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## entomology

### PYRETHROID COMPLAINTS FOR DIAMONDBACK MOTH CONTROL IN CANOLA

Several farmers and crop consultants have complained about the lack of control of the diamondback moth (DBM) with pyrethroid insecticides in canola fields located mainly the northeast area (Walsh to Rolette Counties) of North Dakota. Fields were sprayed up to two times with a pyrethroid insecticide without adequate control. Canola fields appeared white due to larval feeding removing the green epidermis of the stems and pods (see photo).

Diamondback moth migrates into North Dakota each year and can occasionally be a major insect pest of canola. Diamondback moth larvae feed on the leaves, buds, flowers and pods of canola. The severity of infestations varies from year to year depending on when moths arrive, how many flights occur into ND and the density of the populations.

This insect pest is notorious for developing resistance to multiple insecticide modes of action, including pyrethroids and Bt. In the south where DBM originates, they are a severe pest of vegetables / Cole crops and known to be resistant to pyrethroids. We believe that these migrant DBMs that arrived in ND were resistant to pyrethroid insecticides.

We recommend that farmers avoid using any insecticides in the pyrethroid class 3A since they will not provide effective control, and to rotate to a new mode of action. Here's a list of alternative modes of action / insecticides registered for DBM in canola ND:

Product	AI	PHI	Per Acre					Rate Unit
			Low rate	High rate	Price	Low cost	High cost	
Coragen	chlorantraniliprole	1 day	3.5	7.5	7.27	25.45	54.53	fl oz/acre
Prevathon	chlorantraniliprole	21 days	14	20	1.14	15.96	22.80	fl oz/acre
Vantacor	chlorantraniliprole	1 day	0.7	1.7				fl oz/acre
Exirel	cyantraniliprole	7 days	7	13.5	3.52	24.64	47.52	fl oz/acre
DiPel DF	Bt	0 days	0.5	2	13.6	6.80	27.20	lbs/acre



*Canola damaged by DBM larval feeding near Adams, Walsh County.*

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**EPA ANNOUNCES REVOCATION OF ALL FOOD TOLERANCES FOR CHLORPYRIFOS**

On August 18, 2021, the U.S. Environmental Protection Agency (EPA) announced that they were [revoking the food tolerances](#) for chlorpyrifos residues under the Federal Food, Drug, and Cosmetic Act (FFDCA). Non-food uses of chlorpyrifos will be addressed separately under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Chlorpyrifos is the active ingredient found in several insecticide products, either alone (e.g. Lorsban), or as a pre-mix with other insecticides (e.g. Cobalt Advanced). The revocation goes into effect six months after the notice is officially published in the Federal Register. The news release can be found at: <https://www.epa.gov/newsreleases/epa-takes-action-address-risk-chlorpyrifos-and-protect-childrens-health>

The news release contains supporting information on chlorpyrifos, including a summary of EPA regulatory actions regarding chlorpyrifos since 2000. Also, EPA released a pre-publication Internet version of the official final rule which can be found at: [https://www.epa.gov/system/files/documents/2021-08/pre-pub-5993-04-ocspp-fr\\_2021-08-18.pdf](https://www.epa.gov/system/files/documents/2021-08/pre-pub-5993-04-ocspp-fr_2021-08-18.pdf)

For several decades, farmers have used chlorpyrifos for managing a wide variety of insect pests. Below are questions and answers regarding this announcement:

**Question: Why is EPA taking this action?**

**Answer:** EPA is complying with conditions in the Ninth Circuit Court order of April 29, 2021, to grant the 2007 petition filed by Pesticide Action Network North America and the Natural Resources Defense Council for revocation of all chlorpyrifos food tolerances under section 408 of FFDCA. EPA is required by this same law to assess aggregate exposure (dietary and non-dietary routes) when establishing pesticide tolerances. Based on the current data gathered by and available to EPA, EPA is unable to determine that aggregate exposure to chlorpyrifos residues are safe, and this factored into the EPA final decision.

**Question: Who is affected by this action?**

**Answer:** The entire agricultural industry where chlorpyrifos is used, or exposure to chlorpyrifos residues occurs, including crop producers, animal producers, food manufacturers, and pesticide manufacturers and distributors.

**Question: What pesticide products will be impacted by this decision?**

**Answer:** Chlorpyrifos is often associated with the trade name Lorsban, which was used for the first commercially available chlorpyrifos-containing insecticide products. After the patent expired, many generic formulations were introduced to the market. In North Dakota, there are dozens of [products registered](#) for use on crops. At the time of this writing, 46 products are registered. (Not all are designed for use on food crops.)

**Question: What if I use this product in 2021 and then sell my crop after the revocation?**

**Answer:** As long as the application was made prior to the revocation, the FDA will exempt commodities from being designated **adulterated**. Demonstrating when the application is made may become an issue. Therefore, users of chlorpyrifos would be wise to make sure their application records are up to date, secured, and available for inspection. Since chlorpyrifos is considered a Restricted Use Pesticide, users are required by law to keep application records for a minimum of three years.

**Question: Can I store grain now that was legally treated with chlorpyrifos, and sell the grain after the revocation goes into effect?**

**Answer:** Yes. See Answer above.

**Question: Does revocation of tolerances mean the product is no longer available for use?**

**Answer:** Yes and no. It may not be used according to label instructions on food crops, but it may continue to be used on labeled sites that do not impact food crops, including but not limited to grass grown for sod or on Christmas tree farms.

**Question: When will these revocations be implemented?**

**Answer:** Six months after they are published in the [Federal Register](#). The final date is not known. However, in practice, the publication will likely occur in the next one to three months. Under rare circumstances this may take up to six months.

**Question: Will I be able to use existing inventories of chlorpyrifos on my crops in 2022 and beyond?**

**Answer:** This order is likely to come into effect in the first quarter of 2022. Therefore, users in North Dakota and surrounding states would not be able to use it on crops during the 2022 growing season. It would still be available for non-food situations.

**Questions What are the consequences of using chlorpyrifos on food crops after the revocation?**

**Answer:** If **ANY** chlorpyrifos is detected in a food crop, it would be considered **adulterated** by the Food and Drug Administration. There are significant consequences. You can read more about this at NDSU's [Food Law web page](#). In a worst-case situation, crop condemnation is possible and if the commodity is commingled, it could result in contamination and further condemnations. While it is unlikely this would lead to serious health risks, it presents significant risk for loss of crop marketability.

**Question: I have significant inventories of chlorpyrifos, what should I do with them?**

**Answer:** It depends on a variety of factors. Small quantities could be used on labeled use sites, but this may become impractical. One can inquire about buy-back programs with your distributor but at the time of this writing, no manufacturers have announced a willingness to purchase inventories. Waste pesticide collection programs are another option. North Dakota has [Project Safe Send](#) and this would be a logical means of disposal. Waste collections are expected to be available again in July of 2022.

**Question: What alternatives to chlorpyrifos do I have?**

**Answer:** It depends on the crop and pest. The ruling here applies only to chlorpyrifos, and not to other organophosphate insecticides. There are still organophosphate insecticides available for soil and foliar applications, as well as neonicotinoids, pyrethroids, and other modes of action. However, for some crops such as sunflower, the loss of chlorpyrifos restricts foliar applications to the use of pyrethroids for most insect pests, and control may not be as effective for certain pests, such as red sunflower seed weevil and spider mites. The revocation will also limit foliar insecticide applications in sugarbeet to mostly pyrethroids and, to a much lesser extent, neonicotinoids. Therefore, prudent use of pest management practices (e.g., pest monitoring, adherence to economic thresholds, use of alternative control tactics, etc.) will be essential to preserving the effectiveness of the remaining insecticidal tools available to producers.

