UNIVERSITY OF ILLINOIS

AGRONOMY DAY

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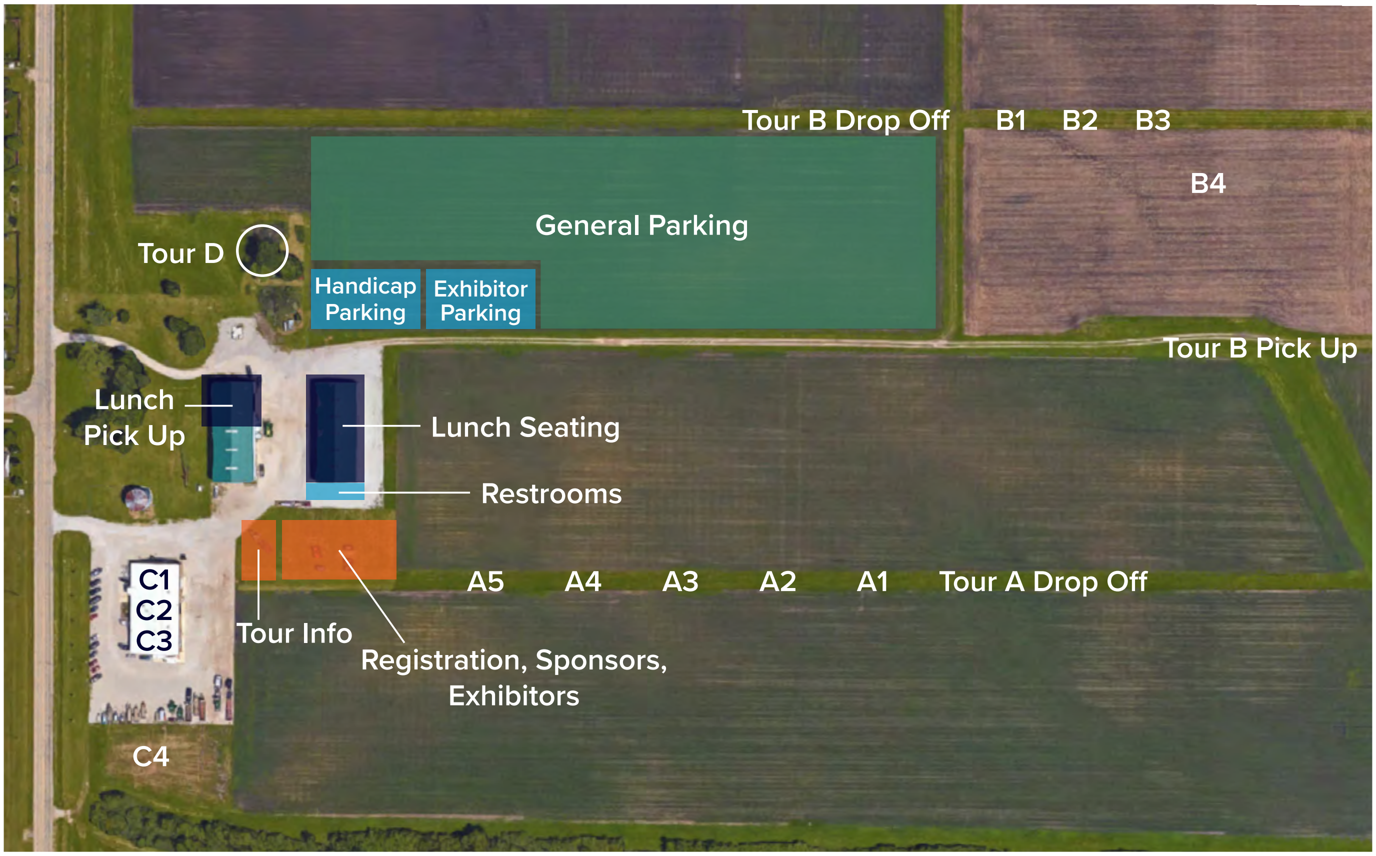
ILLINOIS | ACES College of Agricultural, Consumer and Environmental Sciences

AGRONOMY DAY MAP



UPCOMING EVENTS

Vegetable Field Day 2017

- Directly following Agronomy Day on Thursday, August 17th from 1:30 to 3:00 p.m.
- Vegetable Crops Research Farm at 2921 South 1st Street in Champaign, IL.
- Walk through research plots and hear from U of I Crop Sciences faculty sharing information about pumpkins, cucumber, tomato, squash, basil, peppers, and a new method of mushroom production! Registration is not required.

