North Dakota State University
CROP & PEST REPORT
NDSU EXTENSION

No. 13 July 22, 2021

Inside this Issue...

NDSU FIELD DAYS FOR 2021

Only a couple of annual Field Days events left this year. Please visit the Research Extension Center and Agronomy Seed Farm websites for more details. Hope to see you there!

July 22 - **Langdon Research Extension Center**

(8 a.m.-1 p.m.)

July 27 - **Central Grasslands Research Extension Center**

(10 a.m. - 3 p.m.)

Entomology

EUROPEAN CORN BORER DECREASING

European corn borer (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 (see Table 1 on next page). ECB-Z peaked last week and decreasing trap counts were observed this week (except for Sheldon in Ransom County and Colfax in Richland County). We also detected the first E-race ECB moth at one new trap site, Kindred, Cass county. Corn crop stages were V9 to VT.

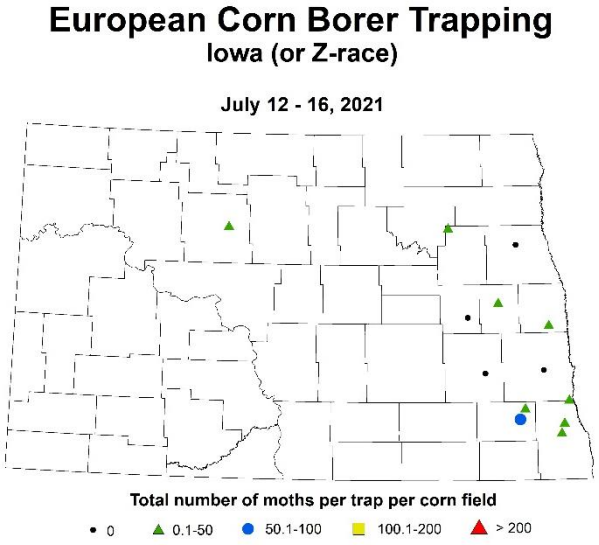
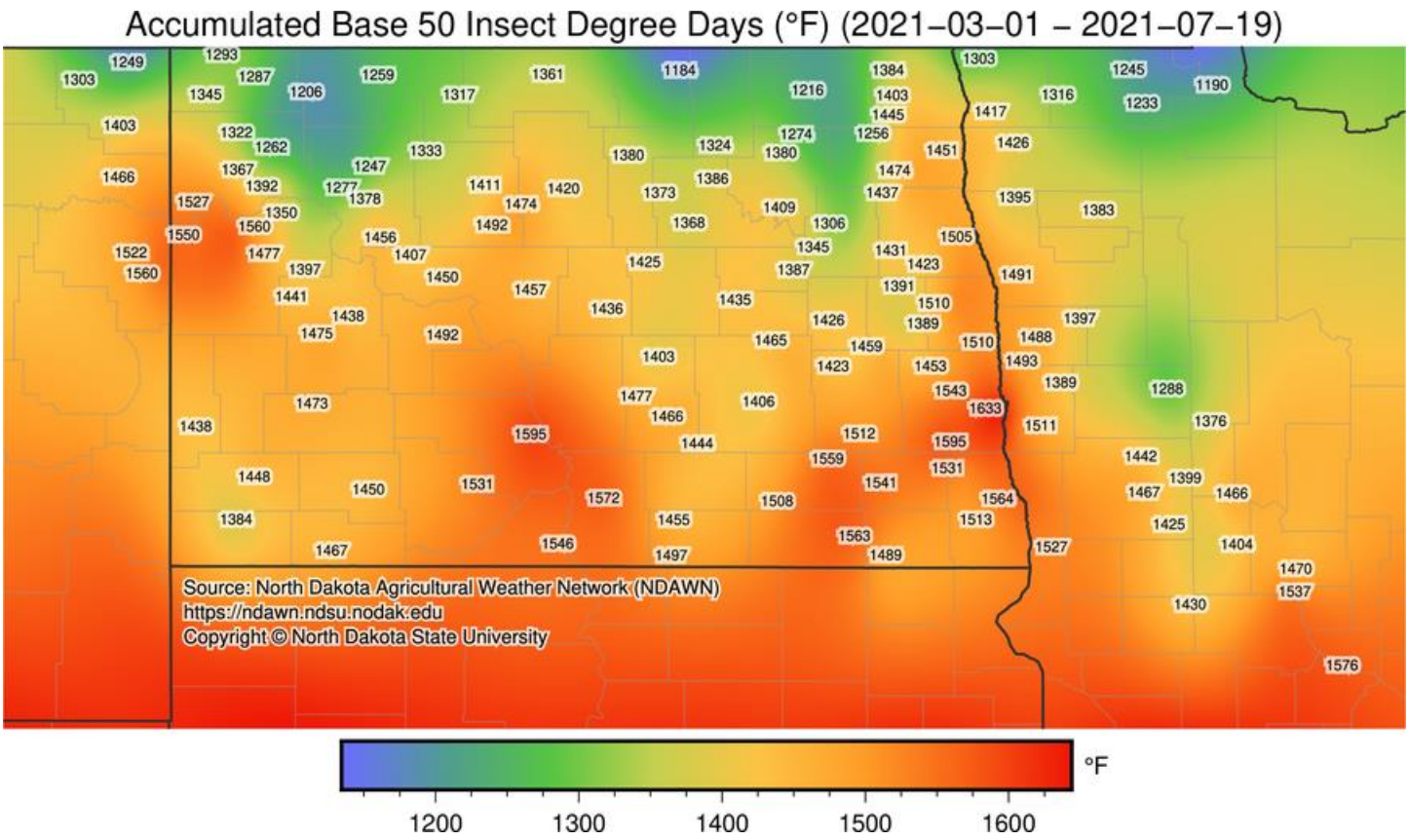


