North Dakota State University
CROP & PEST REPORT

NDSU EXTENSION

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entomology

EARLY SEASON GRASSHOPPER EMERGENCE

With crop emergence now underway throughout North Dakota, crop scouting for young grasshoppers is just around the corner. Grasshopper eggs will begin to hatch from grassy overwintering sites in the coming weeks. Newly hatched nymphs are small about the size of a wheat kernel and pass through 5 to 6 molts, depending on species, before reaching adulthood. The grasshopper nymph can be differentiated from the adult based from the lack of wings that are present. Nymphs have wing pads (undeveloped wings) and are unable to fly. As a result, they must crawl into crop emerged areas from grassy hatching sites.

Grasshopper nymph (J. Knodel)

Grasshopper development is often favored by warm, dry weather whereas cool, wet weather can increase disease incidence and slow the development of grasshoppers, thus reducing the overall population. As we observe the forecast for the last two weeks of May, we see a slightly cooler than normal forecast with an equal chance of wet or dry conditions. However, the overall summer forecast appears to trend towards a drier and warmer period through the month of August. Overall, the long-term forecast appears favorable for grasshopper development.

Grasshoppers, in high numbers, can lead to significant crop defoliation under hot, droughty conditions. Using their chewing mouthparts, young grasshoppers can cause severe defoliation. Adult grasshoppers often chew on reproductive parts (corn ear, wheat or sunflower heads), and can clip heads or pods of crops near the end of the growing season.

Crop scouting is important as populations can fluctuate due to weather conditions. Scouts can use four 180-degree sweeps with a 15-inch diameter sweep net (equivalent to one square yard) to find the number of nymphs in the grassy ditches near emerging field crops. Early detection of nymphs is important for proper pest management.

Action Threshold for Grasshoppers in Field Crops		
Grasshopper	# of grasshoppers per square yard	
	Near field margin	Within field
Nymph	50-75	30-45
Adult	21-40	8-14

TJ Prochaska
Extension Specialist/Crop Protection
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Janet Knodel
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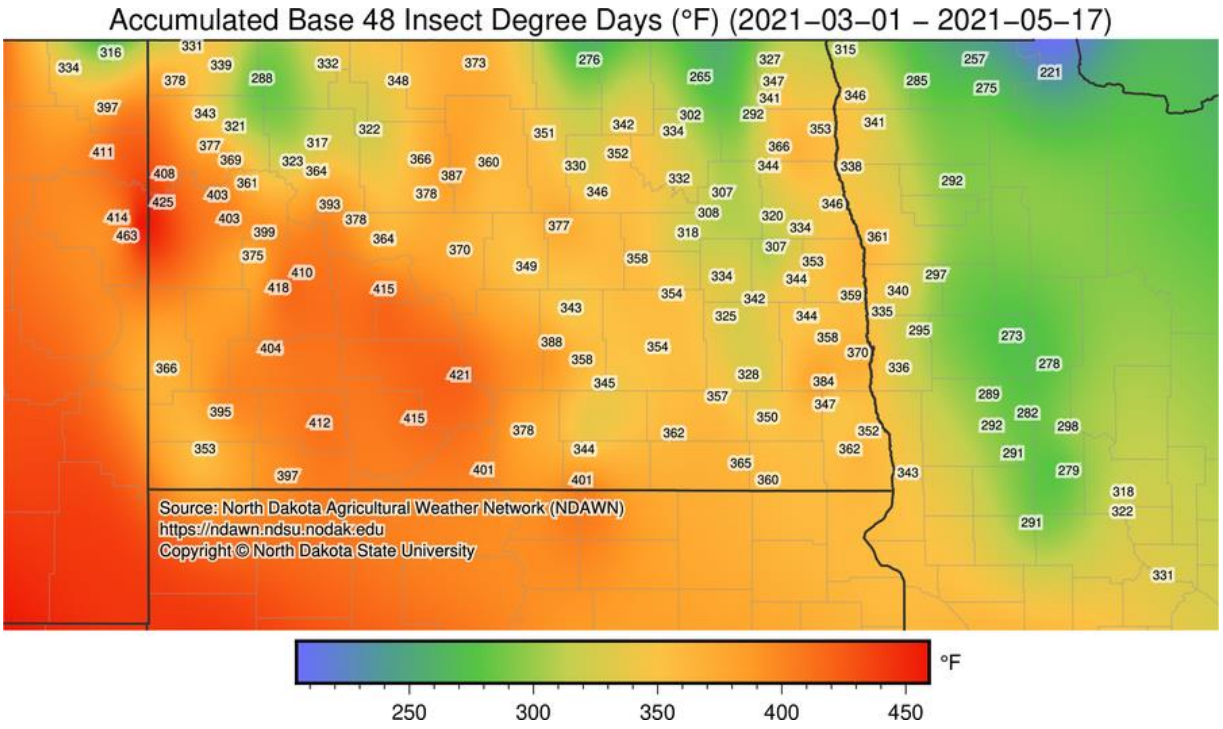
ALFALFA WEEVIL SCOUTING

North Dakota gained about 100 Accumulated Degree Days (ADD) units from last week. This week we have a low of 265 ADD in the northeast area to a high of >400 ADD in the northwest to south central areas (see map). **Start to scout alfalfa fields for adult alfalfa weevils after 300 ADD, and for larvae from 371 through 595 ADD.** The heaviest feeding occurs as mature larvae appear (from 439 through 595 ADD), usually mid-June through mid-July. Most of North Dakota is in the adult weevils to small, early larvae stages, causing damage which will appear as light feeding injury or pin-holes in leaf clusters.

To assess the insect DD model, go to the NDSU's NDAWN website and Applications – Insect DD. Then, click on the *Map* tab and select *48 F* for your base temperature and *Degree Days (DD)* for your map type. Then, click *Get Map*.



How to Scout for alfalfa weevils: To determine if alfalfa weevil is present or absent in a field, a sweep net is a good tool to use for detection. But, for determining if your alfalfa needs to be treated with an insecticide or not, use the **stem-bucket method**. Fields should be scouted weekly up through the first cutting. Scout in a "W" pattern or by selecting random sites in the field, with a minimum of five sampling sites per field.

At each sampling site in the field, select a minimum of 30 stems and cut them off at the base. Invert the cut stems into the 5-gallon pail and vigorously beat the plants in the pail to dislodge the larvae. First-instar larvae feeding in rolled leaf tips won't dislodge easily, so be sure to examine leaf tips for larvae.

Count and record 1) the number of stems sampled, 2) the total number of larvae counted and 3) the height of the alfalfa at the sampling sites. Repeat this procedure for all sampling sites within the field. When finished, total the number of larvae found and divide by the total number of stems sampled to calculate an average number of larvae per stem for the entire field. Then, calculate average plant height for the field.

Alfalfa weevil larvae from bucket sampling method (Photo by P. Beauzay, NDSU)

Threshold numbers in Table 1 are the average number of larvae per stem sampled in the field using the 30-stem sampling method. These economic thresholds apply prior to the first cutting only.

Table 1. Recommended economic thresholds for control of alfalfa weevil larvae for North Dakota prior to the first cutting. [Average number of larvae per stem using the 30-stem sampling method.]

Plant Growth Stage (Height)	Treatment Cost	Crop Value ($/ton)						Management Decision
		$50	$75	$100	$125	$150	$175	
		Number of Alfalfa Weevil Larvae per Stem						
50% bud or greater								Cut early
Early bud (>20 inches)	$7/acre	4.0	2.7	2.0	1.6	1.3	1.2	Cut early, or use a short PHI/PGI product
	$8/acre	4.6	3.1	2.3	1.8	1.5	1.3	
	$9/acre	5.2	3.5	2.6	2.1	1.7	1.5	
	$10/acre	5.8	3.8	2.9	2.3	1.9	1.6	
	$11/acre	6.3	4.2	3.2	2.5	2.1	1.8	
	$12/acre	6.9	4.6	3.5	2.8	2.3	2.0	
Late vegetative (16 to 20 inches)	$7/acre	3.8	2.4	1.8	1.4	1.1	0.9	Use a short to mid-PHI/PGI product
	$8/acre	4.4	2.8	2.1	1.6	1.3	1.1	
	$9/acre	4.9	3.2	2.4	1.8	1.5	1.2	
	$10/acre	5.5	3.6	2.6	2.1	1.7	1.4	
	$11/acre	6.1	4.0	2.9	2.3	1.9	1.6	
	$12/acre	6.7	4.4	3.2	2.5	2.1	1.7	
Midvegetative (10 to 15 inches)	$7/acre	3.6	2.2	1.5	1.1	0.9	0.7	Use a long-residual product
	$8/acre	4.1	2.6	1.8	1.4	1.1	0.8	
	$9/acre	4.7	3.0	2.1	1.6	1.2	1.0	
	$10/acre	5.3	3.4	2.4	1.8	1.4	1.2	
	$11/acre	5.9	3.7	2.7	2.1	1.6	1.3	
	$12/acre	6.4	4.1	3.0	2.3	1.8	1.5	

