

The effects of varietal resistance and fungicide on control of stripe rust of winter wheat

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Outline

- Background
- Hypothesis and objective
- Materials and methods
- Results
- Summary

Winter wheat, *Triticum aestivum*

- Fall sown hexaploidy bread wheat
- 5-7% of wheat in western Canada
- Benefits over spring wheat
 - Higher yield
 - Diversify crop rotation
 - High weed competitive ability
 - Efficient water utilization
 - Provides nesting sites for waterfowl

Winter survival rate of seedlings

High winter survival rate is critical for:

- Weed competitive ability
- Yield

Improvement of survival rate by:

- Breeding
- Agronomy
 - no-till direct sowing
 - optimal seeding rate/timing/depth
 - optimal fertilizer application.
- Disease management

Stripe rust - *Puccinia striiformis* f. sp. *tritici* (*Pst*)

- Globally common and devastating disease
- Threat rewarded slightly in western Canada
- Severe epidemic in 2010-2011



<http://agriculturewire.com/wp-content/uploads/2015/04/striperust.jpg>

Leaf spot diseases

- Multiple pathogens:
 - Septoria complex, spot blotch, tan spot



<http://cropwatch.unl.edu/2016/after-rains-some-wheat-diseases-increasing>

- Common effects from both diseases
 - Compromise photosynthesis on flag leaf and grain filling
 - Similar infection target and timing
 - Controlled by similar fungicide (Mainly Groups 3 and 11)

Stripe rust of winter wheat

- Not a major focus of breeders in the past
- Seedling infection in the fall
- Pathogen sometimes overwinter on seedlings
 - Potential reduction of over all seedling health
 - Potentially higher winter mortality
- Green bridge to nearby spring wheat in spring
- Turkington et al. (2016) – fall-applied fungicide improved yield

Hypothesis

- Fall fungicide application will mitigate the effect of foliar diseases and benefit the production of winter wheat in western Canada.

Objective

- To determine:
 - the effectiveness of cultivar resistance,
 - timing of fungicide application,
 - their interactionto control stripe rust and leaf spot diseases of winter wheat.

Materials and methods

- Field experiments 2015 - 2017
 - 4 sites:
 - Saskatoon, SK – inoculation in fall and spring
 - Indian Head, SK – natural inoculum
 - Lacombe, AB – natural inoculum
 - Lethbridge, AB – natural inoculum
 - Fungicides:
 - metconazole (Group 3),
 - pyraclostrobin (Group 11)
 - 16 treatments arranged as two-way factorial RCBD: 4 spray timings for 4 cultivars

Cultivars

Treatment number	Cultivar	Fungicide Timing
1	CDC Osprey	Unsprayed
2	CDC Osprey	Fall
3	CDC Osprey	Spring
4	CDC Osprey	Both
5	AC Bellatrix	Unsprayed
6	AC Bellatrix	Fall
7	AC Bellatrix	Spring
8	AC Bellatrix	Both
9	Moats	Unsprayed
10	Moats	Fall
11	Moats	Spring
12	Moats	Both
13	Radiant	Unsprayed
14	Radiant	Fall
15	Radiant	Spring
16	Radiant	Both