Table 1. Summary of pheromone trap catches for European corn borer in ND corn, 2021.							
Area	County	Nearest town	Race	June 18-24	June 25-July 1	July 2-8	July 9-15
EC	Barnes	Cuba	Z	0	0	0	0
EC	Barnes	Cuba	E	0	0	0	0
EC	Cass	Casselton	Z	0	0	0	0
EC	Cass	Casselton	E	0	0	1	0
EC	Cass	Kindred	Z	0	0	6	5
EC	Cass	Kindred	E	0	0	0	1
EC	Griggs	Cooperstown	Z	0	1	1	0
EC	Griggs	Cooperstown	E	0	0	0	0
EC	Steele	Finley	Z	0	0	25	8
EC	Steele	Finley	E	0	0	0	0
EC	Traill	Alton	Z	0	0	49	1
EC	Traill	Alton	E	0	0	1	0
NC	Ward	Minot	Z	1	1	0	1
NC	Ward	Minot	E	0	1	1	1
NE	Grand Forks	Gilby/Mcanna	Z	0	1	9	0
NE	Grand Forks	Gilby/Mcanna	E	0	0	0	0
NE	Nelson	Lakota	Z	0	8	31	22
NE	Nelson	Lakota	E	0	0	0	0
SE	Ransom	Shenford	Z	28	106	121	65
SE	Ransom	Shenford	E	0	0	8	1
SE	Ransom	Sheldon	Z	3	30	10	25
SE	Ransom	Sheldon	E	0	0	1	0
SE	Richland	Colfax	Z	0	1	5	8
SE	Richland	Colfax	E	0	0	0	0
SE	Richland	Antelope	Z	0	0	2	2
SE	Richland	Antelope	E	0	0	0	0
			Total # of Z =	**32**	**148**	**259**	**137**
			Total # of E =	**0**	**1**	**12**	**3**

Based on the accumulated degree days (ADD; base 50°F), the univoltine ECB-Z moths are 100% emerged in ND (see map next page). Most areas also have accumulated enough ADD for 3rd instar larvae to be tunneling into the corn stalk. After the larvae are inside stalks, foliar insecticides are no longer effective for control of ECB. See *Crop & Pest Report* #11, July 8th for E.T for ECB.

Univoltine ECB-Z Degree Day Model (Lower base – 50°F)	
Accumulated Degree Days	**ECB Life Stage**
911	10%of moths emerged
986	25% of moths emerged
1078	50% of moths emerged
1100	Egg hatch, begin scouting
1177	75% of moths emerged
1274	90% of moths emerged
1300	3rd instar larvae, make final treatment decision



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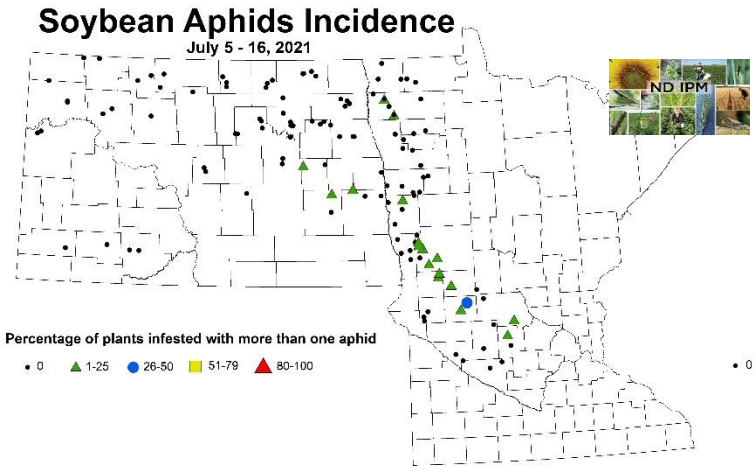
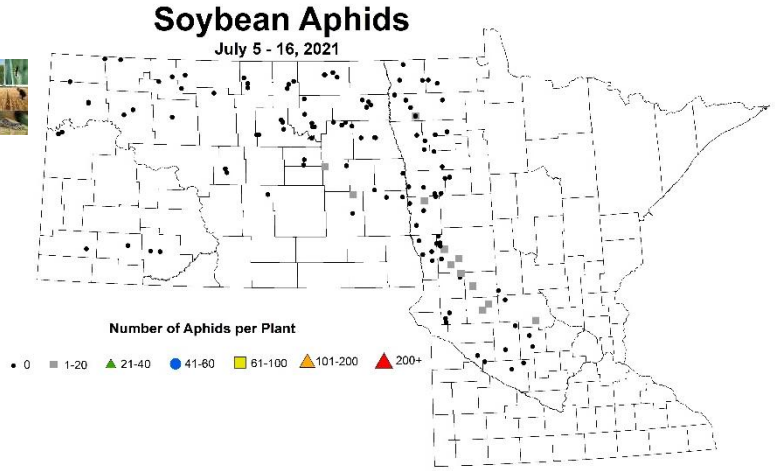
IPM CROP SURVEY - INSECT UPDATE

Soybean aphid numbers continue to be low and aphids were observed in only 22% of the soybean fields scouted last week, mainly in MN. The percent of plants infested ranged from 3-39% with an average of only 1-4 aphids per plant among the positive observations. Growth stages of soybeans ranged from late vegetative to R4 (full pod). Continue to scout soybean fields at least weekly for soybean aphids and spider mites through R6 (full seed).





Grasshoppers are increasing and in mixed nymph-adult stages. The hot and dry weather will quickly push insect development into mainly adult grasshoppers, as well as increase grasshopper movements into greener crops as cereal crops mature and are harvested.

Adult grasshoppers cause more crop damage because adults feed more, are more mobile (adults have wings) and attack many crops where they defoliate leaves and chew on seed / pods. Adult grasshopper feeding activity usually peaks in August.

One of the reasons that we are seeing high densities of grasshopper populations, besides the favorable weather conditions in 2021, is that densities have been slowly building over the past years. The percentage of fields infested with grasshoppers increased from 28% in 2017 to 57% in 2020 and 65% in 2021. The total number of grasshoppers collected with sweep nets also was higher the last two years, 2020 and 2021 (Table 1). [Source: NDSU Extension *IPM Crop Survey Program]*

Continue to scout all crops frequently.

