD

The means of yield (kg of dry matter per ha) were estimated from 7m^2 plots with four replicates per seed line. While the design was not ideal (i.e. not completely randomised), results should still be statistically unbiased as the varieties are well-distributed spatially.

Analysis of variance was done in Genstat for yield at each harvest date (6 harvests for Forest Grove and 5 harvests for Dardanup) and for cumulative harvest yield at each site. A comparison was also done of Ploidy (Tet, Dip) and Flowering (Early, Mid, Late).

Significance level is 5 per cent ($p<0.05$) unless otherwise indicated.

RESULTS

Yield means (cumulative and individual harvests) for both sites are presented in the following tables and figures with the Genstat statistical output. To date, the 2020 pasture samples have not yet been processed in the laboratory for the nutritive components and so results are pending. The cumulative yields for the season are summarised in Table 1.

Table 1. Cumulative yields for commercial seed lines from two sites in Western Australia. Seed lines that share a common letter within columns have no significant difference in yield.

Forest Grove (six harvests)	Kg DM/ha	sig	**Dardanup (five harvests)**	Kg DM/ha	sig
Fuze	9855	a	Fuze	10766	a
Finefeed	9887	a	Ascend	10886	ab
Concord II	10033	ab	Vortex	10945	abc
Ascend	10519	ab	Amass	11075	abc
Hogan	10940	bc	Astro	11228	abc
Exp line 1	11659	cd	Exp line 2	11344	abc
Abundant	11781	cd	Abundant	11462	abc
Amass	11803	cd	Exp line 1	11473	abc
Attain	12035	d	Attain	11513	abc
Control	12110	d	Control	11724	bc
Control2020	12466	d	Control2020	11780	c
Average	11190		Average	11271	
LSD		1023	LSD		885

There were significant treatment effects for the first four harvests at Forest Grove and for the first three harvests at Dardanup. For each of these harvest dates, the highest yield was from one of the control treatments.

There were no significant treatment differences with the fifth harvest at Forest Grove. However, with the sixth harvest there was again significant treatment differences with the control treatments now having the lowest and third lowest yields.

A similar pattern occurred at Dardanup, with its final two harvest dates. With the fourth harvest, the control treatments were no longer highest and mostly not significantly different to the other treatments. With the fifth harvest, the control treatments had the lowest and third lowest yields.

Despite the reversing of treatment performance with the final harvest, the control treatments maintained the highest cumulative yields. The reversal of performance of the controls late in the season is not surprising given that the line is listed as early flowering.

Table 2. The effect of flowering time (Early, Mid and Late) on estimated total yield (Kg of dry matter per ha) at Forest Grove and Dardanup WASP sites

Forest Grove (six harvests)	Kg DM/ha	sig	**Dardanup (five harvests)**	Kg DM/ha	sig
Flowering			Flowering		
Early	11536	a	Early	11578	a
Mid	11269	b	Mid	11256	ab
Late	10712	c	Late	10859	b
LSD			LSD		

Significant differences between flowering was more pronounced at Forest Grove, with Early having significantly higher cumulative yield than Mid, which was significantly higher than Late (Table 2). As expected at the Forest Grove site there was an interaction between flowering and time of season. The extra harvest late in the season (December) resulted in significantly higher yield of the Late flowering compared with Early and Mid at harvest six (Figure 1).

At Dardanup, Early was also significantly higher than Late for cumulative yield. At the final harvest in November, although Mid and Late tended to yield higher than Early, the difference was not significant (Figure 2).

For Ploidy, there was a significant difference in cumulative yield only at Forest Grove with Tetraploid significantly higher than Diploid ($p<0.001$).

