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# VERSATILE OATS FOR THE WIMMERA MALLEE

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## Take home messages

- At Warmur and Kalkee, Bannister was the highest yielding milling oat and Brusher the highest yielding hay oat variety in 2016 – an excellent season.
- Application of fungicides to oats did not create hay or yield benefits in the Wimmera in 2016.
- Choice of oat variety and management should be made according to the intended end-use traits – versatility if conditions change, disease resistance, ability to control problem weeds and likelihood of making premium markets.

## Background

Following dry seasons, 2016 began with low domestic supplies of hay in Victoria. There was also on-going export demand for high-quality milling oats and hay. In response, oat plantings were forecast to rise 19 per cent in 2016-2017 to 1.6 million tonnes across Australia (ABARES 2016).

Grain & Graze 3 began evaluating oats for their versatility in a mixed farming system in terms of early grazing value, hay and grain production. The first season of evaluation in the southern Mallee in 2015 was a poor, Decile 1 season. Trials were sown again in 2016 to evaluate variety performance under different growing conditions.

## Aim

To evaluate the early biomass production, hay and grain yield of oat varieties, as well as their response to a herbicide strategy, in the southern Mallee and Wimmera.

## Paddock details

<b>Location:</b>	Warmur and Kalkee
<b>Annual rainfall:</b>	Warmur – 444mm, Kalkee – 467mm
<b>GSR (Apr-Oct):</b>	Warmur – 371mm, Kalkee – 374mm
<b>Soil type:</b>	Warmur– clay loam, Kalkee – clay
<b>Paddock history:</b>	2015 – fallow

## Trial details

	Warmur – Mallee	Kalkee – Wimmera
<b>Crop type</b>	Oats	Oats
<b>Varieties</b>	See Table 1	See Table 2
<b>Treatments</b>	Varieties	Varieties x +/- disease control
<b>Target plant density</b>	130 plants/m <sup>2</sup>	180 plants/m <sup>2</sup>
<b>Seeding equipment</b>	Knife points, press wheels, 30cm row spacing	
<b>Trial design</b>	Randomised complete block	Split plot
<b>Replicates</b>	Four	Three
<b>Sowing date</b>	4 May	15 April
<b>Harvest date</b>	27 November	21 December
<b>Trial average yield</b>	6.1t/ha	6.0t/ha

## Trial inputs

**Fertiliser:** Warmur Granulock® Supreme Z @ 50kg/ha at sowing, urea @ 50kg/ha on 23 June at GS30, urea @ 60kg/ha 29 August at GS45

Kalkee Granulock Supreme Z @ 50kg/ha at sowing, urea @ 50kg/ha on 19 July at GS35, urea @ 50kg/ha 23 August at GS45

**Fungicides:** At Kalkee, complete control of disease was achieved by Prosaro® @ 150mL/ha on 5 August, propiconazole @ 230mL/ha on 1 September and propiconazole @ 230mL/ha on 27 September. Nil disease control plots received no fungicides

Pests and weeds were controlled according to best management practice.

## Method

Assessments included establishment counts, early biomass, feed test analysis and DSE grazing days (Warmur only), anthesis biomass, lodging score, grain yield and quality parameters (Warmur only).

Using dry matter (DM) and feed tests, dry sheep equivalent (DSE) grazing days were calculated as follows:

$$\text{DSE grazing days} = \text{DM (kg/ha)} \times \text{feed test metabolisable energy (ME)} / 8 \text{ MJ,}$$

which assumes that each DSE requires 8 MJ ME/day.

## Results and interpretation

### Warmur: variety evaluation

Plant establishment was even across varieties at Warmur, averaging 112 plants/m<sup>2</sup>.

Early feed value at eight weeks after sowing (GS30) was highest for Wandering at about 1t/ha of DM and 1549 DSE grazing days (Figure 1). Dry matter for all other varieties ranged between 0.6-0.8t/ha (Table 1). Feed test analysis of varieties indicated high protein at 29-33 per cent, high metabolisable energy at 12-13MJ/kg DM and adequate fibre between 30-37 per cent (NDF % DM).

Of the hay and feed grain varieties, Echidna, Wandering and Wintaroo produced the highest hay yields tipping 12t/ha (Table 1). Other milling oat varieties Dunnart, Possum, Wombat and Yallara also produced hay yields between 11-13t/ha.

