



2025 MDFC CLS Fungicide Program

1. Proline* + EBDC
2. Tin + Topsin
3. QoI + EBDC
4. Tin + EBDC
5. Inspire XT** or Provysol** + EBDC
6. Tin + EBDC

Remember to rotate the triazoles:

*Proline or Domark or Minerva

**Inspire XT or REGEV or Luna Flex or Provysol

Only use one product per group per season

Keep in contact with your Agriculturist - scout your fields to ensure excellent control

Cercospora Management for 2025

- First application ~**June 23**
 - Target 4th week of June
- **Stay on schedule** — 14-day intervals
 - Adjust for rain/weather
 - Keep in mind that a 7th application may be necessary if September weather acts like August
- **Tank-mix**
 - Widespread, but patchy, resistance to triazole/tin/QoI fungicides
 - No resistance ever reported to EBDC since registration in 1948
- **Full rates**
- **20 GPA** water volume

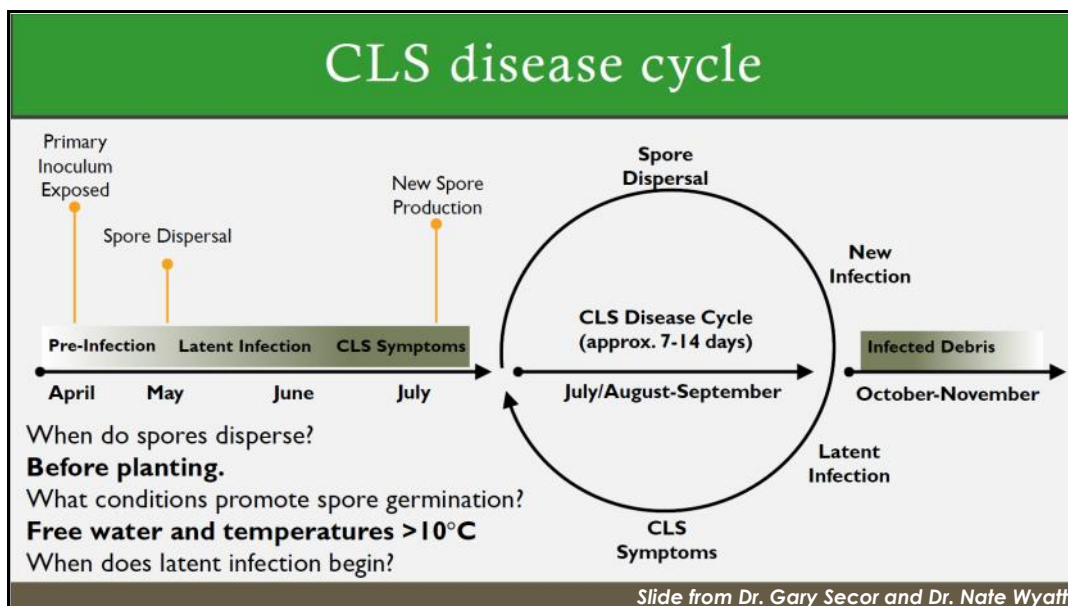
Triazoles	Rate/Acre	Pre-Harvest Interval	Reentry Interval
Proline 480 SC	5.7 oz	7 Days	12 Hours
Phobos FC	7.6 oz	7 Days	12 Hours
Domark	6.9 oz	14 Days	12 Hours
Minerva	13 oz	14 Days	12 Hours
Provysol	4 oz	7 Days	12 Hours
REGEV	8.5 oz	7 Days	12 Hours
Inspire XT	7 oz	21 Days	12 Hours
<i>*Cross resistance exists between Proline 480 SC / Phobos FC and Domark / Minerva; also between Provysol and REGEV / Inspire XT — Only use one product from each of these groups during the 2024 season.*</i>			
EBDC	Rate/Acre	Pre-Harvest Interval	Reentry Interval
Dry	2 lbs.	14 Days	24 Hours
Liquid	1.6 qts.	14 Days	24 Hours
Dithane F-45 / M45, Koverall, Manzate Max / Pro-Stick, Penncozeb 75DF / 80WP			
Tin	Rate/Acre	Pre-Harvest Interval	Reentry Interval
Liquid	8 oz	7 Days	48 Hours
Agri Tin Flowable / Super Tin 4L			
Benzimidazole	Rate/Acre	Pre-Harvest Interval	Reentry Interval
Liquid	10 oz	21 Days	24 Hours
Dry	0.5 lb	21 Days	24 Hours
Topsin 4.5FL / M WSB, T-Methyl 4.5F / 70 WSB			
QoI	Rate/Acre	Pre-Harvest Interval	Reentry Interval
Headline	9 oz	7 Days	12 Hours
Gem 500 SC	3.6 oz	21 Days	12 Hours
Flint Extra	3.6 oz	21 Days	12 Hours
Priaxor	6.7 oz	7 Days	12 Hours
<i>*Azoxystrobin is more effective on Rhizoctonia than CLS. It is not recommended in the MDFC CLS Program*</i>			
Copper	Rate/Acre	Pre-Harvest Interval	Reentry Interval
Dry	2 lbs.	0 Days	48 Hours
Liquid	2 pts.	0 Days	48 Hours
Badge SC / X2, Champ 2 Flowable / ChampION, Kocide 3000 / Cuprofix Ultra / MasterCop			

