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Entomology

CORN ROOTWORM TRAPPING NETWORK

Here's our update for the corn rootworm monitoring network in southeastern North Dakota. Trap results are posted in the NDSU Extension *Crop & Pest Report* and on the IPM website.

Trap Economic Threshold (E.T.): A capture rate of **14 or more adults per trap per week** indicates a high rootworm population and high risk for corn damage for the 2026 season. *A management strategy will be needed for corn rootworm control in that field.*

We captured a total of 583 beetles from August 28 to September 3, a 48% increase from 279 beetles from August 21 to August 27 (Table 1). The cumulative total is 1,323 beetles for the whole trapping season, with the majority being northern corn rootworms. The first western corn rootworm beetles (2) were trapped in Sargent County near Havana last week, near the South Dakota border. There were two fields above E.T. during the fourth week of trapping and three during the fifth. The Sargent County field #2 near Gwinner was above the E.T. for the fourth week in a row. The Cass County field near Argusville and the Richland County field near Colfax were also above the E.T. level. See the corn rootworm IPM maps on the next page.

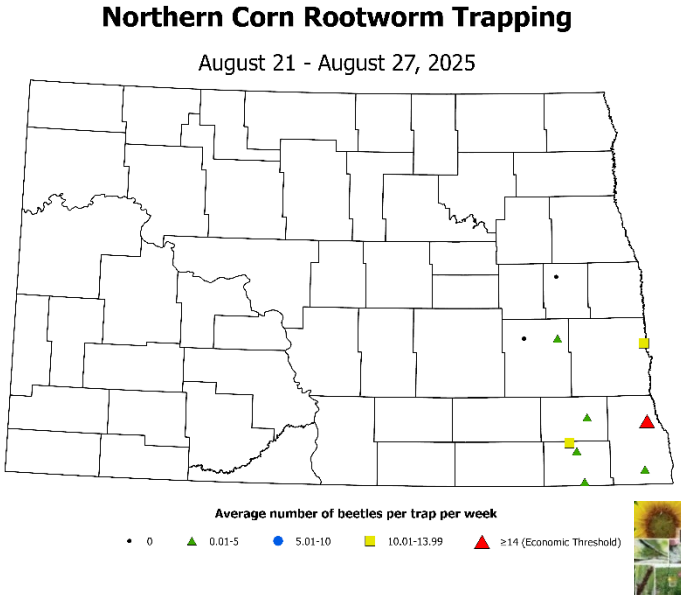
Thanks to the support of the North Dakota Corn Council.

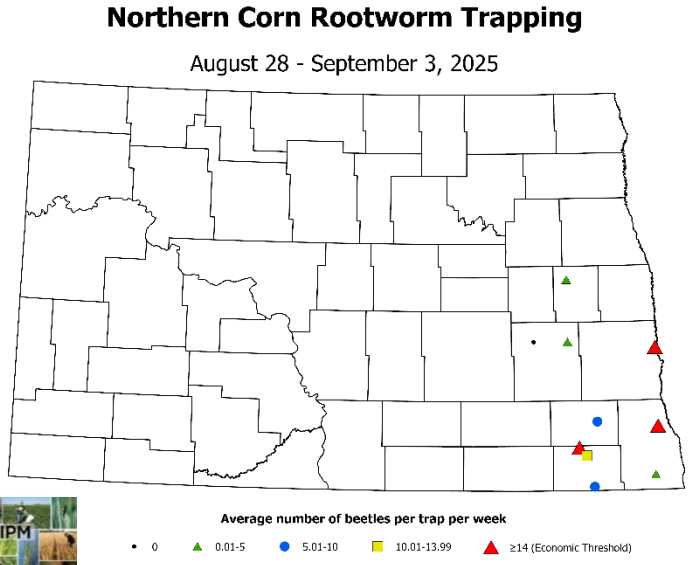
Table 1. Average number of adult corn rootworms (both northern and western) per trap per week in ND field corn, 2025.

Area	County	Nearest town	July 30 - Aug 6	August 7 - 13	August 14 - 20	August 21 - 27	August 28 - Sept. 3	Cumulative Total NCW & WCR
SE	Barnes 1	Pillsbury	0.0	0.0	1.3	1.5	1.0	16
SE	Barnes 2	Rogers	0.0	0.0	0.0	0.0	0.0	0
SE	Cass 1	Argusville	3.0	4.5	20.3	11.4	39.3	321
SE	Ransom 1	Lisbon	0.3	0.5	5.3	4.1	6.5	69
SE	Richland 1	Colfax	3.0	3.3	9.8	16.7	23.5	236
SE	Richland 2	Hankinson	0.8	4.5	7.5	3.0	2.0	73
SE	Sargent 1	Havana	0.8	2.5	4.3	4.7	10.3	93
SE	Sargent 2	Gwinner	4.3	16.8	23.0	13.5	50.5	441
SE	Sargent 3	Gwinner 2	-	-	-	4.9	12.3	72
SE	Steele 1	Finley	0.0	0.0	0.0	0.0	0.5	2
		Total # corn rootworm	48	128	285	279	583	1323
		Percentage of NCR =	100%	100%	100%	100%	99.7%	
		Percentage of WCR =	0%	0%	0%	0%	0.30%	

Economic thresholds (ET) is an average of 14 or more adults per trap per week (regardless of species).

Red highlighted text indicates that the corn field is at or above ET





BEAN LEAF BEETLE FEEDING ON SOYBEAN PODS

There are three periods when the bean leaf beetle can cause a reduction in soybean yields. 1) The overwintering bean leaf beetle feeds mainly on cotyledon leaves in spring. 2) The first-generation beetles feed on soybean leaves, causing defoliation during late June into July. 3) The second generation is the most concerning, as these beetles feed on leaves and pods in late August into September. Pod feeding reduces yield directly and increases the risk of bean pod mottle virus transmission. Symptoms of this virus include stunting, leaf crinkling, light purplish discoloration on the seed coat, and lower yields.

If soybeans are late-planted and still in the pod-fill stages, scout fields for second-generation beetle feeding on pods. Sample 10 plants. Then, count the total number of pods and the number of pods with feeding injury. Calculate the percentage of pods with feeding injury. Once soybeans reach the R7 growth stage (physiological maturity) or beetle populations decline, scouting is no longer necessary.

Economic Threshold for Bean Leaf Beetle during the soybean pod fill stage (R6):

- Treat when the percentage of pods with feeding injury exceeds 10% and beetles are still present in the field.
- If beetles are clipping pods, apply insecticide more aggressively.
- Always use the high labeled rates of foliar insecticides.
- Check the Pre-Harvest Interval (PHI) for your chosen product.

