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:	"Marram", Tullibigeal
Collaborators:	Emma Ayliffe and Terry Newham

Keywords

GOWE063, Wheat, plant populations, competition, varieties

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.

The proposed approach will focus on the impact on yield and grain quality of increasing crop competitiveness through seed rate and crop choice focusing on variety.

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 fallow		**Soil test**	Nitrogen (kg/ha)	Colwell P (ppm)	Sulfur (ppm)	
	2019 fallow		0-10cm	26	18	3	
	2018 fallow		10-90cm	188			
Trial timings	Time of sowing		Harvest				
		10/05/2021	1/12/2021				
Varieties and Target plant pop (plant/m^2): 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
	Mustang	Medium plant height		11	29	50	76
	Scepter	Medium plant height		13	34	59	91
	Spitfire	Medium plant height		14	35	61	93
	Vixen	Short/moderate plant height		14	35	61	93
	Flanker	Tall plant height		11	29	51	78
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 Coolah and Condo at 110 and 150 plants/m and Mustang, Spitfire and Vixen at 70 and 110 plants/m2 where were not different.

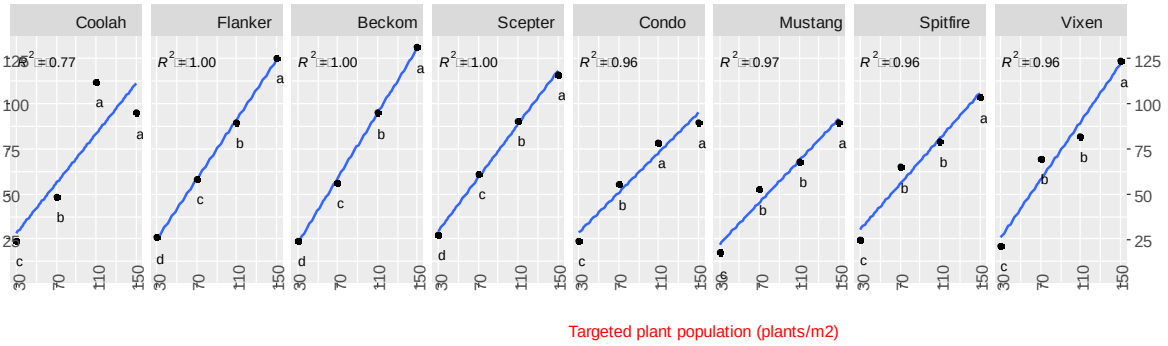

Figure 1. Plant establishment, actual against targeted 30, 70, 110 and 150 plants/m2. Treatments with the same letter within a variety are not significantly different.

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

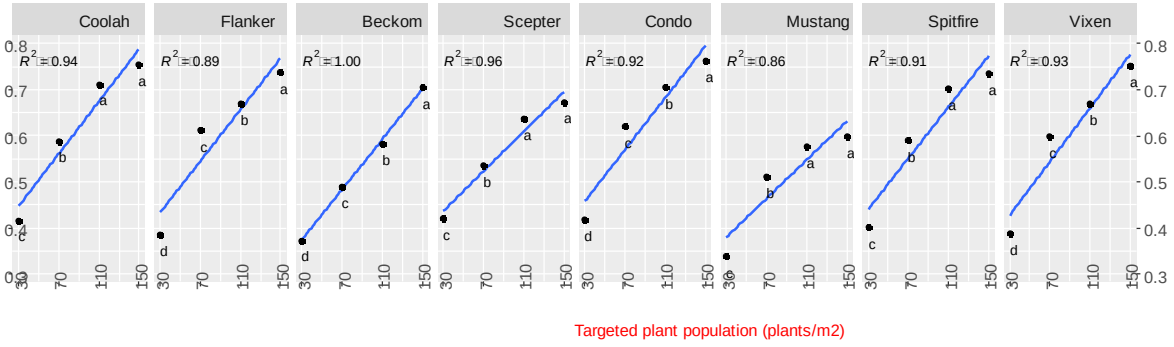

Figure 2. Vegetation index (NDVI) by variety and population (plants/m2). Treatments with the same letter within a variety are not significantly different. Assessed 65 days after sowing.

Yield: For 6 of the 8 varieties, increasing population across the range tested, increased yield, for the remaining 2 there was little or no effect (**Figure 3**). Vixen achieved the highest yield in the trial when sown at the highest seeding rate.

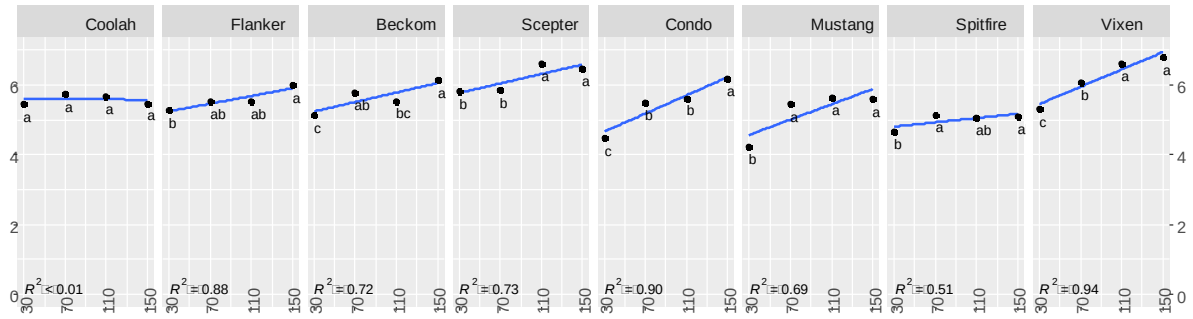

Figure 3. Yield (t/ha) by variety and population (plants/m2). Treatments with the same letter within a variety are not significantly different.

