Corn Seed Size, Plantability, Germination, and Yield Potential

- Corn seed size does not affect genetic yield potential.
- Proper planter adjustments can help achieve optimal stands by minimizing skips, doubles, and triples.
- Plantability can be optimized by focusing on genetic yield potential, increasing populations, and identifying planter settings that can help deliver seed.
- Warm and cold germination scores are indicators of germination potential and not absolute measures of performance.

Seed Size and Yield Potential

Research to evaluate the effect of corn seed size on yield potential has been conducted since the 1930s. Conclusions from these studies have been consistent; corn seed size or shape is not related to genetic yield potential, under normal conditions. When plant stands were similar, yields were usually the same, regardless of seed size or shape.

Since there is always the potential for exceptions to “normal conditions,” it is important to: 1) understand how seed size is determined, 2) examine how it might affect emergence and early growth, 3) understand the importance of proper planter settings, and 4) use management techniques to help improve plantability of various seed sizes with different types of planters.

Varying environmental conditions may result in a variety of seed sizes and shapes from the same corn product. Seed size is also affected by specific corn product characteristics, parent tendencies, and growing conditions, especially during the pollination and fill period. Seed from each ear is categorized into many size/shape categories. Typically, large rounds come from the base of the ear, flats from the center, and small flats and small rounds from the tip (Figure 1). Plateless seed usually comes from the base or the tip.

Effect of Conditions on Germination

Advantages and disadvantages have been related to seed size under adverse planting conditions. Large seed can have slightly decreased emergence rates in dry soil conditions because large seed requires more moisture to initiate germination compared to small seed. Small seed can have slightly decreased emergence in cool or crusted soils, because the energy needed in these environments may be greater than the amount stored in the endosperm. After tasseling, differences in early growth related to seed size are usually not apparent. Similar silking dates and grain yield are expected when emerged plant populations are the same regardless of seed size and shape.

Planter Adjustment for Seed Size and Shape

*Planter settings should be set for accurate seed positioning, placement, and seeding rate.* When adjusted for seed size, a planter can more accurately singulate and deliver seed. Planters can deliver excessive numbers of doubles, triples, or skips when improperly adjusted for seed size. Consequently, grain yield potential can be reduced by 3 to 10 bushels per acre. Stand counts should verify that intended population was met to produce maximum yield potential.

Vacuum Planters. Adjustments can be made to the vacuum pressure, cell size, and seed singulation devices that can affect plantability. Planters equipped with cell or flat disks have different requirements for adjustment. Another component to examine, regardless of disk type, is the way the disk is adjusted relative to the meter housing. Having the disk rub the housing with light contact can help improve singulation, reduce seed damage, and help load the planter drives, improving their consistency.
Using talc or graphite can help improve seed flow and drop, especially with high rates of seed treatments and/or humid conditions. Increased rates of talc or graphite may be necessary for the increased surface area with small seed. Talc or graphite should be mixed well throughout the hopper or tank to provide adequate coverage.

**Vacuum Planters with Cell Disks.** With cell disks, seed is partially held in place by the cell and partially by the vacuum pressure. Plantability is aided by matching different cell sizes and vacuum pressures to fit a given seed size and shape. Disks with cells that are on the larger side of the acceptable range for a given seed size could lead to doubles, even if the vacuum pressure is adjusted to the lower side of the acceptable range. Low vacuum pressures also increase the chance of seed being shaken off of the disk when planting over rough ground, resulting in increased skips. To help reduce doubles and skips, disks with cells on the smaller side of the acceptable range can be used while running vacuum pressures on the higher side of the acceptable range.

**Vacuum Planters with Flat Disks.** Flat disks are less sensitive to different seed sizes and shapes. They can provide more consistent plantability with less need to adjust vacuum pressure. Two flat disk examples are the John Deere® ProMAX 40 Flat Disk and the eSet® system from Precision Planting. Use of flat disks usually requires an additional component or two for singulation. The ProMAX 40 Flat Disk uses a double eliminator and a knock-out wheel while the eSet system requires a non-adjustable singulator. Even with these differences, both systems reduce the need to adjust vacuum pressure to account for seed size and shape variations, thereby improving the plantability of various seed sizes and shapes. Flat seed disks may need a slightly different environment than cell disks, and users may benefit by visiting their equipment dealer for inspection and testing of their seed meters.

