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CAVALIER COUNTY AG ALERT

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Field activity and weather:
All crops are at critical stages of grain development and moisture stress during this period would definitely have an effect on yield. Fortunately, we received a million dollar rain yesterday. The rain came down hard with some wind and hail. The NDAWN station at LREC recorded 0.77 inches of rain last night. The average temperatures ranged from between 78^{o}F maximum and 54^{o}F minimum air temperatures (7-25-19 to 7-31-19). The soil moisture is still down and currently at 11.9% and 18.4% VMC (Volumetric Water Content) at 4 and 8 inches at surface and sub-surface moisture is still holding good at 26.8% VMC at 20 inches below surface.

Bacterial Leaf Streak Prevalence and Commonly Asked Questions
(Source: Andrew Friskop, Extension Plant Pathology, Cereal Crops; Joel Ransom, Extension Agronomist, Small Grains and Corn)

Over the past couple weeks, we have observed high levels of bacterial leaf streak (BLS) in research plots and have fielded several questions from individuals across the state. Also, the NDSU IPM survey scouts identified BLS in 31% of the fields this past week. Both of us have written about BLS in previous crop and pest reports and this week we will expand on some of the most commonly asked questions.

Field Diagnosis
It is important to remember the different type of symptoms the bacterial pathogen can cause. Although we are most familiar with leaf disease symptoms, the pathogen can cause purpling of the grain spikes *(black chaff)* and cause yellow-purple lesions to form on the peduncle *(stem tissue below the head)*. Purpling of the heads with striations along the glumes are both identifying features of black chaff (**Figure 1**).

Figure 1: Black chaff on two wheat spikes. Notice streaks along the glumes of the spikelet

Peduncle lesions are often found on heads with black chaff or flag leaves with BLS (**Figure 2**). The peduncle lesions are not associated with lodging or any other disorders that may lead to problems at harvest. Black chaff can be confused with a fungal disease known as Stagonospora glume blotch. Although both can look similar to each other, here are a few tips to separate the two in the field.
(1) **Check the variety**. Knowing the susceptibility of a variety to bacterial leaf

streak or Stagonospora leaf blotch can start pointing you in the right direction.

(2) **Examine the flag leaves**. Having a high level of BLS on the flag leaf will likely mean the spike symptoms are black chaff.

(3) **Review the field history**. For example, if fungicides have been applied, the field has looked clean prior to flowering, and a thunderstorm came through around heading, black chaff is likely the diagnosis.

(4) **Look for fruiting bodies or bacterial ooze.** Dark pepper grain fruiting bodies in the lesions on the spike are a sign for the Stagonospora glume blotch pathogen, whereas bacterial ooze (shiny exudate) will be a sign of the BLS pathogen.

Figure 2. Purple to yellow lesions on stem tissue directly below the spike (peduncle). These lesions are caused by the BLS pathogen.

Figure 3. A) Spring wheat variety with 30-40% damage on the flag leaf. B) Spring wheat variety with 100%flag leaf damage.

Relationship Between Diseased Leaf Area and Yield Loss in Wheat

One of the most commonly asked questions pertaining to BLS is yield loss. As a reminder, healthy green leaves during grain filling are the major source of carbohydrate that end up in the grain. The tissue comprising the spike, the stem and remobilization of carbohydrates and proteins from other plant tissues are also important contributors to grain development. Field observations in Idaho in the 1980s reported that BLS caused yield losses as high as 40%. Other research completed in high rainfall environments estimated yield losses of 5% when 10% of the flag leaf had BLS and up to 20% yield loss when 50% of the flag leaf was damaged (Duveiller et al., 1993). Another study on spring wheat estimated yield losses of 13-34% when 100% of the flag leaf was damaged (Shane et al.).