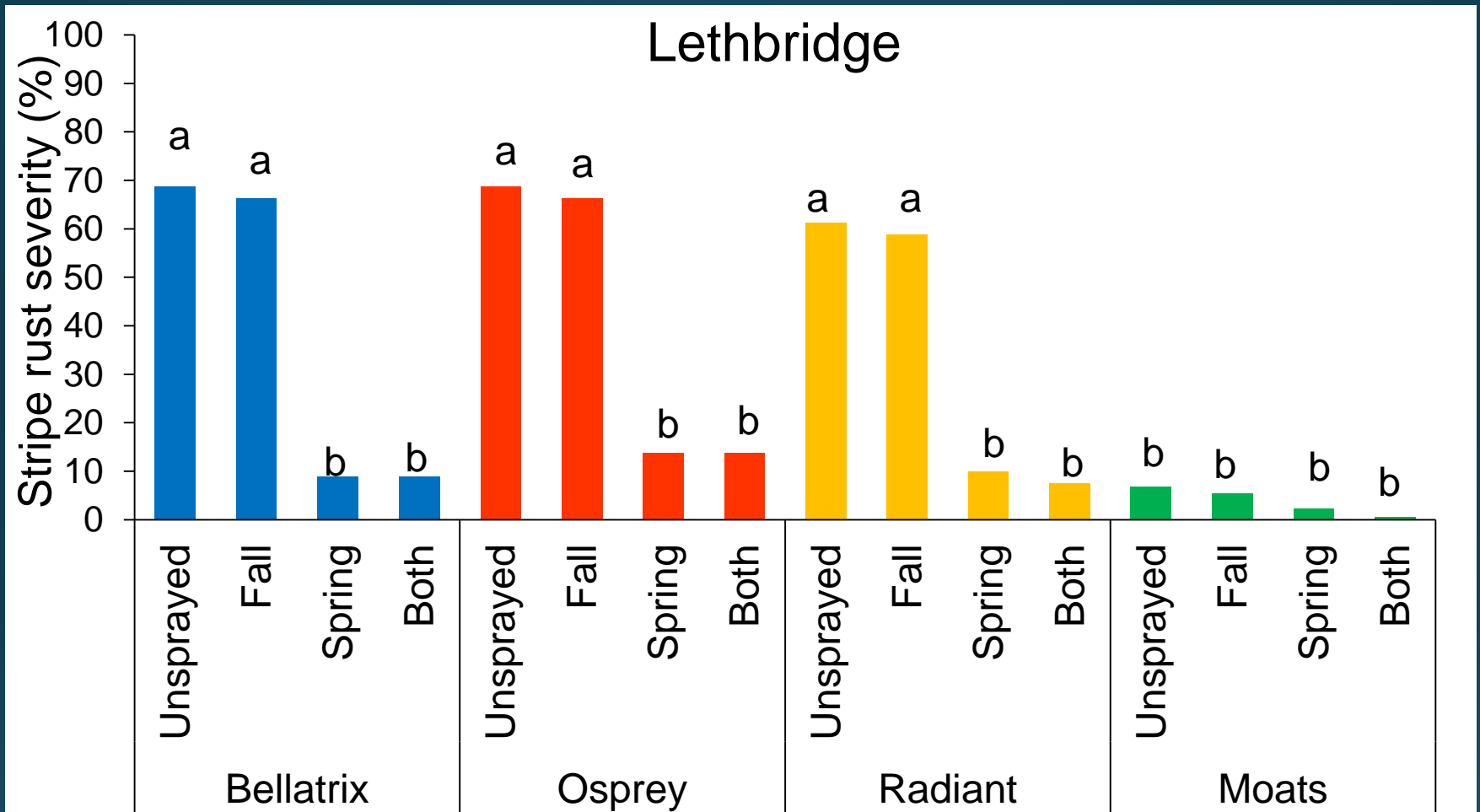
Data collection

- Emergence counts in fall and spring
- Disease rating at soft-dough stage
 - Stripe rust severity – modified Cobb scale
 - Leaf spot severity – Horsfall and Barratt scale, McFadden scale
 - Plated leaves to identify leaf spot disease pathogens
- Harvest data
 - Yield (kg/ha)
 - Thousand kernel weight (TKW) (g),
 - Test weight (TW) (kg/hL)
 - Protein content (%)