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### SOYBEAN IRON DEFICIENCY CHLOROSIS SCORES

North Dakota State University conducts research annually on soybean varieties for their tolerance to iron deficiency chlorosis (IDC). This information can help producers select soybean varieties for 2022 that are more tolerant to IDC, when needed.

During the summer of 2021, NDSU's soybean breeding program tested 205 Enlist, GT27, Roundup Ready and Xtend soybean varieties, as well as 41 conventional and Liberty Link varieties, for IDC tolerance. Soybean varieties have genetic differences in how tolerant they are to IDC symptoms.

Test results are based on replicated trials conducted at a location with a history of IDC. Visual ratings were made on a 1 to 5 scale, with 1 indicating no chlorosis and 5 being the most severe chlorosis (Graph 1). Ratings were taken at three different soybean growth stages.

This summer's tests showed significant differences among soybean varieties. For example, the average scores for the genetically modified organism (GMO) group tested ranged from 1.1 (most tolerant) to 4 (the least tolerant variety). The test results are available at <https://www.ag.ndsu.edu/varietytrials/soybean>.

Although we have had dry soybean growing conditions, IDC was observed in many soybean fields in eastern North Dakota and northwestern Minnesota during the 2021 crop season. Plant leaves with IDC show symptoms of yellow with green veins. Yellowing, browning and stunting of the plants during the early plant growth usually results in reduced soybean yields.

Selecting a soybean variety with tolerance to IDC is an important management decision producers can make to reduce the negative yield effect of chlorosis. Although IDC tolerance in soybean varieties is important, producers are encouraged to look at the yield potential of soybean varieties as well as other important traits. Varieties with similar IDC tolerance can vary greatly in their yield potential.

Soybean variety trials are conducted by NDSU throughout North Dakota and results will be reported on the NDSU variety trial website at <https://www.ag.ndsu.edu/varietytrials/soybean> and the new variety selection tool at <https://vt.ag.ndsu.edu/>.



**Graph 1. Soybean plants with IDC scores; 1 is green and 5 is dead tissue.**

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NDSU Soybean Breeder



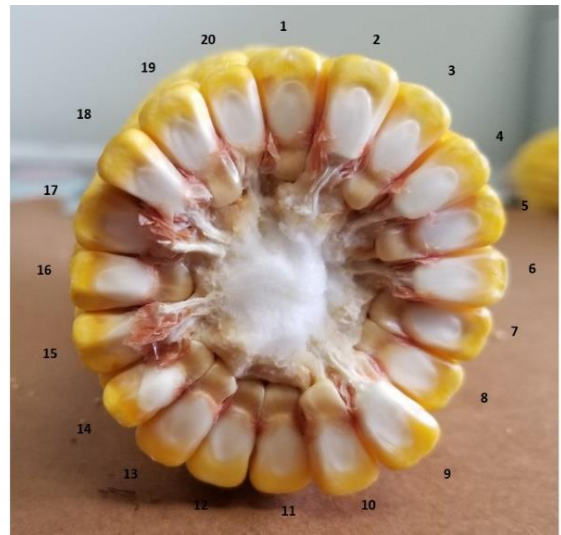
## ESTIMATING CORN GRAIN YIELD

Corn growers are eager to estimate their grain yield potential this year due to the extreme drought experienced over much of the state. The most commonly used method to estimate corn grain yield in the field is the Yield Component Method, developed many years ago at the University of Illinois. The Yield Component Method can be used well in advance of harvest, as early as the milk stage (R3) of kernel development. Estimates made earlier than R3 risk being overly optimistic if later stresses cause kernel abortion or ear loss.

This method is based on the premise that yield can be estimated from the components that constitute grain yield, including ear number, number of kernel rows, and kernels per row. The final factor, weight per kernel, cannot be measured until maturity (black layer) and, even then, depends on grain moisture at harvest. So, the kernel weight used is somewhat of a “fudge factor” and can be adjusted based on the level of stress the crop endured during the growing season.

Crop uniformity also greatly influences the accuracy of any yield estimation technique. The less uniform the field, the greater the number of samples that should be taken to estimate yield. Attempt to sample locations within the field randomly so as to not bias the yield estimate up or down. In a fairly uniform field, calculate yield at five different locations.

1. At each location, measure off a length of row equal to 1/1000<sup>th</sup> of an acre. For 30-inch (2.5 ft) rows, this is 17 ft 5 in. For 36-inch rows, this is 14 ft 6 in. For other row spacings, divide 43560 by the row spacing in feet and then divide that result by 1000.
2. Count and record the number of harvestable ears on the plants in 1/1000<sup>th</sup> acre of row. Do not count dropped ears or ears on severely lodged plants unless you are confident that the combine header will be able to pick them up.
3. For every fifth ear in the sample row, count the number of complete kernel rows per ear. Do not sample nubbins or obviously deformed ears unless they are representative of the sampled area. If row number changes from butt to tip, which can happen due to drought stress, estimate an average kernel row number per ear. Don't count the butt or tip ends, but rather choose an area in the middle of the cob where there is a complete ring of kernels. Do not count aborted kernels. The photo at right shows a cob with 20 kernel rows. Kernel row number is almost always even, but extreme drought or nutrient stress may result in an odd number. Photo credit: North Carolina Extension Service.
4. Using the same ears, determine the average number of kernels per row on each ear. This is done by counting the kernels along the length of the cob from butt to tip. If numbers of kernels per row are not equal among the rows of an ear, estimate an average value for the ear.
5. Estimate the yield for each location by multiplying the ear number by the average kernel row number by the average kernels/row number, and then divide by 90. 90 is the “fudge factor” mentioned earlier and represents 90,000 kernels per 56 lb bushel. In growing seasons with stressful conditions, kernel size will likely be smaller than average and so a higher number, e.g. 100, can be used. In a year with excellent grain fill conditions and little stress, a lower number, e.g. 75, can be used, representing larger kernels. So, the equation looks like this:



$$\text{Corn Yield} = \frac{\frac{\text{Ears}}{1000^{\text{th}} \text{ ac}} * \frac{\text{Kernel Rows}}{\text{Ear}} * \frac{\text{Kernels}}{\text{Row}}}{90}$$

For example, say you counted 24 harvestable ears at the first location. Sampling every 5<sup>th</sup> ear resulted in an average kernel row number of 16 and an average number of kernels per row of 30. The estimated yield for this location would be  $(24 \times 16 \times 30)/90 = 128$  bu/ ac.

Now, let's say this field encountered moisture stress during pollination and silking. Using a higher denominator, that is, smaller kernel size and/or lighter kernel weight, would be appropriate. So, using the same numbers as before but a higher number of kernels/ bushel:  $(24 \times 16 \times 30)/100 = 115$  bu/ ac.

Repeat these steps at as many sites within a field as you deem representative. Calculate the average yield for all sites to estimate the yield for the field.

Remember that this method for estimating corn grain yield is indeed only an estimate. Since kernel size and weight will vary depending on hybrid and environment, this method should only be used to determine ballpark grain yields. Yield will likely be overestimated in a year with poor conditions during grain fill (like our current drought) and underestimated in a year with excellent conditions throughout grain fill. The Yield Component Method for estimating corn grain yield tends to be accurate within +/- 20 bushels per acre. Use the yield estimates obtained by this method for general planning purposes only.

\*This article was adapted from a previous Crop & Pest Report article by Dr. Duane Berglund\*

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## IT'S AN EXCELLENT TIME TO SCOUT SOYBEANS FOR DISEASES TO PROTECT YOUR YIELD IN THE FUTURE!

### Question 1?

What economically important diseases are emerging (and/or spreading) in North Dakota?

Answer.

Charcoal Rot!

Sudden Death Syndrome!

Soybean Cyst Nematode!

### Question 2?

What soybean diseases make an appearance in August?

Answer.

Charcoal Rot!

Sudden Death Syndrome!

Soybean Cyst Nematode!

