North Dakota State University
CROP & PEST REPORT

NDSU EXTENSION

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entomology

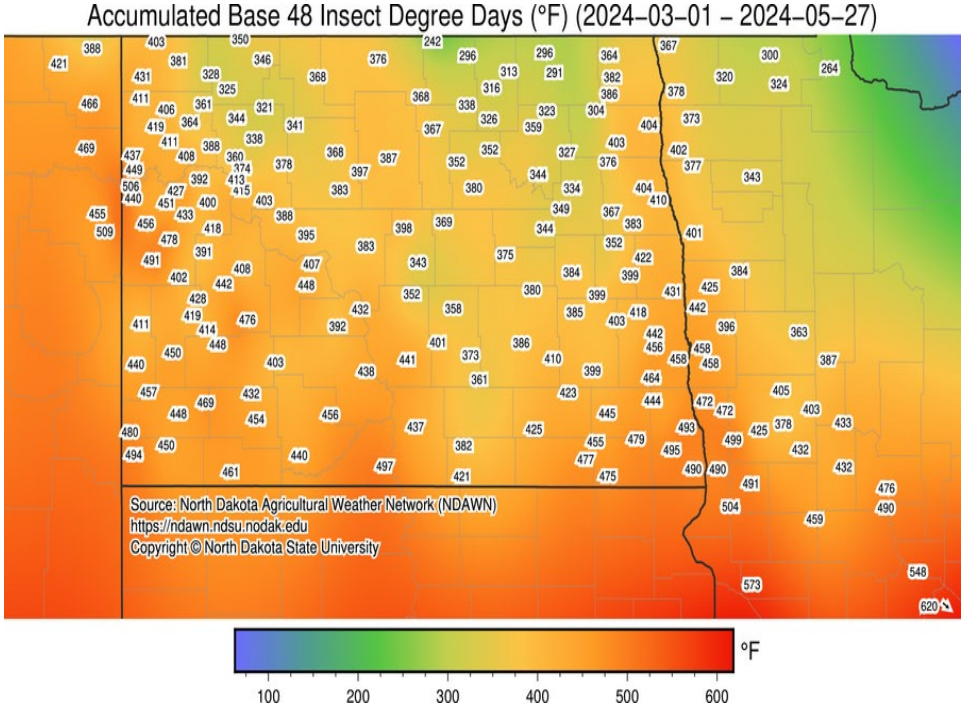
ALFALFA WEEVIL DD UPDATE

Last week, the total accumulated degree days (ADD) for adult activity has slowly increased to 300 - 500 ADD (NDAWN insect degree day map) in North Dakota. We now have 2nd to 3rd instar larvae present in southern North Dakota, while northern North Dakota is behind for egg hatch and early instar larvae. Cool wet weather and even snow in the north has slowed weevil development, while the rain has increased alfalfa growth, compensating for any feeding injury from alfalfa weevil.

Again, scouting should begin when adult or 1st to 2nd instar larvae are present (300 to 438 ADD) and treat with an insecticide if you are above the economic threshold (see Crop & Pest Report #3).

Continue to scout regularly and at least 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.

Current Alfalfa Weevil Degree-Day Accumulations (base 48°F) as of May 27, 2024 (Source: NDAWN)

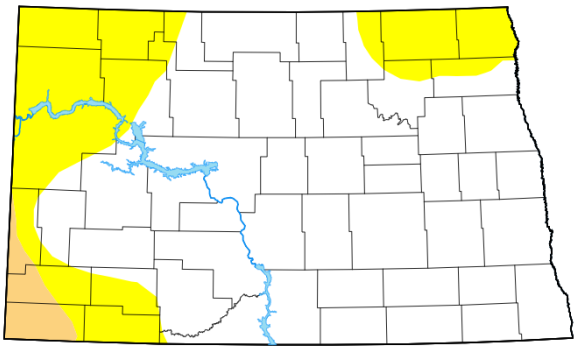


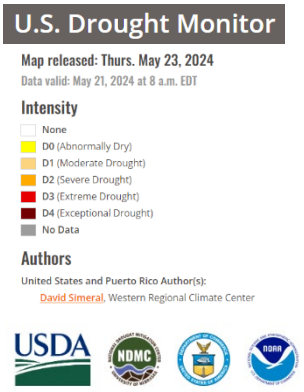
2024 GRASSHOPPER FORECAST & SCOUTING

Grasshopper nymphs (young grasshoppers without wings) have started emerging in ditches where eggs were laid last fall. However, the recent cold temperatures and rain have slowed development and emergence. Areas with >1 inch of rain may have mortality on some of the small 1st-2nd instar grasshoppers about the size of a kernel of wheat. In North Dakota, grasshopper egg hatch normally begins in mid-May with peak hatch occurring into mid-June. Typically, egg hatch will approach completion by late June. **The cool spring this year has delayed the hatch, allowing it to continue potentially into mid-July. So, it is a good time to start scouting for grasshopper nymphs in all field crops.**

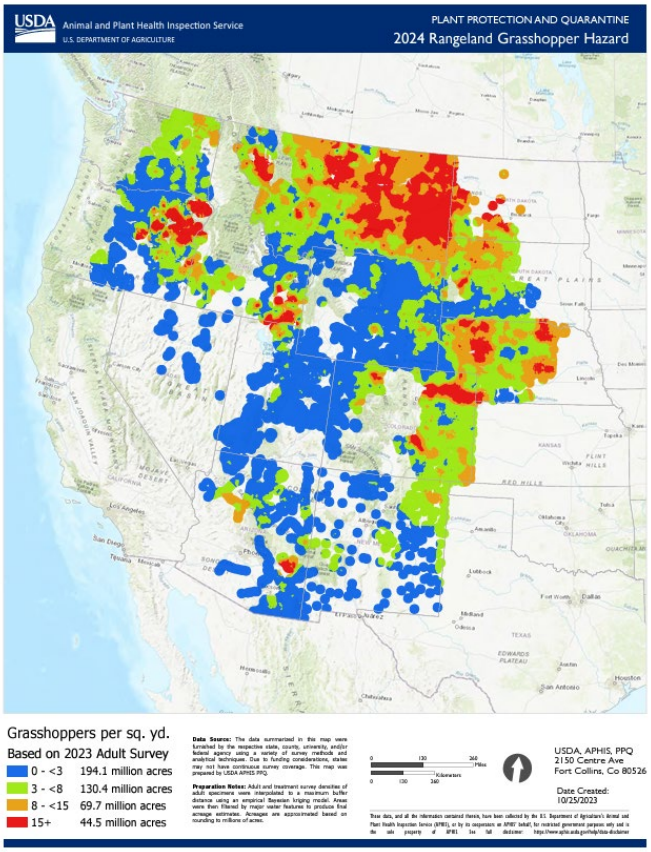
Crop fields should be scouted at least once a week. However, **broadleaf crop seedlings (sugarbeets, sunflowers, canola, dry beans and soybeans) are more susceptible than small grains, and these crops should be inspected at least twice a week.** High densities of grasshopper nymphs can reduce plant stands and cause defoliation on emerging seedling crops in a short time, especially in field edges.

The recent Drought Monitor map for North Dakota indicates improved conditions for most of the state. Moderate drought (D1) is only in the southwest in about 2.6% of the area, and abnormally dry (D0) in 22.61% of the area in the western and northeast counties. Drought favors grasshopper infestations and typically happens in D1 or higher categories.