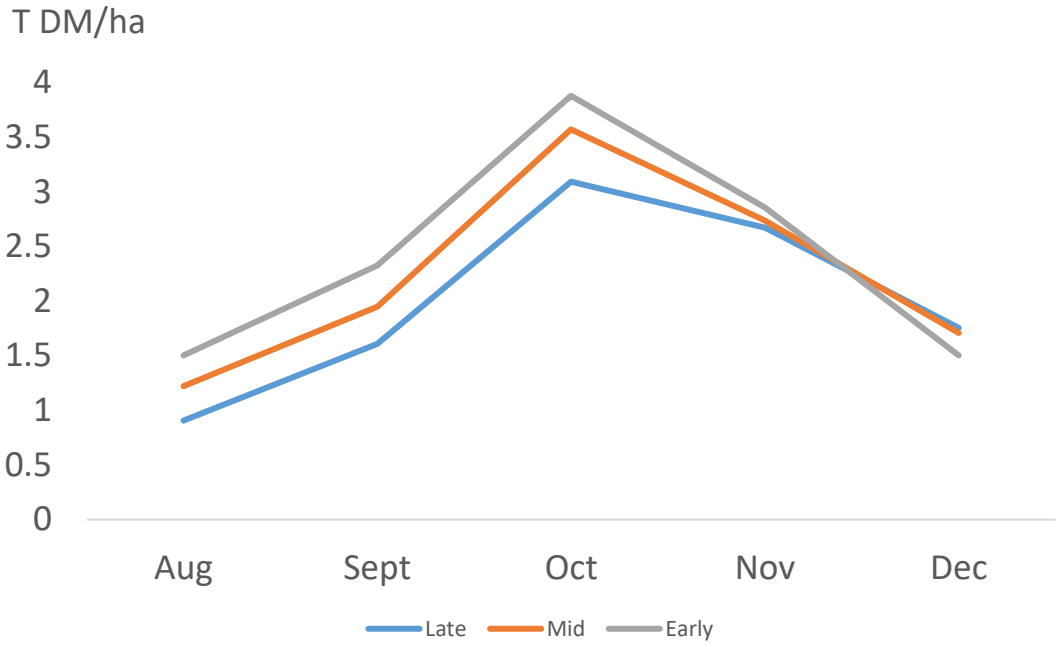

Figure 1. Effect of flowering time (Late Mid and Early) on yield at the Forest Grove site

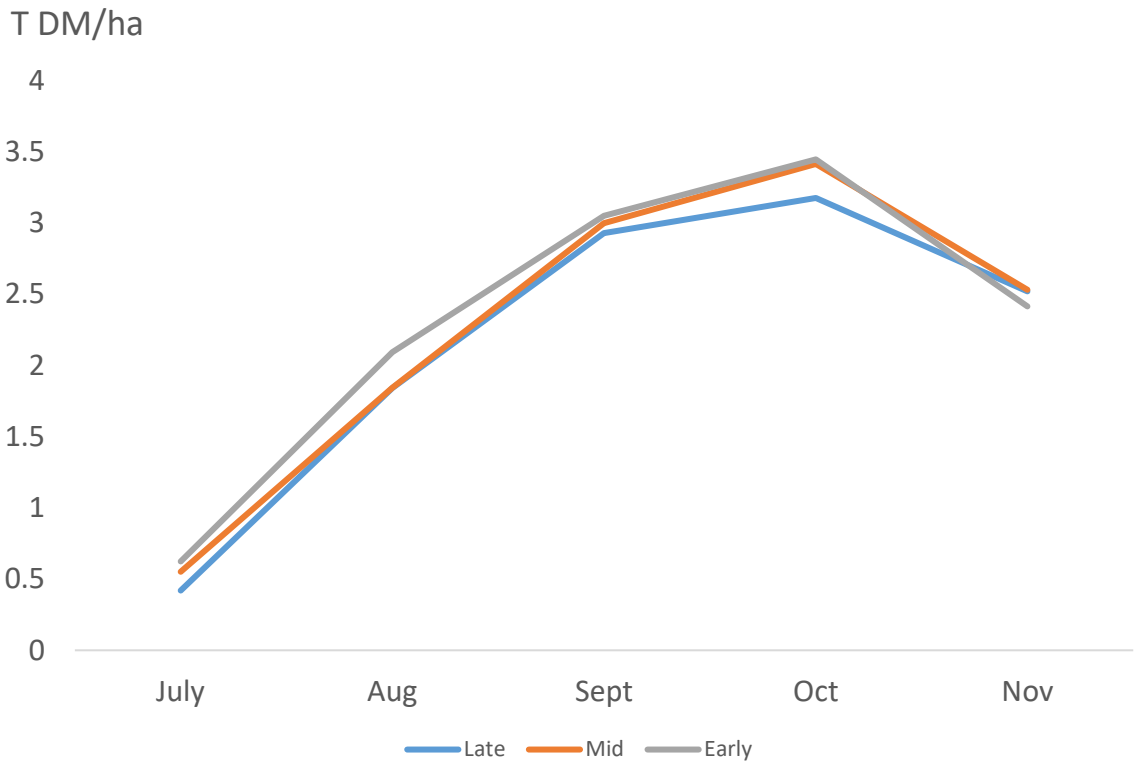

Figure 2. Effect of flowering time (Late Mid and Early) on yield at the Dardanup site

