North Dakota State University
CROP & PEST REPORT
NDSU EXTENSION

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entomology

ALFALFA WEEVIL SCOUTING

Alfalfa weevil adults (Fig. 1) have just started emerging in southeast and southwest areas of North Dakota according to the degree day model for alfalfa weevil, which uses a degree base of 48 degrees F. The total accumulated degree days (ADD) for adult activity is 155 to 344 ADD (NDAWN insect degree day map, next page).

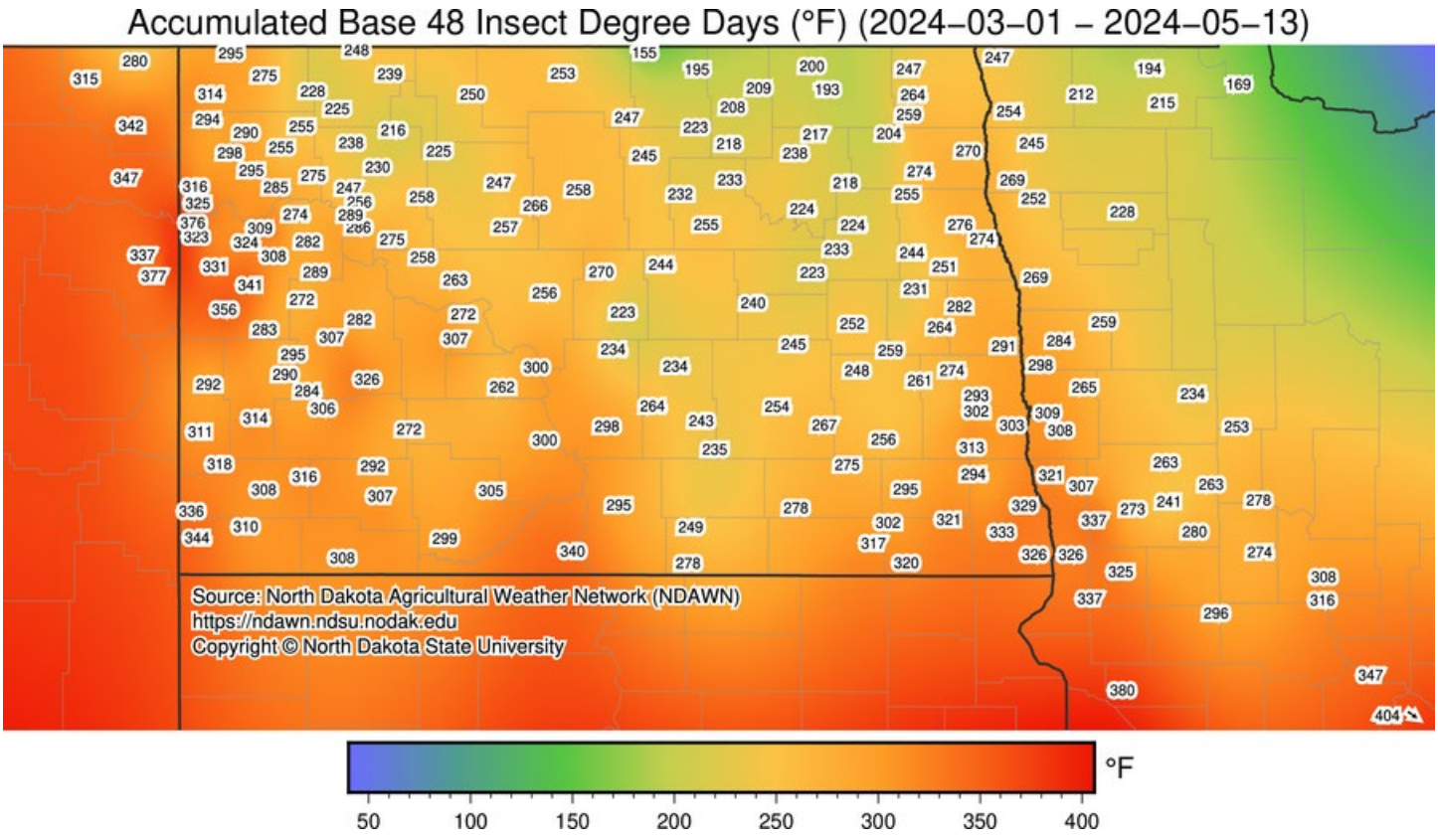
Adult alfalfa weevils overwinter in shelterbelts and wooded areas outside the alfalfa field. Adults are only ¼ inch long, brown with a distinctive dark brown stripe running down the center of the back (Fig. 1). Antennae are elbowed, clubbed and the snout is blunt.

Figure 1. Alfalfa weevil adult (Adam Sisson, Iowa State University, Bugwood.org)

Alfalfa weevil larvae have four instar stages (growth stages). Mature larvae (Fig. 2) are about $^{3}/_{8}$ inch long and have a black head capsule and a wrinkled green body with a white stripe running lengthwise along the top.

Figure 2. Alfalfa weevil larva (Adam Sisson, Iowa State University, Bugwood.org)

Current Alfalfa Weevil Degree-Day Accumulations (base 48°F) as of May 13, 2024 (Source: NDAWN)



The ADD in Table 1 shows the different weevil life stages and the ADD required for each stage. The first instar larvae emerge at 300 to 371 ADD and feed on the leaves causing small pinholes. As larvae mature (3-4 instar larvae) more feeding injury occurs, including heavily skeletonized leaves and even crown injury (Fig. 3). The recent moisture will help weevil damaged alfalfa fields to recover this year.

When adults and 1st to 2nd instar larvae are present (300 to 438 ADD) is a good time to start scouting for economic populations of alfalfa weevil and treat with an insecticide if necessary.

