GOA Trial Site Report

Wheat - improving confidence in high plant populations as a weed control tool in lower rainfall environments.

Trial Code:	**GOWE06321-1**
Season/Year:	Winter 2021
Location:	"Folkestone", Nyngan
Collaborators:	Michael Dutchske

Keywords

GOWE063, Wheat, plant populations, competition, varieties

NOTE: this trial was resown in June (after initially being sown in early May, due to extensive mouse damage). As the trial was harvested after the surrounding paddock there was also significant bird damage. Results should be treated with caution.

Take home messages

Increasing sowing rates increased resultant crop populations and assumedly weed competition, varieties that reached peak biomass earlier may be better choices in paddocks where weeds are a problem.

Increasing sowing rates and crop populations did not negatively impact yields

Increasing sowing rates and crop populations did not result in higher screenings.

Background

The improvement in weed management through enhancing crop competitiveness through decreasing row spacing and increasing plant populations is well documented. However, a key barrier to adoption, particularly in marginal yield/ rainfall environments, is perceived yield instability and risks for lowering of grain quality (e.g. screenings and retention). Furthermore, decreasing row spacing can also impede trash flow which goes against production systems increasingly focussed on maximising stubble retention to maximise water use efficiency. Additionally, there are increases in costs for machinery with narrower rows and/or increased seed rates.

Recent research such as US00084, UWA0071/2, has also demonstrated changes in crop competitiveness through variety and crop choice that requires some further regional validation against standard district practices or commonly grown varieties. However, it can be argued seeding rates will be the most easily changed and more readily adopted by growers as opposed to reducing row spacings.

This is the second year of this work by GOA work investigating the impact on yields and grain quality of variety by altering sowing rates when late sowing.

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Aims

Investigate if increasing sowing rate impacts on yield and grain quality of a range of varieties common to the GOA region.

Investigate any interactions between population and variety on crop biomass as a measure of crop competition

Methods

Trial Details							
Trial Establishment Date	Autumn 2021						
Sowing configuration	275 mm row spacing, KPPW						
Paddock history	2020 wheat		**Soil test**	Nitrogen (kg/ha)	Colwell P (ppm)	Sulfur (ppm)	
	2019 fallow		0-10cm	19	26	6	
	2018 fallow		10-120cm	80			
Trial timings	Sowing	Harvest	Trial initially sown 7th May.				
	23/06/2021	4/12/2021					
Varieties and Target plant pop (plant/m²): a selection of quicker varieties to suit later sowing common to the region			Target plant population and sowing rate (kg/ha)				
	Variety	**Habit**	**30**	**70**	**110**	**150**	
	Beckom	Short plant type	11	28	49	75	
	Condo	Tall plant type	13	34	60	91	
	Coolah	Tall plant type	11	29	50	77	
	Lancer	Medium plant height	11	28	49	75	
	Mustang	Medium plant height	11	29	50	76	
	Scepter	Medium plant height	13	34	59	91	
	Spitfire	Medium plant height	14	35	61	93	
	Flanker	Tall plant height	14	37	65	99	
Trial design	Type: small plot (~12m x 2m) Design: split randomized block Replication: 4		Analysis ASREML – randomized complete block. Tested to a 95% confidence interval				
Treatment related observations and measurements	• Plant establishment • Vegetation index (2) NDVI • Grain yield and quality						

Results

Plant establishment: Increasing seeding rates increased established plant populations. For most varieties, actual establishment tended to be lower than the targeted populations (Figure 1). In most cases each population established within each variety was significantly higher or lower than the other populations established, except for Scepter where the 30 and 110 treatments were not different to the 110 plants/m.

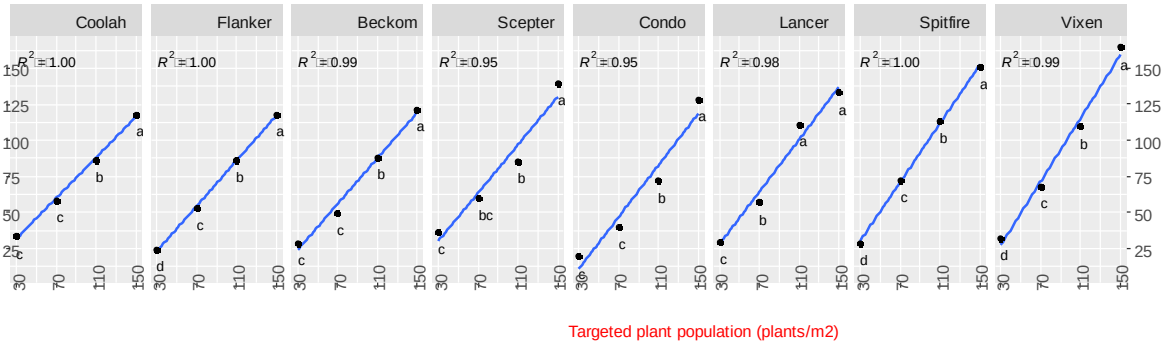

Figure 1. Plant establishment, actual against targeted 30, 70, 110 and 150 plants/m2. Treatments with the same letter within a variety are not significantly different.

