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CROP & PEST REPORT
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Entomology

SCOUT FOR ALFALFA WEEVIL

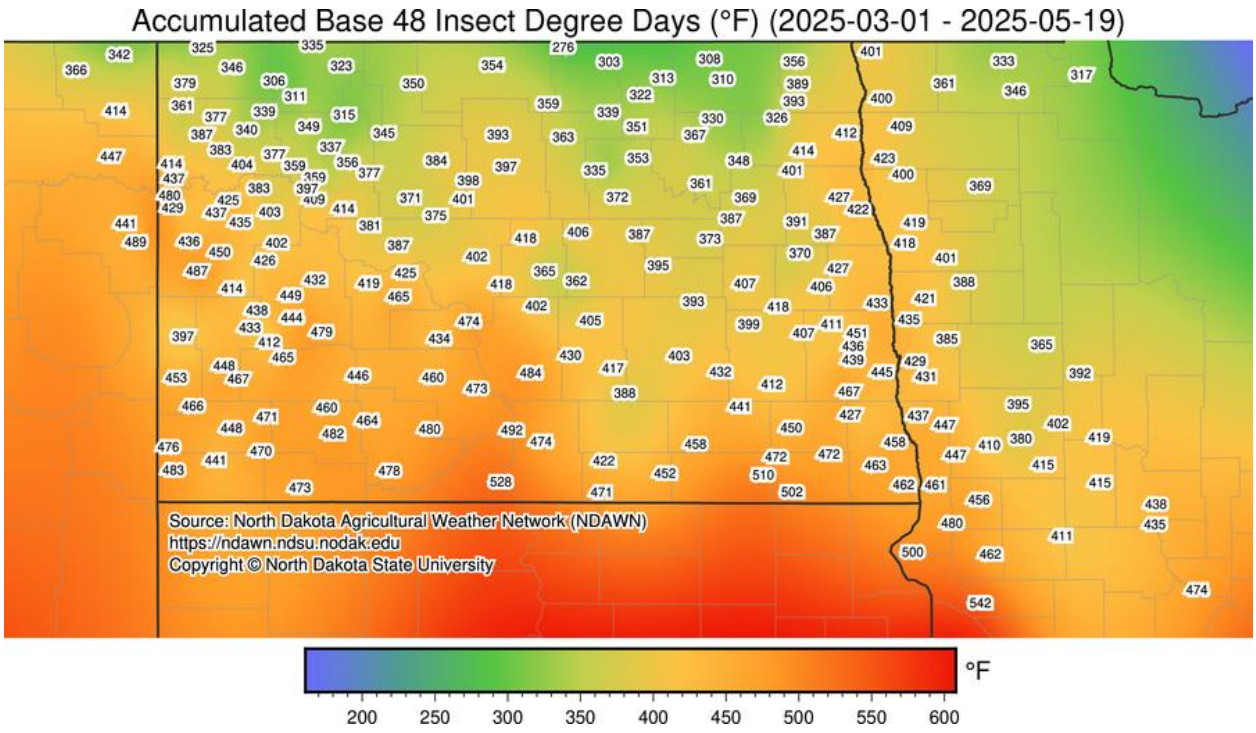
Integrating the degree-day model into your alfalfa weevil management program is essential. Alfalfa weevil development is temperature-dependent, and degree day models have been developed for alfalfa weevil growth using a base of 48°F (Table 1). Accumulated degree days will give you an estimated time to begin scouting, when damage might occur and when control action might be necessary.

Scouting should begin early in the season after egg hatch (300 accumulated DD). It is imperative to scout during peak larval activity (3rd to 4th instar larvae - 504-595 accumulated DD). Fields should be scouted weekly up through the first cutting. Fields with south-facing slopes tend to warm up sooner and should be scouted earlier.

The current NDAWN map degree day (DD) map (see next page) below shows that most of North Dakota is between 276 DD or before egg hatch in the north and <500 DD (Base of 48°F) or second instar larvae in the south. Farmers can determine alfalfa weevil DD by going to NDAWN and selecting Applications – Insect DD, choose the nearest weather station to your farm and using the base temperature of 48°F column for the cumulative alfalfa weevil temperatures.

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	



To effectively scout for alfalfa weevil larvae, collect alfalfa stem samples, observe for damage (defoliation in leaves) and the presence of larvae, and use established economic thresholds (Table 2) to determine when to take action.

Alfalfa weevil larvae – look for black head capsule and white line running down middle of back (J. Knodel, NDSU)

1. Collect Stem Samples:

- **Random Sampling:**
  Select a minimum of 30 stems, randomly distributed across the field by walking a 'M' pattern, with a minimum of five sampling sites per field.
- **Stem Tip Down:**
  Place stems in a white bucket, tip down, to dislodge larvae.
- **Vigorous Shaking:**
  Shake the stems vigorously into the bucket to dislodge larvae, particularly the late 3rd and 4th instar larvae that cause most foliar damage.
- **Close Inspection for pin holes in stem leaves:**
  Check for early 1st and 2nd instar larvae, which may hide inside the rolled leaf tips and buds.

Place stem tips down into bucket to dislodge larvae for counting.

2. Assess Damage and Larvae:

- **Larva Count:** Count the number of larvae on the stems and at the bottom of the bucket.
- **Average Larvae per Stem:** Divide the total number of larvae by the number of stems collected to determine the average larvae per stem.

3. Consider Economic Thresholds:

- **Treatment Thresholds (Table 2):**

Use Table 2 to determine the economic threshold for the average number of third- and fourth-instar alfalfa weevil larvae per stem based on plant height, market value and cost of an insecticide plus its application.

- **Percentage of Tips Damaged:**
  Calculate the percentage of stems with feeding damage, not the percent defoliation (e.g., 35% for weak stands, 40% for vigorous stands).
- Monitor **alfalfa stem height**, as it influences treatment thresholds and decision-making. **Crop market value and management costs (e.g., insecticide and application)** also impact the treatment threshold.

Alfalfa weevil larva feeding on leaf tips (Whitney Cranshaw, Colorado State University, Bugwood.org)

4. Pest Management:

- **Early Cutting:**
  If alfalfa has reached the 50% bud stage and weevil numbers have reached the economic threshold, harvesting can be an effective cultural control strategy and the most economical way to kill about 95-98% of weevil larvae. Larvae will desiccate and die as alfalfa dries down.
- **Post-Harvest:** Scout for 4-5 days after the first cutting to monitor regrowth for weevil presence and feeding on the regrowth of crowns. **Treatment is recommended if 50% of the crowns have weevil feeding or regrowth is delayed 3-6 days due to feeding.**
- For insecticides registered in alfalfa for alfalfa weevil control in North Dakota, please consult the 'Forage' section from the ***2025 North Dakota Field Crop Insect Management Guide E1143-25***.

Table 2. Recommended economic threshold for third- and fourth-instar alfalfa weevil larvae in North Dakota prior to the first cutting.

Early Bud Stage (>20") Number of 3rd and 4th instar larvae per stem									
	Value ($/ton)								
Cost/acre	50	75	100	125	150	175	200	225	250
7	4.0	2.7	2.0	1.6	1.3	1.2	1.0	0.9	0.8
8	4.6	3.1	2.3	1.8	1.5	1.3	1.2	1.0	0.9
9	5.2	3.5	2.6	2.1	1.7	1.5	1.3	1.2	1.0
10	5.8	3.8	2.9	2.3	1.9	1.6	1.4	1.3	1.2
11	6.3	4.2	3.2	2.5	2.1	1.8	1.6	1.4	1.3
12	6.9	4.6	3.5	2.8	2.3	2.0	1.7	1.5	1.4
13	7.5	5.0	3.7	3.0	2.5	2.1	1.9	1.7	1.5
14	8.1	5.4	4.0	3.2	2.7	2.3	2.0	1.8	1.6
15	8.6	5.8	4.3	3.5	2.9	2.5	2.2	1.9	1.7
16	9.2	6.1	4.6	3.7	3.1	2.6	2.3	2.0	1.8
Late Vegetative (16"-20")									
	Value ($/ton)								
Cost/acre	50	75	100	125	150	175	200	225	250
7	3.8	2.4	1.8	1.4	1.1	0.9	0.8	0.7	0.6
8	4.4	2.8	2.1	1.6	1.3	1.1	0.9	0.8	0.7
9	4.9	3.2	2.4	1.8	1.5	1.2	1.1	0.9	0.8
10	5.5	3.6	2.6	2.1	1.7	1.4	1.2	1.0	0.9
11	6.1	4.0	2.9	2.3	1.9	1.6	1.3	1.2	1.0
12	6.7	4.4	3.2	2.5	2.1	1.7	1.5	1.3	1.1
13	7.2	4.8	3.5	2.8	2.3	1.9	1.6	1.4	1.3
14	7.8	5.1	3.8	3.0	2.4	2.1	1.8	1.6	1.4
15	8.4	5.5	4.1	3.2	2.6	2.2	1.9	1.7	1.5
16	9.0	5.9	4.4	3.4	2.8	2.4	2.1	1.8	1.6

CUTWORMS EMERGING

Once it warms up again, we expect to see more cutworm activity in planted field crops. Cutworms were reported in the southwestern area of North Dakota feeding on canola. However, with the cool temperatures, injury has been minimal. With the warmer temperatures, cutworms will become more active.

