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The thief stealing corn yield?

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"The greatest yield potential you're going to have with a corn crop," says John McGillicuddy, "is the day the corn germinates — it's downhill from there, the corn yield curve never goes back upward; there are no do-overs in corn production."

Corn will hold a relatively constant yield potential until it hits stress, and then it can unload 20 bushels, he said during a seminar on corn production at the annual meeting of the Mississippi Agricultural Consultants Association at Mississippi State University.

"Whenever a corn plant goes on the defensive, it starts dumping yield. It could be a nutrition problem, it could be because plants are too crowded — there are many, many reasons. What we're looking for is the thief that stole our last 20 bushels of yield."

McGillicuddy, an independent agronomist at Iowa City, Iowa, with farmer clients in several states, is an expert at determining where yield potential was lost. His education was in chemistry, but his résumé includes more than 20 years in hybrid/fertility research, field agronomy, technical support, and weed science, including stints with seed companies and the largest crop insurance company in the U.S., evaluating agronomic techniques to reduce risk in cropping systems, and as a consultant/trainer for numerous ag companies and organizations.

"We have clients who, if they pick just 220 bushels, are disappointed; they call us up and want to know what went wrong," McGillicuddy says. "With $350 land rent, they have to get that kind of yield to pay the bills and make a profit.

"It wasn't that long ago that 150 bushels was considered a good yield; now, most of our farmers would consider that a catastrophe. The genetic potential in today's corn varieties, we're told, is somewhere around 400 bushels.

"Your mission in a corn field is to determine what you can do to influence the outcome of that crop. And if you don't get the yield you feel the crop should have produced, you need to utilize diagnostic tools and knowledge to determine what went wrong so you can solve the problems that took your last 20 bushels of yield. If you can't solve those problems, you're not accomplishing anything.

Corn yield can be reduced to a simple equation, McGillicuddy says: kernel numbers X kernel weight = yield.

“The first thing I want to know when I look at a field that didn’t meet its yield potential is, which part of this equation let me down? Then, why? And was there anything I could have done about it? This information needs to be collected before you harvest the crop so you will be able to analyze it and determine how you can correct it next year.

“It comes down to this: You can’t afford to grow barren stalks. First, look at the girth and length of ears and weight. We budget for 7 bushels per 1,000 plants. If ear count was down, we almost always are looking at something that happened between germination and emergence. If the loss was because of kernel weight, that indicates something happened mid- to late dough stage and beyond — nitrogen availability, limited sunshine in August, or perhaps dew and fog that can cause leaf diseases.

“Is the ear girth within normal range for that variety? You want one-third or more of the ears to be in the upper range of girth for that variety. Kernel count on the ear should be about equal from a couple inches from the butt to a couple of inches from the tip.”

Corn development has two stages, McGillicuddy notes: yield establishment and yield preservation.

“When you lose yield, it will be either in the early development stage when yield is being established or the late development stage when yield is being preserved.”

Growers are planting much earlier, into colder ground, he says, and that can affect vital nutrient uptake.

“It used to be in Iowa that we planted corn about Mother’s Day in May, now it’s about April 1-10. The weakest period in a corn plant’s life is from germination to emergence, and the faster it gets out of the ground, the better. Until it gets leaves into the atmosphere, the corn plant cannot respirate effectively, so it needs to get up quickly. Thirteen days is the magic number from germination to emergence.”

Replanting is “one of the most difficult decisions to make,” McGillicuddy says, “and the following 60 days of weather after you’ve replanted will prove you really smart or really dumb. The golden rule on replant is that you don’t decide to plant until you can put seed in the ground right now.”

Plant population is important, he says, because “a corn plant knows what its neighboring plants are doing —research has proven this. The closer together plants are, particularly when the spacing drops below 7 inches, the more sensitive they become.

“Seed quality is a big thing — you can’t fudge on this and expect to get maximum yield; it just puts you on the fast track to loss.

Spacing also influences tillering, he says. “Corn plants tiller because (1) they can or (2) had to. A plant with extra space or a competitive advantage is more prone to tillering. Plants damaged early in life may tiller as a survival mechanism. It’s important that you understand just how sensitive a corn plant is to its environment and how competitive it is with neighboring plants.”

Until just prior to tasseling, the plant is still deciding how big its yield is going to be, McGillicuddy says. After that, "it tries to hang onto that yield potential."

In evaluating yield losses, he says he also looks at ears and asks, "Did the plant establish kernels that it didn't finish or did it not establish enough kernels?

"If the loss was between V1 and V5, the cause is usually nutrition. Moisture is the number 1 factor affecting nutrient availability, temperature is number 2. In most years, we are losing more bushels by not feeding plants that came up than bushels we lose from plants that don't come up because it was too cold.

