North Dakota State University
CROP & PEST REPORT
NDSU EXTENSION

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Inside this Issue...

NEW NDSU AGRICULTURE WEBSITE LAUNCHED

This summer, NDSU Agricultural Affairs launched a new website. The NDSU Agriculture website,www.ndsu.edu/agriculture, brings the College of Agriculture, Food Systems and Natural Resources, the North Dakota Agricultural Experiment Station, and NDSU Extension all under one website. One of the featured sections of the site is the Ag Hub, which brings together NDSU ag research and Extension content to create a producer-focused website intended to help you improve your ag operation. We invite you to check out the new Ag Hub, and we ask for your continued patience, as we work to prioritize and reorganize our web content.

Robert Bertsch
NDSU Extension Web Technology Specialist

Entomology

2021 IPM CROP SURVEY – WHEAT AND BARLEY

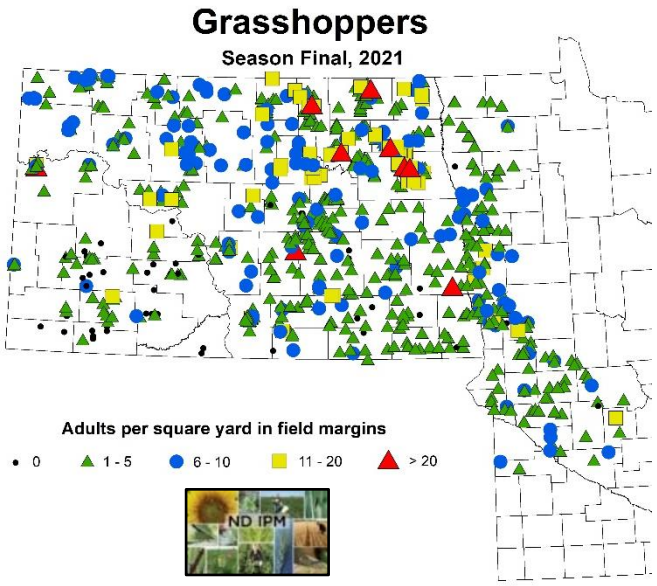
The IPM (Integrated Pest Management) Crop Survey helps ND farmers, crop consultants, and ag audiences stay up-to-date on important diseases and insect pests of wheat, barley, soybean and sunflower grown in North Dakota. Eight IPM scouts and insect trappers operated out of the Dickinson Research Extension Center, the North Central Research Extension Center (Minot), the Carrington Research Extension Center, the Langdon Research Extension Center, the Williston Research Extension Center and the Fargo Agricultural Experiment Station. The NDSU IPM scouts were:

Carrie Nichols, IPM Scout at CREC.

- **Carrie Nichols**, central and south-central counties, worked out of Carrington REC with Greg Endres
- **Iris Dukart**, southwest and west central counties, worked out of Dickinson REC with Ryan Buetow
- **Alexius Holter and Riley Racine**, north central counties, worked out of NCREC in Minot with Travis Prochaska and Leo Bortolon
- **Scott Roseth**, northwest counties, worked out of Williston REC with Claire Keene
- **Tommy Crompton**, southeast and east central counties, worked out of NDSU campus, Fargo with Jan Knodel, Andrew Friskop and Sam Markell
- **Nancy Feil and Jolena Lowery**, northeast counties, worked out of Langdon REC with Anitha Chirumamilla, and Benson County Extension Office with Scott Knoke.

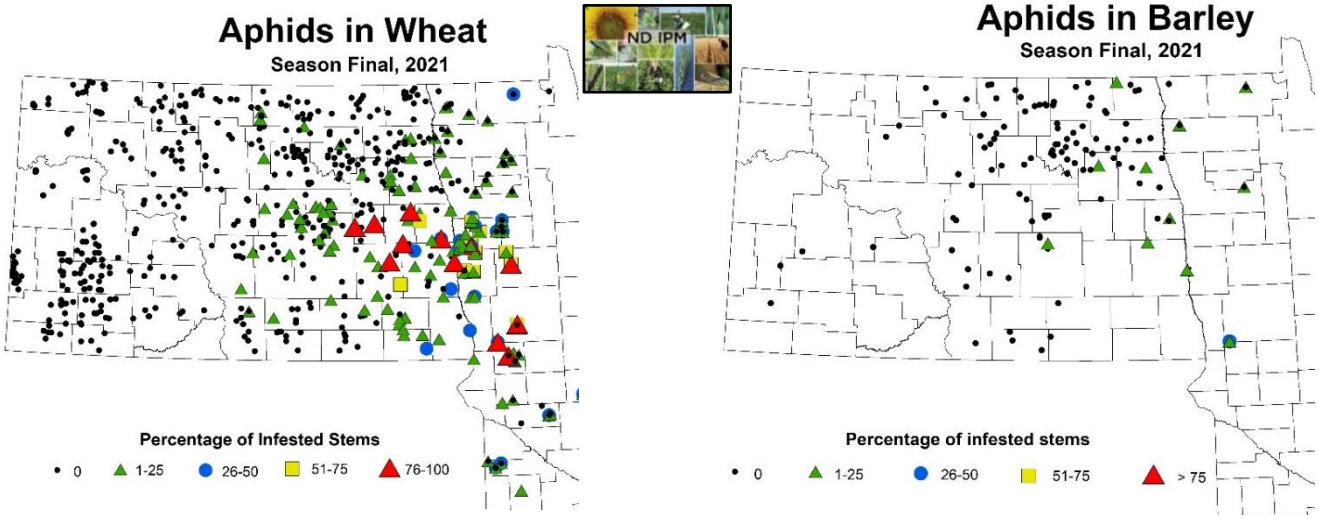
NDSU IPM scouts surveyed a total of 678 wheat fields (winter wheat, hard red spring wheat, durum wheat) and 119 barley fields for 18 diseases and 6 insect pests in North Dakota. The survey started on June 1st and continued through August 13th. Crops were surveyed from the 2-leaf stage (seedling) through ripening stages. IPM survey data/maps provided near real-time pest information to North Dakota farmers and others in agriculture to assist with scouting and pest management decision making. Pest maps from the 2021 IPM Crop Survey in North Dakota were uploaded weekly onto the NDSU IPM website. Please note that the website address will be changing in the near future. Some of the pest highlights for wheat and barley are summarized below.

Grasshoppers – Grasshoppers were surveyed for in all crops including wheat, barley, soybeans and sunflowers. Adult grasshoppers were observed in 91% of the fields surveyed. IPM data showed an increasing trend in the populations of adult grasshoppers over the last four years: 91% in 2020, 86% in 2019, 75% in 2018 and only 36% in 2017. The hot, dry summer increased grasshopper development and reproduction. The number of adult grasshoppers per 4 sweeps (1 yd^2) ranged from 0 to 32 in 2021. The highest densities of grasshoppers were observed in the northeastern North Dakota. Defoliation was common on field edges in most fields throughout the state. Whole-field treatments were necessary in areas where grasshopper populations were high (see yellow and red areas on grasshopper map).