Table 1. Approximate degree day (DD) requirements for alfalfa weevil development using 48 F as the base developmental temperature.

Life Stage	DD Required to Complete Life Stage	Accumulated DD	Typical Feeding Activity
Egg hatch begins	300	300	
1st instar development	71	371	Light
2nd instar development	67	438	Light
3rd instar development	66	504	Heavy
4th instar development	91	595	Heavy
Pupation	219	814	
Adult emergence	—	>814	

In North Dakota, alfalfa weevil feeding can be managed by **cutting alfalfa early**. This is a safe strategy to preserve the natural enemies such as parasitic wasps that attack and kill weevil larvae. Some parasitic wasps that have been introduced in the U.S. to control alfalfa weevil include: *Anaphes luna, Bathyplectes anurus, B. curculionis* and *Oomyzus incertus.*

Scouting should begin immediately after egg hatch, and fields should be scouted weekly up through the first cutting. A 15-inch sweep net is useful for finding adults and larvae in alfalfa fields.

More details on scouting and economic thresholds will be discussed next week.

Figure 3. Defoliation caused by alfalfa weevil larvae (Patrick Beauzay, NDSU Extension)

CANOLA FLEA BEETLE EMERGING

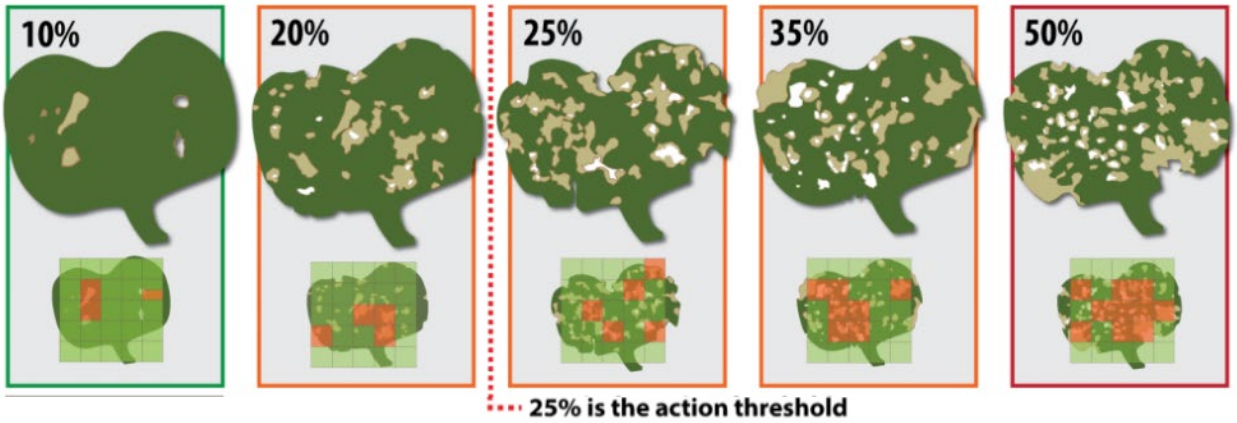
Canola planting is in full swing with about 21% planted, ahead 7% from last year and 2% was emerged (Source: USDA News Release NASS - May 13, 2024). Both the crucifer flea beetle and the striped flea beetle have been observed at the Langdon REC (Anitha Chirumamilla, Cropping Systems Extension Specialist, LREC). Other field reports were negative for canola flea beetles near Minot (Tammy Duchsherer, Scherresky Ag) and Fargo.

Flea beetles are easy to identify in the field 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 their black wing covers.

Striped flea beetle on left and crucifer flea beetle on right (Patrick Beauzay, NDSU Extension)

When canola emerges, scouting for flea beetles 2-3 times a week will be important to ensure that your canola insecticide seed treatment is effective against these hungry flea beetles. Seed treatment residual activity is often only 14-21 days after planting depending on flea beetle pressures. Feeding damage is often worst with hot temperatures, low moisture and low plant stands. Continue to scout until canola is in the 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 is warranted to prevent yield loss. Pyrethroids (3A) are the only class of insecticide registered for foliar control of flea beetles in canola (active ingredients - bifenthrin, deltamethrin, lambda-cyhalothrin, zeta-cypermethrin). One premix is labeled as Besiege (chlorantraniliprole + lambda-cyhalothrin). For insecticides registered for control of flea beetles for canola, please refer to the 2024 North Dakota Field Crop Insect Management Guide.



Source: Canola Council of Canada, https://www.canolacouncil.org/canola-encyclopedia/insects/flea-beetles/#action-thresholds-and-economic-injury

EUROPEAN CORN BORER INSIDE CORN STALKS

In southeast North Dakota, larvae have been observed inside corn stalks. This is the overwintering mature European corn borer (ECB) larva, which passes the winter in corn stalks, corn cobs, weed stems, or in other cornfield debris. When temperatures exceed 50F, the larvae continue development and will eventually pupate in late May and June. Then, moths will emerge in June and continue to emerge well into July depending on its voltinism (number of generations in a year).

