On-farm optimisation of Williams oats by blending

Georgie Troup[1], Mark Seymour[2] and Blakely Paynter[1]

Department of Primary Industries and Regional Development, Western Australia, [1]Northam, [2]Esperance.

KEY MESSAGES

In 2017 this preliminary study found:

- Blending Williams with Mitika was a better option than blending Williams with Bannister to increase grain quality
- There was no grain yield or quality advantage by blending varieties pre-seeding, rather than post-harvest.

Introduction

High yielding milling oat variety Williams dominated the oat grain growing area in Western Australia within a few years of being released. However its tendency to produce narrower grain than other lower yielding milling oat varieties in shorter seasons or in low rainfall environments has resulted in poor grain quality performance compared to other varieties (Troup *et. al* 2016). Unlike wheat, oats cannot be optimised through the Co-operative Bulk Handling (CBH) Quality Optimisation tool; therefore growers must meet quality specifications for each load delivered into the CBH system. Consequently for many years growers have used on-farm blending as a method of meeting quality specifications for milling oat segregations, Oat1 and Oat2.

An alternative to blending oats post-harvest being proposed by growers, is the blending or mixing of two or more varieties at seeding, provided they are eligible for delivery into the same grade. Therefore, we initiated a study to compare the yield and quality performance of Williams and blends of Williams at seeding. Furthermore we compared the quality of Williams and Williams seeding blends to blending grain post-harvest.

Methods

Field experiments

In 2017, three sites were established at Merredin, Yerecoin, and Muresk. Treatments included pure varieties (6 reps of 100% Williams, Bannister, Carrolup, Durack or Mitika), and different blends with Williams (50% Williams + 50% other variety, and 75% Williams + 25% other variety). To establish the target plant density 240plants/m^2 the seeding rate (kg/ha) of each variety was adjusted based on their grain weight and germination percentage. Plant establishment was determined at 4 weeks after seeding. Basal fertiliser comprised of Summit Gusto which was treated with Uniform (40ml/L) and banded below the seed at 100 kg/ha. In-season nitrogen was applied as Flexi-N (20N) at Z31. Further details for each experiment are provided in Table 1. There was an error with the Williams 75% + Carrolup 25% treatment and the results have been omitted from this paper.

Post-harvest treatments

Additional blends of 50% Williams + 50% other varieties (Bannister, Carrolup, Durack and Mitika) were made post-harvest using the pure variety plot grain from harvest to simulate on-farm blending post-harvest.

Results

Site and environment

Growing season rainfall (May-October) ranged from 190mm at Merredin to 251mm at Yerecoin (Table 1). The site mean grain yield ranged from 1.92t/ha (Merredin) to 4.69t/ha (Muresk). Grain quality of all treatments was within the Oat1 limits (hectolitre weight ≥51kg/hL and screenings ≤10%). Mild weather during the grain filling period led to better than expected grain quality.

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Table 1. Location, soil attributes, growing season rainfall, seeding dates and site mean yields for the three oat blending trials in 2017.

Location	Organic C (%)	Total N (% by weight)	pH $CaCl_2$ (0-10cm)	Soil type	May-Oct rainfall (mm)	Seeding date	Site mean yield (t/ha)
Merredin	0.98	0.08 (low)	4.9	Brown sandy duplex	190	26/05/17	1.92
Muresk	0.76	0.08 (low)	5.5	Grey brown sandy duplex	247	03/05/17	4.69
Yerecoin	1.26	0.11 (low)	5.6	Grey brown sandy duplex	251	23/05/17	3.38

Effect of blending varieties on grain yield and quality

The pre-seeding blending of 50% Williams with 50% of dwarf variety Mitika had a positive influence on grain quality, increasing hectolitre weight by 0.7kg/hL and reducing screenings by 31% when averaged across the three trial sites (Tables 2, 3 and 4). Blending 50% Williams with 50% Durack had a larger effect on hectolitre weight, increasing it by 1.3kg/hL (Figure 1), but the blend had no significant effect ($P<0.05$) on screenings percent. The effect of pre-seeding blending on the grain yield and quality of Williams differed between sites.

