

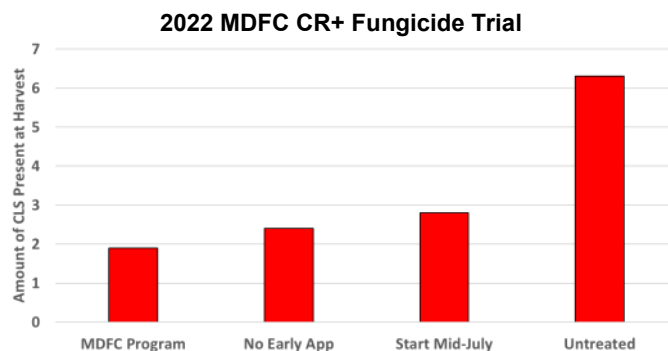
CLS - Putting What Works Into Practice...

Over the past couple of seasons, we have seen a significant shift in the approach Minn-Dak growers are taking to control Cercospora Leaf Spot (CLS). From the rapid adoption of enhanced genetic tolerance in the varieties planted to spraying foliar fungicides earlier than we ever have, these simple but fundamental tactics have proven themselves to be successful in keeping the sugarbeet fields green well into the harvest. Extensive research has gone into these 'new' approaches to CLS control, and the refinement of these practices continues to be the main focus of many of the Minn-Dak Research Trials being conducted this season. Below are several key 'take aways' from the research trials that have been identified to provide enhanced control of CLS. By putting these simple agronomic tactics into practice on your farm, you'll significantly increase your ability to keep your fields green, extend the useful life of your fungicides, and deliver a quality crop come harvest.

Spray Early - CLS Has Been Detected

These past three seasons, the MDFC Ag Staff has partnered with the USDA-ARS (Fargo, ND) to conduct studies to determine when the onset of CLS infection actually takes place in our growing area. We know that as part of its life cycle, spores from leaves previously infected with CLS are released into the air the following spring and that the latent onset and development of CLS lesions can take anywhere from 5 to 21 days depending upon the environmental conditions present. As such, the MDFC Ag Staff has been collecting asymptomatic leaves (no visual signs of infection) from 2023 sugarbeet fields that share a border with last year's beet ground and sending them to Dr. Nate Wyatt for molecular analysis. **Of the 56 fields analyzed this**

past week, 21 of them (~40%) have been identified as having CLS already present within the young plants!



The graph above shows the average levels of CLS present at harvest on each of the different fungicide treatment programs tested last season (the lower the bar the less disease present). One of the most valuable observations we have witnessed in the MDFC Research Trials is that **early applications of a CLS fungicide make a HUGE difference in the level of disease severity experienced throughout the entire growing season** — even considering that the 2022 growing season was the latest planted year in our Coop's history and that we had dry conditions going into 'CLS season.' This is the very premise of the need to start your fungicide applications early so that you do not play 'catch-up' for the remainder of the season. Every single quality attribute that was measured (percent sugar, percent purity, RST, RSA, etc.) increased as the level of CLS severity decreased. **To put it in plain terms...Spraying early = Higher Quality Beets and greater financial returns per acre.**

Your Agriculturist is the best source for information regarding CLS - keep in close contact with them regarding products, rates & program timing.

Time Your 1st CLS App Just Before Row Closure

A general rule of thumb is to target the distance between the rows as your 'application trigger.' Using the picture to the right as a reference, plan on your first application starting when the leaves between each row are roughly 3 to 4 inches apart. Keep in mind that this is the time of the year where your Agriculturist will become your best friend as they are the absolute best source for information regarding CLS. Be sure to keep in close contact with them regarding products, rates & fungicide application timing.

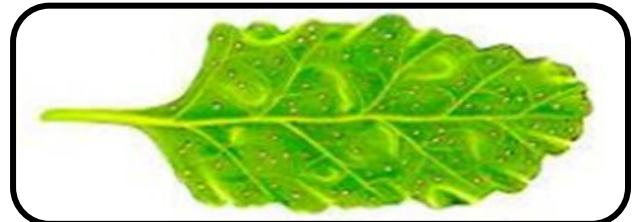
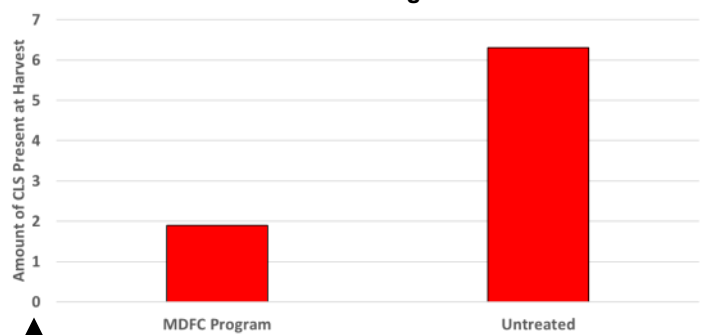