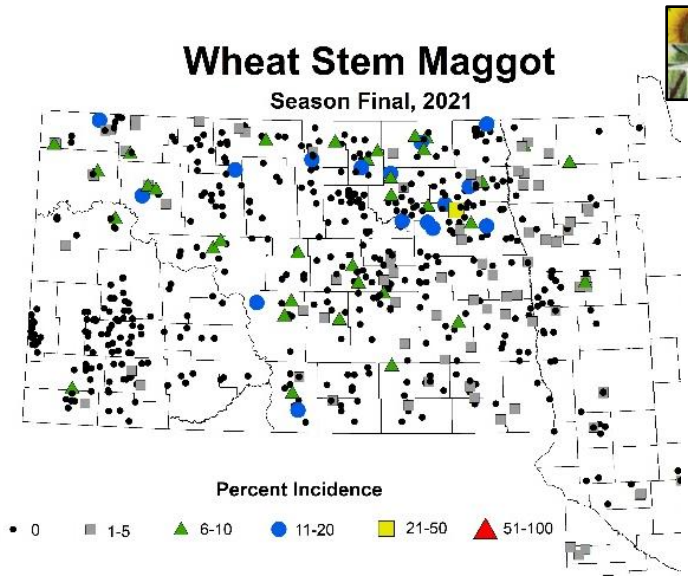
Insect Pests of Small Grains:

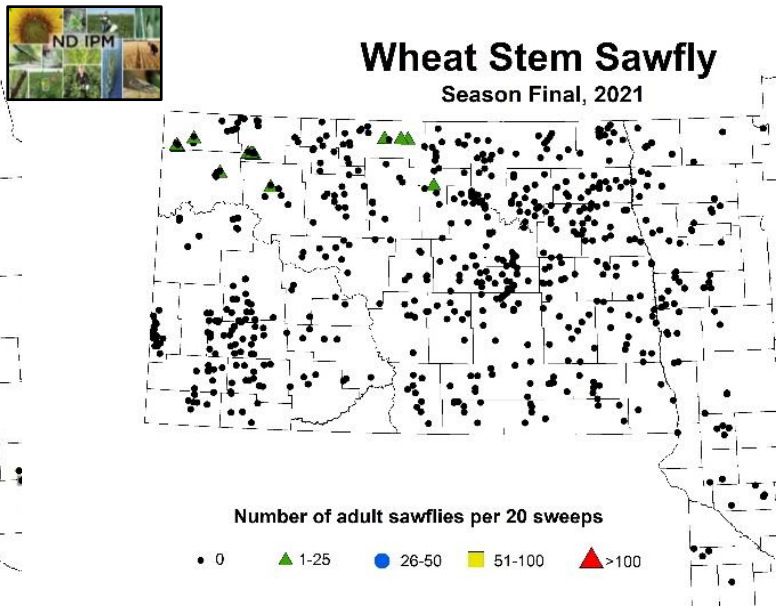
Grain aphids were higher in 2021 than 2020, and observed in 11% of the wheat fields and 6% of the barley fields surveyed in North Dakota. Grain aphids were first detected in late June. The economic threshold is 85% of stems infested with one or more aphids through heading. In wheat, the percentage of infested stems ranged from 1-100% with an average of 17%. In barley, the percentage of infested stems ranged from 2-24% with an average of 7%. In the southeast and east central areas of North Dakota, grain aphids continued to increase past the known susceptible stage (end of heading), and were commonly observed on wheat heads at high densities of >100 aphids per head. Farmers and crop consultants expressed concern about these high numbers on heads and its potential impact on yield.



Wheat stem maggot was observed in 15% of wheat fields surveyed in ND and damaged white heads ranged from 1-24% of plants sampled. In 2021, wheat fields with ≥20% damaged heads were observed in northeast (Nelson, Walsh counties).

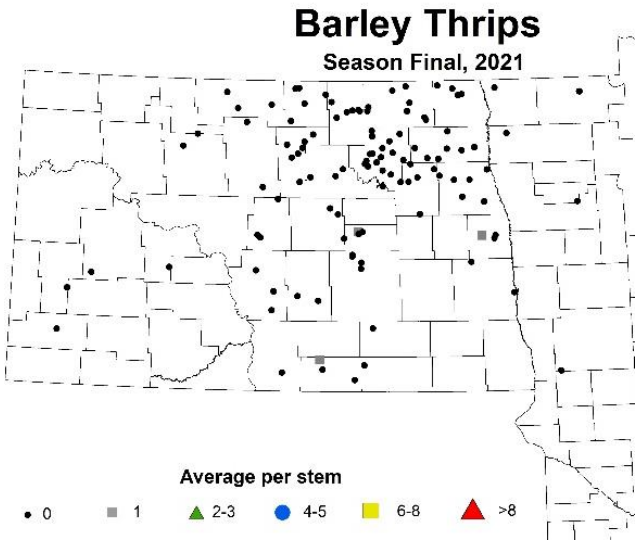
Wheat stem sawfly declined from 2020 and was collected with sweep nets in only 2% of the wheat fields surveyed during mid-June though early July in 2021. Wheat stem sawflies were most common in the northwest (Burke, Divide, Mountrail, Williams Counties); and north central (Bottineau County) areas. Areas with more intense drought could have increased wheat stem sawfly survival for next year.





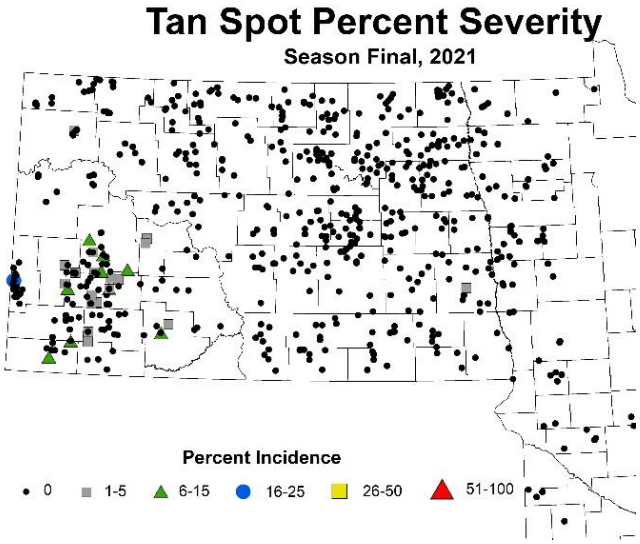
Cereal leaf beetle was not detected in wheat or barley in 2021. The counties of North Dakota that are known to have cereal leaf beetle are Burke, Divide, McKenzie, Mountrail and Williams counties in northwest; Renville, McHenry and Ward counties in north central; and Cavalier and Nelson counties in northeast.

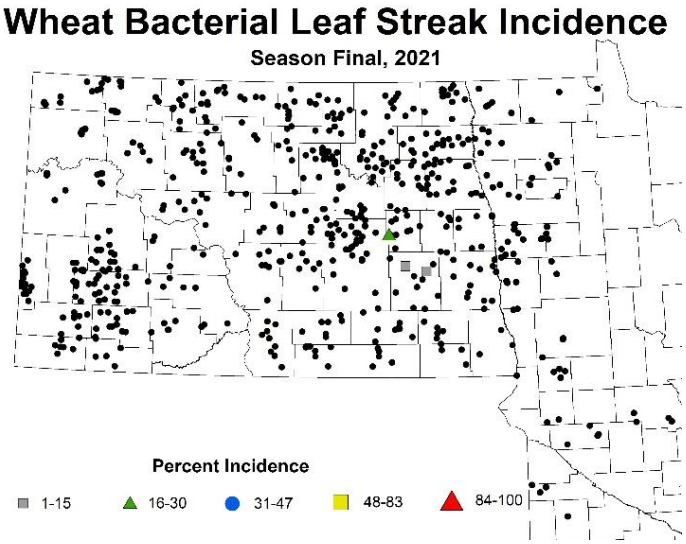
Barley thrips were low and observed in only 3 barley fields in Trail, Foster and McLean Counties.

