AGF-150-02

THE OHIO STATE UNIVERSITY EXTENSION

Extension FactSheet

Horticulture and Crop Science, 2001 Fyffe Court, Columbus, OH 43210-1096

Tips to Reduce Planter Performance Effects on Corn Yield

Greg La Barge
Extension Agent, Ohio State University Extension

Dr. Peter Thomison
Extension Specialist, Corn Production

We ask a lot of planters in seed placement. When planting 28,000 seeds per acre at four miles per hour, 1.6 seeds are dropped by each meter unit every second. Increasing speed to six m.p.h. results in 2.3 seeds delivered every second. Thus, minor planter wear can cause seed depth and distance placement variability to increase, potentially impacting yield.

Plant Space Variability

A properly adjusted planter can singulate and uniformly space seed delivered from a planter to obtain a "picket fence" stand. Even stands reduce plant-to-plant competition and take best advantage of sunlight to make grain. Doubles or triples and large gaps can result in lost yield potential. Indiana research indicates that a *one-inch* increase in standard deviation of plant spacing results in yield losses up to 2.5 bushels per acre. A 1987 to 1996 study of stand observations from 354 corn fields in Ohio and Indiana found that 84% of the fields had a standard deviation in plant-to-plant spacing of more than 4 inches, which translated into potential yield losses of 5 to 12.5 bushels per acre.

Illinois research concluded that skips contribute to the standard deviation or plant-to-plant variability slightly more than doubles. They further concluded that skips reduce yield in fields where the intended population is at or below the optimum, while doubles increase yield when populations are less than optimum.

Three key points for farmers from this research are:

- An adequate plant population should be selected.
- Plant-to-plant spacing variability may not always result in yield loss.
- Skips limit yield more than doubles.

Method to Evaluate Plant Space Variability

The friendliest method to determine planter spacing performance is by measuring the distance between plants in the field. Measuring seed-to-seed distances is actually a better measure of the actual seed drop. Yet we can adjust the interpretation of the plant-to-plant measures to account for seed germination of less than 100%.

Getting plant space variability is a two-step process:

- Measure the distance between plants in a planter row by laying out a tape measure and recording the position of 30 plants along the tape measure to the nearest half-inch (example: 0, 6.5, 12, 18, 26...). Do this for each row of the planter unit at two locations in the field.
- The data can be entered into a spreadsheet program where the standard deviation, plant population, and number of gaps or doubles can be determined.

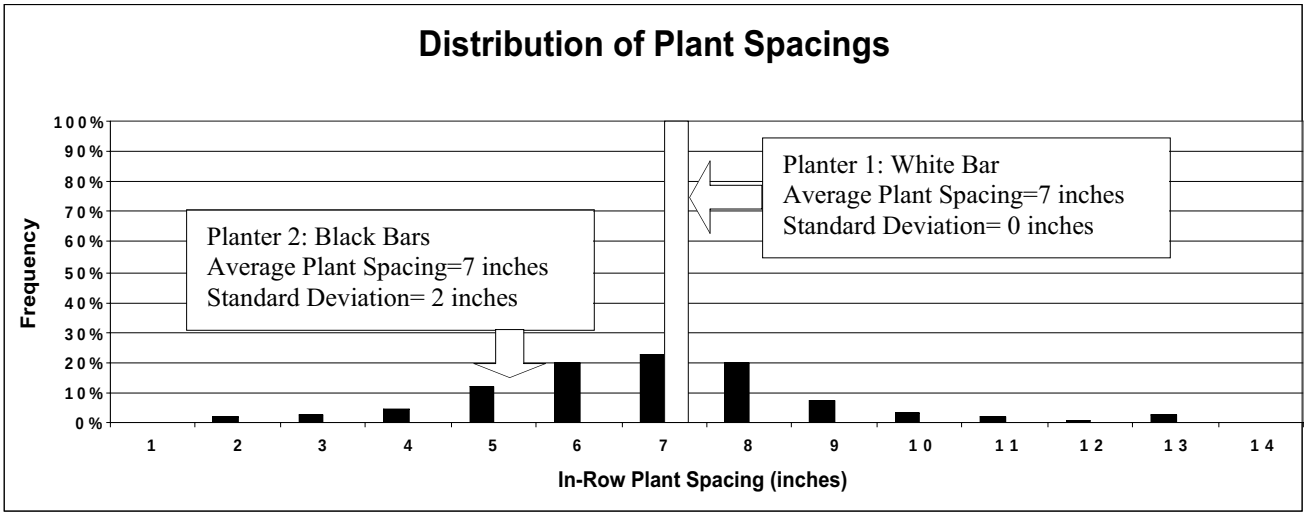
What is a standard deviation and what does it tell you?

