Disease Survey of Cereal Crops in Saskatchewan in 2013.

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Abstract.

Cereal crops in Saskatchewan can suffer a number of diseases that reduce yield and quality. A disease survey was conducted in 2013 to identify pathogenic agents and assess disease severity on oat, canaryseed, barley and winter and spring wheat. Crown rust was detected at trace levels in four of 32 oat crops and the most common leaf spotting pathogens were *Pyrenophora avenae* and *Stagnospora avenae*, similar to previous years. On canaryseed, *Septoria triseti* was observed from plating of leaf samples and appeared to be highest in west-central SK and lowest in the north-east. *Fusarium avenaceum* was identified from plating of seeds in four of 26 crops, but only at low levels. In barley, only two crops were affected by stripe rust, but leaf spots symptoms observed on most crops, most commonly caused by *Cochliobolus sativus* and *Pyrenophora teres*; *Septoria passerinii* was identified in a few samples. Severe stripe rust infection was observed in seven of 89 winter wheat crops, but 60 crops were stripe rust-free. In winter wheat fusarium head blight was generally low in most regions of SK, except near Outlook, where severity was much higher. In spring wheat, stripe rust infection was observed in eight of 17 crops and was severe in one crop.

Introduction

In Saskatchewan a total of 272 crops of winter wheat, spring wheat, barley, oat and canaryseed were surveyed for leaf spotting diseases, fusarium head blight (FHB) and stripe rust at late flower to the soft dough growth stages between late July and September, 2013. The temperatures in Saskatchewan were somewhat below normal for much of the growing season, particularly the mid-July to mid-August period, but somewhat above normal in late August and throughout September, which was conducive to crop maturity and harvest (Saskatchewan Ministry of Agriculture 2013). There was limited precipitation during the months of May, August and September; however, frequent showers in June and July contributed to disease development.

Materials and Methods

Leaf spots of oat, barley and canaryseed

Leaf spotting diseases of oat in eastern Saskatchewan were assessed from late July to mid-August in 32 crops at the milk to soft dough growth stages. Twenty-six canaryseed crops were surveyed between flowering and the soft dough growth stages, in three regions of the province: west-central, from Eston to Kindersley; south-east, surrounding Indian Head; and north-east, near Tisdale. A total of 77 barley crops were surveyed and 44 of these assessed for leaf spot diseases throughout Saskatchewan during late July to mid-August when most crops were at the late milk to soft dough growth stages.

In each field, disease severity was assessed on 2-4 plants at each of 5 locations approximately 20 m apart and 30 m from the field edge. Disease severity was estimated in both the upper (flag and penultimate leaves) and lower canopies and rated using a six-category severity scale of: 0 (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%) adapted from Tekauz et al. (2012).

The causal pathogens were identified from infected leaves by surface sterilizing ten pieces of infected leaf tissue, each from a different leaf. Leaf cuttings were then placed on water agar plates or wet filter paper for about four days to promote sporulation. Identification was based on spore shape and size.

Stripe rust and fusarium had blight of barley, and winter and spring wheat

Commercial crops of winter wheat (86), spring wheat (17) and barley (30), and susceptible wheat lines in the three trap plots, were surveyed at the late milk to soft dough stages for stripe rust (*Puccinia striiformis* f. sp. *tritici* and *P. striiformis* f. sp. *hordei*) in 12 crop districts of Saskatchewan between early July and early September, 2013. The crops surveyed were separated from each other by at least 20 km. Each crop was traversed in a 'V' pattern (Puchalski et al. 2012) within which individual plants, at five locations separated by about 40 m, were evaluated for incidence and severity of stripe rust and fusarium head blight (FHB). Incidence of stripe rust in each crop was estimated as the proportion of infected plants in a 5 m row per observation site exhibiting at least trace levels. The modified Cobb scale (Peterson et al. 1948) was used to estimate stripe rust severity on the flag leaves of 50 plants per crop (10 leaves per site). A six-category scale was used to summarize stripe rust severity in each field: clean (no visible symptoms); trace (<3% leaf area affected); light (3-5%); moderate (>15-20%); and severe (>20%). FHB was assessed on 50 spikes per crop and incidence (proportion of spikes infected) and severity (proportion of each spike displaying symptoms) of symptoms recorded. The FHB index (overall severity) was calculated as follows: (average % incidence x average % severity)/100.