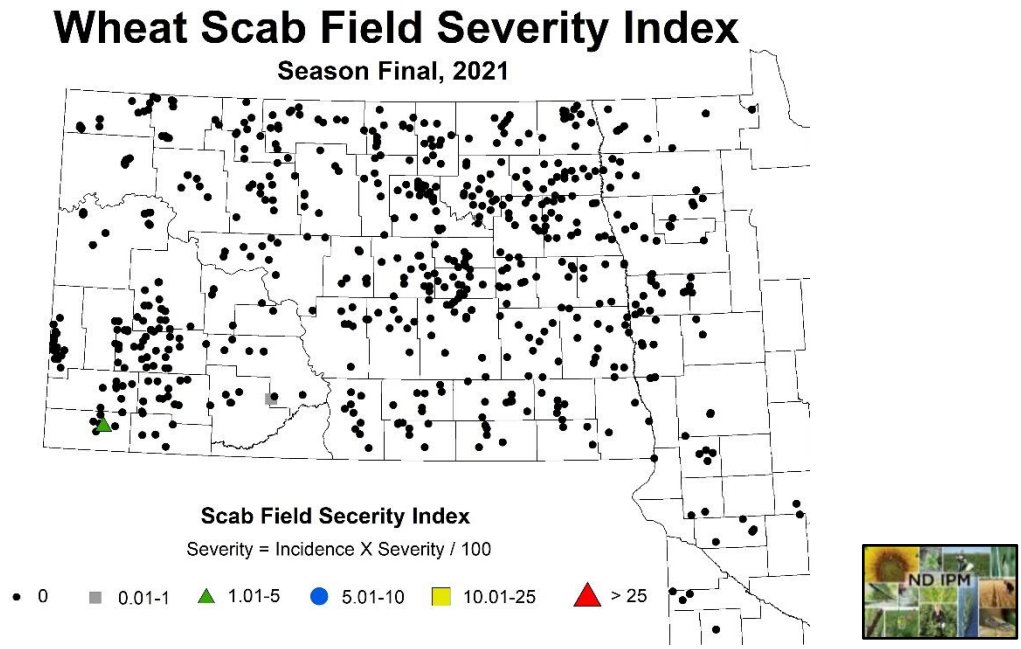


Foliar Diseases of Wheat and Barley:

Disease incidence in 2021 wheat fields was extremely low this year. The low amount of rain, low humidity, and higher than average temperatures in June drastically reduced disease risk. Tan spot was detected in 4% of the fields and bacterial leaf streak was detected in less than 1% of the fields. Leaf rust was only reported from NDSU research plots with no reports from agronomic fields. Foliar disease was also very low in barley fields this year. Fusarium head blight (scab) risk was low in 2021. Less than 1% of the fields had Fusarium head blight, and in those fields, low index values (field severity) were reported. A significant amount of the small grain crop started to head in mid-June at a time during hot temperatures and low humidity





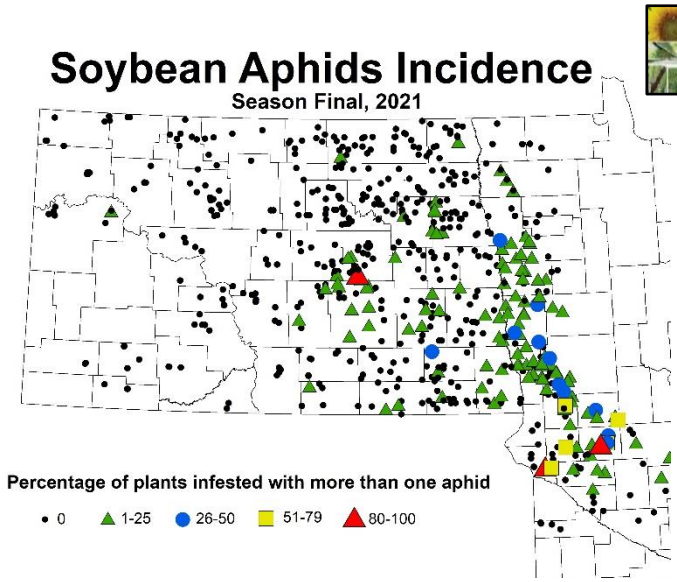


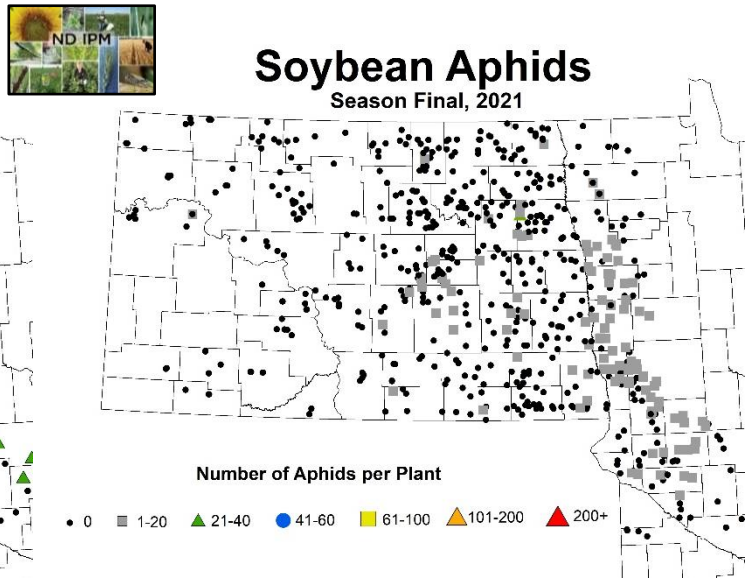
2021 IPM CROP SURVEY- SOYBEAN AND SUNFLOWER

NDSU IPM scouts surveyed a total of 539 soybean fields and 299 sunflower fields in North Dakota during 2021. The survey was initiated in early June and continued through August 13. Crops were surveyed from the 2-leaf stage through R5 growth stage in soybeans and R6 growth stage in sunflowers. Some of the pest highlights for soybean and sunflower are summarized below.

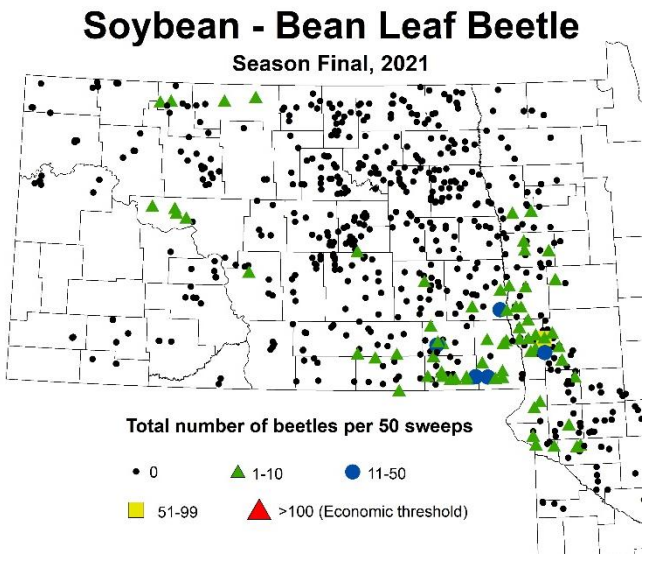
Soybean Insect Pests:

Soybean aphids - No soybean aphids were observed in 91% of the soybean fields surveyed for the third year in a row! There were no soybean aphids observed in 96% of the soybean fields in 2020 and 93% in 2019. The percent of plants infested with soybean aphids in fields was low with an average of 11% of plants infested and ranged from 2 to 94% of plants infested. The average number of aphids per plant was only 2 aphids per plant and ranged from 1 to 32 aphids per plant. Most of the positive fields were located in the eastern half of North Dakota. Soybean aphids never reached the economic threshold (E.T.) level (average of 250 aphids per plant, 80% of plants infested with one or more aphids and increasing population levels) in any of the soybean fields surveyed.





Bean leaf beetles were detected in sweep net samples and is becoming a more common insect pest of soybean in North Dakota. It was most prevalent in south eastern North Dakota, but also was found in north central and east central North Dakota. Bean leaf beetle was not present at economic levels in soybean fields in 2021.