Red-backed cutworm larvae (John Gavloski, Manitoba Agriculture)

Now is a good time to scout field crops for cutworm feeding injury before economic feeding injury occurs. Crops are most susceptible during the early crop stages - seedling to 6-leaf stage.

Cutworms are an early-season pest that feeds on most of the field crops grown in North Dakota. They become active when soil temperatures are above 40°F. Crops with lower plant populations, such as sunflower, peas, or lentils, are most susceptible to cutworm injury.

Larvae (caterpillars) are the crop-damaging life stage of cutworms. Larvae remain in the soil during the day and come out at night to climb up on plants to feed on leaves. Cutworm feeding activity usually extends from May through the end of June, and young emerging plants are the most susceptible stage of crop development. Typical feeding injury symptoms include clipped-off plants with larvae (caterpillars) underneath the soil, foliage defoliation, wilted plants, or bare patches of ground in localized spots in a field. In peas and lentils, seedlings with new sprouts are a good indication of cutworm feeding, where the plant was cut and then the plant tried to initiate new growth (sprouting). Excessively cool, wet soils amplify stand reduction by slowing plant development relative to cutworm feeding. Cool temperatures will also delay cutworm emergence and growth.

Black cutworm larva cutting off young corn plant (W.M. Hantsbarger, Bugwood.org)

The key to successful cutworm control is early detection and knowing your plant population. Cutworm feeding can be noted by defoliation, or cut and wilted plants, leading to bare patches in the field. Cutworms can be found in the soil around cut plants. Few plants can be lost to cutworm feeding if the plant population is below the recommended established stand. The greater the plant population, the more damage can be tolerated without economic yield loss.

When spraying insecticides for cutworm control, applications should be made in the evening when cutworms feed actively. Wet soil conditions will also improve insecticide efficacy, as cutworms feed near the soil surface. Rescue foliar treatments are warranted when cutworms exceed these treatment thresholds by crop:

- Alfalfa – 4 to 5 or more per square foot (new stands – only 2/sq ft)
- Canola – 1 per square foot
- Corn - 3-6% of the plants are cut, and small larvae (<3/4 inch) are present
- Peas / Lentils – 2 to 3 cutworms per square meter
- Small grain – 4 to 5 cutworms per square foot
- Soybean - one cutworm per 3 feet of row or 20% of plants are cut
- Sugarbeet - 4-5% cutting of seedlings or 3-5 larvae per square foot in late summer

• Sunflower - 1 per square foot or 25-30% of plants cut

Spray timing is the most critical aspect of controlling cutworms. **Insecticides are ideally targeted at the young larvae (<¾-inch), which are easier to kill than the larger larvae (>1 inch). Spraying is recommended in the evening when cutworms are actively feeding.** There are questions about tank mixing insecticides with herbicides for early-season weed control. However, check labels for compatibility or do a simple 'jar test' mixing the insecticide and herbicide. If spraying for early-season cutworm activity, re-scout the field as cutworms will continue to emerge over two to three weeks. Some questions about applying an at-plant insecticide, such as in-furrow or T-band application, to control cutworms have been asked. An in-furrow insecticide application is generally less practical in controlling cutworms than a T-band application. Since cutworms often crawl on the soil surface, a 5- to 7-inch T-band application over the seed furrow would be more effective for cutworm control.

For insecticides registered in North Dakota for cutworm control, please consult the ***2025 North Dakota Field Crop Insect Management Guide E1143-25***.

Janet J. Knodel
Extension Entomologist

Patrick Beauzay
State IPM Coordinator
Research Specialist, Extension Entomology

plant pathology

WHEAT RUST MOVEMENT - SLOW IN THE SOUTHERN GREAT PLAINS

Leaf rust, stem rust, and stripe rust are the three rust diseases that can be found in North Dakota (Figure 1). The pathogens responsible for these diseases overwinter in the southern USA and are dependent on conducive conditions and southerly wind currents to carry spores northward. This year, the furthest north reports of leaf rust and stripe rust in the Plains are Oklahoma and Kansas (at very low levels). The good news is that this lessens the risk of the recent thunderstorms, arriving from the south, from carrying spores northward. It is likely we will see at least one of the wheat rusts in North Dakota this year, but it will occur later in the growing season.

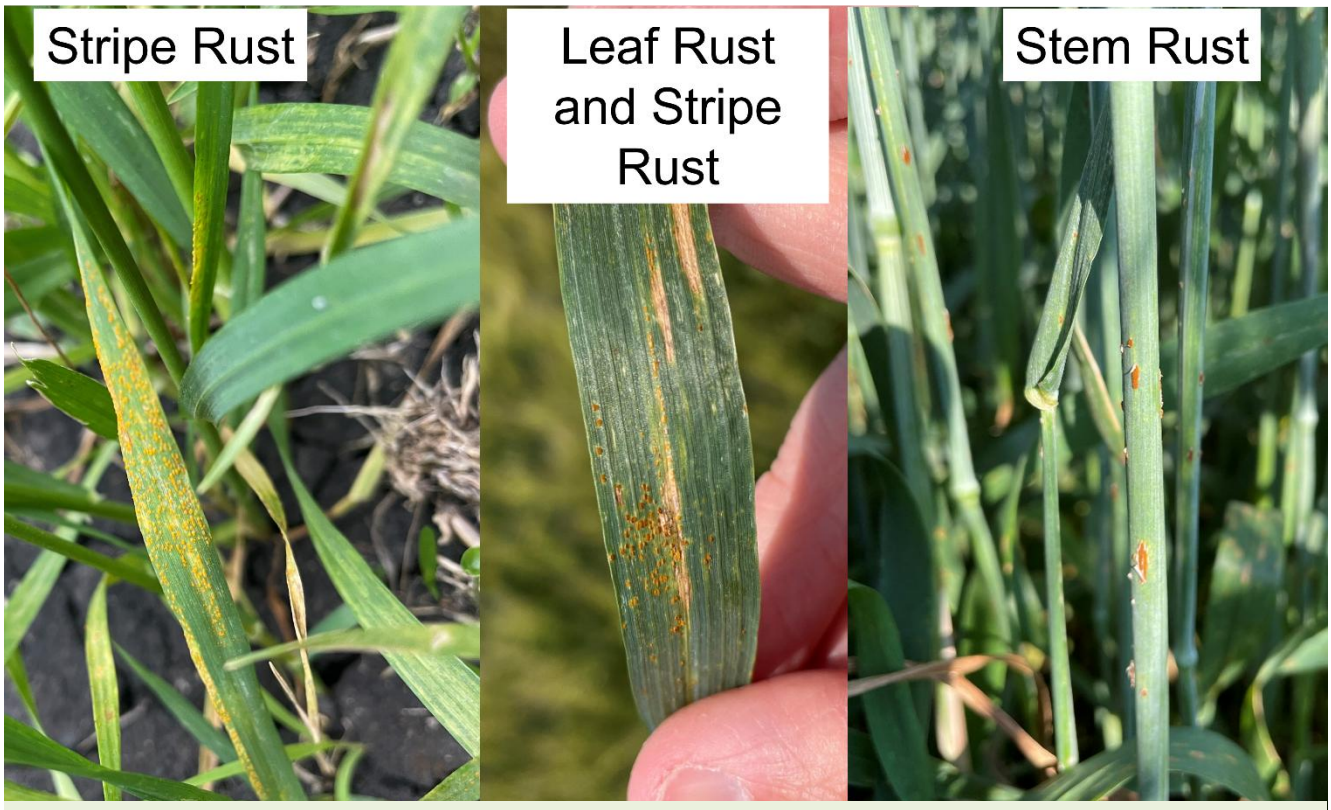


Figure 1. The three wheat rusts that can be found on wheat.