Bean pod mottle virus on soybeans (Martin Draper, USDA-NIFA, Bugwood.org)

Bean leaf beetle feeding injury on soybean pods (Adam Sisson, Iowa State University, Bugwood.org)

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plant pathology

CORN DISEASE UPDATE

The corn disease survey effort has primarily focused on the southeast quarter of North Dakota. Although diseases have been regularly found in fields, disease levels are very low and will have minimal impacts on yield at this point in the growing season (Figure 1). Some of the more common foliar diseases found include common corn rust (88% of the fields), southern rust (77% of the fields), northern corn leaf blight (65% of the fields), and bacterial leaf streak (38% of the fields). Southern rust was first confirmed on August 18, which would be the earliest report of this disease in North Dakota during the past 12 years. There are significant yield loss concerns associated with southern rust across major corn growing regions in the USA. Although we did identify southern rust "early" in North Dakota, the general growth stage of corn combined with low levels of southern rust in surveyed fields, likely indicates the corn will "out-race" damage this year. As a reminder, the southern rust pathogen does not overwinter in North Dakota and we are dependent on wind currents from the south to carry spores into our state.

Figure 1. Foliar diseases of corn commonly found in the 2025 Corn Disease Survey effort.

Tar spot has not been confirmed in North Dakota in 2025. With funding from the North Dakota Corn Utilization Council, we established field research at three sites in southeast North Dakota that had positive tar spot reports in 2024. This research is actively monitoring the occurrence of tar spot and evaluating the use of fungicides at VT/R1 to help suppress foliar disease and protect yield. One of the most popular questions at field days in August was "Why haven't we found tar spot yet in 2025?" Disease development is primarily influenced by three factors: the environment, the pathogen, and the host. It is likely that most of our corn hybrids are susceptible to tar spot and the environment has been favorable for

tar spot development (cool and wet weather). One hypothesis on why we haven't found tar spot in 2025 is the lack of the pathogen. In 2024, we had very low levels of tar spot within impacted fields (1 to 3 lesions on a leaf) and it is possible none of the lesions were able to overwinter and produce spores in 2025. Research has shown that the greatest success for overwintering of tar spot includes high levels of tar spot severity on leaves. It is still possible that we see a late occurrence of tar spot in North Dakota and we will continue to monitor for its presence.

Andrew Friskop
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SOYBEAN CYST NEMATODE VIRULENCE SHIFTS IN NORTH DAKOTA

Soybean cyst nematode (SCN) remains the most damaging soybean pathogen in the United States, and North Dakota is no exception. While previous Crop and Pest Report articles have discussed the biology of SCN, it is important to recognize that the threat is still developing. SCN populations evolve, adapting to the management practices used against them, and this adaptability is most apparent in how SCN overcomes resistance in soybean varieties, making the monitoring of SCN populations critical.

A recent study at NDSU provides updates on the status of SCN virulence in North Dakota. Between 2015 and 2017, SCN populations from 73 field samples were categorized into six HG types, with HG type 0 (36%) the most common, followed by HG type 7 (27%) and HG type 2.5.7 (19%). However, the most recent survey of 21 field soil samples collected in 2024 detected eight HG types, using seven soybean PI lines and a susceptible check. Importantly, the dominant population has shifted. HG type 2.5.7 now accounts for 57.1% of samples, while HG 7 and HG 0 each account for only 9.5%. The HG type system is used to describe which resistance sources SCN populations can reproduce on. An HG type of 0 indicates that the SCN population can be controlled effectively by all sources of resistance. If the number "1" is present in the HG type, it indicates that the SCN population can overcome Peking type of resistance, while a "2" indicates reduced effectiveness of PI88788 resistance. Thus, the detection of HG types containing "1" or "2" is an early warning sign that these historically reliable resistance sources may no longer provide adequate control. Overall, these results confirm a clear shift in SCN virulence phenotypes in North Dakota.
This shift is significant because it is the consequence of relying too heavily on a limited number of resistance sources, particularly PI 88788. For decades, PI 88788 has been the backbone of SCN resistance in commercial soybean varieties across the U.S. Unfortunately, widespread and repeated use of this single resistance source has selected for SCN populations capable of overcoming it. The increase in HG type 2.5.7, known for its ability to attack PI 88788, indicates that the effectiveness of this resistance source is breaking down in North Dakota fields. Without more proactive management, our farmers may see reduced yield protection from resistant varieties they have come to rely on for many years.

While this is disappointing to have a partially broken tool, there are multiple strategies to take going forward. First, be aware of the HG types present in your fields by soil sampling and testing when possible. Second, rotate between different SCN resistance sources, particularly PI 88788 and Peking, to help diversify selection pressure on SCN populations. Even within a resistance source, avoid planting the same variety repeatedly. Rotating between varieties with the same resistance background can help delay resistance breakdown. Finally, integrate resistance with other management strategies such as crop rotation (all crops except dry beans are great alternatives), seed treatment, and active SCN monitoring.

Fig 1. Soybean PI (Plant Introduction) lines and susceptible check 'Barnes' grown in the controlled growth chamber maintained at 27°C and with a daylight of 16 hours for SCN HG type testing.

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FROST AND FREEZE DAMAGE TO CORN

Unfortunately, many areas in western and north central North Dakota experienced their first fall frost of the season overnight Friday, September 5th into the morning of Saturday the 6th or overnight of the 6th into the morning of Sunday the 7th. While most NDAWN stations stayed close to a minimum temperature of 32°F, a few stations recorded lower temps with some in the upper 20's observed. The Dickinson NDAWN station fluctuated between 32 and 33°F for 5 hours between 3:00 and 7:00 am the morning of the 6th. The Hettinger station ranged between 32 and 30°F for 4 hours early Saturday morning.

Corn can be killed at 32°F if the temperature stays at freezing for a few, usually thought to be 3-4, hours; corn plant death occurs more quickly at colder temperatures, with exposure at 28°F or less for just a few minutes sufficient to kill most tissues. When temperatures are just above freezing, 33-40°F, for multiple consecutive hours, damage is likely to be highly variable and strongly influenced by the topography of the field. Cold air is denser/ heavier than warm air, and as air cools overnight, the colder air flows to lower positions in the landscape. Thus, if a corn field has rolling hills or is adjacent to a low creek bed, one should expect to find more damaged plants in the swales or along the drainage points. The weather the day before and after the frost occurs also influences the extent of damage. If it was warm and sunny the day before the frost and also warms up quickly with sunny conditions the morning after the frost, the corn is less likely to sustain as much damage than if conditions were cloudy and cool (high's less than 50 degrees) before and after the frost. This is because the tissues would have more residual warmth going into the frost and also have the chance to warm up more quickly after than they would if conditions were cooler. Greener or less mature corn has more frost resistance than yellowing corn because of its higher water content.

The tops of corn plants are most likely to be damaged by frost. When checking corn field for frost or freeze injury, it is helpful to delay assessment for 5-7 days after the frost event so that tissue that has been killed has time to turn brown and dry out. If you go out less than 5 days after the frost, you may underestimate the damage because tissue might still look green when it is actually dead or dying.

The photo at left was taken in a corn trial at the Dickinson REC on September 8th. Note the silvery appearance of the leaves, an early indication of frost damage.