Fall infection

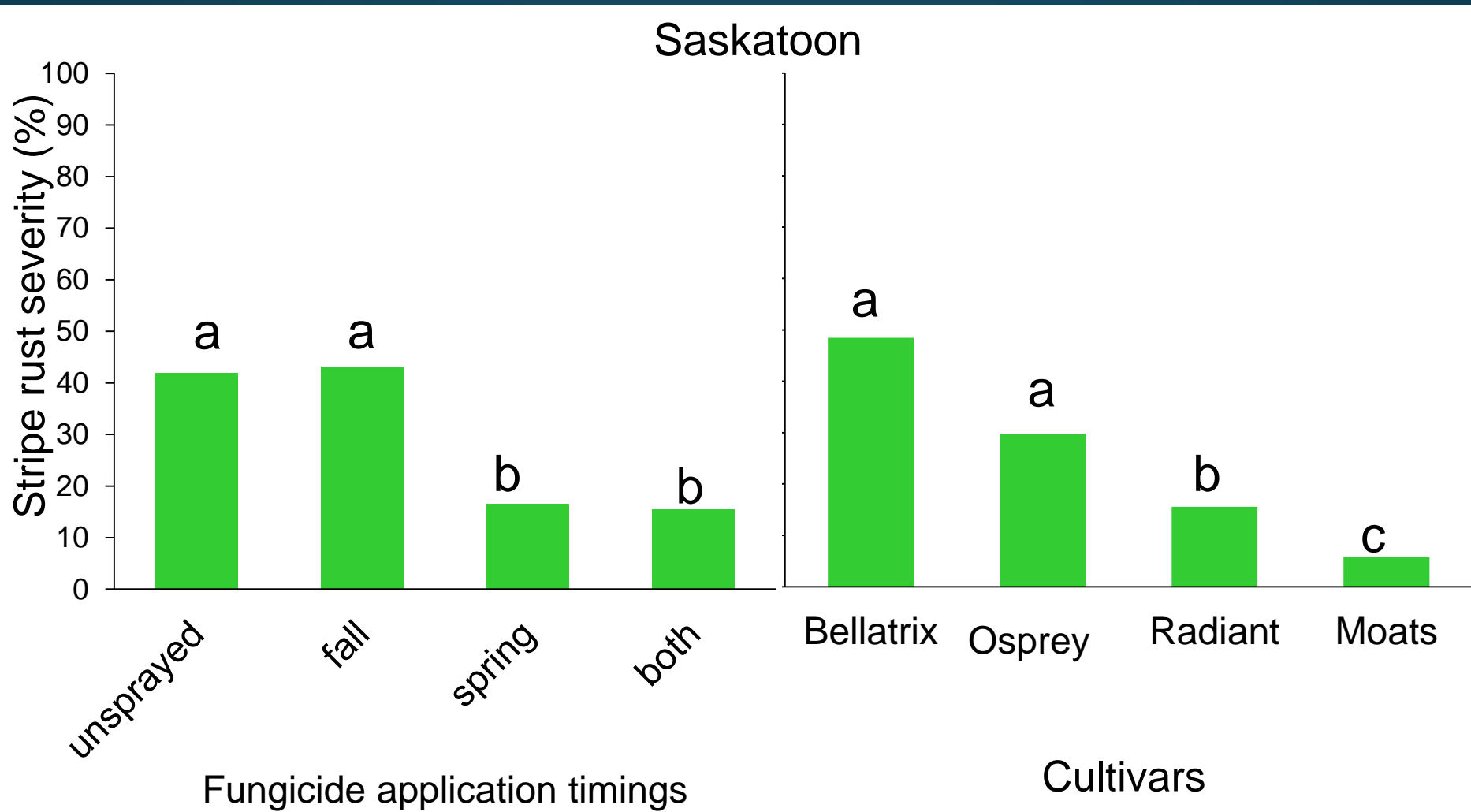
- Trace amount of stripe rust infection in fall at Saskatoon in 2015 and 2016
- Higher fall infection severity at Lethbridge and Lacombe than at Saskatoon in 2016
- No effect of fungicide application timings on winter survival rate at Saskatoon in 2016/2017

