

Corn Plant Population Update

DuPont Pioneer has been conducting plant population studies with corn hybrids for over three decades. These studies test for complex G x E x M (genetics x environment x management) interactions, which frequently play a key role in maximizing yield potential and reducing risk. DuPont Pioneer researchers target representative environments based on maturity zone, expected yield (high or low), specific stresses (drought, pest pressure, high residue, early planting, etc.) and other unique location characteristics that might result in repeatable hybrid x population responses.

Hybrid improvements in stress tolerance have led to higher populations and increased yield potential over the years. Introductions of new traits and technologies as well as continual breeding improvements validate the need for ongoing plant population research. Growers can use the multi-year and multi-location results to identify the best potential planting rates specific to their hybrid, location and management practices.

Plant Population Trends

Each year, Pioneer surveys farmers regarding the seeding rates currently used on their farms (Figure 1).

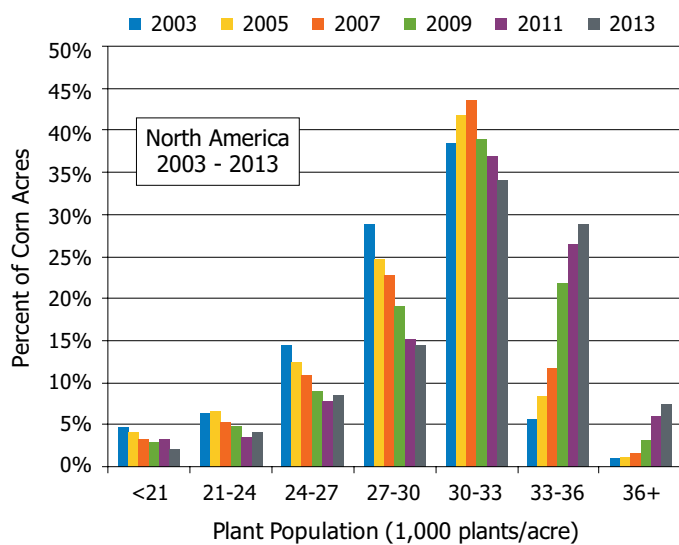


Figure 1. Distribution of reported corn seeding rates, DuPont Pioneer Brand Concentration Survey, 2013.

This survey shows that about 30% of corn acres in North America are currently planted between 30,000 and 33,000 seeds/acre. However, the fastest growing category is 33,000 to 36,000 seeds/acre, which has increased from less than 12% of corn acres in 2007 to almost 30% of corn acres in 2013. The 36,000+ category is also gaining acres but at a slower rate of about one percentage point per year. In the major corn-producing states of Iowa, Illinois and Minnesota, the percent of acres planted over 33,000 seeds/acre is well over 50%, generally due to more productive soils (data not shown).

DuPont Pioneer Plant Population Trials

Pioneer has conducted plant population research at over 700 locations throughout the U.S. and Canada in the last 12 years, generating over 180,000 quality data points (Figure 2).

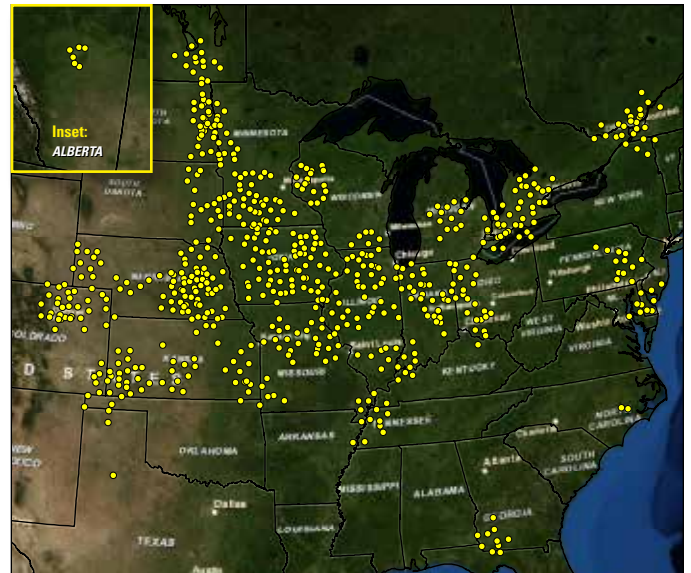


Figure 2. DuPont Pioneer plant population test locations in North America, 2001-2012.