The Animal and Plant Health Inspection Service (APHIS) of USDA conducts an annual survey for grasshoppers in rangeland areas of western North Dakota. The 2024 Rangeland Grasshopper Hazard map shows low to moderate to high grasshopper populations in western North Dakota. These areas are similar to the Drought Monitor map.



Weather has a big impact on grasshopper development and outbreaks. Temperature can affect grasshopper populations:

- Warm spring
  - Early hatch but <70F = No feeding, high mortality
  - Warm and dry = good start for hoppers
- High temperatures in summer - late fall
  - Early maturity of grasshoppers
  - Long egg laying period
- Winter temperatures have little affect

Rainfall also impacts grasshoppers:

- Hot summer with adequate rainfall
  - Good food supply and low incidence of disease
- Cloudy, wet weather for 1+ weeks
  - Promotes fungal pathogens of grasshoppers from prolonged wet periods
- Heavy rains during emergence

  - Kill 1st-3rd instar grasshopper nymphs by drowning and washing them away or embedding them in the soil
- Extreme drought
  - Poor egg hatch
  - Starve from lack of food
  - Low egg production by adult females

Last year, we had a long hot summer and delayed freeze date into late October 2023, which provided a good food supply, low incidence of diseases and a long egg laying period. So, a lot of eggs were laid, which successfully overwintered. We have had cool, wet weather for most of the spring in most of the state, which should prevent early hatching of grasshopper eggs and insure adequate food supply. It looks like the weather forecast is for >70F and less rain in the next week, so that could promote uniform hatch and good conditions for feeding. On the other hand, there is a lot of dense vegetation in the ditches from all the rain, which will delay movement of nymphs into field crops. Overall, conditions have improved but we will probably have problems in some areas of the state, especially where drought is present.

Newly emerged grasshoppers do NOT usually need to be controlled unless the population is at the "threatening" level or action threshold (see Table 1). A sweep net is a good tool to collect and count small grasshopper nymphs. Pest managers can use four 180-degree sweeps with a 15-inch sweep net, which is equivalent to the number of grasshoppers per square yard.

Table 1.	Nymphs per square yard		Adults per square yard	
Rating	Margin	Field	Margin	Field
Light	25-35	15-25	10-20	3-7
Threatening	**50-75**	**30-45**	**21-40**	**8-14**
Severe	100-150	60-90	41-80	15-28
Very Severe	200+	120+	80+	28+

If grasshoppers are above the threatening threshold, they are more easily and economically controlled while they are in the nymphal stages. There are a number of advantages to treating grasshoppers early: (1) treating only field edges results in less acres treated and less insecticide, thus reducing cost; (2) grasshoppers are killed before they have had the opportunity to cause significant crop loss; (3) smaller grasshoppers are more susceptible to pesticides than larger adult grasshoppers; (4) early treatment before grasshoppers reach maturity prevents egg deposition, which may help reduce the potential grasshopper threat for the following crop year.

For the small grasshopper nymphs (<1 inch), **Dimilin® 2L**, a juvenile growth regulator, is recommended for locations west of US Highway 281 in wheat, barley, oats, triticale, alfalfa, grassland, or soybean. Dimilin® 2L (active ingredient diflubenzuron, MOA Group 15) interferes with molting and controls only immature grasshoppers (not adult grasshoppers) by interfering with their normal shedding of skin (exoskeleton) as they grow. It is most effective when applied on 2nd (¾ inch long) to 4th (1-inch-long) instar grasshopper nymphs. After Dimilin® 2L has been applied, growers should notice reduced feeding in three to seven days, and maximum control in 10 to 14 days. Dimilin® 2L has low toxicity to mammals and is safer to beneficial insects. Dimilin® 2L should be applied with one to two pints of an emulsified paraffinic or vegetable crop oil. Canola oil is very effective as a feeding stimulant for grasshoppers (Source: University of Wyoming).

Please refer to the 2024 North Dakota Field Crop Insect Management Guide for a list of insecticides registered for grasshopper control by crop.

Janet J. Knodel
Extension Entomologist

THE 2024 ASTER LEAFHOPPER MIGRATION HAS BEGUN!

Aster leafhopper (also called 6-spotted Leafhopper), *Macrosteles quadrilineatus* (Cicadellidae) has arrived and been reported in small grains in North Dakota and Minnesota over the past week. These small insects (about ⅛ inch long) are migratory and follow a south to north migratory path most years that often brings them into the growing regions of the Northern Great Plains and usually into Canada. Leafhoppers travel on the upper trajectory winds and can be blown over 100 miles until they are brought down by cold fronts. The last time that we saw high densities of aster leafhoppers in wheat in North Dakota was 2012!

Aster leafhoppers are yellowish-green to greyish in color with clear wings, wedge-shaped bodies and 6 spots between the compound eyes. Other than their coloration, adults and nymphs resemble other species of leafhoppers like the potato leafhopper. The leafhopper uses its piercing sucking mouthparts to feed within the plant on sap and can vector aster yellows disease.

Aster leafhopper adult. (J. Knodel, NDSU)

Aster yellows, a phytoplasma disease that can infect many crops and non-crop plants, is vectored primarily by aster leafhoppers. Many different crop plants are affected, with oilseed plants such as **canola** and **flax** particularly susceptible to the effects of the aster yellows phytoplasma, which causes strange symptoms such as virescence (flowers turn green), phyllody (where flower parts are replaced by leaf-like structures), abnormally bushy growth ("Witch's broom") and general yellowing to purpling of new leaves. Cereal plants, such as **wheat, barley,** and **oats**, are preferred hosts for aster leafhoppers for feeding and reproduction, and can also be infected with aster yellows, but symptoms are not as "showy" and obvious as in the dicot plants.

Symptoms in cereals are **yellowing and dieback of the flag leaf, plant stunting, and premature death of the tiller leading to white, empty spikes in fields**. These symptoms, however, are common features of many things that afflict cereals, such as barley yellow dwarf virus (BYDV) vectored by cereal aphids, but the presence of large populations of aster leafhoppers in tandem with these symptoms is a likely indication that aster yellows has struck the field. Wheat varieties vary in their susceptibility to aster yellows infections and yield loss can occur in susceptible wheat varieties. There also are field observations from wheat varietal plots in northern Minnesota which indicate that aster yellows symptoms may be more severe, or that the disease is aggravated under wet conditions (pers. comm., J. Wiersma, UMN). In Canada, wet conditions also exacerbate

Stunted and yellowing wheat plant infected with aster yellows disease vectored from aster leafhoppers. (J. Knodel, NDSU)

aster yellows symptoms in canola (pers. comm., C. Olivier and R. Elliott). A molecular rapid testing method for single leafhoppers and plant tissues was developed by Agriculture and Agri-Food Canada (Pusz-Bochenska et al. 2020 Plant Health Progress. 21: 63-68) that is field adaptable and has reduced testing time to under one hour.

Upon arrival in an area, aster leafhoppers can survive on any green plants. If they arrive in an area before crops are planted, they can remain in areas that first "green up" in the spring, such as ditches with brome and alfalfa or biennial or perennial weeds and winter crops that are the first plants to become green in the spring. Once crops are up, aster leafhoppers will move in and will reproduce in the cereal crops. **Aster leafhoppers are usually not injurious unless they are infected with the aster yellows phytoplasma**. In carrots, a risk index has been worked out that takes into account the number of leafhoppers (abundance) using 25 sweep samples as a base sampling unit and the percentage of leafhoppers that are infected with aster yellows (Frost et al. 2013 Environ. Entomol. 42: 491-502). **Infection of plants is not a rapid occurrence** and in experimental infections of canola, 3-infected aster leafhoppers feeding on one small plant for 10 hours induced infection (Olivier et al. 2014 Canadian Plant Disease Survey 94: 162-175). Infection of aster yellows in canola classified as 2 or higher results in zero yield in the plant (Olivier et al. 2014 Canadian Plant Disease Survey 94: 162-175). Other crops have not been given similar rigorous testing to determine effects on yield. Smaller plants are more susceptible to expression of symptoms and the environment can have a large influence on expressions of symptoms in plants.