### Question 3?

What economically important soybean diseases can cause damage in a hot and dry year?

Answer.

Charcoal Rot!

Sudden Death Syndrome!

Soybean Cyst Nematode!

I strongly encourage everyone to scout their fields for these economically important soybean diseases. A hot and dry 2021 have made these diseases more visible than normal, and now is the best time of the year to grab a pocket knife, a shovel (or probe), a hand lens and get out in the field. If you find these diseases, management tools are available that may help you protect yield for years to come. Below you will find disease identification resources that will be helpful when scouting the fields. One resource that may be of most use is the 'Soybean Disease Diagnostic Series' as the information pertains specifically to North Dakota and Minnesota.

### SOYBEAN DISEASE RESOURCES

I recommend several resources that may help you identify your soybean diseases.

- 1) The 'Soybean Disease Diagnostic Series' jointly created by NDSU and UMN Extension *specifically for our growing region* was just updated last month (some additional photos, updated prevalence information, one additional disease). All diseases common (and some uncommon) in our region are included in the series, with an emphasis specifically on identification. We thank the North Dakota Soybean Council and Minnesota Soybean Research and Promotion Council for support in the creation of this diagnostic guide.  
<https://www.ag.ndsu.edu/publications/crops/soybean-disease-diagnostic-series>
- 2) Another helpful local resource is the UMN soybean pest management website. Diseases are separated into leaf, stem and seed/root diseases – and provides important information about symptoms and signs.  
<https://extension.umn.edu/soybean/soybean-pest-management>
- 3) The Soybean Research and Information Network is a website of the North Central Soybean Research Program (an excellent soybean-checkoff supported multi-state program). This link takes you to the disease page, but information about insects, agronomics and other information can also be found on the site.  
<https://soybeanresearchinfo.com/soybean-diseases/>
- 4) The SCN Coalition is a public private partnership focused on soybean cyst nematode. This information is excellent, with videos, publications and numerous SCN resources. [www.thescncoalition.com](http://www.thescncoalition.com)
- 5) The Crop Protection Network is a website operated by many Extension plant pathologists from across the soybean growing states. The searchable website includes publications, and image library, and information on numerous soybean, corn and small grain diseases. [www.cropprotectionnetwork.org](http://www.cropprotectionnetwork.org)

### CHARCOAL ROT OF SOYBEANS

A few years ago, several fields experienced very severe charcoal rot in the Southeast and East central RRV (Figure 1). While we do not have a good handle on how prevalent the disease is, we are fairly certain it is more common than we think. We encourage you to scout for charcoal rot.

Infection occurs early in the growing season, but is not often observed until after flowering, and is far more severe and obvious when in a hot and dry growing season. The disease is caused by a soil-borne pathogen (*Macrophomina phaseolina*) that infects many crops (corn, sunflower, other legumes, etc.), but we have observed the disease to be most severe in our area on soybeans.

The disease is typically first noticed when patches of soybeans (often large patches) prematurely wilt and die. The leaves will remain ON the wilted and dying plants (Figure 2). Plant tissue on lower stem and tap root may appear gray or silver and 'peeling' away (Figure 3). If you remove the outer tissue ('shaving' tissue gently with a pocket knife works very well) you will see profuse charcoal-colored specs called microsclerotia (Figure 4).



**Figure 1. Large patches of soybean-infected charcoal rot in Cass County, 2018.**





**Figure 2. Wilted soybeans with leaves still attached.**



**Figure 3. Lower stem tissue 'shaved away', revealing black microsclerotia.**



**Figure 4. Lower stem with a dusty gray to silver appearance, with outer tissue peeling away.**



### SUDDEN DEATH SYNDROME (SDS) OF SOYBEANS

Sudden Death Syndrome (SDS) was first confirmed in the state in 2018 (Richland County), and in 2020 was confirmed ***hundreds of miles away*** in Cavalier County. We don't know exactly how prevalent SDS is in the state, but the Richland and Cavalier County confirmations suggest it is more common than we think. Additionally, the severity of SDS is tightly linked to the presence of soybean cyst nematode (see article below). You can certainly have SDS without SCN, but you are more likely to find (and suffer yield loss) from SDS if you have SCN. I suggest you scout areas of your field known to have high SCN pressure.

The pathogen is a soil-borne root rot pathogen (*Fusarium virguliforme*) that can survive for several years. The pathogen infects soybeans soon after planting, and *wet* conditions favor development of the disease. Thus, for infection to occur and disease to develop, that soybeans will have had to have *some* moisture. The pathogen will cause root rotting, but more importantly, produces a *plant toxin* that moves up from the root tissue into the rest of the plant. It is the plant toxin that causes the foliar symptoms.

SDS often shows up in fields in oval/circular spots or clusters of plants in a field (Figure 1). When the disease is becoming severe, yellow patches of soybeans are often visible from a distance.

The first foliar symptoms of SDS are bright chlorotic (yellow) spots that occur diffusely (not connected to one another) between the leaf veins (Figure 2). Soon after, necrotic areas between the leaf veins occur, often bordered by a relatively thin yellow halo (Figure 3). With time, the necrotic areas coalesce, leaving only the veins of the leaves green. In severe cases, leaves may drop, but petioles will remain attached to the plant (Figure 4).

Examination of stem and roots tissue is very important to distinguish SDS from other diseases. With a knife, scrape off the outside of the tissue of the lower stem and tap root near the soil line. SDS infected stems have tanning or browning, but the pith (center of the stem) will remain white (Figure 5). Brown stem rot (BSR) causes a look-alike leaf symptom, but the lower stem symptoms will be opposite; the pith will be brown and the other tissue will be white, giving it a 'lead in a pencil' look (Figure 6).



**Figure 1. Area of a soybean field with Sudden Death Syndrome**



**Figure 2. A mix of beginning and advanced foliar symptoms of Sudden Death Syndrome (Photo: Dr. Berlin Nelson in Richland County August 20, 2020).**



**Figure 3. Progression of symptoms of Sudden Death Syndrome (Photo: Markell).**





**Figure 4. Tan to brown soybean root tissue consistent with Sudden Death Syndrome (Photo: Dean Malvick, UMN, extracted from Soybean Disease Diagnostic Series, NDSU Extension Publication-1867).**



**Figure 6. Not Sudden Death Syndrome. Severe brown discoloration in pith from brown stem rot (Photo: Dean Malvick, UMN)**



**Figure 5. Sudden Death Syndrome infected stems have tanning or browning, but the pith (center of the stem) will remain white. (Photo: Dean Malvick, UMN, extracted from Soybean Disease Diagnostic Series, NDSU Extension Publication-1867).**



**SOYBEAN CYST NEMATODE (SCN)**

Soybean Cyst Nematode (SCN) is the 2,000-pound gorilla in the room. Nationally, SCN is estimated to cause more yield loss than the next three to five most important soybean diseases. And, it makes diseases like sudden death syndrome (above) and brown stem rot worse.

Thanks to the *grower-based* SCN sampling program supported by the North Dakota Soybean Council and operated by NDSU Extension, we do have a good understanding of where SCN occurs in the state. High levels of SCN (as measured by egg counts) occur throughout the Southeast and East Central parts of the state, with expanding prevalence in areas to the north and west.

SCN reproduction is favored by dry and hot growing seasons, *and* these above-ground symptoms are brought on more by drought stress. I expect to see more 'visible' SCN this year.

Please see my next article on the SCN-Sampling Program for details on how to sample and how to interpret the results.