Williams had a similar grain yield to Bannister, Mitika and Durack, but higher than Carrolup at Muresk. The pre-seeding blend of Williams with these varieties did not significantly change the grain yield at either blend ratio (50/50 or 75/25, Table 2). Pre-seeding blends of 50% Williams and 50% Durack improved hectolitre weight by 3.3kg/hL, and this was the only blend to influence hectolitre weight at this site (Table 3). This blend also reduced screenings by 1.4% (Table 4). Pre-seeding blends of 50% Williams with 50% Mitika, reduced screenings by 2%. Williams and Bannister had similar hectolitre weight at Muresk, resulting in no significant difference when they were blended. However Williams had higher screenings (4.3%) than Bannister (2.7%) and the 50/50 blend had screenings of 3.2% which is similar to the expected calculated value of 3.5% and not significantly different to 100% Williams or Bannister treatments.

The pre-seeding 75/25 blending of similarly high yielding varieties Williams and Bannister maintained yield, improved hectolitre weight but did not influence screenings percent at Yerecoin (Tables 2, 3 and 4). Pre-seeding blends with 50% Carrolup, 50% Durack or 50% Mitika reduced grain yield. Hectolitre weight increased by 1.9kg/hL when 50% of Williams was blended with 50% Carrolup pre-seeding. No other blend influenced hectolitre weight at Yerecoin. All treatments had low screenings at this site (<2%), however there was one variety which influenced the screenings of Williams when blended; 50% of Mitika blended with 50% Williams reduced screenings by 0.4%.

At Merredin, varieties differed in their hectolitre weight, with Bannister and Durack having significantly higher hectolitre weight than Williams, however blending these varieties at either ratio (50/50 or 75/25) did not significantly improve the hectolitre weight of Williams (Table 3). In contrast, Williams screenings percent was reduced by 5% when Williams was blended with 50% Mitika, but this reduced the grain yield of Williams by 16% (Table 4).

Table 2. Grain yield response of oat varieties to pre-seeding blending at three sites in WA in 2017

Variety and % in Blend	Merredin		Muresk		Yerecoin	
Bannister 100	100	cd*	104	f	100	ef
Carrolup 100	91	bcd	86	a	86	ab
Durack 100	80	ab	93	bc	84	a
Mitika 100	76	a	93	bc	90	bc
Williams + Bannister 50 / 50	103	d	104	ef	103	f
Williams + Bannister 75 / 25	101	cd	94	abcd	98	def
Williams + Carrolup 50 / 50	95	bcd	98	bcdef	94	cd
Williams + Durack 50 / 50	79	ab	97	bcdef	89	abc
Williams + Durack 75 / 25	88	abcd	94	abcd	96	cde
Williams + Mitika 50 / 50	84	abc	101	bcdef	93	cd
Williams + Mitika 75 / 25	87	abcd	93	ab	97	def
Williams 100 (t/ha)	2.12	d	4.90	bdef	3.63	ef
P=	***0.027***		***0.001***		***<0.001***	

***Values followed by the same letter are not significantly different**

Table 3. Calculated change (as % of Variety) and observed change on hectolitre weight (kg/hL) of pre-seeding blending varieties with Williams.

