INTRODUCTION

Every year, the University of Wisconsin-Extension and the University of Wisconsin–Madison College of Agricultural and Life Sciences conduct a corn evaluation program in cooperation with the Wisconsin Crop Improvement Association. The purpose of this program is to provide unbiased performance comparisons of hybrid seed corn for both grain and silage available in Wisconsin.

In 2019, grain and silage performance trials were planted at 14 locations in four production zones: the southern, south central, north central, and northern zones. Both seed companies and university researchers submitted hybrids. Companies with hybrids included in the 2019 trials are listed in Table 1. Specific hybrids and where they were tested are shown in Table 2. A summary of the transgenic traits tested in 2019 is shown in Table 3. A summary of seed treatment performance in 2019 is shown in Table 4. In the back of the report, hybrids tested over the past three years are listed in Table 24. At most locations, trials were divided into early- and late-maturity trials based on the hybrid relative maturities provided by the companies. The specific relative maturities separating early- and late-trials are listed in the tables.

Growing Conditions For 2019

Seasonal precipitation and temperature at the trial sites are shown in Table 5. The 2019 growing season was colder and wetter than the 30-year normal for most of the season throughout Wisconsin. According to USDA-NASS data, 2019 was the slowest planting season for farmers since records were initiated and kept beginning in 1979. Farmer harvest progress has also been slower than normal. Most trial plots were established by early May, except for sites in northeastern Wisconsin. Stand establishment was good to excellent at all locations, except Hancock. Pollination conditions were above average and ear size was longer than normal. Significant storms in mid-July caused significant lodging at Arlington and Galesville. Significant green-snap occurred at Coleman. In northeastern Wisconsin, some flooding and standing water was observed in the plots and surrounding area. The fall killing frost was later than normal. An exceptionally cool and wet fall made harvest difficult and slower than normal. Grain moisture was higher than normal. Little disease and insect pressure were observed in most trials.

Cultural Practices

The seedbed at each location was prepared by either conventional or conservation tillage methods. Seed treatments of hybrids entered into the trials are described in Table 4. Fertilizer was applied as recommended by soil tests. Herbicides were applied for weed control and supplemented with cultivation when necessary. Corn rootworm insecticide was applied in all trials. Information on cultural practices for each location is summarized in Table 6.

Planting

A precision vacuum corn planter using GIS technology was used at all locations except Spooner. Two-row plots, 25 feet long, were planted at all locations. Plots were not hand-thinned. Each hybrid was grown in at least three separate plots (replicates) at each location to account for field variability.

Harvesting

Grain: Two-row plots were harvested with a self-propelled corn combine. Lodged plants and/or broken stalks were counted, plot grain weights and moisture contents were measured, and yields were calculated and adjusted to 15.5% moisture. Test weight was measured on each plot.

Silage: Whole plant (silage) plots were harvested using a tractor-driven, three-point mounted one-row chopper. One row was analyzed for whole-plant yield and quality. Plot weight and moisture content were measured, and yields were adjusted to tons of dry matter per acre. A sub-sample was collected and analyzed using near infrared spectroscopy.

PRESENTATION OF DATA

Yield results for individual location trials and for multi-location averages are listed in Tables 7 through 22. Within each trial, hybrids are ranked by moisture averaged over all trials conducted in that zone during 2019. Yield data for both 2018 and 2019 are provided if the hybrid was entered in both years. Starting in 2009, a nearest neighbor analysis of variance for all trials as described by Yang et al. (2004, Crop Science 44:49–55) and Smith and Casler (2004, Crop Science 44:56–62) is included. A hybrid index (Table 2) lists relative maturity ratings, specialty traits, seed treatments, and production zones tested for each hybrid.

Relative maturity

Seed companies use different methods and standards to classify or rate the maturity of corn hybrids. To provide corn producers a "standard" maturity comparison for the hybrids evaluated, the average grain or silage moisture of all hybrids rated by the company's relative maturity rating system are shown in each table as shaded rows. In these Wisconsin results tables, hybrids with lower moisture than a particular relative maturity average are likely to be earlier than that relative maturity, while those with higher grain moisture are most likely later in relative maturity. Company relative maturity ratings are rounded to 5-day increments.

The Wisconsin Relative Maturity rating system for grain (GRM) and silage (SRM) compares the harvest moisture of a grain or silage hybrid to the average moisture of company ratings using linear regression. Each hybrid is rated within the trial and averaged over all trials in a zone. Maturity ratings (company, GRM, and SRM) can be found in Table 2.

Grain performance index

Three factors—yield, moisture, and standability—are of primary importance in evaluating and selecting corn hybrids. A performance index (PI), which combines these factors in one number, was calculated for multi-location averages for grain trials. This index evaluates yield, moisture, and lodged stalks at a 50 (yield): 35 (moisture): 15 (lodged stalks) ratio.