The soybean cyst nematode (*Heterodera glycines*) is a parasitic worm that feeds and reproduces on soybeans, dry beans and a few weed hosts found in North Dakota. Essentially, it's a parasite, and like any good parasite, the objective is not to 'kill' the host (that is somewhat counterproductive for the nematode). Rather, the nematode flourishes when it takes water and nutrients from the roots. Consequently, soybeans that are infected by SCN are difficult to detect by their above-ground symptoms. It's not until they are experiencing yield losses of 15-30% (or more), that they may turn yellow and/or appear stunted (Figure 1). You *may* be able to observe the white female cysts on the roots using a hand-lens and flashlight (Figure 2). They are much smaller than a nodule, and when young appear white to cream colored. As they age, they turn brown, and are extremely difficult to see (Figure 3, next page). **Consequently, soil sampling is the most effective way to find SCN, and the only way to quantify how bad your infestation is.**



**Figure 1. Severe damage from Soybean Cyst Nematode**



**Figure 2. Numerous white-cream colored cysts compared to a nodule**





**Figure 3. Numerous older brown cysts of SCN**

### **2021 SOYBEAN CYST NEMATODE (SCN) SAMPLING PROGRAM**

We encourage soybean growers to sample for soybean cyst nematode (SCN) this growing season, and NDSU Extension and the North Dakota Soybean Council are working together again to coordinate a soybean cyst nematode (SCN) soil testing program.

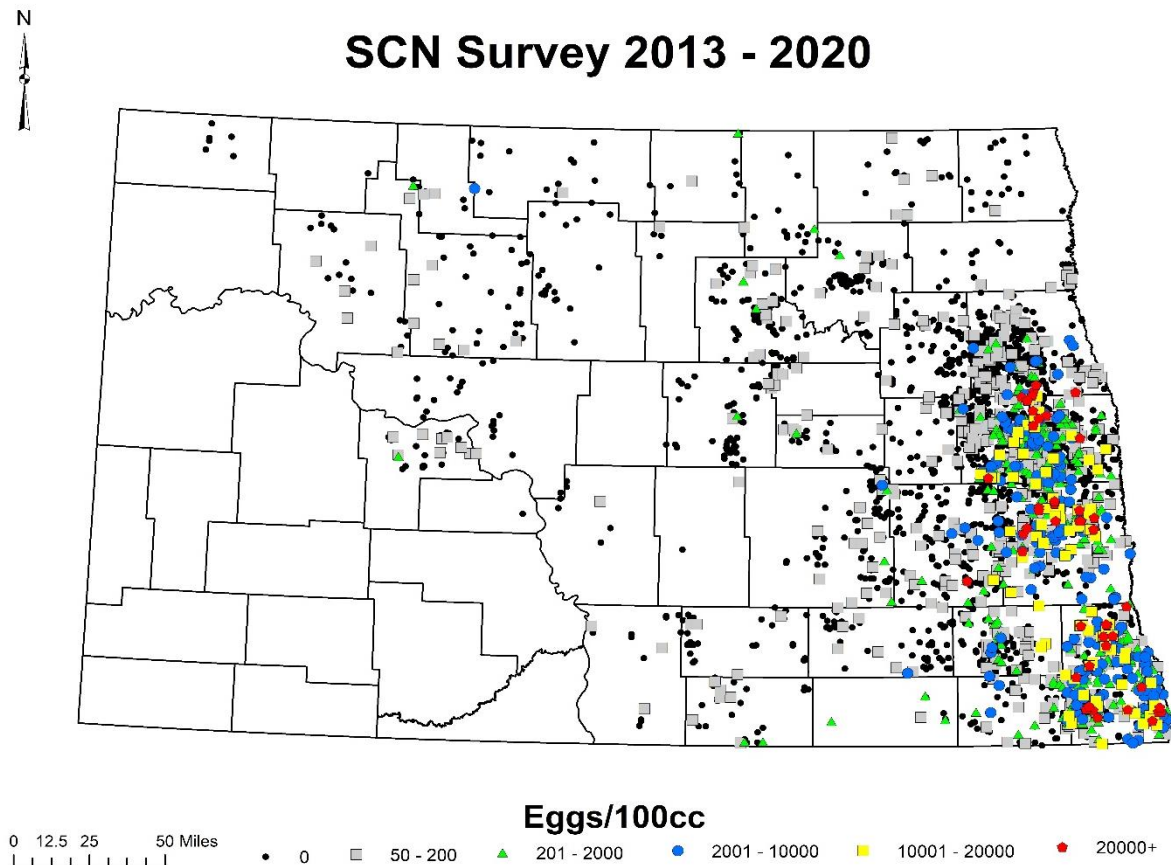
#### **There are three main reasons to soil sample for SCN.**

- 1) It is the best way to identify an infected field (do you have SCN?)
- 2) It is the only way to quantify how bad your infestation is (how high are your egg levels?)
- 3) It is the best way to determine how well your management tools are working (are your egg levels changing?)

Anyone interested in soil sampling for SCN can pick up to three pre-labeled SCN soil test bags from their County Extension office. The laboratory fees from SCN samples submitted through the sampling program are covered by the North Dakota Soybean Council. A total of 2,000 SCN soil test bags will be available to growers on a first come first serve basis.

To submit a sample; fill the bag with soil, provide site information, and send the bag to the partner lab (Agvise). *Results will be mailed directly to the submitting growers.* Notably, laboratory fees are covered for samples submitted in the *pre-labeled bags* only, so it is critical to pick them up from the county Extension office.

The egg levels and geospatial positions from previous years samples that were used to generate SCN distribution maps in North Dakota show 'hot spots' in much of the SE and EC part of the state, and movement west and north (Figures 1 and 2). In 2021, we will use egg level data and add to the map. Importantly, NDSU does not have access to any personal information – just the egg level and geospatial data to generate a map.