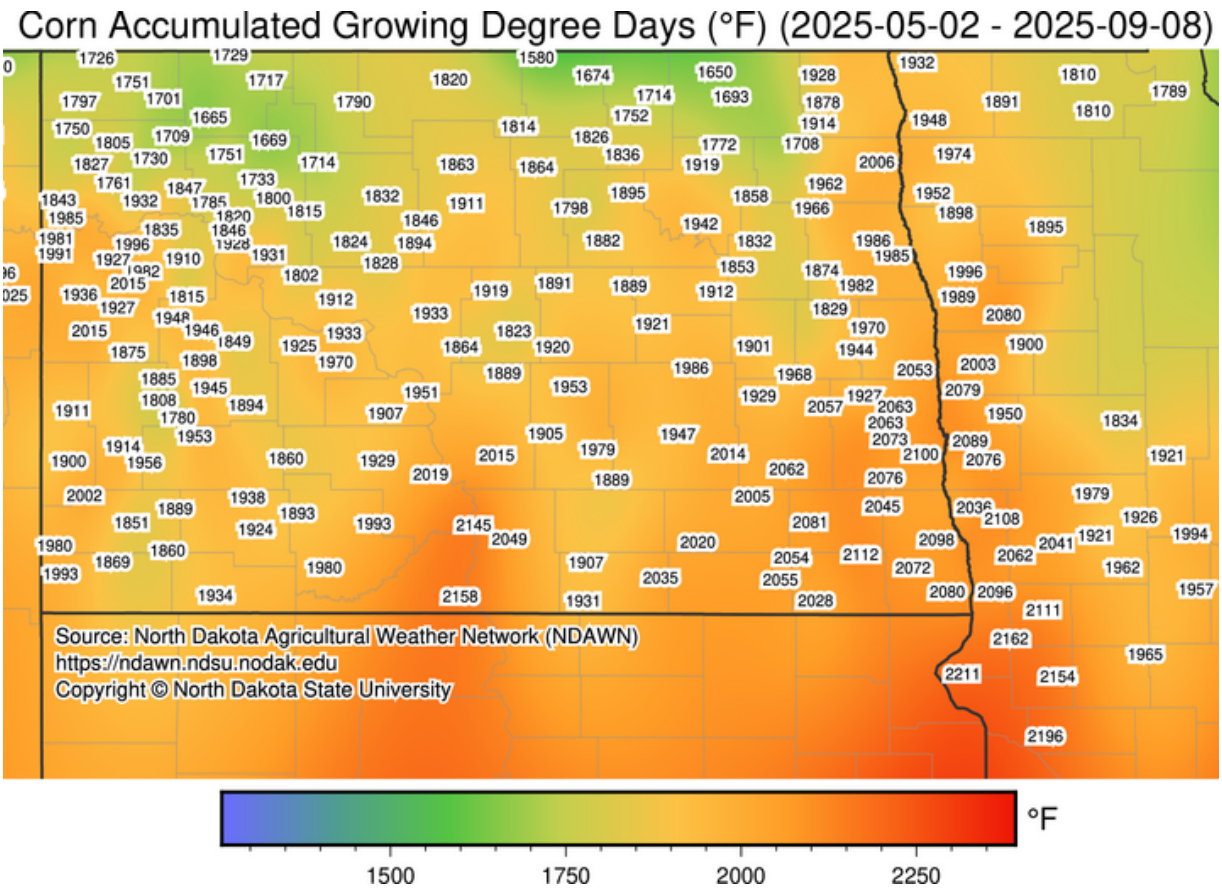
In studies that have sought to quantify potential corn grain yield loss after frost, they have relied on the analogy of defoliation, since frosted leaves die and thus are no longer able to contribute to yield; similar to the leaves being stripped off by hail or wind. If you are checking corn fields and want to estimate damage, check the growth stage of the corn and estimate the percent of leaves killed by the frost. Also pay attention to the status of the stalk. Was the stalk killed by the frost? Fortunately, it usually takes a much harder frost (lower temps, below 28°F, or longer duration—below 32°F, 6+ hours), to completely kill the corn stalk. During late grain fill stages, the corn takes nutrients from the leaves and stalk and sends them to the grain until maturity. If leaves have been killed by frost but the stalk is green, the plant is still able to scavenge nutrients from the stalk. Below is a table from Afuakwa and Crookston (1984) that estimates corn yield loss after frost based on corn growth stage at the time of frost.

Corn development stage	Killing frost (Leaves and stalk dead)	Light frost (Leaves only dead)
	% yield loss	
R4 (Soft dough)	55	35
R5 (Dent)	40	25
R5.5 (50% kernel milk)	12	5
R6 (Black layer)	0	0

As you can see in the table above, losing only the leaves versus the leaves and the stalk to frost at the 50% milk line stage, greatly reduces expected grain yield loss. Unfortunately, if the corn was in the soft dough stage or earlier, yield loss due to frost is substantial. In the table below from Vorst (1990), you can get a sense of expected yield loss based on percent leaf area lost. For example, if your corn was at the dent stage (R5), and you estimate 60% of leaves were killed by frost, estimated grain loss is 10%.

Estimated percent corn yield loss due to defoliation occurring at various stages of growth.					
Corn growth stage	Percent leaf area destroyed				
	20	40	60	80	100
	Yield loss (%)				
Blister	5	16	30	50	73
Milk	3	12	24	41	59
Dough	2	8	17	29	41
Dent	0	4	10	17	23
Black layer	0	0	0	0	0
Data derived from Vorst (1990) which simulated hail damage via leaf removal.					

For corn not experiencing frost or freeze damage this past week, it is logical to start wondering where we are in terms of Growing Degree Days (GDD) for this season and how many more heat units we need to get the crop to maturity, i.e., black layer. Below is an NDAWN map of accumulated corn GDDs from May 1 (planting date) to September 8th. For much of our corn in the southern tier of the state, most locations range between 1800-2100 GDD's. Corn hybrids 80 day RM and earlier typically need 1900-2000 GDD's to reach maturity; hybrids 85-90 day RM need approximately 2000-2200; and hybrids 95-100 day RM need about 2300-2400 GDD's. For places with highs in the 80's and upper 70's the next 10 days, you'll accumulate another 150-200 GDD's. If your highs for the next 10 days are predicted to be in the mid to low 70's or upper 60's, you'll accumulate approximately 100-150 GDD's. I am optimistic that shorter and optimal RM hybrids for their locations will reach black layer this fall, but longer-season material, especially if it was planted May 20th or later, will have a hard time reaching maturity before another killing frost, unless we get a warm up that lasts through the end of the month.



Clair Keene
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EARLY FROST/FREEZE RAISES CONCERNS FOR SOYBEANS, SUNFLOWERS, AND DRY BEANS IN WESTERN NORTH DAKOTA

Parts of North Dakota experienced frost over the weekend, with temperatures dipping into the 20s in several areas. These temperatures are more typical of early to mid-October. The coldest readings were recorded west of Highway 83.

The effect of frost on crops depends on crop type, the growth stage of the plant at the time of the freeze, and the severity and duration of the cold. Below is a summary of expected impacts on soybeans, sunflowers, and dry beans.

