5.7 Evaluation of Dual Purpose Cereal Varieties - Tasmania

Location: "Oakdene", Perth, Tasmania

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Growing season rainfall (Feb-Nov): 385 mm

Summary:

Winter and spring wheat, barley, triticale and oat lines were evaluated for fodder dry matter production and grain yield. The two barley varieties and a spring wheat produced the highest dry matter (DM) in the first cut. However their recovery was poor and DM production from the second cut was significantly lower than for all other material. The highest total DM production was produced by Mackellar/spring wheat and Mackellar/oat combinations, Bass oats and Breakwell triticale. Of the wheat lines, Tennant and Teesdale produced the lowest DM.
Frost damage at ear emergence and flowering was extensive and the range in grain yields (0.5 to 4.5 t/ha) reflects crop species tolerance and flowering time relative to occurrence of frosts. The oats and barley were the least affected by frost damage due to panicles and ears being more protected by the flag leaf sheath. Tennant wheat and Breakwell triticale are later flowering and avoided some of the damage. If flowering of early sown grazed crops regularly occurs in mid-late October, later flowering dual purpose varieties are required.

Background/ Objectives:

Dual purpose oats, and to a lesser extent wheat, have been traditionally grown in many areas of Tasmania. In the mid 1980's wheat varieties such as Isis and Macquarie proved to be very susceptible to stripe rust and area declined significantly to almost nil. With the release of new winter wheat varieties from CSIRO, Canberra and private breeding companies there is again the opportunity to grow wheat for both grazing and grain. This use has particular potential where the crop can be watered up in a dry summer/autumn. The major limiting factor will be greater disease pressure due to the longer growing season.

The aim of this trial was to assess dual purpose wheat, barley, triticale and oat varieties for DM production, recovery from grazing and grain yield.

Given that cereals have different rates of DM production, several combinations of cereals were also evaluated to maximise early DM production with the faster growing and early maturing “bolter” variety to be grazed out leaving the later maturing winter wheat to grow through to grain production. Three combinations were used: winter wheat/spring wheat, winter wheat/triticale and winter wheat/spring oats. Being feed wheat there would be little concern if there is a minor level of “bolter” contamination.

Method:

Varieties/lines:

wheat	Tennant, Brennan, Mackellar + 3 winter wheat breeding lines	CSIRO, Canberra/HRZ Wheat
	HRZ03.0003 (spring wheat)	FAR, NZ
	Teesdale (French variety)	PGG-Wrightsons, Grainsearch
triticale	Breakwell	Waratah Seeds
barley	Yerong, Yambla	NSW Ag
oats	Bass	TIAR
cereal mixes	Mackellar/CSIRO spring wheat line	
	Mackellar/Breakwell triticale	
	Mackellar/Quamby oats	

The trial was sown under a centre pivot and with watering consequently received a good start. There were four replicates in randomised complete blocks.

The trial was sown on 14th March 2006 with 9:16:10 fertiliser at 250kg/ha and followed a poppy crop. Initial DM cuts were taken on 31st May with a second cut on 31st July. Nitrogen (50kgN) was top-dressed on 31st August and a further 50kgN was applied to cut plots (11th October). To cover the range of growth stages three fungicides were applied (24th August, 21st September and 23rd October). An aphicide was sprayed on 13th September. The plots were harvested for grain on 24th Jan.

Results and Discussion:

The trial was irrigated under a centre pivot thus ensuring uniform establishment in a dry March. There was good rainfall in April and early May but that was as good as it got. Subsequent growth was very slow due to record low winter rainfall and cold temperatures from May to July with an extended run of frosts. Irrigation was an option but there was a high risk that this would exacerbate waterlogging with winter rains (which never came). The trial was irrigated in spring due to the continued low rainfall and was growing very well. However there were frosts in mid to late October when most plants in the trial were flowering. A frost on October 16th was particularly severe as it followed a period of warm weather and the plants had little cold "hardening". To further exacerbate problems, there were additional frosts in November with a severe frost on Nov 16th.

