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DO WHEAT CULTIVAR MIXTURES MAINTAIN YIELD AND SUPPRESS WEEDS UNDER ORGANIC MANAGEMENT?

Interim Research Report W2006-16

INTRODUCTION

Organic grain producers on the Canadian Prairies utilize a variety of tools to maintain wheat yield and suppress weeds. One relatively unexplored method of stabilizing yield is the use of wheat cultivar mixtures. Mixtures are gaining popularity across Europe and the United States in conventional production as a means of disease control. There has been extensive research conducted in India, Pakistan and Europe to develop blends of high-yielding, elite cultivars and highly disease resistant, lower-yielding cultivars. Mixtures have great potential in organic production for not only managing disease and insect outbreaks, but also increasing seedlot protein levels and controlling weeds. They can be composed by producers themselves of cultivars that are high-yielding, competitive or of high quality in whatever ratios work best on a given farm. As the organic grain sector continues to grow, wheat cultivar mixtures show great promise as an important tool for producers across Western Canada.

a) b)

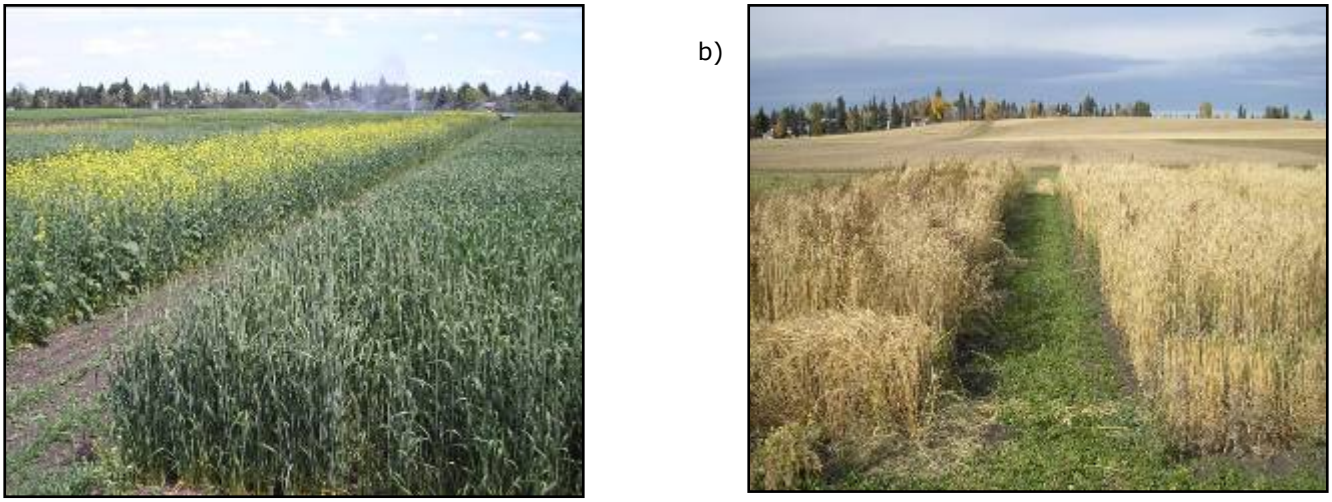

Figure 1. Wheat cultivar mixtures in Edmonton, AB with cross-seeded oriental mustard (left) and no competition (right) on conventional (a) and organic (b) land.

WHEAT CULTIVAR MIXTURE TRIALS

One tall (5600HR), one average height (AC Intrepid) and one semi-dwarf (AC Superb) hard red spring wheat cultivar were combined in two- and three-way mixtures of varying ratios. These mixtures were seeded on one conventional and two organic sites in north-central Alberta from 2003 to 2005. On each site, half of the plots were cross-seeded with oriental mustard to impose simulated weed competition in addition to natural weed levels. Drought in 2003, severe lodging in 2004 and delayed maturity in 2005 affected all mixtures on the Edmonton Research Station (the Conventional and Organic 1 treatments).

Yield results are summarized in Table 1. Total weed levels varied widely between locations: 36 g m^{-2} on Conventional, 201 g m^{-2} on Organic 1 and 257 g m^{-2} on Organic 2. Yield decreased as weed pressure increased. Yield ranged from almost 5 t ha^{-1} on conventional land to under 1 t ha^{-1} on the certified organic farm. Semi-dwarf Superb out-yielded the tall cultivar 5600HR on every location. Superb-Intrepid

Table 1. Grain yield of cultivar mixtures grown under conventional and organic management from 2003 to 2005 in north-central Alberta

Mixture and Ratio	Yield t ha^{-1}		
	Conventional[1]	Organic 1	Organic 2
Superb	**4.92**	**3.61**	**1.43**
Intrepid	4.45	3.53	1.00
5600HR	4.09	3.11	0.80
5600HR-Int 1:1	4.28	3.27	0.91
5600HR-Int 1:2	4.46	3.33	0.92
5600HR-Int 2:1	4.00	3.17	0.88
5600HR-Sup 1:1	4.59	3.44	1.09
5600HR-Sup 1:2	4.42	3.68	1.28
5600HR-Sup 2:1	4.38	3.35	0.97
Sup-Int 1:1	**4.61**	**3.82**	**1.31**
Sup-Int 1:2	**4.69**	**3.53**	**1.23**
Sup-Int 2:1	**4.59**	**3.78**	**1.18**
5600HR-Sup-Int 1:1:1	4.25	3.22	0.99
5600HR-Sup-Int 1:1:2	4.38	3.23	1.12
5600HR-Sup-Int 1:2:1	4.52	3.30	1.12
5600HR-Sup-Int 2:1:1	4.38	3.32	1.11
LSD[2] (α=0.05)	**0.50**	**0.42**	**0.29**

[1] The Conventional and Organic 1 sites were located on the Edmonton Research Station and the Organic 2 location on a certified organic farm near New Norway, AB.
[2] If two mixtures are greater than the LSD value apart, they are significantly different at α=0.05.

blends consistently yielded the closest to their highest-yielding component (Superb). No mixture or monocrop on any location significantly suppressed weeds. Physical differences among blends may account for how the Superb-Intrepid mixtures maintained yield without suppressing weeds. Early season vigor, spikes m^{-2} and leaf area index were above average and powdery mildew levels were below average in some Superb-Intrepid mixtures, but no trends can be seen at this time to explain their superior performance.

Conclusions

Height was not a determining factor for yield on organic land, as the semi-dwarf cultivar in monoculture consistently out-yielded the tall cultivar, regardless of management. Of the cultivar mixtures tested, Superb-Intrepid blends exhibited the highest and most stable yield compared to their highest-yielding component. Although the most successful mixtures did not suppress weeds, they tended to have above average leaf area index, early season vigor and spikes m^{-2}, and lower powdery mildew levels. Further research may center on exploring the mixing ability of other popular cultivars and developing mixtures that both yield well and suppress weeds for use under organic management.

Credits

Amy Kaut (Graduate student), Alireza Navabi, Dean Spaner (all University of Alberta), John O'Donovan (AAFC) and Roxanne Beavers (OACC, ed.)

The Bottom Line...

Superb-Intrepid blends had the highest yield of all the cultivar mixtures tested. Successful mixtures had high leaf area index, early season vigor and spikes m^{-2}, and lower powdery mildew levels, but did not appear to suppress weed competition.

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For more information:
Visit **oacc.info** or contact us at:
University of Saskatchewan
51 Campus Dr., Saskatoon SK S7N 5A8
Tel: (306) 966-4975 Fax: (306) 966-5015
Email: organic@usask.ca

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