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Against the Grain

Expecting the unexpected

My first year in office as president of the Minnesota Association of Wheat Growers has been much different than what I had expected. I am certain that the year ahead will hold some surprises as well.

Our organization has had to change and adapt to the new reality of a country dealing with a pandemic. We have done the best we could, given the trying circumstances. Our board meetings have been held either entirely on Zoom, or with a hybrid



model.

The marketing seminar, held annually in conjunction with Big Iron, was held using the hybrid model. In previous years, we normally hosted 100-130 people for a live event. This past September, about 80 people attended the live virtual event, with another 80 or so watching the recording. Many participants who registered this year were new to this event. Perhaps this model appeals to a somewhat different audience.

We want to continue to offer value to our members by hosting worthwhile educational programs. The Prairie Grains Conference was offered virtually this year and appears to have been successful — we actually increased attendance with the virtual format. In previous years, we have typically seen 600-900 attendees. This year, about 950 registered for the conference; about 700 people watched

the virtual event. I imagine that some of the others who registered may watch the recorded version later.

Unfortunately, it will be necessary to hold the Small Grains Update meetings in a virtual format. The presentation is scheduled for January 12, 2021. We hope all of you can find time to join us for the Small Grains Update meetings, however different these formats may feel.

While we miss seeing all of you in-person and hope for better days, we're continuing to be prudent and work through the challenges as they come. Feel free to contact us at MAWG if you have suggestions regarding the operation of your organization.

Respectfully,



Gary Anderson
President, MAWG

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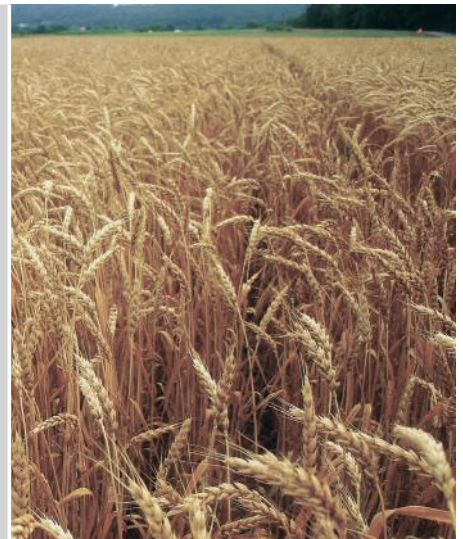
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VIRTUAL

Best of the Best in Wheat and Soybean Research



Monday, January 25, 2021

1:00 - 3:45 p.m.

AND

Tuesday, January 26, 2021

9:00 - 11:45 a.m.



Note: The program is different each day.

Sessions are free. Pre-registration is REQUIRED. Go online to <http://bit.ly/2KmAFl6>

The North Dakota State University and the University of Minnesota Extension, along with the MN Association of Wheat Growers, MN Wheat Research & Promotion Council, MN Soybean Research & Promotion Council, ND Soybean Council, ND Grain Growers Association, and ND Wheat Commission have joined together to present producers with current research information. In this workshop growers will have the opportunity to learn from researchers and extension specialists.

PROGRAM

Monday, January 25, 2021

1:00 p.m. Welcome & Introductions

1:15 p.m. **What Current Research is Telling Us About Managing Fertilizer for Soybean** - *Dr. Daniel Kaiser, Extension Soil Fertility Specialist, U of MN*

1:45 p.m. **2020: Wet Year, Yet Spider Mite and Grasshopper Injury?** - *Dr. Janet Knodel, Extension Entomologist, NDSU*

2:15 p.m. **BREAK**

2:30 p.m. Videos

2:45 p.m. **Considerations for the Xtend and Enlist Soybean Systems** - *Dr. Joseph Ikley, Extension Weed Specialist, NDSU*

3:15 p.m. **More Acres and Less Time - How Do You Address Climate Weirdness?** - *Dr. Jochum Wiersma, Extension Small Grains Agronomist, U of MN*

Tuesday, January 26, 2021

9:00 a.m. Welcome & Introductions

9:15 a.m. **Soybean Sudden Death Syndrome: Changing Lessons Learned in the Northern States** - *Dr. Dean Malvick, Extension Plant Pathologist, U of MN*

9:45 a.m. **FM Reduction in Soybean (a Twofer): Managing Herbicide Resistant Weeds While Protecting Exports** - *Dr. Seth Naeve, Extension Soybean Agronomist, U of MN*

10:15 a.m. **BREAK**

10:30 a.m. Videos

10:45 a.m. **Top Secret Grain Marketing Strategy (Have a Plan)** - *Dr. Frayne Olson, Crops Economist/Marketing Specialist, NDSU*

11:15 a.m. **Expected Weather Patterns for the 2021 Growing Season** - *Daryl Ritchison, Director, North Dakota Agricultural Network, Fargo*

Sponsored by:



TAMING THE BULLS



BY BETSY JENSEN



& BEARS

I've come too far to quit now

Have you ever started watching a movie, get thirty minutes into the movie and realize it is a bad movie? The movie is horrible, but you keep going because you started the movie. You have already wasted 30 minutes of your life, so why not another 90? When the movie is done, you have wasted two hours of your life.

We do it all the time, and not just with movies. We can add books, TV shows, a home improvement project that should have been abandoned before it got worse. In economics it is called the Fallacy of Sunk Costs. We do not want to admit that we wasted 30 minutes on a bad movie, so we keep hoping it will get better, and end up wasting two hours on a bad movie.

I have been doing the same thing with my 2020 soybean sales. There must be a way to make up for the sales I made too early. Can I spend money on call options or find some sort of fancy spread to make up for the fact that I sold too early? I cannot accept that I sold my soybeans too early and I am spending more time and money trying to make up for it.

It is difficult to walk away from a bad sales decision. Most years I would be

thrilled with my fall soybean sales but not in 2020. I cannot take back my 2020 sales and now my bigger concern is my 2021 sales. I am working hard to make sure my 2020 sales are not clouding my judgement for 2021.

Instead of spending time looking back, I need to look ahead and see the opportunities for 2021. Do not invest any more time or money into your previous sales and look ahead to opportunities for your remaining 2020 inventory and the 2021 bushels coming next fall.

Fancy hybrid contracts may be one method farmers will try to add some money to their early 2020 sales. I will caution you to look before you leap. Make sure you understand the contract and the potential risks and rewards. The rewards may be easy to see, but you need to make sure you understand the risks. If you cannot understand how you might lose money, then you do not understand the contract and you need to walk away. Never sign up for something without knowing the risks.

I want you to think about the Fallacy of Sunk Costs not only for marketing but your entire farm. What have you

been doing on your farm every year? It might be your crop rotation, your machinery purchases or even the size of your operation. Are you doing it with a purpose or because it is habit? If you had to start farming from scratch, what would you change about your farm? What would you keep the same?

Let's begin 2021 with a wider view of your farming operation and decide what is working well, and what could be improved. I regret selling soybeans this fall, but selling off the combine has worked well for my operation. I would rather deliver soybeans than wheat in the fall and I am going to stick with my plan for 2021. I have already priced soybeans for fall 2021 delivery. I still want prices to keep going higher so I can sell more.

Keep asking yourself: "Do I want to waste more time on this?" It might be as simple as a bad movie or it could be a tractor that is nothing but trouble. There is a point when we need to stop expecting things to change and instead accept that we have already wasted enough time and need to move on. I am looking ahead to 2021 with optimism and forgetting the regrets of 2020. 🌾



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Between weather, fluctuating markets and ever-shrinking margins, you have enough to worry about. The North Dakota Grain Growers Association will represent your interests on regulation and policy issues so you can focus on raising the best crop you can. Let's work together to ensure North Dakota agriculture remains profitable for generations to come.

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KEYS TO SUCCESS

Balance, consistency can pay dividends in wheat varieties

By Shawna Aakre
Continually Still

After hitting a record 67 bushels per acre average in Minnesota in 2017, wheat yields have seen three consecutive years of steady declines. To top that off, the last three years have included falling numbers, wet weather and low commodity prices. All of these factors weigh on growers' minds as they make wheat variety choices for the upcoming seasons.

"If we look at the state average in Minnesota, we only eked out 53 bushels to the acre," said Jochum Wiersma, University of Minnesota Northwest Research and Outreach Center Small Grains Specialist. "That is three bushels less than the previous year. It begs the question are we in a downward trend or are we just stringing a bunch of bad luck years together?"

He believes the answer may simply boil down to an unfortunate set of circumstances, including the unworked and untreated acres the fall of 2019,

the late start in 2020 and areas with a significant amount of drown-out acres, which have all contributed to recent losses. Within the state average, Wiersma said there is more variability than previous years.

"The highest yield I heard of was actually in Morris where a grower got 95 bushels per acre," Wiersma said. "But that was planted very early in the beginning of April when they got a little break in the weather."

The variation in yields and protein content of varieties has Wiersma advising farmers to continue using what he calls a "hedging approach" to variety selection. He recommends choosing some varieties with a little more grain protein to hedge against high yield years and varieties that will get very close to 14 percent protein to hedge against the low yield years.

"The highest protein varieties are not necessarily the ones that produce

the most protein content on a per acre basis. In this case, the honor goes to 9590. High yielding varieties like Trigger really struggle to get to 14 pro," Wiersma said. "Even though they produce a fair amount of protein, they dilute it with a lot of starch. Then you have a middle cluster of balanced varieties that won't necessarily give you the highest yield, but they are not going to be very low protein because they don't dilute it with as much starch," Wiersma said.

While some average yields may be higher or lower in a given year or field, a variety's rank across locations for a number of years can determine its value. Wiersma said that a stable performer in this arena would be a variety that has performed consistently high in grain yield and protein.

He created a visual representation of these characteristics to map out which varieties farmers can count on to be stable performers (see graphic). Wheat

varieties with a lower number have lower variance, and anything below the blue line is more stable and balanced than the performers above.

“If you look at the three-year data, things start to fall right where our gut tells us they will. Trigger right now is by far the highest yielding variety,” Wiersma said. “Valda is one of the top varieties that is pretty consistent. Shelly is a little bit of a surprise and probably has to do with lodging. Prosper we have seen bounce around a little, which probably has to do a little with straw strength but more so it is probably a symptom of rust, and the varieties in this data set do not receive fungicide.”

Wheat diseases are also an important consideration in variety selection. Wiersma said varieties that are strong against Fusarium Head Blight (FHB), even with fungicides, should be a part of a grower’s variety selection. Avoiding scab damage to wheat is especially important at market.

And selecting for Bacterial Leaf Streak (BLS) is key since there are no control options available. BLS is gaining more attention in both the public and private sector and Wiersma stated breeders are working carefully to select against the disease.

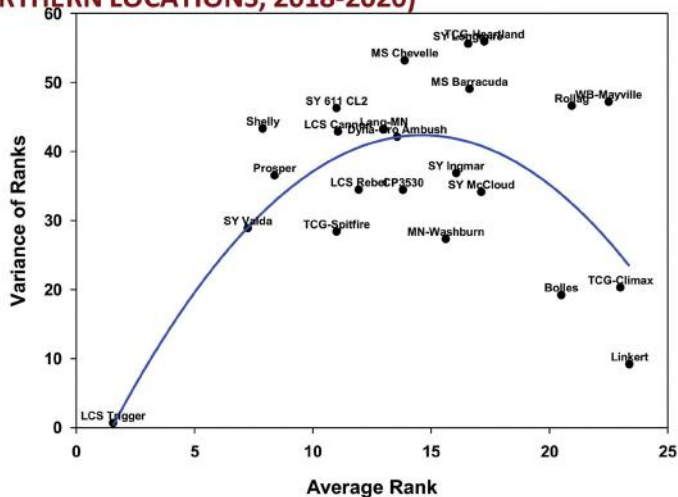
“We now have in both FHB and BLS a lot of options with really good resistance to these two diseases. Inmar, Valda, Torgy Washburn, Trigger and Lang are all varieties that combine very good BLS resistance with very good FHB resistance. Those two things in combination with some very decent stem rust and leaf rust resistance, as well as some decent resistance to tan spot Septoria, means that you more than likely will need only a single fungicide application throughout the growing season, depending upon the risk model,” Wiersma said.