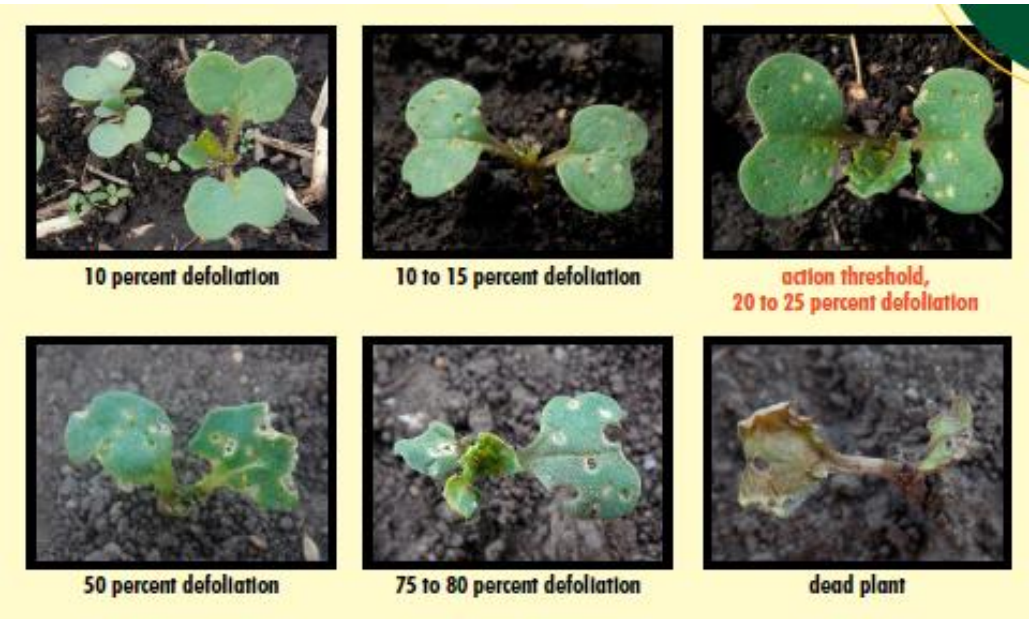
(Source: NDSU Extension *E1676 Integrated Pest Management of Alfalfa Weevil in North Dakota*)

CANOLA FLEA BEETLES EMERGING

Temperatures have warmed up above 60F and this triggers flea beetles to move out of overwintering areas to newly planted canola fields. Crucifer and striped flea beetles have been observed in overwintering shelterbelts, areas with volunteer canola or Brassicacae weeds (wild mustard), or in canola fields in the northeast (L. Lubenow, LREC) and southwest (R. Buetow, DREC). Lower numbers of flea beetles also have been observed in canola fields in the north central area near Minot (T.J. Prochaska, NCREC). The striped flea beetle typically emerges about 2 weeks earlier than the crucifer flea beetle. The first striped flea beetles were actually detected back in early May. Both species are easy to identify by their flea-like hopping behavior. The crucifer flea beetle adult is a small, oval-shaped, dark beetle with an iridescent blue sheen on the black wing covers, measuring about ⅛ inch long. The striped flea beetle adult is similar to the crucifer flea beetle in size and has two yellow stripes on its black wing covers.

Striped flea beetle (on left) and crucifer flea beetle (on right). (P. Beauzay)

Canola fields should be scouted at least biweekly during the first three weeks of emergence to ensure that the systemic insecticide seed treatments are providing 'good' flea beetle protection, especially during this dry year when uptake of insecticidal toxins may be slower. Continue to scout until canola is in 6-8 leaf stage when the crop can tolerate most flea beetle feeding pressure. If more than 20-25% defoliation is observed in canola fields, a foliar insecticide spray would be warranted. Pyrethroids (3A) are the only class of insecticide registered for foliar control of flea beetles in canola (active ingredients - bifenthrin, deltamethrin, gamma-cyhalothrin, lambda-cyhalothrin, zeta-cypermethrin). One premix is labeled as Besiege (chlorantraniliprole + lambda-cyhalothrin). If the 20-25% defoliation level is reached, a foliar insecticide needs to be applied as soon as possible for optimal control and to prevent yield loss.



Janet J. Knodel
Extension Entomologist

plant science

CANOLA

The average North Dakota canola yield for the last 13 growing seasons was 1,728 pounds per acre. The yield potential varies by year, based on environmental conditions; limited available moisture during the growing season will reduce the yield potential (Figure 1). Based on the March NASS report, North Dakota producers are planning to plant close to 1.8 million canola acres.

About 40% of the canola acres in North Dakota have been seeded as of May 16. Canola is a cool-season crop. Research indicates that canola yield potential decreases as planting is delayed. At the most northern location, Langdon, the yields stayed relatively stable from the earliest plant date though the third week of May (Figure 2). At Minot, yields tended to decrease more rapidly after the optimum seeding date, which for that location is the first part of May (Figure 3).

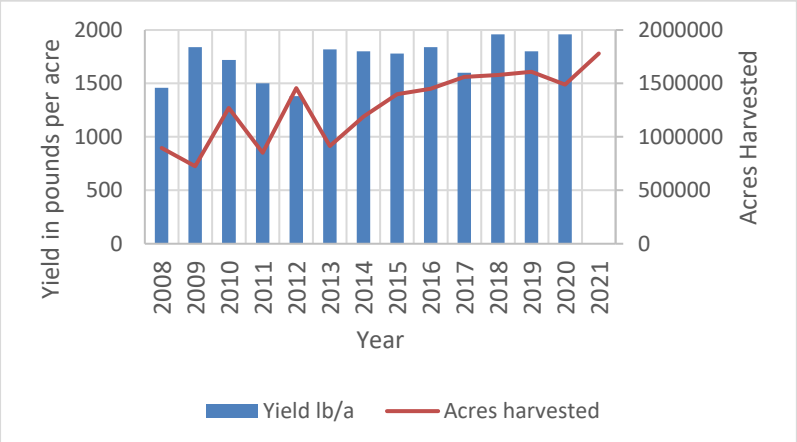


Figure 1. North Dakota state average canola yield in pounds per acre, harvested acres from 2008 to 2020, and forecasted planted acres for 2021.

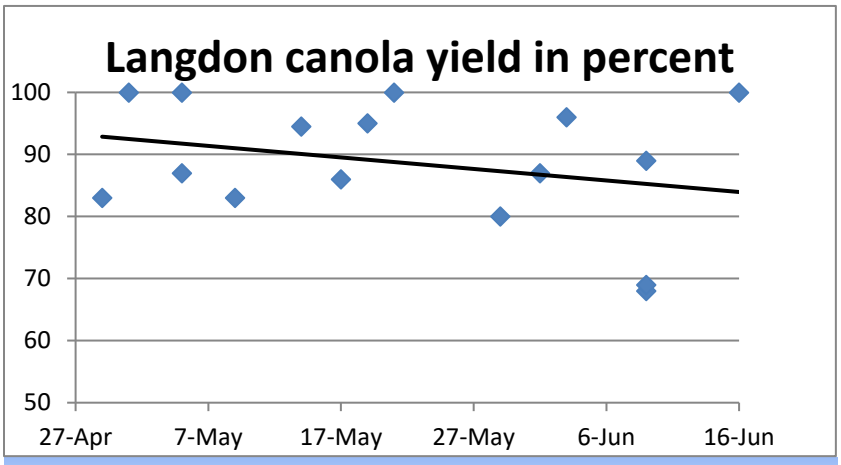


Figure 2. Percent of canola yield by planting date at Langdon REC

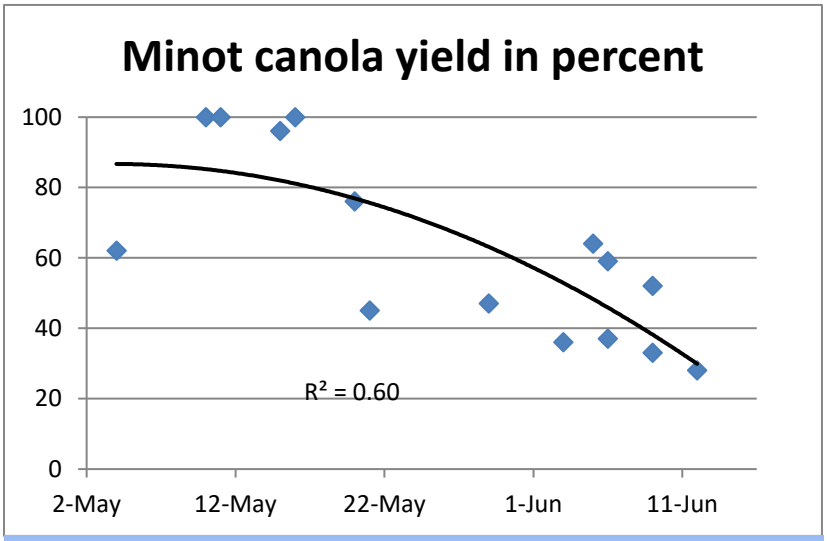


Figure 3. Percent of canola yield by planting date at North Central REC, Minot.