European corn borer larva inside stalk (J. Knodel, NDSU Extension)

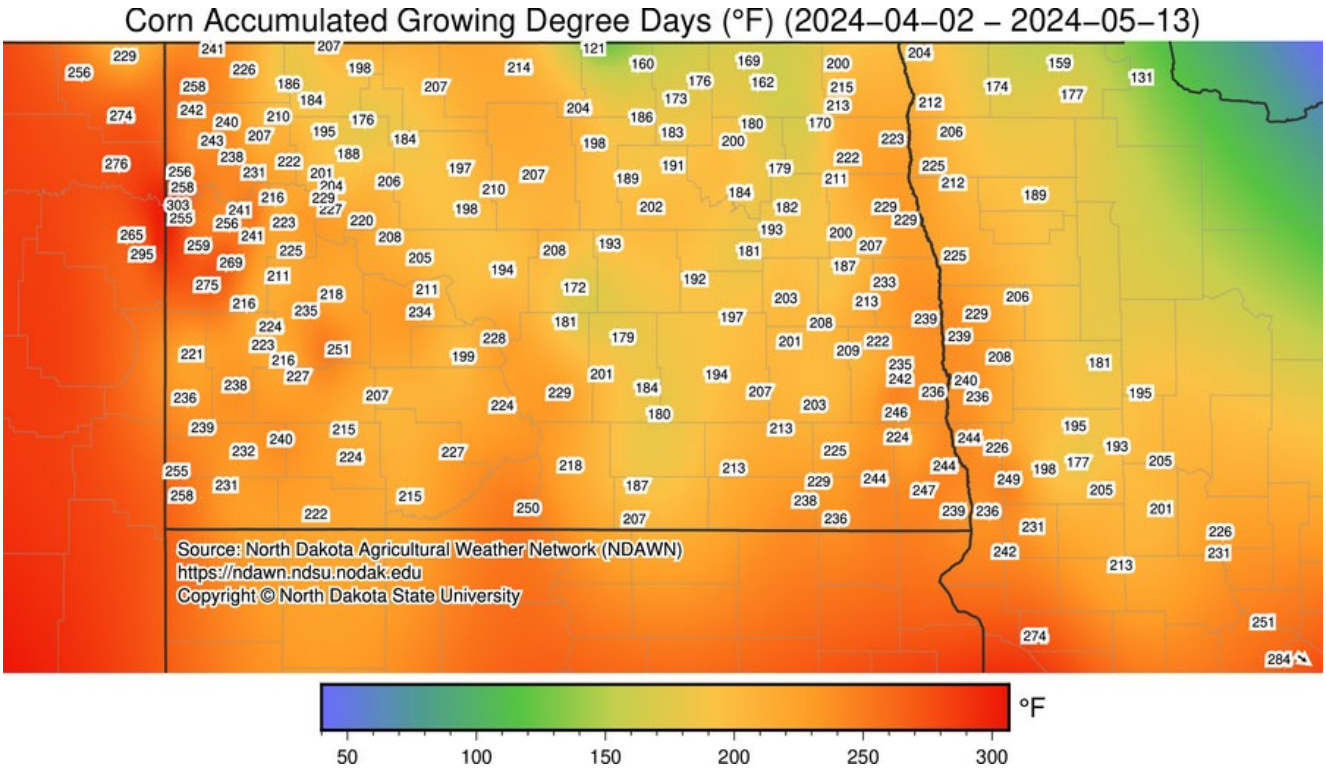
The univoltine ECB (one flight per year) is the most common ecotype of corn borer observed in North Dakota and usually peaks mid-June to mid-July. The univoltine ECBs infest corn in the pre-tassel to tassel crop stages. The bivoltine ECB (two flights per year) is less common and usually peaks early to mid-June and early to mid-August. The first flight of the bivoltine ECB infests whorl stage corn while the second flight occurs later in maturing corn and often infests corn ears-shanks. Cool weather can delay the development of borers; warm weather can accelerate borer development. Management of European corn borer in North Dakota is complicated by the presence of the two ecotypes, which results in a staggered period of moth flight and egg laying that can extend over a five-week period. Routine scouting is critical during this period.

To help identify the time for scouting for the univoltine ECB moths, a degree day model (see table on right) was developed to predict occurrence and the proportion of moths that have emerged based on accumulated degree days from April 1 when using a Max-Min, modified base 50^{0}F (this is the same method used for monitoring corn growth with Growing Degree Days). https://ndawn.ndsu.nodak.edu/corn-growing-degree-days.html

Accumulated Degree Days	Proportion of Emerged Moths
911	10 %
986	25 %
1078	50 %
1177	75 %
1274	90 %

Currently, we have a large amount of degree days to accumulate, about >600 ADD, before the ECB moths will be 10% emerged (911 ADD). Stay tuned.

Current European Corn Borer Degree-Day Accumulations (base 50°F) from April 2, 2024 to May 13, 2024 (Source: NDAWN)



WHITE BUTTERFLIES FLYING

Field reports of large numbers of white butterflies flying over fields and in ditches, especially near last year's canola fields, have been reported in the north central and northeastern areas of North Dakota. These butterflies are called the **cabbage whites or cabbage butterfly** (*Pieris rapae*). The adult butterfly is creamy white with a black wing tip on each forewing with a wing span of 1¼–1¾ inches. The female also has two black spots on each forewing whereas the male has one spot.

Cabbage white or butterfly (David Cappaert, Bugwood.org)

The caterpillar is called the **imported cabbage worm** and is a fuzzy, green, 1-inch long caterpillar with yellow lengthwise lines on its body. It can be a serious pest in your backyard gardens chewing holes in the leaves of cabbage, broccoli, Brussel sprouts, cauliflower, kale, turnips, radish, and other Cole crops. It is not known to

be an economic insect pest in canola, but the butterflies are attracted to the canola flowers for nectar and may lay eggs on the canola plant. Cabbage whites are specific to plants in the family Brassicaceae. The butterfly determines its hosts by tasting them using sensory organs on their legs!