Results Grouped by Time Period

These data were divided into four-year groupings to evaluate if progress was made in increasing hybrid tolerance to high plant density stress. Specifically, yield data of the five highest yielding hybrids from each of three different periods, 2001-2004, 2005-2008 and 2009-2012 were averaged within each grouping, and yield response to plant population was plotted (Figure 3).

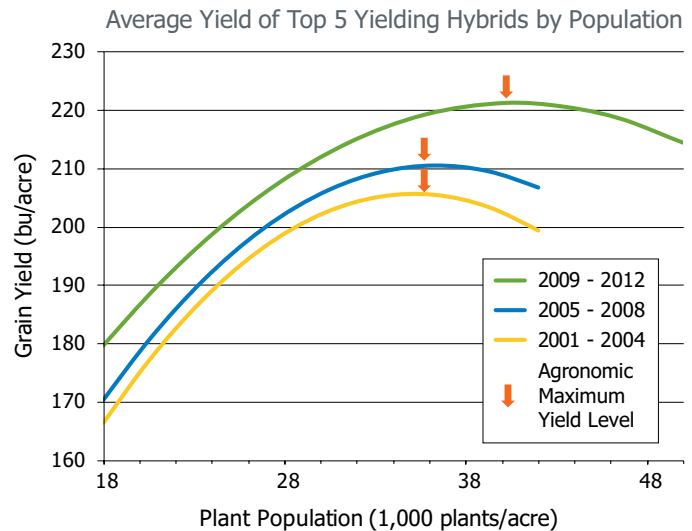


Figure 3. Average yield of top five yielding hybrids in each four-year period by population, 2001-2012.

For the top 5 yielding hybrids per time period, the plant population that maximized yield increased from 36,000 plants/acre in the two earliest groups to 40,000 plants/acre in the most current hybrid group (2009-2012). In addition, yield increased by 10.7 bu/acre in the most current group over the previous 4-year period (Figure 3). These yield gains are consistent with those of previous genetic studies that have indicated a 1.0 to 1.5% per year yield increase attributable to genetic improvement alone. To accomplish these increases, DuPont Pioneer corn breeders have selected for superior tolerance to drought, high plant

density, pests and other stresses. In this study, the benefits of improved agronomic practices (use of seed treatments, foliar fungicides, etc.) may also have contributed to yield gains.

Results by Field Productivity Level

Grouping locations with similar yields is a useful way to analyze plant population results because it can indicate which populations are needed for the yield levels growers intend to achieve. Like previous DuPont Pioneer studies, the 2006 to 2012 trials across the U.S. and Canada show that corn hybrid response to plant population varies by yield level (Figure 4). On inspection, it is apparent that the response curves become steeper and the peak moves farther to the right as yield levels increase. In other words, the seeding rate required to maximize yield increases as yield level increases. Differences are most noticeable between the top and bottom curves, but in fact, this effect is progressive across the entire range of yield levels.

Optimum Economic Seeding Rate

As yields increase with each increment of higher seeding rate, a point is reached where the yield benefit from the next addition of seed no longer exceeds the cost of the seed. That point is the optimum economic seeding rate. By definition, it is the seeding rate that generates the most income when seed cost and grain price are factored in. The red arrows on the graph indicate the optimum economic seeding rate using a corn grain price of \$4.40/bu and a seed cost of \$3.25/1,000 seeds (Figure 4). The calculation assumes that a 5% overplant is needed to achieve the target plant population.