Canola can be planted with a variety of seeding equipment. Good depth control is important. The optimum seeding depth for canola is ½ to 1 inch, and should not exceed an inch with small-seeded hybrids. Large-seeded hybrids may be seeded deeper than 1 inch; however, planting depth should not exceed 1½ inches. Plant canola where a uniform depth can be achieved. Use seed with a high germination percentage and with good seedling vigor. Planting seed treated with an insecticide and fungicides for seedling protection is recommended. Canola is very susceptible to heat and drought stress during flowering. Hot conditions during flowering shorten the time the flower is receptive to pollen, as well as the duration of pollen release and viability. This can decrease the number of pods that develop on the plant and the number of seeds per pod, resulting in lower canola yields, therefore it is recommended to plant the remaining canola acres as soon as possible to avoid heat stress during the reproductive phase.

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EMERGED WEEDS IN SUGARBEET

Our 2021 sugarbeet crop is planted and stands are spotty in many regions. Kochia, common lambsquarters, common ragweed, and pigweed are emerging but generally have been spotty despite lack of rainfall to incorporate preemergence herbicides. I am writing with my best recommendations for managing waterhemp escapes in sugarbeet. But most important, producers need a sense of urgency against weed escapes, especially waterhemp since small waterhemp become large waterhemp in a matter of days and weeks. I recommend two options for postemergence waterhemp control in sugarbeet.

Apply glyphosate with Stinger and ethofumesate at 4 to 6 fl oz/A plus ammonium sulfate and high surfactant methylated oil concentrate (HSMOC) at 1 pt/A. We have observed approximately 75% control of 1-inch glyphosate resistant waterhemp. Some of you might be surprised by this level of control. Two reasons: a) first our fields are a mixture of glyphosate susceptible and resistant populations; and b) according to Dr. Todd Gains, Molecular Weed Science and Associate Professor, Colorado State University, glyphosate resistance is quantitative and not qualitative meaning glyphosate may control 1-to 2-inch waterhemp with resistant alleles but misses 2- to 4-inch waterhemp.

Clopyralid (Stinger) does not control waterhemp. However, Stinger with Roundup PowerMax and ethofumesate improved control of waterhemp up to 1-inch 20% and 27%, 12 and 25 DAT, respectively, compared to Roundup PowerMax with ethofumesate alone in a greenhouse experiment (Figure 1). However, the waterhemp control advantage from Stinger with PowerMax and ethofumesate was less once waterhemp grew to 2-inch.

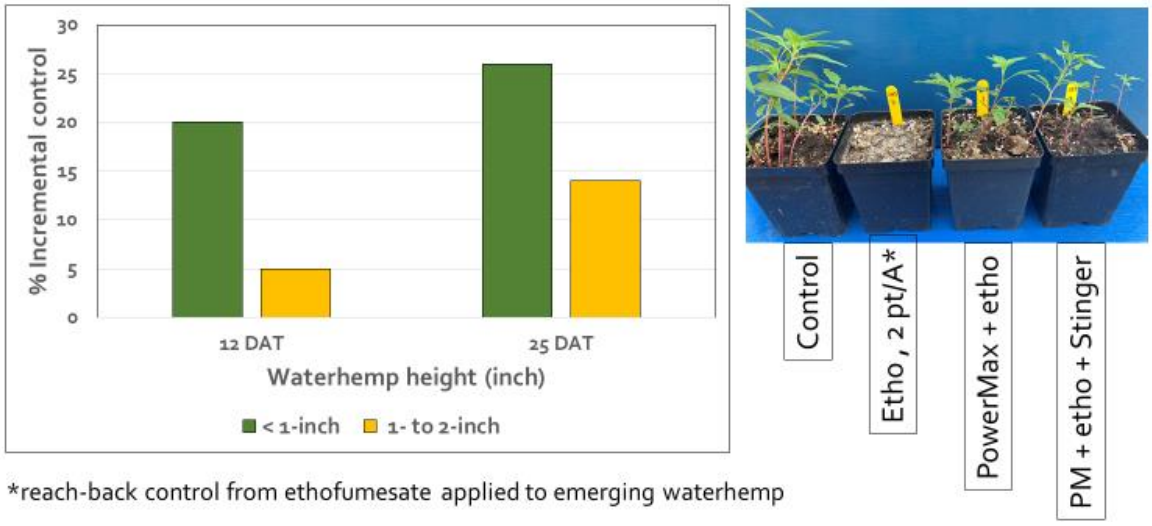

Figure 1. Stinger at 3 fl oz/A with PowerMax and ethofumesate improves waterhemp control compared to PowerMax and ethofumesate alone, greenhouse, 2021.

Some producers have access to Betamix. Betamix is effective on pigweed species such as waterhemp but becomes less reliable once watehemp are greater than 2-inch tall. Betamix rate is dependent on waterhemp size and sugarbeet growth stage. Apply Betamix in at least 15 gpa water carrier and nozzles delivering good coverage. Betamix can be applied in mixtures but be careful of complex mixtures that may increase sugarbeet injury.

MOST COMMON SUGARBEET WEED CONTROL QUESTION, WEEK OF MAY 10

Question. Why is there so much common ragweed and how can I control common ragweed in sugarbeet?

Common ragweed germinates and emerges deeper than small seeded broadleaf weeds like common lambsquarters, redroot pigweed, and waterhemp. Dr. Joe Ikley, NDSU Extension Weed Control Specialist, indicates common ragweed is germinating from approximately a 2-inch depth in the soil. This is much deeper than where lambsquarters and pigweed germinate, and the ragweed is probably germinating in moisture. Common ragweed emerges in the spring after kochia and lambsquarters but before pigweed species.

Common ragweed has become more widespread with the increase in soybean and dry bean in Minnesota and North Dakota. Common ragweed is not controlled by group 15 herbicides (chloroacetamides), and fields with ALS (group 2) and glyphosate (group 9) resistant common ragweed biotypes are frequent. There were few POST options for common ragweed control before the advent of group 4 and group 10 tolerant soybean traits. Common ragweed remains viable in the seed bank longer than pigweed species.

In sugarbeet, Stinger or Stinger HL (clopyralid, group 4) are our most affective herbicides for controlling common ragweed. Stinger should be applied at 3 fl oz/A or Stinger HL should be applied at 1.8 fl oz/A when common ragweed is less than 2-inch tall. Be prepared for a repeat application 14 days after the first application.

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NDSU & U of MN

plant pathology

SUGARBEET PLANT POPULATION FOR HIGHEST RECOVERABLE SUCROSE

Researchers at North Dakota State University and the University of Minnesota have demonstrated that a wide range of plant populations that are uniformly spaced resulted in high tonnage and recoverable sucrose, but plant populations of 175 to 200 plants per 100 foot of 22-inch wide rows consistently resulted in the maximum recoverable sucrose per acre. It was critical that the plants were evenly spaced within the rows to facilitate harvesting.

Figure 1. Picture of late planted and earlier planted sugarbeet. Research done at NDSU indicated that earlier planted populations of 75 to 100 plants/100' row will provide higher recoverable sucrose than higher populations planted three weeks later.

Populations lower than 100 plants /100 ft of row took a longer time for the canopy to cover the soil resulting in emergence of weeds later in the season. However, weed control is currently not a major problem since most growers effectively use glyphosate combined with soil applied herbicides in their operations.

Most growers were able to complete planting by early May. However, dry conditions in some areas have resulted in less than ideal populations. It is recommended that producers who planted early with populations of 75 to 100 evenly spaced plants should not replant. Research done at NDSU indicated that populations of 75 to 100 plants per 100 ft of row had greater yields than higher populations that were planted three or more weeks later in the growing season (Figure 1). Growers with less than ideal populations should consult with their agriculturist and be advised whether replanting is necessary. The grower should consider whether the variety of seed suitable for his/her field is available, and whether conditions are conducive for replanting – is there adequate moisture for germination and emergence? Any replanting of sugarbeet because of poor stands should be considered carefully.