International Agronomy Day 2017

- Monday, August 28th from 8 a.m. to 1 p.m.
- Crop Sciences Research and Education Center South First Street Facility at 4202 South 1st Street in Savoy, IL.
- Nationally renowned faculty share the latest research in agronomy, weed science, crop production, soybean breeding, water quality and more. Registration cost: $30.

THE SEVEN WONDERS OF CORN YIELD - REVISITED

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The Seven Wonders of the Corn Yield World was developed ten years ago as a tool to teach farmers and agricultural professionals the value of their individual crop management decisions. It ranks the top seven factors that can positively impact corn yields and assigns a bushel per acre value to each wonder (Figure 22). I revisit it here talking about what we learned using this concept.

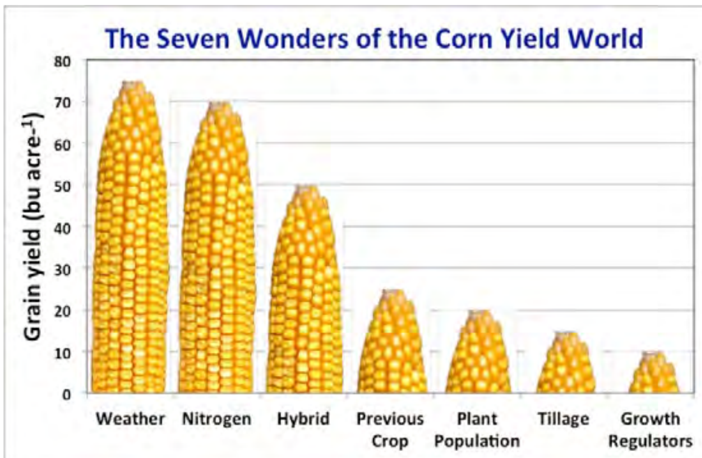

Figure 22. The seven wonders, ranked from greatest to least impact on corn yield, tallying to a 260- bushel per acre impact on yields.

Defining a Wonder

Some practices are important, but are not considered as yield wonders because they are either one-time improvements (tile drainage), they protect rather than increase yield (weed and pest control), or they involve decisions that don't need to be made every year (soil pH and nutrient levels). One nuance of the seven wonders is that they interact with each other to either magnify or lessen a wonder's impact on yield. Understanding a wonder's ranking, and its interaction with other wonders gives farmers an opportunity to increase yields through better crop management.

The Seven Wonders of Corn Yield

Weather and nitrogen (N) availability are the two factors that normally have the greatest impact on corn yields. Hybrid selection is probably the most important decision farmers make each year, and most don't realize the large difference in yield potential among elite commercial hybrids. Hybrids respond differently to growing conditions and crop management, with some tolerating low N conditions, cultivation under continuous corn, or higher planting densities better than others. Continuous corn has a yield penalty due to residue accumulation while increasing plant population (plants per unit area) is one of the management factors that has changed the most in the last 55 years (Figure 23). Plant populations will continue to increase to grow high corn yields, and narrow rows are one way to manage a higher population of plants. The last two wonders, tillage and plant growth regulators, markedly interact with all the factors mentioned above in affecting yield, either positively or negatively. The latter is a catchall group, including compounds that stimulate plant growth, such as foliar fungicides and in-furrow mixes, which can be combined to power greater yields

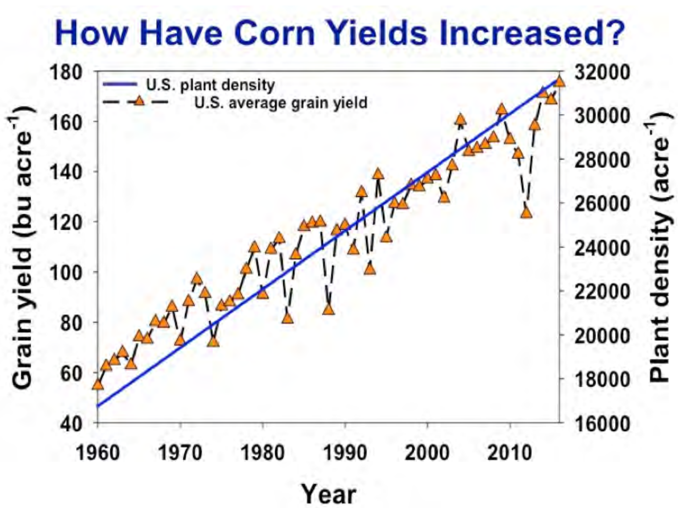

Figure 23. Corn planting populations have steadily increased over the past 55 years, contributing to higher yields.