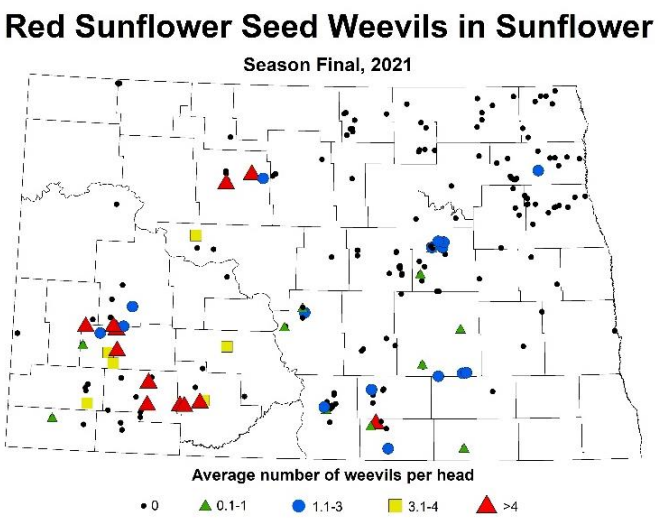


Although it was a hot, dry year, **spider mites** were observed in only 7% of the soybean fields scouted. Most scouting was completed when spider mites started to increase in severe drought areas, and were mainly a problem on field edges.

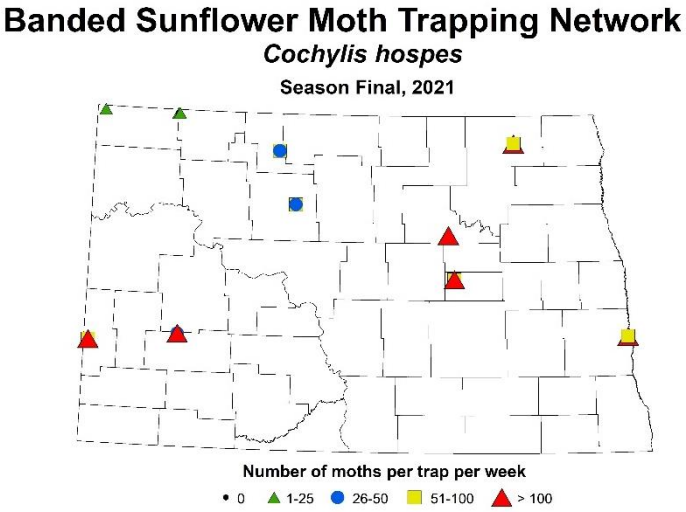
The invasive **soybean gall midge** was surveyed for in 48 counties and a total of 588 soybean fields. Fortunately, it was **NOT detected in 2021** for a second year in a row. Good news for soybean farmers!

Sunflower Insect Pests:

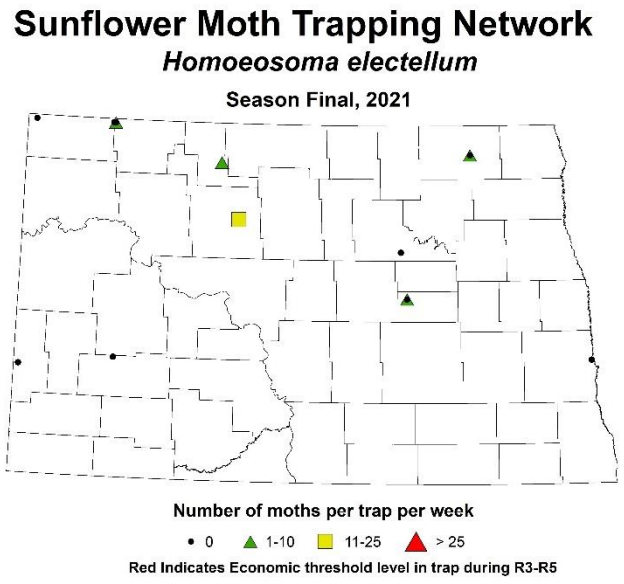
Red sunflower seed weevils were observed during flowering from late July through mid-August. The average number of weevils per head was 2.6 and ranged from 1 to 17 weevils per head depending on field site. About 65% of the total weevils counted were observed in the field edges versus 35% of weevils in the field (>50 ft). In 2021, the E.T. for red sunflower seed weevils was 4-6 weevils per head for oilseed sunflowers. Approximately 24% of the fields surveyed were above the E.T. and these fields required an insecticide application. The highest populations were located in southwest, north central and south-central areas of North Dakota.



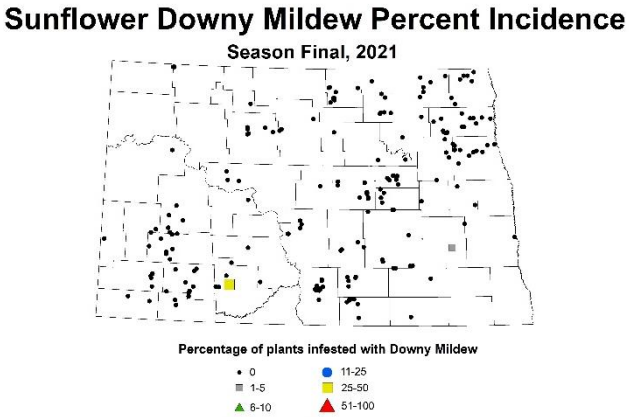
Banded sunflower moth and **Arthuri sunflower moth** were monitored for using commercial winged pheromone traps and lures. Both moths were collected at all 10 trap sites throughout ND. The first moth was trapped early July and peak moth catch occurred from mid- to late July during R4 to early flowering. Traps that captured more than 100 banded sunflower moths per trap per week were located in 6 of the 10 trap sites including Benson, Cass, Cavalier, Foster, Golden Valley, and Stark Counties.

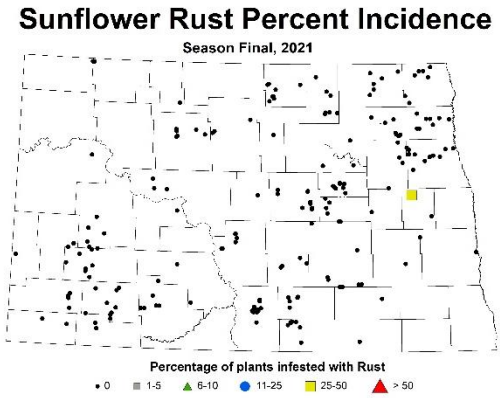


Sunflower moth also was monitored for using commercial winged pheromone traps and lures, and was collected at only 5 of the 10 trap sites. Sunflower moth migrates into ND and was first detected during early July. Peak catch occurred during late July through mid-August during mid-late flowering. Economic numbers of sunflower moths is $\geq$ 25 moths per trap per week, but no trap site reached this level in 2021.

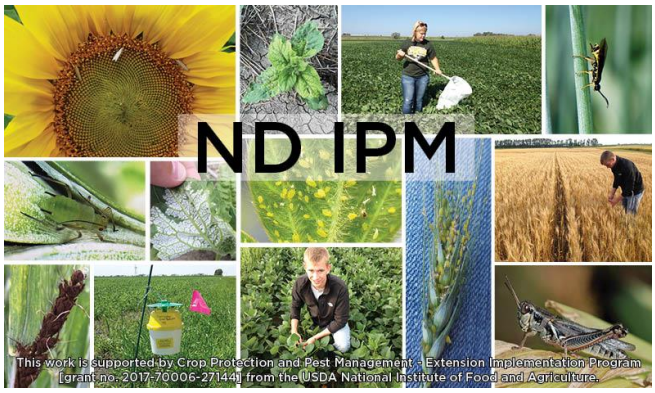


Sunflower Diseases: The IPM scouts scouted for downy mildew and rust. Downy mildew was observed in two fields at 4% incidence in Barnes County and 30% incidence in Grant County. Sunflower downy mildew is favored by cool and wet weather after planting, and the warm and dry weather likely resulted in relatively low incidence statewide. Sunflower rust was observed at 3% incidence and 1% severity in one field, Steele County. Most scouting was completed prior to growth stages R5-R6, when sunflower rust commonly increases in the state. Reports of fields with rust in later growth stages (after the completion of the IPM Crop Survey) are occurring.