	Hectolitre weight (kg/hL)						
	Yerecoin	Merredin	Muresk	Average	Calculated change	Observed change	Difference
Bannister 100	57.6	62.4	57.8	59.3			
Carrolup 100	59.5	60.9	59.8	60.0			
Durack 100	58.9	62.2	61.8	61.0			
Mitika 100	56.6	60.9	57.4	58.3			
Williams 100	55.9	59.0	56.7	57.2			
Williams + Bannister 50 / 50	56.8	60.3	55.7	57.6	+1.0	+0.4	-0.6
Williams + Carrolup 50 / 50	57.8	60.3	55.9	58.0	+1.4	+0.8	-0.6
Williams + Durack 50 / 50	57.1	58.5	60.0	58.5	+1.9	+1.3	-0.5
Williams + Mitika 50 / 50	56.8	60.5	56.5	57.9	+0.5	+0.7	+0.2
Williams + Bannister 75 / 25	57.4	58.9	56.5	57.6	+0.5	+0.4	-0.1
Williams + Durack 75 / 25	57.1	60.4	56.6	58.0	+0.9	+0.8	-0.1
Williams + Mitika 75 / 25	55.7	58.5	56.2	56.8	+0.3	-0.4	-0.7
Lsd(p=0.05) comparing two blends	*1.5*	*2.6*	*3.2*				
Lsd(p=0.05) comparing a blend with a pure variety	*1.3*	*2.2*	*2.7*				
Lsd(p=0.05) comparing two pure varieties	*1.0*	*1.8*	*2.2*				

Table 4. Expected (calculated as % of Variety) and average effect of blending varieties with Williams pre-seeding on screenings percent (<2.0mm).

	Screenings % (<2.0mm)						
	Yerecoin	Merredin	Muresk	Average	Expected change	Average change	Difference
Bannister 100	0.8	10.6	2.7	4.7			
Carrolup 100	0.8	13.1	2.4	5.4			
Durack 100	1.1	8.9	1.5	3.9			
Mitika 100	0.4	6.2	0.9	2.5			
Williams 100	0.8	14.4	4.3	6.5			
Williams + Bannister 50 / 50	0.8	12.6	3.2	5.5	-0.9	-0.9	+0.0
Williams + Carrolup 50 / 50	1.0	12.6	3.4	5.7	-0.5	-0.8	+0.3
Williams + Durack 50 / 50	1.0	12.4	2.9	5.4	-1.3	-1.1	-0.3
Williams + Mitika 50 / 50	0.4	9.3	2.3	4.0	-2.0	-2.5	+0.5
Williams + Bannister 75 / 25	0.6	12.1	3.9	5.5	-0.5	-0.9	+0.5
Williams + Durack 75 / 25	1.1	13.2	3.8	6.0	-0.7	-0.5	-0.2
Williams + Mitika 75 / 25	0.5	11.3	3.1	5.0	-1.0	-1.5	+0.5
Lsd(p=0.05) comparing two blends	*0.3*	*4.5*	*1.6*				
Lsd(p=0.05) comparing a blend with a pure variety	*0.3*	*3.9*	*1.4*				
Lsd(p=0.05) comparing two pure varieties	*0.2*	*3.2*	*1.1*				

Pre-seeding vs post-harvest blending

There was an indication at one site (Muresk) that blending Williams with Bannister, Carrolup or Durack post-harvest had a greater effect on hectolitre weight and screenings percent than when blending was done pre-seeding, although this was not significant, the trend was evident. The mean hectolitre weight of the blended varieties when averaged across the three sites was 58.0kg/hL when blended pre-seeding, and 58.6kg/hL when blended post-harvest

(Figure 1). The mean screenings percent of the blended varieties when averaged across the three sites did not differ between blending occurring at pre-seeding or post-harvest (5.2%).