No economic thresholds have been developed for aster leafhopper in field crops to determine whether an insecticide is necessary to avoid crop losses. When an economic threshold is developed for aster leafhopper, other factors including soil moisture conditions, insect infection level and plant stage will probably be factored into the threshold (T. Wist, Canola Council of Canada). When high densities of aster leafhoppers are infected with aster yellows disease, the risk of disease infection and spread increases in the field. However, it is difficult to reach any pest management decision without more research on thresholds and the impact of the virulence of aster yellows in different crops. Since aster leafhoppers migrate into North Dakota and then in-season populations move around from crop to crop and field to field, fields may become re-infested with aster leafhoppers.

So, routine monitoring for aster leafhoppers using a 15-inch sweep net can help with detecting the presence of aster leafhoppers and their populations levels in fields. Walk a "W" pattern and sweep 25 sweeps at 4 locations in the field.

Next week, we will discuss aster leafhoppers – aster yellows disease in canola!

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Agriculture and Agri-Food Canada
Saskatoon Research and Development Centre

Janet J. Knodel
Extension Entomologist, NDSU

EXIREL LABELED FOR USE IN CANOLA

We've received some questions from *Crop & Pest* Report readers wondering whether the FMC product Exirel (cyantraniliprole) is registered for foliar use in canola. Yes, Exirel is registered for foliar use in canola, and yes, Exirel will control flea beetles. In our foliar spray trials for flea beetles in 2023, Exirel provided excellent control and had at least one week of residual activity. As noted in last week's article, Exirel has translaminar and systemic activity. Please see last week's article for further details on Exirel for flea beetle control. As always, please consult the 2024 North Dakota Field Crop Insect Management Guide for insecticides registered for use in canola.

Patrick Beauzay
State IPM Coordinator
Research Specialist, Extension Entomology

ASTER LEAFHOPPER OUTBREAKS IN ND & MN SUGARBEET FIELDS

Reports of aster leafhopper (ALH) infestations in sugarbeet were received from several Red River Valley (RRV) locations between May 20 and 24. Although the extent of damaging infestations is not known at this time, reports were received from as far south as the Minn-Dak Farmers Cooperative growing area surrounding Wahpeton/Breckenridge and as far north as the Crookston, MN area. Although this pest is occasionally observed in the growing area, it has never been documented as causing noticeable injury to sugarbeet fields in North Dakota or Minnesota. Adult leafhoppers are tiny (1/8-inch long), torpedo-shaped insects that are drab light green to light-gray insects (Figure 1). They quickly hop and fly away when disturbed, making them barely noticeable. Immature nymphs are similarly shaped but are brighter lime green in color and lack fully developed wings.

Figure 1. Adult leafhopper and red mite (Courtesy, C. Wheeler)

I visited some sugarbeet fields in the Thompson, ND area late last week where American Crystal Sugar Company agriculturists had observed ALH activity. The occurrence of characteristic leaf-yellowing and leaf-tip burn ("hopper burn") symptoms associated with leafhopper feeding injury was readily apparent on a fairly large area within one of those fields (Figure 2).

Figures 2. Sugarbeet seedlings showing yellowing and leaf curling symptoms (M. Boetel)

Interestingly, the heavily leafhopper-symptomatic sugarbeet field was established with a spring-seeded small grain cover crop (believed to be barley at the time of this writing, but not confirmed). Another sugarbeet field, located immediately adjacent to (i.e., within the same section) and planted within a day or two of that field, had virtually no visible leafhopper symptomology. The only apparent and known difference between the two fields at this time is the presence/absence of the cereal cover crop, which suggests further investigation.

Aster leafhoppers have a large host range that includes over 300 plant species. In our region, they appear to be most problematic on cereal grain crops but can affect other crops such as potatoes. Leafhoppers feed on plants by using piercing/sucking mouthparts to feed on plant phloem in leaf tissue. Although the direct injury from that activity is not particularly significant, the pest can transmit a phytoplasma that is pathogenic to plants. The organism they vector is the causal agent in plant diseases such as aster yellows in several crops and weed species, as well as causing purple top in potatoes.

These pests are not known to overwinter the northern Great Plains. Rather, they overwinter as adults in Arkansas, Texas, and Oklahoma, and are carried northward in the spring on upper-level air currents into North Dakota, Minnesota, Iowa, Nebraska, South Dakota, and southern Canada, and occasionally a few other neighboring states. Although no single factor has been isolated as the reason for ALH infestations in RRV sugarbeet fields this spring, it is thought that favorable weather conditions in their overwintering region, followed by timely upper-level air current patterns, led to reasonably large numbers of ALH moving into our growing area. Those factors, coupled with an early start to the

sugarbeet planting season, probably created a coincidentally positive environment for ALH infestations in RRV sugarbeet fields.

CONTROL: This is the first recognition of ALH populations rising to potentially economic pest levels in the RRV. As such, there is no established economic threshold for making control decisions. The decision to control them will, unfortunately, need to be a judgement call on an individual field basis. That will require close monitoring of whether plants appear to recover from injury or continue to decline in the next week or so. Pyrethroid insecticides labeled for use in sugarbeet (i.e., Asana XL and Mustang Maxx) should provide control of ALH if they are visibly present in the field. Transform WG, which is a systemic insecticide belonging to a newer mode of action, may also provide effective control.

Remember to always READ, UNDERSTAND, and FOLLOW all label directions and precautions. It is illegal to use a pesticide in a manner inconsistent with its label. For more guidance on postemergence control strategies, consult the "Insect Control" section of this year's Sugarbeet Production Guide.

Mark Boetel
Research & Extension Entomologist

plant pathology

RHIZOCTONIA AND OTHER SOILBORNE DISEASES IN SUGARBEET

Fungicide applications to control Rhizoctonia may be made once plants are in the four- to eight-leaf stage. This period is critical to ensure protection for the rest of the growing season. Seed treatments only provide early-season protection, and subsequent fungicide applications must be preventative to successfully manage Rhizoctonia root rot.

Plant populations of 175-210 plants per 100 ft of row is ideal for sugarbeet. However, plant populations may be impacted in several ways during this especially wet and rainy spring, either directly or indirectly. Excess water and saturated soil may reduce crop stand directly by limiting oxygen available to roots of young plants. Moist soils, particularly as soil temperatures increase, promote infection and growth by plant pathogens. As young plants recover from these saturated soils, they are at increased risk of infection. *Rhizoctonia solani*, *Fusarium* spp., and *Aphanomyces cochlioides* can all infect sugarbeet seedlings. It is important to know exactly which pathogens are causing disease issues in order to better manage future sugarbeet crops through seed treatments, in-furrow fungicides, and crop rotation—all preventative steps taken well before next season begins. Please don't hesitate to reach out to the sugarbeet pathologists at NDSU or the University of Minnesota to help with formal diagnosis.

