

Research studies key crop factors that affect yields

By WILLIE VOGT

HAVE you ever considered all the factors that could add up to a 260-bushel corn yield? It's a question plant researchers have explored. What they're learning could open doors to higher yields from existing hybrids that could boost return on investment for years to come.

When Fred Below from the University of Illinois Crop Physiology Laboratory starts talking about crop yield, he tackles the idea from the perspective of the "Seven Wonders of the Corn Yield World," as he calls them.

And he looks at how a little chemical called ethylene can weigh in on that yield picture.

When Below talks about the seven wonders, he takes a few things for granted first: "Weed and pest control are prerequisites, but not wonders. Weeds don't add yield, but these days we can control weeds."

He notes that other prerequisites include adequate levels of phosphorus and potassium and those one-time improvements to fields you may have identified from yield maps. For example, tiling investments or changes in waterways to improve draining fall into that class.

Here's what makes up the seven wonders, with a quick explanation of their role in plant yield. The table on this page shows each factor, its rank and its value in bushels per acre, according to Below.

Weather. This factor, over which you

Key Points

- Plant stress research turns up new ways to preserve plants.
- Understanding plant interaction with fungicides is important.
- Ethylene release is a stress trigger that can be controlled.

have the least control, has a value of 70-plus bushels and is an important determinant in final yield.

Nitrogen. N ranks No. 2 for yield impact and is one factor farmers understand well.

Hybrid. This gets credit for 50 bushels of total yield, and Below says work on enhanced N utilization and other technologies could one day move this factor into the No. 2 position.

Previous crop. The soy credit can't be underestimated in a crop rotation.

Plant population. Below believes that if you're planting below 32,000 plants per acre, you're too low and are missing yield opportunities.

Tillage. Timing is the issue here, as well as the level of tillage you do. The 15-bushel impact is important. Even if you're a no-tiller, this is a key management area.

Chemicals. While this ranks seventh on the list, Below says it's of growing importance. And this is chemical impact beyond weed control — remember, that's a given.

It's that seventh wonder that Below has been focusing on with research he's done lately, and he's been looking at the interaction of fungicides and plant growth regulators as they relate to plant stress and plant performance.

Fungicides and plant physiology

"There's a known greening effect with the use of the strobilurin class of fungicides," Below says. "The lower part of the plant stays greener longer, and this is more than disease control. Understanding how this can increase yield can help farmers continue to chip away at that 260-bushel yield."

When Below looks at fungicides and plant growth regulators, another class of chemistry, he's finding that these chemicals can in some ways control the weather by managing heat stress. This

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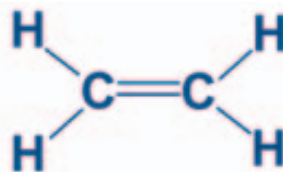
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Seven Wonders of the Corn Yield World

Rank	Factor	Value (bu./acre)
1.	Weather	70+
2.	Nitrogen	70
3.	Hybrid	50
4.	Previous crop	25
5.	Plant population	20
6.	Tillage	15
7.	Chemicals	10
	Total	260

ADD IT UP: The Seven Wonders of the Corn Yield World is a ranking of key factors and how they add up to a top-level yield. The more you can control, the higher the final yield.



LITTLE MOLECULE AT WORK: The ethylene gas molecule looks simple, but it is a big trigger to tell plants it's time to stop growing and start drying down. Controlling its release could boost yields under stress.

can have a serious impact on plant yield. Plants already have their own regulator — ethylene — which can alter the timing of when plants stop growing.

He explains that ethylene gas is a plant growth regulator the plant itself produces. It has a role in fruit ripening (see "Explore the magic of ethylene gas"), leaf senescence and kernel abortion in plants. When a plant is stressed, it ramps up ethylene production, and that speeds up ripening. Once this happens, the photosynthetic process is slowed, lowering yield production.

It turns out that the strobilurin class of fungicides and another chemical — 1-methylcyclopropene, or 1-MCP — can both impact ethylene production in the plant. The result is improved response to plant stress and less likelihood that the plant will senesce too soon.

The chemical 1-MCP is coming to market in the future through an agreement between Rohm & Haas and

Managing stress in plants leads to better returns

WHEN a plant is stressed, either from the weather or some other factor, it releases ethylene gas. Adding products, including fungicides or a new class of plant growth regulators, could reduce the stress response and boost yields.

Fred Below from the University of Illinois put that to the test with field work he's doing using the 1-MCP product — a plant growth regulator — in the field. He conducted two tests: one for heat stress and the other for population stress. The aim was to learn how the ethylene-controlling ability of such products could impact plant performance.

By creating a kind of field hot box, Below was able to apply heat stress to plants both for an untreated check and for plants treated with the plant growth regulator. In these tests, Below recorded a response.

"The product provided partial protection from the heat stress versus the untreated check," he says. In effect, this class of products could allow you to take control of some of the weather factors that impact yield.

In another trial, this one looking at plant population, Below found that at higher populations, stress control can pay off. In a plant density trial at 30,000, 40,000 and 50,000 densities, plants treated with the 1-MCP product at the 50,000 population beat the untreated check by 17 bushels per acre, which is statistically significant.

Fungicide use has taught farmers that plant stress can be managed and higher yields are possible. As research looks further into the mechanism of that stress, farmers may someday have tools to control the weather, in a manner of speaking.

Syngenta. Below says the product shows it can impact ethylene production in the plant when stress is present. And he's demonstrated that impact through both heat stress and plant population research (see "Managing stress in plants leads to better returns").

Explore the magic of ethylene gas

ANYONE who catches late-night television or watches the noon-day news may have seen the commercial for those little green bags that protect produce. The ads talk about the bags allowing for the release of ethylene gas so it can't overripen the fruit.

Ethylene gas (diagrammed at right) is a trigger for ripening in all plants. In field crops, it turns out the gas shows up when plants are stressed. Once the plant starts producing ethylene gas in abundance, it will start to senesce, and as a result will produce lower yield. The best way to stop production of ethylene gas is to control plant stress factors.

Farmers do a pretty good job of that, but a new class of chemicals and an enhanced understanding of this part of the plant life cycle open doors to new ways to control the timing of ethylene gas release.