Next Up

Recently, we've taken a closer look at the management factors under our control. The next stops on the tour will give you the latest updates on what happens to corn yield with changes in soil fertility, crop rotation, and plant population.

HOW CRITICAL ARE SOIL PHOSPHORUS TEST VALUES?

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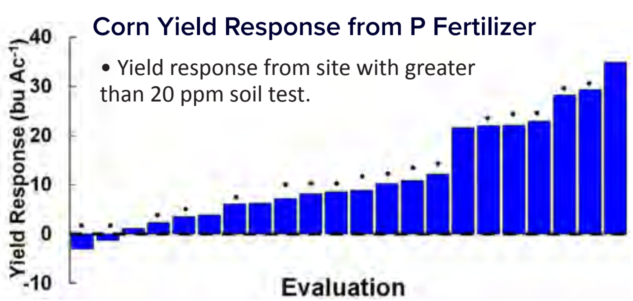
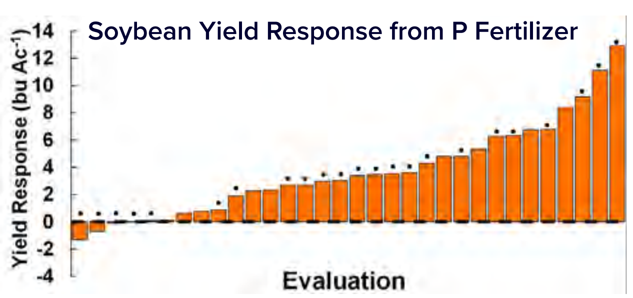
The Illinois phosphorus (P) soil test recommendation has negligibly changed since the 1960's, while crop production practices have changed substantially; therefore, we question if soil test recommendations are adequate for modern crop production practices.

Field Set-Up

Twenty-two corn and 32 soybean evaluations were conducted across Illinois to determine the response from a premium P-based fertilizer, MicroEssentials SZ (12-40-0-10S-1Zn). Soil samples were taken at a depth of 0-6 inches before planting for each evaluation and analyzed using the Mehlich III extraction method. Using 4R nutrient stewardship (right source, rate, time and place), fertilizer applications were estimated based on nutritional needs of high yields of both crops. MicroEssentials SZ was banded 6 inches directly under the crop row in the spring before planting using RTK tractor guidance at rates of 100 and 75 lbs P2O5 per acre for corn and soybean, respectively and compared to unfertilized control plots. Corn was grown in 30-inch rows and soybean was grown, and data averaged across 30 and 20-inch rows, using multiple elite commercial varieties of both crops in each environment.

Figure 24 Yield changes due to banded P fertilizer compared to unfertilized plots arranged by response magnitude over 22 evaluations for corn, and 32 for soybean.





Soil Test P and Yields

The current Illinois critical level for soil P is 20-25 ppm depending on the region, indicating that any soil test levels greater than these should not produce a response from added P fertilizer. Across the 40 corn and soybean environments (74% of all environments) that were above the Illinois current P critical level, banded MicroEssentials SZ increased yield at these sites by an average of 5.5% for corn, and 5.2% in soybean (Figure 24). Regardless of the soil test level, banded P applications increased corn yield by 11.4 bushels per acre (6.1%) and 3.6 bushels (5.4%) for soybean. Neither corn nor soybean yield responses from spring banded MicroEssentials could be adequately predicted with the current P soil test recommendations. (Figure 25).

Summary

Soil testing is a valuable tool for phosphorus management. Increasing environmental concerns dictate alternative technologies of applying fertilizers to decrease nutrient loss and promote fertilizer efficiency. Soils testing below critical P levels should be corrected; however, greater yields can be obtained on soils testing above the critical levels using fertilizer in conjunction with best management practices.

Corn & Soybean Yield Response to MicroEssentials-SZ as a Function of Soil Test P

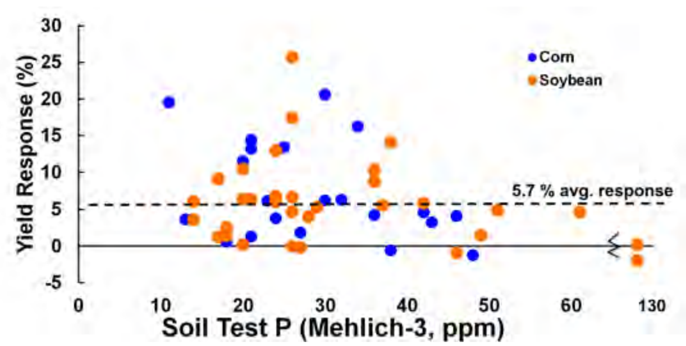


Figure 25. Magnitude of corn and soybean yield response from banded P fertilizer compared to unfertilized plots as affected by soil test P level.