Imported cabbage worm (Whitney Cranshaw, Colorado State University Bugwood.org)

Janet J. Knodel
Extension Entomologist

plant pathology

PREDICTIVE MODEL TOOLS IN AGRICULTURE: SPOTLIGHT ON SPORECASTER

In the evolving landscape of agriculture, predictive model tools (also known as decision support systems) have become increasingly prevalent for modern farming. These tools help farmers anticipate and manage crop diseases, pests, and other challenges with greater precision. This week I am highlighting Sporecaster, an innovative tool designed to predict the risk of white mold in soybeans. Developed at the University of Wisconsin-Madison through extensive research and collaborations across the Midwest, Sporecaster offers farmers a proactive approach to white mold management, potentially protecting yields and minimizing the number of fungicide applications needed during a given season. This tool utilizes data from various sources, including historical weather, local agronomic traits such as row spacing, and irrigation to predict the likelihood of disease outbreaks. By providing local, timely, and accurate risk assessments, these tools can enable farmers to make more informed decisions on their crop management plans.

To use Sporecaster, farmers will first create a field entry by first naming their field and then placing a pin over each of their fields (Fig. 1). Then information about their soybean fields will be inputted including the presence of soybean flowers and if canopy closure has been reached. Then the tool pulls localized weather data from cloud-based servers to predict the risk of white mold mushrooms being present. This tool will then give recommendations of whether fungicide applications should be made or not based on these weather conditions. I will note that predictive tools like Sporecaster should be used to guide decision-making rather than followed blindly, allowing for applications at lower risk levels for fields with a consistent history of high white mold incidence.

Sporecaster is free to use for all Apple and Android devices here. Field Prophet, which also offers Sporecaster models and multiple other predictive models, provides free access and allows for forecasts up to 7 days into the future. Field Prophet is available here.

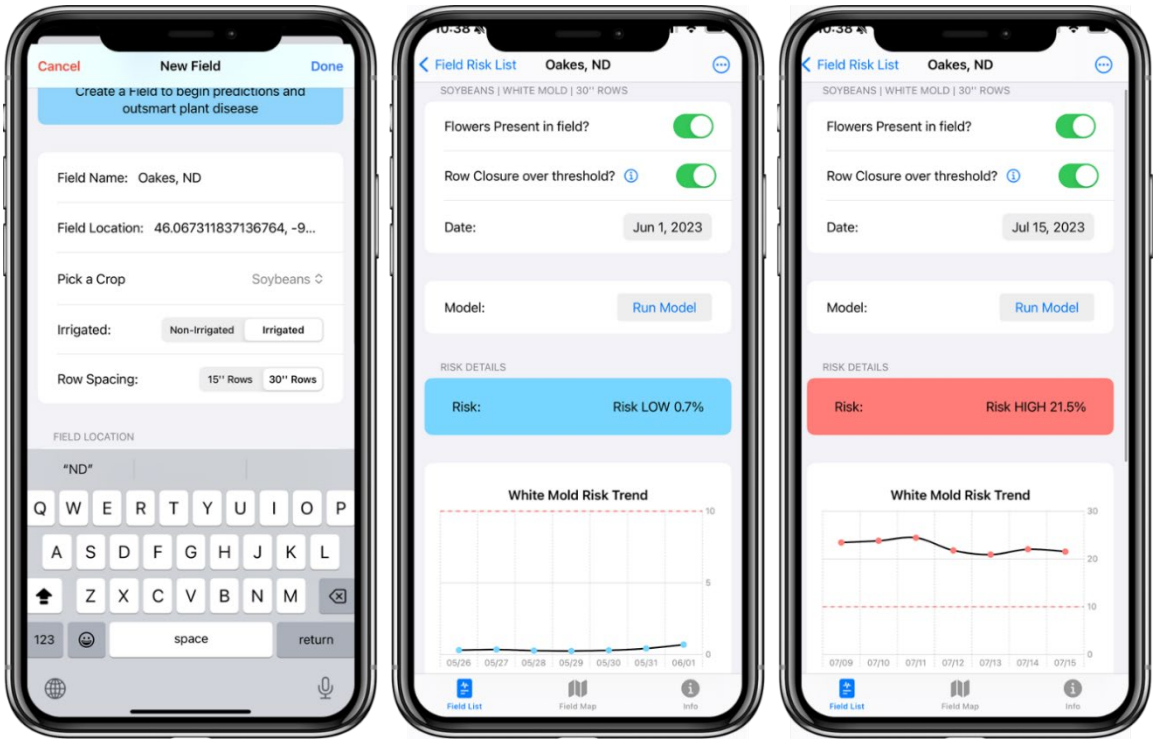


Figure 1. Using the Sporecaster tool: (Left) Setting up a new field location and crop details for Oakes, ND; (Middle) Low risk of white mold in early June when soybeans are not yet flowering; (Right) High risk of white mold during the typical flowering window in middle of July.

Wade Webster
Extension Plant Pathology, Soybeans

plant science

POTATO BACTERIAL ROT

When conditions become wet and cool, the slow growth of potato tubers can cause them to become susceptible to bacterial soft rot (Fig.1). Fresh cut seed is most susceptible to soft rot, and some varieties are more susceptible to soft rot than others. Recent weather patterns were ideal for soft rot development in potato seed that was planted prior to the rainfall. Bacterial soft rot causes plant cells to deteriorate and rot, weaken seed pieces, or prevent them from establishing a healthy canopy (Fig. 2). When a large percentage of seed have rotted, replanting could be needed. One strategy is to plant higher in the soil hill, above previous planted seed and try to plant seed in the gaps of previously planted seed. If a large percentage of seed rot has occurred, or when replanting a field, this causes plants to grow at different rates. As a result, a large size distribution of tubers can be found at harvest. When planting in wet conditions we encourage practices that encourage the quickest emergence from the soil, such as shallower planting and smaller hills. Planting whole seed or seed that has suberized will reduce the risk of bacterial soft rot.