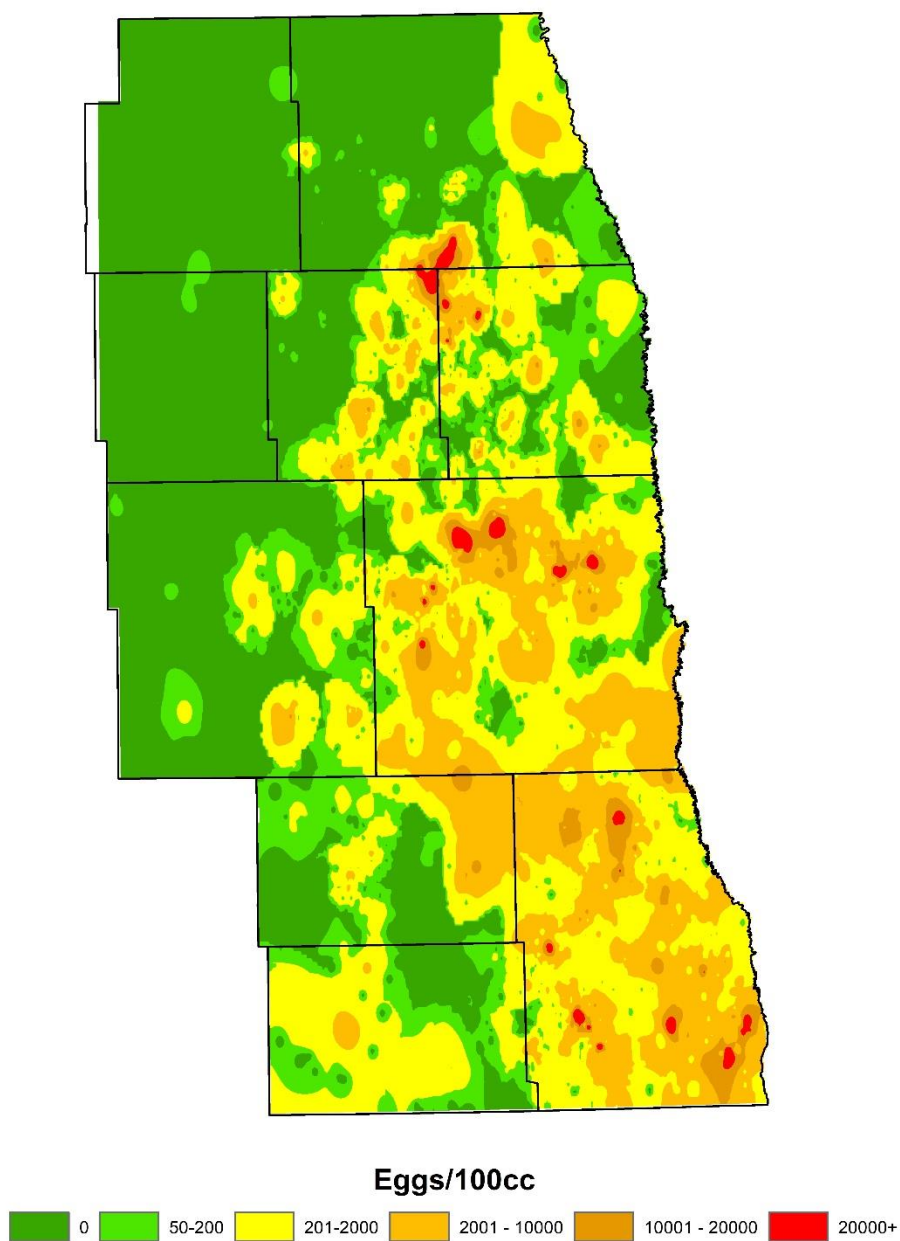


**Figure 1. Egg levels in North Dakota from the NDSU Extension – North Dakota Soybean Council grower-based SCN sampling program. Black circles are negatives. Gray boxes (50-200 eggs/100cc) are very low levels, which could be real, or could be false positives. Green triangles (200-2,000 eggs/100cc) are low-level positives. All other shapes are positives of different eggs/100cc.**

0 5 10 20 Miles



## SCN Survey 2013 - 2020



**Figure 2. Heat maps of egg levels in Southeastern North Dakota from the NDSU Extension – North Dakota Soybean Council grower-based SCN sampling program.**



## HOW TO SAMPLE FOR SOYBEAN CYST NEMATODE (SCN)

**What am I sampling for?** SCN is a parasitic nematode that will complete two to three life cycles each growing season. Each female will produce 100-200 eggs, which are protected within her body wall after she dies (called a 'cyst'). When we soil sample, we are measuring the amount of eggs in the soil, which are measured in 100cc (which is approximately 3.4 ounces).

**When to sample?** The best time to sample is at the end of the growing season; before or after harvest (September/October). This can be done before or after harvest, and will coincide with the highest egg levels in the soil.

**How do I sample?** Aim for the roots, sample right next to the plant! You only need to go 6-8 inches deep. Take 10-20 small samples, mix up, and fill soil bag with the composite sample.

**What sampling strategy do I use?** There are several strategies, depending on the mission. For those who know they have SCN, you can determine how well their management tools are working by evaluating egg levels in the soil. The best strategy to do this is to take soil cores from similar areas in a field and group the samples (strategy 1 and 2 on Figure 1). For those who are sampling to determine if they have SCN at all, the best strategy is to focus on areas when SCN is most likely to be introduced into a field, such as field entrances, shelter belts, and frequently flooded areas (strategy 3 on figure 1).

**Where to sample?** SCN moves with anything that moves soil, loves high pH, and often doesn't show above ground symptoms. Consequently:

Focus on areas that are likely to introduce soil to your field, such as:

- Field entrances (SCN being moved on equipment with soil)
- Low spots where water pools (SCN moving in water)
- Frequently flooded areas (SCN moving in water)
- Along shelter belts or fence lines (SCN moving with wind-dispersed soil)

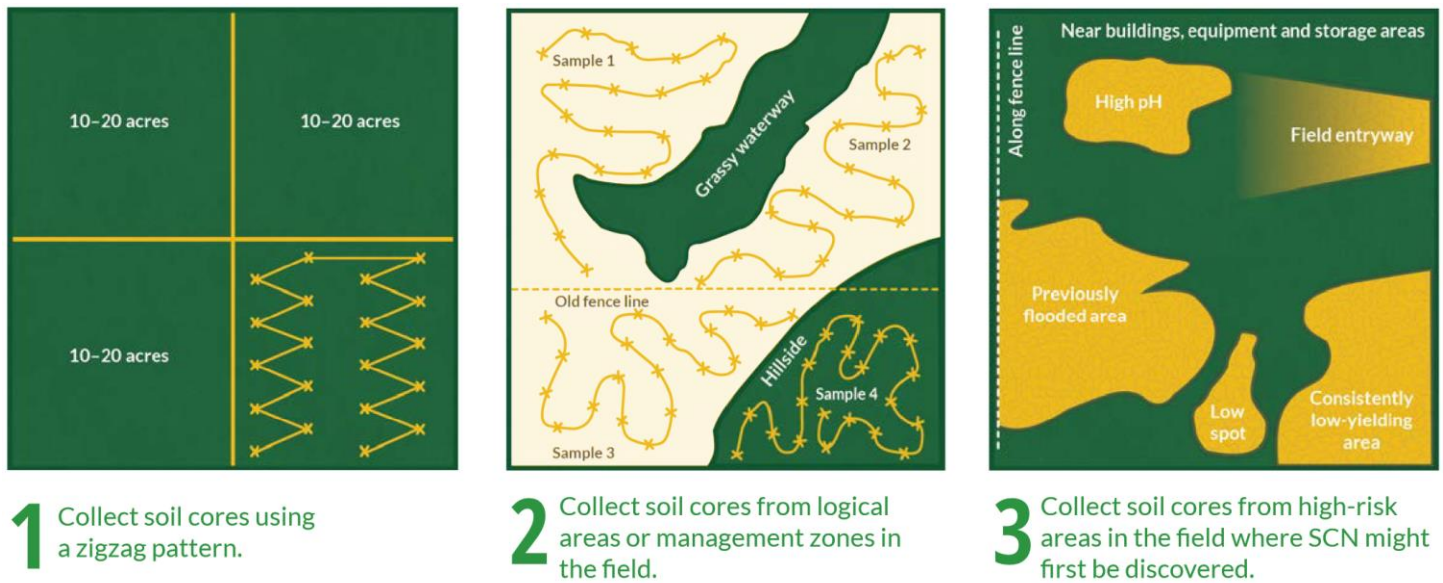
Additionally, several areas should be considered suspicious for SCN, and can be sampled.

- High pH spots in the field (SCN loves high pH).
- Areas with unexplained low yields (do the beans look fine but yield poorly in a spot?).
- Areas that turned yellow in August (heavy SCN damage may show up as stunted or yellow beans when it is hot and dry late in the season).

**How do I interpret the results?** Results come back measured in eggs per hundred cc of soil (eggs/100cc). A 100cc is about 3.4 ounces. During the process, samples are diluted and measured in multiples of 50. If the samples are 0, no eggs were found. Sample 50-200 are very low levels and should be viewed as suspicious (but not necessarily confirmed). There are other nematodes laying eggs in the soil, and these are often indistinguishable from SCN. Anything higher than that should be viewed as a positive, and, it should be managed. SCN can explode very quickly, so a find of 1,000 eggs/100 cc should be aggressively managed, so it doesn't become 10 or 50 times higher after the next planting of soybeans.

### For more information?

The SCN Coalition [[www.thescncoalition.com](http://www.thescncoalition.com)] is a partnership of private companies, universities and soybean checkoff organizations that have rallied together to speak with one voice about SCN. The website contains teaching materials (video, print, grower videos), sampling information, management strategies and much more. Your county Extension agent is also an excellent resource for information.