Results and Comments

Leaf spot disease severity of oat ranged from trace to slight in the upper canopy; in the lower canopy disease severity was trace to slight in 22 crops, moderate in eight and severe in two. Additionally, crown rust (*Puccinia coronata* Corda f. sp. *avenae* Eriks.) was detected at trace

levels in four of the 32 crops. The most common leaf spotting pathogens were *Pyrenophora avenae* Ito & Kuribayashi (pyrenophora leaf blotch), followed by *Stagonospora avenae* (Frank) Bissett f. sp. *avenaria* [stagonospora (septoria) leaf blotch] and *Cochliobolus sativus* (Ito & Kuribayashi) Drechs ex Dastur (spot blotch) (Table 1).

Leaf mottle severity of canaryseed was assessed at trace levels in 15 of the 26 crops, very slight to slight in seven and moderate in five. Analysis of infected canaryseed leaf tissue confirmed the presence of *Septoria triseti* Speg in 21 of the 26 crops (81% prevalence). In these 21 crops, the frequency of *S. triseti*-infected leaf tissue pieces (% of isolations) was 49% for the province overall (58% in west-central SK, 48% in the south-east and 30% in the north-east). *Fusarium avenaceum* was confirmed in four of the 26 seed samples, but at low levels of 4-6% kernel infection.

In barley, leaf spots were observed on 57% of crops assessed as very slight to slight, 20% moderate and 23% severe (Table 2). Three pathogens were identified from barley leaf tissue analyses. The leaf spot symptoms observed were caused most commonly by *C. sativus* (spot blotch) and *P. teres* (net blotch). Speckled leaf blotch, caused by *Septoria passerinii* Sacc. was identified in only a few samples. *C. sativus* was identified 77% of crops, *P. teres* in 61%, and *S. passerinii* in 11% (Table 3). Laboratory analyses indicated that *C. sativus* was present on 52% in 2013; *P. teres* on 43%; and *S. passerinii* on 5%.

On winter and spring wheat and on barley, stripe rust (*Puccinia striiformis* f. sp. *tritici* and *P. striiformis* f. sp. *hordei*) teliospore formation and senescence of plant tissue were observed by mid-August. Many commercial winter wheat crops in Saskatchewan were sprayed with foliar fungicides and thus it is likely that rust development was largely prevented. Stripe rust was observed in 26 of 86 winter wheat crops (30%), all three wheat trap plots, 8 of 17 spring wheat crops (47%), and 2 of 30 barley crops (7%). Of the winter wheat crops, 60 (70%) were rated as clean, 3 (3.5%) had a trace of stripe rust, 11 (13%) had light infection, 5 (6%) moderate and 7 (8%) severe levels of stripe rust (Table 4). Stripe rust-susceptible winter and spring wheat genotypes in trap plots were assessed as moderately severe stripe rust at Swift Current and severe infection at Melfort and Scott. The highest and lowest severity levels were found in Crop Districts 6B and 9A, respectively (Table 4). Severe infection was observed on an unsprayed crop of 'CDC Falcon' winter wheat at Insinger, SK in Crop District 5A. In spring wheat, stripe rust was most severe in one crop located in Crop District 8B, and was observed at only trace levels in all other crop districts (Table 5). Only two barley crops, one in each of Crop Districts 6B and 8B, were affected by stripe rust: both had an incidence of 3% and severity of 5%.

Fusarium head blight was observed in 25 of 89 (28%) of the winter wheat crops surveyed at a mean incidence of 4.6%, severity of 11% and FHB index of 0.7% (Table 6). Average disease levels were generally low in all regions except Crop District 3A-N where the severity and FHB index were much greater than the survey means for all crops. FHB levels were also somewhat higher than the provincial means in Crop Districts 3B-N and 6B.

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Literature Cited

Peterson, R.F., Campbell, A.B., and Hannah, A.E. 1948. A diagrammatic scale estimating rust intensity of leaves and stem of cereals. Can J. Res. Sect. C, 26:496-500.