The product label trumps this information at all times - Always read & follow label instructions

A Review of Data from Dr. Nate Wyatt, USDA, and Dr. Gary Secor, NDSU

CLS is Polycyclic and Genetically Diverse

Cercospora is a hemibiotrophic fungus, meaning that it has an asymptomatic phase where it's present in the fields but we can't see spots yet (we call that latent infection), and a symptomatic phase where we can see spots. It is polycyclic. This means that many generations can happen in the span of just one sugarbeet growing season. There is exponential growth, so one spore can lead to thousands. The graphic to the right is



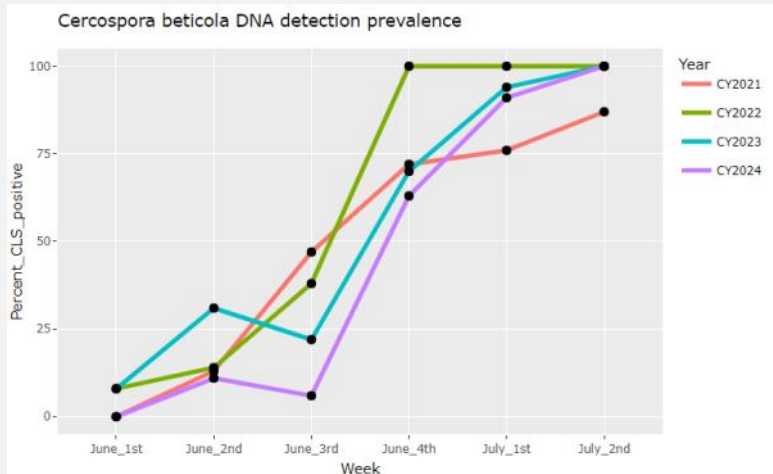
the CLS disease cycle. The latent infection phase is in May and June, and then CLS symptoms start to show up around the end of June/beginning of July. After you see the spots, the disease cycle starts on the circle, where it's going through the whole life cycle every 7 to 14 days; spores are dispersed, new infection occurs, then latent infection, spots are seen, spores are dispersed, and repeat. Once you get on that merry-go-round, it is incredibly tough to control, somewhat of a death spiral if you will. This is why we have to focus on controlling CLS in the latent infection phase. Once we hit those fast cycles, you cannot catch up, and you cannot get ahead.

Spore Trap Results

2021-2024 Latent CLS prevalence

Primary results

- Near **100%** of submitted samples are **positive** for latent CLS infection by the **first week of July** (~row closure)



