DUAL PURPOSE CEREAL VARIETY EVALUATION - BAIRNSDALE, VIC

Location:
Bairnsdale Trial Site, Victoria

Author:
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Background:
Grain and forage crops have been grown in Gippsland for many years, however the need was identified to assess the potential of dual purpose grain and forage cereal varieties that would respond favourably to the vagaries of the Gippsland climate.

Objective:
To evaluate a number of dual purpose wheat varieties at two different sowing times.

Summary:
The trials aim to identify:

- which varieties respond favourably to Gippsland's climatic conditions
- new lines which may be taken through to commercialization
- which lines are most suitable for grain and forage purposes and
- the disease resistance and susceptibility of different lines.

Rainfall (mm): GSR (Mar- Oct): 302 mm

Method:
Two trials were established with 16 varieties of dual purpose grains.

Trial 1 (Grain & Forage): Sown 28th March
Plot size 22 metres (2 metre wide beds) by 4 replicates
Simulated grazing was done with a lawnmower on 11 metres of each repeat at GS30-32, weighed and samples dried to assess dry matter. One replicate from each variety was sampled and assessed for forage value. The other 11 metres was grown through to grain.

Trial 2 (Grain Only): Sown 8th June
The 16 varieties were sown in one bed (100metres x 2 metres).
The varieties were assessed for grain yield and quality (protein screenings and test weight) at harvest.

Treatments:
Counts were taken at first tillering and simulated grazing and sampling undertaken on Trial 1 at GS 30-32.

Sowing Trials 1& 2:
Sowing rate: 100 kg/ha
Sprayed with Glean 20gms/ha & Talstar 100mls/ha at sowing

Fertilizer:
Trial 1: DAP 100kg/ha at sowing followed by 100kg/ha Urea 11th August
Trial 2: DAP 100kg/ha at sowing.

Overall Conclusions
The effect of grazing was to reduce final biomass yield (milky grain stage), whilst maintaining forage energy levels across the varieties. Most varieties showed a significant reduction in biomass protein levels following grazing. This was particularly the case for Monstress triticale.

Grazing had the effect of reducing the final grain protein % on average across all varieties along with decreasing the final 1,000 grain weights. Grazing had no effect on final grain test weight.

The recovery from grazing in terms of grain yield was different between varieties, with varieties such as Monstress benefiting in grain yield from grazing, with many of the wheat varieties showing reductions in final grain yields. Some wheat varieties were less affected than others. Perhaps grazing was too late thereby reducing the grain heads at harvest, and/or nitrogen levels were too low.

Early forage dry matter production was similar across most of the wheat varieties with approximately 600 kg/ha dry matter being produced to the GS30 – GS32 stage. Monstress triticale however produced approximately double the dry matter by this early stage.

Clearly there are superior dual purpose wheat varieties to Kellalac and MacKellar. Varieties such as Amarok and Marombi and several of the CSIRO lines gave much higher forage and grain yields.

The late sowing (8th June) compared to the early sowing (28th March) gave much inferior grain yields along with giving no grazing benefit. Grain quality (test weight, screenings and thousand grain weights) was also poorer than the early sown trial. Clearly the best option is to sow early and have the ability to graze or in fact simply let the crop go through to grain. Care must be taken however that the variety is suited to the early sowing and that frost does not become too great a risk.

Monstress triticale is certainly worth considering as a dual purpose crop, however higher nitrogen rates may be required after grazing to keep forage protein levels up.

Feed shortage caused by the drought in 2006, suggests that higher returns would have been achieved by harvesting most varieties for forage, rather than letting them go through for grain.

Results & Discussion

Table 1: Feed Analysis Results At GS30 – 32

Varieties	Moisture	Dry Matter (DM)	Crude Protein (CP)	Fibre	Digestibility (DMD)	Digestibility (DOMD)	Energy (ME)
KELLALAC	86.2	13.8	30.3	44.6	80.0	74.6	12.1
MAROMBI	84.1	15.9	29.6	39.5	84.6	78.5	12.9
RUDD	87.3	12.7	29.9	37.9	86.2	79.8	13.2
CSIRO 170	84.5	15.5	34.3	39.5	88.2	81.6	13.6
MACKELLAR	85.3	14.7	29.0	42.7	82.4	76.6	12.6
HRZ 58693.3	83.9	16.1	25.6	40.5	83.1	77.2	12.7
H123.1	85.6	14.4	30.2	39.3	85.5	79.3	13.1
HRZ1.102.1	84.7	15.3	28.3	40.2	84.8	78.6	13.0
HRZ.2	84.1	15.9	25.8	42.6	81.9	76.2	12.5
HRZ 95176	84.4	15.6	25.2	41.7	84.8	78.7	13.0
HRZ 95102	86.7	14.3	29.5	38.4	85.4	79.2	13.1
HRZ 01.371.3	84.8	15.2	26.6	45.0	79.7	74.4	12.1
HRZ03.1010.3	84.8	15.2	29.4	42.3	83.3	77.4	12.7
AMAROK	84.8	15.2	29.0	38.6	86.7	80.3	13.3
MONSTRESS	89.0	11.0	25.6	47.3	79.6	74.2	12.1
FRELON	84.1	15.9	28.3	40.4	84.4	78.4	12.9

Key:

MOISTURE is the amount of water in the feed, varying from about 10% for grains and to over 80% for fresh pasture.