Figure 1. Potato tuber rot caused by bacterial soft rot.

Figure 2. Plant compromised by seed borne soft rot.

Andy Robinson
NDSU/U of M Extension Potato Agronomist

WINTER RYE, THE HARVEST WINDOW FOR QUALITY FORAGE IS SMALL

Even though the Northern Plains has a short growing season, when the days begin to get long in late spring, grass growth is crazy fast! Among the cereal grains winter rye, (*Secale cereale*), has one of the fastest growth rates, quickly moving from vegetative to stem elongation and head emergence in the blink of an eye. This impressive rate of growth rate makes winter rye difficult to manage if the goal is to harvest for high quality forage.

There are three major factors that affect plant forage quality. The first is plant species, the second is plant part (leaves are higher in quality than stems) and the third is plant maturity. Within plant species, plant maturity is **the most** important factor influencing forage nutrient content. All forage plants will go from a leafy, vegetative stage that is high in protein and low in fiber (high quality) to reproductive stage that is low in protein and high in fiber (low quality). As the plant moves from vegetative high quality to reproductive low quality, plant yield is increasing. The **rate** at which plants progress from vegetative to reproductive depends on species with some plants such as legumes declining in quality at a much slower rate with increasing maturity than in a grass. Unfortunately, rye declines rapidly in quality with increasing maturity. Meaning that if you wish to capture rye at good forage quality to avoid it being 'just a grinding hay' careful attention must be paid to plant maturity.

Research conducted at the University of Minnesota and at Iowa State University both show that as rye maturity increases from vegetative to reproductive there is a linear decline in crude protein and digestibility (energy). It is also important to realize that with declines in protein and energy, the opposite is occurring with fiber content. Increasing fiber will decrease ruminant daily voluntary dry matter intake. When intake becomes limited, it also limits protein and energy intake which can then cause the ruminant animal to fall short of meeting daily nutritional requirements. If not corrected this can lead to many negative ripple effects on production. Forage yield increases with increasing maturity which is not a bad thing. We need yield to support herd size and reduce and spread-out cost of production so, there needs to be a compromise between forage yield and quality.

For rye the yield quality compromise point for harvest is the boot stage. Boot stage is when the seed head has risen to the top of the stem at the base of the flag leaf. At this point, the seed head can be easily felt at the top of the stem but has not yet emerged. The problem with rye is that the boot stage lasts for only a very short period of time. Once the seed head emerges, forage quality declines rapidly but yield is increasing due to a decreasing leaf to stem ratio. Wisconsin data (ipcm.wisc.edu) has shown that relative forage quality (an index combining dry matter intake and digestibility) drops 4-5 points per day with increasing maturity beyond the boot stage.

As a general rule, in cereal forage crops (oats, wheat, barley, triticale) the yield quality compromise for harvest will be at the boot stage. For grazing you will want to begin grazing earlier, such as late vegetative. There will be variation among these crops in how rapidly they mature past boot stage. For rye this point is very rapid, triticale is similar as it is a cross with rye. There will always be trade-offs, know nutrient demands for the class of livestock you are feeding. For dry cows a more mature forage will meet demands. For young, growing livestock a higher quality forage is required. Variations due to environmental conditions, fertility, and variety will have an effect on yield and quality. To account for these variations, always forage test.

Winter rye in stem elongation stage of maturity

James Rogers, Ph.D.
Extension Forage Specialist

around the state

AROUND THE STATE

NORTHEAST ND

A week of sunshine, warm temperatures and blowing winds dried many fields allowing for great progress in many field activities like tillage, spraying, fertilizer application and planting. Farmers in the region worked all week to get the plantings done. Nearly all the small grains are in and those that were planted in April are emerging with good to excellent stands and robust seedlings. The most advanced fields are at 2-3 leaf stage, while most of them are at 1-leaf stage. Field peas are emerging while corn, canola and soybeans are being planted. There are no reports of dry beans and sunflowers being planted in the region. When the temperatures hit 60°F last week, canola flea beetles were out and were flying around. Both striped and crucifer (black) flea beetles were seen at the Langdon Research Extension Center. The research center crew got a start on their plantings finishing a few trials. Early weeds like kochia and lambsquarters are popping out in the fields. The ample moisture received in the past few weeks is helping the pastures to green up nicely.

Spring wheat field in Ramsey County
Photo: Lindsay Overmyer, Extension ANR Agent, Ramsey County

Kochia and lambsquarters seedlings emerging in wheat residue. Photo: Anitha Chirumamilla, Langdon Research Extension Center

Anitha Chirumamilla
Extension Cropping Systems Specialist
Langdon Research Extension Center

NORTHWEST ND

Last week, I've shared the results from the resistance genetic tests by the National Genotyping Center (NAGC) after sending leaf tissue samples from kochia seedlings that were grown from seeds collected last fall. The seeds came from kochia plants in the field that survived last growing season. The leaf tissue samples came from 20 kochia populations that were collected across the five northwest counties. The majority of the kochia populations were detected to have multiple resistance to either group 14, glyphosate, or group 2 herbicide. Four of the populations were detected to have resistance to all three.

DNA-based resistance tests read and detect specific nucleotide sequences (target-site mutation that confers resistance to herbicide) in the kochia DNA that can be amplified (copied and recopied) to reproduce high enough copies needed for detection. The process of DNA amplification is done with high fidelity and specific to the DNA sequence of the target site mutation. A single copy of the target-site mutation, if present in the leaf tissue sample, can be detected with a very high level of confidence. Three types of target site mutation-based resistance tests were done: PPO (for Group 14 herbicide), EPSPS (for glyphosate) and ALS-W574L (for Group 2 herbicide). (Please see CPR issue 1, page 19).