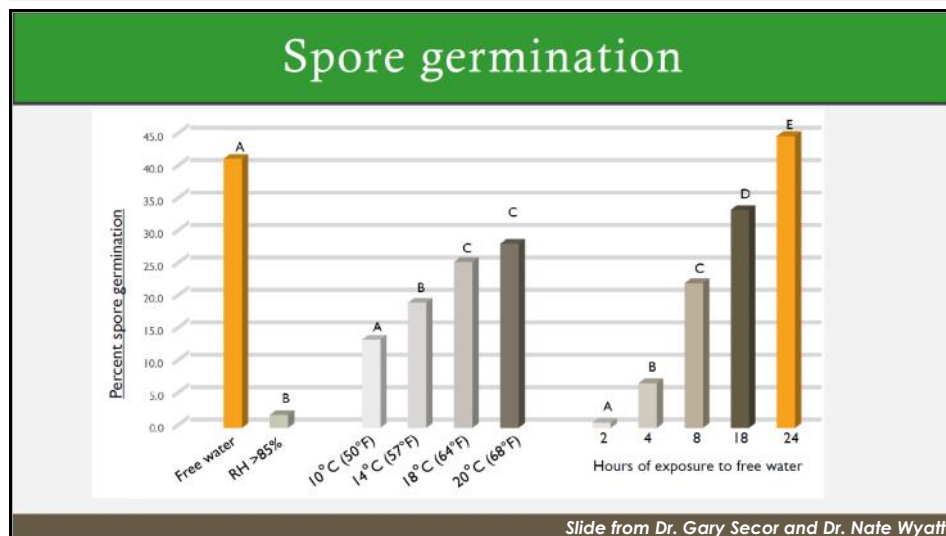
Slide from Dr. Gary Secor and Dr. Nate Wyatt

Dr. Wyatt's and Dr. Secor's labs have placed early season CLS spore traps and tested the isolates present in the traps since 2021. They detect spores as snow melts off fields and temps get above 50° F. **The pattern in the graph is that CLS is detected in a about 25% to 50% of the sampled fields by the third week in June. Then there's a jump in the**

last week of June, and finally almost all sampled fields have CLS detected by the first week of July. Looking at 2024 specifically, the purple line, only about 10% of fields were positive for CLS by the third week of June, but then there was a very steep jump to about 65% positive the next week, that last week of June — a much faster increase than what was seen in previous years. This is why we target the 1st application at this timing.

A Review of Data from Dr. Nate Wyatt, USDA, and Dr. Gary Secor, NDSU

Effects on Spore Germination



The graph to the left displays results from the lab of Dr. Secor. Viviana Rivera started to investigate what has the greatest effect on spore germination, or what has a greater influence on really speeding up CLS. Higher temperatures lead to increased spore germination. As we follow along the middle section of the graph, the percent spore germination doubles as we go from 50° F to 64° F; just a 14-degree change in temperature, but double the percent of spores that germinate. Then back to the left

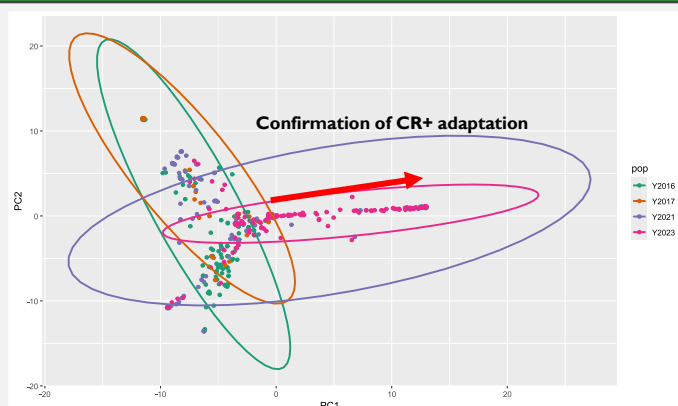
section of the graph, she found that the presence of free water has a much greater impact on spore germination than a relative humidity of 85%. So rather than just focusing on the humidity, we need to take the amount of free water, or leaf wetness, into account too. Put that with the right section of the graph, the number of hours of exposure to free water, and we can see a steep increase in the percent of CLS spores that germinate as we go from 2 hours of exposure to free water to 8 hours of exposure to free water. So, what does this translate to? Well, think about the days/nights where there's more of a difference in daytime/nighttime temperatures – as that temperature difference becomes more extreme, we get more dew, more dew means more free water, or more leaf wetness, and that means more CLS infection.

Shifts in Population Dynamics

Dr. Wyatt has graphed the CLS population dynamics from 2016-2023. The 2016 pop. (teal) and the 2017 pop. (orange) are very similar: same shape, similar direction. But when we look at 2021 (purple), the year that CR+ was introduced, the population shifts. While some of the isolates, (isolates are represented by the dots), still follow a similar distribution from 2016 & 2017, some of the isolates, especially those along the red line, have shifted away from the other clusters,

C. beticola population dynamics: CR+

2016 - 2023



Slide from Dr. Nate Wyatt

This indicates a potentially divergent population cluster that appears to have adapted to CR+. Then focusing on 2023 (pink), the adaptation of the CLS isolates to CR+ is confirmed, as we see that more of the CLS isolates have shifted to this line. We were hoping that after having used CR+ for a few years we'd be able to start dropping the tank mix, or perhaps take a "break" from certain chemistries each year. **But, this data tells us that we absolutely cannot do that.** We have to continue with the tank mixes, we have to continue rotating chemistries, and we have to utilize all available chemistries because the CLS population that we have at Minn-Dak has adapted to CR+.