Disease susceptibility, as well as balanced variety considerations, played a role in top wheat variety picks made by Wiersma and UMN Professor of Wheat Breeding and Genetics Dr. Jim Anderson.

“Jim and I maintain that Lang should be one of our picks, only at the lowest seeding rate of 900,000 to 1 million

RANK STABILITY

(NORTHERN LOCATIONS, 2018-2020)



Wheat varieties with a lower number have lower variance and anything below the blue line is more stable and balanced than the performers above.

plants per acre, especially in southern Minnesota, because it has such a good reaction to BLS, is a big consistent performer, has very good FHB resistance and is in the balanced category,” Wiersma said.

Interestingly, while it is one of their top picks, Lang is actually dropping in planted acres. Wiersma said he finds this a little bit unfortunate because of its strengths, but understands it may be partly because of the lack of straw strength. He said that researchers have learned that for this variety, lowering the seeding rate to their recommendations can significantly improve straw strength and is on par with both Shelly and Valda.

The duo added Trigger to their picks this year because of its yield and BLS and FHB ratings. Wiersma cautioned that Trigger will struggle to get great protein content, especially in the northern part of the Red River Valley. For this reason, he said it should probably not be a grower’s first choice if they farm in that area, but moving south it becomes less of an issue.

Linkert remained in the lineup this year because of its straw strength, despite weakness to FHB. Torgy was added

because it has yielded consistently and has much better BLS and FHB ratings than Shelly. Washburn, Ingmar and Valda also remained on the list because they are mostly balanced and have good ratings for FHB and BLS. Wiersma was quick to point out that while Valda is not great for baking quality, it only becomes an issue if there was too much acreage that couldn’t be blended with higher varieties.

For those wondering why WB9590 is missing from their list, Wiersma said it is simply because the variety has very poor ratings for both FHB (7) and BLS (6). Despite those ratings, the percent of Minnesota wheat acres planted in WB9590 have increased in recent years.

Meanwhile, Linkert has seen a decrease in percent acreage over the same time period. But the 2013 UMN release still holds the top spot of Minnesota’s wheat acres, covering 19.6 percent of the state’s wheat ground. Wiersma attributed that statistic to the variety’s stability and straw strength.

Overall, he said there are a great number of options for farmers looking for a strong, balanced variety in the 2021 growing season. 🌾

Beating back BLS

Variety selection remains best tool against Bacterial Leaf Streak

By **Shawna Aakre**
Continually Still

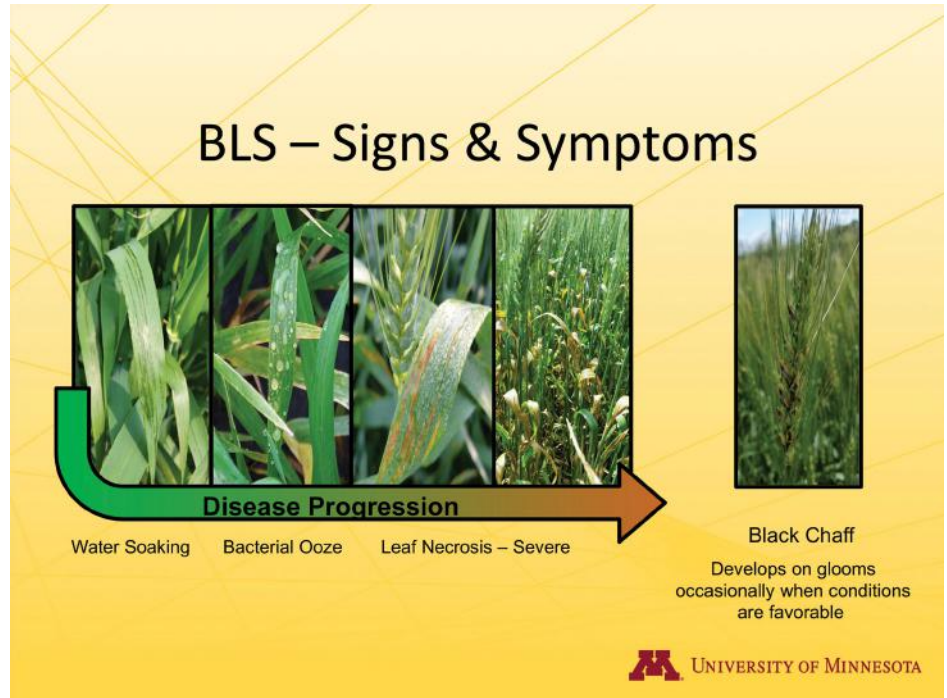
Bacterial Leaf Streak (BLS) has worked its way to the forefront of wheat farmers' minds over recent years, rivalling Fusarium Head Blight for attention. In fact, University of Minnesota Professor Dr. Ruth Dill-Macky said the disease has probably become the second most important for wheat production in the region.

"This is one of the few bacterial diseases we deal with on wheat in the upper Great Plains," Dill-Macky said. "I think the use of fungicides has increased our awareness of BLS in terms of being able to identify it since fungicides kill fungi but not the bacteria. We have some challenges in that we don't fully understand the epidemiology, and so we continue to work to understand pathogen populations."

Dill-Macky pointed out that their research has shown that BLS has several different pathovars that affect different plants. They have found that *Xanthomonas translucens* pathovar *undulosa* is the only group found on wheat and is not the same as the group commonly found on barley. She said for that reason, they plan to concentrate their wheat work on using resistance to *undulosa* specifically.

But while researchers are still trying to paint a full picture of BLS, farmers' most powerful tool continues to be variety selection. Dill-Macky said that avoiding really susceptible lines is as important – maybe more so – than selecting for resistance.

The good news is some varieties from the current breeding programs have shown fairly good resistance, according to Dill-Macky. Varieties that stand out to



her include: Boost, Dyna-Grow Ballistic, LCS Trigger, MN-Washburn, NDVitPro and TCG-Spitfire.

“... it might not be until the plant is more mature that we are seeing infections, which is why often the visual symptoms of the disease won't show up until that five-leaf stage.”

— Dr. Ruth Dill-Macky, UMN

In addition to variety selection, Dill-Macky stressed the importance of weed management.

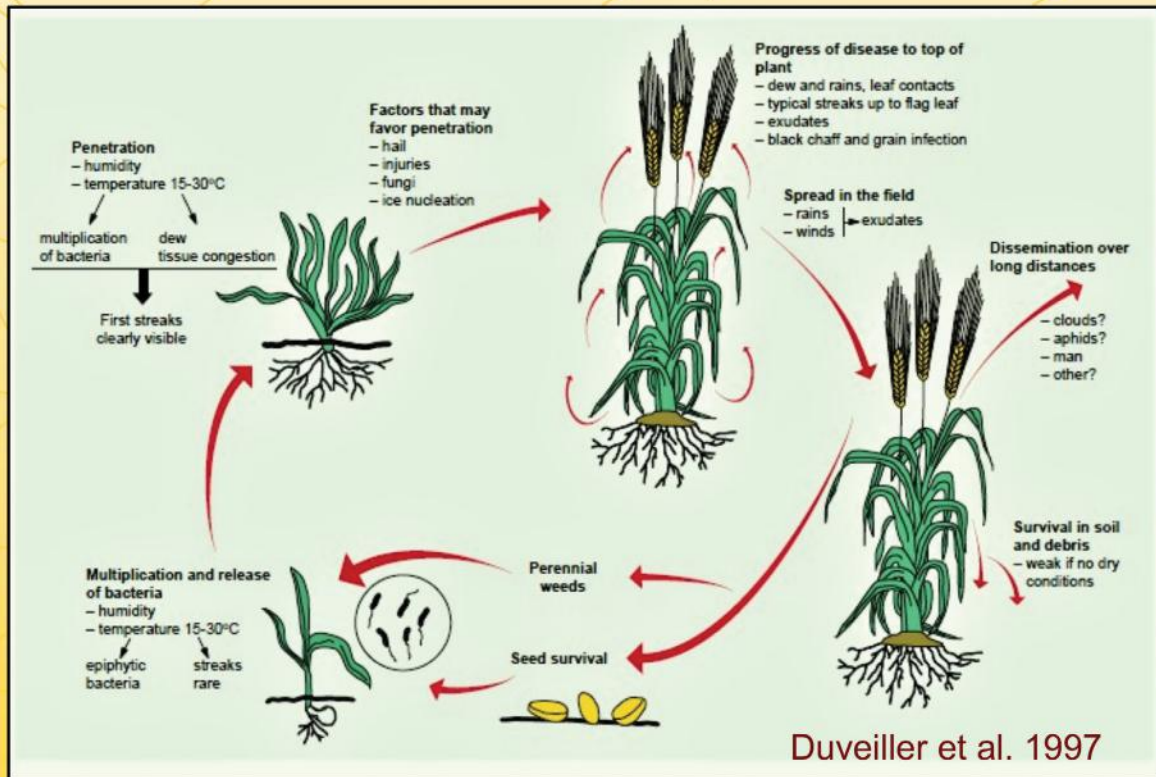
“In the last year or two, we have just

completed work looking at the BLS pathogen *undulosa* and its presence on weedy grasses around the fields,” she said. “This shows we have a presence on many of the common grasses like foxtail barley, green foxtail, perennial rye grass, quack grass and wild oats. We believe these grasses provide a mechanism for this pathovar to survive from one season to the next.”

Dill-Macky said researchers also have questions about BLS's survival on seed from one season to the next. Since molecular techniques for identification of *undulosa* have been identified, Dill-Macky said they can now test seed for the specific pathovar. This could lead to research in potential seed treatments if significant levels of BLS are found in seed lots.

Even if the bacteria survive on a host plant or seed, she said that does not mean they are necessarily good at getting into

Disease Cycle



the plant by themselves. Besides needing a penetration point into the plant, from frost, hail or tire track damage, BLS must go through what Dill-Macky calls the epiphytic phase. This phase involves bacteria multiplying on the plant in order to have sufficient numbers to infect the plant. The period of time for this phase varies greatly depending upon environmental conditions and the condition of the leaves.

“I actually suspect that the leaf epiphytic phase is starting very early,” she said, “but it takes the bacteria weeks and it might not be until the plant is more mature that we are seeing infections, which is why often the visual symptoms of the disease won’t show up until that five-leaf stage.”

She said both warm temperatures and wet conditions are favorable for BLS. But contrary to what researchers thought at the beginning of understanding

the disease, it turns out that warm temperatures are more of a key driver than wet conditions. In her opinion, this observation is one of many that highlight the importance for continued work to understand BLS and identify management techniques.

Wheat farmers have expressed key interest in discovering ways to manage the disease during the growing season, including some biological control and chemical work both at the seed level and exfoliate applications.