Vegetation Index: For all varieties early vegetation index (VI) increased with plant population (**Figure 2**). Beckom and Sceptor had lower early biomass than other varieties. Spitfire and Vixen had the some of the highest VI.

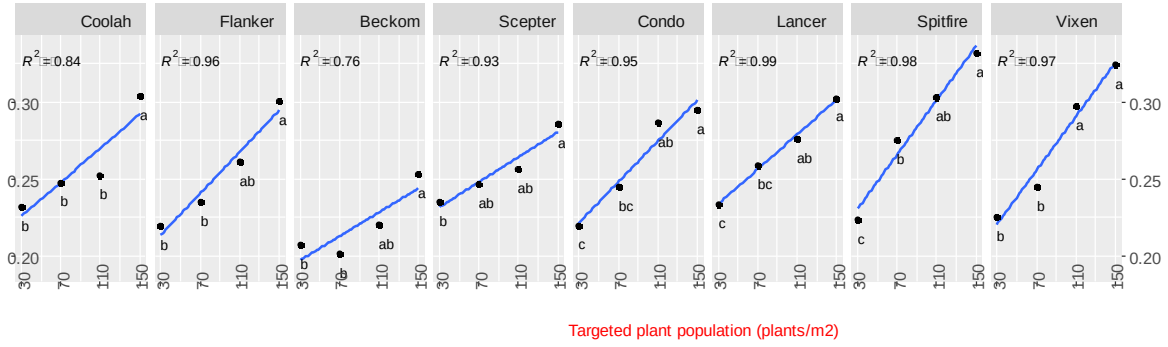

Figure 2. Vegetation index (NDVI) by variety and population (plants/m2). Treatments with the same letter within a variety are not significantly different. Assessed 56 days after sowing.

Yield: For 7 of the 8 varieties, there was very little change in yield in response to increasing sowing rates, however yields did tend to decline for Sceptor (**Figure 3**), however at its lower population it had some of the highest yields.

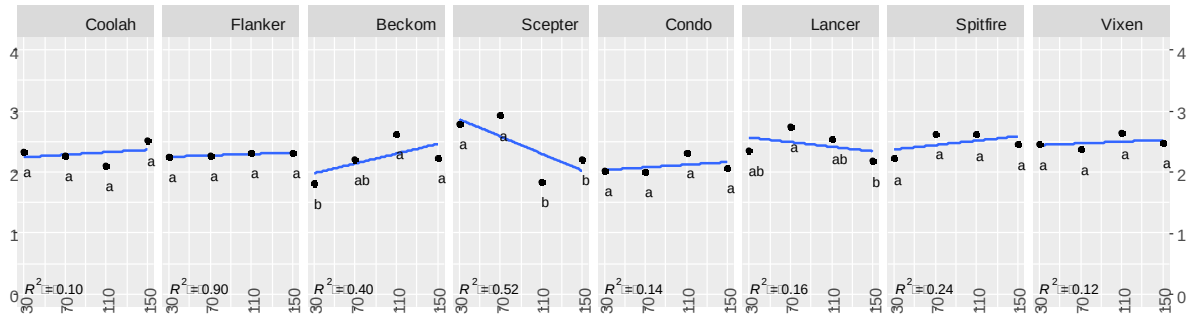

Figure 3. Yield (t/ha) by variety and population (plants/m2). Treatments with the same letter within a variety are not significantly different.

Screenings: were very variable, and for 6 of the 8 varieties population had little effect. For the remaining two (Condo and Lancer), screenings tended to decline with increasing populations (Figure 4).

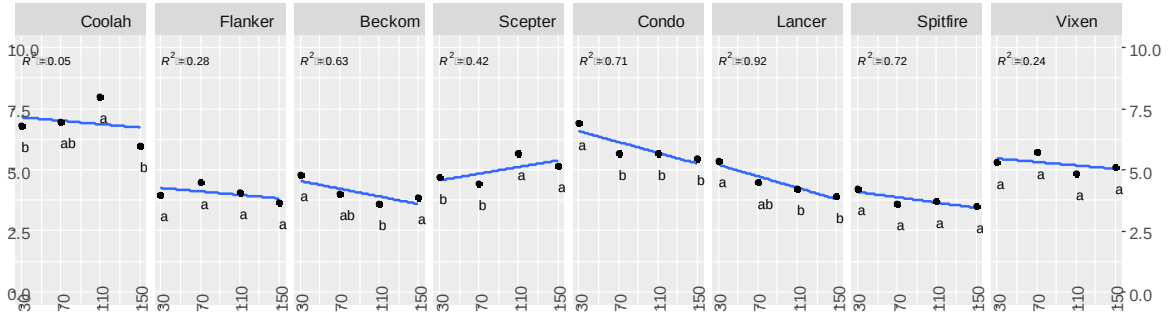

Figure 4. Screenings (%) by variety and population (plants/m2). Treatments with the same letter within a variety are not significantly different.

Discussion

Increasing populations increased the vegetation index (which may be considered a proxy for crop competition) regardless of variety. For the varieties and the populations tested this tended to be a linear relationship. This suggests that growers may consider increasing sowing rates of their existing varieties to increase populations and increase weed competition.