**Figure 1. Three sampling strategies commonly used for SCN. Photo courtesy of the SCN Coalition ([www.thescncoalition.com](http://www.thescncoalition.com)).**

[Sam Markell](#)

Extension Plant Pathologist, Broad-leaf Crops



## AN OPPORTUNITY FOR PLANTING INTO STUBBLE

This fall there has been much more straw removal from small grain fields than normal. This means that there would be far less problems planting into stubble next spring than in most years. In addition, most straw was rather brittle and dry and the ground coverage, even the chaff, was better distributed than usual. Many growers have expressed an interest in starting to plant without tillage. Given the dry soil, the probability of a better seed bed this coming spring, and the reduced residues in many fields, there is an opportunity this winter to improve planters with residue managers and plant directly into the stubble. It takes 5-6 years to transform most soils from beaten-to-death, poorly aggregated specimens that have problems with trafficability and crusting into well-aggregated soils that support field equipment without compaction issues and start the season with excellent planting conditions.

This year would be a perfect year to make a move in that direction. A few growers outside the Valley have expressed concern with compaction (in higher illitic-clay soils) with compaction layers about the 6-8 inch depth. If a compacted layer is present, using a tool that cracks the layer compared to most chisel-plows/deep-tillage tools that lift the soil, would perform the task without the potential to unnecessarily exposing the surface to erosion or producing giant clods that have difficulty breaking down over a normal to dry winter.

There is also more interest in strip-till for row crops than usual. The reduced residue will also help the transition to a strip-till operation. The use of a shank-style strip-till tool will clear a planting width, crack the soil and enable the applicator to apply P and K in the same operation, while maintaining much of the soil biology that makes long-term no-till fertility benefits possible. A disc-type strip-till tool decreases wind erosion greatly, similar to that of the shank-style units, but it does not produce the no-till benefits over time, nor is it as simple to apply fertilizer with, because it tends to concentrate any fertilizer near the future planting depth, limiting rates.

Soybean ground will similarly have reduced residue. Plant height is reduced and residue produced this year will be less. Planting into the soybean residue next spring will be much easier than usual. The benefits of planting without tillage not only benefits the soil, but in years such as this, when moisture is limited, will result in better yields. The soybean image shows an experiment with 5-years continuous no-till in a Fargo soil (left-top, greener crop) compared to conventional tilled, wilted soybeans, (right-bottom, wilted crop).



***Wheat straw bales ready for transport.***



**Green, healthy soybeans in 5-year continuous no-till management on a Fargo soil (top left) compared with wilted soybean under convention tillage management, Fargo soil, (center/bottom). Image taken 8/23/2021 at 4PM, temperature 84°.**

[Dave Franzen](#)  
Extension Soil Specialist



**POTASSIUM DEFICIENCY SYMPTOMS IN DRY BEAN AND SOYBEAN**

Along with many other challenges associated with dry conditions this crop season, potassium (K) deficiency symptoms are being expressed in crops including dry bean and soybean. The image shows K deficiency symptoms in pinto bean from the Carrington REC dryland dry bean variety trial. The dry bean plants have been translocating K from older leaves to upper leaves and pods for seed development, and plants lacking sufficient K are displaying leaves with yellow or chlorotic edges. Extended dry soil conditions reduce K availability, with deficiency symptoms likely with soil K levels below soil test critical values and especially with soil clay chemistry having smectite-to-illite ratio greater than 3.5. In addition to the fixation/retention of K in smectitic clay interlayers, the lack of soil water forces plant roots to only encounter K through direct contact or diffusion. Both of these processes limit the volume of soil with possible plant-available K that can be taken up. In moist soils, K is released from smectitic clays and some K movement is possible with soil water to the roots.

Details on K management (soil testing and K fertilizer application) can be found in NDSU Extension circular 'ND Fertilizer Recommendation Tables and Equations' or specific crop plant nutrition circulars including 'Soybean Soil Fertility'.



[Greg Endres](#)

Extension Cropping Systems Specialist  
NDSU Carrington Research Extension Center

[Dave Franzen](#)

Extension Soil Specialist





# horticulture

## FALL FLOWERS NOURISH THE BEES AND BUTTERFLIES

Planting late-summer and fall-blooming perennials can seal your reputation as an exceptional gardener. When everyone else's garden is looking tired in September, your garden can be the showcase of the entire neighborhood with a fresh set of blooms.

Besides their ornamental appeal, late-season blooms play an important role in sustaining native bee and butterfly populations.

Late summer is when male bumblebees and next year's queens are hatched. The male bumblebees perpetuate the species by mating with the new queens. The pregnant queen then feeds heavily on nectar and pollen to fatten up for winter while the rest of the colony dies in fall. Only the new queen overwinters in an underground burrow and produces offspring the following year to form a new colony.

Likewise, fall flowers are important for butterflies. Painted lady butterflies are frequently observed on fall flowers.

However, the monarchs are the true stars of the garden in fall! They need to find nectar-rich flowers to feed the beginning generations that start the long migration to winter grounds in Mexico.

North Dakota State University has studied late-season native and ornamental perennials for their ability to attract and nourish bees and butterflies. In the study, Extension entomologists counted the number of bees, butterflies, and beneficial insects that landed on the flowers to determine the best pollinator plants for home landscapes.

Ornamental tall sedums that bloom in August and September are surprisingly good pollinator plants. These drought-tolerant succulents attract a surprising range of bees and butterflies. The cultivars, Autumn Fire and Autumn Joy, are two of the best for attracting a wide range of pollinators.

The more compact cultivar, Neon, produces pretty pink blooms that seem to attract butterflies. Every time I approached 'Neon', a cloud of painted lady butterflies would take flight.

Asters are one of the last plants to bloom in the ornamental landscape and are under-utilized. They bloom from late August until the first heavy frost.

Selecting an aster can be tricky for a couple of reasons. First, some of the native asters are too large for a managed landscape. Other asters may bloom too late in the season and may experience a heavy frost before reaching full bloom. The cultivars, Purple Dome and Raydon's Favorite, do not reach their full potential in the northern Great Plains because of their late bloom.



*Painted lady butterfly on aster*  
(V. Calles-Torrez)



*Sweat bee (Halictidae) on aster*  
(V. Calles-Torrez)

Recommended aster cultivars include Alma Potschke and Dream of Beauty. 'Alma Potschke' produces magenta flowers in early fall and is a butterfly magnet. However, the plant may need to be staked to keep it upright.

'Dream of Beauty' with its compact habit fits better in smaller landscapes. Its pink blooms are a welcome addition to the fall garden. This cultivar attracts fewer pollinators than 'Alma Potschke'.

For more information please see the NDSU Extension publication [H1962, Pollinator Preferences for Selected Aster, False Indigo, Bee Balm and Sedum Flowers in North Dakota](https://www.ag.ndsu.edu/publications/lawns-gardens-trees/pollinator-preferences): <https://www.ag.ndsu.edu/publications/lawns-gardens-trees/pollinator-preferences>

For more information about gardening, contact your local NDSU Extension agent.



*The sedum cultivar Neon produces bright pink flowers that attract painted lady butterflies. (NDSU photo)*

[Esther McGinnis](#)

Extension Horticulturist



## AROUND THE STATE

### NORTH CENTRAL ND

Finally, some much needed relief from the summer drought arrived over the last two weeks. Here are the latest precipitation reports as observed by area NDAWN stations over the last two weeks (beginning August 10<sup>th</sup>): Minot: 1.36" (NCREC: 1.79"); Bottineau: 2.61"; Garrison: 0.97"; Karlsruhe: 2.89"; Mohall: 2.29"; Plaza: 1.17"; and Rugby: 4.21". Bare soil temperature at the NCREC is observed at 73 degrees F.

Insect calls have slowed considerably, however, as noted in TJ's crop surveying over the past few weeks, they are still around. Please continue to scout in late maturing crops over the next few weeks. As early maturing crops (small grains, pulses, canola, etc.) are harvested, they will begin shifting to those late maturing crops.