Dill-Macky and her colleagues have plans to explore these in the future. These plans include looking at potential BLS survival on the wheat seed itself, exploring the efficacy of seed treatments and putting together a working group to examine the efficacy of foliar treatments. BLS research to screen materials from the breeding programs in the upper Midwest will continue to be ongoing

through the cooperative screening nursery set up between Minnesota, North Dakota and South Dakota universities.

If farmers are concerned about BLS in their wheat fields, Dill-Macky lists some key characteristics by which to identify the disease.

“Symptoms generally appear after heading. Translucent stripes on leaves start as small sub legions. You can hold leaves up to the light and see through them,” she said. “Later on, the legions produce honey-like milky-dew droplets, which eventually harden into a clear substance. In the field you will see substantial areas of the leaf damage, which causes the yield losses associated with BLS.”

For the foreseeable future, Dill-Macky continues to stress that variety selection remains the best tool for farmers to manage BLS. 🌾

Reasons for optimism

Nitrate from tile drainage, surface runoff remains low

By **Shawna Aakre**
Continually Still

Common knowledge tells us nitrogen leeches to some extent through tile drain water. But there are still questions surrounding just how much nitrogen farmers are actually losing in this form and how it affects soil fertility.

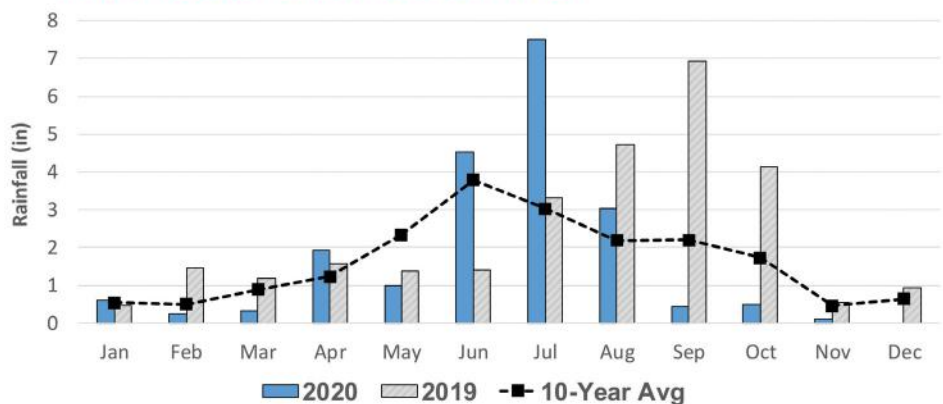
With this in mind, a study to evaluate nitrogen loss via surface runoff and tile drain began in 2020. It was an exciting year to begin collecting samples after a wet fall in 2019 and rain well into the following growing season, according to Dr. Lindsay Pease, Assistant Professor and Extension Specialist in Nutrient and Water Management at the University of Minnesota Northwest Research and Outreach Center in Crookston.

“We did a lot of data collecting this summer, and this year has been unlike any other,” Pease said. “So far, the data shows that we can really see those concentrations of nitrate increasing in both our tile water and our surface runoff from May into June and the highest being in July. And I think that tracked pretty well with what we were seeing with relation to our rainfall.”

Pease noted that nitrate concentrations in surface runoff increased to a lesser amount than in tile drainage. She and her team also found that the concentrations were not high at any of the farm locations monitored.

Instead, measurements were fairly low to average for what should be expected,

It rained a lot this summer



especially compared to the 10 parts per million drinking water standard for nitrate, she said.

“I don’t think that it comes as a surprise to you to know that on average we were well below that standard, even during our really heavy rainfall periods. That is one of those things that is nice to know, put it in your back pocket,” Pease said. “I know a lot of you have heard of the nitrate restrictions in southern Minnesota. But our nitrate concentrations do

look to be lower from this snapshot view. So I would say that the exemption we have in northern Minnesota seems to be holding up, which is always what we like to see.”

She said their continued research will focus on how rainfall influences

the nitrate shift into water and how tile drainage specifically is moving that nitrate out of the field. Pease and her team would also like to determine how much of the field’s nitrogen is actually being lost and if soil fertility is relevant to that loss.

“Nitrogen does not like to stay put. It is rapidly changing forms and readily moving into air or into water. The soil moisture content and how happy the microbes are with their environment are all things that are primary drivers for how nitrate shifts in the environment,” Pease said. “So our work is to really focus on how rainfall is influencing the nitrate to shift into water.”

The future objective is to pair specific rainfall patterns with concentrations data currently being analyzed in their laboratory.

That information will be related back to the pounds of nitrogen applied to a field, and the amount farmers are losing from the field. They hope to paint a more complete picture of nitrogen loss for farmers with drain tile. 🌾





8th Annual On-Farm Research Virtual SUMMIT

Wednesday, January 20, 2021

8:30 a.m. - 12:00 p.m.

FREE to all participants. Pre-registration is REQUIRED.

Register at <http://bit.ly/2WBP9jI>

Listen to MN Wheat's On-Farm Research Network Coordinator about updates on this year's on-farm research results. Other invited speakers will also discuss tile drainage, corn fertility and more.

Participate in group chat discussions about what the data means for your farm and bring your ideas for new research to investigate!

PROGRAM

- **Seeding Rates:** Moving lower in 2020 to compare rates of 0.75, 1.25, and 1.75 mil plants per acre
- **Flag-leaf Fungicide:** 3 years of fungicide trial testing
- **N-stabilizers:** Comparing anhydrous ammonia and urea fertilizers with and without N-stabilizers
- **Within-Field Protein Variability:** Review the current findings of on-combine protein mapping
- **Elevated P and K Fertility:** Year two results of increasing P and K fertility over four years in a wheat-soybean rotation in small and large plots
- **Rye Cover Crop:** Rye affect on soybean stand, weed pressure and soybean yield.
- **Reassessing Corn K Fertility Guidelines in On-farm Trials**
- **N-Losses in Tile Drainage & the RRV Watershed**
- **More to come!**



OFNR Research Funded by:





CONTROL FREAKS

Increasing nitrogen use efficiency is a complex issue

By Shawna Aakre
Continually Still

Farming is a business rife with factors that growers can't control. To learn more about how those factors influence nitrogen use in wheat during the growing season, the Minnesota Wheat Council is taking proactive measures by funding a study.

The research on nitrogen use efficiency (NUE) suggests there is no – or very little – relationship between available soil nitrogen and wheat yield or protein content.

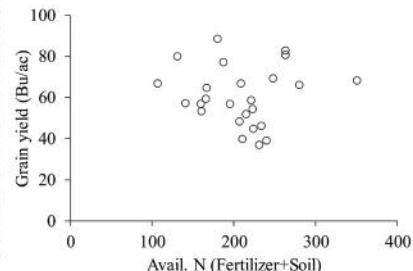
That conclusion comes from the cumulative 25 field sites studied the past three years by North Dakota State University Associate Professor of Soil Science Dr. Amit Chatterjee. He said yield and protein content varied across the Red River Valley depending upon April and July rain amount and intensity.

“Yield and protein content both appear to be more affected by other factors, like growing season conditions, rather than

Site		Applied-N lb N ac ⁻¹	Yield Bu ac ⁻¹	Protein %	NUE %	
2018						
1	Argyle	Linkert	240	66.2	14.54	33
2	Crookston	Climax	180	39.2	16.5	26
3	Roseau	Linkert	100	80.0	12.76	75
4	Red Lake Falls	Linkert	86	53.2	13.18	42
5	Grygla	Linkert	157	80.7	12.22	36
6	Gentilly	Linkert	142	39.7	12.65	28
7	St. Hilaire	Prevail	142	52.1	13.79	32
8	Fosston	Rebel	160	88.5	15.74	78
9	Ada	Shelly	50	64.6	13.86	52
10	Glyndon	Linkert	138	48.3	12.99	29
2019						
1	Argyle	Westbred9590	157	56.8	15.44	45
2	Gentilly	Westbred9590	162	37.0	12.65	21
3	Dorothy	Linkert	151	58.7	14.24	38
4	Mahnomen	Trigger	168	54.3	10.25	25
5	Ada, MN	Shelly	179	82.8	14.92	47
6	Red lake Falls	Ingmar	134	57.0	14.99	54
7	Thief River Falls	Vakla	100	66.8	11.79	74
8	Rustad	Bolles	123	57.2	15.81	65
2020						
1	Argyle	Westbred9590	184	69.2	14.7	39
2	Gentilly	WestBred 9590	175	66.7	12.2	37
3	Ada, GM	AgriPro	169	77.1	15.3	60
4	Ada	Vakla	142	44.7	15.7	30
5	Fosston	Rebel	134	59.4	16.0	55
6	Rustad-no tile	Prosper	190	68.4	17.9	33
7	Rustad-Tile	Lang	168	46.2	18.0	34

NUE= (Grain - Nitrogen)/(initial soil-N + Fertilizer-N)*100

- 25 sites have been survey for N loss in the last three years
- Cultivar selection is becoming diverse (from mostly Linkert in 2018)
- Average fertilizer-N application rate was 149 lb N/ac
- Average grain yield was 60 Bu/ac and protein 14.7%
- Average nitrogen use efficiency was 44%
- Grain yield did not correspond to soil available N



this applied nitrogen application or soil nitrogen,” Chatterjee said. “So, keep that in mind, if you are applying too much nitrogen you are losing nitrogen usage efficiency. You may not have a bunch of nitrogen loss, but what you have is just

sitting out there.”

Chatterjee pointed out that the general NUE (grain-N divided by fertilizer-N) of wheat ranged from about 25 to 78 pounds per acre. He said some key components are driving nitrogen use in

Which factors are driving nitrogen losses?

Factors	C_N2O	C_NH3
Fert-N	0.12	0.08
	0.55	0.70
Soil N	-0.24	-0.22
	0.24	0.29
BD	0.25	0.41
	0.23	0.04
pH	-0.25	-0.61
	0.22	0.001
OM	0.42	0.44
	0.04	0.03
P	0.53	0.74
	0.01	<.0001
K	0.55	0.03
	0.001	0.89
Rainfall		
Apr	-0.29	0.08
	0.15	0.69
May	0.29	0.35
	0.17	0.09
Jun	0.09	-0.15
	0.68	0.47
Jul	-0.44	-0.10
	0.03	0.63
Aug	-0.24	-0.21
	0.24	0.31

More food for micro will increase N₂O loss

Negatively related to July rainfall means more rain less N₂O loss??!

Soil properties control volatilization rather than rain

wheat fields throughout the growing season, including soil organic matter, soil contents like phosphorus and potassium, environmental conditions and cultivar selection.

“These factors have something to do with this cumulative nitrous oxide (N₂O) loss (denitrification). And how much compactness of the soil, soil pH and organic matter content have some relationship with cumulative ammonia (NH₃) volatilization loss,” Chatterjee said. “Rain has little effect, but overall, the nitrous oxide and ammonia losses are mostly driven by inherent soil properties of which growers don’t have much control.”

Based on data collected, more July rainfall can lead to less nitrous oxide loss, while more nutrient food available to microorganisms will increase nitrous oxide loss.

Chatterjee said NUE is also impacted by organic matter. Knowing how much nitrogen to apply then becomes a balancing act.

“So you need to have an idea of how much your soil organic matter is supplying nitrogen and just don’t apply too much nitrogen,” he said. Over time, if you are applying more fertilizer than ideal, your NUE is declining. If you have high soil nitrogen to begin with, then you are going to flatten out your NUE around about 70 pounds of nitrogen per acre. After that your NUE is dropping.”

He said he tells growers they can increase their NUE to 50 or 60 pounds per acre just by reducing fertilizer nitrogen application.