Although all of these studies provided a good estimate of yield loss, it can be difficult to apply these yield loss metrics to the current situation. For example, the research studies listed above documented disease early in the growing season (around tillering). This year it appears most of the bacterial infections started when the state experienced strong thunderstorms in late June/early July and most of the wheat crop was headed or entering early stages of flowering. Therefore, the flag leaf was not likely infected until the heading to flowering growth stages. It is likely yield loss will occur in the impacted fields, but placing a specific yield loss number on these fields is difficult. This is further complicated by the fact BLS can be patchy in the field (*i.e*., areas prone to wind damage, headlands, etc). Regardless, if we use the relationships discussed above, one might expect yield loss of about 15% on the variety in **Figure 3A** and about 30-40% on the variety in **Figure 3B**. We think most of the yield loss in impacted fields this year will range from 1 to 15%.

Ergot Being Reported in Wheat

Ergot has been found in some wheat fields in Cavalier County. Some of the commonly asked questions with the disease are:

What causes ergot and how does it infect wheat?

Ergot is a fungal disease primarily caused by *Claviceps purpurea*. The pathogen has a very broad host range with reports of it infecting over 400 grass species including barley, durum, rye, spring wheat, winter wheat, quackgrass, and brome grass. The pathogen survives as hard-bodied fungal structures called sclerotia or ergot bodies. These sclerotia germinate in the spring giving rise to stroma (mushroom-like) that release hundreds of thousands spores during the growing season. Infection in wheat (or other small grains) occurs when spores land on flowers in the early stages of flowering; prior to the visual appearance of the yellow anthers on the center of the head. The spores will land on the stigma of the wheat flower and replace the developing kernel with strands of mycelial (fungal) growth. Successful infection will produce "honeydew" and will be visible prior to flowering (Figure 1). The sugary and sticky honeydew contains asexual spores that are often carried by insects to infect the flowers of other potential host plants/crops. Eventually, the fungal strands will replace the developing wheat kernel, harden and turn into a black-purple sclerotia (Figure 2). The sclerotia can be harvested with the grain or will fall to the soil and overwinter.

What conditions favor ergot?

All literature indicates cool and wet weather during wheat flowering favors sclerotia germination and infection. However, the definition of cool weather is loosely defined in literature. Our experience suggests that ergot is more apparent when temperatures are in the 70's with ample moisture (dew or rain). Historical accounts of ergot epidemics in North Dakota in the 1920s suggest that prolonged periods of moisture in late June into early July were a major influencer of disease incidence.

Why are there strict thresholds for ergot?

Ergot sclerotia contain toxic alkaloids that can cause harmful effects in both humans in cattle. In humans, the alkaloids will reduce blood flow to limbs resulting in gangrenous symptoms. It also can cause hallucinations and has been linked to the Salem Witchcraft Trials, the weakening of Julius Caesar's troops and the death of Russian soldiers in the late 1920's. Livestock fed ergot sclerotia can develop gangrene symptoms of ears, hooves and tails. The alkaloids can also cause abortions and reduce mammary gland development. Therefore, ergoty seed lots should not be fed to livestock.

Management of ergot

- Crop Rotation – Rotating a broadleaf or corn on a field with ergot will reduce the amount of in-field inoculum. The ergot will survive on the soil surface for about one year, so not providing an available host will reduce the chance of pathogen survival.
- Tillage – Burying sclerotia at least one-inch into the soil will prevent the stromas (mushrooms) from reaching the soil surface and releasing spores.
- Mowing or Preventing Grassy Weeds from Heading – Grassy weeds in field margins such as quackgrass or bromegrass will head and flower prior to the small grain crop. Preventing these grasses from heading will reduce the formation of ergot bodies and reduce the risk of spores being carried into small grain fields.
- Use Ergot Free Seed – The use of ergot free seed will reduce the amount of in-field inoculum.
- Host Resistance – To our knowledge, there are no small grain varieties with resistance to ergot. However, small grains that have a shorter flowering window are less susceptible. For example, rye tends to be the most susceptible small grain as the flowering process and opening of florets can extend several weeks in field. Observations of ergot

in variety trials tend to relate to time of heading and flowering. In other words, varieties that were heading during a conducive time for ergot had a higher incidence than those that escaped the infection window. Other factors that prolong floret openings (cool weather, physiological components or copper deficiency) will increase the risk for ergot as well.