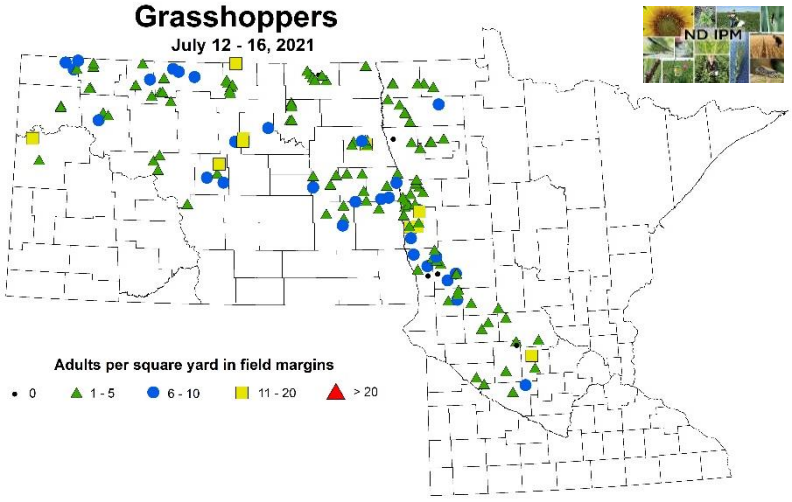


Table 1. Summary of Grasshopper Populations from June 1 - July 10 for 2017-2021

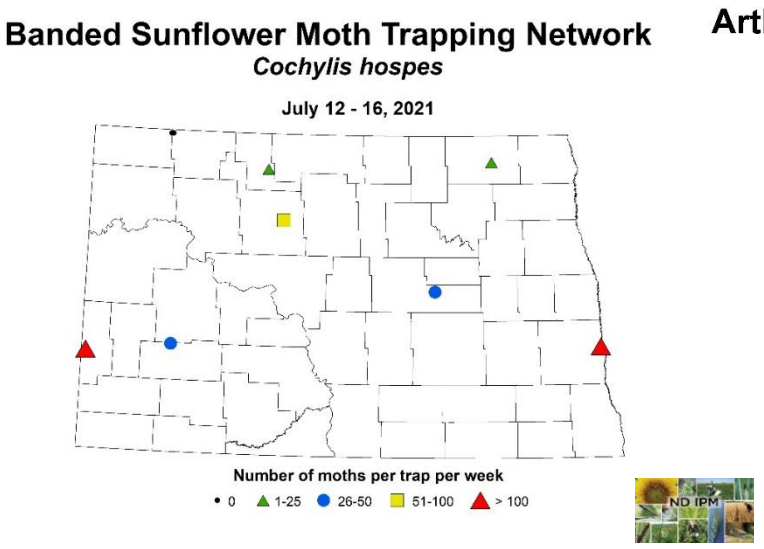
Year	Total # of fields surveyed	% Fields with Grasshoppers	Total number of grasshoppers collected
2017	1012	28	663
2018	1377	40	1377
2019	859	46	732
2020	899	57	1773
2021	817	65	1517

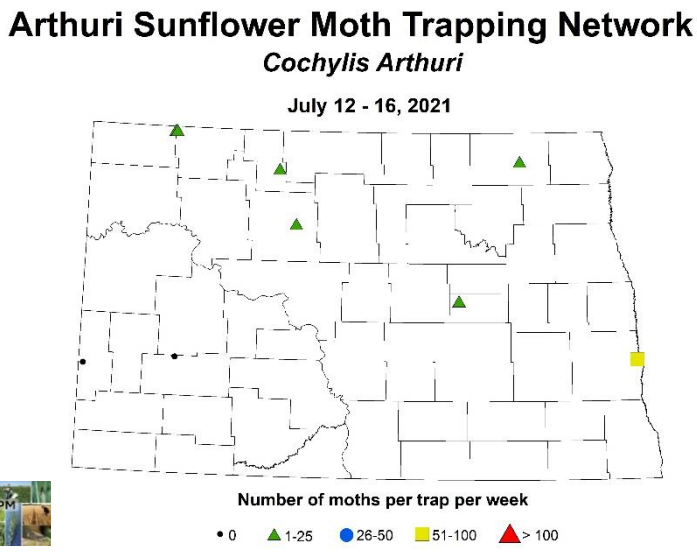
Banded sunflower moth trap update

Trap captures for banded sunflower moth and Arthuri sunflower moth increased this last week. The highest trap numbers for banded sunflower moth were in Cass and Golden Valley counties, both counties in the southern half of ND. Sunflower crop stages were in the late vegetative to R2 (bud <1 inch from leaf) stages.

See last week's article on scouting and thresholds for banded sunflower moth eggs in NDSU Extension Crop & Pest Report 12, July 15.

IPM maps of insect pests and diseases are posted on the IPM website: https://www.ag.ndsu.edu/ndipm





ARMYWORM AND BLACK CUTWORM TRAPPING NETWORK

Trap catches for true armyworm and black cutworm are low at all trap sites last week. Good news for a change!

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

POTATO LEAFHOPPERS IN DRY BEANS

Populations of potato leafhoppers are increasing in dry edible beans in eastern North Dakota and in north central Minnesota, near Park Rapids. Potato leafhopper is a migratory insect pest. Adults are quite mobile and move from field to field, and may migrate from freshly cut alfalfa fields. Other crops attacked include potato, dry bean and soybean. The small (⅛ inch), pale green, wedge-shaped adults move rapidly by jumping. Nymphs are paler green, lack wings and exhibit a characteristic sideways walk when disturbed. Nymphs can be found on the undersides of leaves.

Potato leafhopper adult (left) and nymph (right) (Adult by S. Brown, UGA, Bugwood.org and nymph by F. Peairs, CSU, Bugwood.org)

Damage by leafhoppers is referred to as hopper-burn. Foliage becomes dwarfed, crinkled and curled. Small triangular brown areas appear at the tips of leaves, gradually spreading around the entire leaf margin. Nymphs are generally more damaging than adults, since they feed for several weeks on the leaves where they hatched.

Sweep nets are useful for confirming potato leafhopper presence in a field. Fields need to be scouted to determine whether economic populations are present by sampling at least 5 sites while walking a W-pattern and inspecting about 10 plants per site. Avoid sampling the edges of field. Examine the underside of leaves for adult and nymph leafhoppers. Follow these economic thresholds to help make insecticide spray decisions for potato leafhoppers:

Dry bean = 1 leafhopper (either adult or nymph) per trifoliate leaf
Alfalfa = 1-2 leafhoppers per sweep (or 100-200 leafhoppers per 100 sweeps) when alfalfa is 8-14 inches high
Soybean = 5 leafhoppers per plant in vegetative stage and 9 leafhoppers per plant in early bloom
Potato = 10-20 adults per 20 sweeps, or 1 nymph per 10 leaves

FLEA BEETLES FEEDING ON CANOLA PODS

The summer population of flea beetles has emerged earlier due to warmer temperatures and are in large numbers. Flea beetles were reported feeding on pods in canola fields near Warren, Minnesota.