These was a considerable difference between varieties in early season vegetation. And growers with problem weed paddocks may consider switching to varieties such as Condo and Vixen, that display higher levels of early vigour to compete against weeds.

All varieties had stable yields across populations and screenings were very low, although some varieties responded more positively to increasing population than others.

Selecting a variety that has good early vigour and increasing sowing rates can improve the potential for weed competition with minimal negative impacts on yields or screenings.

Conclusions

Increasing sowing rates in all varieties tested would likely increase crop competition.

Some varieties display higher levels of crop competition at the same population and growth stage.

Increasing sowing rates did not negatively impact yields or grain quality in terms of screenings. In fact, evidence in this trial suggests quite the opposite, yields improved, and screening decreased with higher sowing rates.

Acknowledgements

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DISCLAIMER — TECHNICAL

Appendix

Variety	Target population	Plant establishment (plants/m2)			Vegetation index (June)			Yield (t/ha)			Screenings (%)		
		p.v.[1]	s1[2]	s2[3]	p.v.[1]	s1[2]	s2[3]	p.v.[1]	s1[2]	s2[3]	p.v.[1]	s1[2]	s2[3]
	Beckom												
	30	28.5	nop	c	0.21	kl	b	1.8	g	b	4.8	defghi	a
	70	49.5	jklmno	c	0.20	l	b	2.2	cdefg	ab	4.0	hijk	ab
	110	87.7	efg	b	0.22	jkl	ab	2.6	abcde	a	3.6	jk	b
	150	121.5	cd	a	0.25	fghij	a	2.2	bcdefg	ab	3.9	ijk	ab
	Condo												
	30	19.5	p	c	0.22	jkl	c	2.0	fg	a	6.9	b	a
	70	40.3	klmnop	c	0.24	ghijk	bc	2.0	fg	a	5.6	cd	b
	110	71.8	ghij	b	0.29	bcdefg	ab	2.3	bcdefg	a	5.6	cd	b
	150	128.5	bcd	a	0.29	abcdef	a	2.1	efg	a	5.4	cde	b
	Coolah												
	30	33.5	lmnop	c	0.23	jkl	b	2.3	bcdefg	a	6.8	b	a
	70	58.6	ijkl	c	0.25	ghijkl	b	2.3	bcdefg	a	7.0	ab	a
	110	86.5	fgh	b	0.25	fghij	b	2.1	defg	a	8.0	a	a
	150	117.9	cd	a	0.30	abc	a	2.5	abcdef	a	6.0	bc	a
	Flanker												
	30	24.5	op	d	0.22	jkl	b	2.2	bcdefg	a	4.0	hijk	a
	70	53.0	jklmn	c	0.24	hijkl	b	2.3	bcdefg	a	4.5	efghij	a
	110	86.5	fgh	b	0.26	cdefghij	ab	2.3	bcdefg	a	4.0	hijk	a
	150	117.7	cd	a	0.30	abcd	a	2.3	bcdefg	a	3.6	jk	a
	Lancer												
	30	29.8	nop	c	0.23	ijkl	c	2.4	abcdefg	ab	5.4	cdef	a
	70	57.1	jklm	b	0.26	defghij	bc	2.8	abc	a	4.5	efghij	b
	110	110.5	def	a	0.28	cdefgh	ab	2.5	abcdef	ab	4.2	ghijk	b
	150	133.0	bcd	a	0.30	abc	a	2.2	defg	b	3.9	hijk	c
	Scepter												
	30	36.7	klmnop	c	0.24	hijkl	b	2.8	ab	a	4.7	efghi	a
	70	60.2	hijk	bc	0.25	ghijk	ab	2.9	a	a	4.4	fghijk	a
	110	85.2	fghi	b	0.26	efghij	ab	1.8	fg	b	5.7	cd	b
	150	139.3	abc	a	0.29	bcdefg	a	2.2	cdefg	b	5.2	cdefg	ab
	Spitfire												
	30	29.0	nop	d	0.22	jkl	c	2.2	cdefg	a	4.2	ghijk	a
	70	72.2	ghij	c	0.28	cdefghi	b	2.6	abcde	a	3.6	jk	ab
	110	113.6	cde	b	0.30	abc	ab	2.6	abcde	a	3.7	jk	ab
	150	150.6	ab	a	0.33	a	a	2.5	abcdef	a	3.5	k	b
	Vixen												
	30	31.8	mnop	d	0.23	jkl	b	2.5	abcdef	a	5.3	cdef	a
	70	68.2	ghij	c	0.24	ghijk	b	2.4	abcdefg	a	5.7	cd	a
	110	109.3	def	b	0.30	abcde	a	2.6	abcd	a	4.8	defgh	a
	150	164.4	a	a	0.32	ab	a	2.5	abcdef	a	5.1	cdefg	a
	lsd	26.8			0.04			0.6			1.0		

[1] predicted value
[2] values with the same letter for each variable are not significantly different
[3] values with the same letter for each variable within each VARIETY only are not significantly different