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CROP & PEST REPORT
NDSU EXTENSION

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entomology

SCOUT FOR RED SUNFLOWER SEED WEEVIL

Red sunflower seed weevils (RSSW) are emerging in most areas of the state and scouting should start as sunflower starts to flower. Please send me your reports including locality and numbers when you start finding RSSW.

Identification: RSSW are small (⅛ inch long) weevils with a snout and are reddish-orange.

Adult red sunflower seed weevil (P. Beauzay, NDSU Ext. Entomology)

Scouting: When sampling, use the X pattern and begin counting at least 75 to 100 feet into the field to avoid field margin effects. Rub your hand vigorously across the sunflower face. Count the number of RSSW adults on 5 plants at 5 sites for a total of 25 plants per field. Scout for adults in the early blooming sunflower fields when the yellow ray petals are just beginning to show. RSSW is attracted to early blooming sunflowers, as females must imbibe pollen before laying eggs.

An NDSU YouTube video is available on ***Scouting for Red Sunflower Seed Weevil in Sunflowers***.

Scouting should continue until the economic threshold (Tables 1 & 2) is reached or when most plants have reached 70% pollen shed. At 70% pollen shed, plants are no longer susceptible for egg laying or significant damage. On older flowering plants (after R5.7), larvae of RSSW (and banded sunflower moth larvae) will be feeding inside the seeds and are protected from the insecticide. By then, much of the feeding damage has already occurred.

2021 RSSW Threshold

Oilseed sunflower at 20-24 cents per lb:
18,000 – 22,000 plants per ac**re**
$8 insecticide cost per acre – 3 – 4 weevils per head
$10 insecticide cost per acre – 4 – 5 weevils per head

Confection sunflowers:
1 weevil per head

Table 1. Economic Threshold for Oilseed Sunflowers - Number of adult red sunflower seed weevil per head when the cost of control equals $8 per acre.

Market Price	Sunflower Plants per Acre (x 1,000)											
$ per lb	14	15	16	17	18	19	20	21	22	23	24	25
0.18	5.8	5.5	5.2	4.9	4.7	4.5	4.2	4.1	3.9	3.7	3.6	3.5
0.19	5.6	5.2	4.9	4.7	4.5	4.2	4.0	3.9	3.7	3.6	3.4	3.3
0.20	5.3	5.0	4.7	4.5	4.2	4.0	3.9	3.7	3.5	3.4	3.3	3.1
0.21	5.1	4.8	4.5	4.3	4.1	3.9	3.7	3.5	3.4	3.2	3.1	3.0
0.22	4.9	4.6	4.3	4.1	3.9	3.7	3.5	3.4	3.2	3.1	3.0	2.9
0.23	4.7	4.4	4.2	3.9	3.7	3.6	3.4	3.2	3.1	3.0	2.9	2.8
0.24	4.5	4.2	4.0	3.8	3.6	3.4	3.3	3.1	3.0	2.9	2.8	2.7
0.25	4.4	4.1	3.9	3.7	3.5	3.3	3.1	3.0	2.9	2.8	2.7	2.6
0.26	4.2	4.0	3.7	3.5	3.3	3.2	3.0	2.9	2.8	2.7	2.6	2.5
0.27	4.1	3.8	3.6	3.4	3.2	3.1	2.9	2.8	2.7	2.6	2.5	2.4
0.28	3.9	3.7	3.5	3.3	3.1	3.0	2.8	2.7	2.6	2.5	2.4	2.3
0.29	3.8	3.6	3.4	3.2	3.0	2.9	2.7	2.6	2.5	2.4	2.3	2.2

Table 2. Economic Threshold for Oilseed Sunflowers - Number of adult red sunflower seed weevil per head when the cost of control equals $10 per acre.

Market Price	Sunflower Plants per Acre (x 1,000)											
$ per lb	14	15	16	17	18	19	20	21	22	23	24	25
0.18	7.3	6.9	6.5	6.1	5.8	5.6	5.3	5.1	4.9	4.7	4.5	4.3
0.19	7.0	6.5	6.2	5.9	5.6	5.3	5.1	4.8	4.6	4.5	4.3	4.1
0.20	6.6	6.3	5.9	5.6	5.3	5.1	4.8	4.6	4.4	4.2	4.1	3.9
0.21	6.4	6.0	5.7	5.4	5.1	4.8	4.6	4.4	4.2	4.1	3.9	3.8
0.22	6.1	5.7	5.4	5.1	4.9	4.6	4.4	4.2	4.0	3.9	3.7	3.6
0.23	5.9	5.5	5.2	4.9	4.7	4.5	4.2	4.1	3.9	3.7	3.6	3.4
0.24	5.7	5.3	5.0	4.7	4.5	4.3	4.1	3.9	3.7	3.6	3.4	3.3
0.25	5.4	5.1	4.8	4.6	4.3	4.1	3.9	3.8	3.6	3.4	3.3	3.2
0.26	5.3	4.9	4.7	4.4	4.2	4.0	3.8	3.6	3.5	3.3	3.2	3.1
0.27	5.1	4.8	4.5	4.3	4.0	3.8	3.7	3.5	3.3	3.2	3.1	3.0
0.28	4.9	4.6	4.3	4.1	3.9	3.7	3.5	3.4	3.2	3.1	3.0	2.9
0.29	4.8	4.5	4.2	4.0	3.8	3.6	3.4	3.3	3.1	3.0	2.9	2.8

The threshold for RSSW in oilseed sunflower can be calculated using the following formula:

$$\text{Threshold (weevils per head)} = \frac{\text{Cost of Insecticide Treatment}}{(\text{Market Price} \times 21.5) \times (0.000022 \times \text{Plant Population} + 0.18)}$$

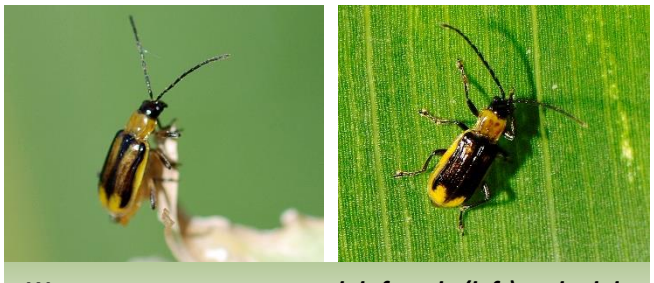
The ideal plant stage for treatment is when most individual plants are at 40% pollen shed. However, we recommend that treatment be considered when three out of 10 plants are just beginning to shed pollen.

ADULT CORN ROOTWORMS EMERGING

The first emergence of adult northern corn rootworm (NCR) was observed last week in corn fields near Casselton, Cass County, and Shenford, Ransom County. The first emergence of western corn rootworm (WCR) was observed near Colfax, Richland County. Other counties scouted last week that had no corn rootworms were Barnes, Griggs, Steele, Trail, and Grand Forks. All monitored fields were below the economic threshold (E.T.). From total counts, 83% of rootworms observed were NCR adults and 17% were WCR adults.

Northern corn rootworm adult (V. Calles-Torrez)

Adult corn rootworm beetles can easily be identified in the field. Northern corn rootworm adults are tan to pale green, ¼ inch long beetles. Western corn rootworm adults are from 3/16 to 5/16 inch long and yellowish-green with three black longitudinal stripes usually on the female's forewings and nearly solid black marking, usually on the male's forewings (see pictures).



Western corn rootworm – adult female (left) and adult male (right) [J. Knodel (left) and P. Beauzay (right)]

Table 1. Adult corn rootworms (northern and western corn rootworms) per 4 traps per week in ND field corn, 2021.