Soybeans

Research shows soybean yield losses are most severe when frost occurs before plants reach full seed (R6) stage. At R7, when one normal pod on the main stem shows mature color, yield impact is minimal. Once soybeans reach physiological maturity (R8), when 95% of pods have turned their mature color, frost will not reduce yield, though harvest timing remains important.

- **R5 (beginning seed):** 75–80% yield reduction
- **R6 (full seed):** 20–40% yield reduction
- **R6.5 (late seed fill):** 10–20% yield reduction
- **R7 (beginning maturity):** 0–5% yield reduction

Soybeans killed at R6 or R7 should be left in the field to dry and harvested along with mature soybeans once seed moisture is at the desired level. Weather conditions during the field-drying period strongly influence the color of the seed coat. R6 soybeans dried under sunny, dry conditions developed a golden-yellow seed coat similar to that of mature soybeans (R8). However, when plants were exposed to freezing temperatures, snow, or rain without sufficient sunlight, beans often retained a greenish cast caused by chlorophyll. Green soybeans are discounted at elevators because chlorophyll removal adds cost to processing, although oil quality is usually less affected.
Even under poor weather conditions, frost-damaged soybeans left in the field may continue to mature naturally. Research has shown that frost-damaged plants often mature and change color more quickly than undamaged plants. Storage conditions also play a role in soybean color. Temperature and aeration have little effect, while light exposure significantly influenced seed coat color change. Chlorophyll degradation continues slowly during storage, but some green tones may persist in immature beans.

Sunflowers

Sunflowers are more tolerant to frost than soybeans or dry beans. A killing frost in sunflower is considered to be 23 to 22°F for six or more hours, as this duration and temperature are required to penetrate the thick back of the head and initiate dry-down.

- **Flowering (R5): Most vulnerable stage. Temperatures at or below 30°F can injure flowers, resulting in missing seed in a ring pattern on the head.**
- **Back of head yellowing (R7): Plants can tolerate down to 25°F with minimal damage. Longer freezes can still reduce yield, test weight, and oil content.**
- **Back of head completely yellow (R8): Some loss in yield and oil quality possible, but most seeds remain marketable.**
- **Physiological maturity (R9): Seed weight is final. Frost at this stage will not harm yield or quality and can even aid dry-down.**

Dry Beans

Pinto and navy beans are very sensitive to frost, with damage possible in the 30-32°F range.

- Earlier pods that have turned yellow or brown are mature enough to escape frost injury.
- Green pods and flowers are easily damaged and will shrivel but should be left in the field to dry, allowing separation from mature beans at harvest.

Harvest timing is critical. Beans should be harvested at the maximum permissible moisture content to reduce cracking and seed damage:

- **Navy beans:** 17–18% moisture
- **Pinto beans:** 14–16% moisture

Harvesting at lower moisture increases losses from reduced harvested weight and greater combine damage. Where possible, frost-damaged or late-maturing beans should be kept separate from higher-quality beans. This may require harvesting low-lying, frost-prone areas separately. Higher areas in the same field may dry down too much and crack if harvest is delayed waiting for later-maturing beans.

Take-Home Message

The impact of the recent frost varies widely across crops and fields. Soybeans and dry beans are most at risk of yield and quality loss. Wait a few days before evaluating the crop damage. Producers are encouraged to wait a few days before making final assessments of frost damage. Considering crop stage, harvest timing, and post-frost handling will help manage seed quality and minimize economic losses from this early frost event.

Ana Carcedo
Broadleaf Agronomist

soils

NORTH DAKOTA GROWERS SHOULD CONSIDER PLANTING A COVER CROP THIS FALL

With favorable soil moisture conditions this year, growers across North Dakota have an excellent opportunity to establish a fall-seeded cover crop. Cover crops provide continuous living cover and roots, armor the soil, improve soil carbon and nutrient cycling, reduce erosion and runoff, help retain snow, and can suppress weeds through competition. For the first time since 2022, North Dakota is officially not in a drought, according to the U.S. Drought Monitor. Since May 1, much of southwest North Dakota has received close to 15 inches of precipitation, with some areas receiving more than an inch in the last 30 days (Figure 1). Localized areas of south-central North Dakota (Logan, McIntosh, LaMoure, and Dickey Counties) have received over 9 inches in the past month. This is a sharp contrast to fall 2024, when drought left soils dry and delayed germination of fall-seeded cover crops. As a result, many winter-hardy cover crops did not emerge until spring 2025 (Figure 2). This fall's moisture offers a much better chance for strong establishment ahead of winter.

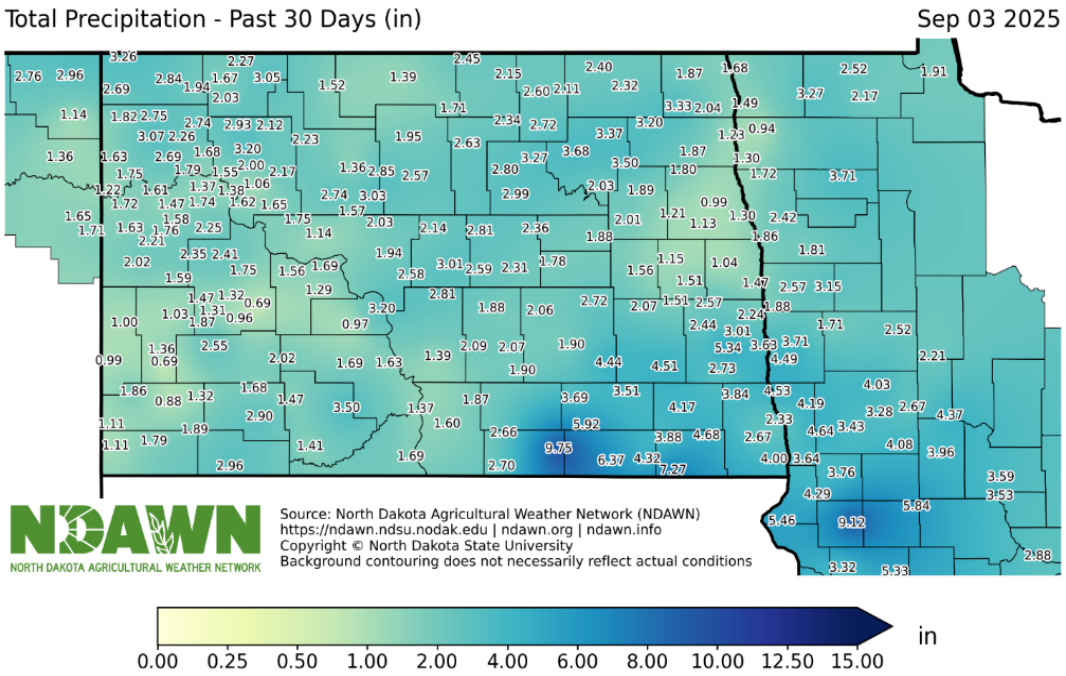

Figure 1. Total precipitation – Past 30 days (in). Source: NDAWN. Data obtained on September 3, 2025.