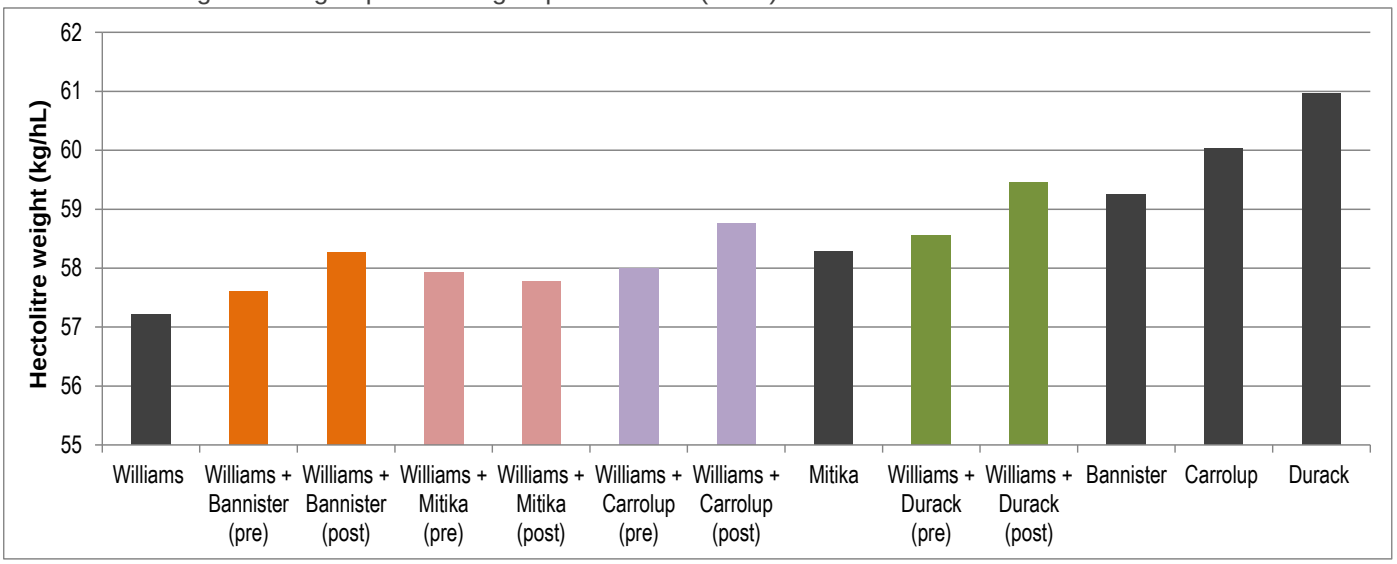

Figure 1. Differences in hectolitre weight (kg/hL) of blended oat varieties (averaged across three trial sites at Merredin, Muresk and Yerecoin) in 2017.

Discussion

Farm advisors have recently been encouraging growers to blend the high yielding varieties Williams and Bannister pre-seeding, to improve the hectolitre weight and screenings of Williams. Additionally, the blend was aimed to balance the sensitivity of Williams with the more stable variety Bannister (Troup *et. al* 2017), providing growers with a greater likelihood of meeting Oat1 receival specifications. This preliminary study in 2017 identified that blending Williams with Bannister had a positive impact on grain quality at one site, Yerecoin. At the other two sites, Merredin and Muresk, grain quality of Williams was improved by blending with the dwarf variety Mitika, or with the recently released short-season variety Durack*.

Whilst there was a slight grain yield penalty of blending Williams with Mitika (-0.1t/ha averaged across sites) when compared to Bannister (+0.2t/ha averaged across sites), if the overall aim is to improve grain quality then blending with Mitika increases the likelihood of meeting Oat1 specifications more than Bannister.

In addition, this study identified no grain yield or quality advantage by blending varieties pre-seeding, suggesting that growers can grow varieties either a) in individual paddocks or b) within the same paddock, and blend as required post-harvest. Growers are encouraged to select their practice based on their ability to a) blend post-harvest efficiently, and b) grow single variety seed crops.

Due to the late season break, and the prolonged growing season during 2017 the grain quality of Williams in this study was high. This study will be continued in 2018.

*Durack is currently undergoing milling evaluation by the Grains Industry of Western Australia (GIWA), and is not deliverable as an Oat1 variety at this date. Please contact the GIWA for up-to-date information on variety eligibility for delivery into the CBH system.

References

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