Think of a standard deviation as how close plants are to the average spacing. Figure 1 shows results from two planters with identical average spacing of 7 inches but very different distributions of plant spacing. Each plant with Planter 1 is exactly 7 inches apart, resulting in a standard deviation of 0. Planter 2 has an average spacing of 7 inches but the standard deviation is 2 inches. Thus, a majority of plants are within plus or minus 2 inches of the average 7 inches or plant spacing is between 5 to 9 inches apart.

Targeted plant space variability is 2 inches (standard deviations) rather than zero, because plant spacing rather than seed spacing is being used. Seed germination in the 90 to 95% range will produce this type of variability

Tips to Reduce Plant Space Variability

- Read the planter's owners manual. Make adjustment checks and perform standard maintenance.
- Check finger pickups for wear on the back plate and brush.
- Check finger tension with a feeler gauge and set tension as recommended by the manufacturer.
- Check wear on double-disc openers and seed tubes.



Source: R.L. Nielsen, Purdue University

Figure 1. Illustration of two different standard deviations in plant spacing.

- Check seed tubes for obstructions or kinks that can hold up seed delivery.
- Match plate and seed grades on plate planters.
- Make sure sprocket settings on the planter transmission are correct.
- Check for worn chains and stiff links. Lubricate chains plus grease fittings.
- Check to see that gears are lined up.
- Check tire pressure and wear.
- Check seed tubes for damage, wear, and burrs. Repair or replace.
- Clean tube sensors for planter monitors.
- Make sure the planter is level. An out-of-level planter has a seed delivery tube that is at a different angle than designed, and the seed is thrown back.
- Any time the operation of the planter causes the metering unit to jerk, variable seed placement will occur. Adjust all elements of planter operation for smooth performance.
- Observe and adjust planting speed to match ground conditions.

Not all university studies have reported major yield losses with unevenly spaced corn. Some have indicated loss only when the spacing variability is extreme and growing conditions are stressful. Moreover research indicates that uneven emergence has a greater adverse effect on yield than uneven spacing.

Plant Emergence Variability

Uneven emergence affects crop performance because competition from larger early-emerging plants decreases the yield from smaller later-emerging plants. The primary causes of delayed seedling emergence in corn include soil moisture variability within the seed depth zone, poor seed-to-soil contact resulting from cloddy soils, inability of no-till coulters to slice cleanly through surface residues, worn disc openers, and maladjusted closing wheels. Other causes include soil temperature variability within the seed zone, soil crusting prior to emergence, occurrence of certain types of herbicide injury, and variable insect and/or soilborne disease pressure.

Based on research at the University of Illinois and the University of Wisconsin, if the delay in emergence is less than two weeks, replanting increases yields less than 5 percent, regardless of the pattern of unevenness. However, if one-half or more of the plants in the stand emerge three weeks late or later, then replanting may increase yields up to 10 percent. Emergence delays of 10 days or more usually translate to growth stage differences of two leaves or greater. Therefore, if two plants differ by two leaves or more, the younger, smaller plant is more likely to be barren or produce nubbins.

Seed will germinate over a wide range of soil moisture conditions. Enough moisture must be available to swell the seed, triggering utilization of starch in the kernel. The optimum temperature for germination and emergence is 68ºF to 72ºF. Emergence occurs in five to six days at these temperatures. Soil temperatures below 50ºF dramatically slow germination and emergence. Individual seeds in a furrow may be subject to different temperature and moisture conditions due to placement.

The recommended depth of planting is 1.5 to 2 inches for most conditions in Ohio. When dry soils are a concern, 2.5 inch planting depth is suggested. When planting into dry soil, differential emergence often occurs, leading to “tall corn-short corn.” Seed furrows should be checked to make sure seeds come into

contact with moist soil. Ultimate seeding depth should be determined in the field, based on soil conditions.

Determining Seed Placement in the Field

Growers can diagnose seed placement problems by digging up and observing the mesocotyl length after emergence as shown in Figure 2. Since the plant develops crown roots at about 0.75 inches deep (when seeding depth is 1.5 inches or more), measure the length of the mesocotyl from the crown to the seed and add 0.75 of an inch to determine seed placement. Common causes of uneven plant emergence are soil moisture and temperature variability within the seed zone.