**Finger Pick-up Planters.** Planter speed is key to calibration and accurate seed placement. Planting at speeds faster than recommended could result in poor seed singulation and placement, and negative affects on yield potential. Alternatively, planting at speeds slower than the recommended range may result in a lowered population.

Maintenance on finger pick-up planters helps minimize planting errors. The following items can be evaluated and adjusted to operator manual specifications:

- **Proper tension on the fingers**
- **Condition of meter brushes**
- **Carrier plate condition**
- **Pliability of seed delivery belt**
- **Seed baffle cleanliness**
- **Proper lubrication (graphite) rate**
- **Good alignment with meter drive and the lugs on the unit drive sprocket**
- **Well-maintained and lubricated drive chains**

![Vacuum Planters with Cell Disks](image1)

*Figure 2. Percent singulation of Case IH ASM, John Deere® Pro-Seriex XP with ProMAX 40 Flat Disk, John Deere® MaxEmerge™ with cell disk, Kinze® EdgeVac® with cell disk, and the eSet® flat disk from Precision Planting. Source: Monsanto Seed Technology Center in Waterman, Illinois.*

![Finger Pickup Planters](image2)

*Figure 3. Percent singulation of John Deere®, Kinze®, and Precision Planting are represented in the data. Source: Monsanto Seed Technology Center in Waterman, Illinois.*
Plantability Studies

Plantability tests have been conducted to provide planter setting recommendations for seed lots. Results of the tests conducted are represented in terms of percent singulation, or the percentage of single seeds released by the seed meter at the proper time. If the seed sensor detects two seeds where only one should be, then it is called a multiple. If the seed sensor detects nothing where a seed should be, then it is considered a skip. Therefore, percent singulation is determined by taking 100% properly timed single seed drops and subtracting the percent multiples and percent skips.

Figures 2 and 3 demonstrate singulation data for vacuum or finger pickup planters and various seed sizes and shapes. The finger pickup units were calibrated for larger seed, and data for smaller seed sizes and shapes are not presented. Simulated planter speed was 5.5 miles per hour. Data was collected using seed harvested in 2004 through 2010 for planting seasons in 2005 through 2011, respectively.

Germination Tests

Warm Germination Test. The Federal Seed Act requires seed companies to report results from a standardized Warm Germination test established by the Association of Official Seed Analysts (AOSA). Warm Germination Scores are required for all seed lots. With seed tested using the same standardized testing procedures, a 95% Warm Germination score means the same thing, across companies, labs, and seed regulatory agencies conducting the tests.

Cold Germination Test. Cold Germination or “Vigor” tests are not required for compliance with state and federal seed law, nor are there testing standards across the seed industry. Many companies, universities, and independent seed testing labs have developed and conducted various forms of Cold Germination tests to help establish and differentiate the quality of their seed beyond the legal testing requirements. Monsanto has developed and deployed a proprietary, internal vigor (Cold Germination) test in an effort to better predict emergence potential across environments. The results of this test are used internally in the quality management system to help provide the highest quality seed through each Monsanto corn brand. This information is kept by the quality review team, as the results from the test are ultimately irrelevant in the context of other tests. For example, an 85% test result from the proprietary test Monsanto utilizes may be an equivalent or better indication of stress emergence compared to a 90% test result from a different, less rigorous test. Even if all of the variables were fully understood for each testing procedure, comparing results across tests could be misleading since they would be based on various assumptions. Therefore, there is no way to compare true differences between Cold Germination scores from various testing sources without an industry standard.

Similar to Cold Germination tests, the “Saturated Cold Germination” test does not have a standardized procedure across the industry. Consequently, testing procedures and test results could vary by lab.

The validity of the Cold Germination test has been demonstrated across millions of acres for numerous seasons. However, germination scores indicate potential and are not guarantees of performance. Scores help demonstrate the experience a grower will likely have when seed is planted. Monsanto takes seed quality very seriously and strives to deliver consistent, high quality seed to growers.

Sources:
Shillington, S. Senior Sales and Service Representative for Planters. John Deere Seeding Group. Moline, Illinois. October 22, 2010;

For additional agronomic information, please contact your local seed representative.

Individual results may vary. and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

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