The use of cover crops such as oats, barley and wheat helps to prevent reduction in sugarbeet plant stand from high winds, reduce soil erosion and also helps to conserve moisture after they are killed-off with herbicide. Growers are encouraged to use cover crops especially in fields that are known to have a history of 'blowing' during high wind events that is common in spring. In areas where beets have emerged, growers should be proactive, scout fields for weeds and take necessary measures to control weeds to avoid competition of the sugarbeet crop with weeds.

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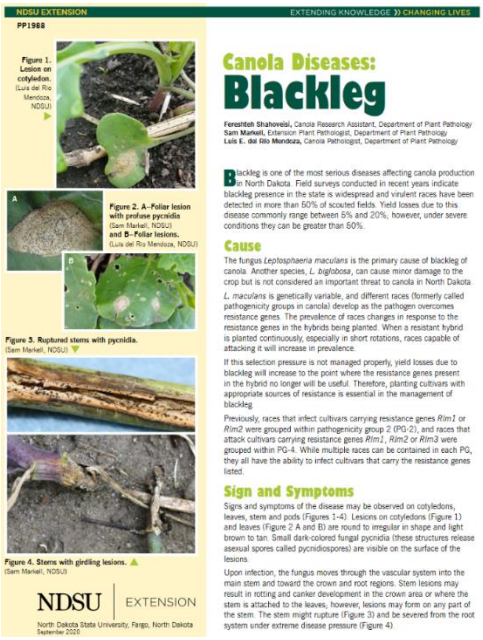
NEW CANOLA PATHOLOGY PUBLICATIONS

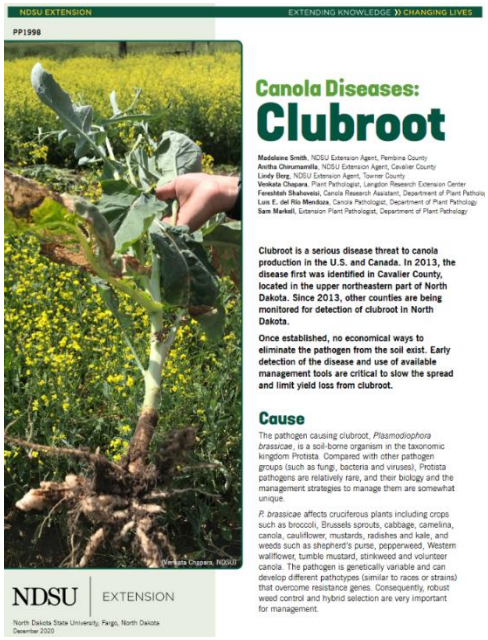
Three new disease management circulars were published in the fall of 2020. Each two to four page publication is designed to help growers identify and manage the three most important canola diseases in the state; blackleg, clubroot and white mold (Sclerotinia stem rot). We thank the Northern Canola Growers Association for their support.

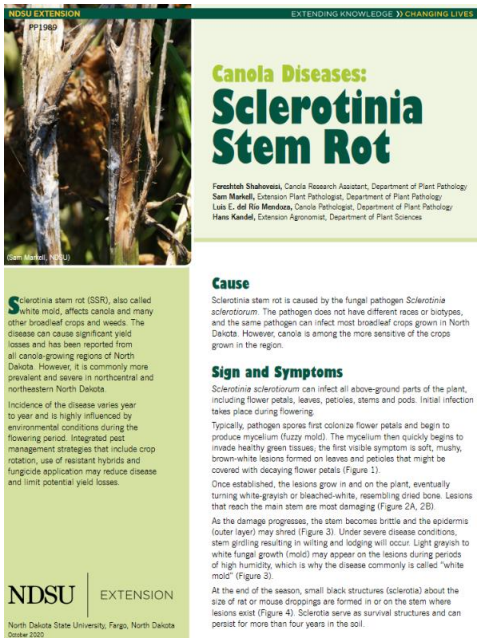
Canola Diseases: Blackleg – PP1988 (Sept. 2020)
https://www.ag.ndsu.edu/publications/crops/canola-diseases-blackleg

Canola Diseases: Clubroot – PP1998 (Dec. 2020)
https://www.ag.ndsu.edu/publications/crops/canola-diseases-clubroot

Canola Diseases: Sclerotinia Stem Rot – PP1989 (Oct. 2020)
https://www.ag.ndsu.edu/publications/crops/canola-diseases-sclerotinia-stem-rot







Sam Markell
Extension Plant Pathologist, Broad-leaf Crops

WHEAT DISEASE PUBLICATIONS AND UPDATES

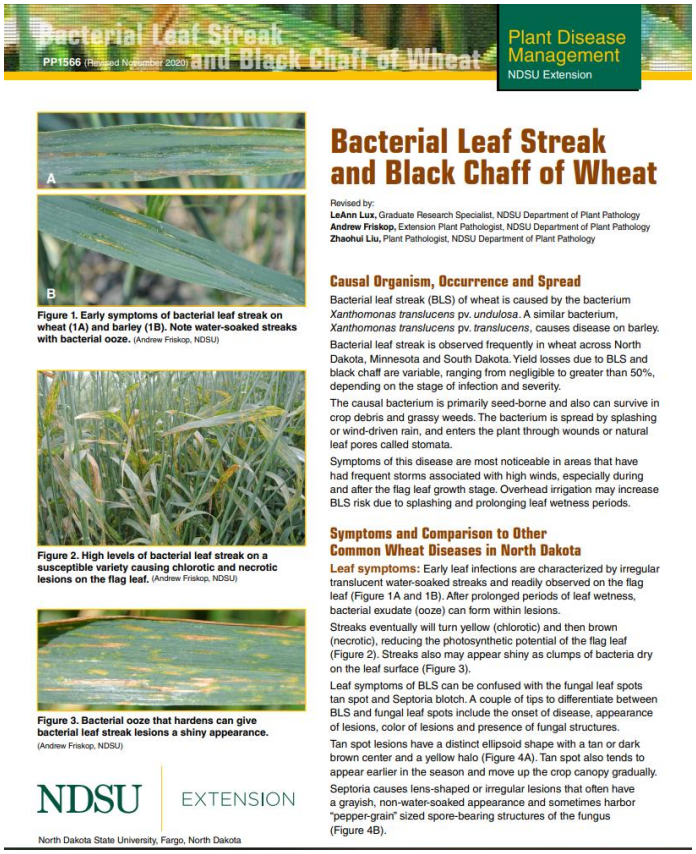
Two NDSU wheat Extension publications on bacterial leaf streak and rust diseases were updated this winter and are now available for download. Both of the publications have updated information on tools that can be used to manage these diseases.

Bacterial leaf streak is becoming more prevalent in North Dakota and was found in 27% of the hard red spring wheat fields scouted between flag leaf and early flowering in 2020. Results from 2020 field research funded by the North Dakota Wheat Commission indicated that that yield loss can vary with bacterial leaf streak ranging from 9% to over 30%. Prevalence of leaf rust and stripe rust can be sporadic because both diseases are dependent on southerly

winds (and rainstorms) to carry spores into the state. Currently, there are widespread rust reports of stripe rust in Kansas and as far north as east central Nebraska. It is possible that we may see an early arrival of stripe rust in North Dakota this year, and it will be important to monitor stripe rust reports in the coming weeks, especially from South Dakota.

Bacterial Leaf Streak and Black Chaff of Wheat – PP1566 (Nov. 2020)
https://www.ag.ndsu.edu/publications/crops/bacterial-leaf-streak-and-black-chaff-of-wheat/pp1566.pdf

Rust Diseases of Wheat in North Dakota –PP1361 (Nov. 2020)
https://www.ag.ndsu.edu/publications/crops/rust-diseases-of-wheat-in-north-dakota/pp1361.pdf



Bacterial Leaf Streak and Black Chaff of Wheat
PP1566 (Revised November 2020)
Plant Disease Management
NDSU Extension

Figure 1. Early symptoms of bacterial leaf streak on wheat (1A) and barley (1B). Note water-soaked streaks with bacterial ooze. (Andrew Friskop, NDSU)

Figure 2. High levels of bacterial leaf streak on a susceptible variety causing chlorotic and necrotic lesions on the flag leaf. (Andrew Friskop, NDSU)

Figure 3. Bacterial ooze that hardens can give bacterial leaf streak lesions a shiny appearance. (Andrew Friskop, NDSU)

NDSU EXTENSION
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Bacterial Leaf Streak and Black Chaff of Wheat

Revised by:
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Causal Organism, Occurrence and Spread

Bacterial leaf streak (BLS) of wheat is caused by the bacterium *Xanthomonas translucens pv. undulosa*. A similar bacterium, *Xanthomonas translucens pv. translucens*, causes disease on barley.

Bacterial leaf streak is observed frequently in wheat across North Dakota, Minnesota and South Dakota. Yield losses due to BLS and black chaff are variable, ranging from negligible to greater than 50%, depending on the stage of infection and severity.