CR+ Varieties **NEED** to be Sprayed - They Are Not Immune to CLS

Even though the genetic protection expressed by the CR+ varieties offers an enhanced level of tolerance to CLS, **it does NOT offer immunity to it.** The pathogen is still able to infect the plant and cause disease — it is just not able to 'take hold and thrive' like it can on traditional-type varieties. The chart to the right is the same data from the previous page and shows the average levels of CLS present at harvest on each of the different fungicide treatment programs. Take note the level of infection present on the CR+ varieties when left untreated - WELL above the economic threshold.

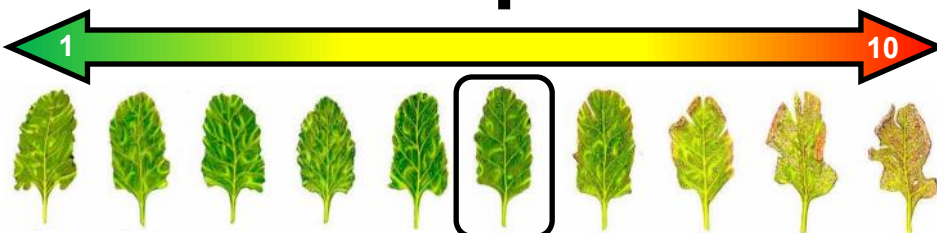
The highest sugar content, root yield, and recoverable sugar per ton in the last two year's inoculated Minn-Dak field trials came from using CR+ genetics in combination with the MDFC recommended CLS program (tagline of 'One, Two, Skip a Few'). This program included an early application of EBDC followed by a Triazole/EBDC tank-mix. It was only after these two initial applications were made in sequence that the intervals between fungicides were stretched. The results of these trials also provided us with a 'golden nugget' for the future - just like the traditional genetics, CR+ cannot play catch up when it comes to this aggressive pathogen.

2022 MDFC CR+ Fungicide Trial



**3% of Leaf Surface Infected
= PROVEN YIELD LOSS**

When it comes to CLS, a little bit of disease goes a long way. A proven economic loss occurs when only 3% of the leaf surface area is covered with lesions (60-70 spots, rating of 6 on scale to the left). When the disease progresses to this point, the result will likely be reduced tonnage and sugar content, increased impurities and additional losses during long-term storage (both of which complicate processing in the factory).



After the First App, No Product Goes Out Alone

With the Strobilurin chemistry class (products like Headline, Gem, Priaxor, etc.) rendered ineffective due to high levels of fungicide resistance, it is critical to protect the few remaining chemistry classes within our Cercospora Leaf Spot (CLS) portfolio. The loss of the Strobys resulted in an increased number of applications of both the Triazoles and Tins. If they are applied alone, the inevitable outcome of the increased application frequency of these two chemistry classes is that more selection pressure will be applied, and the risk of developing resistance to these remaining fungicides will increase significantly over time. Research in sugarbeets and in other crops has consistently demonstrated a couple key points when two effective pesticides are tank-mixed and applied together: 1) The risk of resistance developing can be greatly reduced and 2) Disease control increased on the targeted pathogen. These two reasons are why **no fungicide should be applied alone.**

Do Not Mix Glyphosate and CLS Fungicides

The main reason is the amount of water required with each application. CLS fungicide performance can be linked to the volume of water applied on a per acre basis. Research has shown that high water volumes (15-20 GPA) applied in smaller droplets equates to better fungicide coverage and increased product performance. Glyphosate is just the opposite as it has better performance when applied in larger droplets (pile effect) and lower water volumes (5-15 GPA). They are two completely different approaches to maximize the control offered by each type of product. You are money ahead making separate applications to achieve the needed weed and CLS control, rather than making one single application and getting mediocre control of each.