Puchalski, B.J., Kundrik, K., Wogsberg, S., Wilson, M., Randhawa, H. and Gaudet D.A. 2012. Survey of stripe rust and other foliar diseases of wheat in 2012 in southern Alberta. Can. Plant Dis. Surv. 93:123-124. (www.phytopath.ca/cpds.shtml)

Saskatchewan Ministry of Agriculture. 2013. Final Crop Report. (www.agriculture.gov.sk.ca)

Tekauz, A., Kutcher, H.R., Gilbert, J., Beyene, M., Stulzer, M., Kleiber, F., Ghazvini, H. and Hajipour, Z. 2012. Leaf spot diseases of Manitoba and Saskatchewan oat in 2011. Can. Plant Dis. Surv. 92:92-93. (www.phytopath.ca/cpds.shtml)

Table 1. Prevalence and incidence (frequency of isolation) of leaf spot pathogens of oat in Saskatchewan, 2013.

Pathogen	Prevalence (% of crops)	Incidence (% leaf samples infected)*
Pyrenophora avenae	100	81
Stagonospora avenae	53	15
Cochliobolus sativus	25	4

* Percentage of leaf tissue pieces from which each pathogen was isolated; indicative of the relative amount of foliar damage observed.

Table 2. Leaf spot disease severity of barley in Saskatchewan, 2013.

Disease severity	Number of crops (n=77)	Prevalence* (%)
None	0	0
Very slight (1-5%)	22	28
Slight (6-15%)	22	28
Moderate (16-40%)	15	19
Severe (41-100%)	18	23

*Prevalence – number of crops in each disease severity category expressed as a proportion of the total number of crops surveyed.

Table 3. Pathogen prevalence and incidence of barley in Saskatchewan, 2013.

Pathogen	Prevalence (% of crops)	Incidence (% leaf samples infected)*
Cochliobolus sativus	77	52
Pyrenophora teres	61	43
Septoria passerinii	11	5

*Percentage of leaf tissue pieces from which each pathogen was isolated; indicative of the relative amount of foliar damage observed.

Table 4. Prevalence and severity of stripe rust on winter wheat crops in Saskatchewan, 2013.

Crop District	Prevalence*	Severity				
		Clean	Trace	Light	Moderate	Severe
2B	1/5	4	0	0	0	1
3A-N	2/4	2	0	2	0	0
3B-N	1/7	6	0	1	0	0
5A	4/9	5	1	0	2	1
5B	3/10	7	0	2	0	1
6A	3/11	8	0	2	1	0
6B	4/17	13	0	1	0	3
7A	1/4	3	0	1	0	0
7B	1/2	1	0	0	1	0
8A	0/5	5	0	0	0	0
8B	3/6	3	0	1	1	1
9A	3/6	3	2	1	0	0
Total	**29/89**	**60**	**3**	**11**	**5**	**7**

* Proportion of crops or trap plots affected

Table 5. Prevalence and severity of stripe rust on spring wheat crops in Saskatchewan, 2013.

Crop District	Prevalence*	Severity				
		Clean	Trace	Light	Moderate	Severe
2B	0/4	4	0	0	0	0
3B-N	1/4	3	1	0	0	0
5A	1/1	0	1	0	0	0
5B	1/2	1	1	0	0	0
6A	2/3	1	2	0	0	0
8B	3/3	0	2	0	0	1
Total	**8/17**	**9**	**7**	**0**	**0**	**1**

* Proportion of crops affected

Table 6. Prevalence, incidence, severity and FHB index of fusarium head blight on winter wheat in Saskatchewan, 2013.

Crop District	Prevalence*	Incidence (%)	Severity (%)	FHB index (%)	Index Range (%)
2B	3/5	11.0	3.6	0.40	0.3-2.0
3A-N	4/4	7.5	62.5	4.69	1.0-9.0
3B-N	3/8	7.3	20.0	1.45	1.5-4.0
5A	1/9	3.3	2.2	0.07	1.0-2.0
5B	2/10	7.0	3.0	0.21	4.5-6.0
6A	3/11	1.9	4.1	0.08	0.2-2.0
6B	4/17	4.4	20.6	0.90	0.5-9.0
7A	1/4	2.5	3.8	0.09	0 - 1.5
7B	1/3	6.7	5.0	0.33	0 - 3.0
8A	1/6	0.8	3.3	0.03	0 - 1.0
8B	1/6	1.7	3.3	0.06	0 - 1.0
9A	1/6	0.5	0.8	<0.01	0 - 0.2
All crops	**25/89**	**4.6**	**11.0**	**0.69**	**0.8-6.4**

* Proportion of crops or trap plots affected