Wheat stripe rust disease dynamics in southern Alberta, Saskatchewan and Manitoba, 2009-2014

The Topic

Wheat stripe rust, caused by *Puccinia striiformis* f. sp. *tritici*, is a major pest on the Canadian prairies. Stripe rust was initially limited to the irrigated areas of southern Alberta, but has been frequently observed in Saskatchewan, Manitoba and most of Alberta since 2000 [8]. Surveillance of pathogens, including assessment of incidence, severity and geographical occurrence is important in driving national and international policies, plant breeding and pathology research for successful management of crop diseases. This is achieved by surveying commercial crops or trap plots at multiple locations.

The Questions

- ✓ What is the status of stripe rust disease in western Canada? How did it change over the past 6 years?
- ✓ To what extent does it affects the wheat crops in southern AB, SK and MB?
- ✓ Which varieties are still effective in conferring resistance to the pathogen?

The Experiment

Trap nurseries and commercial wheat crops were surveyed each growing season (Fig. 1) from 2009-2014. In AB and SK, fields were assessed at 10 spots separated by at least 25 m in a "V" pattern [4,5] and the flag leaves evaluated using the scale: clean (no visible symptoms), trace (<3% leaf area affected), light (3-5%), moderate (5-20%), and severe (>20%). In MB, trap nurseries and commercial fields were assessed for stripe rust severity and incidence [1].

The Answer

- ✓ Stripe rust was not a major problem in western Canada until 2000. The incidence and severity of stripe rust on wheat was low in SK and MB until 2011 [6]. The 2011 epidemic affected all three prairie provinces, but previous to 2000, the disease mainly affected irrigated crops in southern Alberta. The change in the pathogen population and the emergence of new races virulent on resistant varieties resulted in increased disease pressure [2]. Over the past six years, virulent races have evolved to defeat seedling resistant gene *Yr10* (in AC Radiant) in 2010 [7] (Fig. 3). The races virulent on *Yr10* were detected in SK in 2013.
- ✓ The southern Alberta region (Lethbridge, Fort McLeod, and Taber counties) is the region for severe stripe rust occurrence [2,4,5]. The disease was observed in wheat crops in one of those regions almost every year. In some years such as 2012, localized overwintering of the pathogen was observed. In SK, stripe rust was observed near Swift Current almost every year [3, 8].
- ✓ Stripe rust incidence is usually lower in SK and much lower in MB as compared to southern AB. However, in 2011 stripe rust was as severe in SK as in southern AB.
- ✓ In the 2011 epidemic, due to high disease pressure, the expression of adult plant resistance (APR) gene *Yr18* was not successful (Fig. 3).
- ✓ Lillian is one of the most effective varieties against stripe rust with three APR genes.
- ✓ Stripe rust first appears in southern AB (noticed in early June in the years of overwintering and late June to early July otherwise). Then it appears in SK and MB almost at the same time in mid-July.
- ✓ The popular varieties such as AC Barrie, AC Radiant, and AC Bellatrix are not effective against stripe rust in southern AB and SK. Although, in SK, AC Radiant is still effective (Brar, 2015) against most of the races, but it could become ineffective in future.

Take-Home Message

Stripe rust is a major disease of wheat in western Canada. The pathogen population has evolved, which is evident from the virulent race that has defeated gene *Yr10*. The overwintering potential, high disease pressure in favourable weather conditions in some years, and the evolution of virulent races could be a major threat to wheat producers and can make the expression of APR genes ineffective.

Fig. 1. Survey of CDC Falcon winter wheat infected by stripe rust in SK, July 2013. The pictures are of urediospores (left) and teliospores (right) produced by the fungus.

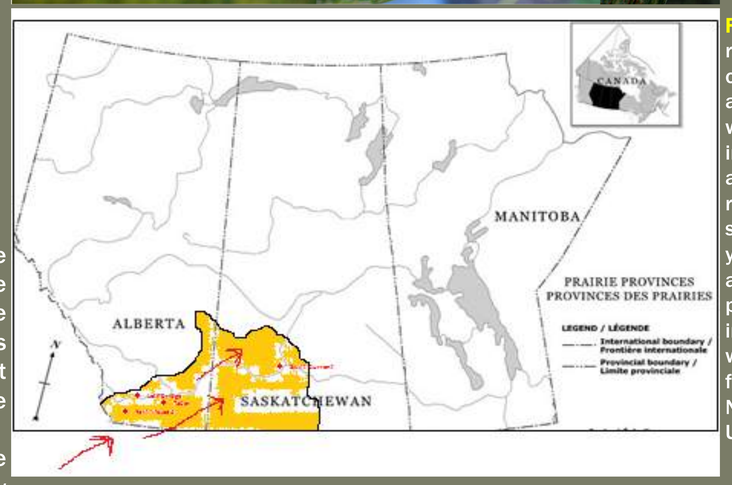

Fig. 2. Areas with regular occurrence of stripe rust in AB and SK. The counties with red dots indicates those areas where stripe rust is reported at severe levels most years. The red arrows indicates the path of airborne inoculum arriving in western Canada from the Pacific Northwest of the USA.

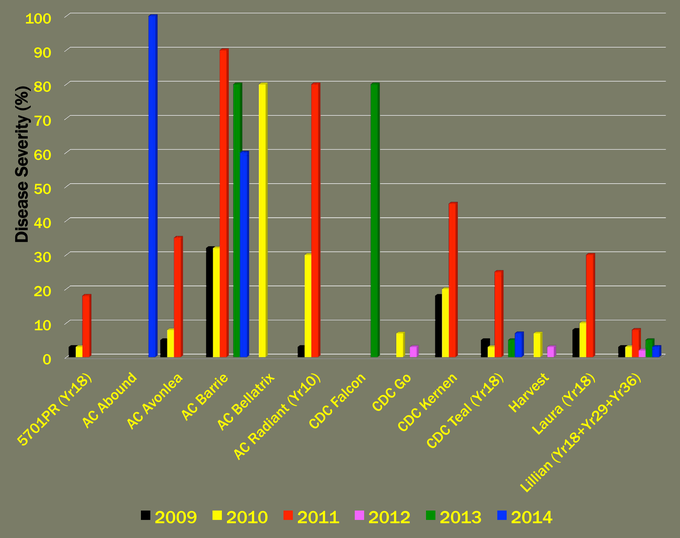

Fig. 3. Reaction of popular wheat varieties to stripe rust in 2009-2014. The 2011 was an epidemic year which resulted in high infection levels on varieties carrying *Yr18*. By observing the change in stripe rust severity level of AC Radiant, it is evident that resistance gene *Yr10* was defeated in 2010.

Citations

[1] McCallum, B. and Seto-Goh, P. 2009-2014. Can. Plant Dis. Surv. [2] Puchalski, B.J. and Gaudet, D.A. 2011. Can. Plant Dis. Surv. 91:68. [3] Fernandez, M.R., Dokken-Bouchard, F.L., Miller, S.G. and Northover, P.R. 2012. Can. Plant Dis. Surv. 92:96. [4] Puchalski, B.J. et al. 2013. Can. Plant Dis. Surv. 93:123-124. [5] Gaudet, D.A., Frick, M.J., Kundrik, K. and Amundsen, E. 2015. Can. Plant Dis. Surv. 95:108-109. [6] Kutcher et al. 2012. 13th ICRPMC, China, 2012. [7] Randhawa et al. 2012. Can. J. Plant Sci. 92:713-722. [8] Brar. 2015. M.Sc. Thesis. University of Saskatchewan.

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