Area small grains are approaching completion of harvest. Yields reported by producers are lower compared to normal years and, in some cases, are as much as 70% lower than what could be expected during an average season. Additionally, pulse crops are mostly harvested in the region. This year, we are seeing an increase of straight harvested canola. Soybean fields are mostly observed at the R-5 stage with a few fields up to the R-7 stage. Sunflowers are nearing the R-6 to R-7 stage with a few fields still playing catchup in the R-4 to R-5 stages. Most of the corn found in the region are at R-3 to R-5 and we are seeing a lot of drought stressed corn being harvested as forage.

[TJ Prochaska](#)

Extension Crop Protection Specialist  
NDSU North Central Research Extension Center

[Leo Bortolon](#)

Extension Cropping Systems Specialist  
NDSU North Central Research Extension Center



**NORTHEAST ND**

Small grains harvesting is underway with yields ranging between 30-70 bu. Producers were pleasantly surprised with ND Froberg wheat yields 65-70 bu. Peas are combined ranging from 20-40bu. Some canola is getting swathed and the rest is a week-2 week away from being swathed or combined. Canola yield is surprising some but not a great yield (1200-1500 lbs). Most of the region received rains over the weekend ranging from 1- 5 inches. Soybeans, corn and sunflowers will benefit from these rains. Edible beans are dropping leaves and turning color. Pig weeds are re-growing in small grain stubble and in soybeans growing above canopy. Good time to check for palmer amaranth. Hay samples are being tested for nitrates with several of them showing high levels. Some producers are still selling cattle because there isn't enough hay. Water samples are still reading high levels of sulfates.

[Anitha Chirumamilla](#)

Extension Agent Cavalier County

**NORTHWEST ND**

A lot of harvest progress has been made in the last two weeks in the Northwest. Before the cold front came in late last week, high temperatures were in the 80s and 90s and close to 100 for a few days. But on August 18<sup>th</sup>, highs were only in the 60s in most places and scattered showers started. Before the rain, many acres of pea, lentil, spring wheat, and durum were harvested. Rainfall totals from Thursday through Sunday ranged from 0.5"-1.25" across the region. Thankfully, the rain was gentle and soaked in most places. The rain has stopped harvest for the moment, but it will likely pick up again Tuesday and Wednesday as farmers try to beat the rain predicted later in the week.

For spring wheat yields, I've heard everything from single digits and fields not worth harvesting and left to stand to catch snow for spring wheat in McKenzie County and southern Williams to mid 20s-35 bu per acre in northern and eastern Williams Co. For those farmers harvesting 30-35 bushels, it is a nice surprise given the severity of the drought but also shows the value of no-till practices.

Looking at this week's forecast, temperatures are predicted to be a lot cooler than the past two weeks with highs below normal for August, only in the low to mid 70s. There are chances of scattered thunderstorms the 26<sup>th</sup> and 27<sup>th</sup>. The rain and cool weather will delay dry down of late planted small grain fields, but should be beneficial for soybean still filling pods.

[Clair Keene](#)

Extension Agronomist Small Grains and Corn  
NDSU Williston Research Extension Center

**SOUTH-CENTRAL/SOUTHEAST ND**

According to NDAWN, the region's August 1 to 23 total rainfall ranges from 0.2 inch (Lisbon) to 5.0 inches (Wishek). Most areas received at least an inch of rain this month including the Carrington Research Extension Center (CREC) at 1.4 inches. Last weekend's rain will provide most value for soybean, especially long-maturing varieties or late-planted fields. Hopefully the rains continue this fall to begin soil moisture recharge for the benefit of 2022 crops.

Currently, 2021 CREC small grain variety trial data is available ([www.ag.ndsu.edu/varietytrials/](http://www.ag.ndsu.edu/varietytrials/)) for one HRS wheat and durum trial, and three barley trials; with more data pending.

The following are the most advanced row crop growth stages observed at the CREC earlier this week: corn, R5 (dent); soybean, R7 (initial seed maturity); dry bean, R9 (full seed maturity); and sunflower, R8 (back of head is yellow). Dry bean harvest will commence when field conditions allow equipment entry.



**1. CREC irrigated dry bean variety trial: ND Falcon (left foreground pair of rows) and ND Palomino (right) pinto bean on August 23.**



**2. Sunflower in the R8 growth stage.**

[Greg Endres](#)

Extension Cropping Systems Specialist  
NDSU Carrington Research Extension Center

## SOUTHWEST ND

According to NDAWN from August 1<sup>st</sup> to August 23<sup>rd</sup> Dickinson received 1.29 inches of rain, Beach 0.94, Amidon 0.70, Bowman 1.04, Hettinger 1.54, Mott 1.18, Carson 1.17, Mandan 0.66, Hazen 0.67, and Dunn 1.78. Most of that rainfall came August 19<sup>th</sup> and 20<sup>th</sup>. Late planted canola and small grains continue to be harvested. Yields continue to be variable, with some who caught timely rains showing average to above average yields. Even though we are in a drought, I am still finding ergot along the edge of some wheat fields. Whether harvesting for grain or cutting for hay be sure to scout for ergot before harvesting and manage accordingly. More information on ergot can be found in the publication "Ergot in Small Grains" <https://www.ag.ndsu.edu/publications/crops/ergot-in-small-grains>

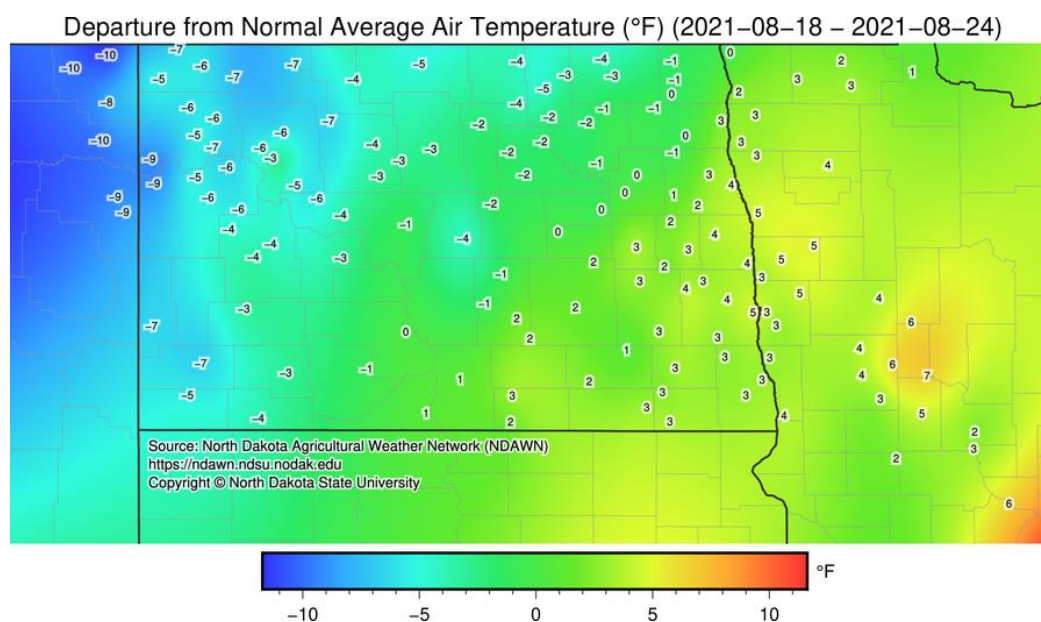
This fall we will be conducting the National Sunflower Production Survey funded by the National Sunflower Association. In this survey we measure yield estimates and factors that limit yield such as disease, insects, weeds, and management issues in North Dakota, South Dakota, Minnesota, Manitoba, Nebraska, Kansas, Colorado, and Texas. If you have a sunflower field that you'd like to be surveyed please contact your local NDSU Extension agent or myself. More information on the survey can be found on the NSA website <https://www.sunflowernsa.com/growers/yield-and-survey/sunflower-crop-survey/>