The decision should not impact yield or protein since the biggest factors he has seen affect those are genetics and environment. Excess nitrogen application is not increasing wheat productivity he said, but is instead being lost due to site characteristics and organic matter content.

Chatterjee and his team will continue to monitor field nitrogen in the first zero to six inches, and top two feet of soil to paint a broad picture of nitrogen use in different situations. 🌱

Advertorial

PREPARING FOR PLANTING SMALL GRAINS

Planning for Planting the 2021 Wheat Crop

Grant Mehring, WestBred® Technical Product Manager, Northern Region

I once heard a good agronomist challenge an audience – he felt that, as important as it is to get seeds planted correctly, no one takes it seriously enough. He concluded that you get one chance to make all the right decisions to get seed-to-soil contact just right and keep your yield potential high. I would like to challenge you to change one thing for 2021 planting so when that seed hits the seedbed, you know you did everything you could to give it the best shot at maximum productivity.

Helpful Tips to Plan Ahead for 2021 Planting

- **Planting Date** – Plant earlier and timelier.
- **Variety Selection** – I know you have two to three wheat varieties on your farm. Now, purposefully switch varieties halfway through a field instead of at the end, to give yourself more side-by-side data to use toward 2022 decisions. Certified Seed Only (CSO) varieties offer newer genetics and improved disease protection and protein potential.
- **Seeding Rate and Calibration** – Know the seeding rate you want to plant at, and have the correct math done from your seed lot’s germination and seeds per pound. Additionally, have your air seeder calibrated to your seed before you really start planting in earnest.
- **Seed Depth and Placement** – Check your seeding depth for a 1.5-inch target depth at the start, and recheck the seed depth throughout planting. Also, check that all row units are dropping seeds and are not clogged.
- **Seed Treatment** – Your first-planted wheat has the highest likelihood of adverse environmental conditions, so ensure there is fungicide and insecticide seed treatment on that seed, if not all seeds.

For additional information, contact Grant Mehring at 701-373-1591 or grant.mehring@bayer.com.

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Searching for answers

FODMAP levels show no relationship to breeding

Shawna Aakre
Continually Still

A downward trend in U.S. wheat flour consumption from 146.3 pounds per capita in 2000 to 132.1 pounds per capita in 2018 is a concern for wheat farms across the region. If this trend continues, it may have negative consequences for the entire wheat industry.

While the removal of starches in recent fad diets have been a large contributor to that trend, concerns remain about

wheat consumption among those with celiac disease, gluten sensitivity, wheat allergy to the protein and non-allergy-no-celiac wheat sensitivity.

“For those who are not impacted by the gluten, the question becomes ‘what is causing the sensitivity?’” said Dr. George A. Annor, University of Minnesota assistant professor of Cereal Chemistry and Technology. “We think the sensitivity could be coming from FODMAPs and ATIs.”

FODMAPs, or fermentable oligosaccharides, disaccharides,

monosaccharides and polyols, aka short-chain carbohydrates (sugars), can also be found in foods other than wheat, like rice, fruits and vegetables. Most people are able to tolerate FODMAPs lower than 0.3 grams per serving, which Annor said would amount to about two slices of bread.

With hopes of increasing wheat consumption in the future and reducing discomforts resulting from wheat-based products, Annor and UMN Professor of Wheat Breeding and Genetics Dr. Jim Anderson are analyzing a diverse panel of 220 wheat lines to determine if they can breed wheat lines to reduce levels of FODMAPs and ATIs (Amylase Trypsin inhibitors), an inhibitor of starch and protein digestion.

To do this, they have taken ancient, heritage and modern wheat varieties grown in Minnesota plots to identify specific genetic markers for FODMAPs and ATIs.

So far, Annor has determined the different sugars and specific fructans on wheat varieties to quantify the

FODMAPs in each variety sample.

“There is a wide variation in some samples,” Annor said. “Even though they look very small as they are all below this 1.6 percent, if you go back to the fact that some people need below 0.3 grams per serving, these values are still significant.”

Anderson has compared his own DNA fingerprint of each variety to Annor’s FODMAP data to develop a picture of which specific genes or genome region(s) are responsible for FODMAP variation. He said the data has shown that there are a few genes on different chromosomes affecting FODMAPs.

“While it is a preliminary result, it does show us that the trait is under complex genetic control,” Anderson said. “We were hoping to get lucky and maybe find one or two genes controlling the trait. That would make it easier and faster to breed for reduced FODMAP levels. But it looks like it is going to be a complex trait based on this early analysis.”

On a positive note, the data demonstrates there is no trend of a higher number of FODMAPs in more

modern wheat varieties versus their heritage or ancient grain counterparts. Anderson said it is reassuring to know regional programs have not inadvertently been increasing FODMAP levels through breeding.

Beyond FODMAPs, Anderson and Annor have yet to explore ATIs.

“Based on the literature that I’m familiar with in this area, I think the ATIs are maybe going to explain some of these issues more than the FODMAPs actually do,” Anderson said. “And then we also have the processing to look at and the effects of different fermentation on FODMAP and ATI activity in wheat food products.”

Anderson and Annor continue to move forward with their multi-year research project that is funded through the Minnesota Department of Agriculture’s Agricultural Growth, Research, and Innovation (AGRI) Grant, in collaboration with the Minnesota Wheat Research and Promotion Council, the Agricultural Utilization Research Institute and Back When Foods. 🌾



NEW 2019 Varieties

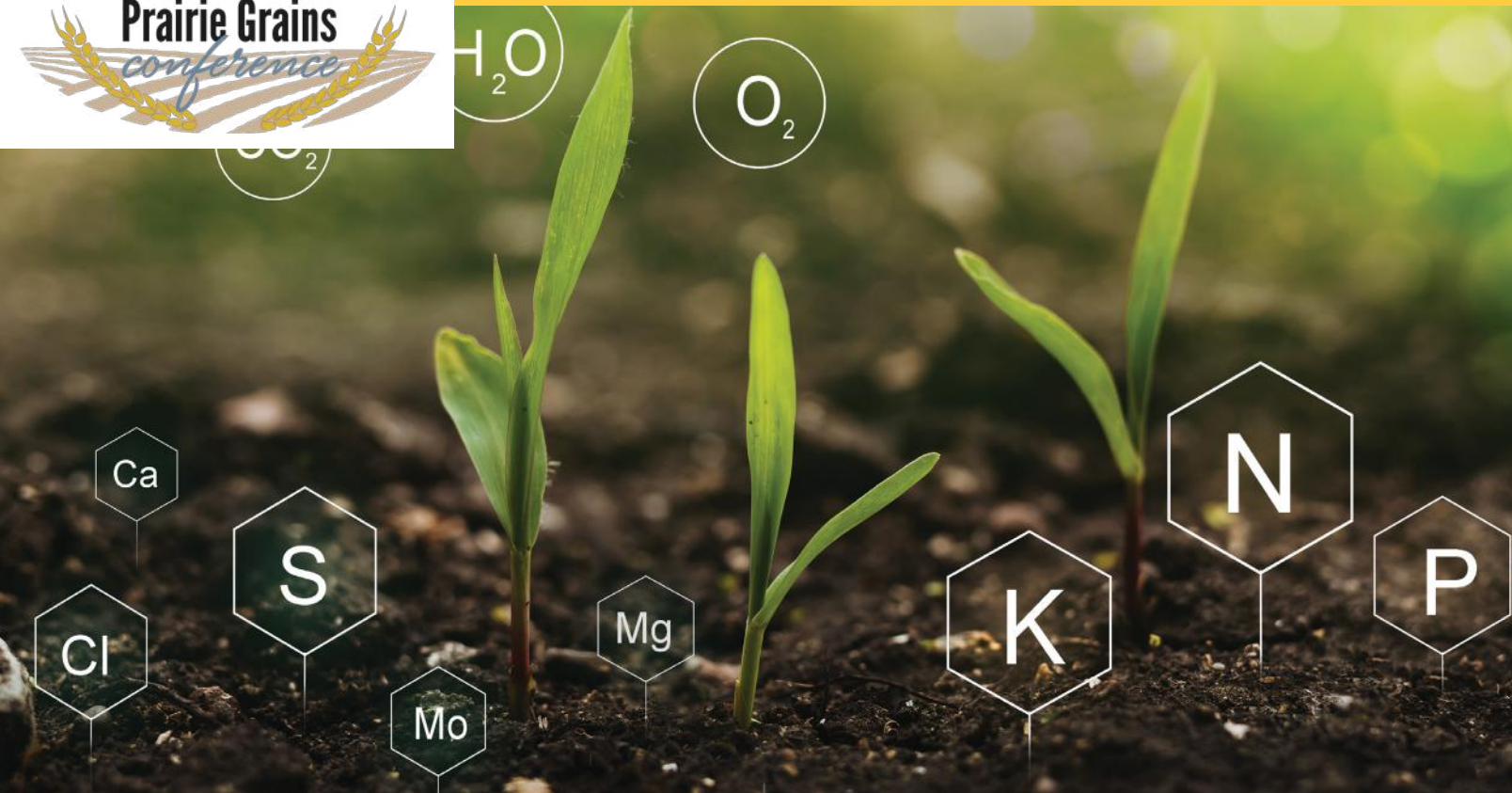
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Maximizing plant growth, yield

Phosphorous, potassium add benefits in wheat-soybean rotation

By Dan Lemke

Spirited Communications

University of Minnesota Research Agronomist Dave Grafstrom and colleagues at the Magnusson Research Farm near Roseau are conducting small plot replicated research and large on-farm trials to determine the influence of elevated levels of phosphorus (P) and potassium (K) on wheat and soybean growth, plant development, yield and seed quality.

Leibig's Law of the Minimum states plant growth is limited by the nutrients that are most scarce.

The goal is to provide the necessary micro and macro nutrients in quantity needed to maximize plant growth and yield. Researchers are evaluating what role P and K levels play in wheat and soybean development.

Grafstrom says a 50 bushel per-acre soybean crop removes about 40 pounds of P and 70 pounds of K. An 80 bushel

per acre wheat crop removes 50 pounds of P and 30 pounds of K. A 7-30-30 fertilizer will not supply the needed P and K, so plants have to mine soil to obtain the P and K needed for high yields.

The four-year research project started in 2019 and incorporates both small plot and larger on-farm trials. Crops are planted in a wheat-soybean-wheat-soybean rotation.

There were two test sites in 2020, one wheat and one soybean plot. Grafstrom says the P source was 0-46-0 and the K source was 0-0-60. Application rates included 20, 40, 60, 80 and 100 units of each product and combinations. The nutrients were applied in the spring and incorporated prior to planting.

Data collection included early season crop vigor, tissue tests, yield and grain quality and post-harvest soil samples. Soil and plant tissue analysis will help determine if elevated P and K levels are causing an interaction with other plant

nutrients like zinc and calcium.

2020 wheat results in small plots showed yields ranged from 67 to 76 bushels per acre.

"Higher wheat yields were detected from the combination of 40, 60, 80 and 100 units of P and K versus untreated," Grafstrom says.

P soil levels tended to or increased as P rate increased in soils testing low, 3.3 parts per million (ppm), or high, 16.3 ppm. P applied alone or in combination at 60, 80 and 100 units increased soil test P. Soil P test levels increased with the application rate K soil test levels tended to or increased with all K rates/.

Soybean test plot yields ranged from 61 to 69.8 bushels per acre. Research showed yields were higher from the combination of 20, 40, and 60 units of P and K versus untreated plots.