KNOCKING OUT THE CONTINUOUS CORN YIELD PENALTY

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Accelerated residue degradation and nutrient cycling is necessary to maximize yield potential in corn grown continuously, in addition to other high volume residue situations such as increased planting densities, crops that annually produce greater than average yields, and reduced or no tillage. Grain yields of continuously grown corn are generally less than when corn is rotated with soybean, denoted as the continuous corn yield penalty (CCYP). The objective of this study was to test if residue management and agronomic inputs could reduce the CCYP.

Field Arena Layout

At Urbana, IL in 2015-2017, 15th-year continuous corn was compared to a long-term corn - soybean rotation (Figure 26). The previous year's corn crop was harvested with either a combine head equipped with Calmer's BT Chopper stalk rollers or with standard knife rollers, and both mechanical residue treatments were managed chemically with Extract Powered by Accomplish (Extract PBA), or with ammonium sulfate (AMS), and compared to an untreated control (Figure 27). In combination with rotation and residue, a standard management system was seeded to achieve a final stand of 32,000 plants/acre and received a base rate of nitrogen fertilizer only, while an intensive management system was seeded at 45,000 plants/acre and included additional sidedressed nitrogen fertilizer, broadcast and banded fertility, and a foliar fungicide application.

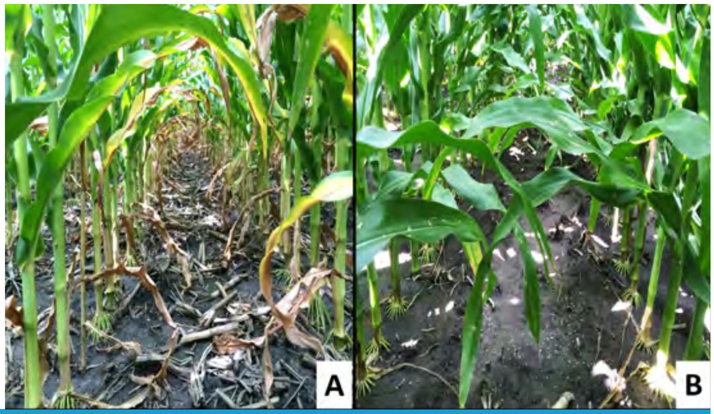

Figure 26. Late-season differences between 15th year continuously grown corn (left) and rotated corn (right).

Management vs. Yield

From fall harvest to spring planting, residue was reduced by 52% when chopped vs. only 45% from standard knife rollers. In addition to chopping, Extract PBA boosted residue decay by 9% while AMS by 12% over the standard stalk rollers with no chemical control.
The continuous corn rotation led to less seedling emergence during the first five days compared to the corn-soybean rotation. The intensive management system led to 2.4 times the biomass accumulation at the V6 growth stage over the standard system, leading to a CCYP reduction of 69%. There was a 20% greater yield response to intensive inputs in continuous corn vs. the corn-soybean rotation (increases of 43 vs. 36 bu/acre, respectively). Regardless of input level, continuous corn grown after standard mechanical residue management tended to increase yield after fall chemical applications of AMS (3 bu/acre) or Extract (7 bu/acre) compared to the untreated chemical control.

Figure 27. Mechanical residue management in corn on corn the previous fall (A and B) and at the R3 growth stage the following growing season (C and D): Standard stalk rollers (A and C) and Calmer's BT choppers (B and D).

1, 2, 3 Punch!

With an additional 7-12% of the residue degraded from the mechanical chopping and chemical applications, more nutrients could be released and readily accessible to the current crop to synchronize with crop needs. Add on sensible population, fertility, and fungicide decisions – and the CCYP was knocked down by 69% in this study, leading to greater yields in continuous corn.

CAN NARROW ROW SPACINGS BE USED TO MANAGE MORE CORN PLANTS?