Research conducted at Agriculture and Agri-Food Canada in Saskatoon, Canada found that late summer feeding by flea beetles is rarely economically damaging (Soroka and Grenkow. Can. J. Plant Sci. 2012: 97- 107). “Flea beetle feeding that occurs when seeds in lower pods of canola are at the green stage or beyond is unlikely to affect seed yields regardless of the infestation rate of flea beetles. Even when seeds are translucent to green, numbers higher than 100 flea beetles per plant, and for some cultivars higher than 350 per plant, may be necessary to cause significant yield reductions.” (Source: J. Gavloski, Manitoba Crop Pest Update #13, August 14, 2019)

Flea beetles feeding on canola pods. (J. Knodel, NDSU)

Flea beetle feeding injury on pods is usually most significant on late-planted canola and on the upper pods. Fortunately, the lower pods of canola are the primary pods that provide most of the canola yield. However, flea beetle feeding injury on pods can result in poor seed fill, premature pod drying, or pod shattering. If the canola is mature, past the 5.2 growth stages (when seeds in lower pods have turned translucent to green), then yield will be less impacted by flea beetle feeding. In a flea beetle trapping study of freshly swathed canola, the number of flea beetles per trap decreased dramatically after 7-days of drying in swaths. Flea beetles are mobile insects and fly around to find ‘greener’ canola fields (late-planted) or other cruciferous host plants like backyard garden vegetables or flowers for summer feeding.

Insecticides registered for flea beetle control with a short, 7 day Pre-Harvest Interval (PHI) include: Delta Gold (deltamethrin), Declare (Gamma-cyhalothrin), Warrior II and generics (lambda-cyhalothrin), and Mustang Maxx (zeta-

cypermethrin). Insecticides that are labeled to control flea beetles on canola are listed in 2021 *North Dakota Field Crop Insect Management Guide E-1143*.

Janet J. Knodel
Extension Entomologist

SCOUT FOR SPIDER MITES IN SOYBEANS, DRY BEANS AND CORN

The first reports of spider mites being found on field edges of soybeans came in this week from West Fargo, ND and Crookston, MN. Spider mites are small ($^{1}/_{50}$ of an inch long) and magnification is usually required to see them. A 10x hand lens is helpful in seeing spider mites in the field.

Spider mites on corn leaf (P. Beauzay, NDSU)

Spider mite infestations typically are first noted near field edges, so start scouting at field edges to see if spider mites are present. A quick sampling procedure to determine whether mites are present is to hold a piece of white paper below leaves, then beat the leaves to dislodge the mites. Spider mites appear as tiny dust specks and they move slowly after being knocked off the leaf. Another method is to pull plants and examine the undersides of the leaves for mites and webbing.

Spider mites edge effect in soybeans (J. Knodel)

Spider mites start feeding on the bottom leaves of plants and then move to higher leaves. Feeding damage by spider mites first appears as small yellow spots (stippling). As feeding activity increases, leaves become yellow, bronzed or brown, and eventually shed from the plant. Be sure to scout during full pod (R4) through full seed (R6) stages since these crop stages are the most important stages for soybean yield.

Pest Management:

If fields are above the action threshold for spider mites, then an insecticide or a miticide treatment may be necessary. In Table 1 (next page), most of the insecticides and miticides available for control of spider mites in dry bean, soybean and corn are listed in addition to the IRAC Group, low and high rates, cost of products, and the pre-harvest interval (PHI).

Spider mite Action Thresholds

Soybean and Dry Bean - When heavy stippling on lower leaves occurs with some stippling progressing into middle canopy. Mites may be present in middle canopy with scattered colonies in upper canopy. Leaf yellowing on lower leaves common.

Corn – Treat when lower ¼ to ⅓ of canopy has mite damage symptoms and / or spider mites are present. Avoid letting spider mite damage reach the ear leaves (Source: UMN Extension).

The only pyrethroid insecticide that will control spider mites is **bifenthrin** (Tundra, Sniper, Brigade, Fanfare, Bifenture, and other generics) in dry bean, soybean and corn. For residual, we expect about a 7 to 10 day residual from bifenthrin (if it is hot, residual will be decreased). While other pyrethroids, such as lambda-cyhalothrin (Warrior, Silencer, and generics) will control other insects like grasshoppers and soybean aphids, they will cause spider mites to flare up and increase in numbers. Then, you will need to re-spray with a different mode of action, such as an organophosphate (OP) insecticide or miticides.

The OP insecticide chlorpyrifos (Lorsban and generics) will control spider mites in soybean and corn. However, chlorpyrifos is NOT registered for foliar application in dry bean. It is only registered as a preplant broadcast or at-plant T-band for control of seed corn maggot in dry beans. Dimethoate will control spider mites in dry beans and soybeans. Expect a 4 to 7 day residual from chlorpyrifos, and a 3 to 5 day residual from dimethoate.

Several insecticide premixes (2 active ingredients mixed together) available for spider mite control include Hero, Tundra Supreme, Match-Up, Skyraider and Minecto Pro. See Table 1 for details.

The efficacy of an insecticide can be improved significantly with sufficient coverage >18 GPA of water by ground and 3-5 GPA by air and application at high pressure (40 PSI) to penetrate foliage. For insecticide resistance management of mites, **do not apply the same class of insecticide (or mode of action) more than twice and alternate the mode of action between applications to prevent buildup of resistant mite strains**.

It is extremely important to re-scout and monitor for recurring spider mite populations after treatment, since the insecticides do not kill the egg stage of spider mites. Check your fields five days after treatment and again at regular intervals to make sure your product is holding. If newly hatched spider mites are observed after 5 days, a second treatment may be necessary with a different mode of action to prevent the development of pesticide resistance. For example, if you use bifenthrin (pyrethroid) for the first application, use a non-pyrethroid product, such as dimethoate or chlorpyrifos (OP), or a miticide for the second application.

Miticides also are available for spider mite control and some products control all life stages, such as Zeal SC in soybean and corn.

Always read and understand the label. The label is the law.

Table 1. Insecticide and Miticides Labeled for Control of Spider Mites in Field Corn, Dry Bean and Soybean.

