PR-863

Agricultural Experiment Station

Overview of Kentucky Corn Yield Contests, 2019–2024

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The Kentucky Corn Yield Contest is organized and administered by the University of Kentucky Cooperative Extension Service. The Kentucky Corn Yield Contest aims to identify management practices that enhance corn yields across the state. It is heavily supported by the Kentucky Corn Growers Association and several agribusinesses.

The contest includes four divisions:
1. Tillage, non-irrigated
2. No-tillage, non-irrigated
3. Irrigated
4. White corn, non-irrigated

The contest spans six areas:
1. Purchase
2. Pennyrile
3. Green River
4. Lincoln Trail and Mammoth Cave
5. Louisville, Northern Kentucky, Fort Harrod, Bluegrass, and Licking River
6. Lake Cumberland, Wilderness Trail, Quicksand, and northeast Kentucky

Farmers submit agronomic data along with the yield entry. The yield check must be supervised and follow specific parameters for field size, harvest area size, and actual harvested entry size. The Kentucky Yield Contest closely follows the National Corn Growers Association (NCGA) Yield Contest rules, such that a farmer who enters the NCGA contest can submit a copy to the Kentucky Yield Contest. The NCGA has different divisions and slightly different requirements on supervision for specific yield levels.

From 2019 through 2024, farmers submitted a total of 357 yield contest entries across Kentucky (Table 1). Daviess County led in participation, with 107 entries (29.97% of all entries), followed by Hardin County (40 entries, or 11.20%), Union County (23 entries, or 6.44%), Logan County (18 entries, or 5.04%), and Henderson and Todd Counties (15 entries, or 4.20%, for each). The number of entries was 14 or fewer in the remaining counties. While the contest attracted participants from across Kentucky, most entries came primarily from these six counties, potentially skewing the results toward their specific environmental and soil conditions (Figure 1). Yield and agronomic data from those six years of the contest were analyzed to identify key management and environmental factors that affect corn yield.

Table 1. The number of entries, the highest yield in bushels per acre (bu/ac), and award-winning county for each contest year.

Contest Year	Award-Winning County	Highest Yield (bu/ac)	Total Entries
2019	Daviess	324.10	82
2020	Carlisle	324.98	53
2021	Carlisle	323.98	41
2022	Daviess	301.83	65
2023	Meade	330.78	63
2024	Daviess	333.47	53

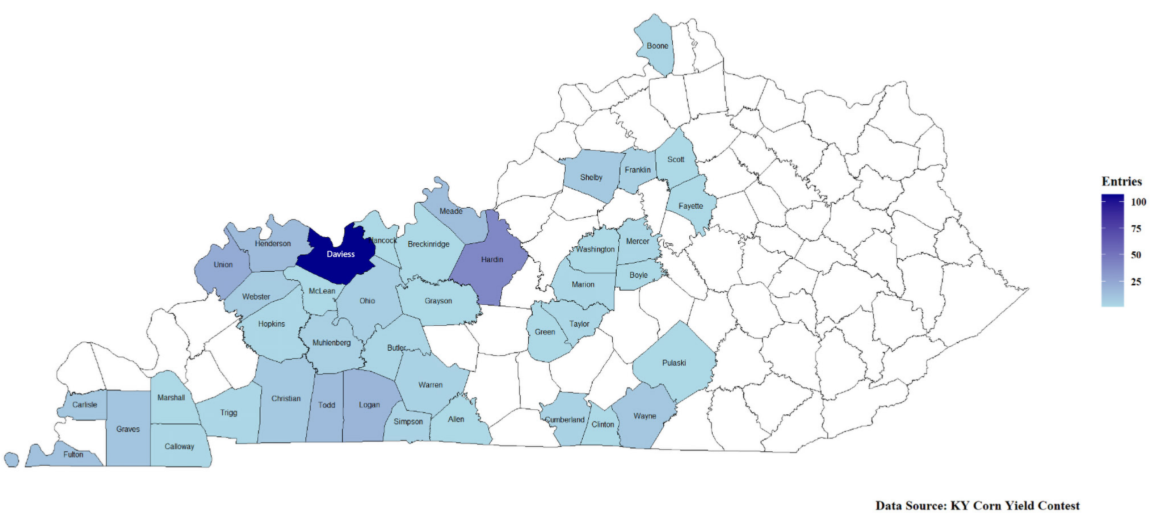

Figure 1. Number of entries received from participating counties from 2019 through 2024.

Box and Whisker Plots

Many of the graphs in this overview include box and whisker plots, which summarize data distribution. The box represents the middle 50% of the data (the interquartile range, or IQR), with the solid line inside the box indicating the median—the value that separates the data into two equal halves. The whiskers extend from the box to the smallest and largest values within 1.5 times the IQR from the quartiles. Data points beyond this range are considered potential outliers.

Larger boxes indicate greater variability in the middle 50% of the data, while longer whiskers suggest a wider overall spread. For example, Figure 2 displays box and whisker plots for corn yields reported each year from 2019 to 2024. The box for 2019 is larger than that for 2020, indicating greater yield variability in 2019. Meanwhile, 2021 shows a wider box but a higher overall yield than either 2019 or 2020.

Observations

The median yield increased from 266 bushels per acre (bu/ac) in 2019 to 289 bu/ac in 2021, reflecting an 8.65% rise. In 2022, the median yield dropped to 264.69 bu/ac, marking an 8.4% decline from 2021. The yield rebounded in 2023 to 283 bu/ac, and the highest median yield in the past six years was recorded in 2024 at 292 bu/ac, representing a 9% increase compared to 2019 (Figure 2).

Row Width and Corn Yield Trends

Corn yield was grouped by row width (Figure 3). Most entries (91%) used 30-inch row spacing, but some farmers opted for 20-inch or 36-inch row spacing. Among these, the median yield was highest in the 36-inch row spacing. Notably, this practice was used by a grower in Hardin County, who submitted two entries in 2019 and two entries in 2024. Despite using different cultivars and fertilizer inputs, his yields remained consistent across both years.