Grafstrom says more data is needed before recommendations can be made from the findings. The third year of the trial will be conducted in 2021. 🌾



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ACTION

Creating a weed control playbook

By Dan Lemke

Spirited Communications

A key to defeating any tough opponent is to formulate and execute a superior game plan. That concept holds true on the football field as well as in the soybean field.

Tom Peters is an Extension Sugarbeet Agronomist and Weed Control Specialist for North Dakota State University and the University of Minnesota. He says winter is the optimal time to prepare and develop a weed management strategy, including one that may include some new approaches because weeds like waterhemp will be prepared for the start of the season.

“This time of year is when you reflect on what worked and what didn’t work, then listen for new ideas to see if there’s something that you can do differently,” Peters says.

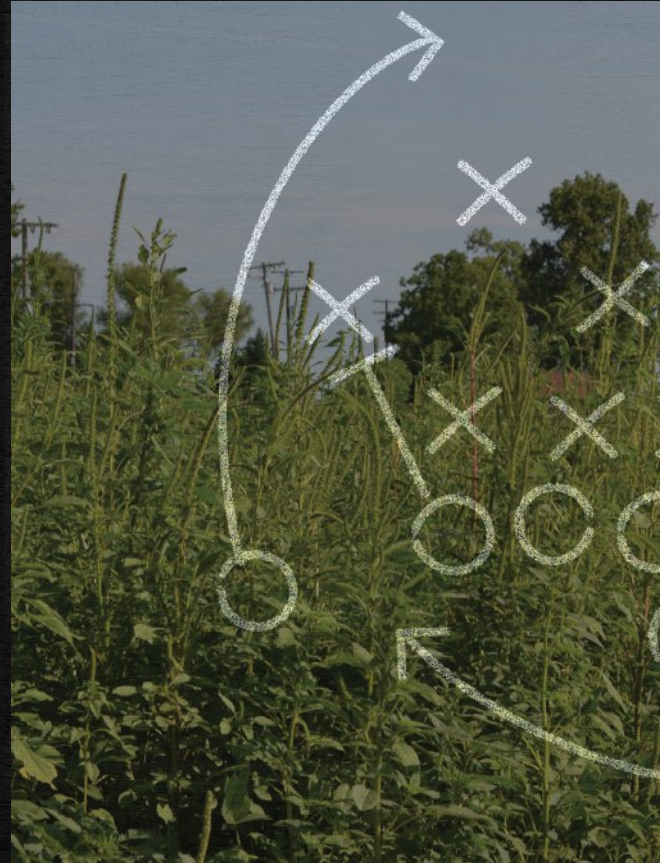
Peters and other Midwestern weed researchers contend waterhemp will be the most problematic weed to manage, especially if farmers rely on herbicides alone.

Waterhemp is hard to manage and it flourishes in part because it can be difficult to differentiate from other pigweed species. Waterhemp has an extended germination period, grows rapidly and is well-adapted to conservation tillage. A reliance on only post-emergence herbicide applications has also allowed waterhemp to thrive.

Waterhemp has a wide window in which new weeds can emerge, creating management challenges. Waterhemp needs a wet period followed by drier conditions in order for seeds to germinate and weeds to develop. Peters says that can happen from May through August or later.

Peters says some of the 2020 waterhemp control issues may be traceable to the wet fall of 2019.

“We had 2-inch tall waterhemp in September that had 50 or 60 seeds on them,” Peters recalls. “Some of the 2020 weeds may



have come from seeds left on the surface. Waterhemp does whatever it can to get up, out of the ground, and make seed.”

Specific plans

Herbicide resistance is problematic for weeds in the pigweed family. Palmer amaranth is resistant to eight herbicide sites of action, waterhemp is resistant to seven and redroot pigweed is resistant to five sites of action. Because of that resistance and a reduced number of herbicide control options, Peters says it’s vital to take care of the active herbicides still available.

“Part of what a management plan does is document what you’ve been doing so you can change it up and do the best you can to create some diversity,” Peters says. “Since there aren’t many herbicide options available,

PLAN



we've got to reach out of the herbicide toolbox and try something different."

Waterhemp and other pigweeds are prolific seed producers. One waterhemp plant alone can produce nearly 300,000 seeds. While those seeds lose viability in the seed bank each year that they're in the soil, research shows 10 percent of waterhemp seed are still viable four years after they were produced.

Peters says farmers can't afford to play the averages, rather they should rank fields based on waterhemp pressure and farm those fields accordingly. That includes planning the crop sequence on those acres to rotate crops and herbicide treatments.

Effective waterhemp management will involve more than chemical treatments. Peters says it may take some unconventional methods to successfully manage

waterhemp populations, including cultural practices.

"We have to consider cultural control practice alternatives," Peters says. "We've got to cultivate again or look at some of the cultural methods."

In some instances, Peters says moldboard plowing could be an option to bury waterhemp seed deeper into the soil. Peters says plowing is like hitting the reset button on a field.

A diverse approach

Peters contends that farmers have made it easy for waterhemp to thrive by doing roughly the same things every year. Incorporating a third or even a fourth crop would help with waterhemp management.

"Small grains are seeded earlier than corn and soybeans. Farmers drill it and fertilize it differently than they do row crops like corn and soybeans," Peters says. "They use different herbicides, leave different residue, and harvest at different times of the year. You make it different for waterhemp, which I think is a good thing."

Alfalfa is a crop that can help thwart the spread of waterhemp. Alfalfa is typically kept in a system for about three years. Waterhemp seed is viable for four years. Hay is mowed several times a year, which would also cut down waterhemp plants and keep them from producing seed.

"Alfalfa isn't going to work for everybody, but it is a way to create diversity," Peters says.

Peters advocates using an integrated weed management approach that includes chemical, mechanical and cultural practices. Research has shown that planting soybeans in narrow rows with higher plant populations helped soybeans reach canopy sooner than wider rows with lower densities. That canopy closure is important to shade out competing weeds.

"Integration is a combination of things. In a herbicide sense, it's using different herbicides, a different sequence of herbicides and mixtures of herbicides," Peters says. "The second phase is mixing it up with cultural and mechanical methods."

Like any good game plan, Peters says it's important that farmers study their foe, learn about the weed's biology and then personalize weed management to match the weed and the field and then make adjustments to that plant if necessary. 🌾



A DAMAGING DUO

SCN, IDC can wreak havoc on soybean fields

By Dan Lemke
Spirited Communications

Soybean cyst nematode (SCN) infestations are an ongoing threat for many Midwestern soybean producers. SCN is the most destructive soybean pathogen in the United States, causing significant yield losses. SCN-induced damage in the U.S. is estimated at more than \$1 billion each year. Since the nematode can be present in fields without causing obvious aboveground symptoms, yield losses caused by SCN may be underestimated.

The soybean cyst nematode is a microscopic roundworm that attacks soybean roots and a number of other host plants. Soybean cyst nematode infection causes damage to plants by physically penetrating and moving through the roots. It also causes physiological damage by altering the metabolism of the root cells surrounding the nematode.



Scouting plays a key role in determining which diseases and pests might be robbing a field of yield gain. Photo courtesy of United Soybean Board and the soybean checkoff.

The SCN life cycle is typically about four weeks. In central to northern Minnesota, the nematode completes three, possibly four generations each growing season.

In addition to battling SCN, many Minnesota and North Dakota farmers also contend with iron deficiency chlorosis (IDC) in their fields. Soybean plants need iron to produce the chlorophyll necessary for photosynthesis. Without iron, plants don't grow normally. Most fields have enough iron in them, but it's not always in a form plants can use. If plants can't meet their iron needs, yellowing occurs in the leaves.

Researchers at the University of Minnesota studied the interaction between IDC and SCN to learn more about their effects on soybeans.

Soybeans were planted in pots with differing SCN populations and different soil pH levels. Researchers evaluated the amount of soybean biomass produced in each scenario, measured the plant chlorophyll content, and counted SCN

populations after the first and second generations.

Results showed that soybeans grow better in soils with lower to neutral pH levels. When compared to pots

“Soil sample to know if you have an SCN infestation and if you're able to keep densities low. You'll never get rid of it, but you can keep numbers low.”

— Angie Peltier, UMN Extension

containing no SCN, even low SCN populations of 500 eggs/100 cc resulted in lower soybean plant biomass. Trends accelerated at higher SCN densities and at higher soil pH.

Research also showed higher SCN

reproduction at higher soil pH.

“It shows that SCN, at least in the first and second generations, produces and reproduces better in more alkaline soils,” University of Minnesota Extension Educator Angie Peltier says.

Peltier says research showed soil pH had an effect on IDC as early as five weeks after planting. Impacts were greater with higher pH.

Research shows that SCN accentuates the impacts of IDC and farmers need to manage both IDC and SCN to achieve maximum yields.

Among the first steps Peltier recommends is getting a soil sample.

“Soil sample to know if you have an SCN infestation and if you're able to keep densities low,” Peltier says. “You'll never get rid of it, but you can keep numbers low.”

Peltier recommends rotating away from host crops to non-host crops like corn, sunflower and alfalfa, and rotating sources of SCN resistance when planting soybeans. 🌱

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High-tech soybean scouting

Remote Sensing for Soybean Aphids

By Dan Lemke

Spirited Communications

Soybean aphids are an all-too-familiar pest that can steal soybean yield if infestations reach damaging levels. Determining the level of aphid populations in fields can be a time-consuming process. Remote sensing is showing promise for helping to determine if aphid populations warrant treatment.

University of Minnesota Extension Entomologist Robert Koch says current recommendations for aphid management includes scouting fields and counting aphids to determine if insect density has reached economic threshold to consider an insecticide treatment. The recommended action level is 250 aphids per plant.

“It’s at that point you need to begin lining up an insecticide application to knock down that infestation before it reaches economically damaging levels,” Koch says.

Aphid scouting is time-intensive,

costly and doesn’t always give a complete picture because it only provides information on a small subset of areas from throughout the entire field. Koch says farmers are looking for a more efficient way to determine if aphid treatment is necessary.

Koch and fellow researchers are evaluating remote sensing technology that involves reading the electromagnetic spectrum. Plants reflect the sun’s energy. Remote sensors can intercept and measure how much energy is being reflected along different wavelengths of that electromagnetic spectrum. Changes within a plant can affect the energy that is being reflected. Those changes could be caused by abiotic stressors, drought stress, pests or other factors.

Tests using handheld sensors to evaluate controlled soybean plots documented that soybean aphids did affect soybean reflectance. The sensor, held just above the soybean canopy, could detect stress caused by the aphids. Researchers took the next step to evaluate if sensors hung from drones could also detect stress in soybeans caused by soybean aphids. An aerial view

would give farmers a look at conditions in a larger portion of the field. As was the case with handheld sensors, the drone-based monitoring was successful.

“From a handheld sensor on the ground or from a drone-based sensor flying over the field, we can detect the stress that soybean aphids are causing to soybean plants,” Koch says.

Koch says further research is being done to determine if scientists can use spectral reflectance data to classify soybean aphid infestations as being above or below the treatment threshold. Results showed that they could.

“Based on machine learning, we were able to accurately classify soybean aphid populations at a level of 89 percent accuracy as being above or below that threshold,” Koch says. “This is really promising from the perspective of being able to use drone-based remote sensing data to make decisions for management of soybean aphids in soybeans.”

Promising research

While results of remote sensing are promising, Koch says there is still a lot to learn, including about other stresses

that may be occurring at the same time as aphid infestations. Tests are underway to evaluate if the presence of Japanese beetles, which chew holes in leaves versus sucking the sap from the plant stem like an aphid, will affect the ability to differentiate between stresses.