Figure 1. Honeydew caused by infection of the ergot pathogen. This sign will be observed right before yellow flowers are visible in wheat (Photo: Grant Mehring – WestBred Technical Product Manager)

- Fungicides – Foliar fungicides at heading have not been shown to be effective in managing ergot. Seed treatment fungicides on ergoty seed lots have been shown to delay and disrupt germination of sclerotia. Studies conducted overseas suggest that triazoles (FRAC 3) have reduced viability of sclerotia.
- Harvesting Strategy – Due to the strict threshold level in wheat (< 0.05% by weight), it is important to scout fields for presence of ergot. Often times, ergot incidence will be higher along field margins bordering a road ditch or section line where grassy weed hosts are present. If you notice a higher level along a field edge, keep that grain source separate from the rest of the field.
- Cleaning an Ergoty Seed Lot – Cleaning using gravity-type or color sorters can help reduce (not eliminate) the amount of ergot sclerotia in a seed lot. Ergot sclerotia tend to be lighter and less dense allowing for the removal of these structures.

Figure 2. Ergot sclerotia on several grass hosts. Notice irregular, purple-black structures extending from head.

(Source: Andrew Friskop, Extension Plant Pathology, Cereal Crops)

New Insecticides Registered in ND

Sefina® Inscalis® *(active ingredient afidopyropen, Group 9D*) from BASF is registered for control of soybean aphids in soybeans. The rate is 3.0 fl oz per acre and there is a 7 day Preharvest Interval (PHI). Residual testing on Sefina® found that the residual was efficacious against soybean aphids for 21 days. The estimated cost of Sefina® is about $6.00 per acre at the 3.0 fl oz per acre rate.

Transform® WG *(active ingredient sulfoxalfor, Group 4C)* from Corteva is registered for use in the following North Dakota field crops: alfalfa, canola, cereal crops *(barley, oats, rye, wheat)*, field corn, dry beans, potatoes and soybeans. It will control piercing- sucking insect pests

including aphids, leafhoppers, plant bugs and potato psyllids. Other crops and insect pests are listed on the label. It is now registered in the **North Dakota State Department of Agricultural Pesticide Database**. For soybean aphids, the rate is 0.75 -1.0 fl oz per acre and there is a 7 day PHI. An estimated pricing for Transform® WG is about $7.37 per acre at the 1.0 fl oz per acre rate.

Both Sefina® and Transform® WG are selective insecticides and control only certain insect pests. An advantage is their favorable profile to beneficial insects and bees. These products also provide a unique mode of action and are a good fit for resistance management of insect pests that are known to be resistant to other insecticide groups, such as pyrethroids, neonicotinoids, organophosphates and carbamates.
(Source: Janet Knodel, NDSU Extension Entomologist)

Spray Timing Important for Effective Sunflower Insect Control
Once sunflower insects reach their established economic thresholds and the decision to treat has been made, it is critical to time the spray application correctly to get effective management of all sunflower head insects including red sunflower seed weevils, banded /Arthuri sunflower moths, sunflower moths and Lygus bugs (for confection sunflowers only).
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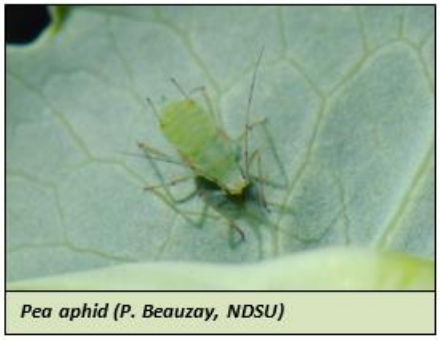
The best sunflower plant stage to treat for all of these head-infesting insect pests is when the majority of the plants are in the early flowering R5.1 growth stage *(when pollen shed on 10% of the outer rim of the sunflower head)*.
Scheduling an airplane may take a week or more if ag pilots are busy spraying, so we recommend planning for your insecticide application when only 30% of the plants in a field reached the R5.1 growth stage. If it's hot, flowering will progress more rapidly and one week may not be enough lead time. Getting the timing right in this situation is difficult, but making arrangements when 5-10% of plants are at R5.1 may be more prudent. At Casselton in 2017, sunflower progressed from 1% at R5.1 to 50% at R5.1 in just a few days. Insecticides should be targeted at the adult RSSWs to prevent egg laying; at the adult and early larval stages of BSM and sunflower moth; and at the adult or nymph stages of Lygus bug.
Please see the NDSU Extension E1143 ***2019 ND Field Crop Insect Management Guide*** for insecticides registered in sunflower. **Please remember that blooming sunflowers are attractive to bees, so insecticides should be applied in the late evening** *(preferred by honeybee keepers)* **or early morning to minimize negative effects of an insecticide on bees.** See the ***ND Department of Agriculture bee map*** for help finding the locations and owners of hives.
(Source: Janet Knodel, NDSU Extension Entomologist)

