
Altering the competitiveness of tame oat verses wild oat with phosphorous and seeding rate

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Introduction

Traditionally, tillage in combination with delayed seeding has been used to control wild oat in tame oat. Recent research in oat has shown the importance of early seeding to optimise yield and quality (May et al. 2004). However, early seeding requires that any flush of wild oat emerging as the tame oat emerge must be controlled using agronomic practices since no incrop herbicide is registered to control wild oat in tame oat. High seeding rates are important for controlling wild oat in tame oat (May 2001). Phosphorous (P) banded near the seed has promoted the early season growth in cereals (Grant 2001). The yield response of oat to P has always been tested in a weed free environment. Therefore, P fertilizer may increase early season growth making the oat crop more competitive resulting in higher yield and quality. Since higher seeding rates increase the competitiveness of oat, the effect of P needs to be measure across a range of seeding rates.

Objective

- to determine if P side banded near the seed would increase the competitive ability, quality and yield of tame oat in the presence of wild oat in the field

Material and Methods

- Three rates of P 0, 15, and 30 kg P₂O₅ ha⁻¹
- Four tame oat seeding rates , 150, 250, 350 and 450 viable seeds m⁻²
- Presence and absence of wild oats
- Conducted in 2003, 2004 and 2005 at the Indian Head, SK
- Land that had low levels of available P in the soil

Results and Discussion

- The weather data is presented in Table 1
- In 2003 very little moisture was received during the growing season
- In 2004 and 2005 moisture was above average and temperatures were below average during the growing season
- Wild oats reduced the grain yield of tame oat (Table 2)
- The effect of seeding rate on yield varied depending on the environment (Table 2)
 - 2003 was dry - no effect
 - 2004 with high rainfall and low temp - yield decreased as the seeding rate increased
 - 2005 with high rainfall and near normal temp - curvilinear response with 350 seeds m² having the highest grain yield
- Small increase in grain yield as the rate of P increased (Table 2)
- Increasing P did not reduce the losses in grain yield caused by wild oat

- Under dry growing conditions (2003), seeding rate did not change the wild oat panicle density, wild oat biomass, or percentage of wild oats in the harvested sample (Tables 3, 4 and 5)
- Under excellent growing conditions, increasing the seeding rate decreased wild oat panicle density, wild oat biomass, and the percentage of wild oats in the harvested sample (Tables 3, 4 and 5)
- Side-Banded P did not decrease wild oat panicle density, wild oat biomass, and the percentage of wild oats in the harvested sample (Tables 3, 4 and 5)
- Increasing the seeding rate or fertilizer P rate increased oat biomass (data not shown)
- Test weight was not affected by seeding rate, P or the presence of wild oats
- There was a small decrease in thin seed and a small increase in plump seed as the seeding rate was increased while adding P fertilizer had no effect on plump or thin seed

Conclusions

- These results indicate that seeding rate is more important than the addition of P when using agronomic practices to control wild oats in a crop of tame oat
- The effect of seeding rate on wild oat is strongly influenced by the environmental conditions during the growing season
- P can increase biomass and grain yield of oat when the level of soil available P is low

References

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Table 1. Precipitation (mm) and soil moisture conditions in spring and monthly mean temperatures at Indian Head during the study

	2003	2004	2005
Soil Moisture Reserves (Spring)	Very Good	Fair	Good
Precipitation	□□□□□□□□ mm □□□□□□□□		
April	55	17	6.8
May	24	105	58
June	18	85	99
July	23	75	59
August	11	71	98
Five month total	131	354	321
% of 30 year Avg.	50	134	122
Average Temperature	□□□□□□□□□□ °C □□□□□□□□□□		
April	4.3	3.7	5.5
May	11.4	6.8	8.7
June	15.5	12.6	14.8
July	18.6	16.3	16.9
August	19.5	13.1	15.6
Four month average [†]	16.3	12.2	14
% of 30 year Avg.	103	77	89