Individual harvests

Note: Average dry matter figures are for the whole site that includes experimental lines

Table 3. Harvest 1 mean of yield (kg of dry matter per ha) estimated from 7m^2 plots with four replicates per seed line

Forest Grove H1	Kg DM/ha	sig	**Dardanup H1**	Kg DM/ha	sig
Fuze	113	a	Fuze	359	a
Concord II	120	ab	Ascend	408	ab
Finefeed	140	abc	Exp line 2	420	ab
Ascend	144	abc	Astro	471	abc
Abundant	200	bcd	Vortex	476	abc
Hogan	212	cd	Amass	522	bcd
Exp line 1	267	de	Exp line 1	564	bcd
Amass	330	e	Attain	614	cde
Control2020	334	e	Control	642	de
Attain	348	e	Abundant	649	de
Control	350	e	Control2020	758	e
Average	233		Average	535	
LSD		83.5	LSD		158.5

Table 4. Harvest 2 mean of yield (kg of dry matter per ha) estimated from 7m^2 plots with four replicates per seed line

Forest Grove	Kg DM/ha	sig	**Dardanup**	Kg DM/ha	sig

H2			H2		
Fuze	755	a	Ascend	1597	a
Finefeed	860	a	Fuze	1784	ab
Ascend	876	a	Exp line 2	1806	abc
Concord II	916	ab	Amass	1861	abc
Hogan	1092	bc	Exp line 1	1876	bc
Abundant	1241	cd	Vortex	1915	bcd
Exp line 1	1270	cde	Attain	1918	bcd
Amass	1287	de	Abundant	1962	bcd
Attain	1431	def	Astro	2058	cd
Control	1460	ef	Control	2067	cd
Control2020	1544	f	Control2020	2154	d
Average	1157		Average	1909	
LSD		194.5	LSD		270.7

Table 5. Harvest 3 mean of yield (kg of dry matter per ha) estimated from 7m^2 plots with four replicates per seed line

Forest Grove	Kg DM/ha	sig	**Dardanup**	Kg DM/ha	sig
H3			**H3**		
Finefeed	1524	a	Ascend	2601	a
Concord II	1587	a	Astro	2842	ab
Fuze	1593	a	Exp line 1	2847	ab
Ascend	1630	a	Vortex	2999	b
Hogan	1730	ab	Control	3004	b
Amass	1831	ab	Fuze	3006	b
Abundant	2017	bc	Amass	3035	b
Exp line 1	2018	bc	Abundant	3040	b
Attain	2238	cd	Exp line 2	3118	b
Control	2242	cd	Attain	3128	b
Control2020	2409	d	Control2020	3149	b
Average	1893		Average	2979	
LSD		316.2	LSD		320.3

Table 6. Harvest 4 mean of yield (kg of dry matter per ha) estimated from 7m^2 plots with four replicates per seed line

Forest Grove H4	Kg DM/ha	sig	**Dardanup H4**	Kg DM/ha	sig
Concord II	2861	a	Vortex	3064	a
Fuze	3153	ab	Fuze	3069	a
Finefeed	3154	ab	Amass	3118	ab
Hogan	3199	ab	Attain	3215	abc
Ascend	3316	abc	Exp line 2	3300	abc
Exp line 1	3547	bcd	Astro	3307	abc
Attain	3587	bcd	Control2020	3451	abc
Amass	3618	bcd	Abundant	3480	abc
Abundant	3786	cd	Control	3582	bc
Control	3831	cd	Exp line 1	3606	c
Control2020	3925	d	Ascend	3659	c
Average	3452		Average	3350	
LSD		516	LSD		477.1