Stripe rust severity - 2016

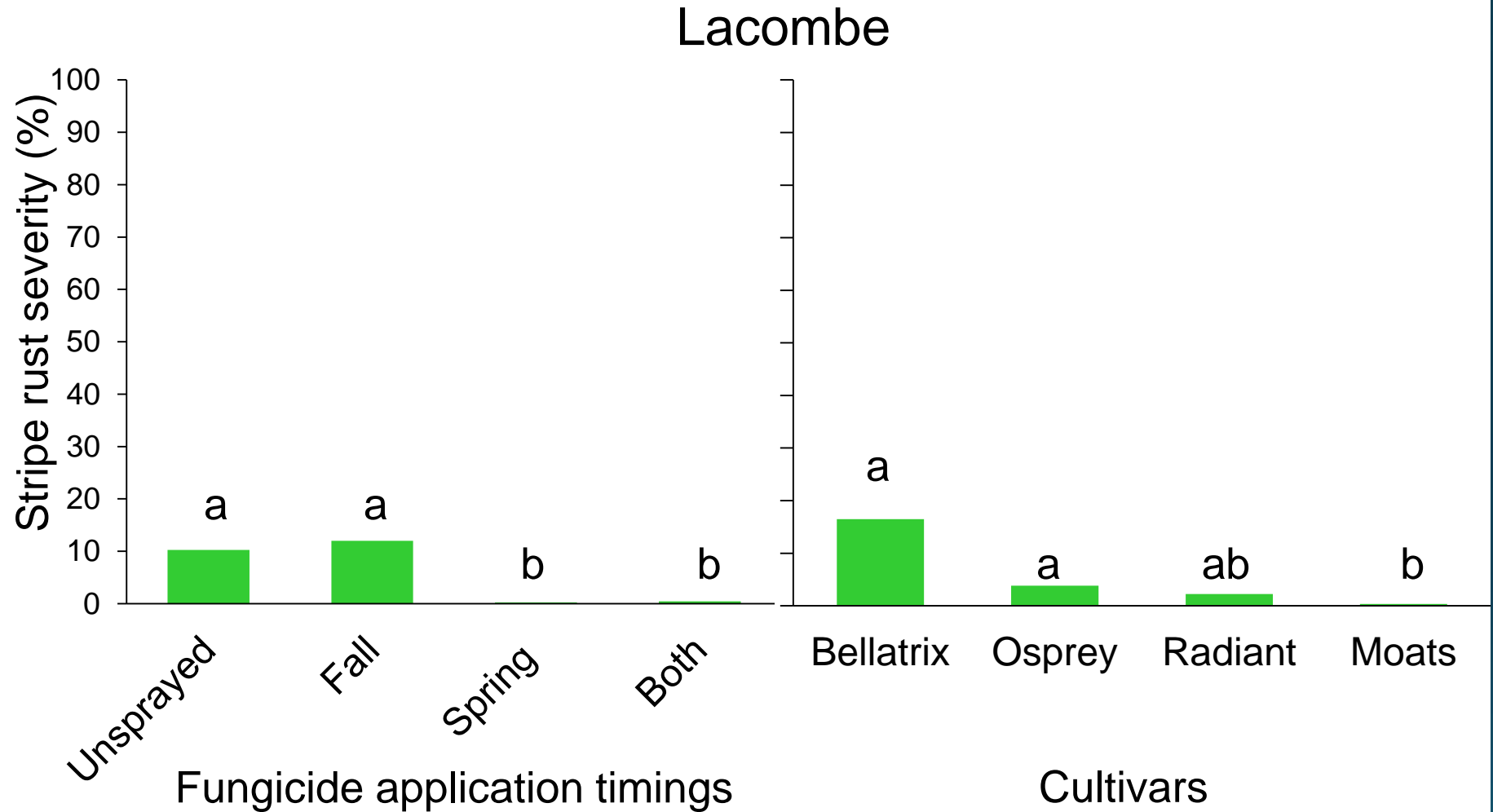


- Saskatoon – similar to Lethbridge, lower over-all severity
- Indian Head – disease severity was extremely low (< 5%)