Acknowledgments: Sincere thanks to the hard-working field scouts and insect trappers! We also appreciate the help of Darla Bakko, NDSU Dept. of Plant Pathology, for data compilation, and Dr. Honggang Bu, NDSU Dept. of Soil Science, for ArcMap programming. This survey is supported by the Crop Protection and Pest Management Program [grant no. 2017-70006-27144/accession 1013592] from the USDA National Institute of Food and Agriculture.



United States Department of Agriculture
National Institute of Food and Agriculture

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WHAT DOES THE LOSS OF CHLORPYRIFOS MEAN FOR FARMERS?

How widespread is the use of chlorpyrifos in North Dakota?

Chlorpyrifos is registered for use in a wide variety of crops grown in North Dakota, including field corn, alfalfa, soybean, sugarbeet, sunflower, wheat, and dry edible beans. Chlorpyrifos is probably best recognized by its original brand name Lorsban. There are liquid, water-soluble powder (WSP), and granular formulations now available under a number of other brand names like Govern, Warhawk, Yuma and other generics. Chlorpyrifos is also available in premix products, such as Cobalt Advanced that also contain a pyrethroid insecticide. Registered uses vary by crop. For example, registered uses in soybean include granular at-plant applications and post-emergence foliar liquid applications. In dry edible beans, chlorpyrifos can be used as a seed treatment slurry (WSP formulation) or as a pre-plant broadcast application, but cannot be used for post-emergence foliar applications. In summary, chlorpyrifos is widely used for control of many insect pests of field crops in North Dakota.

What insects do most ND farmers control with this technology?

Chlorpyrifos is a broad-spectrum insecticide that controls a wide variety of soil and above-ground insect and mite pests. Soil pests include seed corn maggot, corn rootworm larvae, sugar beet root maggot larvae, white grubs, and wireworms. Examples of above-ground pests include alfalfa weevil, aphids, armyworms, cutworms, foliage-feeding caterpillars, grasshoppers, leafhoppers, lygus bugs, corn rootworm adults, sugarbeet root maggot adults, banded sunflower moth, sunflower head moth, red sunflower seed weevil, wheat midge, and spider mites. Chlorpyrifos is also available as a residual bin spray and grain storage protectant against stored grain insect pests like red flour beetles and rice weevils. Other characteristics of chlorpyrifos is its short residual activity, usually about 3-5 days. It also is volatile and is able to penetrate closed canopies and crop floral structures better than other insecticides.

What, if any, other pesticide options are there for growers?

Most crops have several alternatives for controlling insect and spider mite pests. Broad-spectrum insecticides include neonicotinoid seed treatments, granular and liquid pyrethroid formulations for at-plant use, and neonicotinoids, pyrethroids, and other organophosphates for foliar use. There are also several newer alternative chemistries that have specific activity against certain insect pests, such as diamides (Prevathon, Exirel) for foliage-feeding caterpillars like thistle caterpillars and green cloverworms in soybeans or banded sunflower moths and sunflower head moth in sunflowers; and pyropenes (Sefina Inscalis), sulfoximines (Transform) and butenolides (Sivanto) for control of soybean aphids. There are also specific miticides such as abamectin (Agri-Mek) and etoxazole (Zeal) registered for use in soybean and corn to control spider mites, but these products are more expensive than chlorpyrifos.

Some crops such as sunflower have only a few chemistries available for use. Red sunflower seed weevil is best controlled using straight chlorpyrifos or a chlorpyrifos + pyrethroid premix because chlorpyrifos is better able to penetrate flower bracts and other floral structures where the larvae are hiding. Due to an increase in growers' complaints about pyrethroid failures to control of red sunflower seed weevils in some areas of South Dakota (pers. comm. Dr. Adam Varenhorst, SDSU), pyrethroids alone may or may not give adequate control. Currently, there are no other alternative chemistries to control red sunflower seed weevil. The development of pyrethroid resistance is a major concern with red sunflower seed weevil and other insects like soybean aphids, spider mites and diamondback moth.

Pyrethroids are the most widely used mode of action for foliar insecticides, and that comes with an increased risk of insecticide resistance. Resistance to pyrethroids has occurred in soybean aphids in multiple states (Minnesota, Iowa and South Dakota) including eastern North Dakota. While we do have other effective chemistries to control pyrethroid-resistant soybean aphids, the loss of chlorpyrifos means that we have one less tool in our insect control arsenal. This may lead to overreliance on pyrethroids and pyrethroid resistance developing in other insect pests.

How does this change how farmers manage for insects?

The loss of chlorpyrifos forces farmers to use alternative chemistries. In the case of spider mites, where multiple foliar applications may be necessary and rotating products with different modes of action is a must to prevent resistance, the loss of chlorpyrifos may force growers to use a more expensive miticide, which increases their overall

monetary input in the crop. It is vital that farmers practice sound integrated pest management (IPM) principles regarding insecticide use, and to adopt non-chemical IPM strategies, such as crop rotation, host plant resistance and conversation of biological control agents. Scouting fields regularly and using established economic thresholds is more important than ever now. An important IPM strategy when more than one insecticide application is needed for control of a specific pest, is to rotate to a new mode of action to help prevent the development of insecticide resistance and to keep our current insecticides in our IPM toolbox.

Patrick Beauzay
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plant science

ESTIMATING SUNFLOWER YIELD

The sunflower yield for oil sunflower, can be calculated by the number of plants per acre, the head diameter, the seed size, the number of filled seeds per head, observing how much of the center of the head is filled, and estimating the damage done by birds. The yield is calculated by multiplying 2,450 by the "multipliers" from the tables in this article.

First, estimate the plant population from a number of locations within a field, away from the headlands.

Table 1. Multiplier to be used based on sunflower plant population per acre.

Plants per acre	Multiplier
14,000	0.7
16,000	0.8
18,000	0.9
20,000	1.0
22,000	1.1
24,000	1.2

For plant populations between the numbers in Table 1, the value of the multiplier can be estimated. The next measurement is the sunflower head diameter. Measure a number of heads in the field (photo 1), and take the average. Plants with more space tend to have larger heads so it is important to take a representative field sample.

Table 2. Average sunflower head diameter in inches and multiplier to be used in formula.

Head diameter (inches)	Multiplier		Head diameter (inches)	Multiplier
4.5	0.37		7.5	0.91
5.0	0.46		8.0	1.00
5.5	0.55		8.5	1.09
6.0	0.64		9.0	1.18
6.5	0.73		9.5	1.27
7.0	0.82		10.0	1.36

The next multiplier is related to the seed size. Cut a small wedge out of a few heads, thresh seed and put in small container. Take a representative seed sample from bucket and determine seed size for the multiplier (Table 3).

Photo 1. Measure a representative sample of heads. Measure each head from edge to edge.

Table 3. Seed size and multiplier to use.

Descriptor	Light (L)	Medium Light (ML)	Medium (M)	Medium Heavy (MH)	Heavy (H)
Multiplier	0.8	0.9	1.0	1.1	1.2
Size					
Seed width in mm	4.2	5.2	5.8	5.8	5.8
Seed length in mm	7.3	7.8	8.9	9.9	11

Next, take 100 seeds from seed sample (in container) and determine percent filled seeds. For instance, when observing 100 seeds of which 9 seeds are either not filled or severely damaged due to insects, the multiplier will be 0.91 (= 91 % filled seeds).