The causal bacterium is primarily seed-borne and also can survive in crop debris and grassy weeds. The bacterium is spread by splashing or wind-driven rain, and enters the plant through wounds or natural leaf pores called stomata.

Symptoms of this disease are most noticeable in areas that have had frequent storms associated with high winds, especially during and after the flag leaf growth stage. Overhead irrigation may increase BLS risk due to splashing and prolonging leaf wetness periods.

Symptoms and Comparison to Other Common Wheat Diseases in North Dakota

Leaf symptoms: Early leaf infections are characterized by irregular translucent water-soaked streaks and readily observed on the flag leaf (Figure 1A and 1B). After prolonged periods of leaf wetness, bacterial exudate (ooze) can form within lesions.

Streaks eventually will turn yellow (chlorotic) and then brown (necrotic), reducing the photosynthetic potential of the flag leaf (Figure 2). Streaks also may appear shiny as clumps of bacteria dry on the leaf surface (Figure 3).

Leaf symptoms of BLS can be confused with the fungal leaf spots tan spot and Septoria blotch. A couple of tips to differentiate between BLS and fungal leaf spots include the onset of disease, appearance of lesions, color of lesions and presence of fungal structures.

Tan spot lesions have a distinct ellipsoid shape with a tan or dark brown center and a yellow halo (Figure 4A). Tan spot also tends to appear earlier in the season and move up the crop canopy gradually.

Septoria causes lens-shaped or irregular lesions that often have a grayish, non-water-soaked appearance and sometimes harbor "pepper-grain" sized spore-bearing structures of the fungus (Figure 4B).

Rust Diseases of Wheat
PP1361 (Revised November 2020)
Plant Disease Management
NDSU Extension

Rust Diseases of Wheat in North Dakota

Revised by
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Andrew Friskop, Extension Plant Pathologist
Upinder Gill, Rust Pathologist

wheat leaf rust

Figure 1. Leaf rust. (Andrew Friskop, NDSU)

disease cycle

Figure 2. Leaf rust disease cycle. (NDSU graphic)

Three rust fungi have the potential to infect wheat and cause economic damage in North Dakota. Wheat leaf rust is the most common rust disease observed. Stem rust historically caused severe losses, but resistant varieties have made this disease rare in recent decades. Stripe rust is observed when relatively cool springs and summers occur.

Wheat Leaf Rust

Wheat leaf rust, caused by the fungus *Puccinia triticina* (formerly *recondita* f. sp. *tritici*), reduces wheat yields in susceptible varieties when weather conditions favor rust development and spread. The most characteristic signs of the leaf rust pathogen are rusty-red spores found in round to oval pustules breaking through the leaf surface (Figure 1). These spore masses are detected first on wheat in North Dakota in late May or early June, generally in the southern-most counties, and on lower leaves where higher humidity and longer dew periods occur.

Disease cycle: Leaf rust develops early in the spring on wheat grown in the southern U.S. Spores are carried by wind currents northward across the Great Plains as the wheat crops develop (Figure 2).

Leaf rust epidemics occur when the following factors are present: presence of viable spores, susceptible or moderately susceptible varieties are grown, periods of prolonged moisture (dews) and favorable temperatures

NDSU EXTENSION
North Dakota State University, Fargo, North Dakota

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soils

HOW MUCH TOPSOIL LOSS IS ENOUGH?

Wind and water are the main causes of topsoil loss. However, recently tillage has been identified as an additional cause as tillagenot only removes topsoil from agricultural fields but it actually increases the intensity and rates of wind and water erosion (Figure 1). Loss of topsoil due to tillage can increase to severe levels if weather is windy, especially at high speeds and soils are dry. Tillage equipment breaks down soil aggregates into smaller, finer particles which then become airborne in wind and blow away.

A recent use of tillage in fall and spring was to dry the soils faster in spring for early plating. However, not only was it dry in fall-2020 but, so far, in spring-2021 it has been very dry as well. Tilling soils this spring has resulted in evaporation of the little bit of moisture which was there, increased wicking up of groundwater that has deposited excess salts and sodium at or near soil surface and has produced clouds of precious topsoil blowing away. This airborne soil ends up in fields or areas where the wind velocity is lower compared to the original wind velocity that made the soil particles airborne. Some coarser particles drop into neighboring fields or ditches, however, the finer mineral and organic matter particles may go up to hundreds of miles away (Figure 2).

Cihacek et al. (1992, 1993) reported an average of 150 parts per million or ppm (about 300 lbs. per acre) of nitrogen (N) in wind erosion sediments deposited at 34 sites in road ditches of the Red River Valley. Most of this N appeared to be from spring broadcast applications of N fertilizers. The fertilizer materials were abraded by wind movement of soil particles and were carried along with the soil particles from the field. In some instances, pre-plant herbicides were also found in the sediments.

When settled in ponds, lakes, rivers and streams, the soil sediments produced poor water quality for humans and livestock alike. In a nutshell, topsoil should stay where it belongs!

Long-term effects of tillage disturbance are especially evident on hilltops (Figure 3). Consistent dragging of topsoil from hilltops to the lower grounds result in hilltops devoid of organic matter resulting in poor stands and yields. This is called “tillage erosion”. The movement of soil is nearly always downhill due to speed of the tillage equipment and gravity. The

Figure 1. May 12, 2021. Tillage in operation causing a cloud of topsoil blowing away in Cavalier County, N.D.

Figure 2. May 12, 2021. Finer particles of topsoil and organic matter blowing away during windy and dry weather in Cavalier County, N.D.

Figure 3. May 17, 2021. Long-term tillage resulting in dragging of topsoil from hilltops to the lower ground causing tillage-erosion, in addition to wind-erosion in Grand Forks County, N.D.

movement of tillage equipment lifts the soil into the air while gravity pulls the soil particles downhill. The speed of the tillage equipment also provides a forward velocity to the soil particles moving the soil in the direction that the equipment is moving.

If planting no-till was ever an option, it was 2021. Understandably, tillage cannot be eliminated overnight. There could be a need for some tillage for incorporating pre-plant herbicides required for controlling resistant weeds that have already germinated or to manage residual straw for a better seedbed if planters are not designed to handle it. However, producers need to seriously consider the loss of moisture and topsoil versus other objectives in a spring like this. Rock rolling on tilled, loose soil is another management decision, which can cause havoc when it comes to topsoil loss versus potential equipment damage in fall due to rocks. Rolling crushes the soil roughness and aggregates to a point that the wind velocity at the soil surface is not reduced. Thus, the energy imposed by the wind on the soil surface can lift and move soil particles more easily. A tilled, smooth soil is more likely to blow away compared to a tilled, rough soil.

So the million dollar question is: **how much topsoil we are losing per acre?**

Roughly, topsoil having thickness of a dime is five-tons per acre. Considering the erosion events that have happened this spring, some fields have lost several inches of topsoil. Since topsoil depths in our fields are seldom more than six-inches deep to begin with (a sorry shadow of the two to three feet present in 1880) a loss of any topsoil is serious. As per a general rule with the present topsoil depth on most fields of soil productivity by soil depth, if a field lost half of its topsoil, it will lose 35 percent of its relative productivity. One might consider it as losing 35 percent of the land value if land value is related to soil productivity.

So what can producers do to minimize the loss of topsoil?

- Avoid unnecessary tillage. If you think that you can do without another tillage pass or operation, do not do it. Everything helps!
- If planting no-till or strip-till is an option, think seriously about it.
- Once you are caught up with field work, consider planting shelterbelts.
- If fall is dry, avoid any tillage in the fall. A lot of producers tilled dry fields in 2020-fall thinking that 2021-spring will be wet. They are forced to till now as ground is cloddy.
- If weather stays dry in summer and fall, let volunteers grains grow after harvest. In some cases letting non-resistant weeds can also help as long as they do not go to seed. Roots of volunteer plants and crop stubble will hold the topsoil at its rightful place.

In summary, reducing tillage, leaving a cover of crops or crop residues or strips of standing residue, leaving the soil surface rough after tillage (such as after chisel plow tillage), establishing and maintaining shelterbelts are all practices that reduce topsoil loss to wind erosion.

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weeds

GERMINATION DEPTH OF WEEDS

Despite the ongoing dry conditions across the state, we are seeing a significant amount of summer annual weed emergence in many areas. We have received many inquiries about the abundance of waterhemp, a small-seeded weed, despite the lack of moisture in the top 1 to 2 inches of soil in eastern ND and the Red River Valley. So we decided to do a little digging into the matter. The "loose fluffy dirt" that Dr. Dave Franzen wrote about last week made for easy excavation of many waterhemp seedlings. In general, it appears that most waterhemp that is emerged has germinated from 0.5 to 1 inches below the soil surface. This is in stark contrast to most years where waterhemp typically emerges from the top 0.5 inches of soil. So why is waterhemp emerging from deeper in the soil than usual? To quote Jeff Goldblum's character in Jurassic Park: "Life, uh, finds a way".