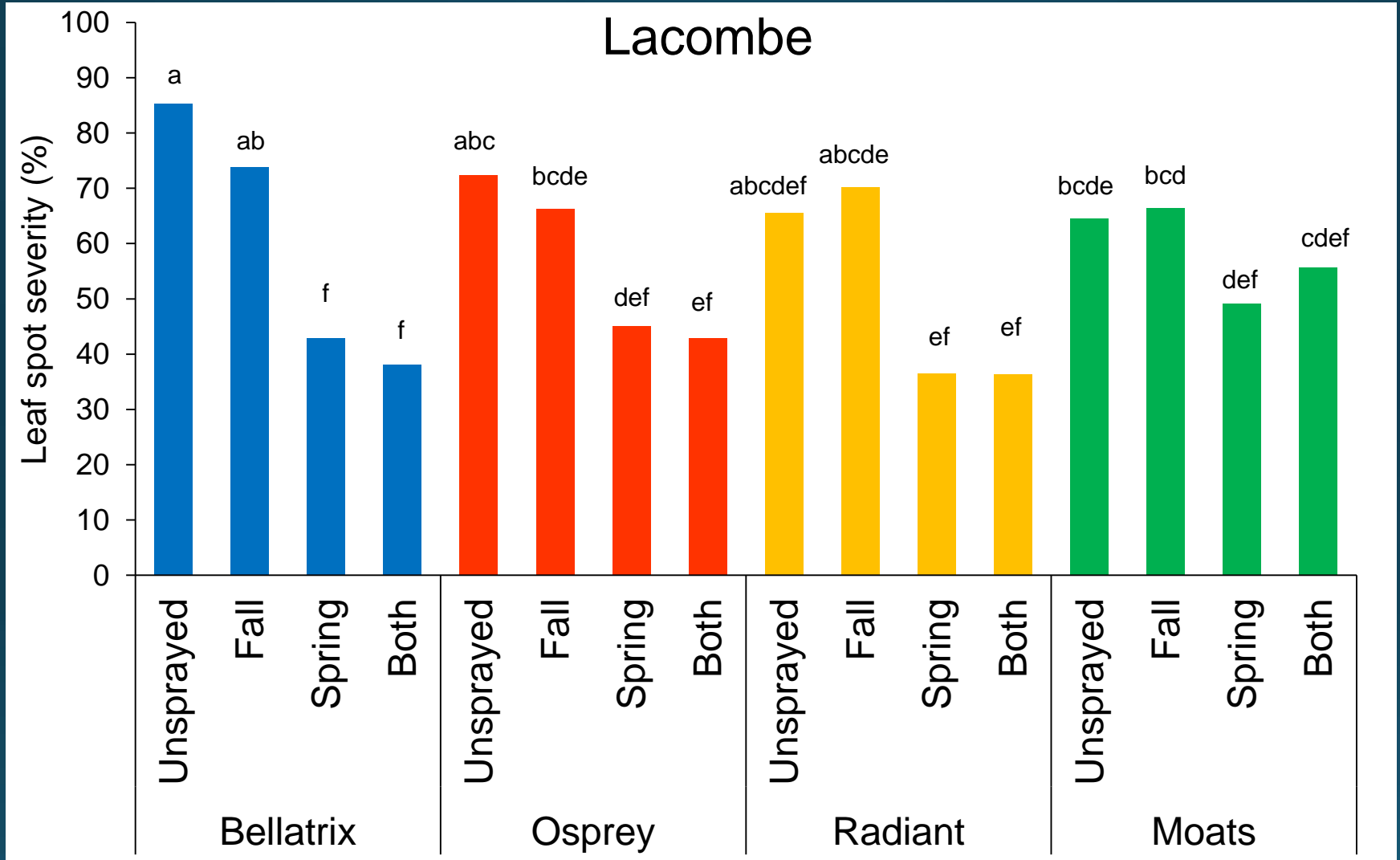
Stripe rust severity - 2017



Stripe rust severity - 2017

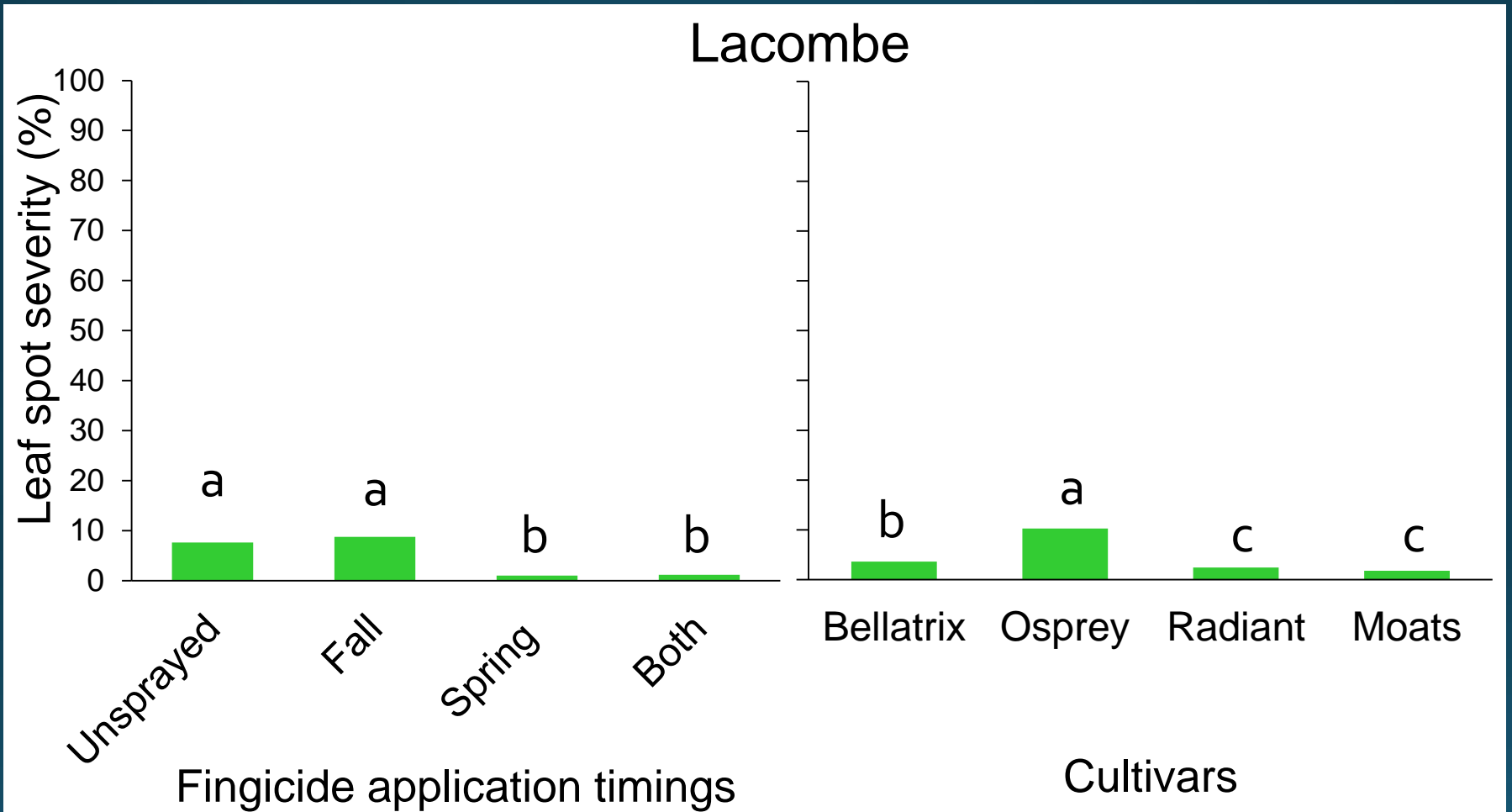


Leaf spot severity - 2016