Andrew Friskop
Extension Plant Pathology, Cereal Crops

PYTHIUM ON THE MIND

As I am sure that most articles this week will be discussing the recent precipitation that we have received in the past week, I will not do any differently. While across much of the state we do need moisture for crops to grow, soybeans are extremely susceptible to a handful of seed and seedling pathogens that thrive under high moisture conditions. One of these pathogens is a group of water molds called *Pythium* species. When *Pythiums* do cause infection on soybeans, the effects are most often observed as rotten seeds that do not germinate, seedling wilting soon after germination, and root rots.

Figure 1. Soybean seedlings dying due to Pythium infection soon after emergence. Note the brown lesion that is creeping up from the soil that has turned the cotyledons yellow.

While we often group many different species into one large category, it is important to understand that the reality is much more complicated in any field. In any given field across North

Dakota, I would expect that *Pythium* species are present at least at low levels. From previous research across the soybean growing states of the U.S., it was found that over 67 species of water molds were found infecting soybean seeds and seedlings (Rojas et al. 2017). Of these, 60 fell within the group of what we often call *Pythium* species, and it was also found that some of these species were most aggressive on soybeans at 55°F while others were most aggressive at 68°F. This suggests that soybeans are potentially at risk for Pythium development regardless of the soil temperatures, especially if excess soil moisture is present.

While there is no management tool that we have in our toolbox once seeds are planted, the best defense is to use a proper seed treatment to fend off the invasion by these many different Pythium species.

Wade Webster
Extension Plant Pathology, Soybeans

plant science

EARLY SEASON RISKS TO CORN: IMBIBITIONAL CHILLING INJURY AND STANDING WATER

It feels strange to be writing an article about imbibitional chilling injury in corn on May 20th after the extremely high temperatures much of North Dakota experienced May 10-14. Many parts of the state had high temperatures in the mid to upper 90's for 3 or 4 consecutive days, conditions more characteristic of August than May. So why am I writing about imbibitional chilling risk given the stretch of record-high temperatures? I wanted to provide some information about it because I think we could see pockets of it given the extreme change in both temperature and soil moisture levels we have seen in the past week.

A lot of corn was planted in the last two weeks of April and the first week of May in the state. If the corn was planted in to moisture (which in some places there was moisture two inches down two and three weeks ago), imbibition began right away. When moisture is present, corn seeds take up a large percentage of the water they need to germinate in the first few hours after planting. Assuming the corn planted in April and early May had adequate moisture and soil temperature at or above 50°F, I do not expect to see chilling injury. If a field was already emerged before the rain started and the temperatures dipped, that corn avoided any temperature-related emergence issues. Where we might run in to chilling issues are fields that were planted into completely dry soil and were thus unable to imbibe water until rain started falling last week; or, in fields that were planted during the heat 1 or 2 days before the cold temperatures and rain took hold. In those fields planted in dry conditions, the first water they will have to germinate is from the rains that started last Wednesday in the West or Thursday-Friday in the East. Looking at the Hazen NDAWN station data, bare soil temperature was 74°F on May 13 and 46°F on May 19, a drop of 28 degrees. It is possible that fields planted dry could experience enough of a drop in soil temperature to pose a risk to germinating corn in places where daytime temperatures have fallen back into the 40's and 30's the past 5 days. Chilling imbibition risk is highest when soil temperatures are in the 40's during the first 24-48 hours of corn germination. As you scout emerging corn fields, check areas of missing plants by digging for seed. If you find seed that seems to have swollen but radicle (seedling root) and/or coleoptile (shoot) emergence has stopped, chilling injury may be the culprit. Other signs of chilling injury may be corkscrewed coleoptiles and stunted roots as cold temperatures interfered with normal elongation of cell membranes and walls.

The first photo shows a corkscrewed coleoptile (shoot) of corn seedling. This malformation was due to imbibitional chilling injury (photo credit: Joel Ransom).

The second photo shows multiple corn seedlings injured by imbibitional chilling (photo credit: Joel Ransom).

I also wanted to address the issue of standing water in corn fields and provide some perspective on how long corn can tolerate flooded field conditions. Two weeks ago, I did not expect to be needing to think about this in 2025, but parts of western and central North Dakota have received 4 to 7 inches of rain over the past 7 days. Corn that has not yet emerged can only survive for about 2 days in standing water. If the corn was in dry soil and had not yet imbibed any water (as was discussed above), this may buy the stand an extra day of time as the seed hydrates, but not much more than that. For corn that has emerged but has fewer than 6 true leaves (V6), these plants can only withstand about 2-4 days of standing water. Standing water in the field coupled with warm temperatures (70°F and higher), increases stress on the corn. If temperatures are cooler, stress on the plants is less. After V6, the growing point (apical meristem) of the corn is elevated above the ground surface and greatly increases the plant's ability to survive standing water. If a field is long-term no-till and typically does not experience ponding or standing water, it is possible that the internal structure of the soil will facilitate internal drainage and help reduce corn stand loss due to saturated conditions. I encourage western North Dakota corn growers who are not accustomed to seeing standing water in their fields keep an eye on their corn stands as the weather warms up and dries out over the coming week. If large gaps are present, a decision might have to be made about re-planting or switching crops.

Clair Keene
Extension Agronomist, Small Grains and Corn

SOYBEAN QUESTIONS? GET ANSWERS WEEKLY ON "IN THE POD"

In The Pod
Soybean Updates

This year, NDSU Extension, in collaboration with the North Dakota Soybean Council, launched a new weekly radio series called *"In the Pod: Soybean Updates."* The goal of the initiative is to deliver timely, relevant information to help soybean producers make informed decisions throughout the growing season. Each episode features interviews with an industry leader, agronomist, NDSU researcher, or innovative farmer who shares their experiences, strategies, field reports, and the latest research developments. From crop protection to soil health, from market trends to emerging technologies, "In the Pod" covers the full spectrum of soybean production.

Highlights from Recent Episodes:

- If you've been wondering how to handle this year's Dicamba restrictions, be sure to catch **Joe Ikley's** episode: Navigating Dicamba Restrictions in Soybeans, where he breaks down how you can adapt your weed management strategy.
- Soil management remains a top priority for North Dakota growers. Concerned about soil fertility? **Brady Goettl's** Ground Rules: Managing Soil Fertility for Soybean Success summarizes key points to ensure your soybeans get the nutrients they need. If your concerns are related to soil limitations, you should listen to **Naeem Kalwar** on Salty Trouble! Understanding Salinity and Sodicity Challenges, and stay tuned for an upcoming episode on soil acidity!
- Markets been on your mind? You're not alone. In Soybean Insights for Riding the Market Rollercoaster, **Frayne Olson** shares valuable strategies for navigating volatility and planning ahead. And if you're curious about the bigger economic picture, don't miss **Dave Ripplinger** discussing how biofuels impact your farm in Are biofuels driving the demand for North Dakota soybeans?, followed by **Bill McBee's** look at North Dakota processing infrastructure in How a Crush Plant Powers Agriculture.

If you want to know more, check: In the Pod: Soybean Updates | NDSU Agriculture

Ana Carcedo
Broadleaf Agronomist

IS MY NITROGEN LEACHING?

What a difference one week can make! Volatilization of N from broadcast urea was the topic of many of my conversations last week, with the above average rain the last few days, concerns have now shifted to leaching and denitrification.

Plant available N exists in the soil in two main forms: ammonium and nitrate. Ammonium has a net positive charge which allow it to "attach" to negatively-charged clay and organic matter in the soil, protecting it from leaching. Nitrate on the other hand, has a net negative charge, making it very mobile in the soil. The mobility of nitrate-N in the soil opens the door to significant leaching potential and movement out of the plant root zone during periods of high rainfall, in fields with coarse textured soil, or in tile drained fields. Additionally, nitrate-N can also be lost through the process of denitrification—the conversion of nitrate-N to N gasses by soil microorganisms under saturated conditions.

Knowing the soil N has to be in the nitrate-N form before it is susceptible to loss by leaching or denitrification, we must first consider how much of the fertilizer applied may currently be in the nitrate-N form. When anhydrous ammonia or ammonium sulfate is applied to field, it must undergo the process of nitrification, converting the ammonium-N to nitrate-N. Urea must undergo hydrolysis, catalyzed by the urease enzyme (remember urease from last week's Crop and Pest Report?) before then being converted to nitrate-N. Under favorable soil conditions (50-85°F and well-aerated) nitrification of ammonia-N begins rapidly, but takes 1-2 weeks before complete conversion occurs, urea takes

approximately 1.25-2.5 weeks from the time of application to be converted to nitrate-N, and anhydrous ammonia approximately 3-8 weeks, based on information from the University of Wisconsin. So, for those who applied fertilizer at the time of planting these past 10 days to 2 weeks, this may be welcomed news depending on fertilizer source and if urease/nitrification inhibitors were used.