Figure 1. Spornado® traps placed in a field in the spring (credit: Gary Secor)

UPDATE ON CERCOSPORA LEAF SPOT SPORE TRAPPING

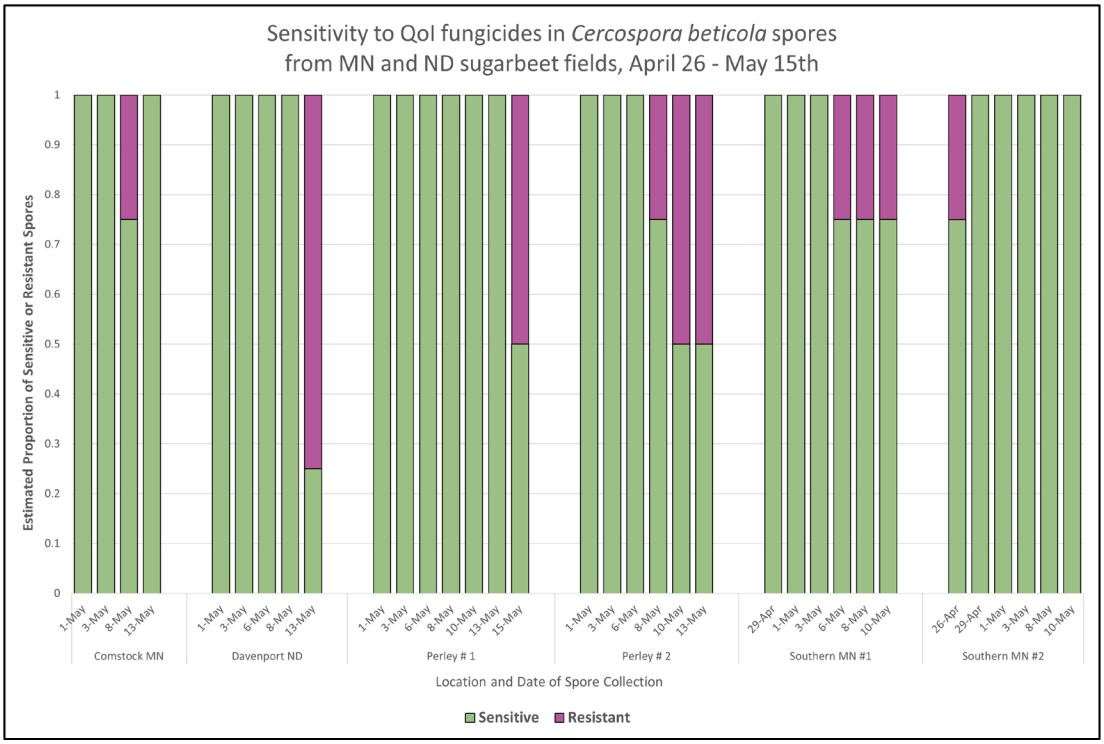
Although the spray season for Cercospora leaf spot has not yet begun, spore trapping is already underway to monitor the population of

Cercospora beticola and assess QoI fungicide sensitivity. *C. beticola* overwinters on crop and weed residue. Spring environmental conditions promote spore release. Even though infection would not occur at this point in the season, these spores offer important clues about the CLS disease cycle and the dynamics of fungicide resistance. We know from NDSU and USDA-ARS research that fungicide resistance in the pathogen population changes throughout the season.

Cooperation between NDSU Plant Pathology, the USDA-ARS Sugarbeet Unit, and each sugarbeet cooperative allows for collection of spores at six locations across North Dakota and Minnesota. The orange cone of the Spornado® spore traps (Figure 1) placed at the edge of the field collect airborne spores. After an incubation period to select only viable spores, detection of *C. beticola* spores is done using an extremely specific molecular assay, qPCR. At the same time, the process determines a relative level of QoI fungicide resistance within the set of spores from each location.

Individual spores are either sensitive or resistant based on a single mutation, detecting resistance to quinone outside inhibitor (QoI) fungicides, a group that includes azoxystrobin (e.g. Quadris) and pyraclostrobin (e.g. Headline). Table 1 shows the estimated proportion of spores from each location and date that are sensitive (green) and resistant (pink) to QoI fungicides. This preliminary data suggests that *C. beticola* spores released more recently (mid-May) are more likely to be resistant to QoIs compared to late-April and early May spores. Many thanks to Dr. Gary Secor and Viviana Rivera-Varas for conducting this ongoing work.

Table 1. QoI sensitivity and resistance in Cercospora beticola spores collected in North Dakota and Minnesota from April 22nd to May 15th, based on qPCR detection of the G143A mutation. Not every spore trap collection yielded viable C. beticola spores every week. Data collection and qPCR testing by Dr. Gary Secor and Viviana Rivera-Varas, NDSU Plant Pathology.



Eric Branch
Extension Plant Pathologist and Sugarbeet Specialist

LOTS OF RAIN! IS MY SOIL RESIDUAL HERBICIDE STILL PRESENT IN SOIL?

I frequently whine about the inability to get my soil residual herbicide activated in soil. There is nothing more frustrating than applying a soil residual herbicide and have it remain on the surface while the waterhemp blows by. It's a challenge for sugarbeet growers since our best soil residual herbicide is more water insoluble than chloroacetamide herbicides.

Most areas received plenty of activating rainfall in 2024. In most places, the rain came slowly, and herbicide was incorporated into the soil and didn't runoff with excessive rainfall. However, it continues to rain. Now growers are asking a different question. Growers are interested in learning if soil residual herbicide is still present in soil. I can't speak for all herbicides, so I will focus on one sugarbeet herbicide, ethofumesate.

As previously mentioned, rainfall came slowly and ethofumesate moved into the soil at point of application. I think ethofumsate is still there! Why? Herbicides, including ethofumesate, are metabolized by soil microbes. Soil microbes need water and heat. It has been relatively cool in most sugarbeet producing areas. Second, most/many growers are dealing with saturated soils not conducive for microbes.

Weed management is a program approach that likely includes herbicides applied in sequence. I encourage you stick to the program even if you are observing good early season weed control. However, it might be more challenging to get products applied with our current rainfall pattern.

BE CAUTIOUS WHEN USING TANK MIXTURES WITH MULTIPLE PESTICIDES, ESPECIALLY WITH STRESS ENVIRONMENTAL CONDITIONS

Dr. Alan Dexter, retired Extension Sugarbeet Weed Control Specialist once wrote, "sugarbeet herbicides may be tank mixed legally if all herbicides in the mixture are registered for use on sugarbeet, and if no prohibitions against tank mixes appear on a label." Questions about tank-mixing herbicides, insecticides, and fungicides are one of the most common telephone calls I receive from growers, agriculturalists, and crop consultants, and rightfully so . Combinations of postemergence herbicides can improve overall weed control and spectrum of control as compared with individual herbicides. Mixtures also improve time efficiency as compared with making individual applications. However, the risk of sugarbeet injury also increases with combinations, especially with 'challenging' environmental conditions.

There are only a few herbicides truly safe to sugarbeet, meaning sugarbeet must metabolize pesticide sprays to an inactive form after application and before normal sugarbeet growth and development can resume. Metabolism is much more challenging with combinations of pesticides or "complex mixtures" as I like to call them. Furthermore, cool and wet conditions slow metabolism and favor development of thin plant cuticles and rapid absorption of postemergence pesticides. Climatic changes from cool and wet to warm and humid increase the likelihood of leaf bronzing or leaf burning.