The following measurement is to observe the center seed set. If there is no seed set in the center one inch of the head, multiply by 0.975; if no seeds are set in the center two inches of the head, multiply by 0.95; if there is a hole in the center of the head, multiply by 0.9. Take the average seed set from a number of plants.

Lastly observe if there is bird damage to the heads. If there is 2% damage, there is no damage for 98% of the head and the correction factor will be 0.98

Yield calculation

Yield is calculated by multiplying 2,450 by the multipliers from the tables. For example in a sunflower field with a stand of 20,000 plants per acre, average head size of 6.5 inches, a medium seed size with good seed count of 95%, and average no seed in the center of the head of one inch, and 2% bird damage you would do the following.

Multipliers used: 2,450 x plant population x head size x seed size x good seed count x center seed set x no bird damage = lbs/acre.

Yield calculations for this example field would therefore be: 2,450 x 1.0 x 0.73 x 1.0 x 0.95 x 0.975 x 0.98 = 1623 lbs/acre. The yield estimate for this example is 1623 lbs per acre. The actual yield may be lower if not all heads can be harvested and/or additional bird damage will occur.

Reference:
National Sunflower Association article How to Estimate Yield

Counting plants per acre and taking sunflower head observations during the annual national sunflower survey.

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plant pathology

IT'S A GREAT TIME TO SAMPLE FOR SOYBEAN CYST NEMATODE (SCN)

From now until freeze up is an ideal time to soil sample for SCN. Soil sampling gives you information on whether or not you have SCN, and/or whether or not your management tools are working. If you use the North Dakota Soybean Council supported sampling program, laboratory fees on soybean samples will be covered. Please consider grabbing a probe/shovel, sample 6-8 inches deep, mix the sample and mail in the pre-marked bag. Take the Test – Beat the Pest

For additional information on SCN, please visit these previous NDSU Extension *Crop and Pest Report* articles.

SCN (general)
North Dakota SCN Sampling Program and Distribution
How to sample for SCN
SCN and dry edible beans

For additional SCN information, please visit: www.theSCNcoalition.com

Sam Markell
Extension Plant Pathologist, Broad-leaf Crops

SEED CONSIDERATIONS FOR 2022

At the end of the cropping season, during harvest, there is a good opportunity to evaluate the crop stands across the field and observe if there is a way to improve the plant distribution in the future. One way to get better stands it to use **certified seed** compared with bin run seed for those crops that do not have company restrictions on replanting your own harvested crop. Good seed and high yielding varieties are keys to optimizing the chances for optimum yields. With the drought of this past season, some of the seeds may be shriveled. It also may be a bit more difficult to obtain seed of varieties that are multiplied in the drought-stricken region of the state. Timely reserving seed of the varieties you would like to plant in 2022 would be advisable.

Another way to increase the plant population it the use of **seed treatments**. Many seed companies will offer the option to purchase pre-applied seed treatment. Usually, with seed treatment the number of seeds developing into and established plant is higher that when no seed treatments are used. Results from a large survey of producers (a total of 1120 data points were used) found about 2/3 used seed treatment on their soybean and there was a significant yield response to seed treatments (Figure 1).

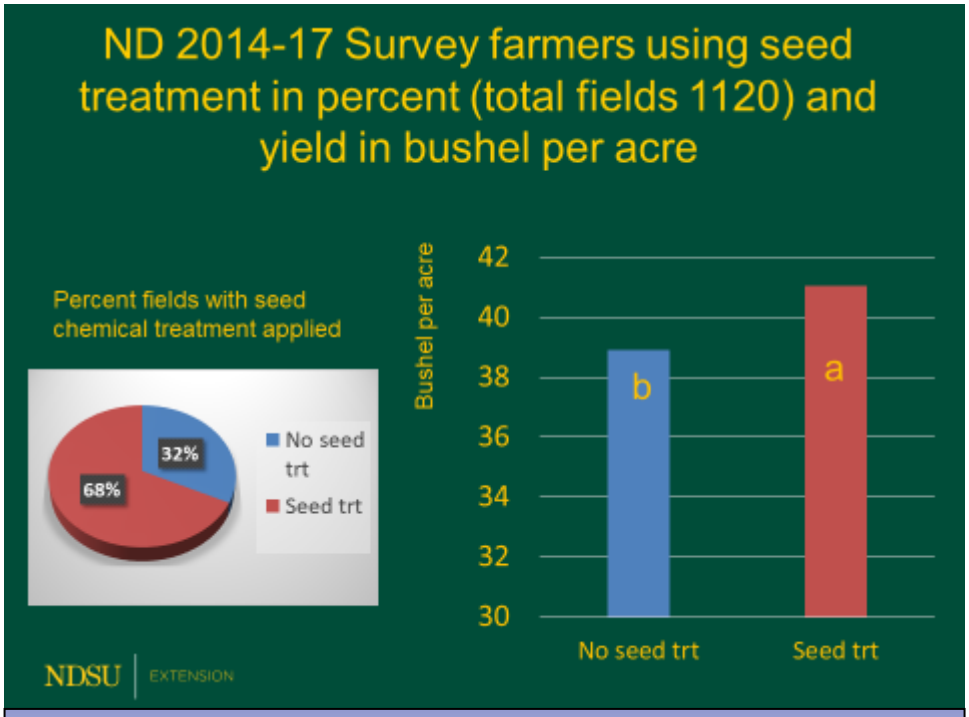

Figure 1. Percent North Dakota farmers reporting soybean seed treatment usage and differences in yield. North Dakota farmer survey results 2014-2017 (1,120 data points).

The impact that a fungicide seed treatment will have on plant population and plant health is related to the pressure from specific pathogens/diseases. Growers are most likely to see yield increases if the seed treatment used targets the pathogen(s) of greatest concern. Alternately, applying broad spectrum product, which provides efficacy on both fungal pathogens (such as *Fusarium* and *Rhizoctonia*) and oomycete pathogens (such as *Pythium* and *Phytophthora*), will increase the likelihood of managing root rots. A helpful resource developed by a multi-state group of University plant pathologists (under the name Crop Protection Network) provides general efficacy information on different fungicide seed treatments on many pathogens that impact soybeans. Although the resource only reports efficacy information on soybean root rots, some of the same pathogens also cause disease on other crops, so data may be useful. Importantly, the resources provide a *general* guide on efficacy against pathogens.

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Extension Agronomist Broadleaf Crops

2021 CORN DISEASE SURVEY

The Extension Cereal Crop Plant Pathology lab visited 110 corn fields in 20 counties during August 13 to August 23. Disease were recorded in each field and results were summarized to provide insight on the corn disease situation of 2021. The three most commonly reported diseases were common rust (non-economical), corn smut (non-economical) and Goss's wilt (economically important). Goss's wilt was found in 23% of the fields, and was mostly found to small pockets or field edges (Figure 1). Economic losses to Goss's wilt in 2021 will be much lower than previous years, and it is important to diagnose this disease this year to make management plans for next year (ie: use of resistant hybrids).

Figure 1. Small pocket of Goss's wilt in a field with close-up of infected leaf.

CORN STALK ROT

The biggest corn disease issue we will face this fall is stalk rot and stalk strength issues. Stalk rots, caused by several pathogens, can prematurely kill plants, shred the inner pith, and lead to lodging (Figure 1). Stalk rots are more problematic in fields that experienced significant stress (ie: moisture, disease, hail, etc), and the plants will cannibalize the nutrients in the stalk to promote cob fill. This allows opportunistic fungi (ie: *Fusarium*) to colonize the inside of the stalk. Sometimes fungal growth can be observed on the outside of infected plants near the nodes (Figure 1). Right now is a great time to scout for stalk strength in the corn crop. The best way to scout for stalk strength is using a pinch or push test. For each test, randomly select 100 plants in a field using a 'W' pattern, and if 10% of the plants fail the test, prioritize that field for an earlier harvest (if possible) to avoid potential lodging issues.