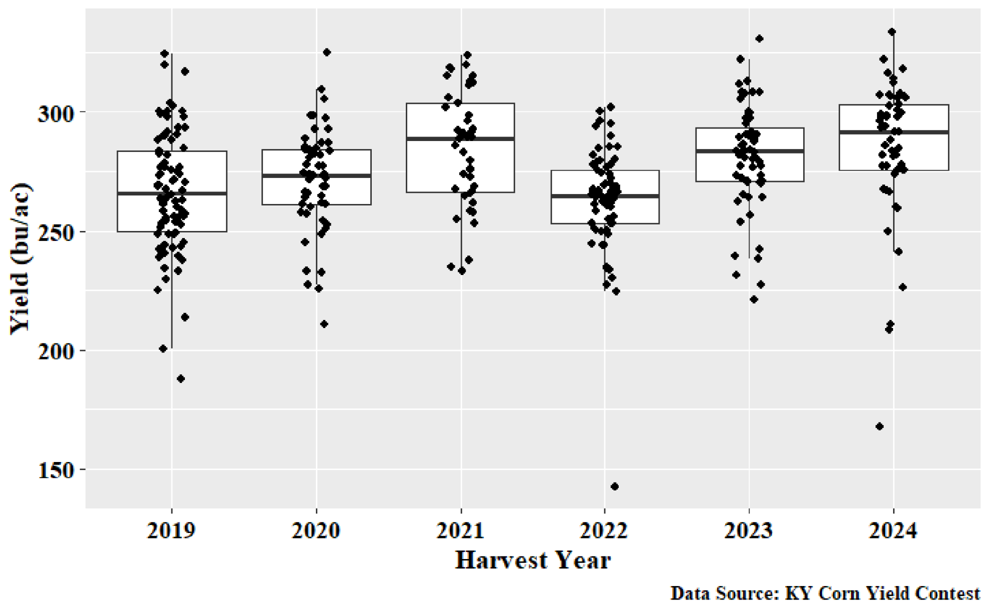

Figure 2. Variation of yield (box and whiskers) and reported yield of each participant in each year (dots). Each box contains 50% of the data observed. The solid line in the middle of the box is the median yield. The median is the middle value between all yields listed high to low. The dots below or above the whiskers are outliers. Generally, a smaller box suggests less variability.

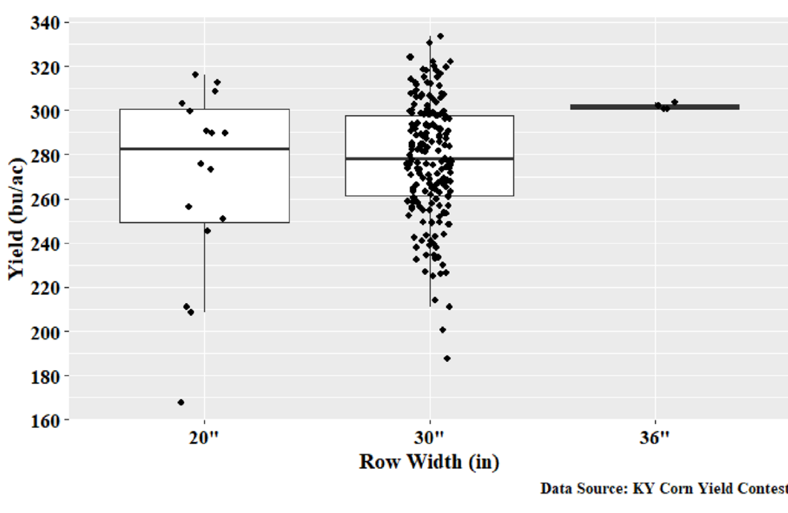

Figure 3. Variation of yield (boxes and whiskers) across three row widths.

Although the median yield in 20-inch rows was 5 bu/ac higher than in 30-inch rows, the distribution of data points showed lower minimums and lower maximums, indicating greater variability compared to the 30-inch row spacing.

The Effects of Planting and Harvest Populations on Corn Yield

Corn yield increased with higher planting populations until reaching a range of 35,000–37,500 plants per acre, beyond which no further yield gains were observed (Figure 4A). This represents a quadratic-plateau response of corn yield to planting population.

Similarly, yield responded positively to increasing harvest population until it reached 34,000–36,000 plants per acre. However, exceeding 36,500 plants per acre led to a decline in yield (Figure 4B).

The data suggests an average loss of approximately 2,000 plants per acre between planting and harvest populations. Farmers targeting a planting population of 36,000–37,500 plants per acre had a greater likelihood of achieving higher yields compared to those planting at lower or higher densities.