Waterhemp seedlings emerged from various depths near Glyndon, MN. (photo by Brett Miller)

Waterhemp seedling that germinated ~0.75" below the soil surface.

Waterhemp is not the only weed emerging from deeper than expected areas in the soil. I dug up some common ragweed from our research plots near Prosper, ND and found emergence from as deep as 2 inches. Digging up other broadleaf weeds like wild buckwheat and common lambsquarters revealed germination depths from 0.5 to 2 inches for many weeds. This is not terribly surprising given the dry conditions we are facing. However, it does (and has) begged the question: what will my PRE herbicides do whenever it finally rains?

I don't need to reinvent the wheel when it comes to writing about PRE herbicide chemistry in a dry environment. So, I will reference readers to an article by Dr. Rich Zollinger back in 2016 (https://www.ag.ndsu.edu/cpr/weeds/fate-of-soil-applied-herbicides-05-26-16). What I will add to his discussion is that we need to be realistic with our expectations this year. Frankly, we will need a lot of rain to push any herbicide, let alone

a root-absorbed herbicide, deep enough into the soil profile to have any significant effect on emerged weeds. HOWEVER, we also should realize that our PRE herbicides will be ready to help control those weeds that have not yet germinated in the top 1 to 2 inches of soil. So if and when it rains, many may be looking at a situation where it appears the PRE has "failed" because there are many emerged weeds in a field. But the reality is that it would be much worse without that herbicide application. There is still a great value to any PRE that was applied this year, but we should be aware that weeds will escape, and we need to be ready to pull the trigger on a POST application to clean up these weeds that have emerged from deeper in the soil profile.

Common ragweed seedling that emerged from ~2" below the soil surface.

Joe Ikley
Extension Weed Specialist

DRY SOILS AND LOW HUMIDITY WILL IMPACT AIR TEMPERATURE INVERSION TIMING, DURATION, AND INTENSITY

North Dakota's drought situation continues to grip most of the state. Because soils are drier than normal, they do not absorb as much solar radiation during daytime hours. Further, the atmospheric relative humidity is lower than what we typically experience. That is why we have recently observed relatively cold nighttime lows with repeated frosts. Indeed, Daryl Ritchison, NDSU NDAWN Director, has been warning for several weeks that we may expect more intense frosts and later frosts than normal well into May and beyond.

For pesticide applicators, it means inversion timing, duration, and intensity will be significantly influenced by the dry weather.

Timing and Duration. In general, inversions develop sometime after the day-time high temperature has been reached. In a typical year, inverted temperatures can be detected three to four hours before sunset. However, in a dry year, an inversion will begin earlier than normal, perhaps one to two hours earlier. On the flip side, in the morning, an inversion will dissipate faster. Instead of one to two hours to restore neutral conditions after sunrise, it may only take 30 to 90 minutes. In drier conditions, applicators are going to encounter a shorter spray window because inverted temperatures will likely exist well into the afternoon and throughout the evening hours.

Intensity. With low relative humidity in the atmosphere and our dry soils, the intensity of inversions will be greater. Three to five-degree F spreads between temperature probes set at three and ten feet above the ground are common, especially on calm clear nights in a normal year. However, under dry conditions the spread could easily go to ten degrees F or more. (Indeed, the NDAWN Logan Center Station in Grand Forks County recorded a ten-degree F inversion on May 10.) When you have that level of intensity it will have a major impact on fine spray droplets. Spray drops will be firmly suspended in the relatively dense cool air near the ground and then easily be moved downrange in light winds.

You can read more details on inversions by downloading: Air Temperature Inversions Causes, Characteristics and Potential Effects on Pesticide Spray Drift (AE1705, Revised Oct. 2019).

Finding acceptable weather to spray any pesticide is challenging, unfortunately the dry weather we are experiencing is going to add another complication from stronger and longer air temperature inversions. The good news

is, through NDAWN, we have excellent tools to monitor them and we also can be alerted via cellphone when they exist. Simply type "NDAWN Inversion" into your favorite app store search and you can download, install, and setup real-time alerts for a station near you.

Andrew A. Thostenson
Pesticide Program Specialist

horticulture

CLOVER MITES IN HOMES

Do you see small dots moving around on the inside of your window sill or climbing up the sides of the house on the sunny-side (south or west)? You are not seeing things. These are probably tiny clover mites called *Bryobia praetiosa*. These reddish-brown mites are cool-season mites and are active in spring and fall. They can be identified by their front legs that are about twice as long as the body and the other legs. Thousands of clover mites can invade a house through cracks in foundations or by crawling through the screens. They do not bite or sting people or pets. When crushed, they cause a blood-red spot that may stain the walls, curtains or carpets.

Clover mites feed on the plant juices of turf grasses, clover and even certain trees or shrubs. They are more common in newly established lawns or older lawns that have been heavily fertilized. For control, caulking any cracks or openings in the foundation will help prevent mites from getting into the house. A grass-free zone of 18-24 inches around the base of the house also can be an effective barrier against mites. Landscape rocks are not effective barriers to clover mites. Some plants are not attractive to clover mites including zinnia, marigold, salvia, rose, chrysanthemum, petunia, juniper, spruce, arborvitae and yew. These plants can be planted in the grass-free zone.

Insecticides registered for mite control and outside use around the house can be applied as a perimeter treatment around the base of the house, windows or doors to reduce mite infestations. Insecticide should be sprayed 3 feet up the side of the house and 3 feet out from the base. Applications should be applied during the warm part of day and concentrated in the area where mites are entering the house, such as the south side. Two insecticide active ingredients that are effective against mites are bifenthrin and malathion. There are many different trade names of insecticides for use the home owner. So, look for the correct active ingredient on the label on the back of bottle. The homeowner should be able to find these two active ingredients at any garden supply store. A vacuum or damp rag can be used to remove mites from inside the house.

(Revised article from May 17, 2018 issue of the NDSU Extension Crop & Pest Report)

Clover mite (R. Lehman, PA Dept. Ag., Bugwood.org)

Clover mites on landscaping rocks (Mike & Jackie Knodle)

Janet J. Knodel
Extension Entomologist

around the state

AROUND THE STATE

NORTH CENTRAL ND

A dry pattern continues to hold tight over the north central region of North Dakota. Some hit-and-miss showers were observed in the area over the last few days, though, small amounts were recorded. However, there appears to be chances of moisture in the short term forecast towards the end of the week. With that said, here are some quick precipitation reports as observed by some area NDAWN stations over the last week (beginning May 10th): Minot: 0.02”; Bottineau: 0.01”; Garrison: 0.00”; Karlsruhe: 0.02”; Mohall: 0.00”; Plaza: 0.00”; and Rugby: 0.03”. Additionally, the bare soil temperature at the NCREC is observed at 68 degrees F.

As of May 17th, planting continues throughout much of the north central region of the state. The NCREC

Figure 1. Spring wheat conditions in the north central region

agronomy teams are hoping, weather permitting, to wrap up planting this week with some soybean and sunflower still to be planted. Pre-emergence herbicides continue to be applied when winds are low. Pennycress, mustards, and kochia are some of the weeds that are being observed. Spring wheat has been observed in several variable conditions across the region. As shown in the accompanying figure (clockwise from top-left), we can see a well-established wheat field;

uneven wheat emergence due to deep planting; emerged wheat showing symptoms of exposed fluctuating temperatures at the soil line with yellow and green color bands; uneven and delayed emergence resulted from soil crusting.

The Good Bugs Workshop is almost here. The deadline to register is Sunday, May 23rd. Participants will learn about supporting beneficial insects that provide pest control throughout this webinar series. Conservation biological control is a science-based pest management strategy that seeks to encourage beneficial insects back into cropping systems for natural pest control, ultimately rewarding farmers with economically-viable pest management systems. Due to the COVID Pandemic, this year's events will be virtual. The cost is free; however, pre-registration is required. To register, email TJ at travis.prochaska@ndsu.edu or use the QR code below.

Scan to register for the Good Bugs Workshop.