Koch says treatment thresholds for the Japanese beetle are 30 percent defoliation before the soybean plants flower and 20 percent defoliation after flowering. Researchers wondered if feeding injury



by the Japanese beetle would affect their ability to detect soybean aphid stress on soybeans.

Research was conducted in 2019 and 2020, and tests are set for 2021. Koch says preliminary results are encouraging.

“Results are not fully analyzed, but preliminary results are indicating that the more typical levels of defoliation caused by the Japanese beetle, right around five percent defoliation, can sometimes cause an increase in reflectance in the red wavelengths, but we’re not seeing an impact on reflectance in the near infrared (NIR) wavelength,” Koch says. “That’s promising for soybean

aphids because we’re seeing the biggest impacts of soybean aphids on those NIR wavelengths, which are not being affected by the Japanese beetle.”

Koch says remote sensing technology is promising for helping farmers decide to treat or not treat soybeans, but there is still a lot of on-going work. Research is looking at other stressors, including diseases, as well as the economic aspects of using remote sensing versus traditional scouting methods.

Koch says researchers are now considering if a satellite-based system could detect infestations on an even broader scale. 🌾



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FIELDS OF DISEASE

As soybeans grow north, so do troublesome foes

By Dan Lemke
Spirited Communications

Soybean acres have expanded in northern Minnesota and North Dakota in recent years, providing farmers with additional cropping options. Along with that expansion comes the spread of soybean diseases that require management.

University of Minnesota Plant Pathologist Dean Malvick says as soybeans move north, some diseases are following close behind. He says soybean diseases will continue to be a challenge to achieving high and consistent soybean yields.

“The challenge is figuring out which of these diseases we need to be concerned about and need to be managed,” Malvick says.

Sudden Death Syndrome

Sudden Death Syndrome (SDS) is relatively new in the northern part of the state, but it can cause significant problems. While symptoms appear on the leaves, Malvick says SDS is really a root disease. The fungus that causes the disease affects the roots and produces a

toxin that moves up into the leaves.

SDS was first discovered in southern Minnesota nearly two decades ago. Since then, SDS has been spreading. The disease is now widespread in Minnesota and is showing up in parts of North Dakota.

Malvick says one of the first major risk factors is having the pathogen in a field.

“Once the pathogen is in there, it will be there for a long time,” Malvick says. “One of the issues is it’s showing up in fields where it’s never been before.”

Other SDS risk factors include compacted and poorly drained soils. High soybean cyst nematode (SCN) populations also increase the risk, as does planting susceptible soybean varieties.

Symptoms show up as yellowing, chlorotic leaves. Those symptoms look very similar to plants infected with Brown Stem Rot.

Malvick says SDS management should include scouting to determine where the risk is highest. Planting resistant varieties is important, but Malvick

admits there are limited options for varieties that can be planted in the north. Seed treatments labeled for SDS are also effective management tools.

Brown Stem Rot

The soil-borne pathogen that causes Brown Stem Rot (BSR) builds up in the soil over time. Malvick says the risk grows as more soybeans are planted.

BSR can cause significant yield loss. Ten to 20 percent losses are most common, but up to 30 percent loss can be attributed to the disease in infested fields. Because it is often confused with SDS, splitting the stems is the key to identifying BSR. Plants infected with BSR will have brown pith in the lower stem.

BSR thrives in cool temps during flowering. Leaf symptoms are most common when conditions are wet at flowering and pod fill, then dry afterward. The disease is also enhanced by SCN and soil pH below 6.5.

“Symptoms aren’t always visible on leaves,” Malvick says. “You have to split

stems to diagnose it.”

BSR can be managed with crop rotation. The pathogen prefers soybeans and overwinters in infected soybean stems, so the longer a field is away from soybeans, the lower the pathogen in the soil. Planting resistant soybean varieties is also important.

White Mold

Malvick says farmers are quite familiar with white mold of soybeans, but the disease can still be difficult to manage. He says among the concerns is low resistance to white mold in new soybean varieties, especially in herbicide resistant varieties. Some varieties are being rolled out without adequate levels of white mold resistance.

Malvick says it’s important that farmers know the white mold risk for each soybean field and plant the most resistant varieties available. Cultural practices such as reducing plant density and increasing row spacing can mitigate white mold risk. Fungicide treatments can dramatically decrease white mold and increase yields when applied properly and at the right time. 🌾

Frogeye Leaf Spot hopping northward

Frogeye Leaf Spot (FLS) is a foliar disease that had been fairly uncommon in the north, but it has been increasing in recent years in both Minnesota and North Dakota.

Malvick says the disease was such a concern in some Minnesota fields that fungicide applications were needed to manage the disease. Symptoms include oval spots on the leaves that gradually grow together and kill leaf tissue. Like other soybean diseases of concern, FLS can cause significant yield loss.

“FLS has been an issue on farms in the South because it favors warm, humid weather,” Malvick says.

The pathogen overwinters in infected soybean residue and is best managed through crop rotation, tillage and fungicides. Malvick says FLS management is complicated because the pathogen is widely resistant to strobilurin class of fungicides.



Frogeye Leaf spot is common in the South but has shown up recently in Minnesota and North Dakota. Photo via the Soybean Research & Information Network.



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Blanket approach

Cover crops offer soil-rich opportunities

By Dan Lemke
Spirited Communications

Spring wheat is one of the first crops harvested each year, leaving a lengthy period between harvest and first frost. Farmers tend to till wheat stubble after harvest to prepare the soil for the next year's crop, but the frost-free period following harvest presents an opportunity for cover crops to really take root.

North Dakota State University (NDSU) Extension Agronomist Hans Kandel says many farmers turn the soil black, so it warms faster in the spring. Kandel hopes farmers consider establishing live cover to improve soil health and mimic nature.

Kandel says cover crop plants can take up leftover soil nitrogen instead of having the nitrogen leach away, but he says there are many other benefits.

"A live crop is important to soil health because we have a living root system, and a crop growing that is able to add organic matter," Kandel says. "Cover crops prevent erosion, improve soil characteristics, reduce pests and enhance subsequent crop yields. What we are aiming for long-term is to add more biological life, to add more nutrition to the soil that is recycled."

Kandel's research has examined the advantages of planting various cover crops including legumes, brassicas and winter annuals.

Each cover crop can serve a different purpose. Legumes, like field peas, can fix soil nitrogen. Brassicas grow well



Live cover crops are important to soil health because of the living root system a living plant offers. Photo courtesy of United Soybean Board and the soybean checkoff.

late into the season because they're cool season crops. Radishes for example, also develops a deep tap root to loosen the ground. Some plants can survive winter, some cannot. Winter camelina and winter rye can survive winter. Once the weather warms in the spring, those plants are already established and ready to take advantage of the sun's energy.

Solar Powered System

Because wheat is typically harvested

in August and the average first frost for North Dakota and northern Minnesota is around Oct. 1, there is an extended frost-free period that provides an opportunity for cover crops to grow.

After the frost, winter annuals go dormant. By March or April, winter annuals break dormancy and begin to grow again, presenting another opportunity for crops to capture sunlight before primary crops are planted.

"There is time in the fall and in the

spring where we can utilize some of the daylight,” Kandel says.

Kandel says ideal cover crops should be inexpensive, easy to establish and grow rapidly, low maintenance, easy to terminate and shouldn't interfere with the following crop.

“The biggest challenge is to fit cover crops into the rotation,” Kandel says. “Farmers need to decide which benefits are important to them, find a system that is adapted to their geographic region and balance short-term economics with long-term benefits. What we're looking at is a system.”

Benefits aplenty

Cover crops not only offer soil health benefits, the forage can be used for grazing cattle, but, Kandel says, there needs to be enough moisture to get the crop established.

Kandel's trials included planting various cover crops into wheat stubble following harvest. He measured the

growth various plants achieved in the period between planting and the typical first date around the first of October. By the end of September, canola that was planted as cover crop 89 percent canopy coverage, field peas had 92 percent ground coverage and rye covered 76 percent. Totals also included the canopy coverage provided by volunteer wheat.

Kandel also measured the amount of biomass produced by the crops between late August and the first frost date. Including volunteer wheat, along with the cover crops, canola provided 1,284 pounds of biomass per acre, field peas produced 1,161 pounds and winter rye 760 pounds of biomass per acre.

Farmers sometimes practice green planting, which is planting crops such as soybeans right into standing cover crops like rye, then terminating the rye before it competes with the cash crop. Kandel says in that case, moisture is important. In a dry year, cover crops may need to be terminated sooner to preserve moisture


for the cash crop.

Kandel says cover crops can be interseeded with soybeans once the lower soybean leaves turn yellow. Following soybean harvest, there is still opportunity for crops like winter rye to establish.

Kandel has experimented planting cover crop seed into small soybeans early in the year when the plant is small. The trial included planting winter camelina and cereal rye into soybeans with a variety of maturities. Cover crops were planted at the R7 stage of the earliest maturing soybean.

In the 2017 and 2018 studies, camelina produced an average of 259 pounds of biomass per acre; rye 449 pounds.

“More cover crop biomass was produced in the earlier maturing soybeans because we had more light there for the cover crop to grow,” Kandel says. “There was no negative effect on the soybean yield from the cover crops, but earlier maturing varieties yielded less than the full season varieties.” 🌾



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opportunity to sell. Farmers could contract out 18 months in advance.

“I hope farmers remember that,” Jensen says. “When we look ahead to 2021, we have some pretty good prices for soybeans. If you’ve already run through your numbers, you’ve already paid for your fertilizer, you’ve written out the checks for your seed, you have a good handle on your 2021 cost of production. Can you lock in a profit at this time? If you have the opportunity, you’ve got to jump on it.”

Jensen says many in agriculture spent most of 2020 believing they weren’t going to make money farming. Prices last spring weren’t profitable, there were huge grain stocks, huge crops on the way. Then the outlook changed in a big way.

“Now we have the opportunity to lock in profits for 2021, and I hope that farmers are looking at that and it’s causing them to take some action,” Jensen says.

One of the most common mistakes Jensen sees in farm marketing is growers

not taking advantage of profitable opportunities.

“The grain bin is not a hope chest,” Jensen says.

How farmers market and contract their grain is a personal issue and should

“That is always my fear when farmers use our numbers or university numbers is that they consider themselves average, and they are not average.”

— Betsy Jensen, FBM Instructor

be tailored to each farm’s needs Jensen explains. Growers should make their plans and schedule deliveries when it works for them, including when they need cash. Available storage and even the

distance from the elevator can also weigh into the decisions.

Soybean markets may have grabbed the most attention, but Jensen says it appears there will be some marketing opportunities for wheat. After years of making sporadic purchases, China became an aggressive wheat buyer in 2020, increasing their U.S. wheat purchases by 788 percent from 2019. Jensen says even though China’s purchases have been hit and miss, there should be some opportunities for profitable sales in 2021.

“Even in spring wheat right now, there is a carrying charge. You can get 30 to 40 cents more for delivery in deferred months, depending on when you want to deliver, than you can for wheat today,” Jensen says. “It is a good opportunity to look ahead to make sales.”

Farmers can still make acreage changes for 2021, but Jensen says right now making some small sales at profitable prices is a great way to start off the 2021 crop year. 🌾



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Dry times?

NDAWN's Ritchison expects drier weather moving forward

Shawna Aakre

Continually Still

At two to three degrees above average, the summer of 2020 was one of the warmest recorded for the northern plains. It also ended as a drier year for most of North Dakota and the surrounding region, although some growers' experiences may differ.