Area	County	Nearest town	July 16-22
EC	Barnes	Cuba	0
EC	Cass	Casselton	4
EC	Cass	Kindred	0
EC	Griggs	Cooperstown	0
EC	Steele	Finley	0
EC	Traill	Alton	0
NE	Grand Forks	Gilby/Mcanna	0
NE	Nelson	Lakota	0
SE	Ransom	Shenford	1
SE	Ransom	Sheldon	0
SE	Richland	Colfax	1
SE	Richland	Antelope	0
		Total corn rootwromm =	**6**
		Percentage of NCR =	**83%**
		Percentage of WCR =	**17%**

For monitoring corn rootworm adults, position four unbaited Pherocon AM® yellow sticky traps into a linear transect at each field. Traps should be set at least 100 feet from field edges and/or waterways. The distance between sticky traps should be at least 165 feet. Attach the sticky trap on the corn stalk at ear height. Replace traps once per week for four to six weeks, or until the threshold is reached. Count and record the number of beetles caught on each trap. Lastly, calculate the average number of beetles per trap per day (add total number of beetles captured from all traps and divide by total number of sticky traps, then divide this result by the total number of days that traps were deployed in the field).

Adult Corn Rootworm Trap Threshold
2 or more beetles per trap per day
This threshold indicates that a high corn rootworm population is expected the following year. As such, a corn rootworm management tool will likely be necessary to protect the following year's corn crop.

Sticky trap for monitoring adult corn rootworm on the corn stalks at ear height (V. Calles-Torrez)

Scouting maps are posted weekly on the NDSU Extension IPM website. For more information on corn rootworms, please see the NDSU Extension publication *Integrated Pest Management of Corn Rootworms in North Dakota* E1852.

Veronica Calles-Torrez
Post-doctoral Scientist

Janet J. Knodel
Extension Entomologist

EUROPEAN CORN BORER CONTINUES TO DECLINE

European corn borer (ECB) moths continue to decline. ECB Z-race moths (univoltine) were detected at 9 of the 13 of trap sites and ECB E-race (bivoltine) at 3 of the 13 trap sites last week (Table 1). The ECB-Z and ECB-E-race moths peaked the week of July 2-8. The ECB-Z moths were 97% of the total trap catch last week, while ECB-E moths were only 3%. Corn crop stages were VT to R1.

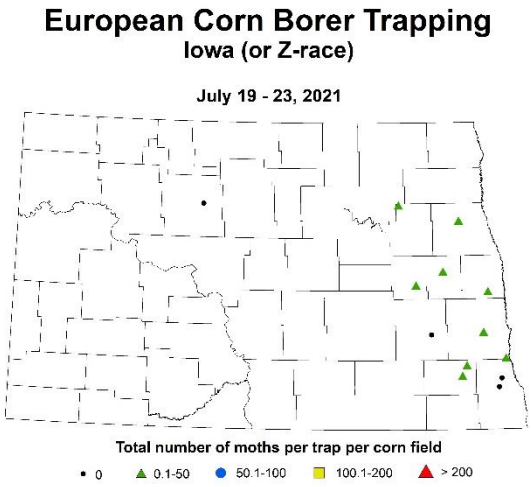


Table 1. Summary of pheromone trap catches for European corn borer in ND field corn, 2021.

Area	County	Nearest town	Race	June 18-24	June 25-July 1	July 2-8	July 9-15	July 16-22
EC	Barnes	Cuba	Z	0	0	0	0	0
EC	Barnes	Cuba	E	0	0	0	0	0
EC	Cass	Casselton	Z	0	0	0	0	4
EC	Cass	Casselton	E	0	0	1	0	0
EC	Cass	Kindred	Z	0	0	6	5	4
EC	Cass	Kindred	E	0	0	0	1	0
EC	Griggs	Cooperstown	Z	0	1	1	0	1
EC	Griggs	Cooperstown	E	0	0	0	0	0
EC	Steele	Finley	Z	0	0	25	8	3
EC	Steele	Finley	E	0	0	0	0	1
EC	Traill	Alton	Z	0	0	49	1	14
EC	Traill	Alton	E	0	0	1	0	1
NC	Ward	Minot	Z	1	1	0	1	0
NC	Ward	Minot	E	0	1	1	1	1
NE	Grand Forks	Gilby/Mcanna	Z	0	1	9	0	2
NE	Grand Forks	Gilby/Mcanna	E	0	0	0	0	0
NE	Nelson	Lakota	Z	0	8	31	22	38
NE	Nelson	Lakota	E	0	0	0	0	0
SE	Ransom	Shenford	Z	28	106	121	65	9
SE	Ransom	Shenford	E	0	0	8	1	0
SE	Ransom	Sheldon	Z	3	30	10	25	17
SE	Ransom	Sheldon	E	0	0	1	0	0
SE	Richland	Colfax	Z	0	1	5	8	0
SE	Richland	Colfax	E	0	0	0	0	0
SE	Richland	Antelope	Z	0	0	2	2	0
SE	Richland	Antelope	E	0	0	0	0	0
			Total # of Z =	**32**	**148**	**259**	**137**	**92**
			Total # of E =	**0**	**1**	**12**	**3**	**3**

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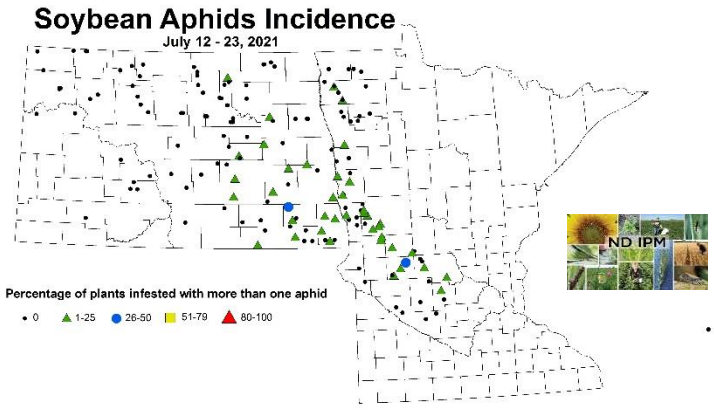
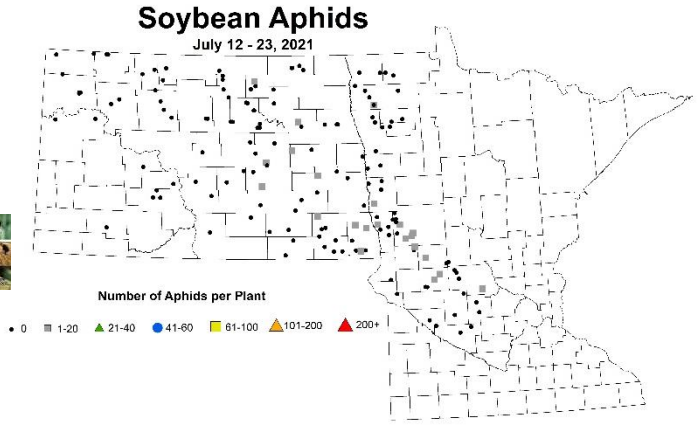
IPM CROP SURVEY - INSECT UPDATE

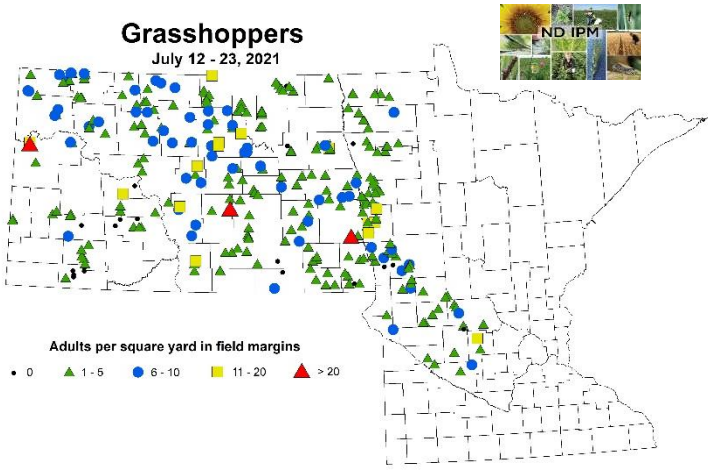
Soybean aphid infestation numbers continue to be low with aphids observed in about 22% of the soybean fields scouted last week, mainly in the eastern half of ND and central to northwestern MN. The percent of plants infested ranged from 3-29% with only an average of 1-5 aphids per plant among the positive observations. The good news is that parasitized aphid mummies were observed in about 10% of fields surveyed and ranged from 36-58% parasitism. Growth stages of soybeans ranged from R2 (full bloom) to R4 (full pod).