A few considerations about mixtures:

1. Sugarbeet growers frequently mix glyphosate with chloroacetamide herbicides. Mixing an auxin or a photosystem II inhibitor herbicide with glyphosate and a chloroacetamide is dependent on environmental conditions but generally has been safe in sugarbeet. Auxin and photosystem II herbicides mixed with glyphosate and a chloroacetamide may cause injury when applied under stress conditions (cool or hot weather). Photosystems II herbicides are especially injurious in the complex mixture when maximum daily air temperatures exceed 85^0F.
2. Azoxystrobin (Quadris) can be mixed with glyphosate and/or clopyralid. However, oil-based herbicides or oil-based adjuvants mixed with azoxystrobin potentially can cause excessive leaf bronzing or leaf burn.
3. Insecticides, especially higher volume insecticides (chlorpyrifos or esfenvalerate), mixed with herbicides may cause excessive injury. We believe injury is related to the formulation and formulated adjuvant in the product.
4. Use 'softer' adjuvants such as nonionic surfactant instead of methylated seed oil or in some cases, consider eliminating surfactants all together since pesticide formulations include adjuvants in the formulation that improve the pesticide's performance and physical properties. Formulation adjuvant from two, three, or four pesticides accomplishes the work of added adjuvant.
5. Don't sacrifice a water conditioner in the tank mix. Water conditioners prevent hard water mineral antagonism of weak-acid herbicides.

Unsprayed sugarbeet control.

Leaf burn caused by a tank mixture of four herbicides and one insecticide on May 18 or when air temperatures reached 90F.

Tom Peters
Extension Sugarbeet Agronomist
NDSU & U of MN

REGULATION OF PESTICIDE APPLICATION BY DRONES

Using drones, Unmanned Aerial Vehicles (UAV), or Unmanned Aerial Systems (UAS), to apply pesticides is no longer a "gee whiz" or a theoretical concept. It is real, it is here, and applicators across North Dakota are using this application method. Unfortunately, the law and the regulations at both the Federal and State Level have NOT even come close to addressing this reality.

First, let's look at this at the Federal level. The Federal Aviation Administration (FAA) is responsible for regulating aircraft in this country, so any aircraft has to be properly registered, and the operator needs to be licensed. So, square one is meeting that obligation. That takes time and patience to comply with the paperwork, fees, and safety obligations.

The Environmental Protection Agency (EPA) is responsible for regulating pesticides. How pesticides are applied mostly falls within the boundaries of the pesticide label. Virtually all pesticide labels describe aerial application from the standpoint of a fixed wing or rotary winged manned system. To date, I am not aware of any labels that specifically discuss or direct applicators in the use of UAS. The difficulty in this situation is that the label rules, so even though a pesticide is being applied by a platform that is not described in the label, UAS operators are still under obligation to apply the product using the conventional manned approach.

Now, let's turn our attention to the use of UAS at the State level. Under North Dakota Law, the North Dakota Aeronautics Commission (NDAC) is responsible for regulating aircraft, so any aircraft must be properly registered, and the operator needs to be licensed. So, square two, is meeting that obligation. That takes time and patience to comply with the paperwork, fees, and safety obligations. Regarding safety obligations, one component of the licensing requirement is that operators of a UAS must be certified Commercially by NDSU to apply pesticides by air. Thus, prospective operators of UAS will need a Commercial Certificate, regardless of whether they intend to apply the pesticide in a Private capacity.

Currently, NDSU will issue a Commercial certificate to apply pesticides by aerial application to an applicant that successfully completes an exam that covers ground related issues and aerial related topics. The curriculum is based on an EPA approved manual that was developed assuming the application is made with a conventional fixed wing or rotary winged manned system. Currently, a UAS specific manual is being developed under EPA sponsorship, but it is not destined for adoption until 2025 or 2026 at the earliest.

Finally, the North Dakota Department of Agriculture (NDDA) is responsible for enforcing pesticide laws in the State. That is easier said than done when it comes to UAS because there are no specific laws, and labels do not acknowledge the application method. Thus, the NDDA is required to enforce the laws and labeling that are focused on manned, fixed wind or rotary winged systems.

Unmanned Aerial Systems are here to stay, regardless of how they are being regulated. If you want more information of just the basics, go here, to the NDAC website and this will get you started: https://tinyurl.com/ND-UAS-FAQ

Andrew A. Thostenson
Pesticide Program Specialist

SPRAY DRONE APPLICATION PRINCIPLES

Spray drones are an emerging technology currently being used by several commercial applicators within North Dakota. There are numerous items for an applicator to consider before purchasing or using a spray drone, such as:

- federal and state regulatory requirements (see Andrew's preceding article)
- spray trailer design and safety
- operational competence (e.g. preflight assessments, flight procedures, application procedures, emergency protocol)
- situational awareness (e.g. roadways and vehicles, overhead electrical wires, other hazards)
- operational niche (e.g. small areas, hard to reach areas, uneven terrain)
- drone lifespan (may be just 2-3 years before hardware or software is obsolete)

For the purposes of this article, I will focus on the application principles when spraying by drone. Due to the low water volumes typically used by applicators (0.5 to 2 GPA) and the turbulence generated by their propellers, spray drone application principles are fundamentally different than the principles underlying spray applications by ground rigs, manned airplanes, or manned helicopters. Therefore, spray drones are not an "off the shelf" solution. Rather, they require iterative configuration, testing, and reconfiguration to ensure sufficient and uniform coverage of applied pesticides. Pattern testing is essential to determine your actual swath width and configure your drone for the most uniform possible application.

Unfortunately, the adoption of spray drones has greatly outpaced the development of sound application technology recommendations. The Louisiana State University AgCenter recently hosted a webinar where they shared recommendations for good operating procedures to optimize spray applications with a drone. I share their recommendations here, organized under headings of my creation:

Winds impact spray pattern

- Drones operate the best (widest swath widths, etc.) in zero to low wind conditions (< 5 MPH)
- Patterns can shift substantially to the side in crosswinds, i.e. 5 to 10 ft. or more
- Typically, flight patterns need to be oriented perpendicular to the wind (cross-wind)
    - This will help preserve equal swath width regardless of flying direction

Flying height determines swath width and impacts spray properties

- Drones can be flown at lower altitudes (6 to 10 ft.) to help maintain even and uniform application in winds, but swath width will be 30 to 50% lower and hard packed ground can "kick up" spray droplets and cause more drift
- Drones may be able to be flown higher than other application methods (10 to 15 feet) to gain a wider swath width and still control drift
    - Drone applications at higher altitudes (> 10 feet) act more like boomless nozzles with more side effect from the winds, but have the advantage of smaller droplets (prop wash from the motors help to spread droplets to the side)
    - Drone applications at lower altitudes (< 10 ft.) are more like regular ground spray systems
- Increasing the speed (tilt of drone) can be used to help increase swath width
- Some people fly low to help preserve drone in case of a crash

Spray droplet dynamics are unique

- Most centrifugal nozzles make very fine droplets, but produce a tightly controlled droplet spectrum around the 300 µm (micron) range

- The downwash of the propellers aid in the movement of the spray droplets from the drone to the crop surface, but not necessarily into the crop itself
- Drones do not seem to create as many suspended droplets as full-size manned aircraft, and thus better control long distance drift (250-300 ft)

Rob Proulx
Agriculture Technology Systems Specialist

around the state

AROUND THE STATE

NORTHEAST ND

Frequent rains continued making the fields wet interrupting planting and herbicide spraying activities. Depending on the location, NDAWN stations recorded 1.65 to 3.9 inches of rain in the region last week. Due to these wet conditions, some farmers might opt for prevent plant in some counties. Small grains ranged from emerging fields to tillering stage with fair to excellent stands. Drown out spots are possible in some locations. Some spots of yellow streaking in older wheat leaves with burnt tips have been reported in Griggs County. Field peas continue to advance with more emerging and reaching tendril stages. Soybean and dry bean plantings continue at a slower pace with some concerns of possible re-plantings due to the wet and cold conditions. Early plantings of corn and soybeans continue to emerge with fair to good stands. Canola plantings are also happening at a slower pace with some farmers wondering about soil crusting issues due to heavy rains following planting. Weeds are emerging but their growth has slowed down due to wet and cold conditions. Flea beetles have emerged, but their activity has slowed down due to the wet, cold, and cloudy conditions. No reports of grasshoppers yet. Alfalfa stands look lush and green, ranging from 12-15” tall. Alfalfa weevil activity has not been reported in this region yet.