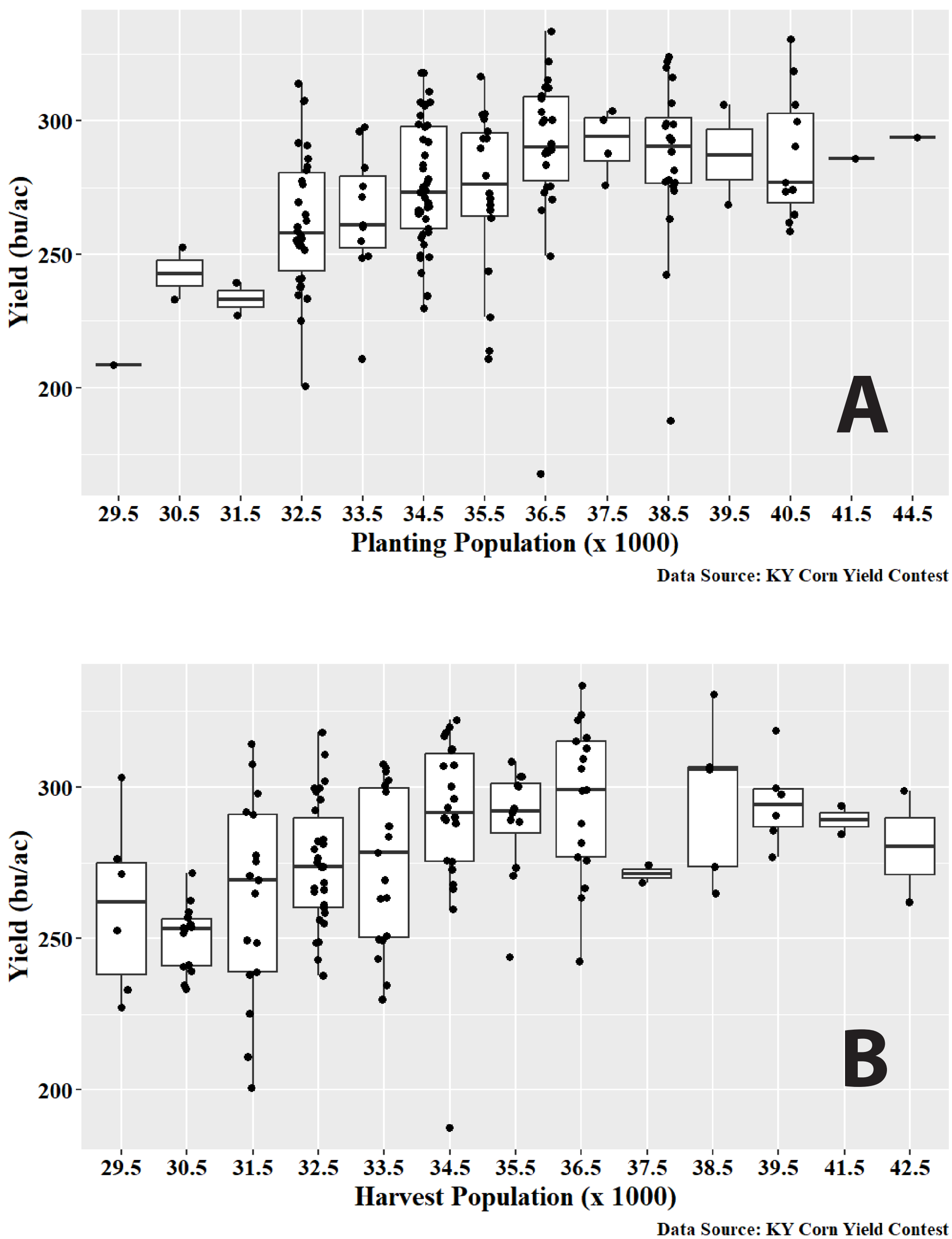

Figure 4. Yield variation across planting populations (A) and harvest population (B).

The Effects of Planting Date on Corn Yield

Although the yield response to planting date varied significantly, the overall trend was negative, indicating that delayed planting reduced yield (Figure 5). A simple linear regression analysis showed that each day of delay beyond April 6 (94th day of year) resulted in an average yield reduction of 0.32 bu/ac. However, the low R^2 value of 0.02 suggests that planting date accounted for only 2% of the variation in yield. This implies that while late planting was not ideal for maximizing yield, other variables also played a significant role. In fact, the second highest yield reported was from corn planted on April 15 (day 125).

The Effects of Crop Rotation on Corn Yield

Most corn was planted after soybean or wheat/double-crop soybean (Figure 6). Very few entries included corn planted after grass/hay, and that corn had the lowest yield of any rotation crop.

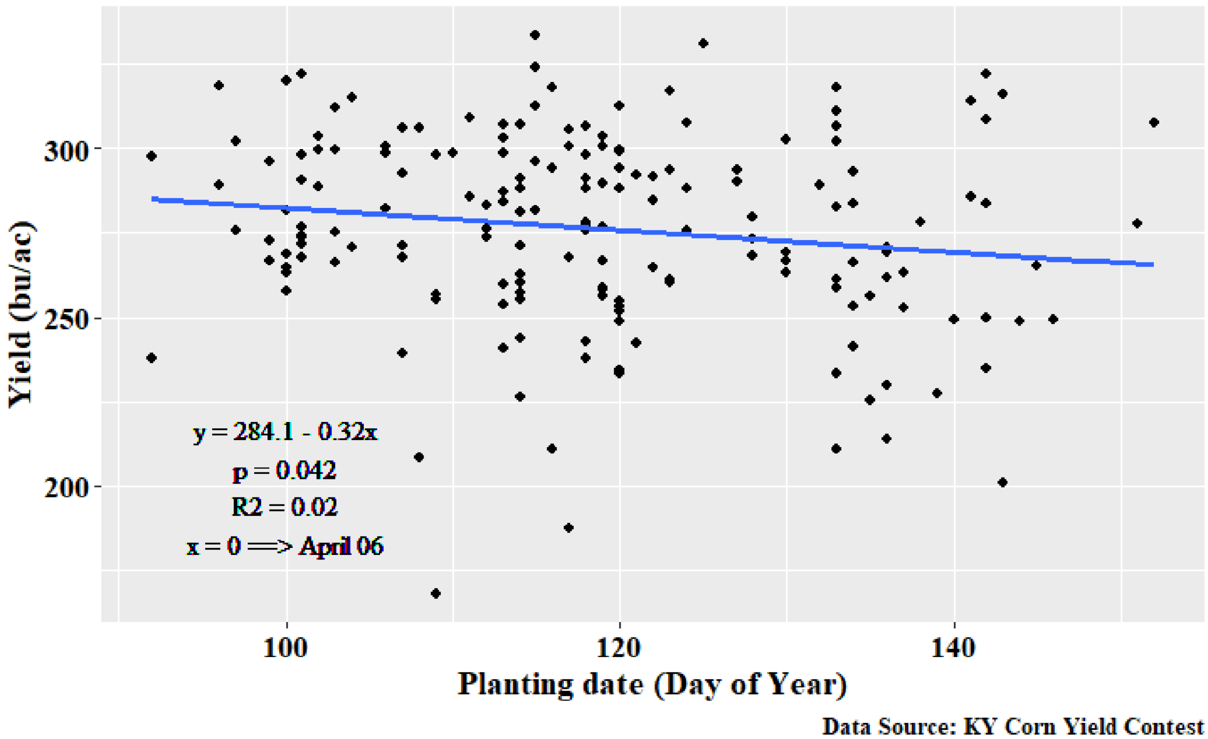

Figure 5. Relationship between yield and planting date. The x-axis represents the number of days since January 1 (e.g., the 100th day corresponds to April 10). The blue regression line has a slope of -0.32, indicating that each day of planting delay reduces yield by 0.32 bu/ac. The intercept of 284.1 suggests that if planted on April 6, the expected average yield would be 284.1 bu/ac.