Spider mites are still hard to find and only present on field edges in about 3% of soybean fields surveyed last week. Continue to scout soybean fields at least weekly for soybean aphids and spider mites through R6 (full seed).





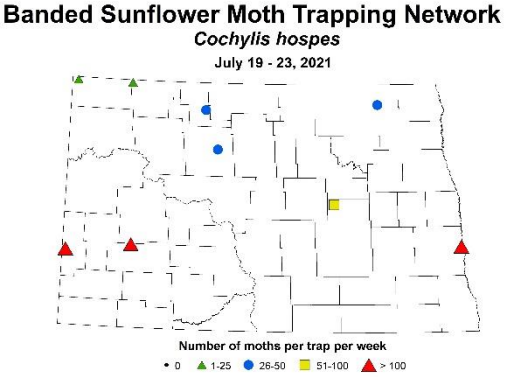
Adult grasshoppers are increasing! Harvesting of wheat and barley is getting started in ND. Be vigilant on scouting for grasshoppers moving into row crops (soybeans, dry beans, sunflower, flax) as cereal grains are harvested.

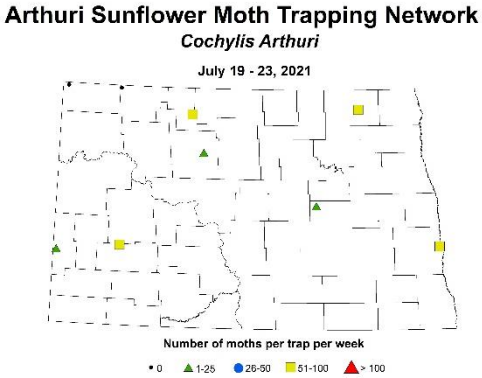


Sunflower insect trap update

Trap captures for banded sunflower moth and Arthuri sunflower moth continued to increase for the second week in a row. The highest trap numbers, >100 moths per trap per week, for banded sunflower moth were located at Cass, Golden Valley and Stark counties. Two sunflower moths were captured at Ward and Renville counties trap sites in north central ND.

Sunflower crop stages were in the R1 (terminal bud) to R4 (inflorescence opening, yellow ray petals visible) stages.





ARMYWORM AND BLACK CUTWORM TRAPPING NETWORK

Trap catches for true armyworm were detected at 30% of the trap sites and numbers increased slightly, mainly due to higher trap catches at Cavalier County. Black cutworms were detected at 30% of the trap sites with low numbers of moths captured.

Table 1. Summary of pheromone trap catches for true armyworm and black cutworm in ND wheat, 2021.

Area	County	Insect Pest	June 7-18	June 21-25	June 28-July 2	July 5-9	July 12-16	July 19-23
Central	Foster	Armyworm	-	0	0	1	0	0
Central	Wells	Armyworm	-	0	0	2	0	0
EC	Cass	Armyworm	4	17	13	7	1	0
EC	Traill	Armyworm	-	11	18	24	15	1
NC	Renville	Armyworm				0	0	1
NC	Pierce	Armyworm	-	0	0	0	0	0
NE	Cavalier	Armyworm	0	0	1	3	0	20
NE	Ramsey	Armyworm	-	0	0	5	0	0
NE	Towner	Armyworm	-	1	18	4	0	1
NE	Walsh	Armyworm	-	0	0	1	0	6
NW	Mountrail	Armyworm	-	1	0	0	0	0
NW	Renville	Armyworm	-	0	1	0	0	0
NW	Ward	Armyworm	-	0	0	0	0	0
NW	Williams	Armyworm	-	1	1	0	0	0
SE	McIntosh	Armyworm	-	-	0	0	0	0
SE	Ransom	Armyworm	-	3	14	15	7	2
SW	Golden Valley	Armyworm	0	0	1	0	0	0
SW	Hettinger	Armyworm	0	2	0	0	0	0
WC	Dunn	Armyworm	0	0	0	0	0	0
WC	McKenzie	Armyworm	-	0	0	0	0	0
		TOTAL #	**4**	**36**	**67**	**62**	**23**	**31**
Area	**County**	**Insect Pest**	**June 7-18**	**June 21-25**	**June 28-July 2**	**July 5-9**	**July 12-16**	**July 19-23**
Central	Foster	Black cutworm	-	0	2	1	0	1
Central	Wells	Black cutworm	-	0	0	0	0	0
EC	Cass	Black cutworm	0	1	1	0	1	0
EC	Traill	Black cutworm	-	0	1	0	0	0
NC	Pierce	Black cutworm	-	1	0	0	0	0
NE	Cavalier	Black cutworm	0	0	0	2	0	1
NE	Ramsey	Black cutworm	-	0	0	0	0	1
NE	Towner	Black cutworm	-	0	0	0	0	0
NE	Walsh	Black cutworm	-	0	0	0	0	1
NW	Mountrail	Black cutworm	-	0	0	1	0	0
NW	Renville	Black cutworm	-	0	1	0	0	0
NW	Ward	Black cutworm	-	0	0	0	0	2
NW	Williams	Black cutworm	-	0	1	0	0	0
SE	McIntosh	Black cutworm	-	-	0	1	0	1
SE	Ransom	Black cutworm	-	0	1	0	0	0
SW	Golden Valley	Black cutworm	2	0	0	0	0	0
SW	Hettinger	Black cutworm	1	0	0	0	0	0
WC	Dunn	Black cutworm	0	0	0	0	2	0
WC	McKenzie	Black cutworm	-	1	0	0	0	0
		TOTAL #	**3**	**3**	**7**	**5**	**3**	**7**

SCOUT FOR LYGUS BUG

Hot dry weather favors the buildup of Lygus populations and increases the risk of damage to field crops like confection sunflowers and canola. Adults are small, cryptically colored insects with a distinctive yellow triangle or "V" on the wings, and are about ¼ inch in length. They vary in color from pale green to dark brown. Lygus bug adults and nymphs insert their mouthparts into developing sunflower seeds or canola pods, and inject a toxic saliva. This causes a brown to black spot called "kernel brown spot" and foul taste in confection sunflowers. In canola, Lygus bug feeding injury causes blasting of flowers or buds and shriveled seeds. Blasted flowers turn white within 24 hours and quickly fall to the ground. The small damaged seeds are lost during harvest.

Adult Lygus bug with nymph in background (Whitney Cranshaw, Colorado State University, Bugwood.org)

Confection Sunflower scouting: Count the number of Lygus bug adults on 5 plants at 5 sites for a total of 25 plants. Scout for Lygus bugs during flowering. Sunflowers are susceptible from feeding injury during flowering through seed hardening.

Lygus Bug Thresholds

Confection sunflower:
1 adult per 9 heads

Oilseed sunflower:
Not a pest problem

Canola:
15 Lygus bugs per 10 sweeps from bud stage through petal drop
20 Lygus bugs per 10 sweeps after petal drop

Canola scouting: Scout for Lygus bugs from just prior to bud formation until seeds within the pod have become firm. Lygus populations can increase suddenly. For example, when an alfalfa (preferred host) is cut, Lygus will migrate quickly into nearby canola fields and often in high numbers. Use a 15-inch sweep net and make 10 180-degree sweeps at several sampling sites. If populations are high, control during the early pod ripening stage is usually the most economical.

Patrick Beauzay
Research Specialist, Extension Entomology

Janet J. Knodel
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plant science

DROUGHT STRESS IN SOYBEAN

Due to the long stretch of dry conditions, many of the soybean fields are showing drought stress in the area. There also has been a long period of high temperatures along with the water stress. With temperatures in the high 80s and 90s, and with low relative humidity, the plant cannot extract water from the soil quick enough during the day, to keep up with transpiration and evaporation. As a result, the leaf stomata close preserving water and the underside of the leaf is turned up (Photo 1). The closed stomata stop gas exchange and no carbon dioxide can enter the leaves therefore reducing photosynthesis.