Figure 1. Corn plant that died prematurely from stalk rot with fungal growth on lowest node.

Pinch Test: Pinch the stalk at one of the lowest two internodes. If your thumb pressure causes the stalk to collapse, it fails the pinch test.

Push Test: Push the stalk to a 30-degree angle (8-10 inches), and if the stalk does not spring back to the original position, it fails the push test.

Andrew Friskop
Extension Plant Pathology, Cereal Crops

weeds

TWO NEW PALMER AMARANTH INFESTATIONS

Two new infestations of Palmer amaranth have been confirmed in Grant and Sioux counties. Investigations are still ongoing, but it appears the findings are linked to contaminated sunflower screenings being fed to cattle, as both operations received sunflower screenings in early 2021 and Palmer amaranth was detected near the remaining piles of screenings. In one operation, Palmer could be found everywhere that feed rations were mixed and spread. Both sites still had some remaining sunflower screenings, and we were easily able to find pigweed seed in the piles of feed.

Pigweed seed stuck to a hand after grabbing a handful of sunflower screenings. The small black dots are the pigweed seed.

Palmer amaranth growing in a pasture where sunflower screenings were fed this past winter.

Palmer amaranth growing near feed storage where piles of sunflower screenings remained from an earlier delivery.

Given the fact that Palmer amaranth infestations have been linked to sunflower screenings in at least 4 other counties in North Dakota, we are strongly encouraging anyone who purchased sunflower screenings for feed in the last 12 months to scout around their feed piles and feeding sites for Palmer amaranth plants. We also encourage everyone to continue scouting for potential Palmer amaranth infestations as we close out the summer and get ready to harvest the rest of our crops. Preventing seed production and seed rain in 2021 are some of the best tools we have to manage infestations beyond this year. If you find plants that you suspect are Palmer amaranth, please contact your county weed control officer, county Agent, local Area Extension Agronomist, Brian Jenks, or myself. Early detection will remain our best management tactic to prevent this weed from gaining a foothold in North Dakota.

Joe Ikley
Extension Weed Specialist

FALL WEED CONTROL CONSIDERATIONS

Fall is often one of the best, and most overlooked, times for weed control. Here are a few considerations for different weed control scenarios as the calendar approaches October.

Winter Annual Weeds

Those who are experienced with no-till production are familiar with the challenges that winter annual weeds present. In general, winter annual weeds were not of great concern in 2021 due to the statewide dry conditions last fall. However, many across the state, particularly the eastern half of North Dakota, have received adequate rainfall since August 1 to stimulate germination of winter annual weeds. Those of greatest concern are horseweed (marestail), narrowleaf hawksbeard, and brome grasses. Horseweed and hawksbeard are particularly difficult to control in the spring, so fall can be the best time for their control. Fall applications of 2,4-D or dicamba are usually sufficient to control our broadleaf weeds. Be careful to pay attention to crop rotations if dicamba is utilized. For winter annual grasses like the bromes, glyphosate is usually sufficient. In general, an application of glyphosate + 2,4-D over the next month will control most winter annual weeds and set us up for success next spring. For more detail on different herbicides and weeds, please see page 7 of the *2021 Weed Control Guide* for a table on weed control efficacy with fall applications.

Perennial Weed Control

Fall is also one of the best times to control our perennial weeds. Canada thistle, dandelion, and foxtail barley are the perennial weeds of most concern in rows crops. The questions we receive most often for control of perennial weeds is "when does our spray window close in the fall". Like everything else in agronomy, there is no black and white answer. However, there are a few key points to consider:

1) In general, herbicide applications will work best as long as daytime highs are in the 50's or above, and we do not receive a frost or freeze at night.
2) Control of Canada thistle and dandelion can often be better after we receive our first frost. The first frost is often a signal for plants to send more carbohydrates to the roots to survive the winter, and our systemic herbicides will follow this translocation pathway.
3) It is best to avoid a herbicide application if there is a frost or freeze in the morning. Systemic herbicides like glyphosate or 2,4-D work best when plants are actively growing. A frost or freeze in the morning will slow down growth of these plants on a given day. So if warm weather is set to follow a frost event, it is best to wait for a better day.
4) Once a hard freeze occurs (28 degrees F or below), plants will need to be evaluated. If above-ground plant tissue is no longer green, then herbicides will not be absorbed into the plants. However, if plants remain green, and if there is a series of warm days following a hard freeze, applications may still continue as the plants will still be growing and susceptible to herbicide applications.

Fall applications for Control of Kochia Next Spring

Dr. Brian Jenks at the North Central REC has conducted a series of trials over the years for fall applications of herbicides to control kochia the following spring. In no-till situations, he has observed fair to excellent control of kochia following an October application of Valor (flumioxazin). Flumioxazin is less water soluble compared to other herbicides like sulfentrazone (Spartan) that we use for kochia control. This helps explain why we see good residual control where we solely have snowfall and early season rain as the precipitation for activation. The best case scenario is near complete kochia control into mid spring, though we at least consistently see a reduction of kochia pressure (i.e. fewer plants to form a kochia 'mat') that allows for better coverage of spring applied herbicides. Note that a fall application of Valor will not control emerged winter annual or perennial weeds. If you have a mix of winter annual weeds, and a desire to control kochia next spring, you will need a mix of glyphosate + 2,4-D (or dicamba) + Valor.

Herbicide Carryover Concerns for 2022

The dry conditions throughout the summer have led to many concerns about herbicide carryover to certain crops next year. It will be beneficial to most everyone this winter to take a look at the herbicides applied this summer, and the rainfall requirements to allow for rotation to certain crops next year. The products of most concern are anything containing clopyralid, or many of our Group 27 herbicides that we use in corn. One note about clopyralid is that we get several questions each winter about a soil test that reports a certain PPM or PPB of clopyralid in a soil sample. As far as I'm aware, nobody has any clue what clopyralid reported in PPM or PPB means biologically for crops planted into that field next year. The best thing to do in fields of concern would be to take a soil sample this fall and conduct a bioassay over the winter. A thorough bioassay would take soil from the field of concern (i.e. a field treated with the herbicide) and compare it to a field with a similar soil type without that residual herbicide. The desired crop would be planted into flats or pots containing soil from both fields, and the growth of crops from both soil sources would be compared. If no herbicide injury is detected in the field treated with the residual herbicide, it would generally be safe to plant that crop into that field next spring.

Joe Ikley
Extension Weed Specialist

WEED MANAGEMENT IS A STRATEGY AND NOT A TACTICAL ACTIVITY

Congratulations for navigating a challenging field season. It is the harvest season which is agricultures' version of 'erasing the board' or 'cleaning the slate.' Stated differently, we erase the memory of spatial weed control challenges in fields when we harvest grain and clear the field for the next cropping season.

I remember when controlling weeds was a tactical activity. We observed weeds and timed their control with appropriate weather conditions. We assumed application would result in complete weed control if we followed label instruction and ensured weed sizes were correct at application. Well, as Bob Dylan once stated, 'the times they are a-changin.' Weed resistance, unfortunately, has changed everything.

Harvest time is note-taking time and a continuation of our weed management strategy. Collect notes at harvest including documenting the most important and second most important weeds in fields and draw spatial maps document where weeds are most severe. Check your record keeping to ensure herbicides used in 2021 was documented. You can add details such as Site of Action (SOA) grouping over the winter. As one prepares for 2022, consider herbicide options ensuring rotation flexibility, and above all, ensuring diverse SOA groupings for your next crop and for future crops.