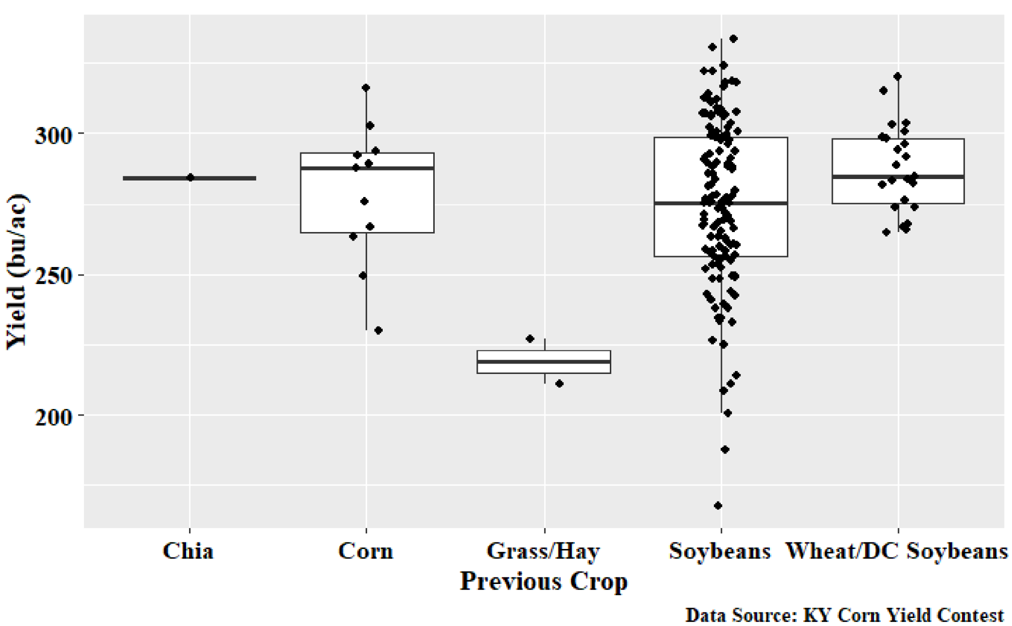

Figure 6. Variation of corn yield in different crop rotations.

The Effects of Soil pH on Corn Yield

Most corn entries were planted into fields with pH between 6.1 and 7.0 (Figure 7). Fields with pH less than 5.5 had lower yields.

The Effects of N Fertilization on Corn Yield

The entries included a wide range of nitrogen (N) fertilizer, with total N ranging from 140 pounds per acre (lb/ac) to 366 lb/ac (Figure 8). A simple linear regression analysis showed a positive relationship between yield and total N, with each additional pound of N fertilizer increasing average yield by 0.2 bu/ac. However, the low R^2 of 0.08 suggests that this relationship held true in only 8% of the cases. An analysis of the Corn Yield Contest data suggests that applying around 200 lb of N per acre may represent an optimal range for maximizing yield.

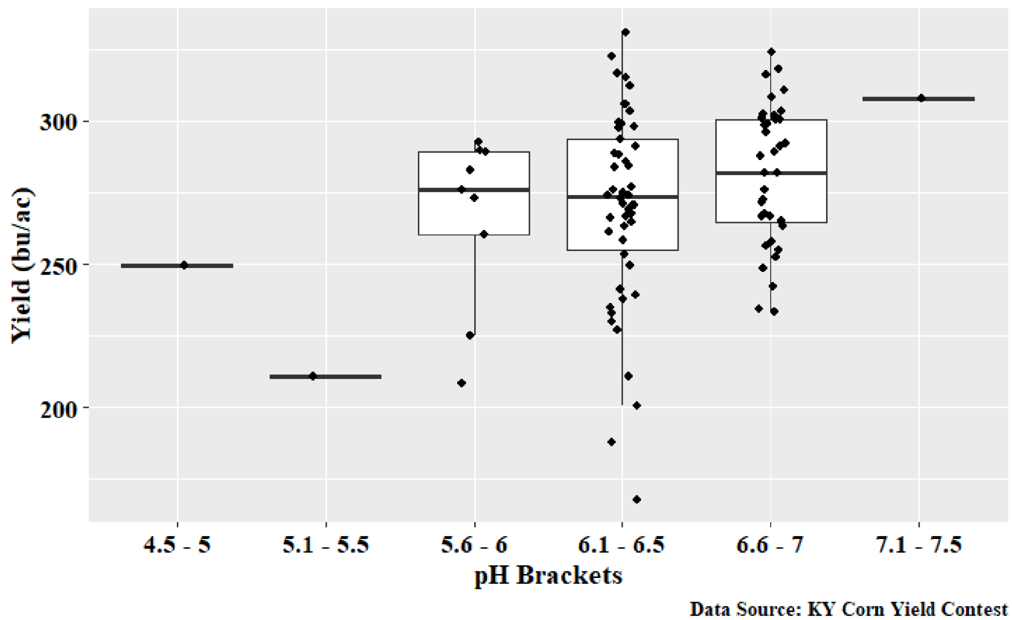

Figure 7. The variation of yield in fields with different pH levels.