Spring wheat field in Grand Forks County Photo: Katelyn Landeis, Extension ANR Agent, Grand Forks County

Biennial wormwood and waterhemp seedlings emerging in a filed in Grand Forks County
Photo: Katelyn Landeis, Extension ANR Agent, Grand Forks County

Field peas in Cavalier County
Photo: Anitha Chirumamilla, LREC

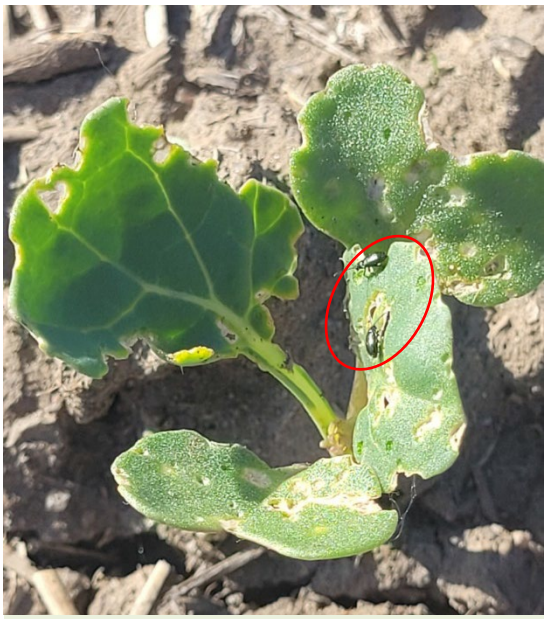
Anitha Chirumamilla
Extension Cropping Systems Specialist
Langdon Research Extension Center

NORTHWEST ND

The Northwest received some scattered thunderstorms and rain showers in the past week. As per NDAWN records, Williston and surrounding areas received about 0.5 inch of rain in the past 7 days, most of which fell last Wednesday (0.12" on May 22nd) and last Thursday (0.30" on May 23rd). Bare soil temperatures at the 4-inch depth averaged 65°F. Daytime highs averaged 71°F and nighttime lows averaged 48 °F. It got a bit windy when the rain came down last Thursday (May 23rd), which averaged 11.4 mph and gusts up to 25 mph. But winds have been calm for the most part in the past 7 days (May 22-28), with an average of 7.3 mph and gusts of 21 mph.

There are a lot of bare fields waiting for crops to emerge, but for the most part the bare fields have already been planted and crop emergence and conditions have been good in many areas. The most advanced crop stage I've seen so far in wheat is 10 to 12 tillers and approaching jointing in winter wheat, 5 to 6 leaf nodes in lentil and field peas, 2 to 3 tillers in spring wheat, and canola at 1 to 2 leaves. Canola at emergence and early seedling stages is very vulnerable to flea beetle attack. This insect physically feeds by chomping on green plant tissues. We've seen fields with small canola seedlings in Williams County that have been damaged by flea beetles. In the second CPR issue on page 3 to 4, Dr. Jan Knodel recommended to scout canola 2-3 times a week after emergence to check if the insecticide seed treatment

against this insect has been effective. Residual activity of the seed treatment typically lasts 14-21 days depending on flea beetle pressures. Additional scouting is needed up to the 6-8 leaf stage, to assess the amount of defoliation and to determine when to apply a foliar insecticide to prevent yield loss. A couple of active ingredients labeled for use in canola to control this insect pest are listed in the 2024 ND Field Crop Insect Management Guide. To know more about flea beetles, please take a look at publication E1234 which highlights just flea beetles in canola. An article about scouting for and treating canola flea beetles can also be found here.



Feeding damage by what looks like crucifer flea beetles (circled) in a 2-leaf canola seedling in Williams County. Picture taken 5/28/2024.

Field pea at 6-leaf node in dryland no till field in Williams County. Previous crop was spring wheat. Picture taken 5/28/2024.

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

SOUTH-CENTRAL/SOUTHEAST ND

The region received 0.5 to 2.5 inches of rain in the past week, with the least rainfall reported on the western edge of the region and the greatest rainfall across the northern and eastern edge of the region. Most of the region has not had additional planting since last Thursday. Nearly all small grains have been planted and are emerged with plants up to the two-tiller stage in the region. Some counties only have about 75% of corn planted. Corn is emerging across the region with the most advanced corn located in the southern part of the region. Most counties above the first tier of counties bordering South Dakota only have 40 to 60 percent of the soybeans planted, with most of the planted soybeans just starting to emerge. Most canola has been planted. About 50% of the dry beans have been planted in the region and are starting to emerge. Other than the western part of the region, few sunflowers have been planted at this time.

Hard red spring wheat is mostly in good to excellent condition across this region of the state, but there are areas of the region where the hard red spring wheat is only fair due to drown-out spots, unevenness in emergence and growth, and pockets of yellow wheat in some fields. Corn looks pretty good where it has emerged, but stands are emerging non-uniformly and most plants are yellow in the region due to cold, cloudy, and wet conditions. Soybeans are emerging now, but non-uniformly as well. Not enough of the soybeans have emerged to know how good the stands will be. Alfalfa is greater than 12 inches in most parts of the region and looks fairly good. Winter wheat and rye are heading in some parts of the region.

Weeds in fields are highly variable across the region from very few weeds in fields to very weedy fields. Weeds have grown slowly in the past week, but also continue emerging. With the cold and cloudy conditions, the leaf cuticle of weeds is quite thin and should allow herbicides to control weeds easily, however the same is true for all crops and herbicide injury may be more likely at this time especially when multiple herbicides and/or other pesticides are mixed. No significant insect issues plague this region currently. No wheat diseases have been observed yet in most fields. Alfalfa leaf spot and spring black stem and leaf spot is present in some alfalfa fields.

Current stage of kochia in a wheat field. Most plants about one inch in height which is half the size to spray kochia at two inches.

Most advanced stage of hard red spring wheat in Griggs County is at the second tiller stage.

Visual differences between seedlings of biennial wormwood at the top of the photo and common ragweed at the bottom of photo.

Jeff Stachler
Griggs County Extension Agent

weather

THE MAY 30 TO JUNE 5, 2024 WEATHER SUMMARY AND OUTLOOK

There was rain, snow and wind impacting North Dakota this past week. Most of the precipitation occurred last Friday, with some additional rain, especially on Memorial Day. The Devils Lake Basin recorded the most precipitation with widespread two to three inch rains or melted snow falling in that region (Figure 1). There is an old English proverb that says "There is no debt so surely met as wet to dry and dry to wet" and that fits northeastern North Dakota, that went from needing some rain to hoping for no more rain over the past several weeks. I wish I could say the pattern is shifting, but besides the rain that is impacting the area today (Thursday), there appears to be other rain/thunderstorm opportunities Sunday Night into Monday and then toward the middle of next week.