Table 2. The effect of wild oat competition, tame oat seeding rate and the addition of phosphorous fertilizer on the grain yield of oats at Indian Head, SK from 2003 to 2005

	2003	Year	
		2004	2005
	(kg ha ⁻¹)		
<i>Wild oat Competition</i>			
Wild oat	2044	4569	5246
No wild oat	2640	4808	5911
Contrast			
Linear	**	**	**
<i>Seeding rate (seeds m⁻²)</i>			
150	2266	4816	5367
250	2357	4854	5638
350	2367	4605	5780
450	2379	4479	5528
Contrast			
Linear	NS	**	0.057
Quadratic	NS	NS	**
<i>Phosphorous fertilizer rate (kg ha⁻¹ of P₂O₅)</i>			
0	4119		
15	4247		
30	4244		
Contrasts			
Linear	0.02		
Quadratic	NS		

Table 3. The effect of wild oat competition, tame oat seeding rate and the addition of phosphorous fertilizer on the wild oat panicles in oats at Indian Head, SK from 2003 to 2005

	2003	Wild Oat Competition				
		Wild oat		No wild oat		
		2004	2005	2003	2004	2005
Wild oat density	58.9	48.8	24.7	0.6	8	0.3
		———— (plants m ⁻²) ————				
		———— (panicles m ⁻²) ————				
<i>Seeding rate</i> (seeds m ⁻²)						
150	58.5	71.7	99.1	0.2	0.0	0.3
250	55.1	58.6	66.8	0.1	0.1	0.1
350	63.7	44.9	72.9	1.0	0.1	0.1
450	58.5	37.6	58.9	1.0	0.3	0.2
Contrasts						
Linear	NS	**	**	NS	NS	NS
Quadratic	NS	NS	*	NS	NS	NS
<i>Phosphorous fertilizer rate</i> (kg ha ⁻¹ of P ₂ O ₅)						
0	32.7					
15	30.8					
30	30.2					
Contrasts						
Linear	NS					
Quadratic	NS					

Table 4. The effect of wild oat competition, tame oat seeding rate and the addition of phosphorous fertilizer on the wild oat biomass in oats at Indian Head, SK from 2003 to 2005

	Wild Oat Competition					
	2003	Wild oat		No wild oat		
		2004	2005	2003	2004	2005
	————— (kg ha ⁻¹) —————					
<i>Seeding rate</i> (seeds m ⁻²)						
150	971.3	1504.7	1385.4	7.5	0.0	8.9
250	860.0	1070.8	888.8	0.8	0.0	3.0
350	886.0	711.4	916.4	13.4	0.0	1.5
450	821.2	600.3	683.0	14.5	0.7	4.5
Contrasts						
Linear	NS	**	**	NS	NS	NS
Quadratic	NS	*	NS	NS	NS	NS
<i>Phosphorous fertilizer rate</i> (kg ha ⁻¹ of P ₂ O ₅)						
0	509.6					
15	457.9					
30	451.9					
Contrasts						
Linear	NS					
Quadratic	NS					

Table 5. The effect of wild oat competition, tame oat seeding rate and the addition of phosphorous fertilizer on the wild oats in the harvested tame oats at Indian Head, SK from 2003 to 2005

	Wild Oat Competition					
	2003	Wild oat		No wild oat		
	2003	2004	2005	2003	2004	2005
	(%)					
<i>Seeding rate</i> (seeds m ⁻²)						
150	1.4	3.3	1.4	0.2	0.1	0.1
250	1.3	1.7	0.9	0.2	0.1	0.0
350	1.4	1.5	0.6	0.4	0.2	0.0
450	1.0	0.8	0.6	0.2	0.1	0.0
Contrasts						
Linear	NS	**	**	NS	NS	NS
Quadratic	NS	*	NS	NS	NS	NS
<i>Phosphorous fertilizer rate</i> (kg ha ⁻¹ of P ₂ O ₅)						
0	0.8					
15	0.8					
30	0.7					
Contrasts						
Linear	NS					
Quadratic	NS					