Broadcasting may work in the wetter eastern part of the state this season, but for quicker germination and better seed-to-soil contact, drilling remains the preferred method—especially in western North Dakota—so that cover crops can make the most of available moisture.

Figure 2. Fall-seeded cereal rye emerging in spring 2025 in Dickinson. Photo: Victor Gomes, NDSU Extension Cropping Systems Specialist.

Choosing the right cover crop

Before seeding, consider what you want the cover crop to accomplish. Cover crops are service plants (Figure 3), and their benefits depend on your goals. They can provide:

- Winter soil cover and erosion protection.
- Nitrogen fixation to boost soil fertility.
- Nutrient scavenging after harvest.
- Weed competition and suppression.
- Fall or early-winter forage options.

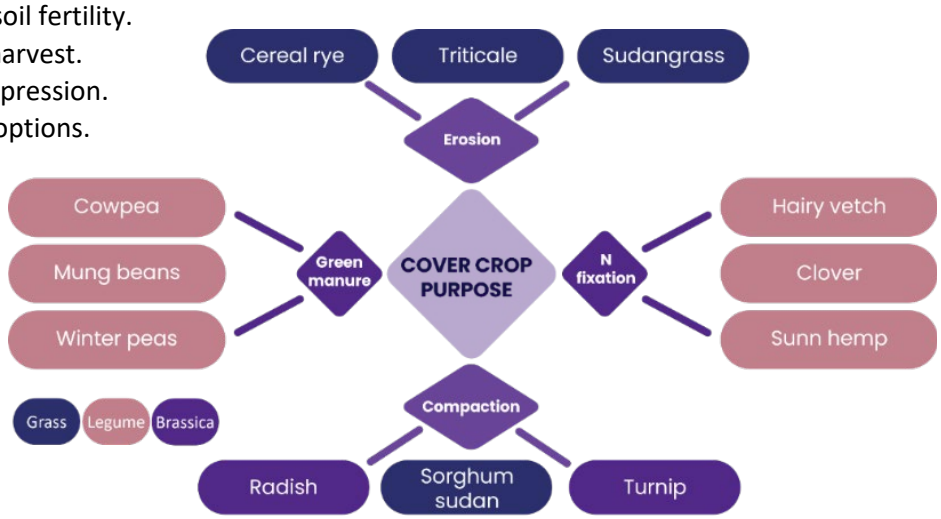

Figure 3. Commonly used cover crop species separated by purpose and type. Source: Carlos Pires, NDSU Extension Soil Health Specialist.

Also keep your crop rotation in mind. Some species can act as a bridge for insects and diseases. For example, cereal rye should not be planted ahead of wheat or barley, since it can host Hessian fly.

Timing matters

Most species germinate at soil temperatures above 38–40°F. For cereal rye, the optimal planting window is late August through early October.

- **Late-summer planting** (after corn silage, canola, pulses, or small grain harvest, Figures 4 and 5) provides strong potential for biomass production, nutrient capture, and soil health improvements, provided that cover crops are well-established.
- **Early-fall planting** slows erosion and scavenges nutrients, though options are usually limited to grasses and non-legume broadleaves.
- **Interseeding** into corn or soybeans can extend the growing window but timing may be past optimal this year.
- **Dormant seeding** (when soils stay below 35°F) shifts all growth to spring, but doesn't take advantage of fall moisture. For cereal cover crops intended for forage, there's also a risk of poor vernalization and reduced grain yield.

Figure 4. Hairy vetch broadcast over Hard Red Spring Wheat in Minot, ND, on 07/03/25. Photo: Carlos Pires, taken on 08/19/25.

Figure 5. Turnips and hairy vetch drilled after Hard Red Spring Wheat harvest in Carrington, ND, on 08/28/25. Photo: Ezra Aberle, taken on 09/04/25.

Winter-hardy and frost tolerant options

North Dakota winters are harsh, so selecting species that can survive overwinter is crucial. Winter-hardy options include cereal rye, winter camelina, hairy vetch, triticale, and winter wheat.

Growers who prefer quicker soil warm-up in spring may choose frost-tolerant, non-winter-hardy species like oats, turnips, and radishes. These extend photosynthesis late into the fall and then winterkill. Low C:N ratio crops like turnip and radish also decompose quickly in spring.

Cost-share opportunities

Cover crops are an input cost, but programs exist to help offset expenses. Farmers for Soil Health offers financial support for adoption (https://farmersforsoilhealth.com/). USDA-NRCS also provides cost-share opportunities—local contacts can be found at: https://www.nrcs.usda.gov/contact/find-a-service-center?state=38&county=.

Final thoughts

This year's statewide moisture conditions create an excellent window for establishing cover crops. Whether drilled in the drier west or broadcast in wetter eastern regions, cover crops can provide lasting benefits to soil health, nutrient cycling, and erosion control. Choosing the right species and seeding soon will help position fields for success going into 2026.

Carlos Pires
Extension Soil Health Specialist

Victor Gomes
Extension Cropping Systems Specialists, DREC

Chris Augustin
Director, DREC

HOW MUCH IS YOUR STRAW WORTH?

In my trips across the state these past few weeks, I have passed many wheat fields where the straw had been baled. In years with tight margins, such as this one, selling straw off the field can bring some welcomed revenue onto the farm; however, selling the straw does not come without costs, both from the cost of baling and from the nutrients it removes. It is important to consider nutrient removal from the straw and price of fertilizer before deciding if marketing the straw this year is right decision this year.

Depending on wheat productivity and height, 2-4 tons/ac of wheat straw can be expected in North Dakota fields. On average, straw contains 12 lb N, 4 lb P_2O_5, and 24 lb K_2O per ton. While removals of N and P are relatively low, the K removed in a crop of straw can be significant, 49-96 lb K_2O/ac. Coupling the high potash prices with wide-spread K deficient fields across the state (see "Bringing K Back" in the October 10, 2024 Crop and Pest Report), care should be taken to not "go negative" when selling wheat straw and plans should be made to replace the nutrients removed.

Table 1. Amount and cost of N, P, and K removed by one ton of wheat straw.

Nutrient	Nutrient Removal (lb/ton straw)	Nutrient Cost ($/lb)†	Cost of Removed Nutrients ($/ton straw)
N	12	$0.60	$7.24
P_2O_5	4	$0.81	$3.26
K_2O	24	$0.32	$7.64
TOTAL			$18.14

†Fertilizer cost based on Northern Great Plains wholesale fertilizer prices reported on 9/5/2025: urea $555/ton, MAP $847/ton, and potash $382/ton.

Brady Goettl
Extension Soil Science Specialist

weeds

LEAVE A LEGACY - MANAGE WEEDS ALONG THE FIELD PERIMETER

One game changing weed management practice is managing weeds along the field borders/perimeters. We have all observed for years, but now with the See & Spray sprayer maps we definitively can see the inside field perimeter almost always has a higher weed density than the rest of the field.

One of the top reasons for this higher weed density on the inside field perimeter is because weeds along the outside field perimeter are allowed to produce seed as observed in photos 1 and 2. Weeds along the outside field perimeter are cut and spread farther into the field by the combine increasing the weed seedbank and eventually weed density in future growing seasons.

