

# University and industry scientists weigh in on fungicides for plant health in corn and soybeans

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As the last of the corn and soybean harvest leaves the fields, growers and consultants may be wondering if extra dollars spent on fungicides paid off this season. Fungicide applications to corn and soybean have been increasing in recent years as a result of industry marketing and a number of field trials showing plant health and yield benefits.

Especially with higher yields this year putting downward pressure on corn prices, “Producers need to look at their budgets and make sure they are implementing practices that have a consistent return on investment,” suggests Bryan Jensen, University of Wisconsin Extension IPM coordinator.

## History

Routine fungicide use in corn and soybean is a relatively

new trend. In the past, producers typically managed diseases through crop rotation, disease-resistant hybrid selection, optimum planting timing, and post-harvest tillage to hasten decomposition of potentially contaminated plant residue. There was little marketing or research attention given to fungicide use. “In corn, there are a lot of great disease-resistant hybrids, and the joke in the industry is if you have a disease, you chose the wrong hybrid,” says Damon Smith, University of Wisconsin field crops pathologist.

This changed when soybean rust, a devastating pathogen caused by the fungus *Phakopsora pachyrhizi*, was first discovered in 2004. Early estimates predicted potential losses of 50% in the Southeast and 10% in the upper Midwest and Canada. Industry ramped up fungicide production to be ready to help growers prevent potentially steep losses.

However, after nine years of living with the threat, economic damage from soybean rust has been largely limited, in part due to the Soybean Rust IpmPIPE. This collaborative effort by USDA, universities, and the soybean industry includes a forecasting system that uses scouting and sentinel plots to alert growers to rust movement northward from overwintering sites in the Deep South. With less-than-expected need for the expanded fungicide inventory, attention turned towards research trials to identify potential uses and benefits.

Claims of improved plant health and higher yields soon followed. Bond McInnes, DuPont’s Fungicide Technical Manager reports, “We found that strobilurins have physiological effects. They reduce senescence, and this greening effect increases shoot and root

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growth. The sterol inhibitor fungicide class has not demonstrated the same effect, so we are really just talking about strobilurins." Other claims suggested strobilurins improve efficient use of water and nitrogen, and improve stalk strength, minimizing yield losses at harvest due to lodging.

Disease management challenges have also increased as producers plant more continuous corn in response to higher corn prices. Continuous corn and other practices, including reduced tillage, increase pressure from diseases like gray leaf spot, northern leaf blight, and in soybeans, frogeye leaf spot. Responding with preventative fungicides before a disease is present is a strategy being employed to manage this risk.

Economic thresholds to guide fungicide application decisions are lacking. "If we have an infection on a leaf or pod, there is such a short window to take curative action," McInnes says. "The worst way to control a plant disease is by playing catch-up. It's far better to control a disease at 1% than 20 to 30%."

Industry recommendations to manage disease and increase plant health have included a single application at V7 to R3 in corn and R1 to R4 in soybeans. A two-pass recommendation for high disease pressure and high-risk continuous corn includes a fungicide early in the vegetative growth stages and then again during flowering or

tasseling. "Early applications protect the leaf tissue, which then protect the developing ear and pod. Plant pathogens can reduce photosynthesis in plants, which will then impact plant growth and yield," McInnes says. The first application can be tank-mixed with herbicides.

## Data inconclusive

Some scientists are skeptical of claims that strobilurins enhance plant health. "I don't think industry results are biased, there is just something going on we don't understand," says Paul Vincelli, plant pathologist and Provost's Distinguished Service Professor at the University of Kentucky. "I don't like the uncertainty of not knowing where fungicide applications fit."

Typically, research trials are replicated in many small, randomized blocks to reduce variability in treatment conditions. "When we look at data from small-plot trials, it is clear yield benefits only apply where there is high disease pressure," Vincelli reports.

In 2011, to investigate whether small plot size might be a complicating factor, Vincelli designed a randomized, replicated trial with three very large blocks and controls. The blocks were 120 ft wide and ran the length of the field. Headline, a strobilurin fungicide, was applied at R1-R2 at 6 oz/ac. "I thought I was going to put the nail in this coffin for good," he says.

One trial showed no significant increase in corn yield or stalk health. The other two trials found a 20 and 27 bu yield increase. One of those two also showed a

20% improvement in stalk health. Due to drought conditions, no trials were completed in 2012. Results for 2013 are anticipated soon.