Drought stressed soybean plants are often short. Drought stress can also reduce or stop biological nitrogen fixation. Stress during the reproductive phase will result in low yield potential. Reduced availability of water in drought conditions may lead to the shedding of flowers and small pods. This plant stress often results in lower pod numbers per plant, fewer seeds per pod, and lighter seeds. If precipitation occurs after the R5 soybean (beginning of seed formation) growth stage, the plant may still be able to increase the seed size; however, there is a genetic limit on how large seeds

can get. Normally, as the plant reaches the R6 (full-size seed) growth stage, pods will not be shed but the plant will preferentially fill the most mature pods to create viable seeds for the species to survive to the next generation. The grain filling period is reduced under prolonged drought stress, and the crop matures earlier than it normally would. For a detailed description of soybean growth stages, see extension publication A1174 Soybean growth and management.

Photo 1. Soybean field showing turned over leaves because of drought stress.

Hans Kandel
Extension Agronomist Broadleaf Crops

plant pathology

REVIEW OF SUNFLOWER RUST

We have been getting reports of sunflower rust, and suggest that growers scout for the disease. Sunflower rust is favored by moderate to warm temperatures, which we have had all summer. Importantly, rust does not need rain to infect, only periods of leaf wetness, such as dew. The disease can cause yield loss, but can be managed with a fungicide application. Confection-type sunflowers are particularly sensitive to rust, but oilseeds can be susceptible to the disease, as well. Yield and quality losses can be very high if an epidemic develops early in the season. Not all fields will have rust; prevalence can be impacted by weather, genetic resistance and pathogen races in the region. So, scouting is important.

Signs and Symptoms.

Sunflower rust is specific to sunflower. Unlike the rusts on some crops (wheat, corn, etc.) the pathogen overwinters in North Dakota and does not need to blow up from the southern states. This makes it appearance a little less predictable, and heavily dependent on weather and microclimates in the sunflower fields. The disease is often observed first near shelter belts (where the plants have longer dew periods), near last year's sunflower residue (where

rust may overwinter) or near wild/volunteer sunflowers (also overwintering hosts). The first signs of rust (which are not always observed) are the small orange aecia cups discussed last week.

Spores from the aecia will eventually lead to formation of the characteristic cinnamon-brown and dusty pustules, often first found on the leaves in the lower canopy (Figure 1). If rust is found in the lower canopy, it often will appear on the upper canopy later in the season. If an epidemic occurs, pustules may be found on stems, petioles and leaves.

Figure 1. Dusty cinnamon-brown rust pustules on a sunflower leaf

Management.

Timing. If rust reaches approximately *1% severity on the upper four fully expanded leaves at or before bloom (R5)* a fungicide should be considered (Figure 2-3). At R6 or later (after bloom) fungicide applications do not commonly impact the yield in our trials.

Efficacy. The National Sunflower Association keeps a robust and searchable database of research reports https://sunflowernsa.com/Research/searchable-database-of-forum-papers/ and presentations https://sunflowernsa.com/Research/Research-Forum-PowerPoint-Presentations-Since-2008/ on their website: https://www.sunflowernsa.com. NDSU Ph.D. student Brandt Berghuis presented a three year summary of sunflower rust trial work a couple years ago, and the summary is available with graphics [https://sunflowernsa.com/uploads/81/1.Berghuis_etal_3yr.summary_2019.pdf] and as a printed report [https://sunflowernsa.com/uploads/research/1343/Berghuis.etal_3yr.summary.fungicide.trials.rust_2019v5.pdf]. In short, he found that DMI fungicides [FRAC 3: Triazole] and QoI fungicides [Strobilurin: FRAC 11] and pre-mixes containing those modes of action tended to be the most effective in our trails; not all available products were tested. I encourage growers to use the NSA website when searching for data on numerous topics, and hope that is helpful if you manage rust.

(*See figures 2 and 3 on the next page*)

Figure 2. Approximately 1% rust severity on a fully-expanded sunflower leaf

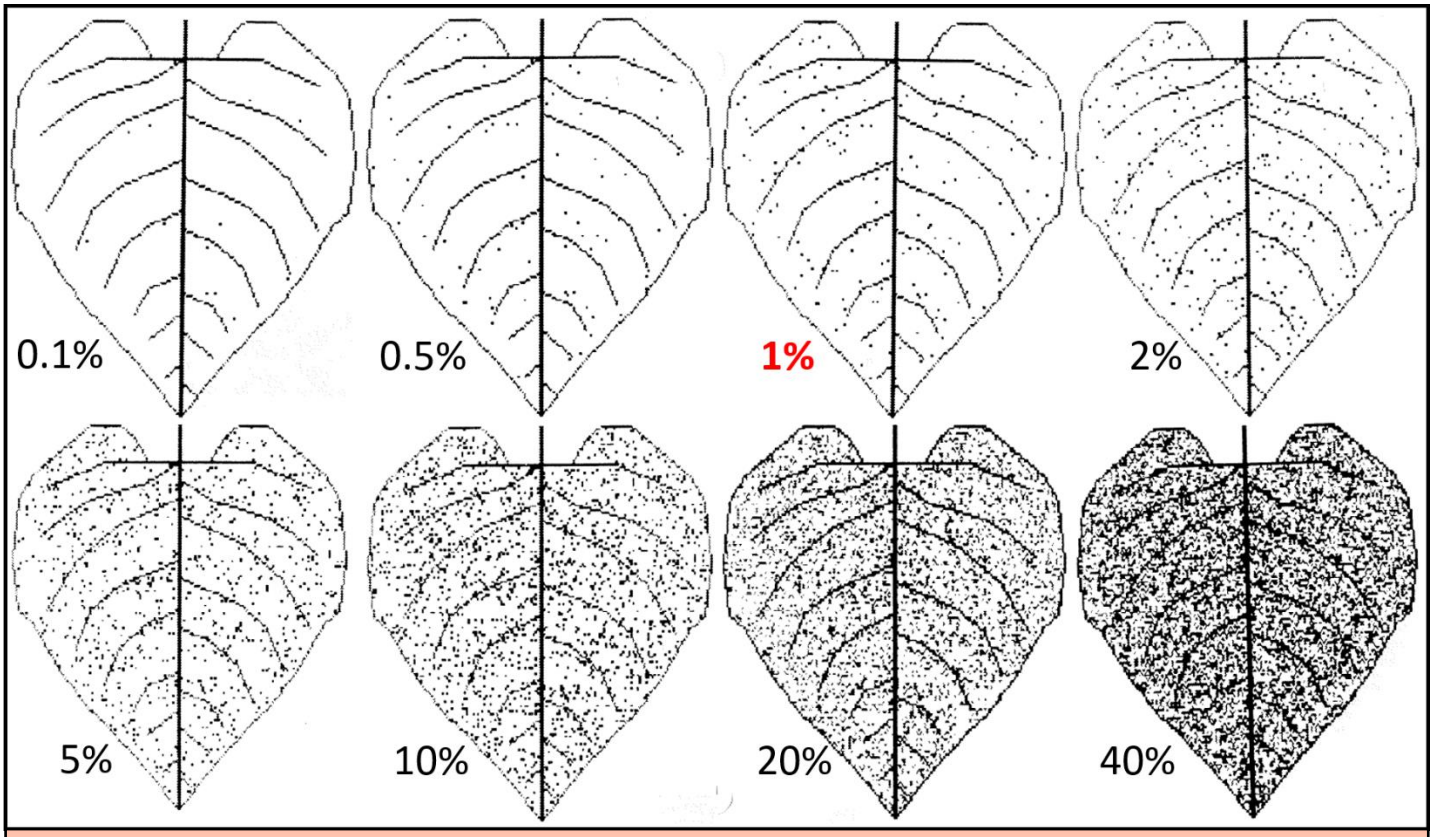

Figure 3. Sunflower rust severity assessment diagram; 1% severity in red

Sam Markell
Extension Plant Pathologist, Broad-leaf Crops

Brandt Berghuis
Post-Doctoral Researcher
NDSU Plant Pathology

DRY EDIBLE BEAN RUST

Currently, I am not getting calls about dry bean rust, but anticipate that it may appear soon. Scouting for dry bean rust is important even in a dry year. The disease definitely won't occur everywhere, but if it is identified it can be managed with fungicides. Dry edible bean rust can occur in dry years and is favored by moderate to warm temperatures. Like other rusts, the pathogen needs free moisture (leaf wetness, dew, fog, etc.) to infect; not necessarily rain. Dry bean rust infection is also influenced by microclimates. Open and/or thin canopies make the microclimate less favorable for dew and less favorable for rust, while a lush dense canopy makes heavy dew and rust infection more likely.