Photo 1: A dense waterhemp population along the outside corn field perimeter.

Photo 2: A dense kochia population just inside and outside the sunflower field perimeter.

Historically, sugarbeet growers have understood the importance of outside field perimeter weed management due to their limited herbicide choices in which they tilled the outside field perimeter (photo 3) multiple times throughout the growing season and even tilled the outside field perimeter of other crops (photo 4) in the rotation. We don't believe tilling the outside field perimeter is necessary, however mowing the outside field perimeter as close to the edge of the crop as possible as in photo 5 is necessary. Sometimes as in photo 2, mowing the outside crop rows along with the weeds when the weeds are denser than the crop on the inside field perimeter is necessary as well. Not allowing weeds to be spread by the combine is critical to improving weed management. It's also a good practice to mow any field perimeter including in and around drowned out areas and high salinity areas of the field. Mowing now is a great option to improving weed management, however mowing all outside field perimeters and poor crop areas when weeds start to flower and additional times as necessary to reduce seed production is the best approach.

Photo 3: A tilled outside sugarbeet field margin as practiced historically in the Red River Valley.

Photo 4: A tilled outside soybean field margin managed by sugarbeet farmers prior to Roundup Ready sugarbeet.

Photo 5: A well mowed outside corn field margin devoid of all weeds from entering the combine and eventually farther into the field.

One of the most important reasons for removing weeds from the outside field perimeter with mowing is to try to kill weeds having received only a partial rate of herbicide since the outside sprayer nozzle usually is not delivering a full dose of the herbicide on the outside edge of the nozzle swath. This reduced rate of herbicide results in a partial kill, increases selection pressure and allows weeds to potentially cross-pollinate with plants in the outside field perimeter as well as inside the field allowing for an increase in the level of herbicide resistance within some plants. Ensuring your sprayer is setup to apply a full dose of herbicide on the outside of the field edge can reduce the chances of selecting for herbicide-resistant weedy plants on the outside field perimeter or just inside the field perimeter.

Please take the time to mow weeds on the outside field perimeter of any crop not harvested yet. This is an important weed management strategy to leaving a positive legacy.

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NDSU Extension Cropping Systems Specialist at
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Tom Peters
Extension Sugarbeet Agronomist
NDSU & U of MN

pesticides

CHANGES TO STATE PESTICIDE LAW

With the completion of the legislative session there are a number of changes in ND State Law related to how applicators can supervise certain types of pesticide applications. There are also some changes related to how pesticide applicators will become certified in accordance with the Environmental Protection Agency approving North Dakota's revised Pesticide Applicator Certification and Training Plan in 2023. It is important that all applicators familiarize themselves with these changes which can be found in chapter 4.1-33 of the Century Code (https://ndlegis.gov/general-information/north-dakota-century-code/index.html). In particular please note section 4.1-33-12. Private applicators can supervise non-certified applicators applying restricted use herbicides only following current definitions. It takes time to draft the new, corresponding, administrative rules. Administrative rules can be found in the administrative code, article 60-03- Pesticides (https://ndlegis.gov/prod/agency-rules/north-dakota-administrative-code/. As such there are currently some discrepancies where the administrative rules no longer reflect the current law. Where there is an inconsistency between the state law and administrative rule, applicators are advised to follow the law. It is important to note that some of these changes are inconsistent with those in the 2023 North Dakota revised Pesticide Applicator Certification and Training plan due for implementation in 2027. These require review by the Environmental Protection Agency and could lead to further changes in the future. If applicators have questions about compliance, they are encouraged to reach out to the North Dakota Department of Agriculture (NDDA), their local NDDA pesticide inspectors or the Sate Extension Pesticide office.

Madeleine Smith
Extension Pesticide Specialist

farm health & wellness

YOUR HEALTH IS THE MOST IMPORTANT RESOURCE IN TIMES OF STRESS

Your health is your most important resource when you're working in agriculture. Farm and ranch stresses can take a toll on your physical and mental health. What can you do about it?

First, the most important thing to do is to just get checked. See a healthcare provider and do an assessment of your physical and mental well-being.

Second, connect with those that you care about. Your relationships can be a source of support and strength during times of difficulty.

And finally, remember that small steps make a big difference. Go for a walk. Call a friend. Rely on your faith.

Put your health first, because your health is the most important resource and what allows you to be resilient during times of stress. Take care of yourself.

If you or someone you know is in need of mental health or substance abuse resources, call or text the 9-8-8 Suicide and Crisis Lifeline, or chat at https://988lifeline.org.

Contact your NDSU Extension County office or search the Web for *NDSU Extension farm stress* for more resources on wellness in agriculture.

Access the NDSU Extension farm stress webpage for resources on wellness in agriculture.

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around the state

AROUND THE STATE

NORTHEAST ND

The small grains harvest is nearly complete, with yields ranging from decent to excellent across the region. Barley yields have varied from 80 to 120 bushels per acre, while wheat yields are between 70 and 100 bushels per acre, with good test weights and protein content ranging from 13-15%.

Canola is beginning to change color, and several fields are either swathed or ready for spraying. Clubroot infestation is showing up in many fields as lodged patches in Cavalier County. Field peas have been harvested, with yields ranging from 50 to 70 bushels per acre. Dry beans are showing signs of maturity, with leaves beginning to drop.

Soybeans are still in the green stage, between R5 and R6. Unfortunately, a severe white mold infestation has been reported in several fields this year, likely exacerbated by the wet conditions during flowering. In addition to the disease, patchy frost early on Saturday morning affected soybeans throughout the region. The extent of damage varied by field, depending on the growth stage and the severity of the temperature drop in different areas.

Corn is in the late milk to early dough stages. With few exceptions, most corn crops seem to have escaped significant damage from the frost event.

Clubroot affected canola patch showing lodging and galls. Photo: Anitha Chirumamilla, LREC.

White mold in soybeans. Photo: Anitha Chirumamilla, LREC.

Frost damage in soybeans. Photo: Hayden Anderson, ANR Extension Agent, Towner County.

Corn at late milk stage at LREC. Photo: Anitha Chirumamilla, LREC.

Anitha Chirumamilla
Extension Cropping Systems Specialist
Langdon Research Extension Center

SOUTH-CENTRAL/SOUTHEAST ND

The two big stories from the region is hard red spring wheat harvest is still happening, and quality is declining more now and the frost and freeze in parts of all counties in the region with some counties worse than others.

The two NDAWN stations within the region having the lowest daily temperature were on the western side of the region with Pickardsville (Sheridan County) and Strasburg (Emmons County) reaching 29 degrees Fahrenheit on September 6th and September 7th, respectively. The McKenzie, Strasburg, and Zeeland areas stayed from 32 to 34 degrees Fahrenheit for a total of 7 to 8 hours over a two-morning period. All three Traill County NDAWN stations reported the lowest temperatures being 30 to 31 degrees Fahrenheit and stayed at 32 to 34 degrees Fahrenheit for 3 to 5 hours consecutively. These temperatures caused significant freeze damage to corn, dry bean, and soybean in whole fields to just the lowest areas of fields in most of the counties in the region as seen from photos 1 through 5. Some of these fields had corn in the late dough stage, soybeans in mid-R6 stage, and dry beans with no colored pods. Crops were not ready for this freeze. Fortunately, most of the region received light frost to no frost, however I would estimate a minimum of 10 percent of the region had freeze-damaged crops and maybe a greater portion of the region.