DRY MATTER (DM) refers to the amount of feed remaining after the water has been removed. The water content of feeds can vary considerably so all analyses are expressed on a dry matter basis.

CRUDE PROTEIN (CP) is the amount of true protein (composed of amino acids) and non-protein nitrogen in the feed. Whilst it is desirable to have a high CP, it can be misleading to use as the sole measure of feed quality.

NEUTRAL DETERGENT FIBRE (NDF) estimates the total cell wall content in a feed and it is the most useful measure of fibre content currently available.

DIGESTIBLE DRY MATTER (DDM) or DRY MATTER DIGESTIBILITY (DMD) is the percentage of the feed dry matter actually digested by animals, estimated using a laboratory method which is standardised against DDM values from feeding trials. High quality feeds have a DDM of over 65%, whilst feeds below 55% DDM are of poor quality and will not maintain liveweight even if stock have free access to it.

DIGESTIBLE ORGANIC MATTER DIGESTIBILITY is the amount of digestible organic matter in the dry matter.

METABOLISABLE ENERGY (ME) is the feed energy actually used by the animal, calculated from DDM and expressed as megajoules per kilogram of dry matter (MJ/kg DM). ME is the most important figure on the report. It is used to calculate whether stock are receiving adequate energy for maintenance or production.

Key definitions provided by Suzanne Dalton, FeedTest®, Mount Napier Rd, Private Bag 105, Hamilton VIC 3300, Ph: 1300 655 474.

Table 2: Average Dry Matter Yield KgDM/Ha At GS30 - 32

Varieties	Av. %DM	Av. Yield KgDM/Ha at GS30 - 32
KELLALAC	18.40	596
MAROMBI	18.29	661
RUDD	17.40	682
CSIRO 170	19.25	608
MACKELLAR	18.76	674
HRZ 58693.3	17.49	630
H123.1	20.16	685
HRZ1.102.1	18.55	552
HRZ.2	18.85	613
HRZ 95176	18.02	528
HRZ 95102	20.06	905
HRZ 01.371.3	18.94	672
HRZ03.1010.3	18.55	643
AMAROK	18.56	677
MONSTRESS	15.89	1204
FRELON	18.45	593

Table 3: Yield And Quality Of Wheat Varieties Grazed And Ungrazed At Late Crop Development

Plot name	Growth Stage	DM%	DM (kg/ha)		ME (MJ/kg DM)		CP (%)		NDF (%)	
			Ungraz.	Grazed	Ungraz.	Grazed	Ungraz.	Grazed	Ungraz.	Grazed
Kellalac	Late flowering	37.4	8383	*8760*	8.4	*8.7*	10.9	*12.4*	58.0	*56.6*
Marombi	Clear liquid	42.5	15614	*12055*	9.0	*10.1*	7.1	*9.7*	52.5	*45.8*
Rudd	Early flowering	36.4	10490	*11416*	9.9	*9.9*	13.1	*10.0*	50.0	*48.2*
CSIRO 170	Flowering	30.6	10088	*9151*	10.0	*10.0*	12.9	*11.6*	50.2	*48.8*
MacKellar	Soft dough	38.7	9260	*9538*	10.2	*9.5*	11.9	*9.0*	48.5	*50.7*
HRZ 5869.3.3	Flowering	34.5	12105	*7536*	10.3	*10.1*	13.7	*7.8*	51.5	*48.1*
H 123.1	Milky-soft dough	38.5	12621	*9387*	10.5	*9.7*	9.9	*6.0*	45.3	*46.9*
HRZ 1.102.1	Late ear emerg.	34.6	12749	*7700*	9.9	*10.3*	10.7	*8.3*	49.6	*47.3*
HRZ 2	Clear liquid	39.2	12763	*9925*	9.8	*9.6*	11.9	*6.9*	52.2	*49.3*
HRZ 95176	Clear liquid-milk	33.7	10710	*12143*	10.0	*10.1*	12.5	*10.1*	49.3	*48.1*
HRZ 95102	Clear liquid	36.6	8953	*9195*	10.4	*10.2*	12.0	*7.8*	47.8	*45.9*
HRZ 01.372.3	Late flowering	36.7	13050	*8458*	9.5	*10.7*	9.2	*9.1*	52.6	*45.8*
HRZ 03.1010.3	Flowering	35.6	12633	*7357*	9.7	*9.6*	9.9	*7.3*	53.7	*51.7*
Amarok	Clear liquid	35.5	11009	*10390*	10.1	*9.8*	12.5	*9.9*	50.6	*50.9*
Monstress	Milk	43.5	15786	*12745*	10.5	*9.0*	9.2	*6.4*	42.9	*52.2*
Frelon	Flowering	32.7	10582	*7176*	10.2	*9.4*	13.0	*9.0*	52.2	*53.0*
Average			**11674**	**9558**	**9.9**	**9.8**	**11.28**	**8.83**		