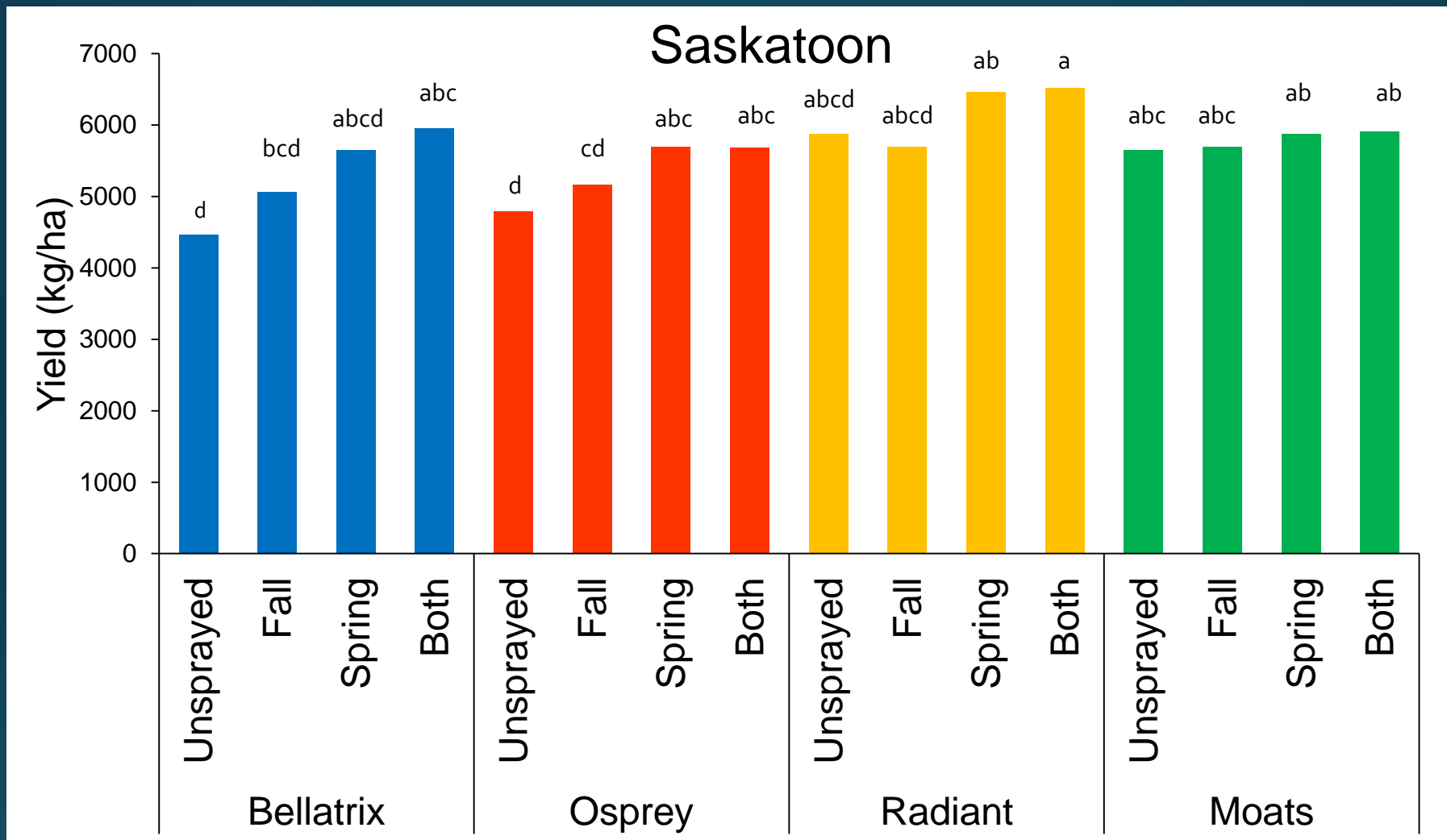


- Saskatoon and Indian Head, SK – low disease pressure
- Lethbridge – no leaf spot incidence reported