Photo 1: Freeze-damaged corn in northern Wells County, ND (photo from NDSU Extension Wells County Agent, Ciera Kotaska).

Photo 2: Freeze-damaged corn in the Sheyenne River Valley in Griggs County, ND.

Photo 3: Freeze-damaged soybean in Logan County, ND (photo from NDSU Extension Logan County Agent, Josh Becker).

Photo 4: Freeze-damaged soybean in Wells County, ND (photo from Ciera Kotaska).

Photo 5: Freeze-damaged soybean in the Sheyenne River Valley in Griggs County, ND.

Corn in the region varies from R4 (dough) to mid-R5 (dent) stage with the southern part of the region the farthest along. Corn condition has stayed about the same over time with two exceptions, sandier areas of fields through Steele to Kidder Counties dropping ears prematurely from lack of soil moisture and deep root growth to now the freeze in some fields. As of September 9th, 2025, based upon the four corners of the region, Skogmo to Mooreton and Mayville to Linton and Carrington in the center, if corn was planted May 24th, Skogmo GDD's are -193 from normal and +11 from 2024 (new station so no history before 2024), Mooreton GDD's are -135 from normal, -86 from 2024 and -214 from the 5-year average, Mayville GDD's are -53 from normal, -72 from 2024, and -216 for the 5-year average, Linton GDD's are -86 from normal, +6 from 2024, and -138 for the 5-year average, and Carrington GDD's are -87 from normal, +15 from 2024, and -165 for the 5-year average. Based upon the U2U Corn GDD Tool from University of Nebraska (https://hprcc.unl.edu/agroclimate/gdd.php), May 24th planted corn will likely reach black layer on September 29th, 3 days before the average freeze (28 degrees Fahrenheit) at Skogmo for 85-day hybrids, October 1st, 7 days ahead of the average freeze at Mooreton for 95-day hybrids, October 9th, 1 day after the average freeze at Mayville for 85-day hybrids, September 28th, 7 days ahead of the average freeze at Linton for 85-day hybrids and October 2nd, 4 days ahead of the average freeze at Carrington for 85-day hybrids. There is still much time needed to get corn to maturity and some in the region did not make it, but hopefully most corn stalks and the ear shanks are normal and not injured despite most leaves being frozen and the corn can reach physiological maturity with minimal yield loss. Be sure to read Clair Keene's article about freeze-damaged corn and potential yield impacts.

Photo 6: A dense patch of white mold in soybean in Sheridan County, ND.

Soybean growth stage in the region ranges from R5 (seeds forming) to R7 (1 brown pod) with an average stage of about R6 (full seed). Soybean condition declined this week due to lack of moisture in sandy soils from Steele to Kidder Counties and the freeze. Be sure to read Ana Carcedo's article regarding yield and seed quality impacts on frozen soybean. The most common soybean disease this year across the region and is very severe in some fields and patches within fields is white mold as seen in photo 6. I'm expecting yield losses this year in some fields due to white mold compared to 2023 when it was fairly common and did not seem to negatively impact yields. I have been finding more Cercospora leaf blight is present in some fields as well as seen in Photo 7. Cercospora leaf blight in soybean is unlikely to be an economic issue this season, however be on the look-out for purple-stained soybean seeds during harvest which is caused by at least one Cercospora species. After white mold, I believe Fusarium wilt (photo 8) is the next most prevalent soybean disease in the region this season. I have observed Fusarium wilt as far north as just south of New Rockford in small patches in some soybean fields to large areas of a few fields that likely will negatively impact yields. Soybean aphids (photo 9) are still present at high numbers in some fields, but the soybeans are too

advanced to need to spray now. Two other insects on the rise in at least the central and western parts of the region are young grasshoppers and the return of the bean leaf beetle. Photo 10 shows grasshopper feeding in the upper leaflet with the large hole and veins missing and the areas with holes and veins remaining are due to the bean leaf beetle. I even saw some pod feeding from the bean leaf beetle in one Burleigh County field a week ago. Photo 11 shows bean leaf beetle feeding on pod and leaf. Please read Jan Knodel's article about bean leaf beetles.

Photo 7: Cercospera Leaf Blight of soybean in Foster County, ND.

Photo 8: Fusarium wilt of soybean in Foster County, ND.

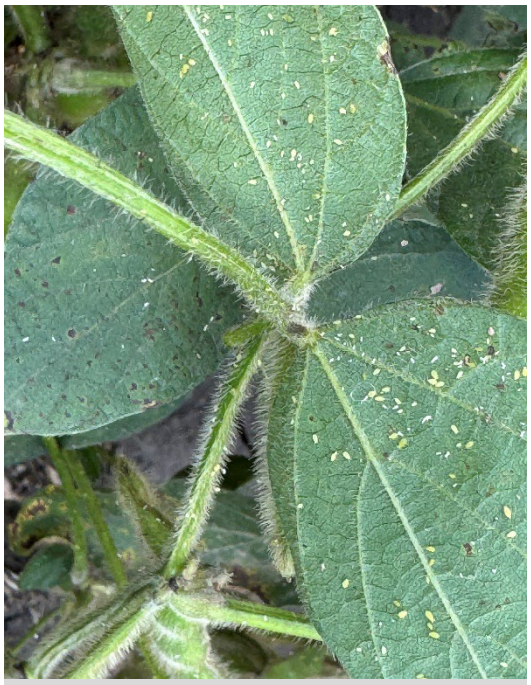

Photo 9: Numerous soybean aphids in Foster County, ND.

Photo 10: Grasshopper damage on bottom part of the upper trifoliate leaf blade and bean leaf beetle damage on the other two leaf blades of the leaf in Burleigh County, ND.

Photo 11: Bean leaf beetle pod and leaf damage.

Canola harvest is over 60% completed in all counties of the region with some counties completely finished. I have not heard any canola yield and quality numbers yet.

Dry bean stage is from R7 (Oldest pods fully developed green seeds) to harvested. Dry bean harvest has started in Wells County, with some other counties about to begin as well. Most dry beans in the region are at the R8 (leaves yellowing) stage. Dry bean condition declined drastically across the region if the dry bean development was not far enough along where the freeze occurred. White mold and bacterial leaf blight are the two most common dry bean diseases in most fields in the region.

Sunflowers are in the late R6 (petal drop) to early R8 (back of seed head turning yellow) stage in most of the region with most at the early R7 stage. Sunflowers are still looking good for the most part, but all stages of white mold can be found in many sunflower fields in the region.

Some sugarbeet fields, especially in the southern part of the valley are nearly all brown now from Cercospora leaf blight.