[Ryan Buetow](#)

Extension Cropping Systems Specialist  
NDSU Dickinson Research Extension Center

**WEATHER FORECAST****The August 26 to September 1, 2021 Weather Summary and Outlook**

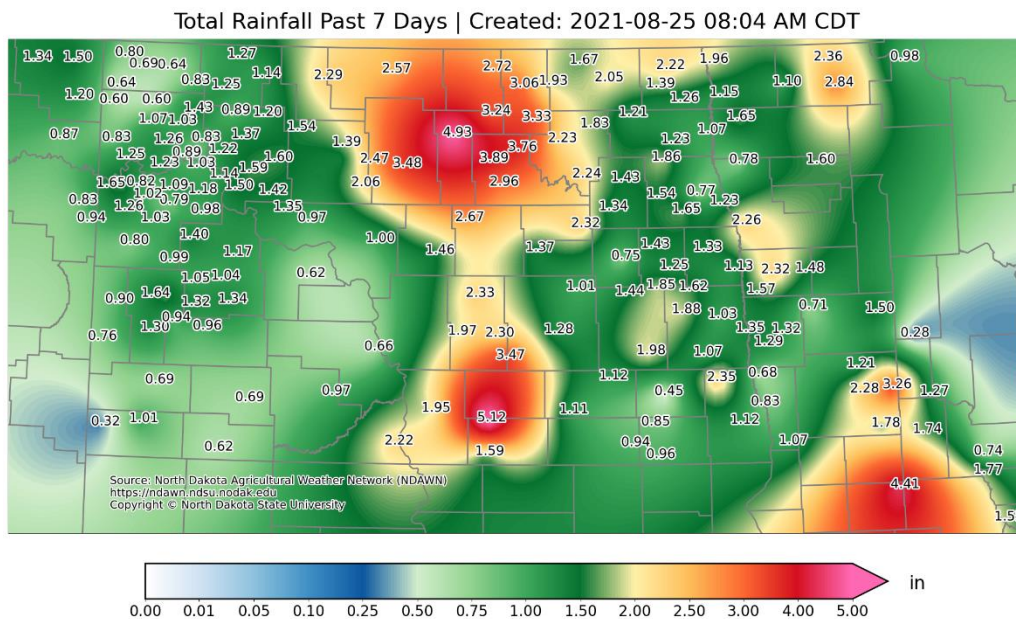
If you live in eastern North Dakota or in Minnesota, the past week was either near or several degrees above average for temperatures. If you live in western North Dakota or in Montana this past week was quite chilly with temperatures between 5° to 10° below average (Figure 1).



**Figure 1. Temperature departures from average at selected NDAWN stations for the period of August 18 through August 24, 2021**

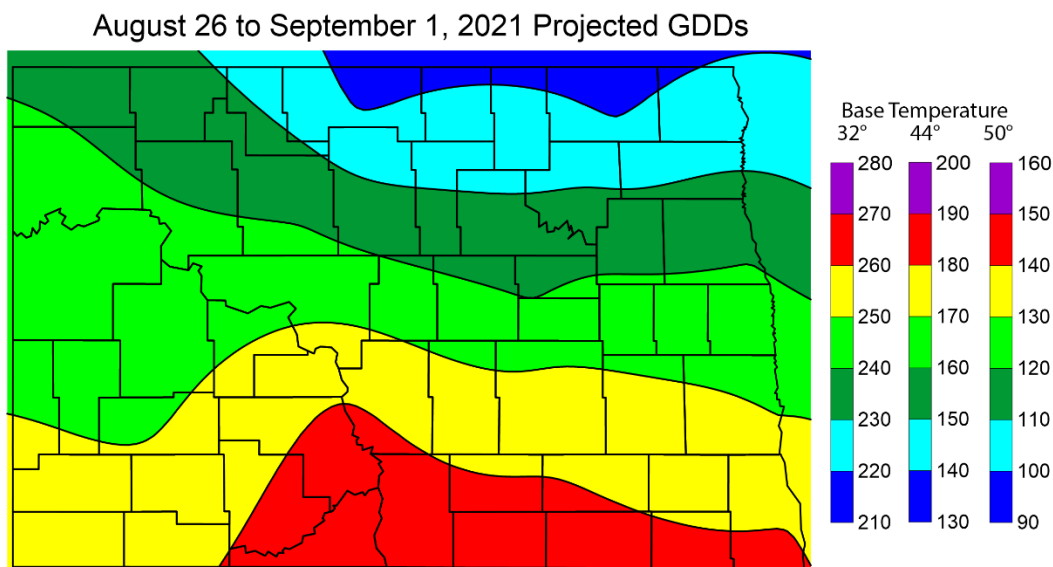
It was this boundary between those two air masses that was partially responsible for the widespread and in many instances heavy rain that fell across the region in the past week (Figure 2). This pattern change, over what the region has been experiencing during most of the 2021 growing season, will continue for the next couple of weeks with several disturbances expected. With that rain in the forecast and the accompanied cloud cover, it is likely the region will experience more below average temperature days than above average temperature days.





**Figure 2. Total rainfall for the 168-hour period ending at 8 AM on August 25, 2021 at NDAWN weather stations**

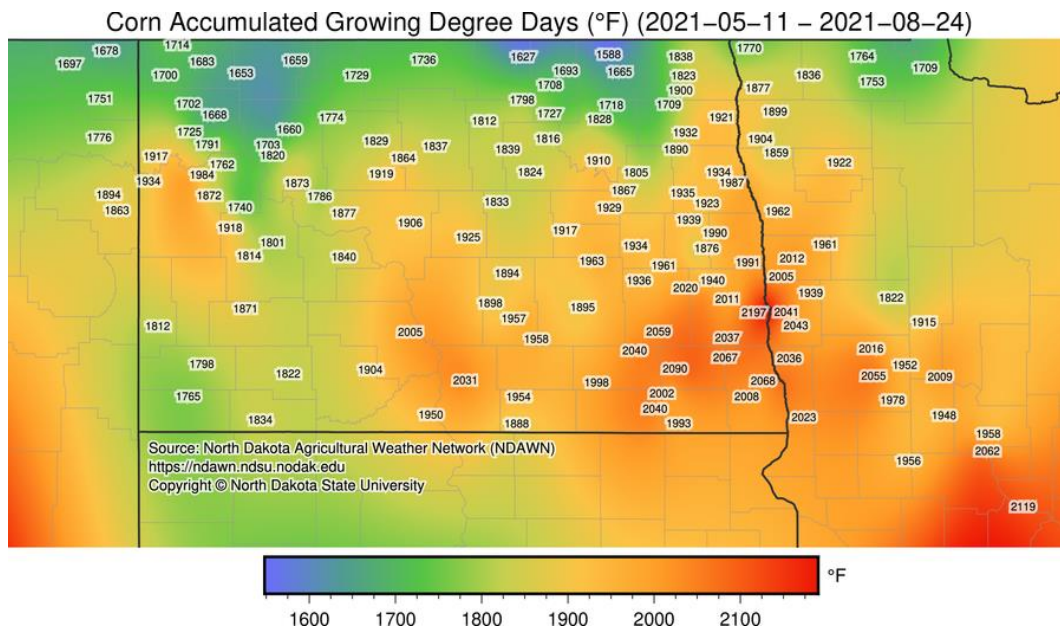
The projected growing degree days (GDDs) base 32°, 44° and 50° for the period of August 26 through September 1, 2021 can be found in Figure 3.



**Figure 3. Projected Growing Degree Days, Base 50°, 44° and 32° for the period of August 12 to August 18, 2021**

Using May 10 as a planting date, the accumulated growing degree days for corn (base temperature 50°) is given in Figure 4. 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 4. Accumulated Growing Degree Days for Corn (Base 50°) since May 10, 2021**

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 your 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)

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