The resistance confirmation by each type of test only reflects the specific type of target-site mutation that was selected for detection. A kochia population could have individuals with a mechanism that confers herbicide resistance other than target-site mutation. For instance, herbicide resistance can also be conferred through non-target site mechanisms such as significantly reduced herbicide absorption and translocation and higher metabolism rate of herbicide molecules into non-toxic forms at the cellular level in resistant weed plants. As stated on the first CPR issue on page 13 in the Weeds section, "It is important to note that DNA testing can only detect known target-site mutations that confer resistance. There could be unknown mutations, or other mechanisms of resistance that these tests cannot detect". One thing is for certain, at least one resistance mechanism, the target-site mutation, is present in kochia populations included in the tissue samples that came back positive for resistance, as detected by the three types of tests.

However, the level of resistance (frequency of resistant individuals) present in each of the 20 kochia populations is not known at this moment (possibly low, moderate, or high). That is why it is important to scout the field after each herbicide application in either burndown or in-crop applications within 7 to 14 days, to get a feel of how much resistance is out there. While out scouting, take leaf tissue samples of suspected individual plants and send them to the NAGC to genetically confirm resistance. Right now, the resistance testing by NAGC is free for the first 1000 samples from ND, thanks to North Dakota Corn Utilization Council, North Dakota Soybean Council, North Dakota Specialty Crop Block Grant, and Minor Crop Utilization Grants for covering the costs. Test results come back with confidentiality within a week of sending leaf tissue samples.

Confirming and knowing resistance level in which part of the field help make informed decisions to better manage weeds both in short and long term.

Due to safety concerns, the spray chamber we have at the WREC is not operational at the moment. I'd like to know the resistance level in each of the 20 populations, at the very least for PPO herbicide resistance. Once the spray chamber becomes operational again, I will be able to test and share results in future CPR publications.

Envelopes for tissue sampling of kochia are available at the Williston REC or at NDSU Extension County Extension Offices. Send a max of four (4) total plants for testing. DO NOT mix leaves from multiple plants when sampling.

Kochia escapes after Rifle®-D burndown application on thick kochia mats. Wheat at 2-leaf. Picture taken 5/14/2024

Green foxtail is out in Williston after recent rain events followed by warm weather. Cohorts will continue to come out typically to mid-summer. Picture taken 5/14/2024

Charlemagne "Charlie" Lim
Extension Cropping Systems Specialist
NDSU Williston Research Extension Center

SOUTHWEST ND

Last week, we received between 0.1 to 0.7 inches of rain, causing some delays in activities. In drier areas, there was action mid-week, while moister areas saw activity starting on Saturday, although with reports of machinery moving big chunks of mud. This week, we'll likely see rain and windy conditions (but less frequent) that could further stall progress.

Crop-wise, we're over 80% planted with small grains, with some of the earlier planted crops emerging well. Canola planting is nearly complete, as the last date for insurance is drawing near. Pulses and soybean planting is starting to pick up and sunflower planting has not quite yet started.

Growers should be on the lookout and scout their fields for alfalfa weevil in Southwest North Dakota, as we have had enough degree days for them to start emerging.

Victor Gomes
Extension Cropping Systems Specialist
Dickinson Research and Extension Center

weather

WEATHER FORECAST
The May 16 to May 22, 2024 Weather Summary and Outlook

The first half of May brought varying amounts of rain across the region (Fig. 1). Northeastern North Dakota, that was experiencing some of the driest conditions by late April, has recorded over 2 inches in many areas from May 1 through May 14. Many of those areas likely recorded more Wednesday night into this morning (if you're reading this on release day of May 16). Looking forward, rain amounts during the next 7 days will likely be more hit and miss on amounts with some areas perhaps recording very little additional rain.

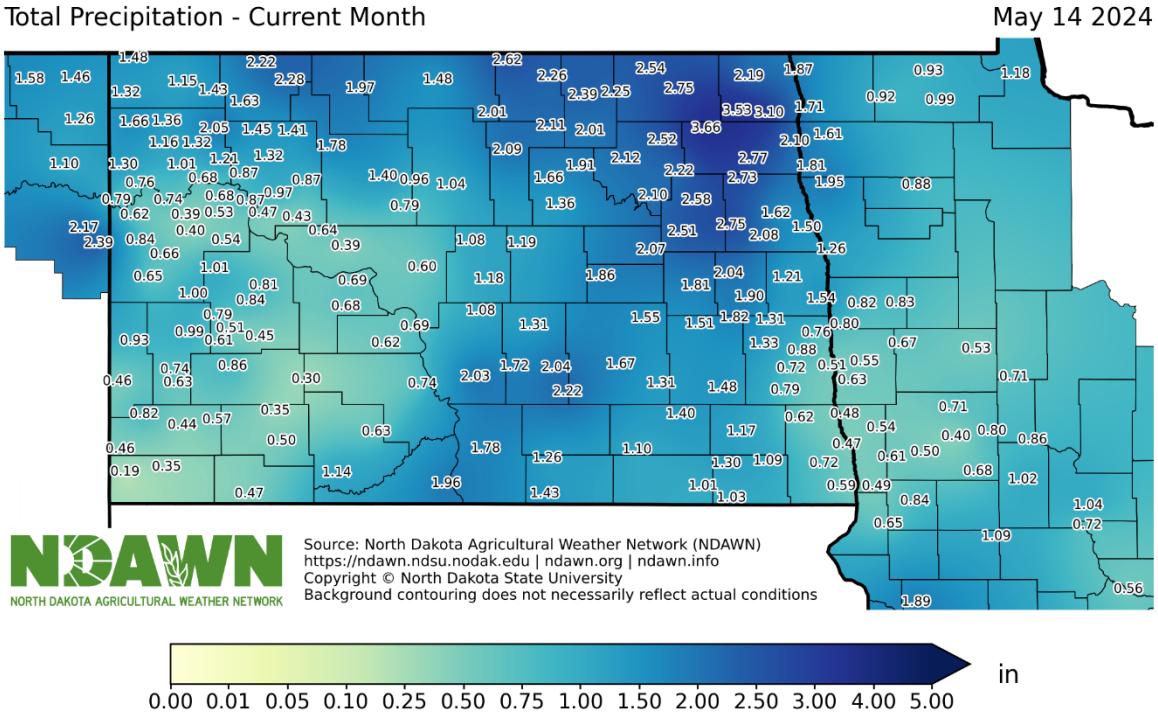


Figure 1. Total Rain at NDAWN Weather Stations from May 1 through May 14, 2024.