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Corn yields have increased significantly since the 1930s largely due to genetic improvement and better crop management. Grain yield is the product of the number of plants per acre, kernels per plant, and weight per kernel. The average U.S. corn planting density has increased 400 plants per acre per year since the 1960s. As this trend continues, narrow row spacings can be used to increase the distance between plants within a row and provide greater plant spacing across a given area. Better plant spacing provides the opportunity to capture more sunlight and increase photosynthetic potential.

Plant Density Changes

In 2016, eight commercial DeKalb hybrids were planted at 32,000, 38,000, and 44,000 plants per acre in a 30” row spacing and at 38,000, 44,000, and 50,000 plants per acre in a 20” row spacing. Canopy coverage was 7% greater in the narrower row spacing compared to the wider row spacing at the V8 growth stage (Figure 28). Tillering is an indication of the environment and the space around a corn plant. Better growing conditions and greater plant spacing results in tillering. The percent of plants with tillers ranged from 2% at 44,000 plants per acre in a 30” row spacing to 39% at 38,000 plants per acre in a 20” row spacing. At the R2 growth stage, leaf area per plant significantly decreased as planting density increased for both row spacings. However, when expressed on a land area basis, leaf area index was greater at the higher planting densities but unrelated to row spacing. In contrast, when averaged across hybrids, root weight per plant decreased as planting density increased but tended to be greater in the narrower row spacing. Plants with smaller root systems could devote more energy to yield, but need to be better managed, especially with fertility (Figure 29).

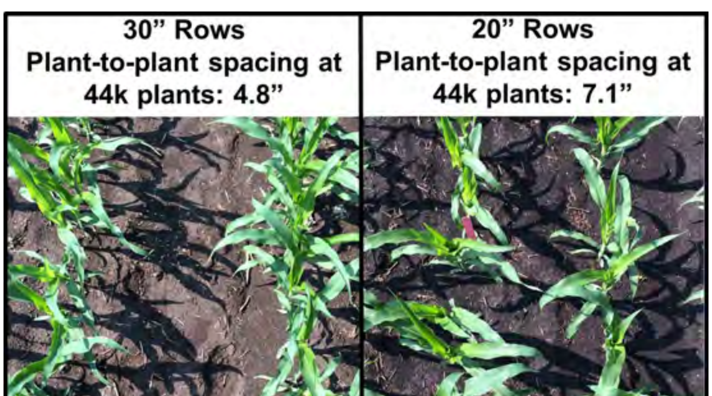

Figure 28. At the same planting density of 44,000 plants per acre, greater plant-to-plant spacing is achieved in the 20” row spacing compared to the 30” row spacing.

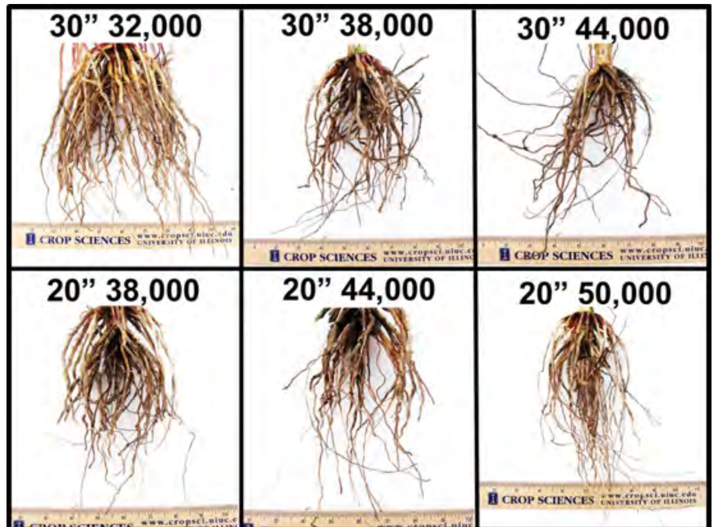

Figure 29. Individual plant root size (by weight) decreases as planting density increases. At a given planting density, the 20” row spacing has a larger root system compared to the 30” root system.

Corn grain yield, when averaged across all hybrids, significantly increased as planting density increased at a given row spacing. The narrower row spacing yielded 6 bu per acre greater at a given planting density compared to the wider row spacing. Planting 50,000 plants per acre in a 20” row spacing achieved the greatest yield of 289 bu per acre. When comparing a standard management practice (32,000 plants per acre in a 30” row spacing) to a progressive management practice (50,000 plants per acre in a 20” row spacing), the latter gave a 44 bu per acre boost with DKC64-87, and 19 bu per acre with DKC62-08.

Summary

Selecting a hybrid with greater yields at the higher densities and narrower rows is critical to earning a positive return given the additional seed costs.