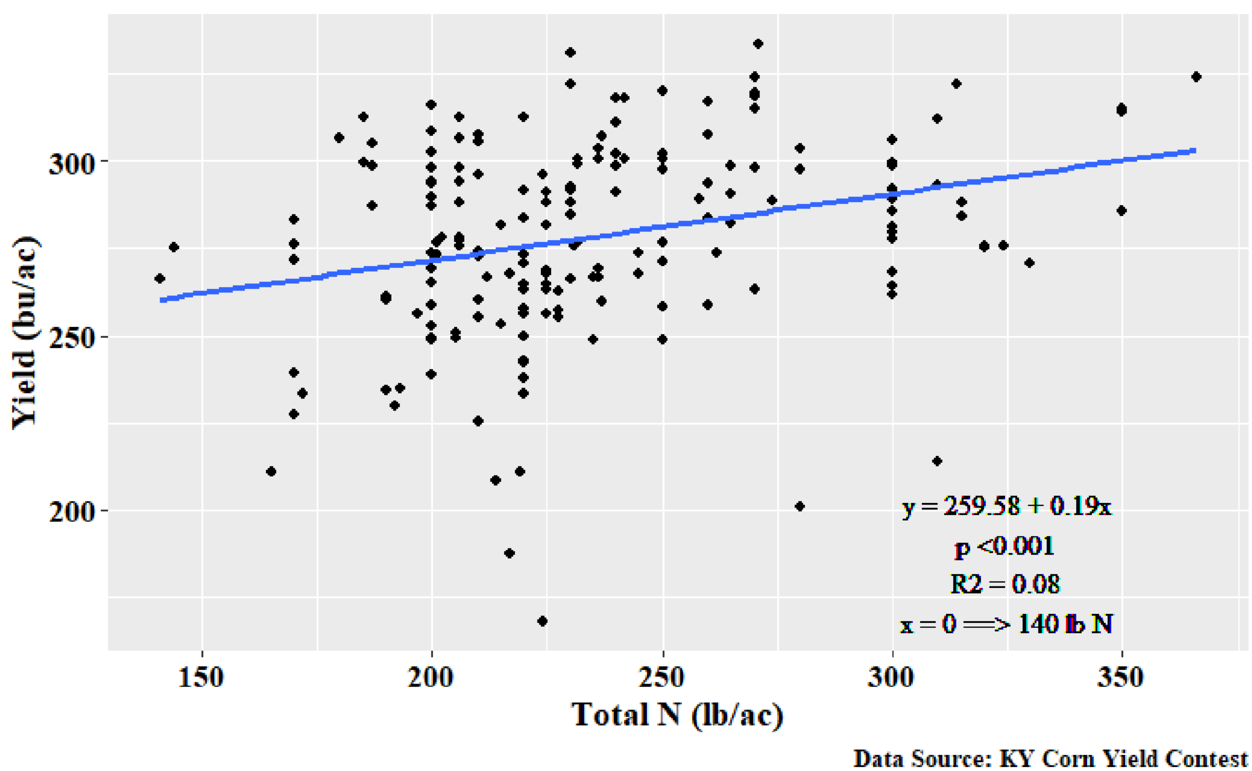

Figure 8. The relationship between corn yield and total N fertilizer. The blue line represents the regression line, with a slope of 0.19, indicating that an increase of one unit in N rate (lb/ac) resulted in a 0.19 bu/ac increase in yield. The intercept of 259.58 suggests that entries using 140 lb N per acre would have achieved an expected average yield of 259.58 bu/ac.

The Effects of N Application Timing on Corn Yield

To understand the effect of N application timing on corn yield, entries were grouped by application timing. All reported combinations of N fertilizer timing (preplanting, at planting, sidedress, and pre-tassel) were created, resulting in 10 groupings. The graphs in Figure 9 compare corn yield to nitrogen timing and medians of total N applied. Growers who applied total N before planting ("preplanting") had comparable yields to those split-applying N. Lower median yields were seen when applying N only at planting or only sidedressing corn, which could be due to low median N rates (in addition to other factors). Among all entries, only three entries performed pre-tassel application of N. Although they used 300 lb/ac of N, their yields were not necessarily the highest. For comparison, 34 entries that used less than 300 lb/ac of N and did not perform pre-tasseling application of N recorded higher yields than those using pre-tassel N applications. While the specifics of management practices and growth environment add to the complications of interpreting results, the overall picture suggests that a preplanting application of N could lead to competitive yields.

The Effects of Starter N on Corn Yield

There was considerable variation in yield response depending on whether or not starter N was used (Figure 10). Entries that did not use starter N had a higher median yield of 282 bu/ac compared to those using starter N (274 bu/ac).

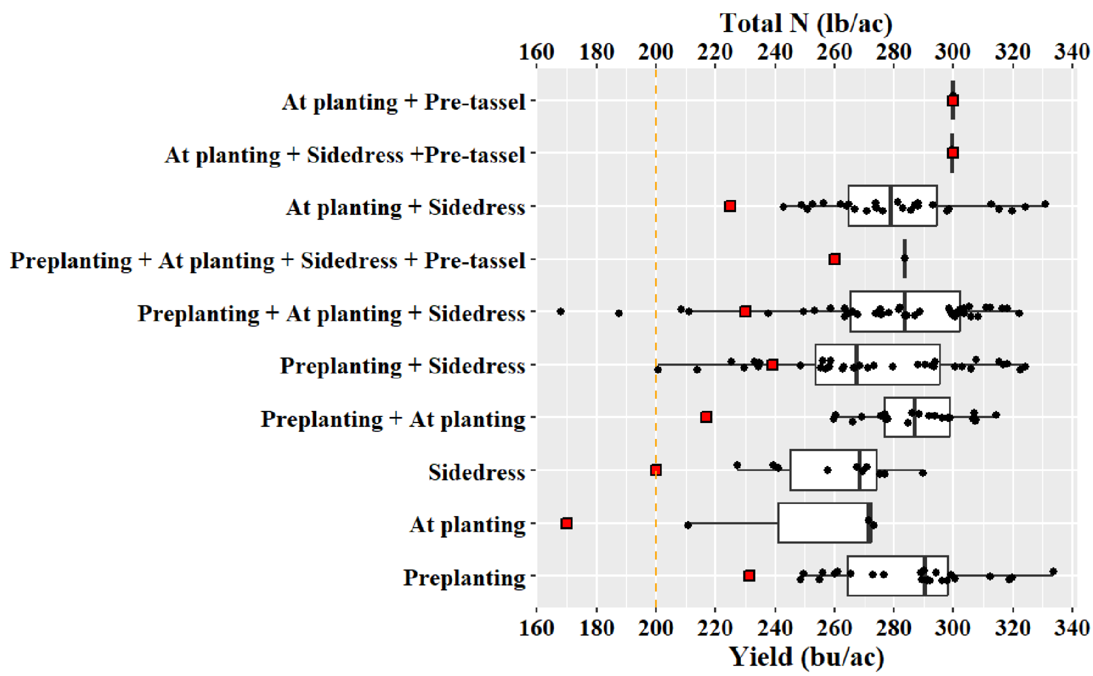

Figure 9. Yield response to various N timing (boxplots). The red squares are the median value of total N. The orange broken line is the reference maximum amount of total N the University of Kentucky recommends in publication AGR-1. The number of applications may have been higher than the number of timings listed, due to some entries sidedressing more than once.

