The Quest for 300 Bushel/A Corn Yield

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Some may use the marketing term 'stretch goal' when they talk about achieving 300 bushels per acre corn yield, but Dr. Fred Below, Univ of ILL crop physiology professor, knows it's possible and has outlined how to reach it in a program he calls the 7 Wonders of the Corn Yield World.

Dr. Fred Below, Univ of ILL crop phys prof, explains the 7 Wonders at FP Show in Decatur in early Sept

"Increasing corn yield to the elusive 300 bushels/A mark is needed to feed a growing world population, and the 7 Wonders is an actual scientific explanation of more corn yield," Below said in an interview at the Farm Progress Show in Illinois. "It's part of the quest for 300 bushels/A." His research shows how a high-tech management package, compared to most farmers' practice over the last two years, has increased yield by over 50 bushels per acre and can reach 60 bushels in a good year like 2009.

Adam Henninger, Univ of Illinois crop science research assistant, said the 7 Wonders rank the seven most important factors that we find that have a positive impact on yield year-in and year-out. After ranking them, Henninger and Below assigned each an average bushel per acre value based on their research.

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	Growth Regulators	10

Prerequisites to the 7 Wonders

Henninger said the 7 Wonders also come with prerequisites - things that you have to get right, before you start to think about the 7 Wonders. "Drainage, pest/weed control and soil fertility are crucially important to farming but don't necessarily directly add yield," Henninger said. "If farmers can provide better prerequisites, especially mineral nutrients, they have better chances of achieving high yields."

The 7 Wonders of the Corn Yield World

1) Weather

"Number 1 is, of course, weather; weather also determines the success of planting day," Below said. "This year, I had the weather working against me here (in Illinois) completely." On its own, weather contributes 70+ bu/A or more resulting in 27% of the value of total yield.

2) Nitrogen

Of the factors that growers have some control over, nitrogen fertilizer is the one that gives farmers the best opportunity to increase yield, he said. "There's nuance to the factors that affect yield; they interact with each other. When you think about nitrogen, every single thing about it is influenced by the weather - the application, the loss, the use by the plant," he said. "And since weather and nitrogen combine to make a path of your yields, you're never going to be able to grow 300 bushels unless you manage your nitrogen against weather-induced losses."

3) Hybrid

Choosing the right hybrid is one of the most important decisions a farmer makes each year. Because of advances in biotechnology with triple stack genetics, there are significant differences in yields and traits in each hybrid. Insect protection traits allow plants to realize their full growth potential by taking up more water and mineral nutrients. "All hybrids aren't created equally, and soon the biotech divide will become wider with the addition of drought-tolerant weather-induced hybrids," Below said.

4) Previous Crop

If you aren't rotating crop, Below said it's costing you yield. Residue from the previous year's corn crop will cost more each year corn is grown. But on fields where corn has been rotated with soybeans, corn has better vigor and produces higher yields.

5) Plant Population

Below said plant pop is the key to high yields. Row arrangement is one way to increase plant population. Using a twin row system with plants arranged in 7-1/2" staggered rows eliminates plant-to-plant competition and provides a perfect place for nutrient and water management.

6) Tillage

While farmers consider tillage a major factor in yield, it only ranks #6 in the value scale. However, it does play an important role in saving soil and retaining valuable moisture and nutrients. This year, Below said those who used low-till likely saved some yield.

7) Growth Regulators

Growth regulators can increase yields by affecting growth. The growth regulator of Below's focus is leaf health or leaf performance that comes from strobilurin fungicides in the absence of disease. However, Below cautioned growers to be careful as it's possible to decrease yield if you use a growth regulator incorrectly. He said if you add up all the values that the seven factors bring, it's 200 bushels. The key to bumping up to 300 is to combine these factors in a way that they can work together to further increase crop yield.

In their research plot at the Farm Progress Show, Below and Henninger compared a standard management system currently used by most farmers with a high technology package of five optimized management practice and inputs.