"According to data we are looking at, it is drier than 2012, 2006, 1936 and 1934. So, compared to some of the dry years that come to everyone's mind as exceptionally dry, this past year was just as dry. One of the things that ended up saving us in many ways was the wet fall in 2019," North Dakota Agricultural Weather Network (NDAWN) Director Daryl Ritchison said.

The autumn of 2019 was historically one of the wettest on record, but he said recorded data since 1825 does not tell the whole story. He said there is evidence provided by historical tools that show some weather events that may happen once every 200 to 400 years.

Using many of these historical tools, including bur oak chronologies and Great Lakes water levels, Ritchison likes to paint a picture of wet and dry periods before determining future forecasts. Those indicators show that wet cycles tend to last anywhere from 15 to 30 years, with an average between 20 and 25 years.

He cited scarring on bur oak trees in wet years as a record of these cycles. They point to wet periods in the 1820s, 1870s and early 1900s and distinct dry periods in 1830s, 1860s and 1930s.

Ritchison said he also believes pairing historic data alongside more recent markers shows that North Dakota and the region are in a slow process of transitioning out of a wet cycle that began in 1993 and moving into a slightly drier pattern that began in 2020.

To demonstrate this, he said drought in the northern plains tends to follow close after the year peak water levels are reached in the Great Lakes.

“We now have reached another peak in the Great Lakes in the years 2018 and 2019. Using history as a guide, what do you think is going to follow us into the 2020s? No one knows the future,” Ritchison said. “I look at this as just another tool.”

He carefully pointed out that no one should assume 10 straight years of drought because there are always some wet years thrown into drier periods. Similarly, there are drier years thrown into wet cycles.

“Even in the 1930s it was not 10 straight years of drought. But really, what I tell people is that we are going to go back to that historical rainfall average,” Ritchison said. “Most of North Dakota has averaged between 15 and 25 percent more rainfall during this wet cycle than we did from the century average.”

Also, a generally drier forecast does not mean there will not be wet pockets.

“I always want to remind folks that it is extremely rare that everyone is dry or wet. Looking back, I would say my forecast that we would be drier for the past year was mostly good. But the folks

in Kittson County just call me crazy because you are exceptionally wet. And that’s always the case when you live where we live because we are highly dependent upon thunderstorms.”

He said precipitation forecasts give the general flavor for the region. But his forecasts will not be 100 percent accurate for everyone due to problems associated with thunderstorm precipitation varying drastically from location to location.

Oceanic temperatures are another tool Ritchison takes into consideration to give an outlook. The equatorial Pacific Ocean is currently seeing a moderate La Nina, a cooling of ocean surface temperatures, which he said is the strongest since 2010-12. Ritchison said the region began to dry in 2011, after a few wet years, and then was hit by a significant drought in 2012.

But since there have been La Nina times with and without drought, he said it is also important to look at where El Nino zones are located throughout the oceans before making a determination.

“I always remind people that in the weather, x never equals y . In reality it is more like t , u , v , w and x equals y . There is always something else going on. To say just one thing is causing another thing is way over simplistic.”

Ritchison foresees two different precipitation scenarios during the next six months that are largely not much different for the northern plains.

“In the first scenario North Dakota is drier than average in 2021. In the second, the southern plains are a little bit above average, but again we are dry, Ritchison said. “If this comes true, then it would in a way be a repeat of 2016-17 for western North Dakota. I think there are many reasons we can expect 2021 being dry more than we can wet.”

Ritchison also believes the northern plains can expect above average temperatures during the summer. But he does expect those temperatures to be cooler than 2020, which means growers will see less growing degree days in comparison. Farmers in many parts of North Dakota had anywhere from one to

300 more growing degree days for corn and soybeans in 2020 than in 2019.

A La Nina has also been noted to bring colder than average temperatures in the spring months of March and April, so Ritchison said farmers could be held back in the spring.

He said that when narrowing in on local forecasts there are more factors to take into consideration. Soils, for example, have a huge impact on localized temperatures. Farmers know these things very well, Ritchison said, and he continues to learn about these micro climates as more NDAWN stations go up around the state.


There are 161 NDAWN stations in North Dakota and 50 of those collect soil data. NDAWN does have plans to expand the number of stations monitoring soil characteristics.

More than 30 NDAWN stations have been added to the western part of the state and the hope is they will be online before the 2021 growing season Ritchison said. Also of note is the \$6.4 million grant from the Army Corps of Engineers to add more stations and upgrade current ones in the Upper Missouri River Basin to help monitor river water flow.

More stations located across the state have allowed Ritchison to confirm differences in localized weather patterns that farmers say they observe. But on a broad scale, he believes a lot of our current weather is following historic patterns reasonably well.

Ritchison said his long-range forecasts come down to putting a bunch of puzzle pieces together to create a full picture.

“What I do is look at where we are at, look into the past to when we saw similar conditions and in turn what kind of weather we had during those conditions,” he said. “My track record has been pretty good in the last five or six years, never perfect for all areas. And I’ll be honest, I am due for a big giant bust at some point in these long-range forecasts, it’s just the nature of the beast.”

NDAWN station data can be found online at cloud.ndawn.org. 

A year of blockbuster deals

While rough, 2020 wasn't all bad

By **Dan Lemke**

Spirited Communications

Trade with global partners is vitally important for agriculture, and the nation's top ag negotiator says that despite significant challenges, 2020 was a remarkable year for trade.

Ambassador Gregg Doud has served as the chief agricultural negotiator for the Office of the U.S. Trade Representative since 2018. Doud told participants in the 2020 Prairie Grains Conference that the United States has made sizeable trade progress in the past three years, including updating agreements with the nation's top four trading partners: Canada, Mexico, China and Japan.

China

Doud says ag exports to China increased by 69 percent this year. The month of October was the best month in history for ag exports to China and the all-time best month for soybean exports.

"China is still in a ramping up period," Doud says, "so there is potential November will be even better. We are on a roll with China in ag trade. It's extraordinary from an ag standpoint."

Trade progress with China has been hard fought following a trade war and competing tariffs imposed on imported goods. Negotiators worked out and agreed to a "Phase One" agreement between the U.S. and China to get exports flowing more freely again.

Doud says negotiations with his counterpart from China started in 2019

and included 33 negotiating sessions, each lasting between four and 12 hours.

"We spent hundreds of hours talking about ag trade between the U.S. and China," Doud says.

The Phase One agreement faced many challenges, including navigating two vastly different regulatory systems, Doud says. There was also the language barrier.

The Phase One agreement has more than 20 pages dedicated to agriculture. "We argued over every sentence," Doud says. "There was difficulty in translation and we had to make sure the words meant the same thing."

In the end, Doud says, China agreed to 57 structural changes, and he says, they've made almost all of them.

Doud says in addition to making enormous progress in grain exports, more U.S. companies have access to sell into China. Previously only about 1,500 facilities were approved to sell into China. That number is now over 4,000 and includes grain, meat processing and even pet food facilities.

The U.S. sold \$48 million in beef to China, and, \$1 billion in poultry, according to Doud. Dairy exports to China are up nearly 40 percent.

Doud sees a growing opportunity to sell meat products, especially beef.

"We are now in a really good position going forward with China in agriculture," Doud says. "It will be interesting to see if we set a new export record to China for a calendar year. That would be remarkable since we really didn't get ramped up until April."



Trade issues with China aren't totally resolved and there continues to be export challenges, including for pork products. But there is tremendous potential to supply feed ingredients for China's hog herd.

Half of the world's hogs are raised in China. Previously, many animals were fed scraps rather than grain-based diets. An outbreak of African Swine Fever decimated the Chinese swine herd as millions of hogs were lost. As China works to repopulate their herd, most operations are being pushed to use more corn and soybean meal, providing a market opportunity for U.S. farmers.

Japan

A trade agreement between the United States and Japan went into effect on Jan.



Agricultural exports to China increased by 69 percent in 2020. The month of October was the best month in history for agricultural exports to China and the all-time best month for soybean exports.

1, 2020. The bilateral deal was necessary after the United States withdrew from the Trans-Pacific Partnership (TPP), which would have included Japan and nearly a dozen other countries.

Doud says unlike the TPP, the bilateral agreement with Japan did not require Congressional approval. While some people have been critical of the U.S. decision to pull out of the TPP, Doud doubts Congress would have ratified the agreement.

“The agriculture parts were fine, other aspects were more problematic,” Doud says.

Doud says the agreement gives access to 90 percent of U.S. ag exports into Japan. The trade pact puts the United States on equal footing in most areas with the

countries that signed on to the TPP. Those trade advantages are especially important for a couple key U.S. ag sectors.

“Japan is very important market for wheat and beef,” Doud says. “We were able to get even footing with other countries.”

USMCA

Doud contends the U.S. Mexico, Canada (USMCA) trade agreement is a historic deal, and one of the largest bipartisan trade deals in U.S. history. The USMCA replaced the North American Free Trade Agreement (NAFTA).

“It’s the gold standard and offers a template for other agreements,” Doud says.

As is the case with most agreements, the USMCA isn’t perfect. Doud says challenges remain with Canada over dairy

issues. He’s also concerned with Mexico’s stance against biotechnology.

“I hope we can work on that,” Doud says.

The Office of the U.S. Trade Representative is established to be a driving force in trade. While the U.S. pushes for trade, not every country is receptive.

Doud says he regrets not being able to do more to spur trade with the European Union (EU). He says while the U.S. is trying to lead the world in technology and biotechnology in agriculture, other countries are trying to undermine it. Other countries, India for example, offer tremendous potential but have many barriers in place that make it extremely difficult for U.S. companies to enter the market. 🌾

Hindsight is 2020

COVID-19 crisis, trade deals put ag economy on roller coaster ride

Shawna Aakre
Continually Still

Minnesota net farm income in 2019 was down 58 percent compared to the 2008-2018 average, largely a result of low commodity prices, natural disaster impacts and a trade surplus partly due to retaliatory tariffs from China. Exports in 2018 and 2019 declined significantly as China slapped tariffs on about 99 percent of United States products regularly shipped to the country.

Those circumstances, paired with crop projections at the beginning of 2020 to be higher than in 2019, gave farmers reason for concern over future market prices. American Farm Bureau Federation Chief Economist Dr. John Newton said at that time the biggest hurdle for farm income to overcome was if demand could overcome the supply.

“But coming into 2020, when you think what this administration has done from a trade perspective, I think folks were optimistic that we were finally

going to turn the corner and it was going to be a better year,” Newton said during the virtual Prairie Grains Conference.

The market outlook appeared positive for increased prices in 2020, he said, in part due to improved access through the U.S.-Japan Trade Agreement, renegotiated U.S.-Mexico-Canada Agreement (USMCA) and the China “Phase One” Agreement, among other trade commitments.

“Unfortunately, that light that we thought we saw at the end of the tunnel turned out to be a freight train,” Newton said. “It is hard to imagine where we are today with COVID-19 and how the reactions to this virus have really significantly impacted food and

agriculture in a way that we simply could not have anticipated in early March.”

Newton said the ongoing pandemic rerouted the supply chain from the food service industry and restaurant base to the grocery store channel. Food and drink away-from-home sales in 2019 accounted for nearly 54.8 percent of a total \$1.77 trillion spent on food. Between March and April of 2020, that spending rapidly decreased as grocery store sales hit record highs.

But rerouting a supply chain to match an immediate shift in demand is not quickly or easily done, Newton said. This caused some agricultural producers to have to dump milk, hold back animals from market or plow under



crops until the supply chain could adjust appropriately.