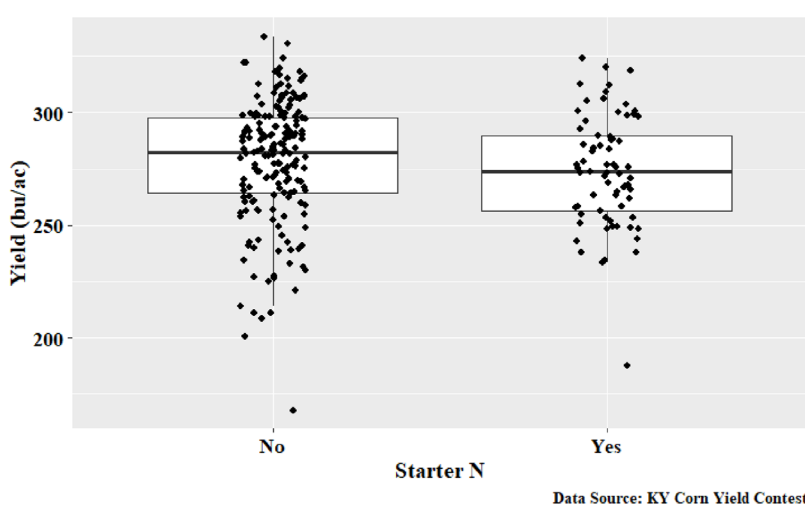

Figure 10. Variation and response of yield to starter N.

The Effects of Seed Treatment on Corn Yield

Seed treatment appeared to have an effect on corn yield, with entries using seed treatment generally showing a slightly higher median yield (Figure 11). However, the data points for these entries fell within the range of those not using seed treatment. This suggests that while some entries may have benefited from using seed treatment, those that did not use it were still able to achieve competitive yields.

The Effects of Number of Fungicide Active Ingredients Applied on Corn Yield

Median yield for corn was higher when a fungicide was applied and generally higher when more than one active ingredient was applied (Figure 12). The highest median yield occurred when four fungicide active ingredients were applied. Since most studies with corn fungicides suggest that corn yield increases occur when at least one fungal pathogen is controlled, these observations would suggest that protecting corn with fungicides could lead to increased yield.

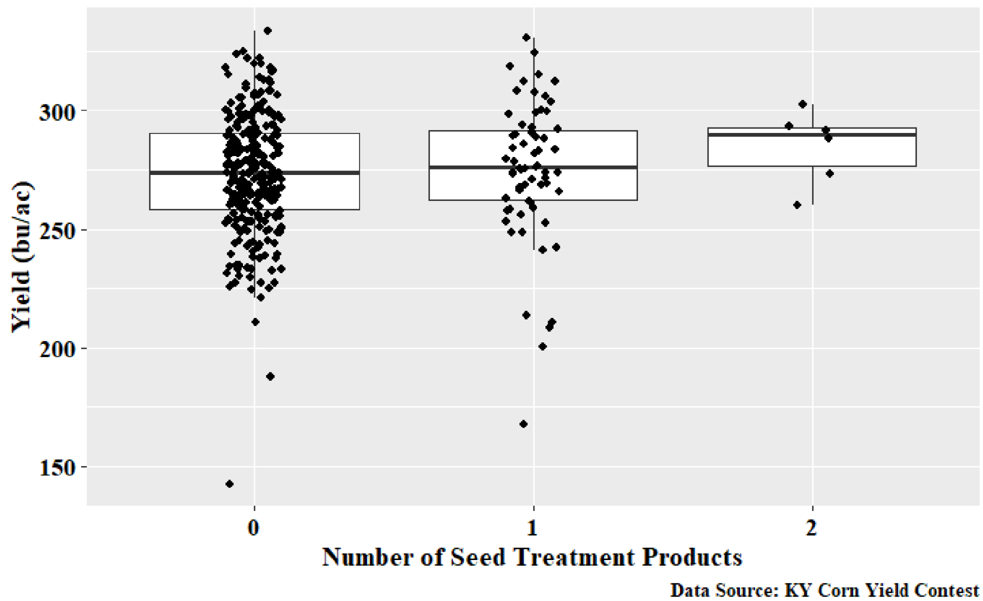

Figure 11. Variation and response of yield with three different levels of seed treatments.

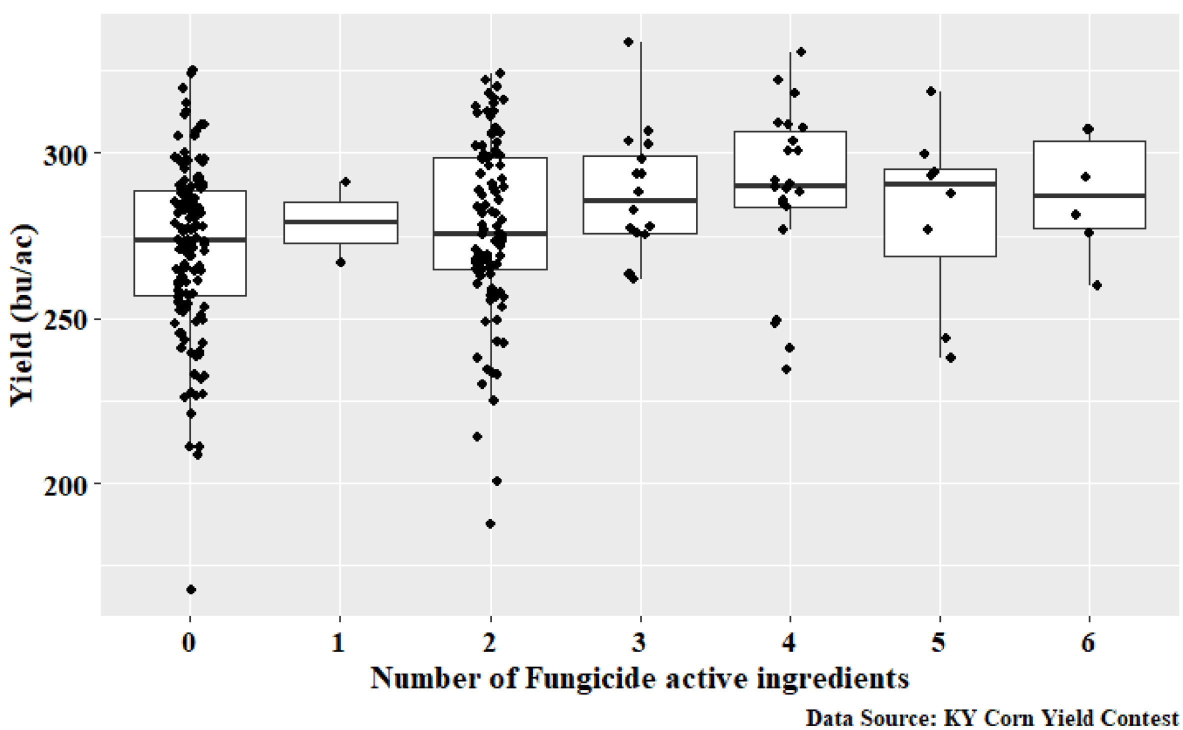

Figure 12. Variation and response of yield based on number of fungicide active ingredients applied. A fungicide active ingredient is the chemical that serves as an anti-fungus agent.