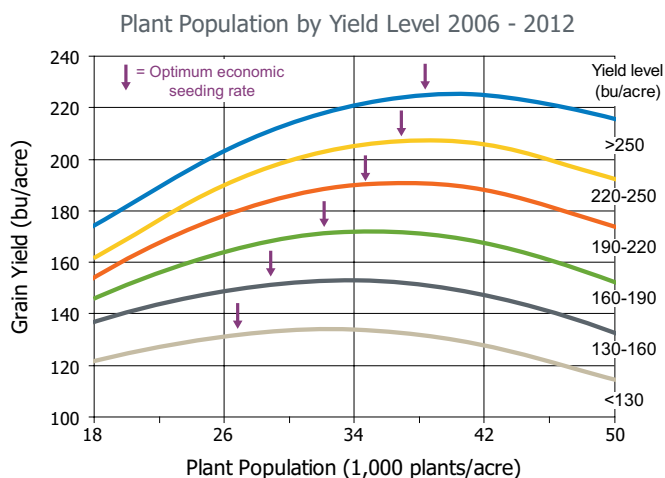


Figure 4. Corn yield response to population and optimum economic seeding rate by location yield level, 2006-2012.

As the graph indicates, the optimum economic seeding rate varies from about 27,000 seeds/acre for locations yielding less than 130 bu/acre to about 38,300 seeds/acre for yields over 250 bu/acre. For the high yield levels common in many areas of the Midwest in 2013 (190-220 bu/acre), the studies indicate an optimum economic seeding rate of 34,600 seeds/acre. A higher corn price relative to the seed cost would increase the seeding rate recommendations.

Results by Hybrid Maturity

Population response of five comparative relative maturity (CRM) groups is shown in Figure 5. These data show a fairly similar response of hybrid maturities to plant population.



Previous research has shown that early maturity hybrids (<100 CRM) may require higher populations to maximize yield. Although this trend can still be detected when examining the response curves closely, it is a smaller difference than in the past. This change may be the result of different genetic backgrounds predominant in early maturities historically vs. currently, or other unknown factors.

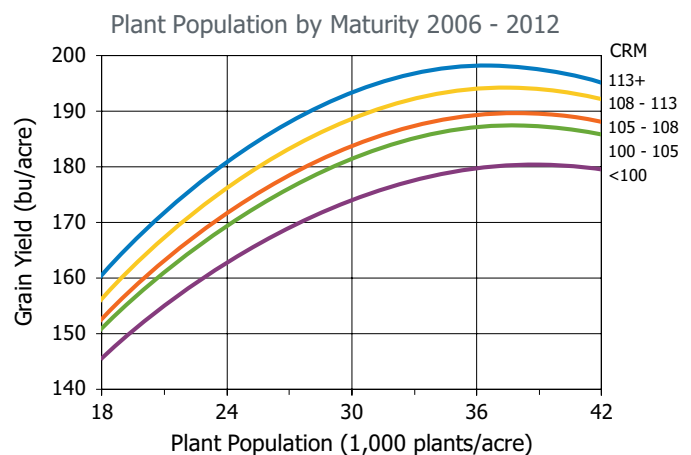


Figure 5. Yield response to plant population for corn hybrids from five maturity (CRM) ranges, 2006 to 2012.

Seeding Rate Recommendations

Challenging growing environments may reduce corn plant populations below optimum levels. These conditions can occur when planting into no-till or high-residue seedbeds, or cloddy or compacted soils. Soil-borne diseases and soil insects can also diminish stands. All of these factors can interact to challenge stand establishment, and effects are magnified when planting early into cold, wet soils. Therefore, consider the following points when choosing your seeding rate:

- In general, plan to drop 5% more seeds than the target population to account for germination or seedling losses.
- Boost target seeding rates by an additional 5% for extreme or challenging environments such as those described in the paragraph above.
- In areas with perennial drought stress, seeding rate targets are lower. Base your seeding rate on the specific hybrid population response at the historical yield level of the field.