Signs and Symptoms. Dry bean rust is usually first found on the lower leaves of bean plants in 'hot spots', which are clusters of plants with relatively severe damage (Figure 1). Hot spots are often small (a few feet to several yards in diameter) and can occur anywhere in a field, but are more common near shelter belts or last year's crop residue. Rust is usually first observed on the upper sides of the leaves and appear as dusty cinnamon-brown pustules that may be surrounded by a small yellow halo (Figure 2). Pustules on the undersides of the leaves may appear more robust and lack the yellow halo (Figure 3).

Figure 1. Rust hot spot in dry edible beans

Figure 2. Dusty cinnamon-brown rust pustules the upper side of a dry edible bean leaf

Figure 3. Pustules on underside of dry edible bean leaf

Scouting. While rust can occur anywhere, I tend to look for the disease first near shelterbelts or where fields are close to the previous year's crop. Shelterbelts create a microclimate very favorable for dew formation (less wind, greater shade, etc.), which is optimal for rust infection. Dry bean rust can survive the winter in North Dakota, so often we see it show up first where a field is close to previously infected residue. Other areas in a field you might scout first include anywhere more prone to free moisture (foggy areas or areas with particularly dense canopies). Remember to focus on the low to mid canopy, where the microclimate is most favorable. Its relatively rare to see rust on the upper leaves until later in the season.

Management. Dry edible bean rust can cause significant yield loss when the disease occurs early in the growing season, and conditions remain conducive for infection and spread. A hot-spot can turn into a full blown epidemic in just a few weeks. The best timing for a fungicide application to manage rust is shortly after it is first found. However, fungicides are not needed (or impactful) if rust is found in later growth stages (for example,

once pinto's begin to stripe, fungicides are no longer economic). QoI fungicides [strobilurins: FRAC 11] (Headline, Quadris, Aproach, etc.), DMI fungicides [Triazole: FRAC 3] (Proline, Quash, tebuconazole generics, etc.) and mixtures containing these products (Priaxor, Propulse, etc.) have been the most efficacious in our trials. Fungicides with other modes of action, some of which are more commonly applied for white mold (Endura, T-methyl, etc..), can still reduce disease onset, but are less effective once rust is occurring. As always, exceptions to the general rules have occurred.

Sam Markell
Extension Plant Pathologist, Broad-leaf Crops

DURUM SYMPTOMS IN WESTERN ND

Growers and agronomists have reported discolored awns and glumes of durum heads in several fields in western ND. The symptoms resemble those of Stagonospora glume blotch (fungal disease) and black chaff (bacterial disease). However, we believe that these symptoms may be caused by an abiotic (non-living) disorder. This article will review some of the key characteristics and observations from these samples.

Figure 1. Bleaching on the upper portion of durum awns.

Bleached Awns

Some of the samples have bleaching occurring on the upper half of the awns (Figure 1). This can be a common symptom when hot weather occurs at the start of heading. The damage caused by the heat is often localized on the upper portion of the awns and does not spread down to the glumes. We have also observed this symptom in hard red spring wheat this year.

Black Awns and Blotches on Head

The most puzzling symptoms have been blackening of awns and glumes that resemble a disease. The discolorations have been reported to occur across an entire dryland field and appear to be more spotty in occurrence in irrigated fields. The discolorations have also been found on more than one variety. When looking at these samples, there a few things that suggest an abiotic disorder is the cause:

1. First thing to consider is the weather. The hot and dry conditions throughout July have not been favorable for disease development and has stressed the durum crop. Warm and humid conditions are needed for Stagonospora glume blotch and black chaff to develop.
2. Leaf lesions. Check the flag leaves to determine if Stagonospora nodorum blotch or bacterial leaf streak are present. When durum or hard red spring wheat have Stagonospora glume blotch or black chaff, the pathogen will also be found on the leaves of the plant. In the submitted samples, the leaf lesions do not resemble Stagonospora nodorum blotch or bacterial leaf streak (Figure 2).

Figure 2. Leaf lesions are variable in shape (angular and oval) and in color (white, brown and black). These do not resemble lesions of Stagonospora nododrum blotch or bacterial leaf streak.

3. Symptom location. When looking through the samples, it appears the symptoms are found on the entire head or are restricted to only one side of the head (Figure 3). Given that most main stems have symptoms on the entire head and tiller heads only have partial symptom development, leads us to believe that the stressor occurred during the heading stages of durum development. One potential stressor could be hot temperatures causing a physiological response (ie: blackening of awns) on the durum.

4. Disease incidence in the state. Recent NDSU IPM survey efforts have found little to no disease present on wheat in the state. This includes the foliar diseases of Stagonospora/Septoria (referred to as SSC complex in the IPM survey) and bacterial leaf streak.

If you suspect disease or want lab confirmation that symptoms are abiotic in nature, submit samples to the NDSU Plant Diagnostic Lab for evaluation. Detailed submission instructions can be found at their website: NDSU Plant Diagnostic Lab.

Figure 3. Symptoms on the glumes vary ranging from an entire head to only one side of the head.

Audrey Kalil
Plant Pathologist

Andrew Friskop
Extension Plant Pathology, Cereal Crops

soils

THE FERTILIZER VALUE OF WHEAT AND BARLEY STRAW, 2021

Wheat straw contains some of all essential plant nutrients, but nitrogen (N), phosphorus (P) and potassium (K) are the only nutrients in sufficient amounts to be considered. Calcium and magnesium are also present in similar amounts, but all regularly cropped and productive soils in North Dakota have very large amounts of each of these, so they are not considered a value that needs to be considered in the fertilizer value of the wheat straw.
Generally, there are about 10 pounds N, 5 pounds P_2O_5 (phosphate fertilizer equivalent) and 24 pounds K_2O (potassium fertilizer equivalent) in a ton of wheat straw. At present day retail fertilizer estimates, the value of these is:

N at 40 cents per pound = $4/ton
P_2O_5 at 66 cents per pound = $3.30/ton
K_2O at 53 cents per pound = $12.72/ton
Total fertilizer value of wheat straw = $20.02/ton

For barley straw, there are about 15 pounds of N, 5 pounds of P_2O_5 and 30 pounds of K_2O per ton. The value of these nutrients is:

N at 40 cents per pound = $6/ton
P_2O_5 at 66 cents per pound = $3.30/ton
K_2O at 53 cents per pound = $15.90/ton
Total fertilizer value of barley straw = $25.20/ton

Eastern growers (Stutsman county and east) have generally grown soybeans and also corn for more than 20 years and have depleted their native potassium supply. The new corn potassium recommendations result in a higher soil test critical level (200 ppm instead of the old 150 ppm recommendation in highly smectitic clay soils) to sustain corn production in drier summers.

However, western growers have very high K tests as a rule. Many western fields have soil test K levels over 400 ppm, and these growers probably would not put a value on the K since they do not consider K in their fertilizer budget, except as a carrier for the nutrient chloride. Eastern growers have to consider the K value of the straw or experience decline of soil test K requiring fertilization. Failure to do so will result in yield losses in alfalfa, sugar beet and corn production, particularly.

For average values of nutrients contained in other straw/crop materials, the NDSU circular SF1978- 'Effectiveness of using low rates of plant nutrients' may serve as a helpful guide.
https://www.ag.ndsu.edu/publications/crops/effectiveness-of-using-low-rates-of-plant-nutrients

Also, since yield of grain and straw is reduced compared to most years, the amount of nutrients in the straw is likely greater than those indicated in the SF1978 tables. It is also important that if these straws/green chop are intended to be used for livestock feed, a nitrate test is performed to help the end-user know how to best mix the ration.