The past week, as expected, recorded above average temperatures with most of the region 3° to 6° above normal (Fig. 2). Temperatures are expected to be at least near and many areas above average during this forecast period, as well, although not as warm as these past 7 days.

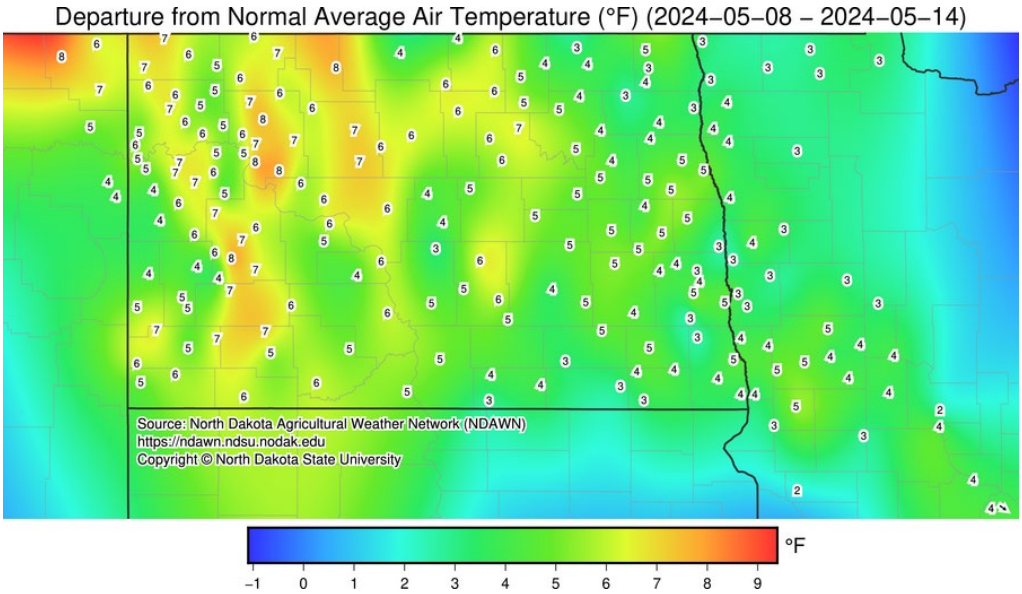


Figure 2. Departure from Average Air Temperature at NDAWN stations from May 8 through May 14, 2024

Figures 3 and 4 below are forecasted growing degree Days (GDDs) base 32° (wheat and small grains) and 50° (corn and soybeans) for this forecast period. For daily, 2 day, or 7 day updates on GDDs for differing crops you can go to: https://ndawn.info/agriculture_gdd.html

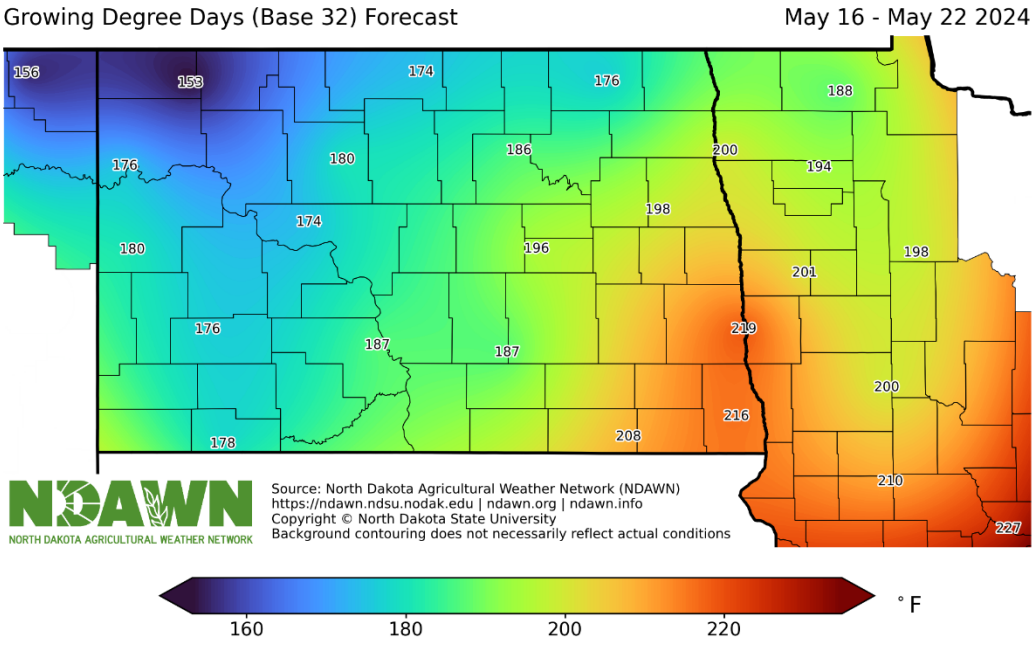


Figure 3. Estimated growing degree days base 32° for the period of May 16 to May 22, 2024.