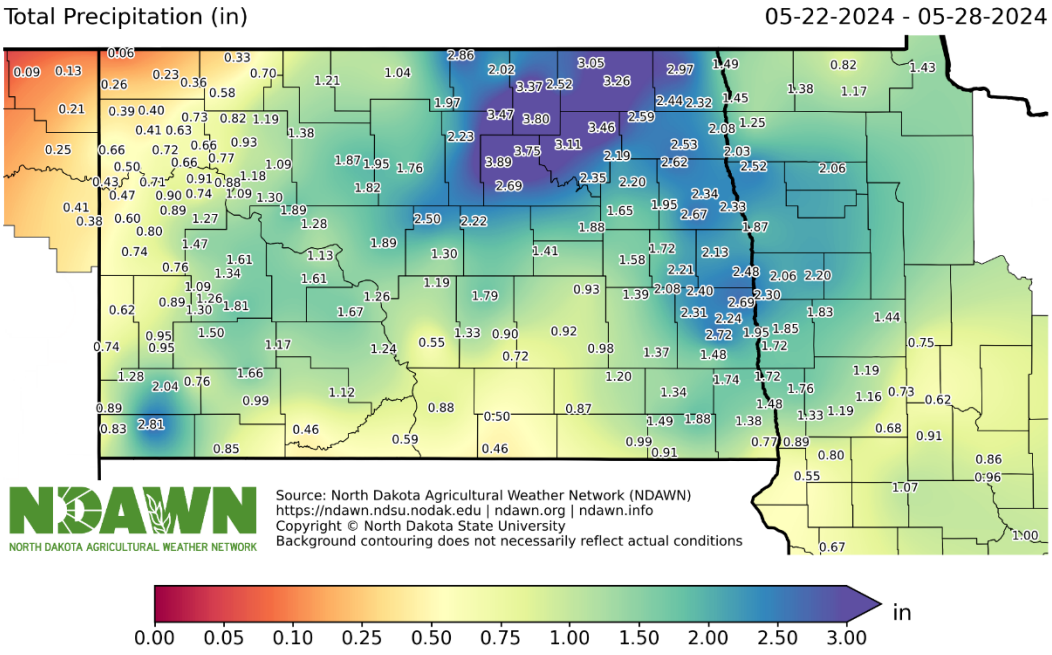


Figure 1. Total Rain at NDAWN Stations for the Period of May 22 through May 28, 2024.

In between the rain (snow) systems, temperatures dropped into the 30s at least once, with the exception of far southeastern North Dakota, in the past week. Many parts of the state dropped into the 30s on several mornings. The lowest temperature recorded in the past week is presented in Figure 2. Hopefully, with June upon us, we won't have to worry about freezing temperatures again until September.

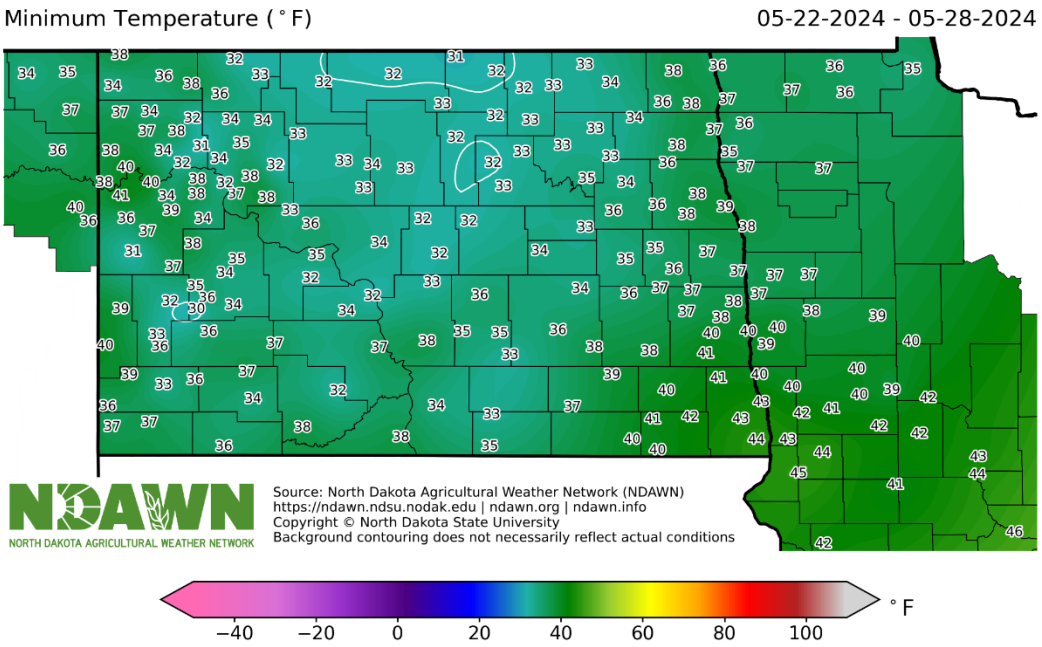


Figure 2. Lowest Temperature Observed for the Period of May 22 through May 28, 2024 at NDAWN stations.

Temperatures this past week were 3° to 5° below average across North Dakota. Temperatures should be slightly above average this forecast period bringing many more growing degree days. 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.

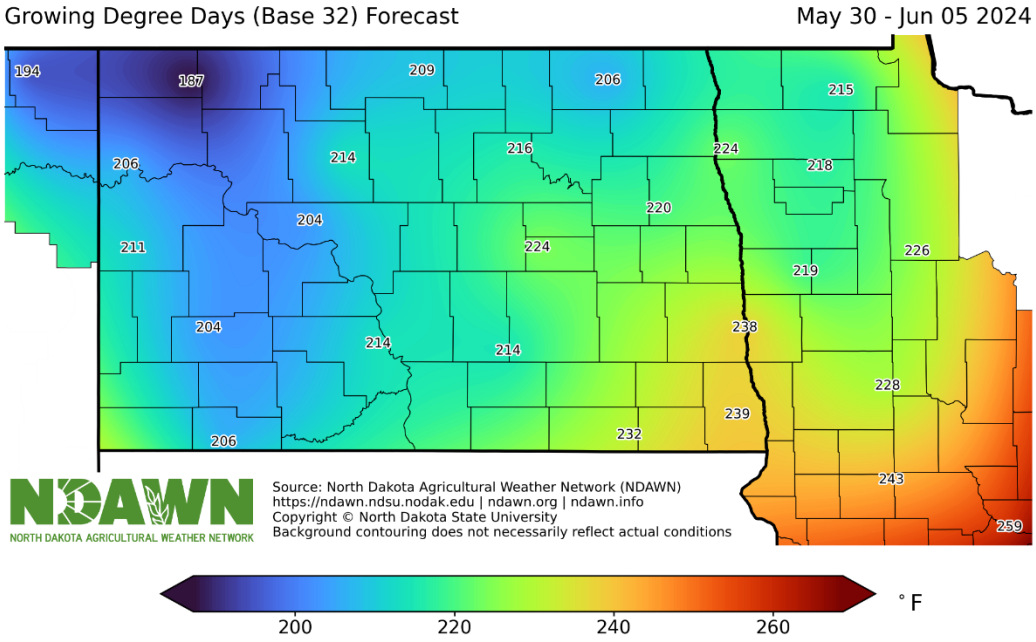


Figure 3. Estimated growing degree days base 32° for the period of May 30 to June 5, 2024.