For the N which is in the nitrate-N form, leaching from the crop root zone (Figure 1) will only occur when the amount of rainfall received is greater than the soil's water holding capacity, which is low in sandy soils and greater in fine-textured soils. The water holding capacity for various soil textures are listed in Soil, Water and Plant Characteristics Important to Irrigation ranging from as low as 0.5 inches of precipitation per foot of soil in sands to 2.8 inches per foot in silt loam. Taking your soil's texture, moisture levels prior to the rain, and total rain received (less the amount lost to runoff) into consideration, one can estimate the likelihood of nitrate-N being reached out of the root zone in a particular field and crop.

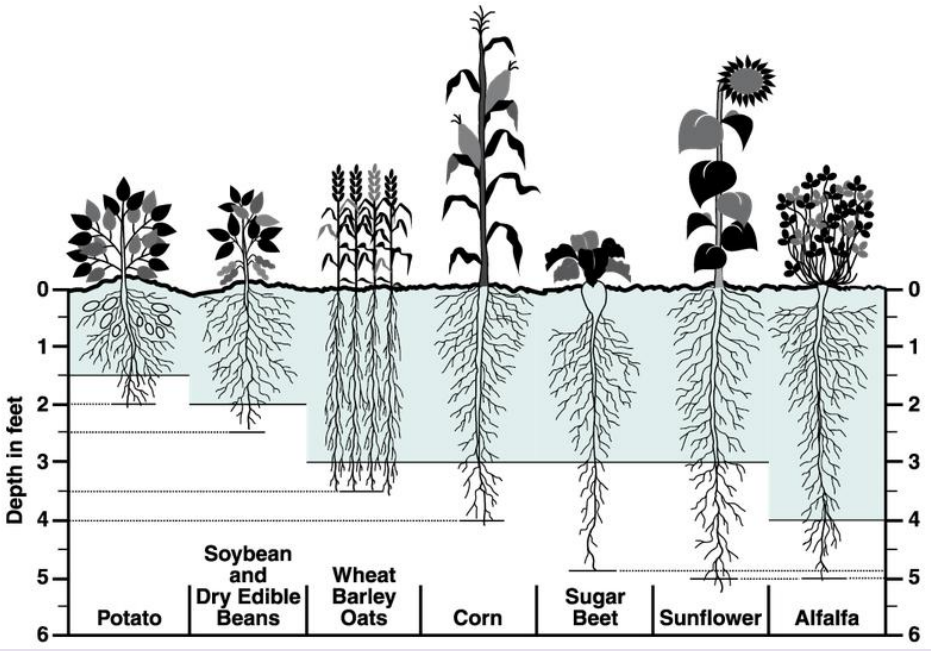


Figure 1. Typical fully developed root zone depths for common North Dakota crops, from Irrigation Scheduling by the Checkbook Method.

When soil is anerobic (saturated and lacking oxygen) for several days and soil temperature is 75°F or warmer are "ideal" conditions for denitrification. Cooler soil temperatures and shorter periods of saturation reduce denitrification risks substantially. For example, denitrification is estimated to be 1-2% per day of saturation when soil temperatures are 55-60°F while denitrification losses can reach 4-5% per day of saturation when temperatures are 65-70°F. With NDAWN soil temperatures in the mid to upper 40s on May 20th, concerns of denitrification are low right now—but this could change if we see continued rain and increasing temperatures in our future.

Brady Goettl
Extension Soil Science Specialist

ANHYDROUS AMMONIA CONSIDERATIONS FOR A DRY CROPPING SEASON

With the persistent drought conditions, especially in western North Dakota, a number of concerns were raised. One question that was raised is how anhydrous ammonia is impacted by the low soil moisture at application and potential nitrogen losses.

First, anhydrous ammonia is a fertilizer high in nitrogen (82% N). When stored, it consists of a clear, odorless, pressurized gas. This substance changes its chemical form when placed in the soil, starting as ammonia, which then reacts with water to form ammonium. These ammonium ions containing nitrogen are then held on the soil's negatively

charged particles, reducing their likelihood of being lost from leaching due to water or denitrification. Denitrification is the conversion of nitrogen to nitrogen gas. Additionally, ammonium can be held by organic matter, a factor that can be increased over time to increase the holding capacity of nitrogen in the soil. Increasing retention prevents it from volatilizing off as a gas or from leaching, and floating away your investment.

In the southwest there were reports of the soil being dry during anhydrous ammonia application, and getting the soil sealed properly above the injection slot was difficult. Loss of the ammonium gas can begin immediately after application and continue for several days to weeks if there is a failure to seal the soil properly, leaving a dry, cracked soil or an open site above the injection slot and if no moisture is available. Under such conditions, N losses can be greater than 50%. As discussed in last week's *Crop and Pest Report* in the Soil section from Brady Goettl about urea, there is no silver bullet regarding nitrogen management under droughty conditions.

How can I avoid potential nitrogen losses from anhydrous ammonia application?

Overall, the deeper the anhydrous is injected, the greater are the chances that the ammonia will encounter sufficient moisture to react with, and adhere to the clay and organic matter in the soil. According to Dave Franzen (NDSU Professor Emeritus, Extension Soil Specialist), "*if the soil flows around the ammonia application band and the band is placed at least 4 inches deep in the soil then the ammonia should be safe from loss*."

If ammonia can be smelled during application, it is a clear sign that it is being lost from the soil. In that case, the producer should either change the equipment setup to improve sealing, shoot for a deeper injection, or wait until the soil has adequate moisture conditions.

What should you do if you suspect nitrogen loss from your system?

Currently, limited options exist to quantify how much nitrogen was lost via volatilization, leaching and other pathways right after fertilization occurs. One issue is that various forms of nitrogen are applied, with some growers using more than one source simultaneously in one season in the same field (e.g., anhydrous ammonia, urea, and ammonium sulfate). The different forms of nitrogen are constantly reacting in the soil solution and being converted to different forms, with some becoming plant available over time during the season. Nitrate and ammonium soil testing is one way to determine the nitrogen levels in the soil, but visual deficiency symptoms can draw your attention to a problematic part of the field.

Above Ground Estimate of Nitrogen

- Chlorophyll meters, like a SPAD meter, can be used on leaves to estimate nitrogen levels in an area of concern.
- Normalized difference vegetation index (NDVI) uses leaf color of a plant presumed to be sufficient in nitrogen compared to a deficient plant

Below Ground

- In-season soil testing that some may call a pre-sidedress nitrate test. This can help you estimate levels from forms of nitrogen that have been converted since your spring or fall soil test. The in-season soil analysis method is also effective to assess potential anhydrous ammonia losses from the system.

Apply Nitrogen or Not?

- Once you know how much nitrogen is available to the plants, by doing a pre-sidedress nitrate test, the next step is to calculate the application amount and source. Keep in mind that this application may not always be economically viable.

- Some growers in our area have reported applying a lower rate of nitrogen fertilizer in the spring due to the dry conditions and potential losses. In those cases, a sidedress application may be justified.

Too much water? Now what?

Another concern that has been brought to us recently is that some fields have received a large volume of precipitation over the last week, with some regions receiving up to 7 inches of rain. Growers are concerned that nitrogen losses to leaching might occur.

Anhydrous ammonia losses to leaching are hard to assess, but one thing to keep in mind is that nitrogen in the soil can only be leached in the nitrate form. Ammonium-N or organic-N will not be lost to leaching. You can roughly estimate how much of the N applied was converted to nitrate. It takes 3 to 8 weeks for anhydrous ammonia to be converted to nitrate while it takes 1.25 to 2.5 weeks for urea to convert. Once nitrogen has been converted to nitrate, leaching can happen if rainfall totals surpass the soil's capacity to retain moisture within the crop's root zone. This problem is aggravated in sandy, coarse-textured soils when compared to medium- or fine-textured soils. To assess the risk of nitrate loss below the root zone, compare the recent precipitation in your area to the water-holding capacity of your soil.

In summary, nitrogen losses from anhydrous ammonia application can be minimized either by waiting for adequate soil moisture, but if that is not feasible, applying anhydrous ammonia at the proper depth (at least 4 inches) and using covering disks or sealing wings behind the injection knifes.

