WHEAT LEAF DISEASE SURVEY

Part 1: Wheat Disease Survey in North Central Alberta

This report was written and contributed by:

AAFC Prairie Biovigilance Network (PBN) Wheat Leaf Disease Survey – 2024
Report to the Gateway Research Organization (GRO)
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Introduction:

Prairie plant pathologists have a long history of annual surveying that dates back over 100 years. Sometimes surveying doesn't get the respect it deserves, but it is a critical aspect of the biovigilance continuum, providing key insights into what is happening and implications of these observations, which ultimately shapes research to develop appropriate management tools. Knowing your enemy provides insight into where it is, what impact it is having, and is it changing.

1. Looking at alternative effective sources of disease resistance or the need to pyramid resistance genes in the new varieties they are developing for farmers;
2. Developing a better understanding of changed or new pathogens also assists in developing management strategies that complement the use of resistant varieties; and
3. Looking at further research and recommendations to manage the risk of fungicide resistance to ensure their long-term effectiveness.

In 2024 the AAFC Prairie Biovigilance Network (PBN) enlisted the support of Gateway Research Organization (GRO) to assist with the 2024 AAFC PBN wheat leaf disease survey. The goal of this survey is to create awareness regarding the prevalence, variability and impact of leaf diseases across the Prairies. The PBN wheat leaf spot survey is not meant to replace important annual surveying by wheat pathologists and extension staff, but rather to complement these activities and to expand the area of coverage each year.

The AAFC PBN was developed to address concerns related to surveying of wheat diseases in the Prairie region as well as general insect and weed issues. Support for survey activities ebbs and flows, but access to wheat samples is critical for subsequent work in relation to studying pathogen variation and any potential shifts in virulence, etc. As researchers we need to stay up-to-date on the diseases and pests of concern so that we can focus research efforts with regard to cultural management, the development of resistant varieties, identification and evaluation of current and potential sources of resistance, to provide ongoing assessments for the potential appearance of fungicide insensitive pathogen strains, and to know which pests to focus our efforts on. In addition, this information is important for the development of appropriate extension materials by extension staff from government and producer groups.

Materials and Methods for the 2024 PBN wheat leaf spot survey

A survey to document leaf diseases of wheat was conducted in 61 Prairie fields across Alberta, Saskatchewan and Manitoba in late July/August 2024. Leaf collections were done by volunteer producers, extension/industry staff and researchers at the late milk to soft dough stage. Gateway Research Organization staff participated in the Alberta component of the PBN wheat leaf disease survey.

Collaborators were each sent a kit with survey instructions and materials to collect five flag leaves randomly at each of five sampling sites along a "diamond-shaped" sampling pattern, for a total of 25 leaves per field. In addition to the sampling kit, a questionnaire was included to collect information on cropping practices related to rotation, fungicide use, variety, etc. The leaf samples and completed questionnaires were returned to AAFC Lacombe for rating, assessment of causal agents, and tabulation of questionnaire results.

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Leaf samples were rated for the total wheat leaf complex comprised of tan spot (*Pyrenophora tritici-repentis*), the septoria complex (*Zymoseptoria tritici* and *Parastagonospora nodorum*); spot blotch (*Bipolaris sorokiniana*) and physiological leaf spotting but were also checked for the presence of leaf rust (*Puccinia triticina*) and stripe rust (*Puccinia striiformis*). Each leaf was rated for percentage leaf area diseased (PLAD) and then averages were calculated for each field. Other issues such as bacterial leaf streak was also noted and rated if present. Representative leaf samples from each field were placed in moist chambers and incubated for up to 48-72 hours to promote pathogen sporulation. Causal agents and other saprophytic fungi were identified based on fruiting structures and/or spore morphology.

Results and Discussion

In total, samples from 61 wheat fields were sent back for rating and tabulation of cropping information. Samples from 23 fields were submitted from Alberta, 31 fields from Saskatchewan, and seven fields from Manitoba. Overall, the average PLAD was 7.9%, with values of 4.7%, 10.5%, and 7.0% for AB, SK, and MB, respectively (Table 1). Identification of causal agents indicated that symptoms in the 61 fields were associated mainly with tan spot (20.2%), followed by the septoria complex (10.1%) and spot blotch (2.3%). The most common fungus observed in all fields was the saprophyte *Alternaria* spp., which was present on 89.8% of the leaf tissues tested; *Epicoccum* spp. were associated with about 28.2% of the leaves tested, also. Saprophytes don't cause damage to leaf tissue but infect after the leaf has already been damaged due to a pathogen, heat stress, drought, hail damage, or physiological leaf spotting. No symptoms of rust or BLS were observed on the collected leaf samples in 2024.