Crop	Active ingredient	Brand	IRAC Group	Fl oz per acre		Price/fl oz	Per acre		PHI (grain harvest)
				Low rate	High rate		Low cost	High cost	
Corn	Bifenthrin	Brigade 2EC, generics	3A	5.12	6.4	$ 0.75	$ 3.84	$ 4.80	30 days
Corn	Bifenthrin + zeta-cypermethrin	Hero	3A	10.3	10.3	$ 1.83	$ 18.85	$ 18.85	30 days
Corn	Chlorpyrifos	Lorsban Advanced, 4E generics	1B	8	16	$ 0.43	$ 3.44	$ 6.88	21 days
Corn	Chlorpyrifos + bifenthrin	Tundra Supreme	1B + 3A	13.5	16.8	-	-	-	30 days
Corn	Chlorpyrifos + bifenthrin	Match-Up	1B + 3A	13.2	16.4	$ 0.64	$ 8.45	$ 10.50	30 days
Corn	Dimethoate	Dimate 4E	1B	10.7	16	$ 0.34	$ 3.64	$ 5.44	28 days
Corn	Etoxazole	Zeal SC	10B	2	6	$ 7.10	$ 14.20	$ 42.60	21 days
Corn	Spiromesifen	Oberon 2SC	23	5.7	16	$ 2.87	$ 16.36	$ 45.92	30 days
Dry bean	Abamectin	AbbA Ultra	6	4	8	$ 0.90	$ 3.60	$ 7.20	7 days
Dry bean	Abamectin	Agri-Mek SC	6	1.75	3.5	$ 2.58	$ 4.52	$ 9.03	28 days
Dry bean	Bifenazate	Acramite 4SC	20D	16	24	$ 2.38	$ 38.08	$ 57.12	7 days
Dry bean	Bifenthrin	Brigade 2EC, generics	3A	5.12	6.4	$ 0.75	$ 3.84	$ 4.80	14 days
Dry bean	Bifenthrin + imidacloprid	Skyraider	3A + 4A	5.12	5.6	$ 1.24	$ 6.35	$ 6.94	14 days
Dry bean	Bifenthrin + zeta-cypermethrin	Hero	3A	10.3	10.3	$ 1.83	$ 18.85	$ 18.85	21 days
Dry bean	Bifenthrin + zeta-cypermethrin	Hero	3A	10.3	10.3	$ 1.83	$ 18.85	$ 18.85	21 days
Dry bean	Cyantraniliprole + abamectin	Minecto Pro	28 + 6	7.5	10	$ 3.49	$ 26.18	$ 34.90	7 days
Dry bean	Dimethoate	Dimate 4E	1B	8	16	$ 0.34	$ 2.72	$ 5.44	0 days
Dry bean	Naled	Dibrom 8 Emulsive	1B	16	16	$ 0.98	$ 15.68	$ 15.68	1 day
Soybean	Abamectin	Agri-Mek SC	6	1.75	3.5	$ 2.58	$ 4.52	$ 9.03	28 days
Soybean	Bifenthrin	Brigade 2EC, generics	3A	5.12	6.4	$ 0.75	$ 3.84	$ 4.80	18 days
Soybean	Bifenthrin + imidacloprid	Skyraider	3A + 4A	5.12	6	$ 1.24	$ 6.35	$ 7.44	21 days
Soybean	Bifenthrin + zeta-cypermethrin	Hero	3A	10.3	10.3	$ 1.83	$ 18.85	$ 18.85	21 days
Soybean	Chlorpyrifos	Lorsban Advanced, 4E generics	1B	8	16	$ 0.43	$ 3.44	$ 6.88	28 days
Soybean	Chlorpyrifos + bifenthrin	Tundra Supreme	1B + 3A	13.5	16.8	-	-	-	28 days
Soybean	Chlorpyrifos + bifenthrin	Match-Up	1B + 3A	13.2	16.4	$ 0.64	$ 8.45	$ 10.50	28 days
Soybean	Dimethoate	Dimate 4E	1B	16	16	$ 0.34	$ 5.44	$ 5.44	21 days
Soybean	Etoxazole	Zeal SC	10B	2	6	$ 7.10	$ 14.20	$ 42.60	Do not apply after R5

Disclaimer: Mention of any insecticide products do not imply endorsement of one product versus another nor discrimination against any product not mentioned by the authors or NDSU.

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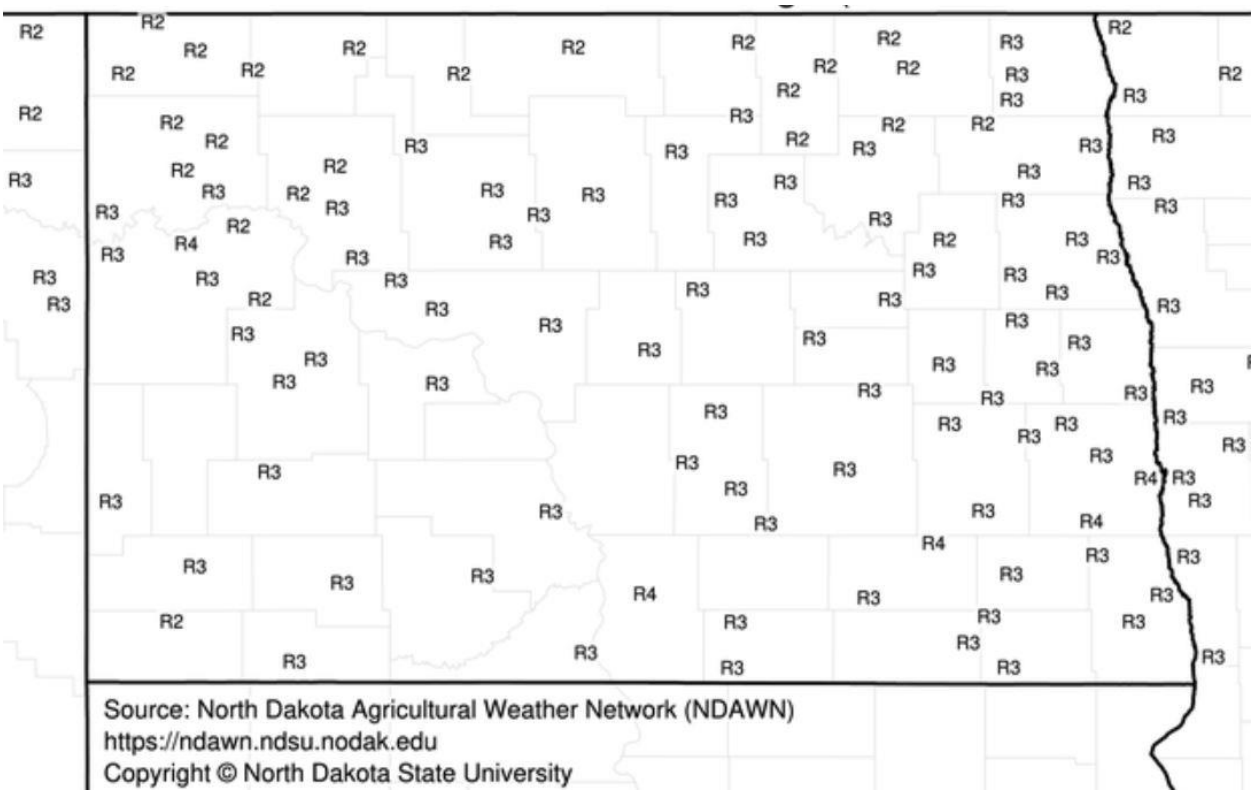
plant science