Dry matter production: Although there was good plant establishment the dry and cold winter reduced early growth and dry matter (DM) production.

In past trials, after taking quadrat DM cuts, sheep and cattle have been used to remove the remaining growth. However with animals being introduced from paddocks of wheat it was found that the triticale and oats were preferentially grazed. Consequently entire plots are now cut with a mower. Also, from past experience, cutting at a height of 50mm has been too low for triticale resulting in loss of tillers. Consequently the faster maturing lines, Breakwell, Yerong and HRZ03.0003 were cut at 70 mm which is probably more in line with commercial practice. Total DM production would therefore have been higher than indicated for the triticale. For the second cut, plots were cut at 70-80mm above ground level to avoid damage to growing points.

Data is presented in the accompanying table on an oven dried basis. The barley varieties both bolted early with Yerong producing nearly 2t/ha of DM from the first cut. The spring wheats also produced high first DM cuts, both solely (NZ line) and in combination with Mackellar (CSIRO spring line). However recovery of the barley varieties and NZ spring wheat line was poor and DM production from the second cut was significantly lower than for all other material.

The highest total DM production was produced by the Mackellar/spring wheat and oat mixes, Bass oats and Breakwell triticale. Bass plots grew very well and being later maturing, a third DM cut in August is probably warranted in future trials. Of the wheat lines 95102.1, Mackellar, the NZ spring wheat and Brennan yielded the highest DM. Not surprisingly the wheats cutting the lowest weights were generally later maturing types with poorer early vigour ie Teesdale and Tennant. These two varieties have consistently produced lower DM over several years of trialling. Teesdale, although not late flowering, is generally a slow developer during most of the vegetative stage. Mackellar was very vigorous after the first cut and DM from the second cut was high. Relative to other varieties the Mackellar seemed to be earlier maturing in 2006-07 than in other seasons. As a consequence there was some damage to growing points after the second cut.

Tissue samples were sent to FeedTest, Hamilton and CSIRO, Canberra for analysis. Data is not presented here but some generalisations can be made. Relative to the winter wheats:

- The two spring wheats produced higher crude protein (CP) but lower digestibility (DMD) and metabolisable energy (ME).
- The two barley varieties also produced higher CP but also reasonably high ME.
- Each line of oats and triticale tended to have higher ME and lower CP.
- During periods of maximum growth the winter wheat and triticale germplasm were lower in magnesium than the other cereals and this combined with levels of potassium and calcium may result in Mg deficiencies in livestock.

Dry matter production and grain yields (t/ha and % of Tennant) from dual purpose cereal trial, Perth, Tasmania, 2006-07.

DM production

Variety/line	1st cut DM Yield (t/ha)	Total DM Yield (t/ha)	% Tennant
Mack+spr wheat	1.61	2.93	159.0
Bass (O)	1.36	2.90	157.2
Mack+oats	1.32	2.82	152.9
Breakwell (T)	1.18	2.62	142.1
Yambla (B)	1.75	2.42	131.4
95102.1	0.87	2.35	127.2
Mack+trit	0.99	2.29	124.3
Mackellar	0.63	2.26	122.5
HRZ03.0003	1.62	2.25	122.2
Yerong (B)	1.96	2.22	120.2
Brennan	0.61	2.12	114.6
H123.1	0.46	2.05	110.8
K89.44	0.55	1.94	105.4
Tennant	0.40	1.85	100.0
Teesdale	0.40	1.53	82.7
l.s.d. (5%)	*0.231*	*0.409*	
cv%	*15.4*	*12.4*	

