Disease Control Questions

Two questions usually lie at the center of every question I try to answer about a disease control product or method: Does it work? Does it increase yield?

Answers to these questions come from many sources. Foremost are replicated field trials done under VC conditions. Nothing beats a first-hand look at product performance in randomized trials. Trials must be done under realistic cultural conditions and with sufficient disease pressure. Conditions are favorable for leaf spot in most years and locations and disease is abundant once established. In contrast, it is very difficult to get consistent results from trials targeting soilborne diseases like stem rot and Sclerotina blight. They occur in hot spots of high disease surrounded by areas of very low or no disease, leading to highly variable results from trial to trial and within trials.

I also pay close attention to the results from my university colleagues around the US, especially work from Hillary Mehl in Virginia and Dan Anco in South Carolina. These states are the most similar to ours in climate, cultivars and production practices. While I value results from my colleagues in the Southeast, I always bear in mind that their work is done on different cultivars, and under much more challenging disease conditions, especially from stem rot, than we have in the VC area. Extreme disease pressure in the Southeast can be helpful for testing the limits of fungicide performance, but it has some drawbacks too, especially as one moves from interpreting disease control data to yield data.

Does a product increase yield when compared to current standards and competitors? This question can be tough to answer because many things affect yield. As discussed above, leaf spots tend to be fairly predictable, but predicting yield loss from defoliation and yield is still challenging particularly when trying to balance defoliation against maturity and digging.

Yield impacts of stem rot are even harder to predict. About 50% of the viability in yield in a typical fungicide trail in North Carolina is related (directly or indirectly) to stem rot incidence. The correlations between yield and defoliation are much higher, usually around 90% or more. We consistently see higher yields when a program includes stem rot control compared to leaf spot control alone, but putting a number on "higher" is extremely difficult due to the variability characteristic of stem rot in North Carolina. Factoring in the cost of products is important too. Many relatively economical products perform just as well as the most expensive products available, with no measureable difference in yield.

Growers can be frustrated and skeptical when I say a 500, 700, or 1000-pound yield difference is not significant. An additional 500 pounds puts money in a grower's pocket, but it's my job is to make sure that any difference I report will apply in many situations. Because of the uncertainties involved in fungicide trials, differences in yield can be pretty big before we can be confident they are real. It's extremely common for the smallest measureable yield difference (LSD) to be 700 pounds or more in disease trials.

For example, the data in Table 1 are from a trial with 11 fungicide treatments and an untreated control, but Treatments 7 and 11 are duplicates. The treatments are numbered because the specific products are not relevant here. The four plots per treatment were randomized across the field to assure unbiased results. Since Treatments 7 and 11 were the same, you'd expect that results should be nearly the same. But in this trial, Treatment 7 had the second highest average yield among treatments, while treatment 11 placed 10^{th} among all treatments. Nevertheless, the LSD of 734 pounds indicates that the 525-pound difference between Treatment 7 and 11 was probably due to chance. This makes sense given that the treatments were duplicates and shows how differences between averages can be misleading.

Keeping all this in mind, beware of claims that a product increases yield by X pounds. Without more information, those claims are hard to interpret. Products must be compared on equal footing, in similar programs overall, at appropriate rates, and in keeping with label recommendations; watch out for apples-to-

oranges comparisons. In my experience, measurable differences in yield between comparable products in comparable programs are the exception rather than the rule. As discussed, you should rely on data from the VC area when you can. Treatments that have large impacts under a very challenging disease situation in the Southeast may have smaller effects in the VC area. Check graphics for a measure in variability such as an LSD or standard deviation. Keep an eye out for obvious cherry-picking, such as results from a handful of trials. Finally, be extra skeptical of claims that products will give extraordinary results but only if used in a very specific way. Products from reputable agrochemical companies are designed to work as expected under a range of common, real life situations. As one of my colleagues says "If a product works, it works."

Table 1. Results of a disease control trial at Lewiston in 2019. Treatments 2-12 varied by the products applied and Treatment 1 was an unsprayed control. There were 4 replicate, randomized plots per treatment.

Treatment number	**% Leaf spot** 9/4	**% Defolia-tion** 9/4	**% Leaf spot** 9/18		**% Defolia-tion** 9/18		**Plant Condi-tion** 10/1		**Stem rot incidence** 10/7		**Yield lb/ A** 10/16	
1 Untreated control	52.5	21.3	92.9	a	53.8	a	8.0	e	27.8	a	4490	c
2	1.0	1.9	1.0	c	5.0	b	89.8	bc	3.3	b	6505	ab
3	1.0	2.5	1.8	c	5.6	b	89.3	cd	5.3	b	6868	ab
4	0.6	0.6	1.1	c	5.0	b	91.8	abc	3.8	b	6500	ab
5	0.9	1.9	4.1	c	5.0	b	91.5	abc	3.5	b	7098	a
6	0.9	3.8	1.1	c	6.3	b	92.3	abc	1.3	b	6787	ab
7 (Same as 11)	**2.0**	**1.9**	**2.5**	**c**	**5.0**	**b**	**89.3**	**cd**	**5.3**	**b**	**6911**	**ab**
8	0.9	3.8	1.0	c	6.3	b	94.3	a	3.8	b	6314	b
9	0.9	1.4	1.0	c	5.0	b	91.0	abc	3.8	b	6787	ab
10	0.9	0.6	1.0	c	5.0	b	92.8	ab	7.0	b	6883	ab
11 (Same as 7)	**1.1**	**2.5**	**3.3**	**c**	**5.0**	**b**	**94.3**	**a**	**1.8**	**b**	**6386**	**ab**
12	8.8	4.4	14.9	b	5.6	b	86.3	d	10.5	b	6410	ab
LSD $P \leq 0.05$	--	--	5.3		7.1		3.4		11.8		734	