Newton said agricultural markets shifted as a result, contributing to a drop in commodity prices across the board.

“The impact on commodity prices was significant as well, it doesn’t matter what you had. Hog prices were down more than 50 percent at one point, class four milk prices were down 25 percent, oil demand was down which impacted ethanol, corn prices dropped, wheat prices were down,” Newton said. “Imagine trying to market wheat in the time of a volatile environment. Just about everything saw some disruption in prices as a result of COVID-19.”

Bright spots

International trade also took a big hit due to COVID-19. He cited decreased sales of more than \$500 million to Japan, nearly \$1 billion to European Union and United Kingdom, \$300 million to Canada and \$1.6 billion through October to Mexico. Newton pointed out that these decreases in agricultural purchases are a reflection of the economic challenges countries around the world have faced because of a COVID-19 recession.

“The lone bright spot in the world right now is China. Sales to China are up nearly \$7 billion compared to 2019,” Newton said. “That is in part due to multiple things.”

The African Swine Fever that hit China in 2018 left them in strong demand for U.S. protein products. Soybean demand has also grown recently as the country rebuilds their herds. In addition, Newton said there are anecdotal reports of a corn crop that is struggling in China.

Finally, the “Phase One” deal, signed in January 2020, has caused the country to make a number of structural changes to facilitate improved imports of U.S. agricultural products. In October, China bought nearly \$5 billion of agricultural products from the U.S., a record for a single month’s purchase from the country.

While Newton said China has been about 28 percent below the pace needed to meet the Phase One goals as of fall 2020 and will likely not hit the goal, the U.S. will still see a final record high in total

purchases from China and the strongest exports to their country since 2014.

Newton said that President-elect Biden, who takes office Jan. 20, has indicated he will keep the current tariffs on China – at least in the short-term – and wants to review the Phase One agreement.

“I think in the agricultural community, we want to see the gains that we have made on the Phase One agreement remain,” Newton said. “We want to continue to have China be a good and fair-trading partner. So, we want to see everything that we have accomplished remain, and then we want to see a phase two process move forward that can accomplish some additional gains in trade with China.”

In addition to a positive trade outlook with China, the USDA expects higher average marketing year crop prices, in part due to lower acreage and yields than previously thought.

“When you take that into consideration, along with the ad hoc support for farmers and farm bill payments, we are expecting to see a higher gross income in 2020,” Newton said. “Combine that with expenses decreasing by \$5 billion from 2019, and we are going to find ourselves with a farm profitability scenario that looks pretty good across the country. The USDA now (as of November) projects net farm income in 2020 to be \$120 billion, the second highest only to 2013.”

Newton was quick to point out that their projection does not adjust for inflation, nor does it mean farmers are getting their return out of the market place.

The road ahead

Commodity prices have yet to fully recover, and government aid to producers totaled nearly 40 percent of net farm income, or 10 percent of gross farm income.

Total trade and COVID-19 assistance to agricultural producers from the government is expected to be close to \$47 billion in 2020. That number includes money from the Market Facilitation Program and Coronavirus Food Assistance Program, but does not include money from the Paycheck Protection

Program (PPP), Wildfire and Hurricane Indemnity Program (WHIP), WHIP-Plus or other traditional farm bill programs. Minnesota received more than \$3 billion, North Dakota more than \$1.7 billion and South Dakota more than \$1.8 billion of that assistance as of Nov. 15.

The support has helped keep land prices and cash rents robust and farm bankruptcies declining throughout the first three quarters of 2020. Newton cautioned that while some governmental financial assistance may continue, agriculture cannot count on support payments at the levels seen in 2020.

“I think what we are likely to see into 2021 are higher commodity prices and livestock prices, assuming this demand rally continues,” Newton said. “But if you take around \$20 to \$30 billion away in ad hoc support, we could potentially see net farm income in 2021 drop considerable, maybe even 15 to 25 percent depending on where commodity prices end up.”

Newton said farmers will be keeping a watchful eye on market prices into the spring of 2021 to better determine which planted crops have the best potential to make them profitable.

Another priority for agriculture to keep an eye on in the near future is the growing emphasis around greenhouse gas emissions, Newton said. Agriculture is less than 10 percent of total greenhouse gas emissions, but, according to Newton, there will be more emphasis in the industry on what processes exist to capture and sink carbon in the soils.

He believes the incoming Biden administration’s priority is going to be on domestic and climate issues, a conversation in which agriculture groups want to be involved.

“One of the things that we continue to say when we are at the table is that farmers are willing to do more,” he said. “We have long been good stewards of the land, protecting the water, protecting the air and protecting the soil. And we can do more, but it has got to be economically sustainable as well.”

Newton remains optimistic that a valued seat at this table and potential trade opportunities are a positive for agriculture in the year ahead. 🌾

THE GREAT PLAINS GAME CHANGER

Agricultural Products Development Center will allow NDSU, NCI to harness technology, showcase region

By Nicole Thom-Arens
Director of Communications
NDSU Foundation

From east to west and north to south, there isn't a community in the Great Plains untouched by agriculture, with commodities grown in the region ending up on the plates of consumers across the United States and the world.

As such, there is a project on the horizon at North Dakota State University (NDSU) that promises to be a game-changer for agriculturists in the region — the Agricultural Products Development Center (APDC). Designed to be the region's premier teaching and research facility, the APDC would house North Dakota's first sensory lab and be a showplace that highlights ways to utilize regional commodities.

"While the new building may be located in Fargo, it will pay dividends in every corner of North Dakota through enhancing end-use quality of key agricultural commodities," said Greg Lardy, NDSU's vice president for agricultural affairs.

The APDC will house NDSU's food science, meat science, and cereal science laboratories and will be co-located with the Northern Crops Institute (NCI).

"For decades, the partnerships between NDSU, NCI, industry, grower groups, and producers have resulted in industry-leading advances that have fueled agriculture in this region," Lardy said. "Agricultural success in North Dakota, the region, and the world has been shaped and, in part, led by the research that has grown out of these dynamic programs."

Currently, the Northern Crops Institute (NCI) is attached to the south side of Harris Hall, which houses NDSU's Cereal Science and Food Science programs. Harris Hall was built in 1954 and has undergone several additions to accommodate the changing needs for agricultural research across the region and globally, but quite simply, 21st century

technologies don't fit in the 1950s design of Harris Hall.

"NDSU and NCI have been linked since NCI was conceived," NCI Director Mark Jirik said. "While wheat and barley continue to be a focus for NCI, soybeans, pulses and corn have expanded the focus

“A good facility brings a good impression, and we have great people manning that facility.”

— Keith Peltier, APDC benefactor

of what we are doing — and the space that is needed. Food safety rules and regulations have changed dramatically and with modern food regulations, NCI is limited on what we can do based in the current building.”

Investing in the future

While space is limited, there are seemingly infinite areas to expand research related to regional commodities. Despite less-than-ideal building accommodations, research and teaching conducted inside Harris Hall and market development work conducted by NCI is vast and impressive.

Modernizing the space for research, teaching and outreach work will allow the faculty and staff who work in these units to be more efficient and productive, as well as better serving the needs related to an expanding array of crops raised in the region. Bringing the food science, cereal science and meat science programs together under one roof and co-locating them with NCI enhances opportunities for multi-

disciplinary research as well as increasing focus on enhanced end-use quality and utilization of co-products. All of this leads to better return for regional farmers.

"Research pays big dividends, especially ag research," said Keith Peltier, Proseed president and general manager and APDC benefactor. "Ag research is a great return on your money, but it's not a short-term return, it's a long-term return — an investment in the future."

The APDC, which would be located on the southwest corner of the NDSU campus, will help recruit and retain highly talented and highly skilled scientists, teachers and other professionals. NDSU scientists have international stature and the new facility would match their research capabilities.

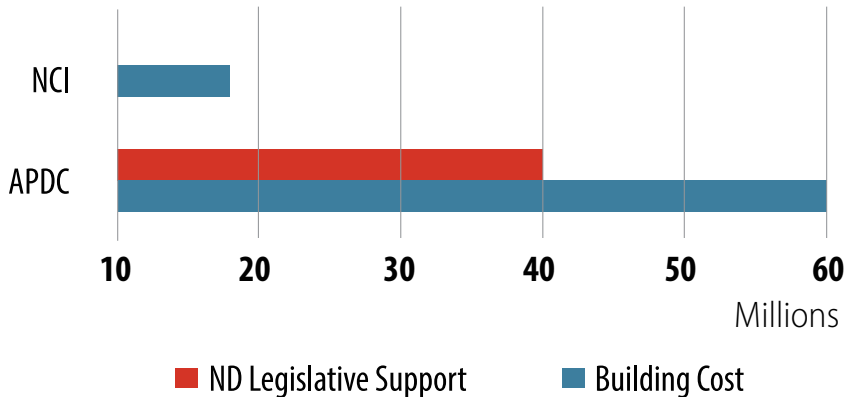
"A good facility brings a good impression," Peltier said, "and we have great people manning that facility."

The APDC houses classrooms and laboratories that will train the next generation of students, facilitate research that increases end-use quality of regional agricultural commodities, and will help NDSU develop and commercialize new food products in collaboration with companies. These spaces will allow NDSU to take a field to fork approach with food systems.

NDSU has a long history of wheat and barley breeding and



APDC AND NCI FUNDING PROGRESS



research on grain, milling and end-use qualities, particularly as they relate to bread, pasta, malting and brewing.

Senay Simsek, NDSU's Bert L.

D'Appoloni Cereal Science and Technology of Wheat Endowed Professor, conducts end-use quality evaluations for NDSU's spring wheat breeding program — one of the largest public spring wheat breeding programs in the world.

Simsek's research benefits producers by ensuring the very best quality lines are advanced and the poorer performing lines are eliminated. She advises and educates buyers from around the world on wheat functionality to ensure top results and premium price. The NCI also educates and hosts buyers from around the world each year. These visits are an invaluable opportunity to market regional commodities to a global audience.

"The APDC would create the spaces necessary to expand areas of research to include ancient grains, oilseeds, and pulse crops," NDSU Professor and Cereal Science Graduate Program Coordinator Frank Manthey said. "Furthermore, the new facility will allow for expanding research in sensory analysis including detection and identification of compounds associated with aroma and flavor. The facility will also facilitate research related to sustainability of food systems including research on recycling and recapturing phytochemicals, nutrients, proteins and carbohydrates from food waste associated food processing."

Regional farmers will benefit directly from the enhanced and expanded research capabilities in the APDC.

Improvements in quality, utilization, end-use and consumer sensory characteristics will add value to crops grown in the region.

Co-location with the NCI allows buyers of these agricultural commodities to see firsthand how they can be used in their applications, and how they fit their specific needs.

"Combining the Agricultural Product Development Center with the Northern Crops Institute will harness the combined power of NDSU's research capabilities with NCI's mission to grow markets

for crops in Minnesota, Montana, North Dakota and South Dakota," Jirik said.

North Dakota legislators recognize the value this facility adds to every corner of the state, and in 2019 the North Dakota legislature approved \$40 million in funds toward the project. Additional public and private funding are required to bring the APDC to fruition.

The end result aims to benefit farmers throughout the Great Plains.

"All of this leads to enhanced revenue, market access and growth opportunities for producers in this region," Lardy said. 🌾

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Choose the type of membership that is best for you and your farm operation. Call the MAWG office at 218-253-4311 to join.

Visit mnwheat.org to join today.



**Minnesota Association
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