The Effects of Insecticides on Corn Yield

The vast majority of growers did not apply any form of insecticides in their fields (Figure 13). However, two entries reported using three insecticide products, and one entry reported using four different products to control insects. While the median yield was higher in entries where two insecticides were used, the overall trend suggests that there was no clear benefit from using insecticides. Alternatively, it could indicate that in entries where more insecticides were applied, insect damage was minimized to the point where the yield response was comparable to entries where insecticides were not needed.

The Combined Effect of Management Practices and Meteorological Variables on Corn Yield

To try to identify if multiple management practices combined with weather variables influenced corn yields in the corn contest, a conditional inference tree (CIT) analysis was conducted. The CIT is a machine-learning approach that uses statistical tests to split the data and select the variable with the strongest association to the response (e.g., corn yield) while avoiding bias.

The CIT analysis suggested that planting population was the primary driver of yield differences in the contest. Farmers who targeted seeding rates between 35,000 and 37,500 plants per acre achieved a significantly higher median yield—approximately 20 bushels per acre more than those who planted at lower seeding rates (Figure 14). Interestingly, increasing seeding rates beyond 37,500 plants per acre did not result in further yield gains (Figure 4).

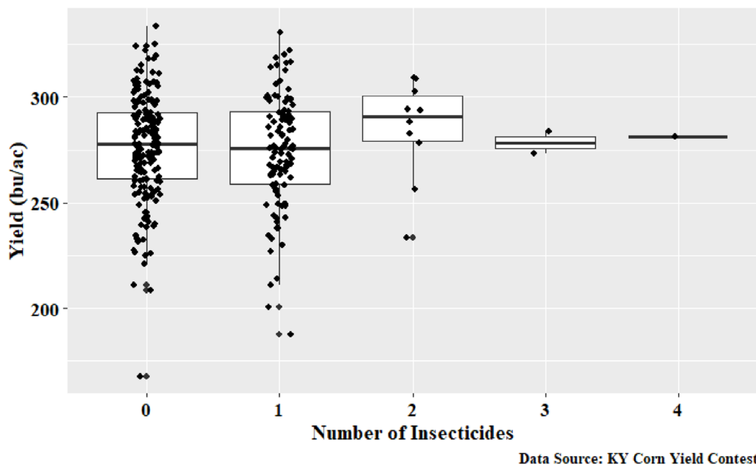

Figure 13. Variation and response of corn yield based on number of insecticide products applied.

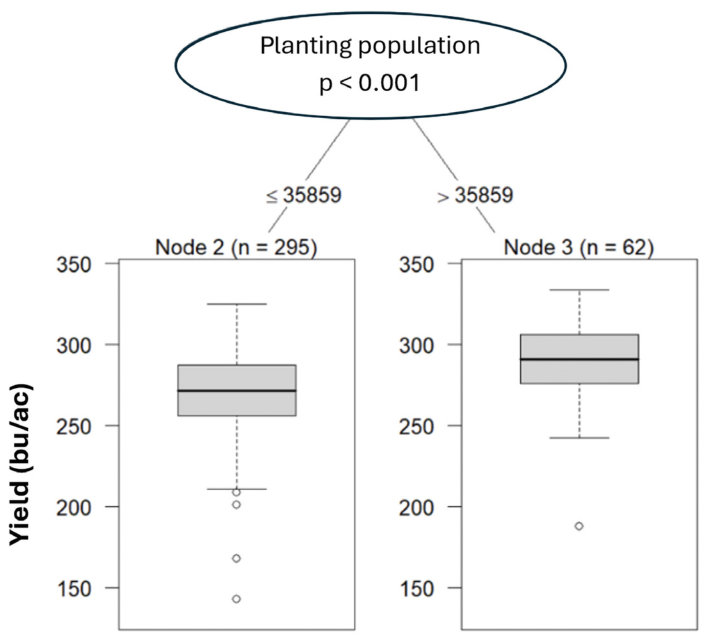

Figure 14. Conditional inference analysis reveals planting population to be key in determining yield variability in the Corn Yield Contest. In this analysis, corn populations above 35,859 plants per acre had higher yields. The graph displays box and whisker plots. Each box contains 50% of the data observed. The solid line in the middle of the box is the median yield. The median is the middle value between all yields listed high to low. The dots are outliers. Generally, a smaller box suggests less variability. In this example, the box and median are both higher for the scenario on the right (the higher plant population).

The CIT analysis suggested that solar radiation and precipitation, when combined in some interesting ways, appear to have driven corn yields (Figure 15). When average daily solar radiation in August was below 24.64 watts per square meter (w/m²), the solar radiation in July became the dominant factor influencing yield. If July's average daily solar radiation exceeded 21.6 w/m², the median yield was significantly higher than when radiation levels were lower. However, when August's daily solar radiation average exceeded 24.64 w/m², April precipitation became a key factor influencing yield. In this scenario, higher April rainfall was associated with lower median yields compared to drier conditions.

When analyzing the combined effect of management practices and meteorological conditions, the weather-related patterns remained consistent. However, in years when April precipitation exceeded 4.48 inches, harvest population played a critical role in mitigating yield losses (Figure 16). Fields with a harvest population above 33,500 plants per acre had better yields compared to those with lower plant populations.