SUNFLOWER DEVELOPMENT AND GROWING DEGREE DAYS (GDD)

The USDA weekly crop progress report stated that by May 23, 30% of the sunflower acres were planted, and 5% of the sunflower crop was flowering as of July 18. Sunflower growth and development is related to the accumulation of heat or temperature units above a threshold or base temperature below which little growth occurs. The base temperature for sunflower is 44°F. In some crops, there is also an upper threshold temperature above which little or no growth occurs however, no upper limit has been identified for sunflower. Although temperature is the most important factor controlling the rate of plant development, other factors such as plant available water and daylight length may modify its effects. North Dakota is currently in a drought period; however, sunflower has a deep taproot allowing the crop to extract soil moisture from deep in the profile.

Accumulated growing degree-days (GDD) are used to predict plant development rate and growth stage. In sunflower, this information is used to help plan crop management decisions such as insecticide application timing or harvesting. The sunflower growth stage for a specific planting date and location can be estimated by selecting "Sunflower GDD" under the application section of the NDAWN web site. In graph 1, I used the mapping function for a May 23 planting date. Similar maps can be created for other planting dates.



Graph 1. North Dakota estimated sunflower growth stage on July 19 2021, when planted on May 23, 2021.

Table 1 provides a short description and the approximate accumulated GDD after planting, to reach a specific growth stage. A more detailed growth stage description can be found in the extension publication "Stages of Sunflower Development".

Table 1. Sunflower growth stage description and approximate accumulated GGD.

Growth stage	Description	Approximate accumulated GDD
R1	The terminal bud forms a miniature floral head.	1048
R2	The immature bud elongates 0.5 to 2 cm above the nearest leaf.	1188
R3	The immature bud elongates more than 2 cm above the nearest leaf.	1328
R4	The inflorescence begins to open. When viewed from directly above, immature ray flowers are visible.	1469
R5	This stage is the beginning of flowering.	
R5.1	10% of the head area (disk flowers) has completed or is flowering.	1609
R5.2	20% of the head area (disk flowers) has completed or is flowering.	
R5.3	30% of the head area (disk flowers) has completed or is flowering.	
R5.5	50% of the head area (disk flowers) has completed or is flowering.	1749

The flowering growth stage should be appearing soon across the state according to the growth stage calculator. Flowering is a critical stage for insect management and producers should scout sunflower fields regularly during this critical period in order to establish if economic insect thresholds are reached.

Hans Kandel
Extension Agronomist Broadleaf Crops

plant pathology

BACTERIAL PUSTULE ON SOYBEAN

I am following up last week's soybean leaf disease article (bacterial blight, frogeye leaf spot and Septoria leaf spot) with another disease we are beginning to see, bacterial pustule.

Bacterial pustule is *not* an economic threat to soybeans in our region. Bacterial pustule is very rare in North Dakota. The disease is favored by periods of hot weather, so it is not be a surprise that we are beginning to see it. Leaf

symptoms begin as very small light green spots with raised centers. Unlike most bacterial diseases on most crops, these symptoms do not have a water-soaked appearance. Lesions turn brown and small and tan, raised 'blisters' often develop in the lesion centers. Light green to yellow halos may develop around the lesion, but are less pronounced that those that are characteristic of bacterial blight. Lesions may coalesce into larger brown spots and infected areas often tear away from the leaf.

Importantly, and the main reason I am writing this article, is that bacterial pustule has been commonly confused with soybean rust in areas where both exist (very far southern US). To be clear, we *do not* have (and have never had), soybean rust in North Dakota. So, if you see some 'pustules' in your soybean fields this summer/fall, think *bacterial pustule*.

For more images and information on soybean diseases in North Dakota and Northern Minnesota, visit: https://www.ag.ndsu.edu/publications/crops/soybean-disease-diagnostic-series

Figure 1. Topside of leaf with light green lesions and tan pustules of soybean bacterial pustule disease

Figure 2. Underside of same leaf (Fig 1) with pustules

Figure 3. Close up of topside of leaf with numerous brown lesions and pustules

Figure 4. Close up of underside of the same leaf (Fig 3) with lesions and tan pustules

BE PREPARED TO SCOUT FOR SUNFLOWER RUST

We are starting to see the first stages of sunflower rust appear. IPM scout Tommy Crompton snapped a picture of the aecial stage of rust in a sunflower field last week (Figure 1). Aecia are characterized by a cluster of orange cups that occur on the underside of sunflower leaves (Figure 2); opposite the aecia on the topside of the leaf will be a relatively non-descript orange bumps approximately 1/8-1/4 inch in diameter (Figure 3). Aecia produce aeciospores, which infect sunflowers and produce the characteristic cinnamon-brown rust pustules (uredinia). Once uredinia form, the uredinia cycle will repeat every 7-14 days in favorable conditions.

Sunflower rust can cause yield loss when the disease appears early and conditions remain favorable (warm temperatures and dew or fog). Several fungicides are very efficacious against rust and may be a viable economic option if the disease becomes an issue later in the season. For now, I suggest you be prepared to scout for rust before bloom. I will include more information on scouting and management in upcoming Crop and Pest Report articles.

For more images and information on sunflower diseases in our region, including rust, visit: https://www.ag.ndsu.edu/publications/crops/sunflower-disease-diagnostic-series

Figure 1. Early stage of sunflower rust (aecia), Photo by IPM scout Tommy Crompton.

Figure 2. Close up of sunflower rust aecial cups with quarter for size reference.

Figure 3. Topside of same leaf (Fig. 2) opposite the aecial cups.

Sam Markell
Extension Plant Pathologist, Broad-leaf Crops

THE COST OF EROSION

Most people experienced the serious dust storms in certain areas of North Dakota this spring. A common misconception is that the soil that blows is just exchanged with the neighbors, with a net result of zero loss except for the pesky dirt that ended up in the ditch. There certainly was a great deal of ditch digging the first part of June next to some fields this spring, but the loss in soil was a lot more than what was in the ditch. The dust clouds that blew past the area to parts unknown certainly didn't land in any ditch nearby.