GRO collaborators were able to survey and collect flag leaves from seven fields in the area NW of Edmonton, Alberta. The average PLAD for GRO samples was 2.7%, which was lower than the overall averages for AB, SK, and MB (Table 1). The minimum and maximum average PLAD per field was 0.3 to 8.2, respectively. Differences between provinces likely reflected overall moisture levels, especially in late June and throughout July of 2024. The lower PLAD levels for GRO collected samples likely reflected drier weather conditions during the same period.

In 2024, fields were classified as to the number of wheat crops planted previously from 2020-2023 (Table 2). For some fields specific numbers were not available and were coded as =<three years and =>1 year (Table 2). There was no consistent trend of increasing leaf spot severity as the number of previous wheat crops increased from zero to three, with the highest average levels of disease being where either no wheat crops occurred, or where two-three wheat crops occurred during the previous four years (Table 2). Fields were also classified as to the number of non-host crops planted prior to wheat being grown in 2024 (Table 3). Non-host crops for wheat in relation to leaf diseases include canola, pulses, barley, forage legumes, summer fallow, etc. Complete rotation information was available for all four previous years for 52 crops in total. PLAD was 14.7% in fields planted to wheat on wheat, and 6.2%, 7.4%, and 7.5%, respectively, with one, two, or three years of non-host crops prior to wheat being grown in 2024 (Table 3). There were seven and two fields that had ranges of >=four years, or =>one year, and PLAD ratings were 8.3% and 2.6%, respectively. The trends observed for the number of non-host crops preceding the 2024 wheat crop illustrate the potential role of avoiding wheat on wheat rotations in reducing leaf spot risk and impact.

Fields were also classified according to whether leaf samples were collected from fungicide-sprayed areas versus samples collected from fields that were not sprayed or where samples were collected from unsprayed strips (Table 4). There appeared to be a slight reduction in leaf spot severity in samples collected from fungicide-sprayed areas (6.4%) versus non-sprayed fields/areas (9.7%) (Table 4).

Given that as of 2013 leaf spots are no longer a priority one disease for the Prairie Recommending Committee for Wheat, Rye and Triticale, candidate lines proposed and approved for registration no longer have leaf spot ratings assigned. Thus, it is not possible to categorize the varieties used in the survey according to leaf spot resistance rating. Instead, ratings will be given for individual varieties (Table 5). The most common varieties

grown were AAC Wheatland (10), AAC Viewfield (six), and AAC Starbuck and Hockley (three fields each), with each of the remaining varieties planted in one to two fields (Table 6). For three fields, the variety information was not available, while one and five fields didn't have variety indicated, but did have class, i.e. HRSW and CWRS, respectively. Varieties with the highest levels of leaf disease (>10% PLAD) were AAC Alida, AAC Hodge, Brigade, Accelerate, AAC Spitfire, and AC Andrew (Table 6).

Once again, we would like to sincerely thank collaborating farmers and GRO staff, for participating in our survey. For further information, please contact us at the email addresses below.

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Table 1. Prairie Biovigilance Network (PBN) wheat leaf disease survey results for Alberta, Saskatchewan and Manitoba, 2024.

		Percent leaf area affected (PLAD)[a]			Average percentage of leaves with the causal agents of tan spot, the septoria complex, spot blotch, and saprophytes (*Epicoccum* spp. and *Alternaria* spp.)				
Province	Number of fields	Average	Minimum	Maximum	Tan spot	Septoria complex	Spot blotch	*Epicoccum* spp.	*Alternaria* spp.
AB	23	4.7	0.2	33.5	14.8	14.8	4.3	42.6	89.6
GRO (b)	7	2.8	0.3	8.2	5.7	11.4	0.0	37.1	80.0
MB	7	7.0	2.8	14.8	40.0	5.7	0.0	8.6	80.0
SK	31	10.5	0.1	78.5	19.8	7.6	1.3	21.9	92.3
Overall	61	7.9	0.1	78.5	20.2	10.1	2.3	28.2	89.8

[a] Based on a combination of tan spot, septoria complex, spot blotch, and physiological leaf spotting.

[b] GRO = Overall Gateway Research Organization (GRO) collaborator results, Alberta, 2024.

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Table 2. Prairie Biovigilance Network (PBN) 2024 wheat leaf disease survey results based on the number of wheat crops previously grown from 2020-2023.

Number of wheat crops from 2020-2023	Number of fields	Average percent leaf area affected (PLAD)[a]
0	7	8.3
1	29	7.4
2	18	9.2
3	2	9.2
=<3	2	2.6
=>1	3	6.8

[a] Based on a combination of tan spot, septoria complex, spot blotch, and physiological leaf spotting.

Table 3. Prairie Biovigilance Network (PBN) 2024 wheat leaf disease survey results based on number of years of non-host crops grown prior to the 2024 wheat crop.

Number of years of non-host crops prior to the 2024 wheat crop	Number of fields	Average percent leaf area affected (PLAD)[a]
0	8	14.7
1	20	6.2
2	12	7.4
3	12	7.5
=>4	7	8.3
=>1	2	2.6

[a] Based on a combination of tan spot, septoria complex, spot blotch, and physiological leaf spotting.

