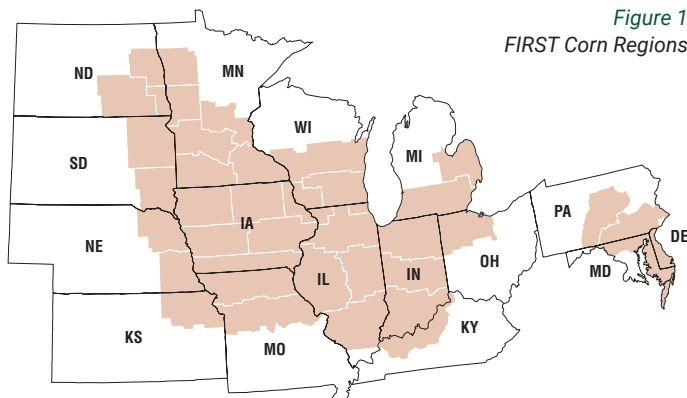


# FIRST Testing Methodology and Procedures

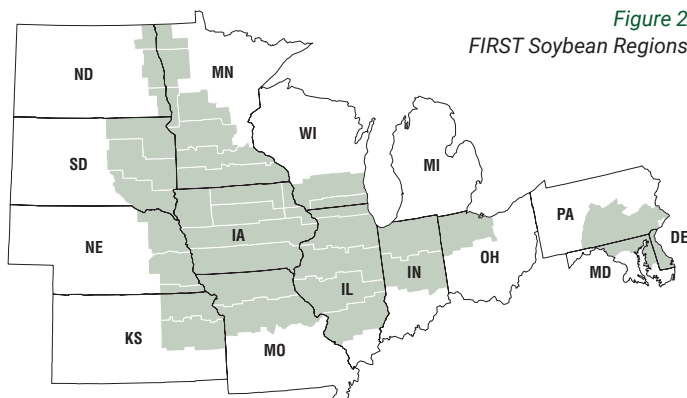
## TESTING PROGRAM

Our testing program compares corn and soybean seed product yield and agronomic performance in grower fields across 16 states: Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Pennsylvania, South Dakota and Wisconsin (Figure 1 & Figure 2).

Testing regions have been established to provide similarity by geography and crop maturity. Seed products within a predefined maturity range (e.g., 106 to 116 RM corn or 0.7 to 1.5 maturity soybeans) are pooled into a single, all-season test or split into early- and full-season tests depending on entry volume. Products are planted at five or six corn test locations or four soybean locations within a region.



**Figure 1**  
FIRST Corn Regions



**Figure 2**  
FIRST Soybean Regions

Test locations are selected to represent the geographic diversity within a region. Ideal sites have uniform, well-drained soils where farmer hosts use standard production practices for the area. Typically, all tests at a location are conducted adjacent to each other to minimize yield variance between tests.

Seed companies and/or seed distributors are invited to submit their most promising seed products within specified test maturity limits to desired test regions. They provide high-quality seed from commercial lots and fees to enter FIRST tests. The only exceptions are check products (CK after product names, i.e. A1234 CK), chosen by FIRST Managers to bridge results between early- and full-season tests, and Grower Comparison products (GC after the product name), often provided by host farmers for their knowledge as test space permits.