With high production and several rainfall events during spring, lodging occurred in all varieties

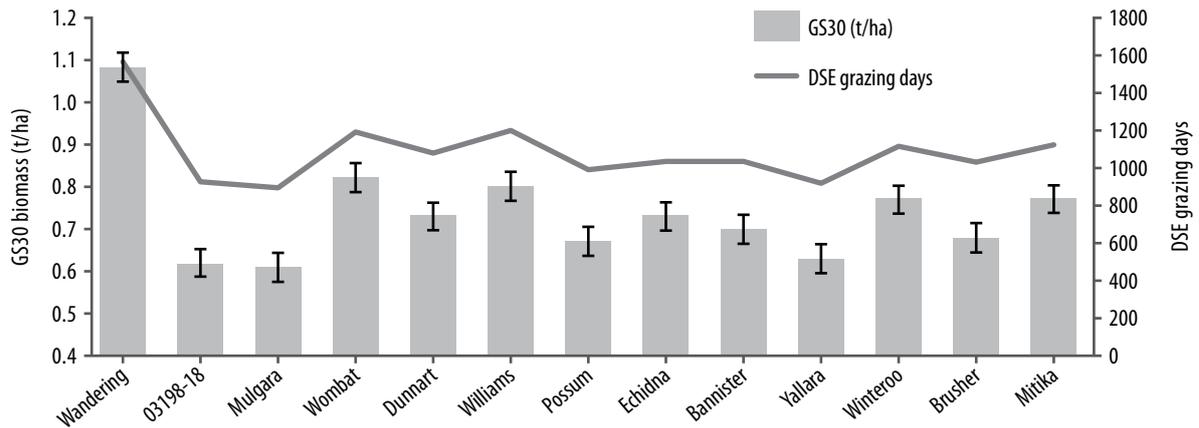


Figure 1. Grazing biomass and DSE grazing days of oat varieties, Warmur 2016.

(Table 1). Hay varieties Brusher and Mulgara, followed by Wintaroo suffered the most amount of lodging (all have tall stature, and are more susceptible to lodging under their own weight) while varieties Mitika, Wandering, Wombat, Echidna and breeding line 03198-18 incurred the least.

Of the milling lines, grain yield was highest for Bannister with an impressive 8.5t/ha, followed by Dunnart, Williams and Wombat all yielding over 7t/ha. Echidna and Wandering yielded the highest out of the hay/grazing/feed varieties, also yielding more than 7t/ha (Table 1).

Most milling oats had test weights above 51kg/hL and made Milling 1 grade, except very early maturing Durack and Dunnart. National trial data (Hoppo and Zwer, 2016) between 2011-2015, indicates Durack has an average test weight of 51.5kg/hL – the low result in 2016 may have been symptomatic of the season. Dunnart averages 47.4kg/hL so is usually a lower hectoliter weight variety. Screenings did not differ between varieties and were all below five per cent.

Table 1. Oat variety evaluation, Warmur 2016.

Variety	End-use	Plant height	Maturity	Early biomass (t/ha)	Anthesis-hay biomass (t/ha)	Lodging score 3 November (0=all standing, 10=all lodged)	Grain yield (t/ha)	Test weight (kg/hL)
<b>Milling oats</b>								
Bannister	M, H	TD	M	0.70 <sup>bc</sup>	13.1 <sup>a</sup>	2.1	8.5 <sup>a</sup>	53.9
Dunnart	M	TD	M	0.73 <sup>bc</sup>	12.7 <sup>a</sup>	3	7.1 <sup>c</sup>	50.7
Williams	M	MT	E	0.80 <sup>bc</sup>	9.0 <sup>cd</sup>	3.8	7.1 <sup>c</sup>	52.8
Wombat	M	D	EM	0.82 <sup>b</sup>	11.4 <sup>ab</sup>	1.5	7.0 <sup>c</sup>	53.5
03198-18	M	D	E	0.62 <sup>bc</sup>	8.0 <sup>d</sup>	1.3	6.3 <sup>d</sup>	51.9
Mitika	M	D	E	0.77 <sup>bc</sup>	8.9 <sup>cd</sup>	1.5	6.1 <sup>d</sup>	52.5
Possum	M	D	EM	0.67 <sup>bc</sup>	13.2 <sup>a</sup>	1.8	5.9 <sup>d</sup>	51.8
Durack	M, H	MT	VE	0.71 <sup>bc</sup>	8.5 <sup>d</sup>	3.5	4.7 <sup>e</sup>	49.8
Yallara	M, H	MT	EM	0.63 <sup>bc</sup>	11.1 <sup>abc</sup>	4.3	3.7 <sup>f</sup>	52.1
<b>Hay/grazing/feed</b>								
Wandering	F	D	EM	1.08 <sup>a</sup>	13.1 <sup>a</sup>	1.5	7.2 <sup>c</sup>	53.0
Wintaroo	H,G,F	T	EM	0.77 <sup>bc</sup>	12.6 <sup>a</sup>	6	4.3 <sup>ef</sup>	51.7
Echidna	F	D	EM	0.73 <sup>bc</sup>	12.1 <sup>a</sup>	1.3	7.9 <sup>b</sup>	52.4
Brusher	H,G,F	T	EM	0.68 <sup>bc</sup>	9.7 <sup>bcd</sup>	8.5	4.3 <sup>e</sup>	47.6
Mulgara	H, F	T	EM	0.61 <sup>c</sup>	8.5 <sup>d</sup>	7	4.2 <sup>ef</sup>	48.4
<b>Sig. diff.</b>				P=0.007	P<0.001		P<0.001	P<0.001
<b>LSD (P=0.05)</b>				0.21	2.26		0.55	1.10
<b>CV%</b>				19.5	14.5		6.3	1.5