For more information read this NDSU Extension article: Ammonia Application in a Drought
For safety tips read: Anhydrous Ammonia: Managing The Risks

Chandler Gruener
Extension Soil Health Specialist

Victor Gomes
Extension Cropping Systems Specialist

CAN WIND CARRY WATERHEMP SEED WITH SOIL?

The wind has been a topic of conversation recently. Wind blowing 20 to 40 miles per hour has been a topic of conversation and mentioned by many, including farmers trying to make pesticide applications, homeowners trying to prepare gardens, or seniors trying to get out and take walks to get some exercise.

Of course, many have observed dust blowing with the wind. I was wondering what else is carried by the wind; is it possible the wind carries weed seed, perhaps waterhemp seed?

Waterhemp seeds (Figure 1) are small (1/32 to 2/32 inch diameter) and can easily be carried by farm machinery, in surface water, and by birds. Further, waterfowl, particularly ducks and geese, have been documented to disperse pigweed seeds, including waterhemp and Palmer amaranth, with an estimated 1,700-mile range. But can waterhemp be carried with soil and by the wind?

Waterhemp seed are small. There are 70 seeds on the surface of this dime.

I found reports suggesting 'yes', 'no' and 'maybe' during my internet query. Reports stated 'the wind' could be a means for waterhemp seed dispersal especially waterhemp seed in dry and loose soil which can more easily become airborne. Thus, fields or areas of fields previously believed to be clean from waterhemp could abruptly contain waterhemp. Other reports stated waterhemp doesn't move with soil and wind. That is, your new found waterhemp infestation was more likely in the field as scattered plants perhaps hidden from view, then spread by the combine during harvest, and likely was not blown into the field by wind. Still other reports suggest it is the wind in the fall and not the winter or spring; that wind in the fall may carry mature seeds from plants to adjacent fields.

So, while wind may play some role in seed dispersal, the wind events from the last two weeks probably are not dramatically contributing to the spread of waterhemp seed to neighboring fields. However, one more reason to keep soils covered in the fall with crop residue or fall seeded cover crops.

HOW CAN I GET RID OF EMERGED WATERHEMP IN SUGARBEET?

I received numerous calls about waterhemp escapes the week of May 11. Unfortunately, ethofumesate alone has not performed as well as hoped/expected in some geographies. I am afraid our rainfall was too spotty in those places. In those same geographies, ethofumesate mixed with Dual Magnum performed better. Finally, the cover crop is healthy, even in fields with 3 and 4 pints of ethofumesate, suggest activation challenges. So, what do we do now?

1. Roundup PowerMax3 kills some small waterhemp. I attribute this to a mixed population of resistant and susceptible waterhemp found in fields. Use full rates, AMS and an adjuvant. However, unlike kochia control, tallow amine adjuvants are not going to save the day for waterhemp control. I conducted an experiment this winter investigating waterhemp control from Roundup PowerMax3 mixed with Nortron and tallow amine adjuvants and observed similar control as compared to other adjuvants.
2. Spray small waterhemp with Roundup PowerMax3 mixed with Stinger HL. I conducted an experiment in 2019 in the field and in the greenhouse investigating waterhemp size and mixtures. For the record, Stinger HL does not control waterhemp! However, we observed a bump in waterhemp control when Stinger was mixed with glyphosate as compared to glyphosate alone. Use full glyphosate rates with adjuvant and AMS.
3. Get your laybys on, weather permitting.

4. Betamix. Not much is left but this is an opportunity to use it if you have it. Strike hard, even on small waterhemp. Decision rules for Betamix application for waterhemp control mimic kochia control with Spin-Aid. However, sugarbeet size, maximum daily air temperature, and mixture with Betamix ultimately determines use rate.
5. Ultra Blazer. We received an Ultra Blazer Section 18 EE for Ultra Blazer use in Minnesota and North Dakota for 2025. Remember, greater than 6-lf sugarbeet. I prefer Ultra Blazer alone with an adjuvant. Roundup PowerMax3 mixed with Ultra Blazer is too hot. Don't waste your time with waterhemp bigger than 6-inch.
6. Electricity, inter row cultivation, or Liberty applied through the hooded sprayer.

The key is to be proactive. Small waterhemp unfortunately grow into big waterhemp very quickly.

Tom Peters
Extension Sugarbeet Agronomist
NDSU & U of MN

forestry

TENT CATERPILLARS FEEDING ON TREES

You know it's spring when you smell the crabapple flowers and then notice an unsightly webbed tent and hairy caterpillars in the fork branches of chokecherry, pin cherry, or other hardwood trees.

This is the Eastern tent caterpillar (*Malacosoma americanum*) with one generation annually. It overwinters as fully developed embryos within the eggs. Larvae are gregarious and construct tent-like silk nests in the forks of trees. The tents are used as shelters or resting places. Larvae forage during the day for new foliage in nearby branches and cause defoliation. Larvae feed for six to eight weeks and are about 2 inches long when mature. Larvae are black and somewhat hairy with a

Eastern tent caterpillar larvae (Patrick Beauzay, NDSU)

Eastern tent caterpillar larvae in web (Patrick Beauzay, NDSU)

whitish-yellow stripe down the middle of the back, narrow broken orange-colored subdorsal stripes, and lateral white and blue markings.

When mature, they disperse and spin cocoons in sheltered places. Adult moths appear during early summer (late June or early July) and lay their eggs in a bandlike cluster of 150 to 350 eggs around a small twig, covering them with a froth substance called spumaline. Adult moths are yellowish-brown, medium-sized (1 to 1 1/2 inch wingspans) and stout-bodied, with hairy bodies, legs, and eyes. Two oblique whitish bands run across the forewings.

The simplest control method is to remove and destroy the nests. The bacterial-based pesticide *Bacillus thuringiensis var. kurstaki* (Btk) works well to control young larvae, while pyrethrins or synthetic insecticides are needed for older larvae. Do not take a blow torch to the nest, as that will also damage the tree! Other insecticides available to homeowners include: acephate (Orthene), azadirachtin (Azatin), carbaryl (Sevin – old formulation), esfenvalerate (Bug-B-Gon), malathion, permethrin, spinosad (Conserve), or other insecticides registered for ornamental trees. *Always read, understand and follow the insecticide label directions*.

The caterpillars will complete their feeding in mid-to-late June, so control measures should be applied as soon as possible.

Janet J. Knodel
Extension Entomologist

Joe Zeleznik
NDSU Extension Forestry Specialist

around the state

AROUND THE STATE

NORTHEAST ND

Field Conditions and Crop Progress Update

Farmers across the region rushed to get seed in the ground ahead of the forecasted rains early in the week. The much-needed precipitation was beneficial for already planted fields, as surface soils had been drying out. Rainfall totals recorded by NDAWN stations across the northeastern region ranged from 1.32 to 2.26 inches as of noon Tuesday.

Uniform spring wheat emergence observed in Cavalier County. Photo: Venkat Chapara, LREC

Most small grains have emerged with good stands, particularly in well-leveled areas. However, emergence has been reported as uneven and poor in low-lying or saline spots. Continuous rainfall and cooler temperatures have halted field operations and slowed crop development. Fields are now saturated, with standing water visible in lower areas. Temperatures dropped to 32°F in the early hours of Saturday, resulting in frost that has raised concerns about potential damage to emerged crops. Early planted wheat, corn, soybeans, and canola may have been impacted by the frost event.

Low spots with poor emergence in a small grain field in Grand Forks County. Photo: Isaac Cuchna, ANR Extension Agent, Grand Forks County

A B

Frost damage observed in A) wheat and B) corn fields in Cavalier County. Photo: Lahni Stachler, ANR Extension Agent, Cavalier County

Shepherd's purse in a field in Grand Forks County. Photo: Isaac Cuchna, ANR Extension Agent, Grand Forks County

Lambsquarters infested field in Grand Forks County

Anitha Chirumamilla
Extension Cropping Systems Specialist
Langdon Research Extension Center

SOUTH-CENTRAL/SOUTHEAST ND

Agronomists, Extension personnel, and farmers please mark your calendars for the annual Crop Management Field School June 27, 2025 at the Carrington Research Extension Center! Registration starts at 8:30 AM and the program ends at 2:45 PM. Registration deadline is June 23, 2025 with maximum participants of 50 people, so register soon. You may register at the following link: ***www.tinyurl.com/payCREC*** **.**

Planting came to a screeching halt last Thursday for everyone due to much needed rain and most farmers have stayed parked since in the region!