Start Time is Key and Adjusted Intervals

The MDFC Research Team conducted a trial in 2024 that focused on CLS program timings ~ when the program started and the interval length. Treatments included are shown to the right. The *MDFC Rec* is exactly that, the standard 4-spray program that was recommended last year. The *No Early* treatment did not have the EBDC application at row closure. The *Late Start* treatment was started 2 sprays behind the *MDFC Rec*. *All Short* was that all applications were made on a 10-14-day interval. *All Long* was that all applications were made on a 21-day interval. *Short Long Short* was that we alternated between a 10-14-day interval and a 21-day interval. *Long Gap* was that we started with the EBDC application but then didn't spray again for about a month and a half. All were compared to an untreated check where no fungicides were applied.

2024 MDFC CLS Timings Trial

- **MDFC Rec:**
 - Standard 4-spray program, "One, Two, Skip a Few"
- **No Early EBDC:**
 - No EBDC application at row closure
- **2 Sprays Behind:**
 - Started the program late, didn't apply first two applications
- **All Short:**
 - All applications on 10-14-day intervals
- **All Long:**
 - All applications on 21-day intervals
- **Short Long Short:**
 - Alternated between 10-14-day and 21-day intervals
- **Long Gap:**
 - EBDC application at row closure, spray again ~1 month later

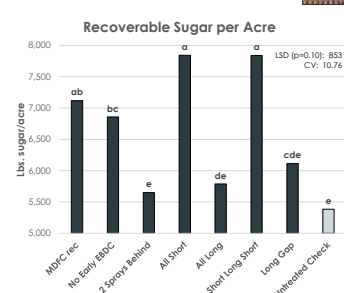
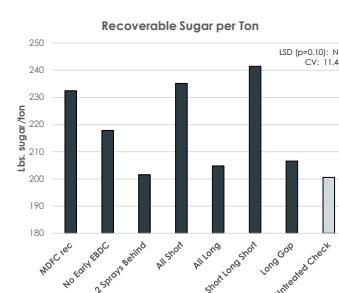
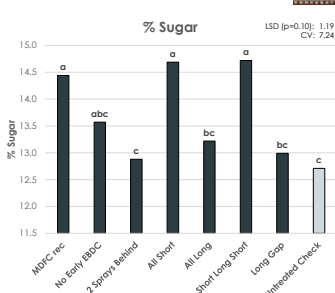
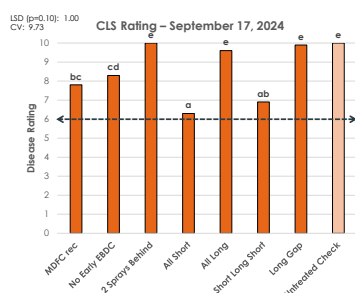


Minn-Dak Farmers Cooperative

2024 MDFC CLS Timings Trial



2024 MDFC CLS Timings Trial



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Looking at the first graph on the left, with the orange bars, this is the CLS rating at the end of the season. Lower bars = less disease, and the dotted line is there to show the threshold for proven economic damage. These were inoculated trials, meaning we added CLS inoculum to these trials, so there were more spores present than just what was natural in a typical field. And, given the environment in 2024, the disease pressure at our CLS research site was pretty heavy. It makes for some very good observations though. Going back to the CLS ratings, all of the treatments ended the season above the economic damage threshold. Again, not super surprising given the high pressure at the site. Two treatments that I want to call out though, the *All Short* and the *Short Long Short* treatments ~ both are better than the *MDFC Rec*, with *All Short* even statistically better. A reminder here that the letters above the bars denote whether treatments are statistically different. Since *All Short* and *MDFC Rec* don't share any letters, they are statistically different. *Short Long Short* and *MDFC Rec* do share the letter "b", so they are not statistically different, even though *Short Long Short* is rated about a point less (AKA better) than *MDFC Rec*. Switching to the second graph on the left, now we're looking at % Sugar. A few important things here: almost a point of sugar is lost by not making the EBDC application; starting the program late is hardly any better than not spraying at all; again, *All Short* and *Short Long Short* are the best treatments. When we look at Recoverable Sugar per Ton or Recoverable Sugar per Acre, it's the same story. If we think back to the CLS disease cycle this all makes sense – **the later you start, and the longer you have between sprays, the worse the CLS infection gets.**