The PI was computed by converting the yield, moisture (dry matter), and upright stalk values of each hybrid to a percentage of the test average. Then the PI for each hybrid that appears in the tables was calculated as follows:

$$\text{Performance Index (PI)} = [(\text{Yield} \times 0.50) + (\text{Dry matter} \times 0.35) + (\text{Upright stalks} \times 0.15)] / 100$$

Silage performance index

Corn silage quality was analyzed using near infrared spectroscopy equations derived from previous work. Plot samples were dried, ground, and analyzed for crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), in-vitro cell wall digestibility (NDFD), in-vitro digestibility (IVD), and starch. Spectral groups and outliers were checked using wet chemistry analysis.

The **MILK2006** silage performance indices, milk per ton and milk per acre, were calculated using an adaptation by Randy Shaver (UW–Madison Department of Dairy Science) of the MILK91 model (Undersander, Howard, and Shaver; Journal Production Agriculture 6:231–235). In MILK2006, the energy content of corn silage was estimated using a modification of a published summative energy equation (Weiss and coworkers, 1992; Animal Feed Science Technology 39:95–110). In the modified summative equation, CP, fat, NDF, starch, and sugar plus organic acid fractions were included along with their corresponding total-tract digestibility coefficients for estimating the energy content of corn silage. Whole-plant dry matter content was normalized to 35% for all hybrids. The sample lab measure of NDFD was used for the NDF digestibility coefficient. Digestibility coefficients used for the CP, fat, and sugar plus organic acid fractions were constants. Dry matter intake was estimated using NDF and NDFD content assuming a 1,350-pound cow consuming a 30% NDF diet. Using National Research Council (NRC, 2001) energy requirements, the intake of energy from corn silage was converted to expected **milk per ton**. **Milk per acre** was calculated using milk per ton and dry matter yield per acre estimates (Schwab, Shaver, Lauer, and Coors, 2003; Animal Feed and Science Technology 109:1–18).

Least significant difference

Variations in yield and other characteristics occur because of variations in soil and growing conditions that lower the precision of the results. Statistical analysis makes it possible to determine, with known probabilities of error, whether a difference is real or whether it might have occurred by chance. Use the appropriate least significant difference (LSD) value at the bottom of the tables to determine true differences.

Least significant differences at the 10% level of probability are shown. Where the difference between two selected hybrids within a column is greater than or equal to the LSD value at the bottom of the column, you can be sure in nine out of ten cases that there is a real difference between the two hybrid averages. If the difference is less than the LSD value, the difference may still be real, but the experiment has produced no evidence of real differences. Hybrids that were not significantly lower in performance than the highest hybrid in a particular test are indicated with an asterisk (*).

HOW TO USE THE RESULTS

The results provide you with an independent, objective evaluation of the performance of unfamiliar hybrids that seed company sales representatives are promoting, as well as a comparison of these unfamiliar hybrids with competitive hybrids. Below are suggested steps to follow for selecting top performing hybrids for next year using these trial results:

1. **Use multi-location average data in shaded areas.** Consider single location results with extreme caution.

2. Begin with trials in the zone(s) nearest you.
3. Compare hybrids with similar maturities within a trial. You will need to divide most trials into at least two and sometimes three groups with similar average harvest moisture—within about a 2% range in moisture.
4. Make a list of five to 10 hybrids with highest 2018 performance index within each maturity group within a trial.
5. **Evaluate the consistency of the performance of the hybrids on your list** over the years and in other zones.
   a. Scan the 2019 results. **Be wary** of any hybrids on your list that had a 2019 PI of 100 or lower. Choose two or three of the remaining hybrids that have relatively high PIs for **both** 2019 and 2018.
   b. Check to see if the hybrids you have chosen were **entered in other zones.** (For example, some hybrids entered in the Southern Zone Trials, Tables 7 and 8, are also entered in the South Central Zone Trials, Tables 9 and 10.)
   c. **Be wary** of any hybrids with a PI of 100 or lower for 2019 or 2018 in any other zones.
6. Repeat this procedure with about three maturity groups to select top-performing hybrids with a range in maturity in order to spread weather risks and harvest time.
7. Observe the relative performance of the hybrids you have chosen based on these trial results in several other reliable, unbiased trials and be wary of any with inconsistent performance.
8. Consider including the hybrids you have chosen in your own test plot, primarily to evaluate the way hybrids stand after maturity, dry-down rate, grain quality, or ease of combine shelling or picking.
9. Remember that you don't know what weather conditions (rainfall, temperature) will be like next year. Therefore, the most reliable way to choose hybrids with greatest chance to perform best next year on your farm is to consider performance in both 2019 and 2018 over a wide range of locations and climatic conditions.

Note: You are taking a tremendous gamble if you make hybrid selection decisions based on 2019 yield comparisons in only one or two local test plots.

FOR MORE INFORMATION

Current and past versions of *Wisconsin Corn Hybrid Performance Trials* (A3653) are available in Microsoft Excel and Acrobat PDF formats at the Wisconsin Corn Agronomy website: corn.agronomy.wisc.edu. To obtain a printed copy, visit UW-Extension's Learning Store at learningstore.uwex.edu, where the most current version of *Wisconsin Corn Hybrid Performance Trials* (A3653) can be ordered or downloaded. For more information on the Wisconsin Crop Improvement Association, visit: wcia.wisc.edu.