As of May 20th, nearly all small grain species, field peas, canola, and potatoes have been planted across the region with at least 70% of each of those crops emerged already in the region. The small grain crops and canola are emerging non-uniformly across the region and within each county looking poor to excellent. The most advanced hard red spring wheat in the region is producing at least one tiller already. Field peas probably look the most uniform and have the best quality of the crops in the region. Few potatoes have emerged yet.

As of May 20th, corn planting ranged from 30% in Burleigh County to nearly 100% in Logan and Sargent Counties, with an average corn planting across the region of 80%. As of May 20th, corn emergence ranged from 5% in Eddy County to 80% emerged in Sargent County, with an average emergence for the region of about 25%. With the cold weather corn emergence is progressing slowly, especially since soil temperatures are currently below 50 degrees Fahrenheit in the entire region! Corn stands are looking good across the southern tier of counties in the region, but in most other counties in the region corn is emerging non-uniformly and slowly and not looking good at the moment. The most advanced corn reported is at least V2 (second-collar) in Emmons County, but I understand there is some V3 (third-collar) corn in Sargent County already.

As of May 20th, soybean planting ranged from 7% in Eddy County to nearly 100% in Sargent County, with an average across the region of nearly 50%. Soybean emergence in the region ranges from 0% in Eddy County to at least 35% in Sargent County, with an average emergence across the region of 10%. The most advanced soybean plants I've seen north of Interstate 94 just have the unifoliate leaves unfolded. Sargent County probably has the most uniform stand of soybeans while the rest of the region has non-uniformly emerging soybeans and unknown quality of stands at the moment. Farmers and agronomists in the region need to scout soybean fields closely as it dries out and warms up to see how the seedling blights of rhizoctonia, phytophthora, and pythium are affecting soybean emergence and properly identify the pathogens causing any stand loss.

A few sunflower fields have been planted in Burleigh and Emmons Counties with none emerged. I'm not aware of any dry beans having been planted in the region yet, but that doesn't mean some haven't been planted. It's a good thing that nearly all dry beans have not been planted at this point in time.

With all of the wind in the past week, burndown and/or preemergence herbicides were not applied to all fields. Some no-tillage fields have emerged crops and but no herbicides applied yet. For these fields, postemergence herbicides will need to be applied sooner than normal when weeds are small irrespective of the size of the crop as long as the crop is at a stage that the herbicide can be applied. With the warmer than normal temperatures prior to the rain last week, kochia plants became larger and more of them have axillary (branch) bud growth occurring. Once kochia plants have axillary bud growth most herbicides will not control the kochia as effectively. Weeds are clearly the biggest pest problem at the moment. Flea beetles are still around to bother canola, but their activity has been diminished greatly since the rain due to cold temperatures.

Of the 27 NDAWN stations chosen this season for this region, the average maximum daily air temperature from May 13 to May 19, 2025 ranged from 56 degrees Fahrenheit near Pickardville to 68 degrees Fahrenheit near Gardner, with an average for the region this past week of only 63 degrees Fahrenheit! The eastern part of the region still had 90 + degrees Fahrenheit days for Tuesday and Wednesday before the rain, with Gardner having the highest temperature of 96 degrees Fahrenheit! The average daily high temperature for the week was below normal for the entire region! On May 17, 2025, Cooperstown tied the record for the lowest daily high temperature! I'm sure this occurred in most of the region. The average daily minimum air temperature for the past week at the 27 NDAWN stations across the region ranged from 42 degrees Fahrenheit near Pickardville, Wishek, and Zeeland, to 47 degrees Fahrenheit near Hillsboro and Wahpeton, with the daily average for the region for the week of 44 degrees Fahrenheit.

Rainfall for these stations across the region for last week ranged from 0.44 inch near Gardner to 4.7 inches near Livona, with an average for the week of 1.5 inches! Based upon historical weather data at Hazelton, ND which is the closest historical weather records to Livona, the 4.7 inches of rain for the week broke the past record by 0.73 inch set in 2023! The southwestern part of the region received the most rainfall this past week while the eastern part received the least. As of May 19th, the Jamestown NDAWN station had the lowest four-inch depth of soil moisture at 17% while McKenzie NDAWN station reported 49% soil moisture. The average four-inch soil moisture increased 13% over last week with all of this rain. As of May 19th, the Wing NDAWN station still had the lowest 39-inch depth of soil moisture at only 5% and the Cooperstown NDAWN station still had the greatest at 51%. The only other stations having a 39-inch depth of soil moisture below 10% on May 19th was Linton, Livona, Pickardville, and Stirum. These NDAWN stations did not report a change in moisture for these sites at the 39-inch depth from the previous week.

The lowest daily average four-inch bare soil temperature in the region on May 19th was 42.9 degrees Fahrenheit at Wishek! This is the coldest four-inch bare soil temperature on this date at Wishek since the NDAWN station was installed in 2001! The average four-inch bare soil temperature at the Wishek NDAWN station for May 19th should be 56.4 degrees Fahrenheit! What a change from last week!

The other big story this past week was the strong winds again! The daily average wind speed for these stations across the region for the past week ranged from 10.6 mph near Casselton to 17.4 mph near Zeeland, with an average of 14.0 mph, 1.2 mph greater than last week for the region!

Hopefully we warm up and dry out by next week at this time and can report additional crops planted.

Most advanced hard red spring wheat in Wells County on May 15, 2025 at the first tiller stage.

Corn emerging in Sheridan County on May 15, 2025

Soybean emerging in Sheridan County on May 15, 2025

A young Russian thistle plant found in Sheridan County on May 15, 2025

Jeff Stachler
NDSU Extension Cropping Systems Specialist at Carrington Research Extension Center

SOUTHWEST ND

Much-needed moisture has finally arrived in southwest North Dakota, significantly slowing field activity over the past week. As of May 20, precipitation totals across the region ranged from 1.78 inches in Bowman County to 7.11 inches in Grant County, with more rain forecast for this week. Given how dry soils had been, and the fact that much of the rainfall was relatively gentle, the moisture has mostly infiltrated rather than run off. While a few reports of standing water and concerns about flooding impacts on crops have begun to emerge, these remain few and far in between. It will be important to monitor how the situation evolves in the coming days, however, since potential flooding could be severely detrimental to crops this early in the season.

Planting progress is expected to remain slow until fields reach suitable moisture levels for fieldwork. Most producers have completed small grain seeding, and canola is more than 50% planted. Many growers took advantage of the brief window ahead of the rain to get corn and soybeans in the ground. However, with the recent drop in soil temperatures, germination and emergence in those crops will likely be delayed. Scouting early for diseases and other stressors will be essential to ensure good stand establishment. Corn, soybean, and sunflower planting will resume as soon as field conditions allow. Ideally, these crops should be planted once the ground is at least at 50°F. Growers should refer to the NDAWN website to monitor soil temperatures in their area.

Reports from the region estimate 10–20% stand loss in pulse crops (chickpeas, lentils, and peas), likely due to a combination of last week's 95°F temperatures and droughty conditions followed by a weekend frost. Most legume crops, however, can compensate for reduced stands by branching out and filling in gaps. In general, yield losses remain minimal unless final stands fall below 70% of the target population. Other crops, such as wheat and canola, appear to have largely escaped frost damage.

Nitrogen leaching is another concern that has been brought up with the recent rains. Nitrate leaching occurs when precipitation exceeds the soil's ability to hold water in the crop root zone and is worse in sandy soils. In so far, the moisture we've received hasn't been enough to surpass field capacity in most places. To determine potential nitrate leaching from your soil, compare the rainfall totals to the number of inches of water your soil can hold in the crop root zone. Denitrification on saturated soils could also be a concern, however, the predominantly low soil temperatures (<50°F) slow down the denitrification process and losses through this pathway will likely be minimal.

If wet conditions continue and progress to flooding, germination and emergence could be compromised. In a year marked by weather extremes, early stand assessments are more critical than ever to guide decisions and mitigate potential yield losses.

For tips on how to appraise crop injury, stand reduction and yield potential, please refer to this NDSU Extension Publication: Replanting or Late Planting Crops.

Victor Gomes
Extension Cropping Systems Specialist

weather

WEATHER FORECAST

The May 22 to May 28, 2025 Weather Summary and Outlook

Over the past week, two storms brought significant rainfall to the region. The first storm hit last week from Wednesday to Friday, followed by another one earlier this week mainly on Monday and Tuesday. Much of western North Dakota recorded four to seven inches of rain (Figure 1), with some areas receiving about 40% of their average annual rainfall. The steady, moderate rain allowed much of it to soak into the soil. Many NDAWN stations reported soil saturation down to 40 inches in the heaviest-hit areas. The next seven days should bring only light rain amounts, giving fields a chance to dry out gradually.

