Agriculture and Agri-Food Canada Agriculture et Agroalimentaire Canada

Influence of seeding rate and cultivar on winter wheat establishment, yield, and weed competitiveness in southern and central Alberta, Canada

Brian Beres[1], George Clayton[1], K. Neil Harker[2], Robert Blackshaw[1] and Robert Graf[1]

[1]Agriculture and Agri-Food Canada, Research Centre, 5403-1st Avenue South, Lethbridge, AB T1J 4B1, Canada; [2]Agriculture and Agri-Food Canada, Research Centre, 6000 C& E Trail, Lacombe, AB T4L 1W1, Canada (contact: beresb@agr.gc.ca)

Introduction

Advances in cultivar development and the demand for winter wheat as an ethanol feedstock have renewed interest in winter wheat (*Triticum aestivum* L.) across the Canadian prairie leading to an increase in acreage (498 000 ha) not observed since 1986. This research was initiated to develop integrated crop management strategies for winter wheat in order to sustain this upward trend in acreage.

Objective

To determine the effect of cultivar and seeding rate on stand establishment, weed management, and crop yield.

Materials and Methods

Winter wheat cultivar

AC® Radiant: good quality, med. height, strong straw, wheat curl mite resistant, very good winter hardiness. Eligible for CWB select variety program.

CDC Falcon: short stature, very strong straw, early maturity, fair winter hardiness. General purpose/feed wheat – not eligible for CWB select variety program.

CDC Osprey: very good quality, med. height, med. straw strength, good winter hardiness. Eligible for CWB select variety program.

CDC Ptarmigan: General purpose soft white winter wheat, med. height, high yield, fair to poor winter hardiness.

Seeding rate – 300, 450, and 600 seeds m^{-2}.

Weed management – 1) fall applied 2,4-D, or 2) fall applied 2,4-D plus a spring in-crop tank mix of Refine Extra®/Horizon®.

Experimental design and analysis – Factorial RCBD analyzed using Proc Mixed of SAS®, with block*year as a random effect and year, cultivar, seeding rate, and herbicide management factors as fixed effects.

Locations – Lethbridge (Partial Irrigation) and Lacombe, Alberta, Canada.

Results

Stand establishment and weed competitiveness

Optimal spring stand establishment for winter wheat is 200-275 plants m^{-2}. This range was consistently met or exceeded with seeding rates of 450 and 600 seeds m^{-2} (Fig. 1), however, spring emergence for the 300 seeds m^{-2} rate was below 200 plants m^{-2} in three of the six location years.

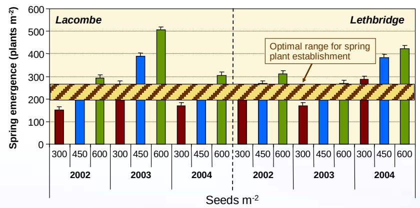

Fig. 1. Effect of seeding rate on winter wheat spring emergence - Lethbridge and Lacombe, Alberta.

Weed biomass was significantly reduced when spring herbicide was applied. Reductions in weed biomass were also achieved with increased seeding rates (Fig. 2).

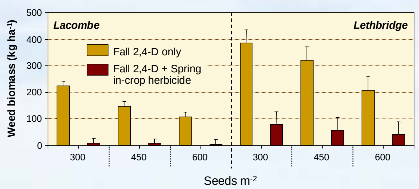

Fig. 2. Influence of seeding rate and herbicide on weed biomass in winter wheat - Lacombe and Lethbridge, Alberta, 2002-04.

Yield characteristics

At both locations, yield of CDC Ptarmigan was usually higher than the other cultivars (Fig. 3). This was not a surprise as CDC Ptarmigan (under contract for ethanol market) is a soft white wheat, a class that is generally higher yielding than red wheat classes. CDC Osprey was generally lower yielding than the other cultivars. There was no yield difference between rates of 300 and 450 seeds m^{-2}, but yield was significantly reduced at the 600 seeds m^{-2} rate in Lacombe (Fig. 4).

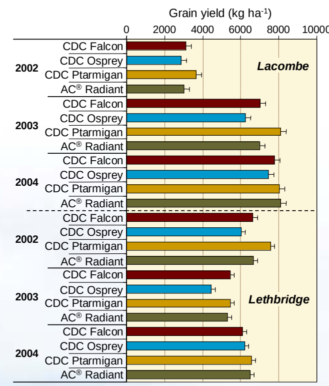

Fig. 3. Effect of winter wheat cultivar on grain yield - Lacombe and Lethbridge, Alberta.

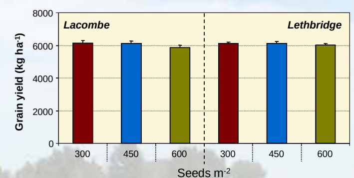

Fig. 4. Influence of seeding rate on winter wheat grain yield - Lethbridge and Lacombe, Alberta, 2002-04.

Although weed biomass was significantly reduced when the spring in-crop herbicide application was performed, this practice did not increase grain yield (Fig. 5). One explanation may be that winter annuals represent the greatest weed threat to winter wheat yield, and therefore, the fall 2,4-D application is the herbicide tool that has the greater impact on grain yield.

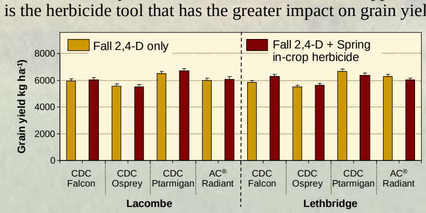

Fig. 5. Effect of variety*herbicide on grain yield of winter wheat - Lacombe and Lethbridge, Alberta.

Conclusion

Our study demonstrates that winter wheat can be just as productive without spring herbicide applications, particularly at higher seeding rates. Optimal stand establishment and early canopy closure, major factors for crop competitiveness, were achieved with higher seeding rates (Fig. 6).

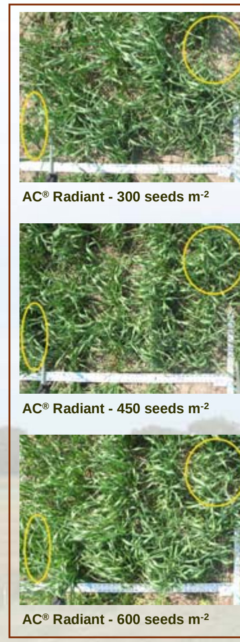

Fig. 6. AC® Radiant planted at seeding rates of 300, 450, and 600 seeds m^{-2}. Lower seeding rates i.e., 300 seeds m^{-2} → sunlight penetration through canopy = opportunity for weeds. Higher seeding rates i.e., 600 seeds m^{-2} → canopy closure = weed suppression.

Acknowledgements

The laborious nature of this work could not have been completed without the technical support of: L. Michielsen, T. Alexander, R. Dyck, K. Coles, H. McGlynn, S. Leusink, T. Foot, K. McKenzie, A. Larson, J. Butterwick, R. Meyer, and J. Michaelis.

Canada