For perspective, take the Wheatland soils in Cass County and elsewhere, which take their name from Wheatland, ND, oddly enough. The 1903 Cass County soil survey describes a Wheatland soil as having 2 feet of topsoil with about 6.9% organic matter. I have had experiments on Wheatland soils in the past, and they had between 2-2.5% organic matter. This means that they have lost at least 2 feet of soil during the past 100 years. A productive soil (and these soils were certainly productive without fertilizer 100 years ago) has about 2,000 pounds per acre of P_2O_5 in the surface 6 inches. With a topsoil 2 feet thick, these soils contained about 8,000 pounds of P_2O_5 one hundred years ago. One ton of 11-52-0 (MAP) fertilizer contains 1040 pounds per ton of P_2O_5, at a current cost of roughly $600 per ton of fertilizer (with the N cost subtracted). This means that these soils have lost **$4,615 per acre of P_2O_5** in the past 100 years. No one sent farmers that farmed Wheatland soils a bill for this, but the loss has meant that large amounts of phosphate fertilizers have been applied to these soils and continue to be applied for the past 70 years. In addition, 6.9% organic matter means that the soils had 4% organic carbon. Since organic matter has a 10 to 1 carbon to nitrogen ratio, these soils also contained 0.4% nitrogen in the organic matter. With soil weighing about 2,000,000 pounds per 6 inch per acre, the weight of soil in 2 feet is about 8,000,000 pounds per acre. The weight of soil multiplied by 0.4% N equals 32,000 pounds of N that has been lost over the past 100 years. At a current cost of about 50 cents per pound of N, the **lost N amounts to $16,000 per acre**. If a farmer had a soil today that was 2 feet thick, close to 7% organic matter, there would be little need to fertilize more than just a minimal amount of N to make a 200 bushel corn crop.

What's past is past. What about this spring? There were some fields that probably lost an inch of topsoil over most of the field, or at least a great part of the field. There were several dust-loss events, with the worst on May 25 this spring. Given a starting organic matter content of 3%, total P_2O_5 of 2,000 pounds per acre 6 inches, 300 ppm K soil test, the financial loss in legacy fertilizer would have been:

N- 580 pounds per acre at 50 cents per pound N = $298/acre
P_2O_5 – 333 pounds per acre at 58 cents per pound P_2O_5 = $193/acre
K – 600 pounds K_2O per acre at 30 cents per pound K_2O = $180/acre
S- 58 pounds per acre S at 30 cents per pound S = $17.40/acre

Total cost of major nutrients lost in 1 inch topsoil = $688.40 per acre

The farmer will not get a bill for this, but fertilizer rates over time will need to be more than recommended to keep pace, and it will only be replaced by adding it over time, as tracked by soil test values.

There are only certain neighbors who can and do take advantage of this topsoil loss- neighboring no-till farms with standing residue. As can be seen in the image of blown soil deposits on a no-till field, the coarser particles of soil from the neighbors have nestled into the low-wind-velocity soil surface environment, increasing the no-till farmers' fertility. I have observed over many years that no-till farmers, especially those who were first in their neighborhood to

convert to no-till, have much higher soil test P values than their conventional till neighbor fields. No-till farmers do not apply more fertilizer than conventional till farmers, they typically apply less, partly because their neighbors contribute some to their fields nearly every year.

A newly established no-till field with standing corn stalks that has received a new soil layer, following a spring 2021 dust storm.

Dave Franzen
Extension Soil Specialist
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Weeds

WATERHEMLOCK REPORTED IN CASS COUNTY

I have received a couple questions and ID samples for spotted waterhemlock over the last two weeks. Spotted waterhemlock (*Cicuta maculata*) is one of the most acutely poisonous plants we have in North Dakota. The reported infestations have been in grass hayland adjacent to dried up cattail sloughs, adjacent roadside ditches and water drains. It is probable that these plants were established several years ago and have since spread. Waterhemlock spreads by seed and thrives in moist soils, so floodwaters are of great concern in aiding the spread of waterhemlock.

Spotted waterhemlock is a perennial weed in the parsley family. It can be easily confused with other plants in this family due to the flowering structures. Spotted waterhemlock has clusters of white flowers arranged in an umbel, similar to other weeds like wild

Spotted waterhemlock in a ditch with cattail (Photo courtesy of Stan Wolf).

carrot or poison-hemlock. The leaves of spotted waterhemlock can help differentiate it from similar species. Spotted waterhemlock leaves are narrow-toothed, 1-4 inches long, and divided 1-3 times. The leaflet veins run from the midrib to the tips of the leaf margins. Another identifying characteristic is a hollow stem that often contains hollow, horizontal chambers that can be observed by splitting the root base of the plant. Use caution when splitting a root, as this is the most toxic part of the plant and can cause skin rashes on some individuals.

Close up of leaves of spotted waterhemlock. Note veins that spread from midrib to toothed margin of leaves (Photos courtesy of Stan Wolf).

Hollow horizontal chamber found in root of spotted waterhemlock.

Spotted waterhemlock is a weed of great concern to livestock producers due to its toxicity when ingested. Typically, ingestion will take place when spotted waterhemlock is mixed in with hay bales. Any potential plants should be mowed around to avoid baling, and care should be taken to avoid feeding at all costs. Other states have reported that chemical control is best achieved with high rates of glyphosate, 2,4-D, or MCPA at the bud-to-early-bloom stage. The infestations that were walked are all past that growth stage, so the level of control using these products is not known, but will likely be less than earlier applications. If plants are in or near water, then formulations that are safe to apply in aquatic settings should be used. Livestock producers should be on the lookout for this weed and long-term management will be needed to control these infestations and prevent accidental ingestion by livestock.

Joe Ikley
Extension Weed Specialist

WATERHEMP IS FLOWERING

I was taking notes last week and observed flowering structures on waterhemp plants. Why is flowering important? Because female waterhemp plants produce a tremendous amount of seed and seed remains viable from 4 to 6 years. It has been reported that waterhemp in an open canopy can produce 200,000 to 500,000 seeds per plant.

Researchers at Iowa State University and the University of Illinois examined the number of days after flowering for waterhemp to produce viable seed. In the experiment, waterhemp with multiple branches were pollinated for 24 hours. Branches from pollinated waterhemp plants were harvested and exposed to either warm (86F) or cold (-4F) conditions for 48 hours and then moved to room temperature. Researchers

measuring seed germination as an indicator of seed viability determined that seeds from branches exposed to warm treatment were viable 7 to 9 days after pollination whereas seeds from branches exposed to cold treatment were viable 11 days after pollination.