End-use: M=milling, F=feed grain, G=grazing, H=hay. Plant height: D=dwarf, TD=tall dwarf, T=tall, ST=short tall, MT=moderate tall. Maturity: E=early, EM=early mid, M=mid, ML=mid late, LM=late mid, L=late, VL=very late

## Kalkee: variety x disease control

The trial was sown into moist soil conditions at Kalkee and germinated relatively evenly. Growth across plots however was uneven, and was thought to be from herbicide residues from spot spraying weeds in the previous fallow phase, as well as leaf disease. The oat varieties grew away from this leaf infection by peak biomass.

Application of fungicides to control fungal leaf diseases had no effect on early plant growth, hay biomass or grain yield compared with nil application of fungicide in 2016. Therefore, only variety data has been presented.

The two foliar diseases that infected the crops, red leather leaf (RLL) and bacterial blight, are discussed later in this paper.

NDVI assessment of early feed value at eight weeks after sowing was similar for most varieties (Table 2).

Hay production was variable, but high for all varieties. Brusher, Echidna, Kangaroo and Wandering all had hay yields over 8t/ha, closely followed by Wintaroo and Mulgara. Outstanding milling variety hay yields were achieved by Dunnart, Williams, Yallara and Possum yielding over 9t/ha (Table 2).

Like Warmur, lodging occurred in all varieties at Kalkee, except the breeding line 03198-18 (Table 2). Milling types (shorter) generally had less lodging compared with taller hay types – with Brusher, Mulgara and Wintaroo incurring the greatest lodging.

Of the milling lines, grain yield was highest again for Bannister with an impressive 8.8t/ha, followed by Kojonup, Wombat and Williams yielding 7.6-7.9t/ha. Echidna and Wandering also again yielded the highest out of the hay/grazing/feed varieties, yielding more than 7.5t/ha (Table 2).

**Table 2. Oat variety evaluation, Kalkee 2016.**

Variety	End-use	Height	Maturity	NDVI early biomass	Anthesis-hay biomass (t/ha)	Lodging score 3 November (0=all standing, 10=all lodged)	Grain yield (t/ha)
<b>Milling oats</b>							
Bannister	M, H	TD	M	0.77 <sup>ab</sup>	6.0 <sup>e</sup>	1.8	8.8 <sup>a</sup>
Kojonup	M	D	M	0.72 <sup>d</sup>	8.6 <sup>ab</sup>	1.8	7.9 <sup>bc</sup>
Wombat	M	D	EM	0.79 <sup>a</sup>	8.2 <sup>abc</sup>	1.3	7.7 <sup>cd</sup>
Williams	M	MT	E	0.78 <sup>a</sup>	9.2 <sup>a</sup>	3.5	7.6 <sup>cde</sup>
Dunnart	M	TD	M	0.80 <sup>a</sup>	9.0 <sup>a</sup>	1.3	7.3 <sup>de</sup>
03198-18	M	D	E	0.77 <sup>ab</sup>	6.3 <sup>de</sup>	0	7.2 <sup>de</sup>
Mitika	M	D	E	0.79 <sup>a</sup>	8.4 <sup>abc</sup>	0.5	7.0 <sup>e</sup>
Possum	M	D	EM	0.80 <sup>a</sup>	8.9 <sup>a</sup>	1.2	7.0 <sup>e</sup>
Durack	M, H	MT	VE	0.80 <sup>a</sup>	7.9 <sup>abc</sup>	2.6	5.4 <sup>f</sup>
Yallara	M, H	MT	EM	0.72 <sup>cd</sup>	9.0 <sup>a</sup>	2.5	3.9 <sup>hij</sup>
<b>Hay/grazing/feed</b>							
Brusher	H,G,F	T	EM	0.81 <sup>a</sup>	8.6 <sup>ab</sup>	6.8	4.8 <sup>fg</sup>
Wandering	F	D	EM	0.81 <sup>a</sup>	8.4 <sup>abc</sup>	1.8	7.5 <sup>cde</sup>
Kangaroo	H	MT	ML	0.71 <sup>d</sup>	8.3 <sup>abc</sup>	3.5	3.3 <sup>jk</sup>
Echidna	F	D	EM	0.77 <sup>ab</sup>	8.1 <sup>abc</sup>	1.3	8.4 <sup>ab</sup>
Wintaroo	H,G,F	T	EM	0.76 <sup>abc</sup>	7.9 <sup>abc</sup>	6.2	4.3 <sup>gh</sup>
Mulgara	H, F	T	EM	0.72 <sup>bcd</sup>	7.7 <sup>abcd</sup>	5.2	3.6 <sup>ijk</sup>
Forrester	H	MT	VL	0.81 <sup>a</sup>	7.1 <sup>bcde</sup>	4.3	3.2 <sup>k</sup>
Tungoo	H	MT	ML	0.78 <sup>a</sup>	7.0 <sup>cde</sup>	3.9	4.0 <sup>hi</sup>
<b>Sig. diff.</b>				P<0.001	P=0.002		P<0.001
<b>LSD (P=0.05)</b>				0.049	1.55		0.62
<b>CV%</b>				5.5	16.7		8.9