BORON/CALCIUM DEFICIENCY IN DROUGHT-STRESSED SUGAR BEETS

Boron and calcium are unique as plant nutrients, because their transport through the plant is nearly exclusively through the xylem flow. This is the flow of water through the plant from roots through leaves and out the stomates. Soils in North Dakota and the Valley-part of Minnesota have ample supplies of calcium (Ca) and boron (B) in their soils as a natural part of their organic matter and mineral base. However, when it is continuously humid/rainy in the growing season, or the crops are under severe drought, the movement of water through the xylem flow in crops stops. When this happens, a physiological deficiency of B and/or Ca may result. Below are images from a sugar beet field near Gary, MN.

The diagnostic symptom for B is a dead growing point (note the brown center of the single beet image). If the center is 'sticky' to touch, it may also be a Ca deficiency, since this deficiency interferes with cell membrane/wall development, resulting in cells that 'ooze' to some degree. Also note the drooped leaves in the beets. The leaves in this field droop early in the day when it is hot. Application of B or Ca fertilizers is not the answer for these beets. Rainfall will be important for the condition not to worsen and spread to other parts of the field.

Images of B-deficient sugar beets caused by excessive drought near Gary, MN.

Courtesy of Joe Hastings, Agronomist, American Crystal Sugar Company.

Dave Franzen
Extension Soil Specialist
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weeds

PREHARVEST WEED CONTROL OPTIONS IN WHEAT

The amount of kochia and other weeds poking their heads above our wheat canopies has triggered a lot of questions about options for preharvest weed control in wheat and other small grains. Some folks are asking about using paraquat or glufosinate in order to help quickly desiccate the weeds. These products are not labelled for use in preharvest situations in any small grain crop. For a list of all registered products (and the list is small) for preharvest weed control, please seed page 19 of the 2021 NDSU Weed Control Guide (https://www.ag.ndsu.edu/weeds/weed-control-guides/2021%20nd-weed-control-guide-1/2021-nd-weed-control-guide).

Joe Ikley
Extension Weed Specialist

around the state

AROUND THE STATE

NORTH CENTRAL ND

After some relief a week ago, the region returned to a dryer, warmer pattern in the north central region of the state. Brief hit and miss popcorn showers were observed across the region over the last seven days. The following are the latest precipitation reports as observed by area NDAWN stations over the last week (beginning July 19th): Minot: 0.07" (NCREC: 0.12"); Bottineau: 0.00"; Garrison: 0.94"; Karlsruhe: 0.22"; Mohall: 0.00"; Plaza: 0.14"; and Rugby: 0.00". Bare soil temperature at the NCREC is observed at 83 degrees F.

It has been amazing to see so many friendly faces over the last two weeks with all the REC and off station field days underway. They were a complete success – thanks to all who came out to participate in your local field tours. Phone calls have dropped off just a little bit into the NCREC Crop Protection Office. Grasshopper calls continue to be the leading concern with localized spots of higher grasshopper numbers. Please keep in mind the importance of scouting during this time and reflect on the two different possible thresholds for grasshoppers in adults – border threshold (21-40 per square yard) and an in-field threshold (8-14 per square yard). If thresholds are met, control may be required in some circumstances. Some grasshopper nymphs are still observed in the area. Aphids are still being found in area small grains, however, due to advancing staging of small grains, aphids are no longer leading to damage.

Figure 1. Corn showing drought stress in North Central region.

Crop harvest of small grains and pulses are slow in the region but expected to increase by the end of the week and into next week. As expected, the crop yield reported by producers is low due to drought conditions in the region. Corn fields are highly impacted by drought, with most fields found in the VT stage with some fields observed in the R1 stage (Figure 1). Last week the Balfour area was affected by hail causing severe damage in corn fields and small grains. Soybeans are observed in R2 stages and shows signs of drought stress. Flax is observed in stage 10 to 12, but there are farmers reporting that they will have to harvest flax later this week. Canola is observed in the 4.3 stages to 5.1. Sunflowers are found ranging from V12-R2 stages with a few fields under R3 and R4. Several producers in the region are seeking information regarding the management of saline soils and as expected, the drought conditions make the saline spots more visible and sometimes larger than what farmers were expecting.

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 are near ripening with uneven maturity in some fields. Early fields of wheat are getting harvested. In areas that did not receive rains in the past week, crops continue to decline and are collapsing in parts of fields. Corn is silking with very small ears. Early planted canola is mature and turning color. Late planted canola is flowering. Diamondback moth (DBM) adults were spotted in huge numbers in canola fields of Cavalier County. Late planted canola is susceptible to DBM larval damage. Soybeans are in early reproductive stages. Soybean aphids are being reported in several counties at below threshold numbers. However, the aphid populations can double in numbers when the conditions are right. Sunflowers are blooming. Field peas are mature and are turning color. Alfalfa is approaching the second cutting. Hay is short and producers are cutting whatever they can. Cattle are being sold on many ranches. Water quality continues to be an issue with livestock. Some high levels of sulfates and algal blooms have been reported.

Anitha Chirumamilla
Extension Agent Cavalier County

NORTHWEST ND

Temperatures were a little more moderate, though still hot, this past week in the Northwest. Highs for last week were in the upper 80s to low 90s. A little rain, less than 0.5" in most places, fell in the southern portion of the NW early last week, but otherwise, no rainfall was recorded at most NDAWN stations. Crops continue to dry down quickly in the heat. Peas, lentils, and early planted small grains are turning color ahead of normal. I've heard from farmers with early planted wheat fields that the crop is very uneven with soft to hard dough stages present in the same field as a result of the uneven emergence that happened in the dry conditions. Harvest is probably a week or two away for most farmers in NW ND, though a few have started on the MT side of the border. Just a reminder to be safe out in the field with the hot temperatures and low humidity. Carry plenty of water to drink and a fire extinguisher.

Clair Keene
Extension Cropping Systems Specialist
NDSU Williston Research Extension Center

SOUTHWEST ND

According to NDAWN, from July 1st to July 26th Dickinson received 1.22 inches of rain, Beach 1.39, Amidon 1.89, Bowman 1.41, Hettinger 1.02, Mott 1.51, Carson 0.79, Mandan 2.22, Hazen 1.78, and Dunn 1.31. Drought and heat stress have had a negative impact on crop conditions. Grasshoppers continue to be an issue. Sunflowers are beginning to flower in the region. Small grain and canola harvest will be in full swing within the next couple of weeks. There are pockets where crop condition looks relatively decent, but most are expecting heavily reduced yields.

Ryan Buetow
Extension Cropping Systems Specialist
NDSU Dickinson Research Extension Center

SOUTH-CENTRAL/SOUTHEAST ND

According to NDAWN, the region's April 1-July 26 rainfall total ranges from 3.3 inches (Dazey) to 10.6 inches (Jamestown), with the Carrington REC at 3.8 inches. Estimated corn water use on July 26 was about 0.3 inch for plants emerged May 20. This water use over 13 days would reach the current season's total rain for Carrington – no wonder leaves are rolling by mid mornings under the adverse weather and soil moisture conditions!

The region's small grain crop is generally mature, and harvest has commenced with winter cereals and early planted barley and spring wheat. The following are the most advanced crop growth stages observed at the CREC earlier this week: corn R1 (silking) but nearing R2 (blister), soybean R5 (seed development on pods within the upper four plant nodes) but primarily R3-4 (pod development), dry bean R6 (seed developed to at least 0.25 inch in length) and sunflower R5 (flowering) but nearing R6 (ray flowers drying). All are at critical growth stages that require minimal stress to maintain yield potential.

If grain corn has been 'zeroed-out' and will be soon harvested for livestock feed, note that foliage N levels peak near silking. Test the material for nitrates and feed accordingly.

An early alert: Corn nodal root and brace root development has been restricted with dry soil. Also, stalk integrity will be reduced as dry matter is translocated to the grain from all areas of the plant, including the stalks. Plus, weakened stalks may be more susceptible to disease. These factors add up to increased lodging potential as the plant nears physiological maturity. Monitor fields and prioritize accordingly as you plan field sequence for harvest.