Please take the time to read the weed article regarding field perimeter weed management and mowing all weeds along the outside and even inside the field perimeters.

Of the 27 NDAWN stations I've chosen this season across the region, the average maximum daily air temperature from August 26 to September 8, 2025 ranged from 69 degrees Fahrenheit near Finley to 78 degrees Fahrenheit near Livona, with an average of 73 degrees Fahrenheit. The average daily minimum air temperature for the above mentioned period at the 27 NDAWN stations ranged from 43 degrees Fahrenheit near Pickardsville to 50 degrees Fahrenheit near Hurdsfield, McHenry, and Wirch with an average of 46 degrees Fahrenheit.

For August at the 27 NDAWN stations the average maximum daily air temperature ranged from 75 degrees Fahrenheit near Finley to 83 degrees Fahrenheit near Livona. Only two of these 27 stations recorded any 90-degree temperatures with the Livona station recording 4, 90+ degree Fahrenheit days in August. The Linton area had the 5th coldest maximum daily air temperature for August and Carrington had the 8th coldest maximum daily air temperature for August. Of the 27 NDAWN stations, these two were had the coolest daytime highs. The average minimum daily air temperature for August ranged from 54 degrees Fahrenheit near Pickardville to 59 degrees Fahrenheit near Hurdsfield, Lisbon, and Wirch with an average of 57 degrees Fahrenheit.

Rainfall across these 27 NDAWN stations ranged from 0.04 inch near Oakes to 1.46 inches near Wirch with an average for the period of 0.28 inch.

Rainfall for August for the 27 NDAWN stations ranged from 1.16 inches near Finley to 10 inches near Wirch. The average for August for the region was 3.1 inches. I could not find any long-term historical rainfall data for Wirch, but the closest location I did find historical rainfall data, the 10 inches of rainfall is a new record smashing Wishek's August record of only 5.33 inches. Edgeley's 6.23 inches of rainfall for August comes in second place historically. The south central part of the region received the most rainfall during August.

Have a great week and please be safe!

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

SOUTHWEST ND

Over the last 14 days, precipitation in southwest North Dakota ranged between trace amounts in Dunn and Billings Counties to over one inch in Hettinger, Adams and Morton Counties.

Small grain harvest has progressed steadily with little to no rainfall and cooler temperatures over the last couple of weeks.
Last weekend's frost will surely accelerate crop maturity, and many row crops have now entered the senescence and dry-down process. Harvest of these crops will likely begin within the next four-six weeks. However, some late-planted fields may not have completed grain filling successfully before the frost and could face yield and quality penalties. Based on my scouting trips, corn was the most affected crop. A colleague driving from Halliday to Dickinson over the weekend also said he did not see a single field that had not been nicked by frost.

Figure 1. Corn fields in southwest North Dakota endured different levels of freeze damage over the weekend. A) Stark County; B) Dunn County. Photos: Victor Gomes.

The full extent of the damage caused by this frost will largely depend on two factors:

1. The intensity and duration of the frost, and as a result, how much of the leaf tissue was lost.
2. The crop growth stage.

With regards to corn growth stages in southwest North Dakota, it ranges from Milk (R3) (Figure 1A) to dent stage (R5) (Figure 1B). Because it is difficult to distinguish living from dead tissue immediately after a frost event, this assessment should be done 5-7 days after the frost.

Figure 2. A) Corn at the Milk Stage (R3) in Stark County, and B) at the Dent (R5) stage in Dunn County. Photo: Victor Gomes.

For frost damaged soybeans, first keep in mind that at this point in time, soybean plant tissue is more tolerant of freezing temperatures than corn. However, temperatures below 32F can damage leaves, and temperatures below 30F for an extended period can damage stems, pods and seeds. Similarly, to what was discussed before, the potential yield penalties from frost damage to soybeans will be dependent on the intensity of the frost and the crop growth stage. Soybeans in southwest North Dakota are more or less in the same growth stage – around R6.

Figure 3. Frost damaged soybeans in Grant County. Photo: Aaron Friesz.

Research information from Wisconsin indicated that all varieties tested had reduced yields when frost occurred at or before R6 (full seed). The greatest yield losses occurred when frost occurred at stage R5 (beginning of seed development). The number of beans per plant and reduced bean size all contributed to overall yield loss. A frost between R6 and R7 may or may not affect yield depending on the temperature and duration of the freeze. A frost will not hurt soybean yields if the soybean growth stage is beyond R7.

Frost damaged R6 soybeans could experience yield penalties as high as 50%. Recommendations for handling frost-damaged grain coming from the University of Minnesota and Pioneer® include:

- Isolate frost-damaged areas (especially late planted and/or drowned-out areas) and harvest them after the unaffected areas. While this can add logistical challenges for large operations, it could reduce the risks of storing damaged grain and will isolate potential dockages to individual loads rather than whole bins.
- If soybeans have been frosted prior to maturity or have higher than normal moisture at harvest, combine settings may have to be adjusted to minimize harvest losses. Reduce the concave clearance and then begin to increase rotor or cylinder speed if more aggressive threshing is needed for wet, tough soybeans. Check behind the combine and readjust settings as conditions change throughout the day or season.
- Soybeans should be at 16% seed moisture or below for ideal threshing, but with delayed maturity or early frost, some fields may be wetter than this late in the season.

Sunflowers in the area are either in the late R5 stages and mostly in the R6 stage. Once pollination is completed and 10 to 14 days after petal drying occurs, the sunflower plants can withstand frost temperatures as low as 25F and have only minor damage. If hard frosts do occur, many times only the seed in the center of the head (the last to pollinate) will be affected.

To complement my harvest report from two weeks ago, I contacted several grain elevators in the region for updated information on crop yields and quality. Here's what I gathered:

Hard Red Spring Wheat: Yields are averaging 50–60 bushels per acre with protein levels around 14–15%. Some low-protein wheat (<11%) is still being reported, mainly in counties along the Missouri River valley where growing conditions were wetter than further west. Overall quality remains good, with limited reports of vomitoxin or falling number issues. However, recent rain before harvest increased the occurrence of bleached kernels in some fields.

Barley: Quality has been strong, with yields highly variable—from 44 bushels per acre up to 120. On average, most fields are yielding in the upper 70s to low 80s.

Canola: Yields are generally average to below average, ranging from 1,250 to 1,800 pounds per acre. Seed quality has been excellent, with good seed color and minimal green or heat-damaged seed. The main issue has been high dockage levels, largely due to weed management challenges before harvest.

The 2025 National Sunflower Survey will launch in a couple of weeks. The Sunflower Crop Survey is conducted bi-annually prior to harvest. Volunteers from all levels of the sunflower industry visit sunflower fields to survey the crop condition. Teams survey for yield and production practices, weeds, insects, diseases and bird damage. If you are growing sunflowers this year and would like to have your field surveyed, please contact your NDSU County Extension Office.

Figure 2. Sunflower Survey Training with County ANR Extension Agents in Dickinson, ND. Photo: Victor Gomes, NDSU Extension Cropping Systems Specialist.

Victor Gomes
Extension Cropping Systems Specialist

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