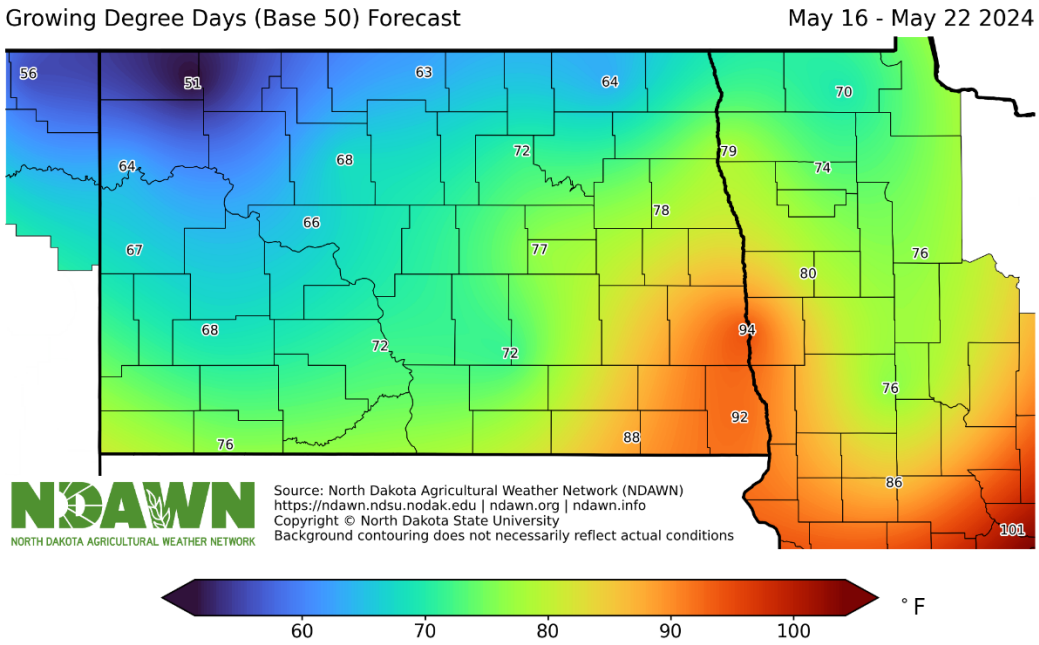


Figure 4. Estimated growing degree days base 50° for the period of May 16 to May 22, 2024.

With the recent rains, most of the region now has adequate topsoil moisture (Fig. 5). The scale in Figure 5 shows deficit readings when soil moisture is in the lowest 30% of capacity, adequate readings when the soil moisture is between 30% and 70% of capacity, and excess readings when the soil moisture is in the top 30% of capacity. A reminder that soil moisture readings are like rainfall, you can have widely varying readings in short distances, yet the data gives a general idea of soil water availability in a general area.

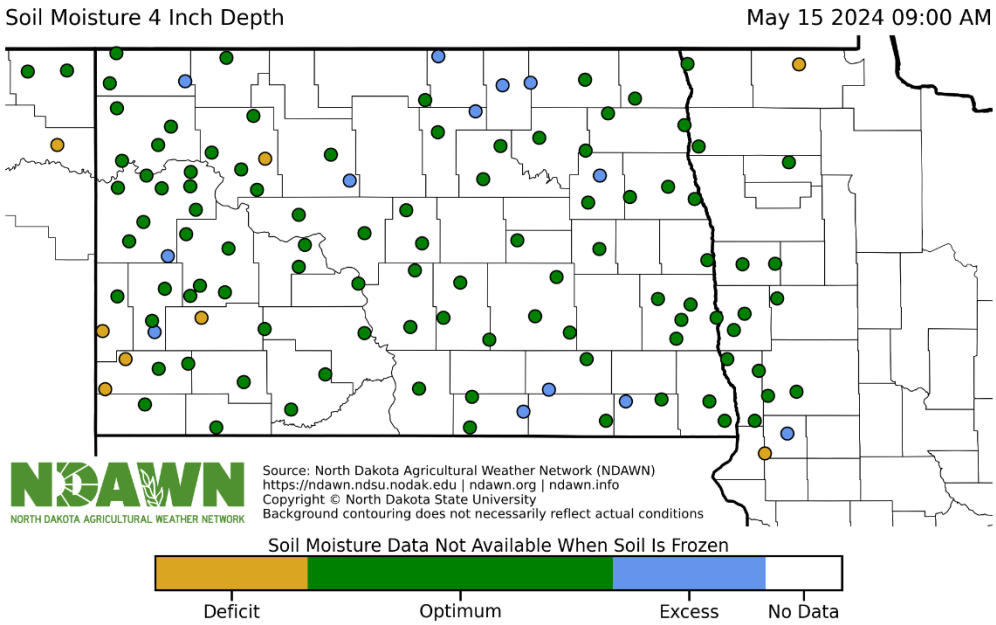


Figure 5. Soil Moisture conditions at the 4-inch depth at 9:00 AM on May 15, 2024, at NDAWN Weather Stations.

Daryl Ritchison
Meteorologist
Director of the North Dakota Agricultural Weather Network (NDAWN)

North Dakota State University
CROP & PEST REPORT
NDSU Dept. 7660; PO Box 6050
Fargo, ND 58108-6050

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Janet Knodel
Co-Editor

Entomology
701-231-7915

Plant Sciences
701-231-7971

Soils
701-231-8881

Sam Markell
Marcia McMullen
Co-Editors

Plant Pathology
701-231-7056

Weeds
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NDSU EXTENSION

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