Upcoming crop tours:

August 4 – Oakes Irrigation Research Site/Robert Titus Research Farm; 9 a.m.

August 12 – CREC Fingal area off-station corn and soybean research

August 25 – CREC Row Crop (corn, soybean and dry bean)

Afternoon shots of stressed pinto bean (note vertical leaves to reduce interception of sunlight [heat]) and sunflower (lack of stress symptoms).

Greg Endres
Extension Cropping Systems Specialist
NDSU Carrington Research Extension Center

weather

WEATHER FORECAST

The July 29 to August 4, 2021 Weather Summary and Outlook

This past week was another period with well above average temperatures (Figure 1). Most of the region recorded temperatures anywhere from 3° to 6° above average. There were pockets of even warmer temperatures in localized areas. These next 7 days look to be noticably cooler with some locations even recording a high in the 70s on a day or two. Overall, mainly low to mid 80s expected during this forecasting period. In other words, a period of near average temperatures, although, there are signs that well above average temperatures may return in the 6-10 day period just beyond this forecasting period. I have a feeling that there will be at least a couple of periods of thunderstorms in the next week, but odds favor more missing than hitting which will mean yet another week with many areas struggling with a lack of adequate moisture.

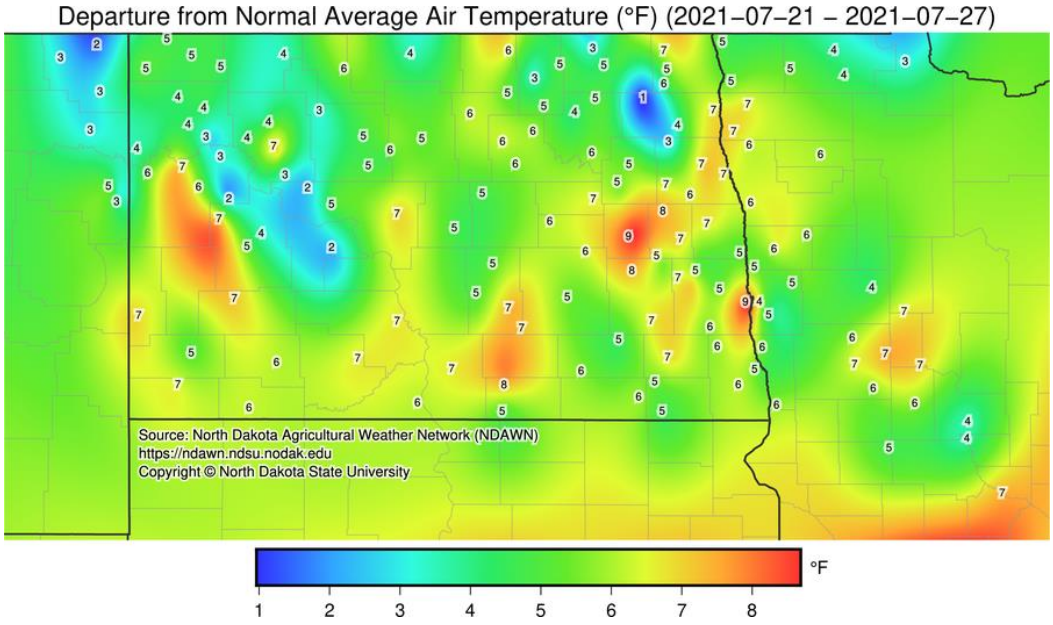

Figure 1. Temperature departures from average at selected NDAWN stations for the period of July 21 through July 27, 2021

This past week the main rains were across southern North Dakota into west central Minnesota. Most northern areas recorded little or no precipitation in the past week (Figure 2).

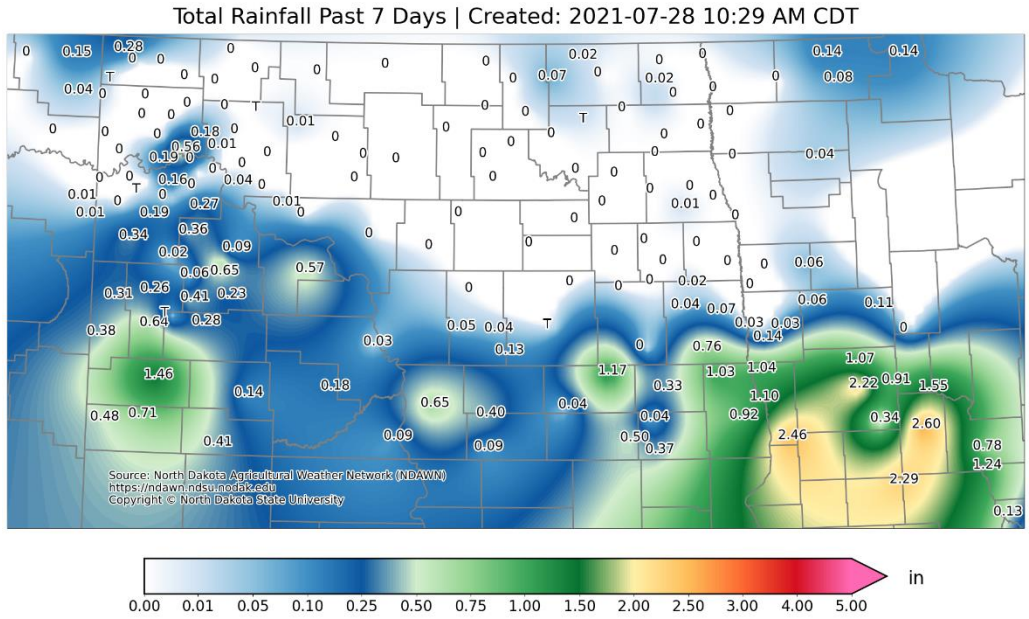

Figure 2. Total rainfall for the 168-hour period ending at 10:30 AM on July, 28, 2021 at NDAWN weather stations

Several of you requested that I post rainfall departures from average this growing season. Figure 3 has the departures from average rainfall from May 1 through July 27.

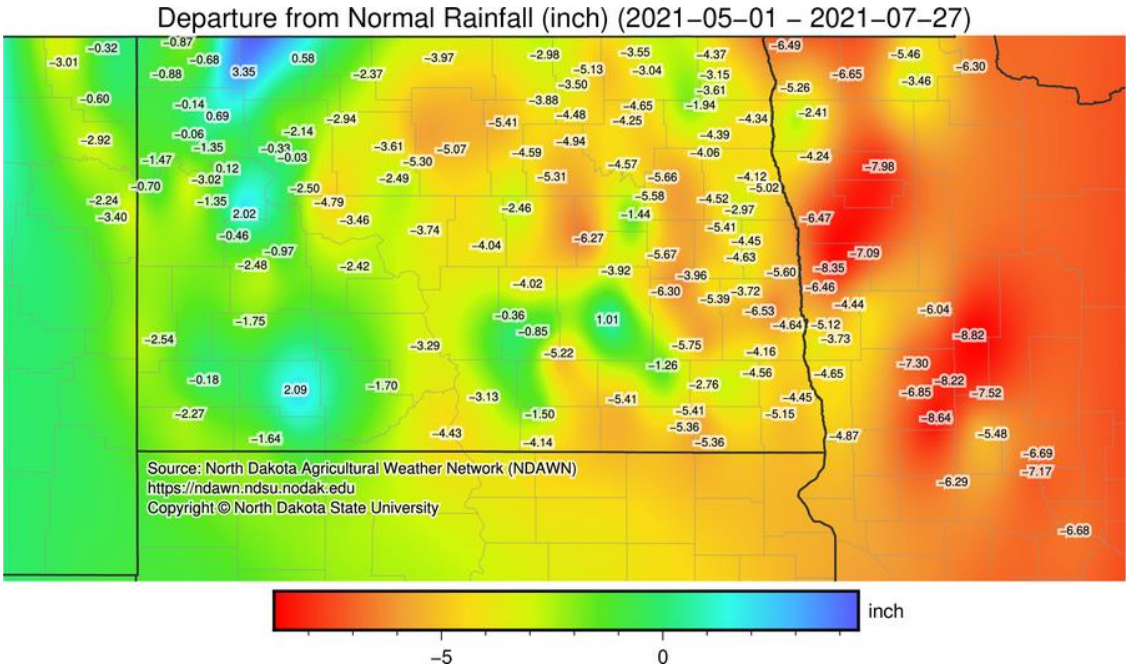

Figure 3. Departure from Normal Rainfall for selected NDAWN stations from May 1, 2021 through July 27, 2021.