I talk a lot about an integrated weed management plan for weed control. An integrated weed management plan is the most important component of weed control and it includes multiple levels. It begins by combining mechanical, chemical, and cultural control options. If you are like me, your weed management plan probably is heavily weighted to herbicides. I try to incorporate tillage into my programs by ensuring no emerged weeds at planting. I also am a believer in inter-row cultivation. However, the foundation of my weed control programs are herbicides. Next, I structure my programs to have at least two effective herbicides soil-applied and postemergence for control against my most important weeds in fields. Finally, and most important of all, I use the crop rotation to extend the integrated weed management plan into the next season, introducing unique herbicides from different SOA groups, especially against troublesome weeds like pigweed. What crop provides the best opportunity to nail your most troublesome weed? Seize that moment but don't let up; maintain weed control across the cropping sequence.

There was a time when weed control was a series of discrete operations that started and ended with each cropping season. Not anymore. Weed management must be a series of premeditated plans providing

continuous control extending across the crop sequence. And don't hesitate to change it up. As Stephen Powles, professor at the University of Western Australia stated, if your weed management plan is working then change it as you will want to ensure diversity in your programs and to protect against weed resistance.

Tom Peters
Extension Sugarbeet Agronomist
NDSU & U of MN

diagnostic lab

INTRODUCING SUZETTE BALDWIN

Suzette Arcibal Baldwin is the new Plant Diagnostician in the Plant Diagnostic Laboratory at NDSU. She obtained a B.S. in Agriculture at the University of the Philippines and a M.S. in Plant Pathology at the University of Georgia. She is currently a Ph.D. candidate in Plant Science working on Fusarium head blight on wheat and barley at the University of Idaho and is close to finishing her dissertation. Her contact information is below.

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forestry

WINTER PREP FOR TREES

This past year has been extremely tough on trees, especially in central North Dakota where the drought has been exceptionally bad. Some trees are doing okay, others are struggling, and some have already succumbed to a combination of drought, insects and/or disease. For the trees that are surviving, the dormant season will come with its own challenges. However, there are some management actions that we can take now to help trees survive the winter and even thrive next summer.

All trees could use some water, but it's even more critical for conifers that they go into winter fully hydrated. Conifers that are drought-stressed are more prone to the type of damage that is generically called 'winter injury'. Winter injury takes many forms and has several potential causes; nevertheless, studies have shown that trees that are well-hydrated going into winter are less likely to suffer damage over the cold season. Watering should get the soil moist, but not saturated, to as deep as you can get it. Remember also that tree roots extend far beyond the edge of the tree crown. The larger the area that can be watered, the better.

A young crabapple tree that was girdled by rabbits during the winter. Note that bark was removed from branches as well as the stem.

Foliar diseases haven't been as prominent this year because of the drought. However, if your trees had foliar fungal problems such as frogeye leaf spot, apple scab, oak leaf blister, or one of the anthracnose diseases, then be sure to rake up and remove or destroy all the fallen leaves this autumn. The fungal spores over-winter in the fallen leaves so getting rid of this source of inoculum will go a long way towards preventing foliar diseases next year.

Finally, make sure to protect the stems of young/small trees from the various ravages of winter. Often, this means putting some type of white wrap or corrugated white pipe on the stem to help prevent sunscald (another form of winter injury). Perhaps more importantly, these products can help prevent damage from deer, rabbits or voles. Make sure that the wrap goes high enough that it will reach well beyond the expected snowpack, as rabbits can climb the drifts and girdle stems or even branches of deciduous trees. Sometimes, it may even be better to place a fence further out from the stem, to keep the deer away from the branches.

Joe Zeleznik
NDSU Extension Forestry Specialist

AROUND THE STATE

NORTH CENTRAL ND

Several small rain events have moved through the area of the past couple weeks and have been a welcomed sight for so many. As we look forward, a drier pattern seems to be setting up once again in the short-term forecast. Here are a few local NDAWN station rainfall reports from the last two weeks (beginning September 6th): Minot: 0.16" (NCREC: 0.25"); Bottineau: 0.18"; Garrison: 0.20"; Karlsruhe: 0.47"; Mohall: 0.12"; Plaza: 0.23"; and Rugby: 0.21".

Grasshoppers continued to be observed in the region, but their activity has dropped significantly. In early August, the Ryder area was a high impact grasshopper zone. I had the opportunity to speak with a rancher from that area. He indicated that while grasshoppers are still being noted, the numbers are down overall.

Most area small grain fields have been harvested with a few select canola fields remaining to be completed. Soybean fields are mostly at the R-7 stage with several fields approaching full maturity. Sunflowers are nearing the R-6 to R-7 stage with a few fields still playing catchup in the R-5 stage. Most of the corn found in the region are at the R-4 to R-5 stage. Several area producers are applying herbicides for fall weed control.

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

Majority of the crops have been harvested and growers are pleasantly surprised with yields considering the drought situations of this cropping season. The crops remaining for harvesting are sugarbeets, potatoes, corn, sunflowers, soybeans and dry beans. Issues of white or greyish powdery stuff coating the combines was reported during canola harvest in Pembina and Cavalier Counties. This was identified to be powdery mildew infecting canola at later stages. No yield losses have been reported due to this disease. Livestock producers are worried about feed shortages in winter. Nitrate levels in feed hay continues to be a concern.

Anitha Chirumamilla
Extension Agent Cavalier County

SOUTH-CENTRAL/SOUTHEAST ND

According to NDAWN, the region's September 1-20 rainfall ranges from 0.8 inch (Zeeland) to 4.1 inches (Pillsbury), with the Carrington Research Extension Center (REC) receiving 1.7 inches. April 1-September 20 rainfall ranges from 6.9 inches (Cooperstown) to 16.3 inches (Wishek), with the Carrington REC receiving 8.1 inches.

Dry bean harvest continues; soybean harvest should be a general field activity this week; and corn is also in the harvest mix. Sunflower harvest also should soon be commencing.

Results of a sunflower survey, conducted during the past week by NDSU Extension in 15 commercial fields in northern and western counties of the region, estimate seed yield ranging from 1175-2820 lb/A and averaging 1780 lb/A. The most common yield reducing factors were drought, bird feeding and reduced plant populations.

2021 REC small grain and field pea variety trial data are available at www.ag.ndsu.edu/varietytrials/. The Carrington REC will be harvesting soybean trials this week. Also, planting of winter cereal variety trials commenced last week at the Center.

Extension agents Chandy Howard (left), Eddy County and Jeff Gale, Foster County, participating in the sunflower field survey.

Carrington REC irrigated soybean variety trial (September 20).

Greg Endres
Extension Cropping Systems Specialist
NDSU Carrington Research Extension Center

SOUTHWEST ND

According to NDAWN from April 1st to September 19th Dickinson received 8.85 inches of rain, compared to normal total rainfall of 12.34 inches. Over the same period Beach received 6 inches of rain with a normal of 10.9, Bowman 7.34 with a normal of 10.77, Hettinger 9.51 with a normal of 12.32, and Mott received 13.14 with a normal of 11.61 (most of this came in heavy rainfall events in May and early June causing the strange effect of flooding and drought stress in the same field). Utilize soil sampling this fall to identify and manage any issues that can cause drought stress on plants, even in adequate rainfall years, such as salinity and acidity. While conducting the National Sunflower Association sunflower survey we've seen a wide range in yields with drought a major yield limiting factor for most and weed control being highly variable. Some of the more common weeds seen in southwest ND sunflower fields this year are kochia, stinkgrass, green foxtail, tumble pigweed, and lanceleaf sage.

Figure 1 Drought conditions have had an impact on sunflower yields this year, pictured above is Ryan Buetow in a drought stress field estimated at 700 lb/ac in Bowman county.

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