"With nitrogen, because of cost, we always want to miss the high side of application rate."

If plants are yellowing, McGillicuddy says, the question becomes, is it due to a shortage of nitrogen, zinc, genetics, iron, sulfur, or something else?

"It could be all of these. We've seen yellowing corn for decades — at 150 bushels, it didn't matter that much, but at 220 bushels, it does matter.

"If corrected quickly enough, yield potential can be preserved. The trick is, how do you change your preplant program to keep it from ever happening in the first place?"

About 80 percent of the zinc in the marketplace "accomplishes nothing," he says. "Formulation and placement are important. How micronutrients are formulated and making them work for you is a valuable skill."

Boron response has been seen "on the very highest-yielding fields," McGillicuddy says, "but the window for boron is very critical, at the V1-V5 stage."

A corn plant's first unloading of yield potential starts before the V5 growth stage, he says, and can claim 14 bushels to 20 bushels.

"It's important to identify the culprit. When plants have small ears or no ears, it often is due to competition for sunlight. The length of the ear and husk is also a diagnostic tool, because husk length is determined before ear length."

And, he cautions, "Any year when you see really long silks, that's when your aflatoxin radar should click on and you should start watching for signs of the disease."

It's important to actively manage soil temperature in the corn field, McGillicuddy says.

"Every part of the corn plant above ground has a mechanism to manage heat, but below ground there is no mechanism to protect roots and tiny root hairs from heat.

"When corn leaves roll up because of heat, it means just that much more sunlight is now hitting the soil and pushing temperatures underground even higher. It's not uncommon to have soil temperature at 3 inches that is 20 degrees to 25 degrees hotter than the air temperature — which immediately creates stress on the fine root hairs that are extremely valuable to the plant's health and survival.

"If you can keep subsurface temperature in the mid-90s or below, you can avoid heat stress to the roots and root hairs and allow plants to hang on for another 15 days or so until you get a rain — and avoid that 20-bushel yield loss.

"You should always remember that corn is a cool-season prairie grass, and actively think about managing soil temperature, with a dust mulch, residues, etc. Keep a set of good thermometers with you all the time to measure soil temps."

Hard subsurface soil layers can create barriers to moisture below the plants' rooting zone, McGillicuddy says. "Anywhere you've got yellow roots, the plants are not able to effectively access nutrients and water. You can correct this next season by narrowing sweeps on your field cultivator and creating areas for aeration and water penetration.

"If you can get the field to silk before temperatures get scorching hot, that's important. During the period pre-tasseling to the dough stage, stress can have a major impact on yield. In many cases, it's the two weeks before tasseling that's going to get you."

If corn successfully made it past the pollination stage, but at harvest kernels on the end of ears are not fully developed, it's usually due to a potassium deficiency, he says.

"But, by the time you see potassium deficiency in the leaves, you've already lost yield. Today, we're producing 10,000 to 12,000 more plants per acre than we used to, but we're feeding them the same. Potassium is the water regulator in the corn plant. All sorts of things can go wrong when it isn't getting enough potassium.

"Stomates — tiny openings in the plant leaf, as many as 1,000 in the space of a dime — don't function properly if they don't have enough potassium and they can't manage water efficiently.

"The problem with some soils is there isn't enough potassium to allow the plant to take it up rapidly enough. From V6 to VT, the critical uptake period when you're building a huge plant and taking up the potassium needed to hold and develop kernels on the ear tips, you need to deliver 75 percent of the total potassium for the season — about 155 pounds per acre."

If pollination is below expectations, he says, it can be due to environmental shock (hot/dry conditions or insects feeing on tassels and silks). If there is loss of kernel size/weight, it can be caused by nutrient stress (N, K, Mg), low sunlight, or premature death due to disease.

For below expected kernel set, look for environmental shocks (saturation/cold), herbicide injury, physical damage (root loss/hail), or nutrient deficiencies (N, K, B).

For kernel abortion after pollination, look for nutrient stress (N, K, Mg), low sunlight, or clouds/dew/fog/leaf diseases.

"Continuous corn can have a problem with autotoxicity," McGillicuddy notes. "One year's crop leaves behind a compound that stunts corn seedlings. This can cause a seven-day to 10-day delay, which you can't make up in October."

A grower has many choices for investing his time and money — technology, machinery, labor, land rent, and on and on, he says.

"There are a lot of screwball products out there. Almost anything will work somewhere; absolutely nothing works everywhere. So, when you spend money on a product, you need to be sure there is an expectation that it will work and give you a return on that expenditure.

"If you invest your money in what gives the quickest return most consistently, you'll have more money at the end of the year. Your decisions shouldn't be based on emotion — establish a production plan and stick to it. And if something goes wrong, determine where it happened and take steps to correct it before the next crop."

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