The projected growing degree days (GDDs) base 50°, 44° and 32° for the period of July 29 through August 4, 2021 can be found in Figure 4. With temperatures near or slightly above average these next 7 days, GDDs will be lower than what was recorded in the past few weeks.

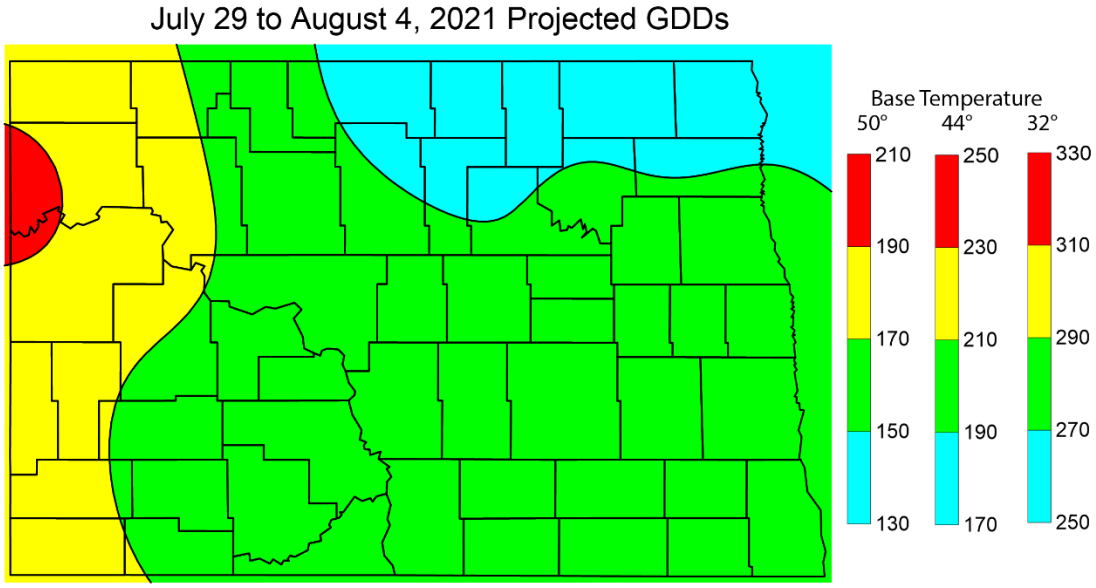

Figure 4. Projected Growing Degree Days, Base 50°, 44° and 32° for the period of July 29 to August 4, 2021

Using May 1 as a planting date, the accumulated growing degree days for wheat (base temperature 32°) is given in Figure 5. You can calculate wheat growing degree days based on your exact planting date(s) here: https://ndawn.ndsu.nodak.edu/wheat-growing-degree-days.html

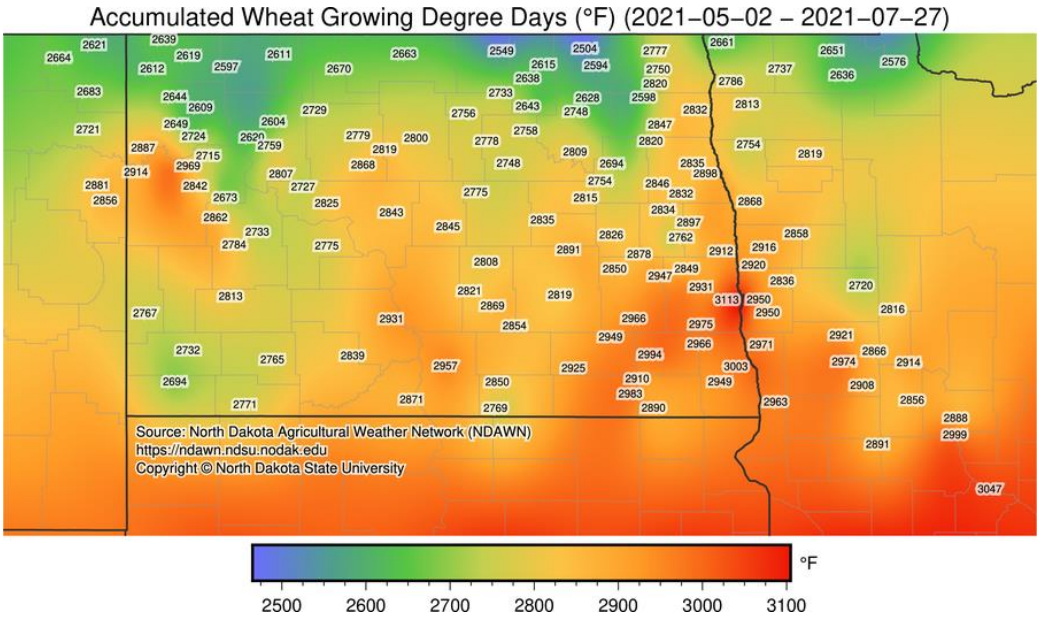

Figure 5. Accumulated Growing Degree Days for Wheat (Base 32°) since May 1, 2021

Using May 10 as a planting date, the accumulated growing degree days for corn (base temperature 50°) is given in Figure 6. You can calculate corn growing degree days based on your exact planting date(s) here: https://ndawn.ndsu.nodak.edu/corn-growing-degree-days.html.

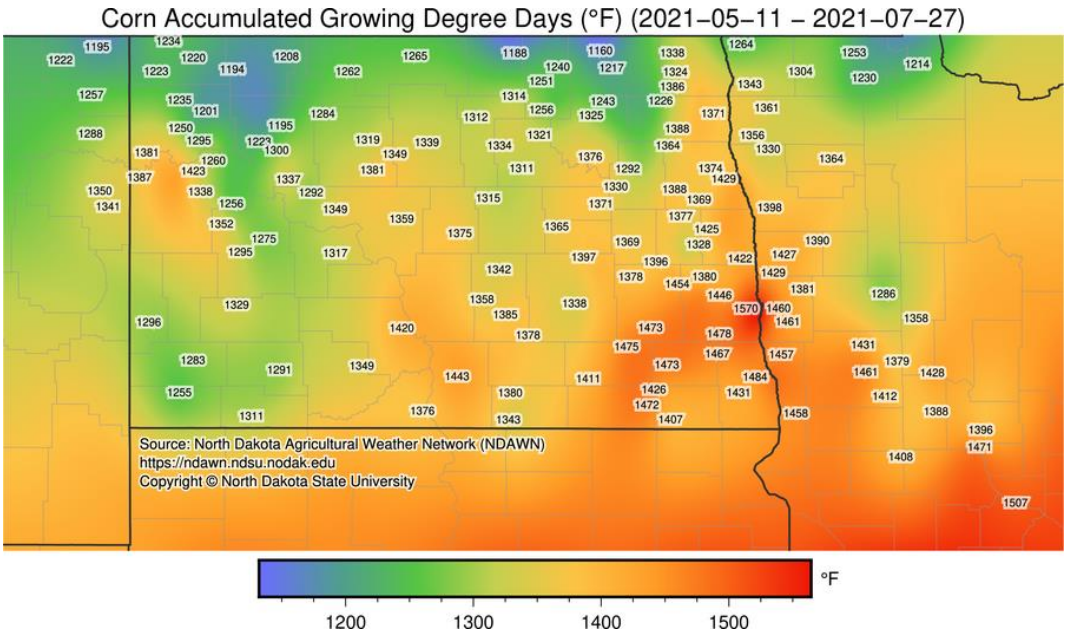

Figure 6. Accumulated Growing Degree Days for Corn (Base 50°) since May 10, 2021

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

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