Is it too late to spray waterhemp? We think so. Applying herbicide to waterhemp at the flowering stage is not a recommended practice since herbicides do not reduce waterhemp seed production. We recommend hand-weeding scattered flowering waterhemp, especially large plants in open areas of the field or waterhemp near field borders. Bag and carry waterhemp plants from the field if you are unsure how long plants have been flowering.

Tom Peters
Extension Sugarbeet Agronomist
NDSU & U of MN

AROUND THE STATE

NORTH CENTRAL ND

Some rain continued to be observed in the area over the past week. Some areas across the City of Minot received 1-3 inches; however, much of the significant rain hugged the area immediately around and throughout the city. Some hail and gusty winds were also observed in the area. With that in mind, some regions experienced much smaller precipitation amounts in the area. Here are some quick precipitation reports as observed by area NDAWN stations over the last week (beginning July 12th): Minot: 1.19" (NCREC: 1.31"); Bottineau: 0.22"; Garrison: 0.00"; Karlsruhe: 0.17"; Mohall: 0.17"; Plaza: 0.07"; and Rugby: 0.01". Bare soil temperature at the NCREC is observed at 84 degrees F.

Grasshopper calls continued to come into the NCREC. On Monday, TJ was in the Bottineau and Renville County areas and observed increased populations of adults. Please keep in mind the importance of scouting during this time. Also, reflect on two different possible thresholds for grasshoppers – both a border threshold (21-40 per square yard) and an in-field threshold (8-14 per square yard) to determine if control is needed. Some grasshopper nymphs are still observed in the area. Accumulated growing degree day thresholds for wheat midge have surpassed the 2000-degree day mark, meaning action is no longer required in area wheat fields if thresholds had been met.

Crop harvest has started in the region. Some small grains, field peas and other pulses are being harvested. Although we had rain in the past couple of days, the rain was not enough to alleviate drought stress in the crops, especially for corn and soybeans. Field corn is showing signs of curling and drought stress. Several fields of corn are observed in the VT stage. Soybeans are found in R2 stages and shows additionally signs of drought and heat stress. Flax is found in field from stage 10 to 12, but there are farmers reporting that they will have flax to harvest later this week. Canola is found in the 4.3 stage to 5.1. Additionally, sunflowers range from the V8 to V12 stages.

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

Most of the region received showers in the past seven days ranging from 0.3 to 1.76 inches. However, yield losses are expected in several crops due to the moisture stress endured in previous weeks. Small grains are maturing 1-2 weeks before normal which would impact the yields. Wheat and Barley harvest could begin as early as the first week of August. Soybeans, Canola, and Sugar beets in sandy ridges are showing moderate to severe drought stress. Canola, soybeans/dry beans, field peas and sunflowers in high clay soils are looking good. Corn looks promising. No disease issues. Sprayings for grasshoppers are being reported. Hay is being cut with yields half of those harvested in a typical year. Supplemental feed is being given to cattle and many ranchers have been hauling or laying pipe to bring additional water to pastures. Concerns over water quality for cattle are increasing with high levels of TDS. Blister beetles in alfalfa continue to be a concern. Home gardens and trees are also showing moisture stress symptoms.

Anitha Chirumamilla
Extension Agent Cavalier County

NORTHWEST ND

Hot temperatures set in mid-week last week and are here to stay through the weekend, according to the current forecast. Highs were in the 90s late last week and hit 101°F in Williston on Sunday. Highs are predicted to be in the 90s through the coming week with very low chances of rain. The heat is pushing crop maturity and causing crops to turn color quickly. During the WREC field day last Wednesday, July 14th, the pea variety trial was mostly green, but just today (July 19) a lot of plots are yellow and some even a little brown (see photo). Some lentils in the variety trial are also starting to turn and small grain drill strips are also showing some brown color (see photo). The small grain drill strips are at late milk to early dough stages, so there should be some grain out there to harvest. Unfortunately, the continued high temperatures and lack of rain will be very stressful to later planted crops that are flowering to early fill, any the heat may shut them down before the can successfully make grain. For anyone working outdoors this week, take breaks, drink plenty of fluids, and avoid heat stress to stay safe. It's going to be a hot one!

WREC pea variety trial on 7/19/2021.

WREC spring wheat drill strips on 7/19/2021.

Clair Keene
Extension Cropping Systems Specialist
NDSU Williston Research Extension Center

SOUTH-CENTRAL/SOUTHEAST ND

According to NDAWN, the region's rainfall during the last two weeks (July 6-19) has totaled about 0.5 inch or less (e.g. Carrington REC at 0.1 inch) with few exceptions (1.1-1.2 inches at Oakes and Wishek). During the past week (July 13-19), daily water use by row crops averaged 0.2-0.25 inch per day.

Small grains are nearing or are at mature seed stage. Corn (VT-R1), soybean (R3-4), dry bean (R1-4) and sunflower (V3-5) are at critical growth stages that require minimal stress to maintain yield potential.

The following is a list of positive items this season despite the adverse growing conditions:

Field Day audience intrigued by the robotic rock picking demonstration.

- Cool overnight temperatures have provided some relief to stressed crops
- Small grain – no lodging, disease, or preharvest sprouting; high protein in wheat; potential for very efficient harvest
- Generally, no hail
- Haying conditions have been generally very favorable
- Disease threats to row crops, including white mold, continue to be low
- Expected increased levels of residual soil N for 2022 crops

The Carrington REC had a very good Field Day on July 20 with favorable weather, diversity in subject matter, and good attendance. Thanks to the speakers for their presentations, and farmers, crop advisers and ag industry representatives for attending our educational event.

Greg Endres
Extension Cropping Systems Specialist
NDSU Carrington Research Extension Center

SOUTHWEST ND

According to NDAWN, from July 9th to July 19th Dickinson received 0 inches of rain, Beach 0.01, Amidon 0, Bowman 0.08, Hettinger 0.06, Mott 0, Carson 0, Mandan 0.89, Hazen 0.08, and Dunn 0. Early planted small grains are turning and peas in the region will be harvested within the next 2 weeks. Sunflowers have switched to reproductive growth with most in the late bud stage and some fields beginning to flower. Red sunflower seed weevils are present in wild sunflowers along roadsides. Be sure to check the Sunflower Production Guide for more information on managing insects in sunflower https://www.ag.ndsu.edu/publications/crops/sunflower-production-guide. Corn is looking poor across most of the region with some 4ft tall and tasseling.

(*See Photos on the next page*)

Figure 1 Drought impacted corn in Adams Co. ND July 20th 2021. Corn is 4 feet tall and tasseling.

Figure 2 Red Sunflower Seed Weevil on wild sunflower

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