Table 4. Prairie Biovigilance Network (PBN) 2024 wheat leaf disease survey results based on whether samples were collected from fungicide sprayed or unsprayed fields.

Fungicide applied in areas where leaf samples were collected[a]	Number of fields	Average percent leaf area affected (PLAD)[b]
Unknown	1	1.4
No	30	9.7
Yes	30	6.4

[a] Unknown = incomplete spray information. The sprayed category also includes samples collected from unsprayed areas within fungicide-sprayed fields.

[b] Based on a combination of tan spot, septoria complex, spot blotch, and physiological leaf spotting.

Table 5. Prairie Biovigilance Network (PBN) 2024 wheat leaf disease survey and varieties grown.

Variety	Number of fields	Average percent leaf area affected (PLAD)[a]
AAC Elie	2	0.6
AAC Viewfield	6	2.7
Accelerate	1	14.8
CDC Defy	1	3.9
CDC Go	1	1.2
CWRS*	5	5.4
HRSW**	1	1.4
Transcend	1	0.1
AAC Wheatland	10	9.7
AAC Starbuck	4	4.1
AAC Stronghold	2	4.9
AAC Wheatland	2	4.5
AAC Hodge	3	28.2
AAC Paramount	1	0.2
AAC Brandon	3	3.0
Parata	1	9.1
AAC Grainland	1	2.0
CDC Precision	2	3.8
AAC Spitfire	1	11.7
AAC Alida	2	53.4
Brigade	1	18.0
AAC Hockley	4	3.3
AAC Penhold	1	0.3
AAC Connery	1	6.6
AC Andrew	1	10.8
Unknown*	3	1.7

* CWRS = Canadian Western Red Spring; ** HRSW = Hard Red Spring Wheat; *** Unknown = no information provided.

[a]Based on a combination of tan spot, septoria complex, spot blotch, and physiological leaf spotting.

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Part 2: Wheat Disease Survey in North Central Alberta

A seed fungal scan was the second wheat disease survey that GRO was fortunate to participate in. This **seed fungal scan** consisted of taking a random harvested wheat seed sample, submitting them to BASF, who in turn had SGS conduct a fungal spore scan. Three samples of seed from the GRO area were analyzed in detail for the presence of fungal spores. The percentage of spore colonies obtained from lab growth of these seed samples are as follows:

Spore Type	Average Percentage of Presence per Sample
Alternaria Leaf Spot	61.3
Aspergillus	0.0
Cladosporium	1.8
Root Rot: Cochliobolus sativus	0.7
Epicoccum	8.5
Fusarium avenaceum	1.7
Fusarium culmorum	0.0
Fusarium graminiarum	0.7
Fusarium poae	8.2
Fusarium sporotrichloides	0.5
Net Blotch: Pyrenophora	0.0
Penicillium	0.0
Septoria Leaf and Glume Blotch	1.2

These numbers indicate the percentage number of spores obtained per seed from the samples. If a seed produces more than one spore colony of a type, they are both counted, possibly resulting in a percentage over 100 in some cases, which has an impact on these numbers.

Fungal Spore types:

Leaf Spot caused by Alternaria species can have a major impact on the factories of the plant, its leaves if conditions are moist enough for its spread late in the season and damage is already present. Major infestations of Alternaria on susceptible varieties can cause significant reductions in yield.

Cladosporium is one causative agent for black sooty head mold, which can cause seed damage in particularly moist fall situations. Its presence in all samples is not a huge concern, particularly if it has a protective impact against powdery mildew.

Cochliobolus sativus is the fungus that causes root rot, and it is an indication of the need to either use varieties tolerant to the rot or to use protective seed treatments.

Epicoccum is an interesting fungus, with little impact on the wheat plant, but may instead have a protective factor against other fungi. Its strong presence in the local wheat samples may actually prove to be a positive factor for local wheat crops.

The **fusarium c**omplex of fungi may be the most concerning of the positive samples. The most damaging of the fusariums, graminearum, is present in low levels of the wheat samples sent in, but its presence indicates a need to be wary of fungal diseases and their local spread.

The **septoria complex** of fungi are responsible for leaf and glume blotch. While their presence has been known

for a while, the current level indicates it is still present but not by itself in high enough concentrations for local wheat producers to use this as the sole reason to consider the use of protectants to maximize yield, but rather one may use the varietal susceptibility as a means of selection.

Conclusion:

While fungal concentrations on seed, as determined by testing of the samples submitted to GRO, do not generally appear to be high, if conditions are ideal for the propagation of the diseases, producers still need to be wary of yield damaging impacts. The presence of these diseases indicates that their spread is possible, despite an adequate field rotation. Prevention by variety selection is the first tool in the toolbox to consider minimizing the impact of these conditions.