Data from other independent research also suggest fungicides do not consistently increase profits. Iowa State plant pathologist Daren Mueller and his Purdue colleague Kiersten Wise completed a meta-analysis of 39 trials from 2000 to 2010 that examined efficacy of strobilurin and sterol inhibitor fungicides. The strobilurin fungicide applications had a statistically significant effect on yield in only 18 of 39 trials (Wise and Mueller, 2011). A more targeted analysis including only strobilurin fungicides applied between V14 and R5 in corn, and only where foliar diseases were present, showed 80% of 472 treatment comparisons demonstrated a positive yield response.

However, only 48% of these comparisons generated a sufficient yield gain to cover the fungicide costs. Despite this less than 50% chance of return on investment, "There is obviously something going on worth keeping this conversation going," Mueller notes.

## Resistance concerns

Pathogen resistance to fungicides weighs heavily on the minds of both industry and university scientists. "We have a lot of great products, and the last thing we want to do is follow the path of glyphosate resistance in weeds," Mueller says.

Rotating fungicide mode of action is a good way to manage resistance. However, "We only have three fungicide groups to work with," Smith reports. "As recently as three years ago, we only had two, the sterol inhibitors and

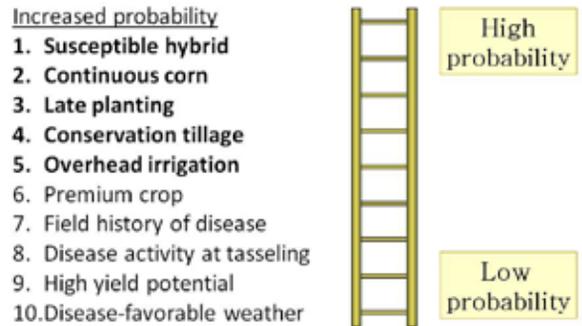


Photo courtesy of Wikipedia



Kiersten Wise, Purdue University, shows a diseased leaf at the university's Crop Diagnostic and Research Training Center. Photo courtesy of Extension Entomology, Purdue University.

## Factors that increase probability of positive fungicide response in corn



**Fig. 1.** Hierarchy of risk factors for disease and potential for a positive yield response from fungicide applications to corn. Courtesy Paul Vincelli, University of Kentucky.

strobilurins. Now we have the SDHIs. There is a big push for pre-mixed products, but remember, we only have three groups. If we apply a product that is mixed with multiple modes of action, what do we rotate with?"

McInnes agrees that growers need to be concerned about resistance. "The number one way to reduce resistance is to reduce the number of applications. Most growers traditionally will only make one." If a two-pass system is used, McInnes recommends applying the strobilurin in the first application. "During the second application, a grower could rotate to one of the other fungicide classes."

### Are fungicides the right investment for your clients?

"Industry and university pathologists have not identified the best path forward. There is no black and white, it's all gray," Mueller explains. He encourages consultants and growers to scout their fields and to pay attention to what is going on elsewhere. "In 2013, soybean rust was a problem in several southern states. Keeping up on the regional reports and crop susceptibility is critical."

Consultants can also perform a simple assessment to help judge where fungicide applications have the greatest potential to generate a positive return on investment. Planting a susceptible hybrid tops the list for disease risk and potential for return (Fig. 1). Disease-favorable weather is surprisingly not a good predictor.

Jensen recommends reading testimonials and product trial reports with a critical eye. "Ask questions about study design. Was it replicated? Was disease severity evaluated? Was a susceptible hybrid/variety used?"

Consultants might also consider evaluating fungicide recommenda-

tions by setting up replicated on-farm trials with clients. Spray four passes and skip two," Vincelli suggests. "Repeat this across the field. With this replication, you can see at harvest if the applications made financial sense."

Learn more about soybean rust at <http://sbr.ipmpipe.org/cgi-bin/sbr/public.cgi> and managing fungicide resistance at <http://ipcm.wisc.edu/download/pubsPM/A3878FungicideResistance.pdf>.

### References

- Wise, K., and D. Mueller. 2011. Are fungicides no longer just for fungi? An analysis of foliar fungicide use in corn. *APSnet Features*. doi:10.1094/APSnetFeature-2011-0531. Available at [www.apsnet.org/publications/apsnetfeatures/Pages/fungicide.aspx](http://www.apsnet.org/publications/apsnetfeatures/Pages/fungicide.aspx).

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