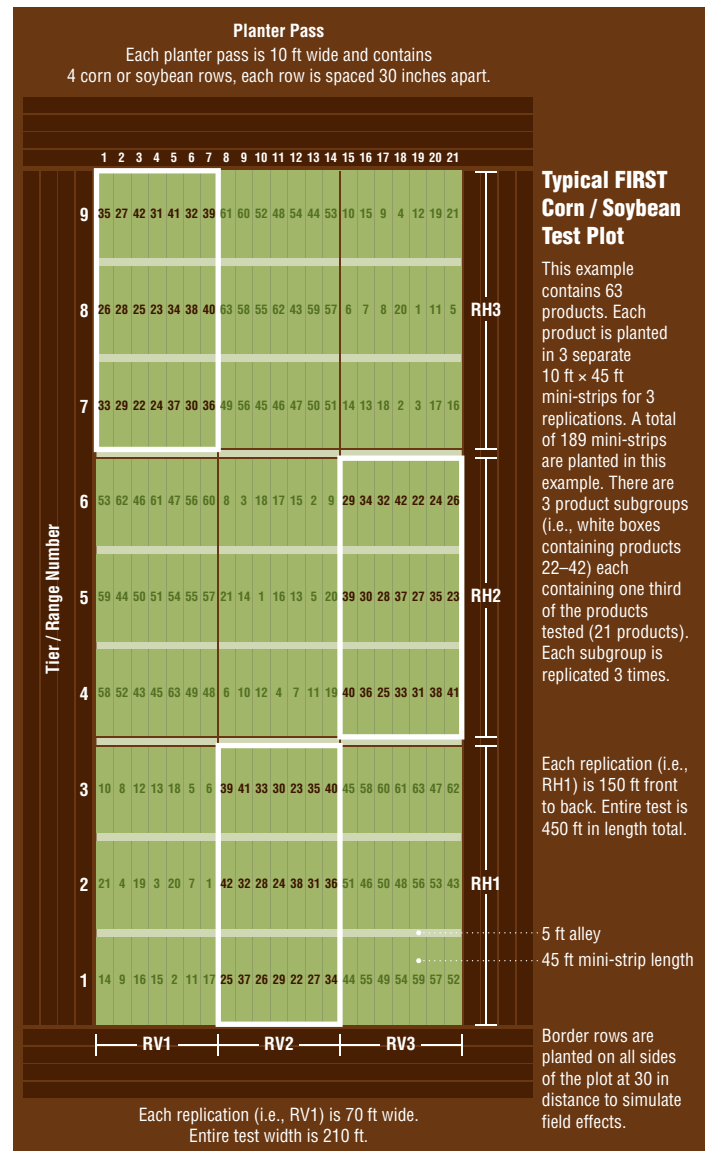
Products are replicated three times minimum per test and grouped in sub-blocks arranged in replication blocks from front to back and side to

side. This provides more precision in yield measurement and flexibility should a disruptive event (i.e., standing water) require elimination of non-uniform test areas.

FIRST Field Managers package, randomize, and plant seeds into host grower fields using slightly modified commercial planting equipment to facilitate mini strip research. Individual plots (a.k.a. mini-strips) contain four corn rows spaced 30-inches apart, 45 feet in length (Figure 3). Soybean is planted in four rows spaced 30-inches apart or seven 15-inch spaced rows. Soil insecticide is typically applied to corn at planting. Seeding rate is based on standard area practices.

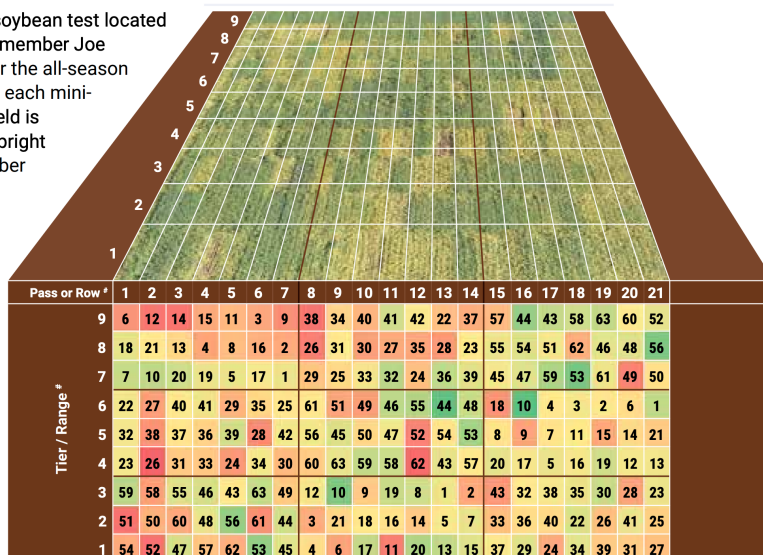
FIRST Managers measure yield from the center two corn rows or all soybean rows using customized commercial self-propelled combines. Grain from each plot is electronically weighed and moisture content measured. Soybean grain is sampled from one replicate per test for protein and oil content analysis.