Leaf spot severity - 2017

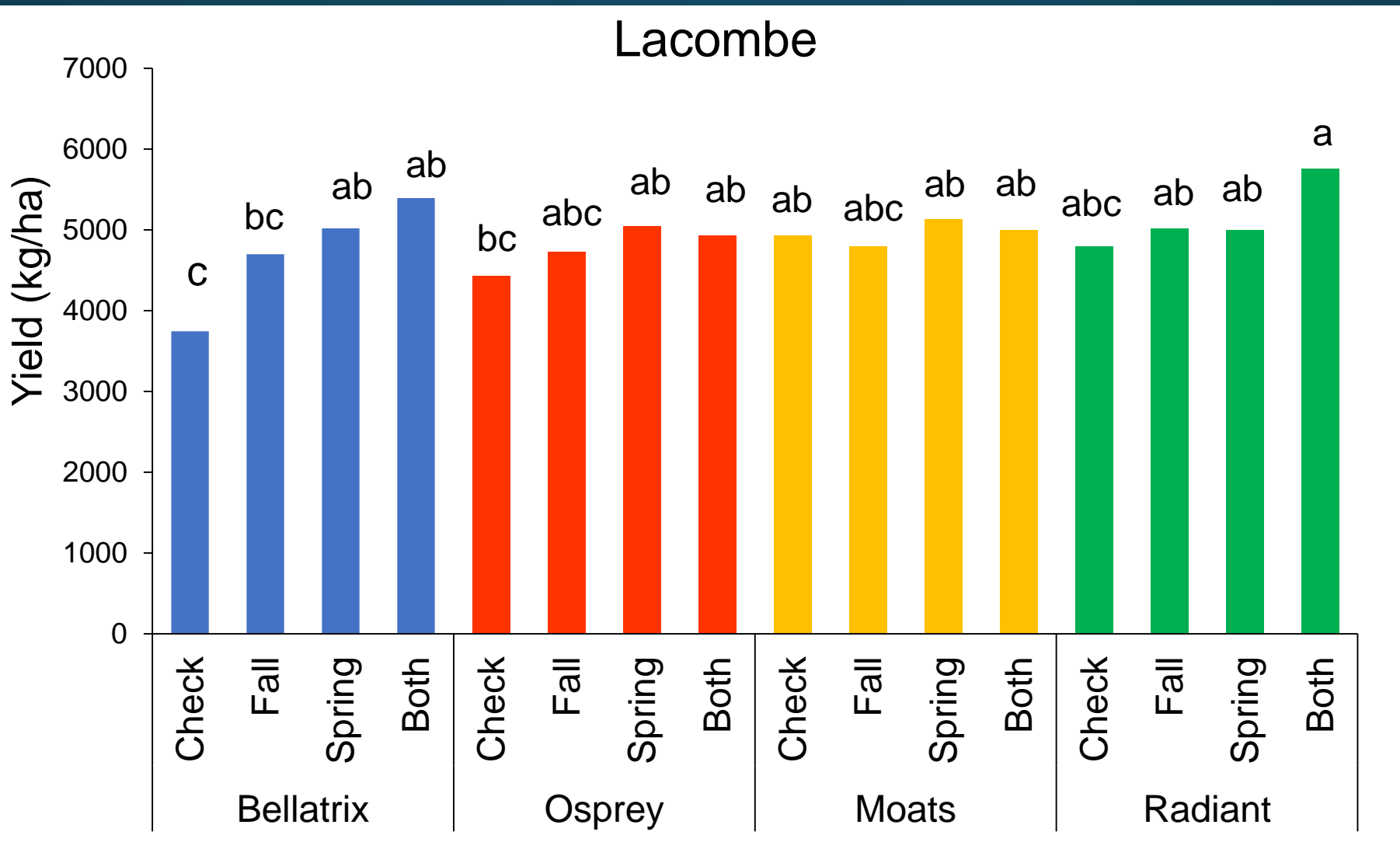


Yield – 2016

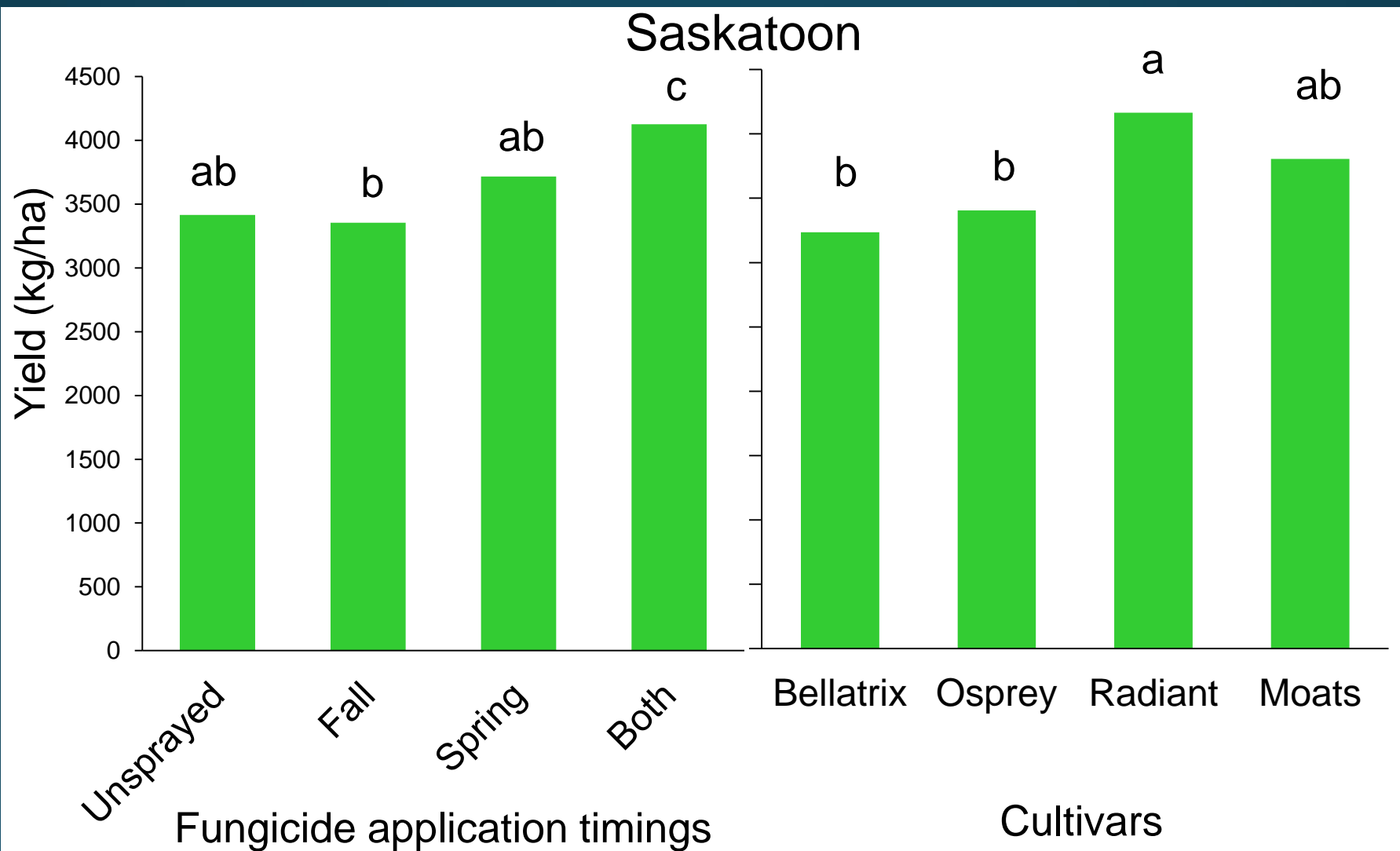


- No yield difference by spray timings in Lethbridge and Indian Head.

Yield - 2016



Yield - 2017



TW, TKW, and protein content

- TW and TKW varied by fungicide applications, cultivars and locations in 2016
- Both TKW and TW were improved by spring fungicide application at Saskatoon and Lacombe in 2017
- Protein content was affected more often by cultivars all years

Summary

- Spring or both spring and fall fungicide application
 - reduced stripe rust and leaf spot severity
 - improved yield of stripe rust susceptible cultivars.
- Variable reaction with cultivar 'Radiant' with *Yr10*
 - Break down of *Yr10* gene by Pst but different degree at different locations

Summary

- No benefit of fungicide application to the stripe rust resistant cultivar (Moats) at any timing
- Inconsistent improvement of grain quality of the disease susceptible cultivar by fungicide
- Fall fungicide application did not show an effect on disease control, yield or grain quality

Thank you

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