End-use: M=milling, F=feed grain, G=grazing, H=hay. Plant height: D=dwarf, TD=tall dwarf, T=tall, ST=short tall, MT=moderate tall. Maturity: E=early, EM=early mid, M=mid, ML=mid late, LM=late mid, L=late, VL=very late.

At Kalkee, test weight for varieties was similar to Warmur. Bannister and Wombat met milling 1 grade with test weights at 52.4 and 52.1kg/hL respectively, while test weights for Dunnart were again lower at 49.6kg/hL and Durack 48.6kg/hL.

Due to harvest delays, at the time of publishing the National Oat Breeding Program had not yet analysed their harvest results for comparison. However, results at both sites were in line with previous expected variety performance with Bannister and Williams at the top of the yield list, hay varieties generally lower yielding compared to milling varieties, and dwarf lines producing less dry matter.

## Oat disease agronomy

Growing conditions in 2016 were above average for May, July, September and into October. This resulted in cool, damp conditions and very heavy crops that were infected by RLL and bacterial blight – two diseases that can't be satisfactorily controlled by current fungicides.

Little is known about the red leather leaf pathogen worldwide, with only a few reports of its incidence. Victoria is where it occurs most in Australia, and it's becoming more prevalent as the popularity of oats is growing. The RLL fungus (*Spermospora avenae*) survives on oats stubbles, so an oat-on-oat crop will exacerbate the problem. Infection causes reddening of leaves often in long stripes. Crops often recover well from RLL when conditions turn warmer and dry. In 2016, Hugh Wallwork at SARDI lead laboratory and field research to develop more comprehensive RLL ratings for varieties, and Nufarm conducted fungicide trials.

Bacterial blight (*Pseudomonas syringae*) causes long brown stripes (pv. *striafaciens*) or buff-coloured, oval shaped spots surrounded by a pale halo (pv. *coronafaciens*), both which can fuse together into blotches. Similar to RLL, crops will normally outgrow the infection in spring when it becomes warmer.

The National Oat Breeding Program has an extensive testing program across Australia, and produces a summary of variety traits tested for grain and hay quality, and reactions to disease. Check this and your NVT variety guide for the latest ratings for both diseases.

## Commercial practice

Oats are a very versatile crop that allow flexibility to respond to the season, markets and weather events (frost and dry finishes). They offer the paddock rotation a tool for cereal root disease management (take-all and CCN), weed seed management and livestock feed. Hay can also offer some early income, helping cash flow.

Choosing an oat variety and end-use that will result in the greatest return can be complex. Grain and hay quality will be the deal breaker, so looking at long-term data for not only yield performance, but also disease resistance, and grain and hay quality is important to understand what varieties consistently produce the best quality. If you plan to deliver grain for milling or hay for export it is good to contact the mill or exporter to see if they have preferred varieties.

## On-farm profitability

Oat plantings are increasing across Australia, with demand anticipated to continue for Australia's milling oats, particularly from China due to the health benefits derived from beta-glucan.

2016 was a very high yielding year at both Warmur and Kalkee. Bannister was the highest yielding milling oat at both sites at 8.5t/ha and 8.8t/ha respectively, with a gross income on average of \$1730/ha.

Brusher produced the most hay at Warmur and Kalkee with 8.5t/ha and 6.8t/ha respectively.

Choosing a variety that will increase hay production by 0.5t/ha would reward you with an extra square bale of hay/ha worth \$150.

## References

Australian Bureau of Agricultural and Resource Economics and Sciences, 2016, Australian crop report: June 2016, No. 178.

Hoppo, S. and Zwer, P., 2016, Oat Breeding Newsletter – October 2016.

## Acknowledgements

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