Table 4: Average Grain Yields (Grazed + Ungrazed) T/Ha

Entry	Variety	Yield T/Ha
14	Amarok	4.442
11	HRZ 95102	4.325
4	CSIRO 170	4.232
2	Marombi	4.213
15	Monstress (Triticale)	3.910
8	HRZ 1.102.1	3.683
7	H123.1	3.678
10	HRZ 95175	3.617
6	HRZ 5869.3.3	3.458
16	Frelon	3.445
3	Rudd	3.353
13	HRZ 03.1010.3	3.300
12	HRZ 01.372.3	3.053
5	MacKellar	2.880
9	HRZ 2	2.202
1	Kellalac	2.190
Average		**3.499**
LSD 5%		**0.654**
CV		**22.68**

Harvest was undertaken on 9th February 2007. Due to an error in the harvest operation resulting from the grazed and ungrazed treatments not being separated, a combined grazed and ungrazed yield is shown in.

Several grazed and ungrazed plots were harvested in part of the trial, once the error was detected. Table 5 shows the effect of grazing on yields in just 1 rep of the trial. Unfortunately not all entries were represented in this harvested area.

Table 5: Grain Yield Reduction From Grazing

Entry	Variety	Grazed Yield	Ungrazed Yield	Yield Grazed vs Ungrazed %	% Yield Reduction from grazing
1	Kellalac	2.137	2.590	82.50	17.50
2	Marombi	4.047	4.824	83.89	16.11
5	MacKellar	3.076	3.464	88.79	11.21
6	HRZ 5869.3.3	3.497	4.598	76.06	23.94
7	H123.1	4.015	4.403	91.18	8.82
8	HRZ 1.102.1	3.108	4.792	64.86	35.14
9	HRZ 2	2.525	2.655	95.12	4.88
12	HRZ 01.372.3	3.141	4.630	67.83	32.17
13	HRZ 03.1010.3	2.590	3.821	67.80	32.20
14	Amarok	4.598	5.245	87.65	12.35
15	Monstress	3.497	3.303	105.88	-5.88
16	Frelon	3.108	3.788	82.05	17.95
Average		**3.278**	**4.009**	**82.80**	**17.20**

Table 6: Grain Test Weight kg/hl And Grain Protein %

Entry	Test Weight Grazed	Test Weight Ungrazed	Protein Grazed	Protein % Ungrazed
1	74.58	75.46	11.4	13.6
2	79.58	77.12	10.0	11.1
5	73.44	73.62	10.1	11.5
6	72.58	74.12	11.3	11.3
7	73.92	75.96	10.6	10.6
8	69.88	72.30	10.1	10.8
9	74.20	74.84	10.7	12.3
12	69.32	75.22	11.9	11.2
13	77.26	75.16	10.4	11.5
14	77.94	78.12	9.7	9.9
15	69.04	66.76	10.2	11.8
16	75.26	75.76	10.2	10.4
Average	**73.92**	**74.54**	**10.55**	**11.33**

Talbe 6 indicates that grazing had little effect on grain test weight, however it did affect grain protein, dropping it on average from 11.33% to 10.55%. Some varieties were more affected than others. This is indicating that not enough nitrogen was available to the crop post grazing.

Table 7: Grain Screenings % And Grain Thousand Grain Weight (TGW)

Entry	Screenings % Grazed	Screenings % Ungrazed	TGW grams Grazed	TGW grams Ungrazed
1	7.05	4.85	27.74	29.87
2	6.69	4.49	36.60	36.62
5	10.73	8.67	29.50	32.59
6	8.54	5.10	30.17	35.48
7	8.58	4.74	34.48	40.25
8	6.84	5.89	38.39	42.25
9	12.10	11.01	29.80	30.62
12	7.91	4.52	27.85	33.88
13	4.04	6.31	34.93	34.32
14	6.08	5.63	35.52	37.87
15	3.77	4.88	38.05	37.95
16	10.74	5.60	33.39	37.52
Average	**7.76**	**5.97**	**33.04**	**35.77**

Table 7 indicates that grazing increased the amount of screenings and decreased the thousand grain weight (TGW). In other words grazing reduced grain size and weight and therefore increased the level of screenings in the sample. The varieties MacKellar and Frelon had high levels of screenings (both grazed and ungrazed), whereas Monstress triticale had low screenings.