Scout for Pea Aphids in Pulse Crops (Field Peas, Fababeans)
Economic populations of pea aphids are being reported in NC and NW areas of ND. Pea aphids are small, about ⅛ inch long and pale to dark green with reddish eyes.


Pea aphid (P. Beauzay, NDSU)

Life Cycle: Pea aphids have multiple generations per year and overwinter as eggs in alfalfa, clover or vetch. In the spring, nymphs hatch from eggs and appear similar to the wingless adult but smaller. Nymphs molt four times and mature into adults in 10 to 14 days. Pea aphids can reproduce rapidly when temperatures are around 65 F and

Pea aphids on tip of field pea plant (J. Knodel, NDSU)

Crop Damage: Pea aphids have piercing-sucking mouthparts, which suck the juices from plants. Pea aphids are effective vectors of viral diseases. For example, pea seed-borne mosaic virus (PSbMV) is an economically damaging viral pathogen of field pea that can cause significant losses in seed yield and quality, especially when infections occur before or during flowering. Consult the NDSU Extension publication ***PP1704 Pea Seed-borne Mosaic Virus (PSbMV) in Field Peas and Lentils*****,** for more information.
Pulse crops are especially susceptible from the flowering to early pod stage and during drought stress. An economic infestation can result in lower yields due to less seed formation and smaller seed size. Protein content and other quality issues do not appear to be affected by aphid feeding. Aphid populations are usually kept low naturally by heavy rains or beneficial insects including parasitoid wasps and predators, such as ladybird beetles and lacewings. Early seeding also can reduce damage caused by pea aphids.

Pest Management: Scouting for aphids in pulse crops is conducted using a sweep net or examining the number of aphids per plant tip when 50 to 75 percent of the crop is flowering. Take 180-degree sweeps using a 15-inch sweep net or check at least five 8-inch plant tips from five different locations in the field. Population estimates should be calculated by averaging counts taken from five separate areas of the field.
If the economic threshold is exceeded, a single application of insecticide at 50 percent of plants in young pods stage will protect the crop against yield loss. If an insecticide application is necessary during flowering, spray when bee foraging is minimal, preferably during the evening hours (after 8 p.m.).
For more information, consult the NDSU Extension publication ***E1877 Pulse Crop Insect Diagnostic Series: Field Pea, Lentil and Chickpea***
Threshold for Field Pea: Aphid feeding on peas in the flowering and early pod stage can result in lower yields due to less seed formation and smaller seed size. Protein content and other quality issues are not impacted by pea aphid feeding injury. During early reproductive growth stages of field pea, an insecticide treatment is recommended when **an average of 5 to 19 pea aphids per plant or 3 to 12 pea aphids per 180-degree sweeps with a 15-inch diameter sweep net.**

Threshold for Faba Beans: Being a relatively new crop, there are no economic threshold that have been established for this insect. But in general, pulse crops are especially susceptible from the flowering to early pod stage and during drought stress. An economic infestation can result in lower yields due to less seed formation and smaller seed size. Protein content and other quality issues do not appear to be affected by aphid feeding. It is expected that late pod stage is safe from yield losses due to aphid feeding with a good population of predators like lady beetles, lacewings, etc. that are eating the aphids.