TJ Prochaska
Extension Crop Protection Specialist
NDSU North Central Research Extension Center

Leo Bortolon
Extension Cropping Systems Specialist
NDSU North Central Research Extension Center

NORTHWEST ND

Most farmers are wrapping up seeding and getting very close to done. For many, planting is winding down earlier than most years due to the dry weather allowing for early and quick seeding. A few scattered showers moved through the area the middle of last week, but most places recorded only a few hundredths up to 0.1" inch of rain. Very few crops have emerged, though the earliest planted fields are starting to look a little green. I expect that emergence is going to be very spotty in early-planted fields in which some seeds have enough moisture to germinate and others do not. Later planted fields may not germinate until we receive a more substantial amount of rain. Everyone is hoping the rain in the forecast happens. Currently, there is a chance of scattered thunderstorms Friday and showers over the weekend and into Monday. Rain is needed to get crops out of the ground in many fields. Temperatures will be lower with highs in the 50's and 60's over the weekend and into next week with the cold front and storms moving through, but we are expected to warm back up late next week.

Clair Keene
Extension Cropping Systems Specialist
NDSU Williston Research Extension Center

SOUTH-CENTRAL/SOUTHEAST ND

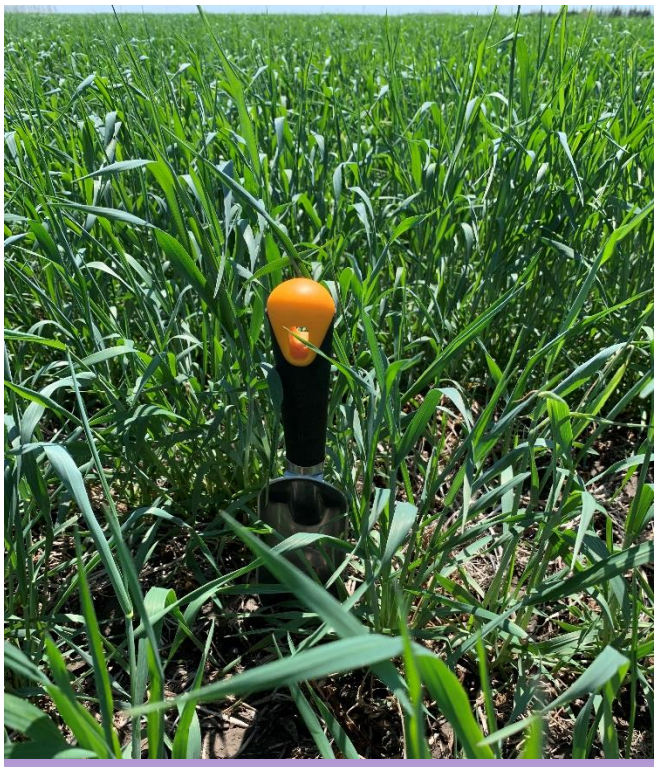
According to NDAWN, the region's rainfall during May 1 through 17 totalled one inch in McIntosh County (Zeeland), while many other locations received one-third inch or less. If you are reading this article on May 20, hopefully you also are watching it rain (as earlier forecasted)!

Alfalfa regrowth at the CREC is at ≤8-inch height. Winter rye and winter wheat growth stages range from tillering to emerging flag (see picture). Most advanced spring-planted small grain are tillering. Plant densities are variable with dieback occurring in some fields due to dry topsoil. Corn and soybean planted acres are at 75% or greater. April-planted corn is emerging.

Prominent annual weeds at the CREC include wild buckwheat, common lambsquarters and foxtail, and pigweed species have started to emerge. Leafy spurge bracts are out and flowers are starting to open.

The following are NDSU's guidelines for dry bean plant populations by row spacings:

- Black - 90,000 to 120,000 plants/A (across rows)
- Navy - greater than 115,000 plants/A with 22-inch rows or narrower; 90,000 plants/A with wide rows
- Pinto - greater than 80,000 plants/A with 18- to 22-inch rows (preliminary; trials continue in 2021 at Carrington and Langdon RECs); 70,000 plants/A with wide rows



Growth stage on May 17 of CREC irrigated winter rye field for seed production.

If winter rye was planted last fall as a cover crop on land to be planted to dry bean this spring, carefully monitor topsoil moisture and consider weather forecast as termination timing of rye is determined in relationship to dry bean planting. Considering our lack of topsoil moisture, it would be wise to terminate rye with glyphosate as soon as possible. As an example, in four years (2017-20) of research at the Carrington REC, all years with relatively dry springs, pinto bean yield was reduced an average of about 25% when 'planting green' (beans planted into living rye) compared to terminating rye at least two weeks before bean planting. In dry conditions, delaying rye termination allowed the cover crop to remove topsoil moisture needed to timely establish the bean crop.

2020 rye/pinto bean trial – Left: beans with rye terminated several weeks before planting; Right: beans with rye terminated at planting time.

Greg Endres
Extension Cropping Systems Specialist
NDSU Carrington Research Extension Center

SOUTHWEST ND

Canola in the region is emerging and with it comes heavy flea beetle activity. Rainfall events over the past week were very short lived and scattered. Many are in extreme drought conditions in the area. Average soil temperatures have reached up into the 60s for much of the region. There is enough moisture for planted crops to emerge in the Dickinson area, there are reports of some in the region where seeds have not sprouted. If this continues, many will be in need of forages. Annual forage crops such as pea/barley, oat, or rye may be some valuable cropping options this year.

Ryan Buetow
Extension Cropping Systems Specialist
NDSU Dickinson Research Extension Center

weather

WEATHER FORECAST

The May 20 to May 26, 2021 Weather Summary and Outlook

Last week in my Crop and Pest Report I mentioned we would likely record a warm week with spotty precipitation. Looking at Figure 1, the spotty precipitation ended up being an appropriate term. There were clearly pockets with some good rains, yet most of the region recorded little or no rain during the past week.

Almost the entire North Dakota Agricultural Weather Network (NDAWN) recorded above average temperatures in the period from May 12 through May 18. Some parts of the northern Red River Valley were 8 to 10 degrees above average (Figure 2). This next week will probably be a bit cooler, especially across northern North Dakota, but those cooler temperatures will be associated with cloud cover and rainfall, which will be very welcomed.

Most of you have likely heard that there are rain possibilities today (Thursday) through early next week. This is the system I hinted to last week in this report. I doubt any given spot will record precipitation each day, but there will be rain impacting at least a portion of North Dakota on each day through Monday. There will likely be winners and losers as rain doesn't fall evenly and there will very likely be locations that won't get as much as they would like. Yet, having said that, this looks to be the most widespread rain in a very long time. Plus, the rains

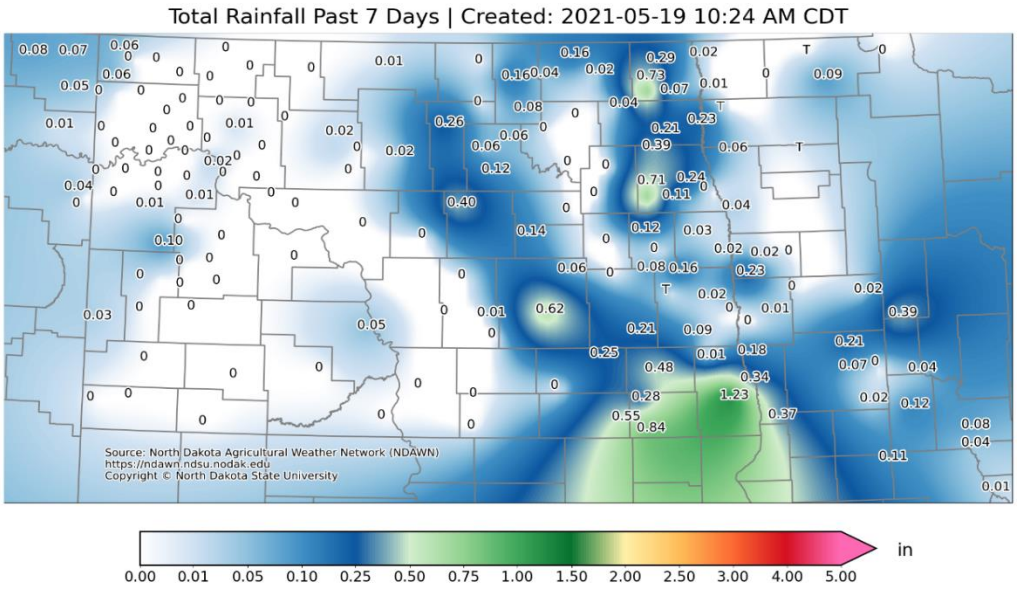


Figure 1. 7 Day (168 hours) Rain Totals at NDAWN station through 10:30 AM, Wednesday, May 19, 2021