High Tech Package

- MicroEssentials$^{Â®}$ SZ (14-40-0-10S 1Zn) improving soil fertility from spring banding 250 lb/acre four to six inches deep directly beneath the crop row just prior to planting to provide 100 lbs P2O5, 35 lbs N, 25 lbs S and 2.5 lbs Zn.
- SuperU$^{Â®}$ and AGROTAIN$^{Â®}$ protecting the applied N against weather-induced losses and making sure that adequate N was available throughout the critical periods of crop development. At planting 180 lbs of SuperU was broadcast, followed by an extra 60 lbs of N as urea with AGROTAIN surface banded between the rows at the V5 growth stage. SuperU contains a urease and a nitrification inhibitor to prevent loss by volatilization, leaching, or denitrification. AGROTAIN is a urease inhibitor that prevents volatilization losses from surface-applied urea.
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- Use of full-season triple-stacked or SmartStax$^{Â®}$ hybrids that have a high management yield potential. Traited hybrids have resistance to the key insect pest that can damage corn, while a hybrid with a high management yield potential will tolerate high plant populations and can respond to additional N.
- Growing at higher plant pops than standard (45k compared to 32k plants/acre) because plant pop is an important component of grain yield because more plants can intercept more sunlight.
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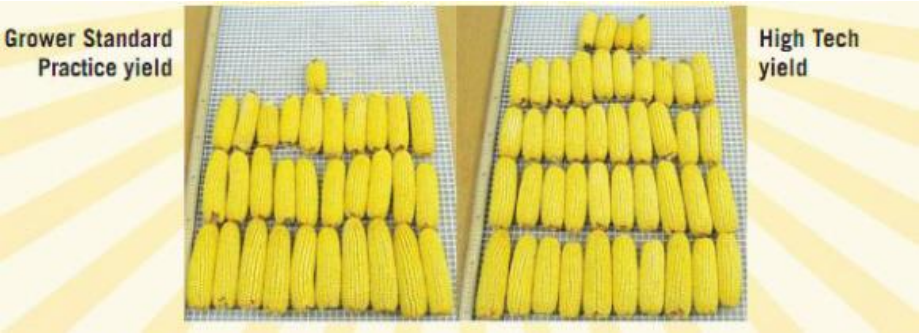
- Applying Headline, a strobilurin foliar fungicide, at flowering to control leaf disease and protect late season leaf and plant health.

2011 Observations

Due to weather, Below consistently saw uneven emergence this year, resulting in what he calls "plants left behind". When a plant emerges even a day later than other plants, it never catches up and usually has a small ear or the ear is lost completely. "When you manage those plants right from the beginning with extra fertility and extra population, yield is made when you plant - no plants are left behind," he said. "This is the kind of trajectory needed to grow 300 bushels. Even under dry conditions like we saw this year, population is the key to high yield. It's opposite to what most farmers think, but the only way to increase yield if you have a drought is to have more well-managed plants."

If you are planting 32,000 plants/A in dry conditions, ears will be tipped back, likely a quarter on every plant, due to a combination of temperature and moisture. At 45,000 plants/A with the High Tech Package, ears will still be tipped back a quarter, but there's 13,000 more and that's where the 35 or 40 bushel difference in yield comes from, he said.



Planting higher populations amid dry weather is a concept that goes against the grain for many growers. "If you think about what happens when a plant is drought-stressed, it rolls its leaves and therefore, it doesn't intercept all of the sunlight," said Below. "When you have more plants with rolled leaves, they're still rolled, but more sunlight is intercepted."

Below warns growers that just planting higher populations won't necessarily do the trick to increase yields. "The key to increasing yield with higher population is to manage it and feed it well," he said. "Our package has insect-protected genetics, higher population right in a band of balanced fertility soil with added nutrients from the start. And then we finished it off with a fungicide package. We've done everything we can to manage and feed this higher population." Below says that if each of the 7 Wonders is optimized, farmers can routinely grow 260 bushels/A corn. To reach the goal of 300 bushels/A requires better prerequisites, soil fertility, most importantly, combined with optimized packages of the 7 Wonders.

Industry Support

Below and Henninger's research and the 7 Wonders of the Corn Yield World are sponsored by Agrotain, BASF, Dekalb and Mosaic. Jeff Whetstine, VP of marketing for Agrotain, said Agrotain approached Dr. Below and asked him to share his research with growers at Farm Progress Show because it makes a difference when they see it in the field.

Typically, the research we do as individual companies compares our product to not using our product. The unique thing about Dr. Below's research is, he uses all the latest high-tech products and then takes each one out to see what impact that has on yield," Whetstine said. "Here, growers can get a good idea what the yield contribution is for each of these factors, and how they act synergistically to make more yield. A 55-bushel difference over two years at multiple sites is a pretty significant yield difference-especially when corn is priced where it is today."