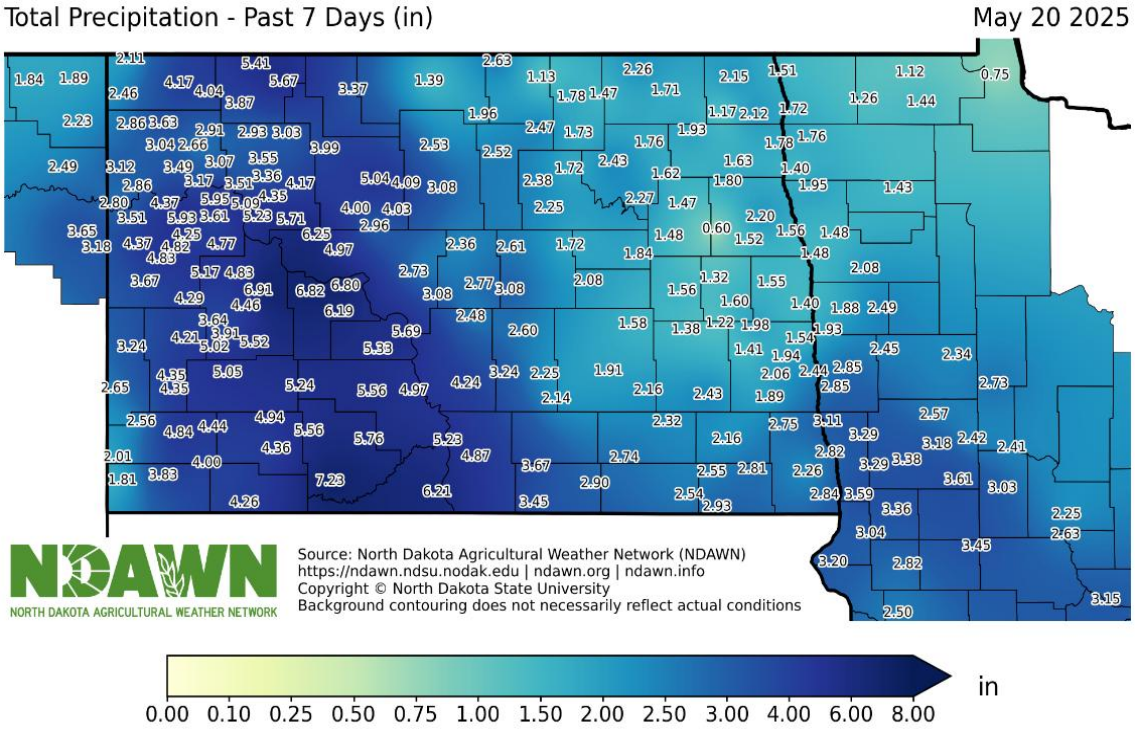


Figure 1. Total Rainfall for the period of May 14 through May 20, 2025.

The rain and clouds this past week brought unusually cold May temperatures, with snow reported in western North Dakota on Tuesday and south-central North Dakota on Wednesday. Temperatures averaged as cold as 18 degrees below normal (Figure 2) in recent days. The good news, warmer weather will return to the state this forecast period. Conditions will remain slightly below average through the weekend but are expected to reach average levels next week.

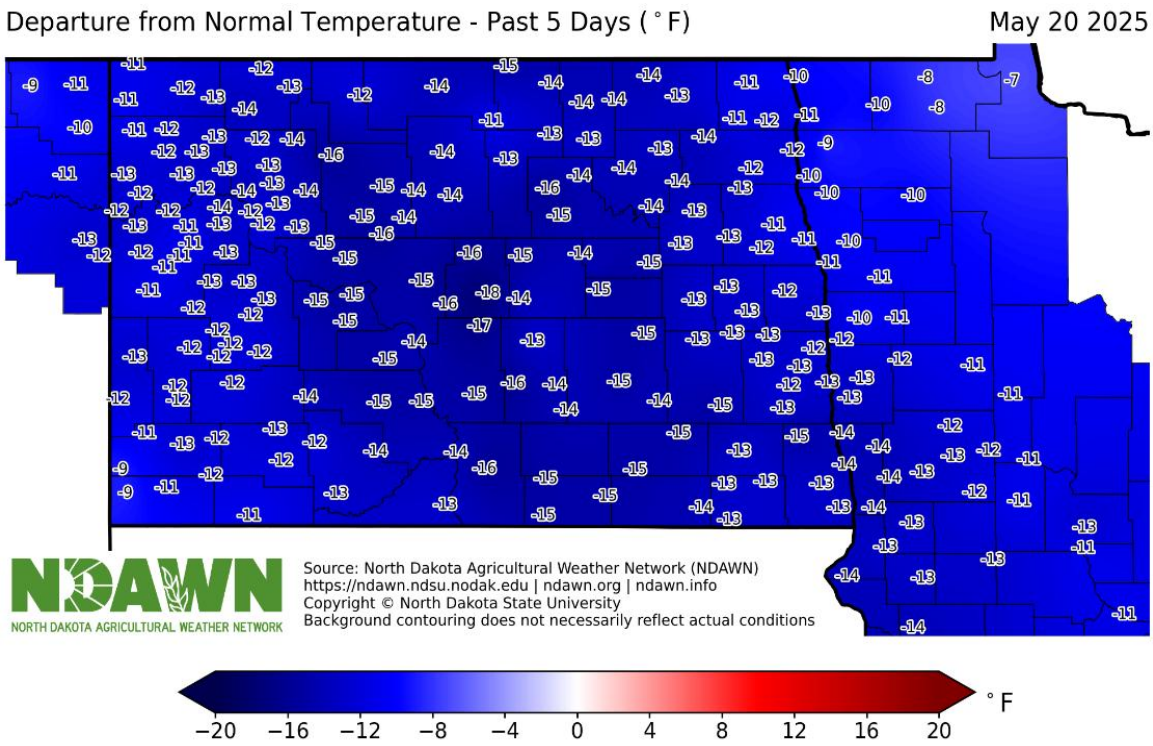


Figure 2. Departure from Average Air Temperature for the Period of May 16 through May 20, 2025

Figures 3 and 4 show forecasted Growing Degree Days (GDDs) for base 32°F (wheat and small grains) and 50°F (corn and soybeans) during this forecast period.

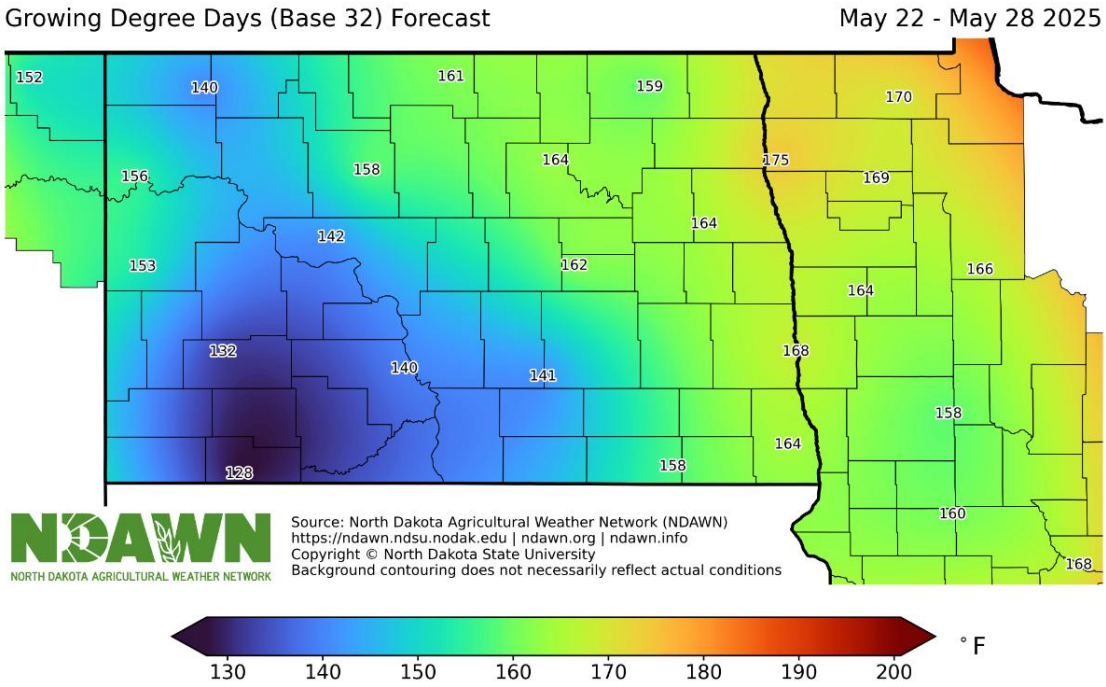


Figure 3. Estimated growing degree days base 32° for the period of May 22 to May 28, 2025.