**Figure 3** FIRST Test Plot Layout



The aerial image shows the 2018 FIRST soybean test located at Thomasboro, Illinois hosted by farmer member Joe Burke. The "heat-map" superimposed over the all-season test uses color to represent yield level for each mini-strip (10 ft wide by 45 ft long). Highest yield is bright green while lowest yield levels are bright red. Mini-strips containing the same number have identical seed products (3 mini-strips per product).

LEGEND VALUES	
92.6	Yield Maximum
76.9	Yield Average
65.2	Yield Minimum



## PERFORMANCE MEASUREMENTS

- A Yield (Bu/A)** — Harvested grain weight and grain moisture are used to convert yield results to bushels per acre at 15% moisture (base moisture) for corn and 13% moisture for soybean. Grain shrinkage is additionally applied to product yields exceeding the base moisture.
- B Moisture (%)** — A calibrated electronic sensor measures moisture content of harvested grain.
- C Lodging (%)** — Estimated percentage of corn plants leaning more than 45° from vertical or stalks broken below the ear at harvest. Encompasses both stalk and root lodging. Estimated soybean plant leaning (0% = all plants vertical, 100% = all plants flat on the ground).
- D Gross Income (\$/A)** — Harvested crop value in dollars per acre is derived by multiplying crop yield and price per bushel minus drying costs, if any, to reach base moisture. Each Harvest Report and Performance Summary details specific crop price and drying costs.
- E Gross Income Rank** — Gross Income values are sorted from high to low then numbered consecutively (1, 2, 3...) from highest to lowest value. Ties are broken based on higher yield, lower lodging and lower moisture values.

## STATISTICS REPORTED

**Least Significant Difference (LSD)** is provided on all replicated results to facilitate valid product comparisons. Statistically, the LSD value is the minimum difference needed between two products to declare that one product is greater than another. FIRST calculates LSD at the 10% level ( $p = 0.10$ ). Product yield differences equal or greater than the LSD (0.10) value would have been greater one versus the other nine times out of 10 (90% probability). Typically, low LSD values indicate high-quality test results. However, keep in mind that LSD values increase as: test yield level increases,  $p$  values decrease [i.e. LSD (0.05) value > LSD (0.10) value > LSD (0.25) value] and as data variability increases. Just because LSD values are higher in some tests vs. others does not mean the results are low quality. Multiple factors have a role in LSD value magnitude.

**Coefficient of Variance (CV)** measures the average difference between the replications of a test entry, averaged for all the entries in the test, then divided by the average of all observations recorded and expressed as a percentage. Higher values indicate more unexplained variability in proportion to the test average than lower values. Researchers within the seed industry may drop yield data from consideration when CV's are above 15% because the unexplained variance is high or the yield level is low or both. Low yield levels at a test site do not estimate yield potential well, nor are there as many or as great a difference between hybrids and varieties compared to higher yield conditions.

## OTHER INFORMATION

**Estimated Maturity (corn only)** — Product maturity is determined by linear regression comparison of harvest grain moisture and company stated relative maturity (RM). Products with estimated maturity exceeding the test maximum by at least 1 RM are identified in italics. These products may have an unfair yield advantage over peers due to later maturity.

**Bold Identified Means** — These product means are significantly better than the test average for that measured parameter.

**Check Product (CK)** — When early- and full-season tests are conducted at a site, an identical check product is planted in both tests. Check yield results allow growers to comparatively view product performance in both early- and full-season tests. No product yield adjustments are made based on check performance.

**Grower Comparison (GC) products** — These products, identified with a "GC" product name suffix, are often supplied by growers hosting test sites and included when space permits. Grower comparison products allow direct comparison to products in our tests.

**United Soybean Board (USB) Products (soybean only)** — Products identified with a "S" product name suffix are funded by soybean checkoff dollars. This program strives to gather yield and grain composition results from genetics that otherwise would not be available.