Table 8 gives the grain yield from the 2nd time of sowing on the 8th June. These yields are significantly lower than obtained from the earlier sowing.

Table 8: Grain Only Trial – Late Sown Grain Yield And Quality

Entry	Variety	Yield T/Ha	Test Weight kg/hl	Protein %	Screenings %	TGW
16	Frelon	3.149	n/a	n/a	n/a	n/a
15	Monstress	2.843	n/a	n/a	n/a	n/a
10	HRZ 95175	2.788	66.48	12.9	7.91	27.16
7	H123.1	2.670	67.90	11.7	8.92	30.58
11	HRZ 95102	2.670	n/a	n/a	n/a	n/a
14	Amarok	2.628	n/a	n/a	n/a	n/a
3	Rudd	2.614	69.18	12.6	6.07	29.22
5	MacKellar	2.433	69.02	11.5	14.55	25.47
13	HRZ 03.1010.3	2.357	n/a	n/a	n/a	n/a
8	HRZ 1.102.1	2.315	68.74	11.4	7.62	31.73
9	HRZ 2	2.280	73.68	12.0	9.04	27.60
2	Marombi	2.225	70.88	12.3	5.98	29.09
6	HRZ 5869.3.3	2.183	70.30	13.1	5.04	26.55
12	HRZ 01.372.3	2.009	n/a	n/a	n/a	n/a
4	CSIRO 170	1.842	71.30	10.9	7.07	27.27
1	Kellalac	1.752	74.50	14.0	7.11	25.55
Average		**2.425**	**70.20**	**12.24**	**7.93**	**28.02**

The late planted trial certainly gave lower yields than the early sown trial. Screenings were higher, with MacKellar showing quite high levels. Grain protein levels were generally higher than those in the earlier sown trial, although test weights and thousand grain weights were generally lower. This indicates that there was not enough moisture to fill the grain.

Discussion:

Table 1 indicates little difference in the quality of the forage produced at the GS30 – 32 stage. The energy levels ranged between 12.1 and 13.6 MJ ME/kg dry matter. Crude protein levels ranged from 25.2% to 34.3%, with CSIRO 170 giving the highest reading. The quantity of dry matter harvested at the GS30 – 32 was very similar between the wheat varieties, although Monstress triticale gave significantly higher levels.

The highest yielding varieties (late harvested) for biomass dry matter in the ungrazed treatments were Marombi, Monstress and several of the HRZ lines. These lines also produced very high levels of biomass dry matter in the grazed treatments (Table 3). The effect of grazing however, was to reduce the total biomass dry matter at the late stage on average from 11,674 to 9,558 kg/ha dry matter. Some varieties were more affected than others, with varieties such as Marombi, HRZ 5869.3.3, H123.1, HRZ 1.102.1, Monstress and Frelon showing a significant reduction in total biomass dry matter due to grazing. Varieties such as Rudd, MacKellar and Amarok either slightly benefited from grazing or showed little adverse effect (Table 3).

Table 3 also shows that grazing had little effect on the energy levels, on average dropping from 9.9 to 9.8 MJ ME/kg dry matter due to grazing. The effect on Monstress Triticale was however quite significant, reducing energy levels from 10.5 to 9.0 MJ ME/kg DM.

The effect on protein from grazing was however dramatic, with protein levels dropping on average from 11.28% down to 8.83%. This tends to indicate that the site may have run low on nitrogen, thereby reducing forage quality. This may also have had an adverse effect on forage yields and grain yields in the grazed treatments. This may explain the results in Table 5.

Table 4. gives the average grain yield (grazed and ungrazed) for each of the varieties. Amarok gave the highest grain yield, although not significantly better than Marombi and Monstress. The varieties MacKellar and Kellalac were clearly inferior in yield.

Table 5.shows the effect of grazing on final grain yield, with the average reduction being 721 kg/ha dry matter. Interestingly Monstress benefited from grazing, whereas all other varieties showed some reduction. It would appear that canopy management in Monstress from grazing had a positive effect on final grain yield, reducing the biomass by approximately 3,000 kg/ha dry matter, as shown in Table 3.

The effect of grazing was to reduce the amount of grain protein (Table 6) whilst maintaining the grain test weight. Grazing had the effect of increasing grain screenings and decreasing grain test weight (Table 7). The late sown trial gave lower yields, poorer grain quality (test weight, thousand grain weight and screenings) compared to the early sown trial