Grain yield

Variety/line	Yield (t/ha)	% Tennant
Yambla (B)	4.52	120.5
Bass (O)	4.29	114.4
Tennant	3.75	100.0
HRZ03.0003	3.75	99.9
Yerong (B)	2.94	78.3
95102.1	2.79	74.4
K89.44	1.97	52.4
Breakwell (T)	1.53	40.7
Mack+trit	1.22	32.5
Teesdale	1.15	30.7
Mackellar	1.08	28.7
Mack+spr wheat	0.94	25.2
H123.1	0.83	22.2
Mack+oats	0.65	17.3
Brennan	0.47	12.6
l.s.d. (5%)	*0.450*	
cv%	*14.5*	

Grain production: Grain yields ranged from low to exceptionally low due to the severe frost damage in mid October, vindicating the growers decision to cut the surrounding Mackellar crop for silage. The variation was due to crop species tolerance and flowering time relative to frosts. Oats and barley are recognised for greater frost tolerance and for this reason have been traditionally the predominant crops in the central midlands. The oat variety Bass was probably the least affected by frost damage and unlike most of the other cereals, panicles were still in the boot with the severe October 16 frost. Frost damage was also significantly less in the barley varieties with the ear being protected by the flag leaf sheath. The lower yields of Yerong compared with Yambla were due to being more advanced and poor

recovery after cutting. Breakwell yielded reasonably well given the susceptibility of triticale to frost damage at flowering. This was largely through avoidance with flowering occurring after mid October and just prior to the mid November frost.

The two wheat varieties producing the highest yields achieved this through different frost avoidance mechanisms. Tennant is much later flowering and like Breakwell avoided most of the damage. In contrast the NZ line HRZ03.0003 is early maturing and a significant proportion of the main stem growing points were removed during the second DM cut. As a result tillers were later developing and these avoided some of the frost damage –an example of the fickle nature of frost damage.

Of the remaining wheats the yield of 95102.1 was surprisingly high. This line scored consistently low in frost damage assessments. Flowering was about the same time as most of the other wheats but one or two days difference can result in large variations in grain yield. Given the very high yield of this line in a high input trial (reported elsewhere) and in previous years, it would be nice to think this line may have some (limited) frost tolerance. This is probably wishful thinking but the effect has been flagged with the CSIRO breeder for further observation. At the other end of the scale Brennan was the lowest yielding but again this is probably a time of flowering effect and yields were not statistically lower than Mackellar.

The cereal mixes performed as expected ie the yields from combinations were intermediate between yields from the varieties grown solely (in a single plot the yield of the CSIRO “bolter” was only 0.3 t/ha with very poor recovery from cutting and severely frosted). The exception was the Mackellar/Quamby mix. An animal, maybe a deer or possibly a wombat, took a liking to rolling in all plots of this mix three weeks prior to harvest. Incredibly these were the only plots in the whole trial damaged (and the four plots were randomised over the whole trial area). With up to 50% flattening this data should be ignored.

Impact from frost damage was the most significant influence on grain yield and interpretation of data is limited by this effect. However there were other points of interest. Prior to this damage BYDV was evident in plots. The least affected were in order: Bass, Yerong, Yambla and Mackellar. Bass and Mackellar have been bred for resistance and the lack of expression of this disease in these barley varieties has been documented previously. The worst affected varieties were Tennant and Teesdale which consistently scored high for symptoms. BYDV resistance or spraying for aphids is more important for high grain yields with earlier sowing than for a May sowing. There were no other diseases of significance apart from some minor leaf rust in the barley between fungicide applications and some septoria on the Bass oats.

While frost damage at flowering can never be realistically avoided there is a greater long term probability of frost damage when flowering occurs in October. Most of the March sown cut wheat varieties were at ear emergence at the time of the mid October frosts which was up to 10 days earlier than May sown plots. Possibly the colder weather in April to June had a greater effect on satisfying the vernalisation response with the earlier sowing. If earlier flowering of grazed crops occurs regularly, new dual purpose varieties are required that are later flowering through either flowering being triggered by photoperiod (daylength) or a stronger vernalisation response to delay flowering i.e. using a later flowering type than is optimal for grain-only varieties.

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