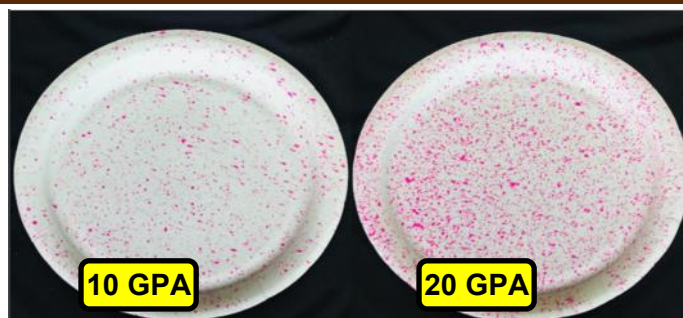
Pre-mix Does Not Mean Tank Mix

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 in our geography 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 in such a manner 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

Don't Cut Your Water

The picture to the right demonstrates the clear difference between spray water volumes on a per acre basis. A spray solution consisting of water and a pink dye was ‘captured’ on the back of paper plates. The same solution was applied with TeeJet XR8002 flat fan nozzles - the only difference was the spray volume. **Remember: Coverage = Control**



2023 MDFC Fungicide Program

For CR+ Varieties: "One, two, skip a few..."

1. Early EBDC
2. Proline or Domark + EBDC
3. skip
4. Tin + EBDC
5. skip
6. Inspire or Provysol + EBDC

Keep all fungicide applications to a 10-12 day spray interval or tighter if rainfall and/or DIVs require

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			

Triazoles	Rate/Acre	Pre-Harvest Interval	Reentry Interval
Provysol	4 oz	7 Days	12 Hours
Inspire XT	7 oz	21 Days	12 Hours
Proline 480 SC	5.7 oz	7 Days	12 Hours
Domark	6.9 oz	14 Days	12 Hours
Minerva	13 oz	14 Days	12 Hours
REGEV	8.5 oz	7 Days	12 Hours

Cross resistance exists between Proline 480 SC and Domark / Minerva, and between Provysol and REGEV / Inspire XT — Only use one product from each of these groups during the 2023 season.

TPTH	Rate/Acre	Pre-Harvest Interval	Reentry Interval
Liquid	8 oz	7 Days	48 Hours
Agri Tin Flowable / Super Tin 4L			

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

Odds & Ends to Make Your CLS Program More Effective...

- **Start your program on time** and stay on schedule.
 - **Keep your spray intervals tight** - everything in this year's program should be kept to a 10-12 day interval ('skips' included). Utilize the reminder feature in your smartphone - it's a handy tool to help stay on schedule!
 - **Use the MDFC recommended tank-mix partners.** Given the high level of CLS resistance present in our growing area, strobilurin products (Headline, Priaxor, etc.) and benzimidazole products (Topsin) are NOT effective tank-mix partners.
 - **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
 - **Use the correct nozzles.** The same nozzles you utilize for glyphosate applications are generally not the best for fungicide use (small vs large droplet size). Generally speaking, your target for fungicide applications should be around a medium droplet size (250 to 350 microns).
 - **High water volumes.** Many of the tank-mix partners are protectants and as such, require a little more water than you'd normally like to use. Like I have said before, water is the cheapest thing you put into your spray tank; there should be no reason to cut back on it. Ground applications should target 20 GPA and aerial applications no less than 5 GPA.
 - **Be wary of 'miracle-type' adjuvants.** Please keep in mind that 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.
 - **Do not mix fungicides with glyphosate.** CLS fungicide performance is best when applied with medium droplets at high water volumes (20 GPA). Glyphosate is just the opposite as it has better performance when applied in larger droplets (pile effect) and lower water volumes (5-15 GPA). They are two completely different approaches to maximize the control offered by each type of product. You are money ahead making separate applications to achieve the needed weed and CLS control rather than making one single application and getting mediocre control of each.
 - **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.
 - **Don't give up on the dry formulations.** They will give you little to no trouble if handled & mixed correctly. 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...*
- Warm water will also help dissolve each product into solution. Leaving dark-colored bulk tanks filled with water out in the sun a few days before spraying will make a world of difference.
- **There is a pecking order when it comes to the Copper fungicides.** Cu-Hydroxide and Cu-Oxychloride formulations are most effective (i.e. Badge, Kocide, Champ, etc.), whereas products containing Cu-Sulfate (Cuprofix Ultra, MasterCop, etc.) do not perform as well in our research trials.
 - **Pay attention to Pre-Harvest Intervals.** Pay close attention to the PHI of each product you pour into the spray tank - it will likely have an impact if we have an August start.