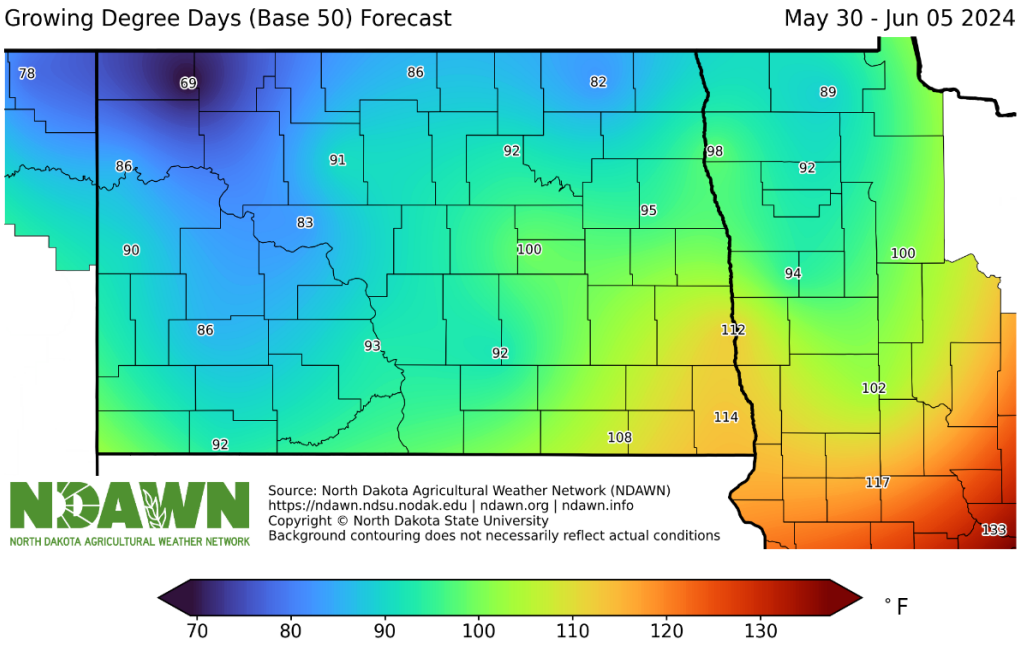


Figure 4. Estimated growing degree days base 50° for the period of May 30 to June 5, 2024.

Using May 1 as a planting date, the accumulated growing degree days for wheat (base temperature 32°) is given in Figure 5. 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

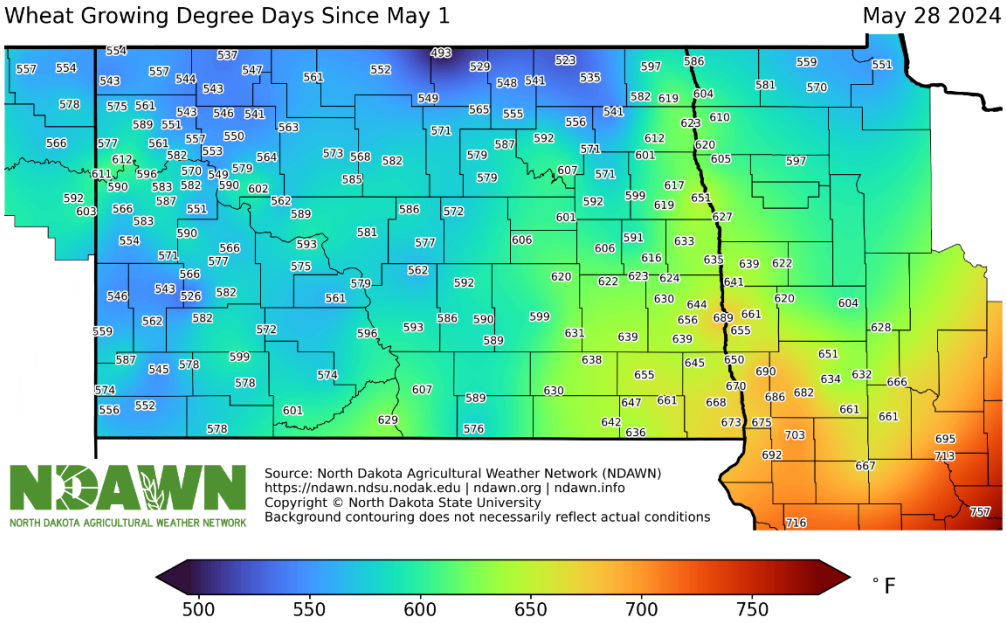


Figure 5. Wheat Growing Degree Days (Base 32°) for the period of May 1 through May 28, 2024

Using May 10 as a planting date, the accumulated growing degree days for corn (base temperature 50°) is given in Figure 6. 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.

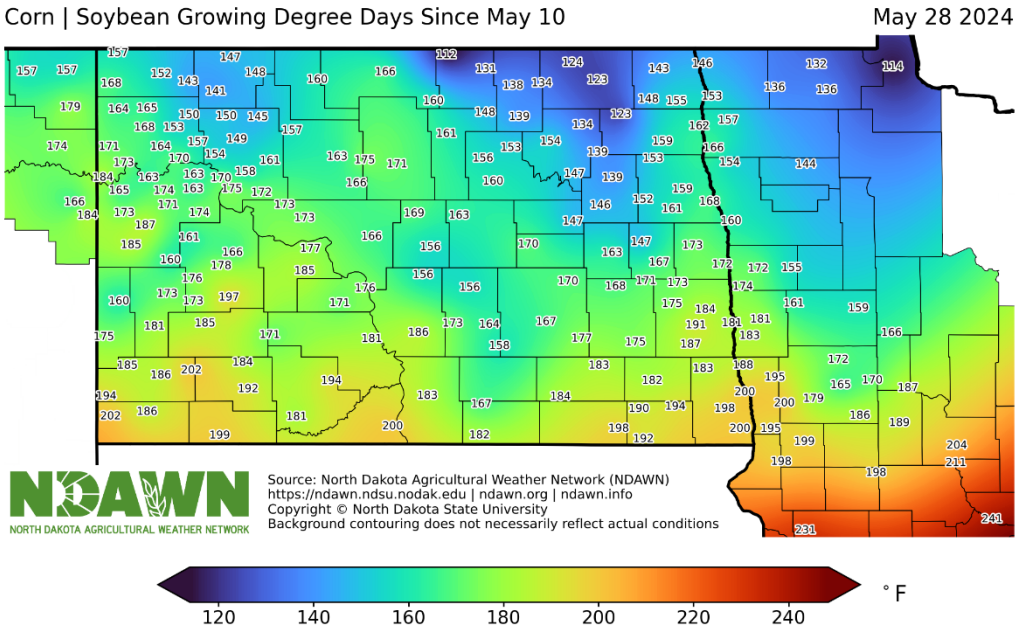


Figure 6. Corn Growing Degree Days (Base 50°) for the period of May 10 through May 28, 2024

Soybeans also use base 50° like corn, but NDAWN has a special tool for soybeans that, based on your planting date and cultivar, can estimate maturity dates based on average temperatures, as well as give you GDDs based on the 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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