Screenings: were very low, and for 5 for the 8 varieties population had little effect. For the remaining three (Condo, Mustang and Spitfire), screenings decreased as plant populations increased (Figure 4).

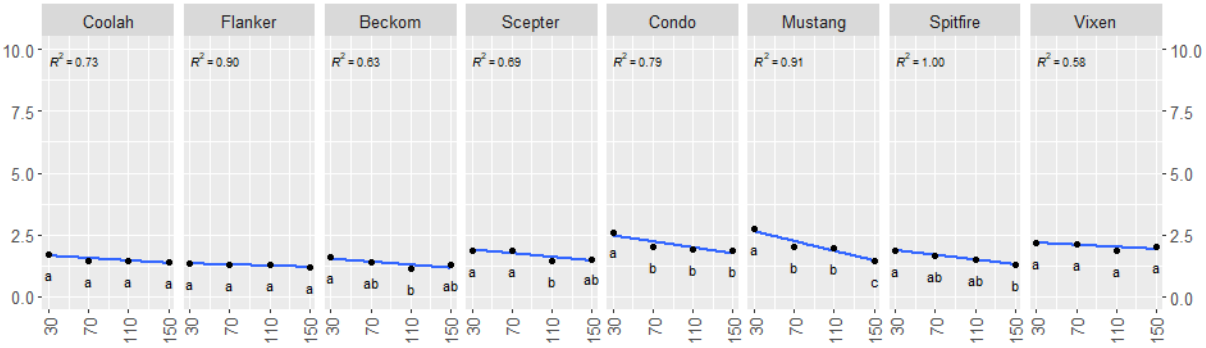

Figure 4. Screenings (%) by variety and population (plants/m2). Treatments with the same letter within a variety are not significantly different.

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 generally growers may consider increasing sowing rates of their existing varieties, increasing plant populations and increasing weed competition.

These was a considerable difference between varieties in early season vigour. 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, this 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

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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	24.2	k	d	0.37	ij	d	4.9	lmn	c	1.6	defghi	a
	70	56.3	ij	c	0.49	h	c	5.5	efghi	ab	1.4	ghijk	ab
	110	94.8	def	b	0.58	fg	b	5.3	ghijklm	bc	1.1	k	b
	150	131.1	a	a	0.70	bc	a	5.8	cde	a	1.3	ijk	ab
	Condo												
	30	23.8	k	c	0.42	i	d	4.3	p	c	2.6	a	a
	70	55.4	ij	b	0.62	ef	c	5.2	ghijklmn	b	2.0	bc	b
	110	78.2	fgh	a	0.70	bc	b	5.3	fghijk	b	1.9	bcd	b
	150	89.7	ef	a	0.76	a	a	5.9	bcde	a	1.9	bcde	b
	Coolah												
	30	24.2	k	c	0.42	i	c	5.2	hijklmn	a	1.7	cdefg	a
	70	48.1	j	b	0.59	ef	b	5.5	efghi	a	1.5	ghijk	a
	110	111.8	bcd	a	0.71	bc	a	5.4	efghij	a	1.5	ghijk	a
	150	94.8	def	a	0.75	ab	a	5.2	hijklmn	a	1.4	ghijk	a
	Flanker												
	30	25.7	k	d	0.39	ij	d	5.0	jklmn	b	1.3	hijk	a
	70	58.4	ij	c	0.61	ef	c	5.2	ghijklmn	ab	1.3	hijk	a
	110	89.5	ef	b	0.67	cd	b	5.3	ghijklmn	ab	1.3	ijk	a
	150	125.3	abc	a	0.74	ab	a	5.7	defg	a	1.2	jk	a
	Mustang												
	30	17.3	k	c	0.34	j	c	4.0	p	b	2.8	a	a
	70	52.7	ij	b	0.51	h	b	5.2	hijklmn	a	2.0	bc	b
	110	67.9	ghi	b	0.58	fg	a	5.4	fghij	a	2.0	bcd	b
	150	89.5	ef	a	0.60	ef	a	5.3	fghijkl	a	1.5	fghijk	c
	Scepter												
	30	27.5	k	d	0.42	i	c	5.5	efgh	b	1.9	bcde	a
	70	60.7	hij	c	0.53	gh	b	5.6	efgh	b	1.9	bcde	a
	110	90.5	ef	b	0.64	de	a	6.3	abc	a	1.4	fghijk	b
	150	116.1	abc	a	0.67	cd	a	6.1	abcd	a	1.5	efghij	ab
	Spitfire												
	30	24.7	k	c	0.40	i	c	4.4	op	b	1.9	bcdef	a
	70	64.7	ghij	b	0.59	ef	b	4.9	klmn	a	1.7	cdefgh	ab
	110	79.4	fgh	b	0.70	bc	a	4.8	no	ab	1.5	efghijk	ab
	150	103.5	cde	a	0.73	ab	a	4.8	mno	ab	1.3	hijk	b
	Vixen												
	30	21.0	k	c	0.39	ij	d	5.1	ijklmn	c	2.2	b	a
	70	69.4	ghi	b	0.60	ef	c	5.8	def	b	2.1	b	a
	110	81.8	fg	b	0.67	cd	b	6.3	ab	a	1.9	bcde	a
	150	123.4	ab	a	0.75	ab	a	6.5	a	a	2.0	bc	a
	lsd	19.5			0.05			0.5			0.4		

[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