Table 7. Harvest 5 mean of yield (kg of dry matter per ha) estimated from 7m^2 plots with four replicates per seed line

Forest Grove H5	Kg DM/ha	sig	**Dardanup H5**	Kg DM/ha	sig
Fuze	2582	a	Control2020	2267	a
Finefeed	2596	a	Abundant	2331	ab
Control	2620	a	Control	2428	ab
Concord II	2674	a	Exp line 2	2483	ab
Amass	2744	a	Vortex	2492	ab
Ascend	2771	a	Amass	2539	ab
Attain	2790	a	Fuze	2548	ab
Hogan	2835	a	Astro	2551	ab
Control2020	2853	a	Exp line 1	2580	ab
Exp line 1	2883	a	Ascend	2621	ab
Abundant	3085	a	Attain	2639	b
Average	2767		Average	2498	
LSD		567	LSD		354.7

Table 8. Harvest 6 mean of yield (kg of dry matter per ha) estimated from 7m^2 plots with four replicates per seed line

Forest Grove H6	Kg DM/ha	sig
Control2020	1401	a
Abundant	1453	a
Control	1608	ab
Finefeed	1614	ab
Attain	1641	ab
Fuze	1660	ab
Exp line 1	1673	ab
Ascend	1782	bc
Hogan	1872	bc
Concord II	1875	bc
Amass	1993	c
Average	1688	
LSD		291.8

CONCLUSION

This year soil moisture probes were put in place at both sites. Soil moisture at Dardanup was close to perfect for plant growth throughout the season, and as expected, dried quickly in mid-October to below the stress point. Late rain enabled a final harvest in November. At the Forest Grove site, the soil was often saturated and this limited plant growth. However, this year there was a very nice “wag in the tail” of the season and soil moisture remained above the stress point until the end of November. This resulted in one additional harvest at Forest Grove than at Dardanup.

This year the WASP trial featured early, mid and late flowering seed lines (diploid and tetraploid) and a statistical analysis was carried out to determine the changes in relative yields across the year. The hypothesis was that early seed lines would produce more yield early in the year, mid in the middle and late at the end of the season. There was not a comprehensive number of seed lines tested, but in these conditions and with these varieties, the early season lines on average yielded higher across the season than mid and late maturing varieties. The strong finish to the season at Forest Grove did produce higher yields for the mid and late flowering seed lines in the final harvest and this showed that although WA has a short growing season there can be reward at the end of the season when using late flowering seed lines. However, there is an element of risk in planting late maturing varieties because cumulative yields may be compromised.

Significant effort went into the nutritive analysis of plant samples each season. Feed quality was assessed at least four times over each season. To date, the 2020 samples have not yet been processed in the laboratory for the nutritive components, so results are pending. The results from previous seasons indicate variable but small differences between seed lines, except for late in the season when late maturing varieties tended to hold their leaf longer and so have a higher nutritive value. However, this in itself is a finding.

There is a real opportunity for future generations to increase profitability by increasing the digestible energy content of ryegrass. The gene technology work at Hamilton SmartFarm in Victoria is currently focussing on the development of transgenic plants, where a second copy of a ryegrass genome is added to an elite ryegrass. The results promise to not only improve dry matter yield and persistence but increase the metabolizable energy value by 0.5 to 1 MJ.

I stand by Western Dairy's attempt to deliver the real value of home-grown feed. We used an algorithm to calculate the milk production potential (MPP) by including DM yield, ME, seed price and estimated milk produced to give a dollar value per hectare. The index was presented as a relative value to the control ryegrass each year, and as a ranked dollar value with a colour key. When seed lines shared a common colour there was no significant difference in MPP.

The MPP was not perfect because nutritionally it only took ME values into consideration and ignored crude protein. Other groups have attempted a similar index but it is difficult to assign values to all nutritive components. I was relatively happy to not include CP because it was always in excess of nutritive requirements of the cow, although I do acknowledge its importance as a component of conserved feed that is fed out during the dry season when farmers are reaching for crude protein. However, the full set of nutritive values are presented separately to the MPP on the Western Dairy website. I would really like to keep the MPP or a similar index in the conversation because it represents the likely true value of a seed rather than just dry matter yield potential.