Odds & Ends to Make Your CLS Program More Effective

- **Start your program on time** and stay on schedule. Remember that while the program calls for 6 applications, if the weather in September is hot and humid, a 7th application will be crucial. EBDC alone or mixed with a copper is a good choice should that application become necessary.
- **Keep your spray intervals tight.** The 2025 program is based on 14-day intervals, but shortening the interval to 10 days may be needed for some applications — pay attention to weather conditions. Scout your fields and keep in contact with your Agronomist.
- **Watch the NDAWN Daily Infection Values (DIVs).** These color-coded ratings can be found on the NDAWN site. Users can select CLS data from the ten NDAWN stations within the Minn-Dak growing area - Campbell, Elbow Lake, Foxhome, Herman, Rothsay, Sabin, Underwood, and Wolverton, MN, and Mooreton and Wahpeton, ND. The app also features real-time weather conditions from each station for decision making and recordkeeping during spraying season. **Specifically for CLS, the Daily Infection Values (DIVs) can be displayed in both table and graphical formats as well as providing a map with 'infection zones' by station.**
 - ndawn.info/crops.html
- **High water volumes.** Many of the tank-mix partners are protectants and require a little more water. Ground applications should target 20 GPA and aerial applications no less than 5 GPA.
- **Be wary of 'miracle-type' adjuvants.** If there was a 'silver bullet' that could be added to the tank to significantly increase CLS control we would be recommending it. We test LOTS of these products every year and publish the results on our website. Invest your money where you know it will return dividends - increased water volumes, tighter spray intervals, full rates, etc.
- **Use an aerial applicator if needed.** If rain/wet ground is prohibiting you from staying on your spray schedule, call in the 'Air Force.' You are money ahead by staying on schedule - once you get behind the eight-ball of CLS pressure, it's almost impossible to catch up.
- **Pay attention to Pre-Harvest Intervals.** Pay close attention to the PHI of each product you pour into the spray tank - it will have an impact on the August start of preharvest.
- **Don't give up on the dry formulations.** When in doubt, follow the A.P.P.L.E.S. approach recommended by NDSU Weed Science:
 - ⇒ **Agitate**
 - ⇒ **Powders soluble (SG, SP)**
 - ⇒ **Powders dry (DF, WDG, WP)**
 - ⇒ **Liquid flowables & suspensions (ASC, F, ME, SC, SE)**
 - ⇒ **Emulsifiable concentrates (EC, EW, OD)**
 - ⇒ **Solutions (S, SL)**

Make sure that each product is uniformly mixed in the tank before adding another.

Pre-mix ≠ Tank Mix

When it comes to CLS fungicide applications, a "pre-mix product" does NOT mean that it can be considered a 'tank mix.' The table below lists some of the most common products that contain multiple active ingredients in the same jug. If you use these products, they still need to have a tank-mix partner included. Although many of these products utilize the same chemistries that are in our recommended program, the formulations are often 'not as strong' as the stand-alone formulations of each. For example, Delaro (a mixture of Proline and Gem) is formulated such that you would need to add ADDITIONAL Proline to the spray mixture to get the concentration required for adequate control of CLS. Another example of the complexity surrounding these premix products is resistance management. We all know that when it comes to CLS control, using the same product back-to-back is a poor resistance management practice. So when using a premix product like Minerva Duo (a mixture of a triazole and a tin), what would you use next in your rotation since both of the flagship chemistries were utilized at the same time?

Name	Modes of Action
Lucento	Triazole + SDHI
Propulse	Triazole + SDHI
Acropolis	Triazole + benzimidazole
Brixen	Triazole + strobilurin
Delaro	Triazole + strobilurin
Veltyma	Triazole + strobilurin
Minerva Duo	Triazole + tin
REGEV	Triazole + tea tree oil