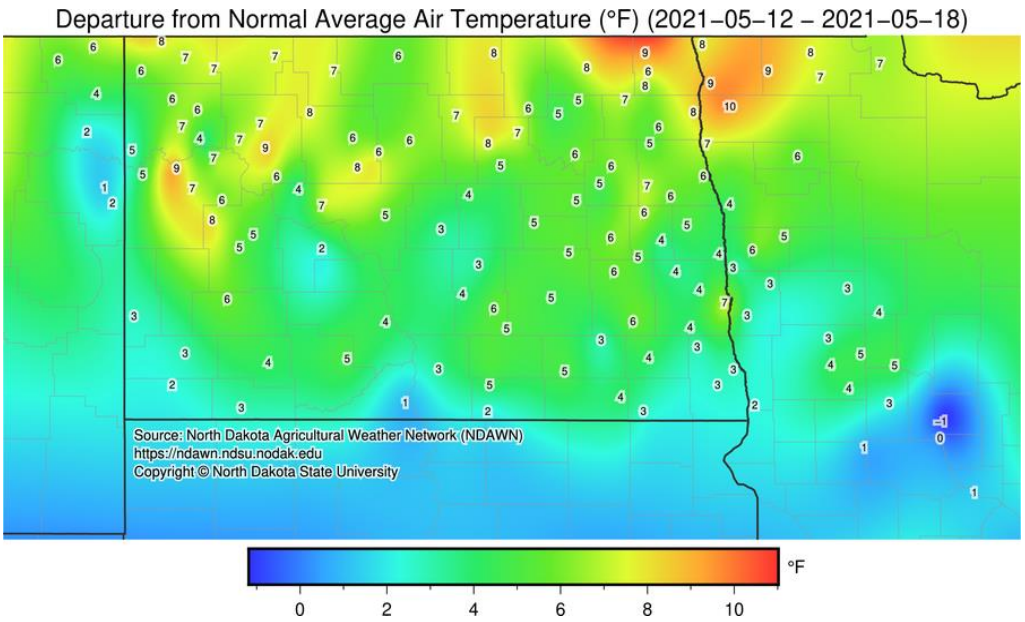


Figure 2. Departure from Average temperature at selected NDAWN weather stations for the period of May 12 through May 18, 2021.

will come over several days, so if you don't get much today, there will be other opportunities. After this stretch of rain chances, I would not be surprised if another system impacts us toward the end of next week as this temporary pattern change looks to be lasting for 7 to 10 days.

The projected growing degree days (GDDs) base 50°, 44° and 32° for the period of May 20 through May 26, 2021 can be found in Figure 3.

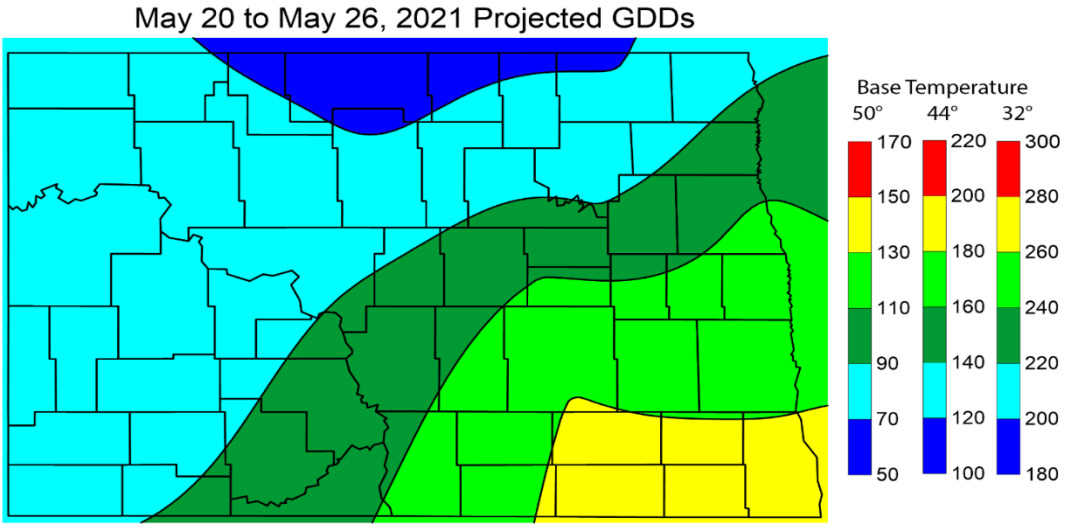


Figure 3. Projected Growing Degree Days, Base 32°,44° and 50° for the period of May 20 to May 26, 2021

Using May 1 as a planting date, accumulated growing degree days for wheat (base temperature 32°) is given in Figure 4. You can calculate wheat growing degree days based on your exact planting date(s) here: https://ndawn.ndsu.nodak.edu/wheat-growing-degree-days.html

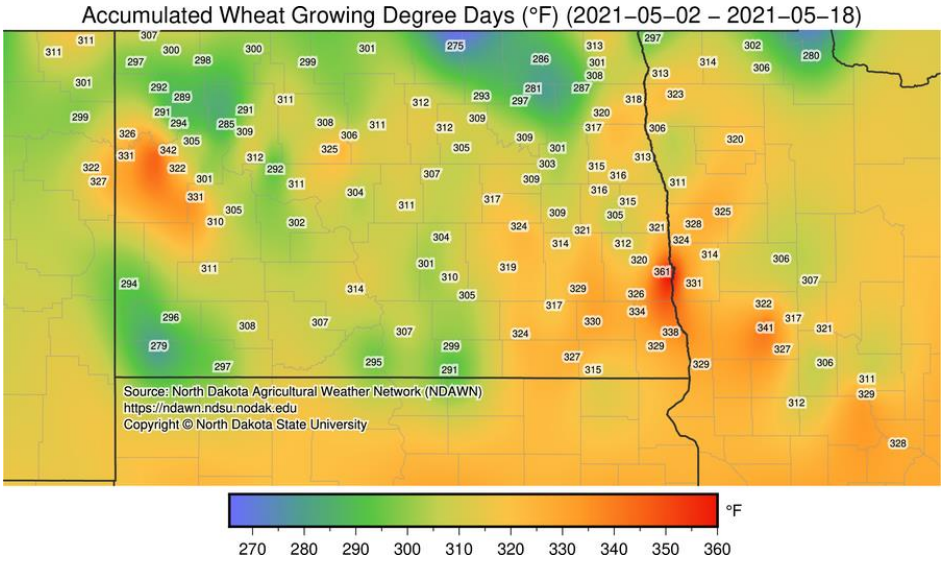


Figure 4. Accumulated Growing Degree Days for Wheat (Base 32°) since May 1,

Using May 10 as a planting date, accumulated growing degree days for corn (base temperature 50°) is given in Figure 5. You can calculate corn growing degree days based on your exact planting date(s) here: https://ndawn.ndsu.nodak.edu/corn-growing-degree-days.html.

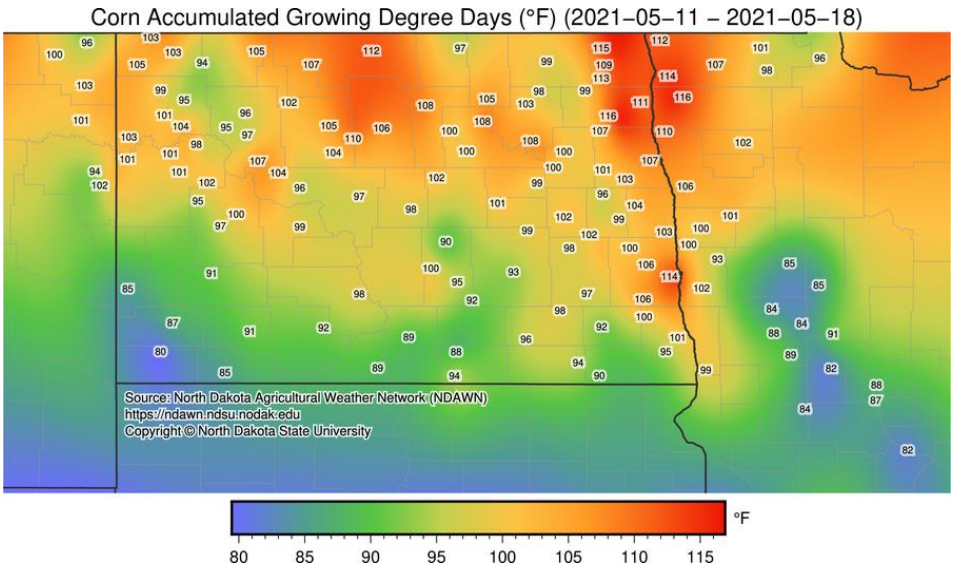


Figure 5. Accumulated Growing Degree Days for Corn (Base 50°) since May 10,

Soybeans also use base 50° like corn, but NDAWN has a special tool for soybeans that, based on your planting date and cultivar, it can estimate maturity dates based on average temperatures, as well as give you GDDs based on your planting date(s) you set. That tool can be found here: https://ndawn.ndsu.nodak.edu/soybean-growing-degree-days.html

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EXTENDING KNOWLEDGE ❯❯ CHANGING LIVES

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