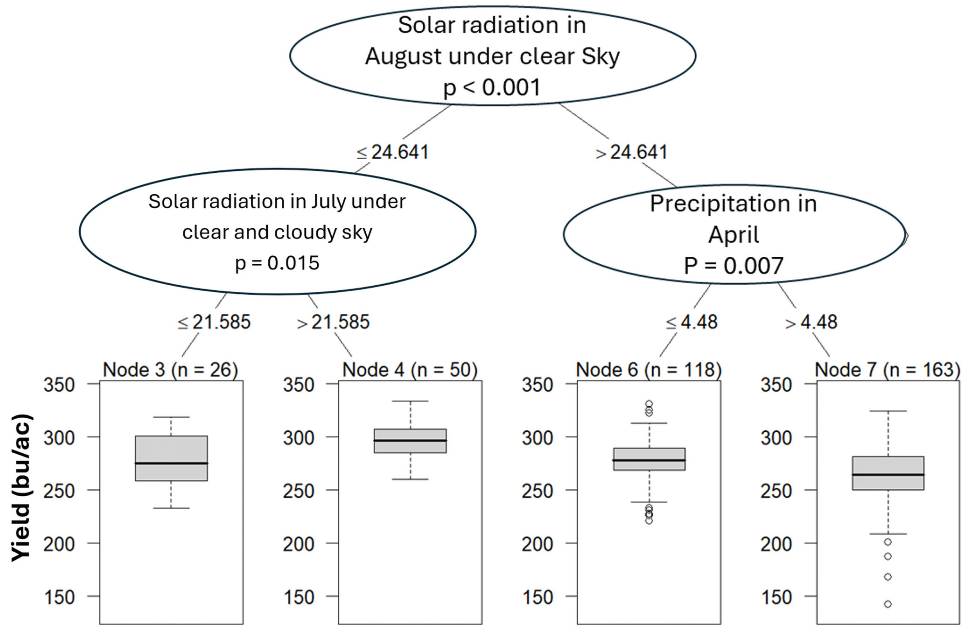

Figure 15. The effects of meteorological conditions on corn yield in the Corn Yield Contest, as indicated by a conditional inference tree analysis. The first separator was solar radiation in August. If average daily solar radiation in August was less than 24.642 watts per square meter (w/m²), then July average daily solar radiation above 21.585 w/m² increased corn yields. If average daily solar radiation in August was above 24.642 w/m², then precipitation in April below 4.48 inches increased corn yields.

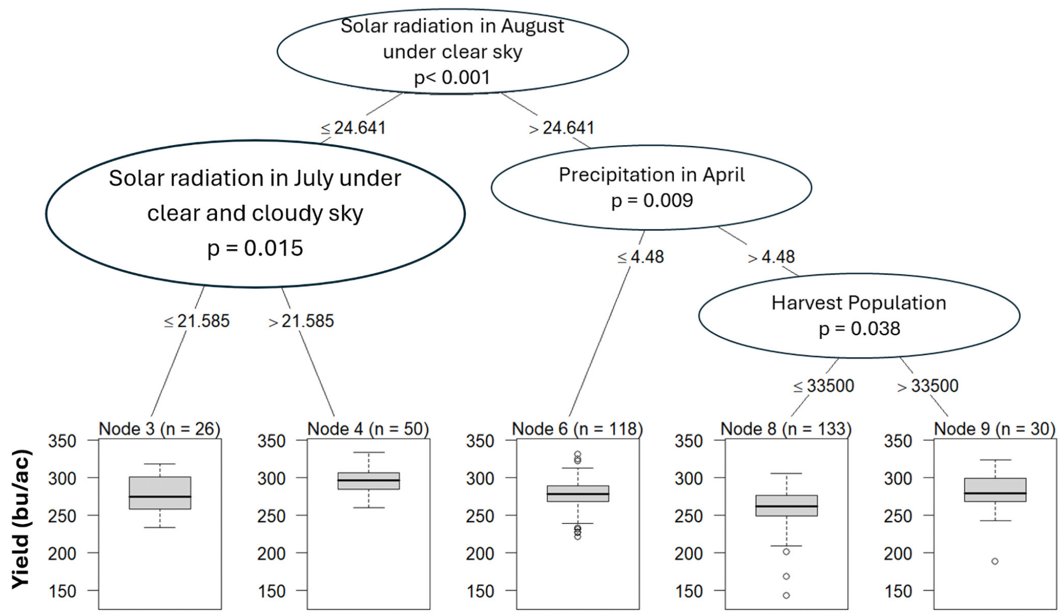

Figure 16. The effect of meteorological conditions and management practices on corn yield in the Corn Yield Contest as indicated by a conditional inference tree analysis. If solar radiation in August was above 24.641 w/m² and April precipitation was above 4.48 inches, then harvest populations above 33,500 plants per acre had the highest yields.

What This Means

Lower solar radiation in August suggests increased cloud cover and sufficient rainfall. In years when August had fewer sunny days, total solar radiation (both under clear and cloudy skies) in July became a key factor driving yield. This suggests that July provided enough light to support photosynthesis, but frequent cloud cover could have also meant periodic rainfall, creating an ideal balance of moisture and radiation. The best yields were achieved when August was not excessively dry and July had both adequate solar radiation and frequent showers.

On the other hand, when August had higher solar radiation under clear skies, it likely meant fewer cloudy days and potential drought stress. In such cases, early planting (in April) allowed corn to progress through critical growth stages before the onset of late-season drought. However, if April had excessive rainfall, delaying planting until May, then a harvest population above 33,500 plants per acre helped mitigate yield losses.

This CIT analysis suggests that if a farmer is delayed in planting until May because of a wet April, corn populations should be increased to ensure sufficient ear production to maintain yield.

Disclaimer

The results presented in this document are based on entries submitted by farmers for the Corn Yield Contest. These findings represent real-world examples of top-tier corn yields in Kentucky. Therefore, conclusions should be drawn within the context of this dataset only.

The University of Kentucky Cooperative Extension Service provides comprehensive, research-based guidelines on all aspects of crop management practices. Readers are encouraged to conduct their due diligence and follow the University of Kentucky Cooperative Extension recommendations for their farm management decisions.

Acknowledgment

We extend our gratitude to the University of Kentucky Agricultural and Natural Resources Extension Agents and other supervisors whose efforts serve as the cornerstone of the Corn Yield Contest. We also appreciate the growers, the Kentucky Corn Growers Association, and all agribusinesses for their continued support in facilitating this contest.

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Food and Environment

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