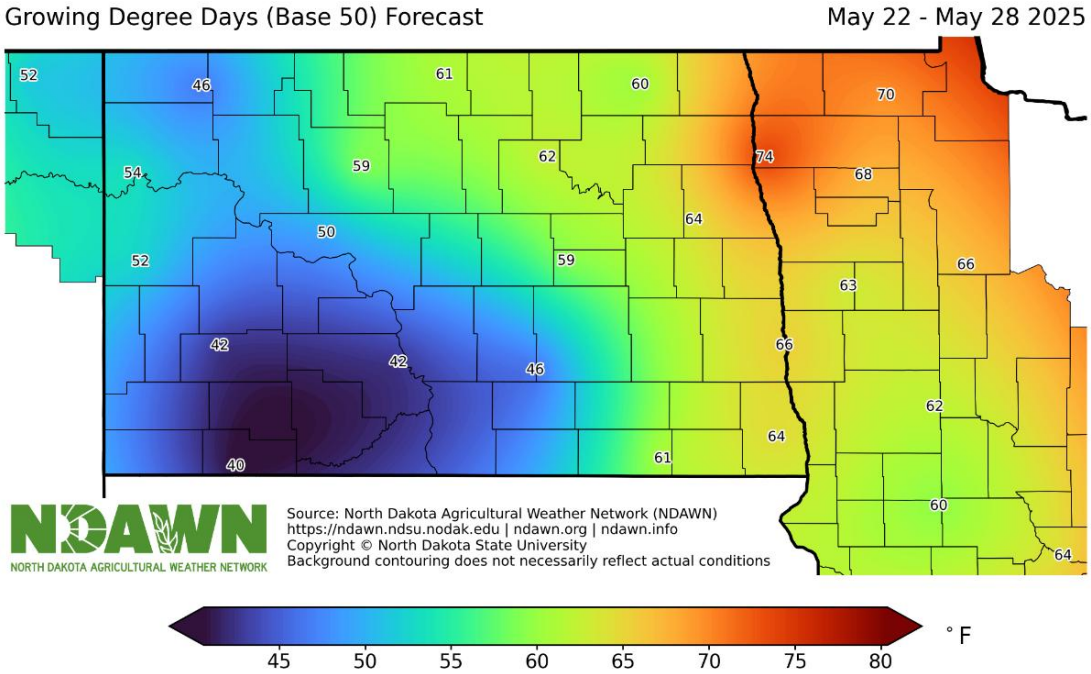


Figure 4. Estimated growing degree days base 50° for the period of May 22 to May 28, 2025.

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

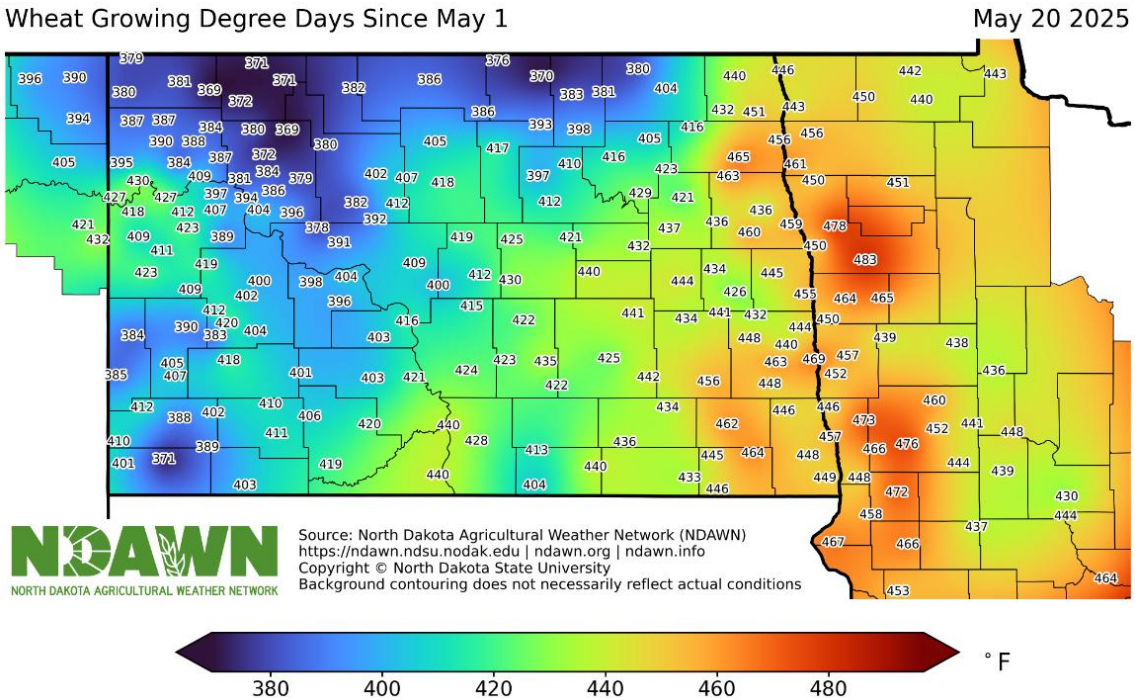


Figure 5. Wheat Growing Degree Days (Base 32°) for the period of May 1 through May 20, 2025

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.

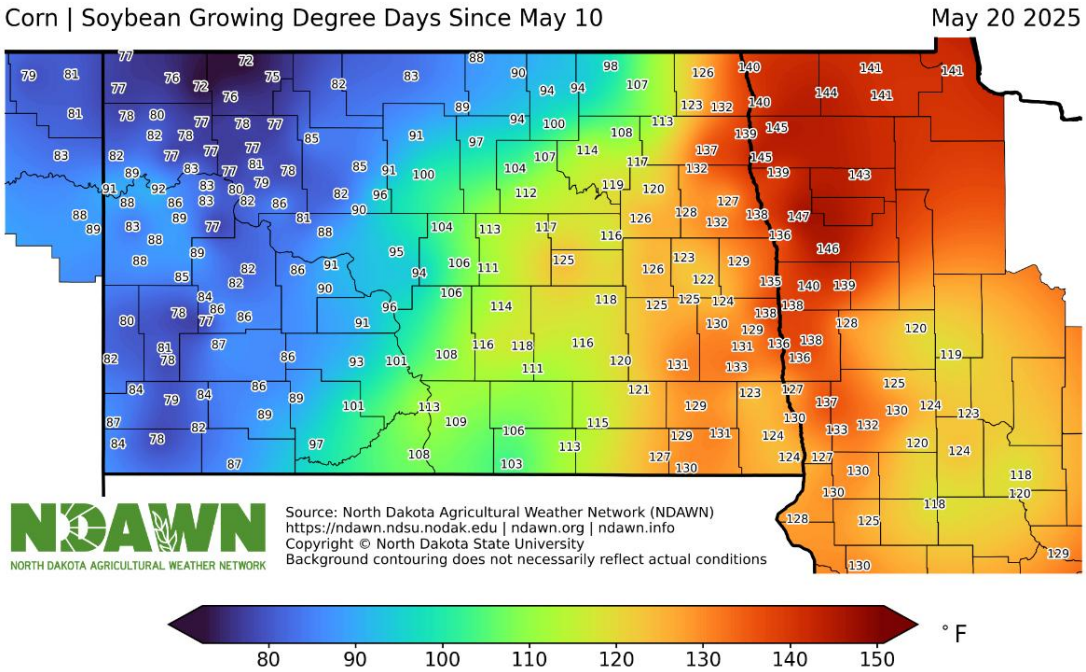


Figure 6. Corn Growing Degree Days (Base 50°) for the period of May 10 through May 20, 2024

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

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

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

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Janet Knodel
Wade Webster
Co-Editors

Entomology
701-231-7915

Plant Sciences
701-231-7971

Soils
701-231-8881

Eric Branch
Marcia McMullen
Co-Editors

Plant Pathology
701-231-7056

Weeds
701-231-7972

Ag Engineering
701-231-7261

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