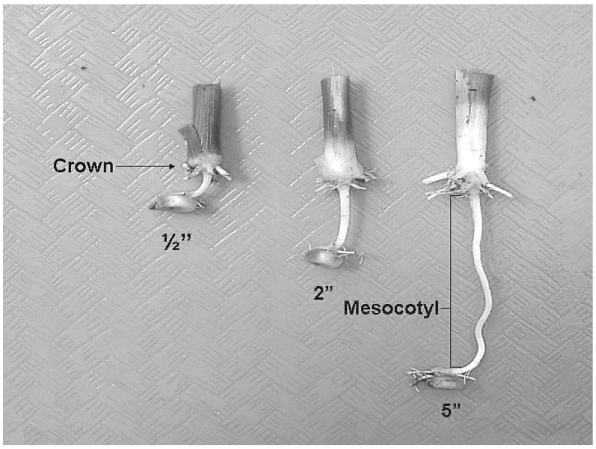


Figure 2. Crown roots develop at nearly the same depth although seeds were planted at 0.5, 2, and 5 inches deep. Corn mesocotyl elongation adjusts for varying seeding depths.

Tips to Reduce Emergence Variability

- Check to see that planter adjustments are accurate and the depth setting matches actual performance.
- Make sure the rocker arm assembly is properly lubricated and operating, if your planter has one.
- Make sure the planter is operating level. If too much down pressure is used to insert worn coulters in the ground, the planter will operate out of level. Seeding depth will be changed, and the seed tube will not deliver the seed into the furrow at the proper angle.
- Worn double disk openers can move apart at the bottom of the furrow and slice a "W" instead of a "V" shape, placing the seed higher in the furrow and leaving air around the seed.
- Use a seed firmer to assure the seed is placed in the bottom of the furrow and not hung up on the sidewall.
- Operate coulters at the same or slightly higher depth than the double disk or the seed placement will be at the coulter depth, not the disk opener depth.
- Use only the amount of down pressure needed to place the seed at the depth desired. Adjust tension so that depth control is met and back off one notch.
- Make sure gauge wheels are tight to the disk opener or a small mound of loose soil is formed that can fall into the furrow in front of the seed and affect depth of planting.
- Observe and adjust planting speed to match ground conditions.

Planter Speed of Operation

Planter speed of operation has received considerable attention in recent years. It has the potential to affect both seed placement and seed spacing. Some studies evaluating planter speed of operation show it can be an important factor in seed placement, while others show little effect.

A Purdue study with planters operated at speeds of 4 to 7 m.p.h. showed faster planter operation increased seed placement variability in 10 out of 22 sites. Yet this observed variability resulted in yield decreases at only five of the 10 sites. Yield decreases ranged from 1.9 to 4.7 bushels per acre per m.p.h. speed increase. A 1998-99 study from Wisconsin showed yield reduction of 7 bushels per acre when operating a planter at 8 m.p.h. vs. 4 m.p.h., or about 1.8 bushels per m.p.h. In a recent Illinois study, planter speeds of up to 8 m.p.h. had no effect on yield.

The fact that a yield response was detected at only five of 22 sites in the Purdue study would indicate that properly adjusting and maintaining the planter can reduce the impact of planting speed. It could also be suspected that speed effects would increase with rough ground conditions in a no-till field or cloddy seedbed. When the planter units are operating under conditions that cause the units to bounce, depth placement problems can result.

Planting speed should be based on the farmer's knowledge of equipment operation, soil conditions, and the actual operation of the planter. Planting speed needs to be a balance between seed placement issues and planting timeliness. Farmers may want to establish their own strip trials under common ground conditions operating at different speeds to get a better feel for their situation.

Summary

Determining the cause of an uneven stand is an important step in correcting variable emergence or plant stand problems. Cultural practices that promote uniform plant establishment will maximize grain production. Uneven corn emergence will generally have a greater impact on yield than uneven plant spacing.

Sources

Carter, P. R. and E. D. Nafziger. 1989. *Uneven Emergence in Corn.* NCR-344. Iowa State University.

Hoeft, G. H., E. D. Nafizer, R. R. Johnson, and S. R. Aldrich. 2000. *Modern Corn and Soybean Production.* MCSP Publications.

Nafziger, E. 1996. Effects of Missing and Two Plant Hills on Corn Grain Yield. *J. Prod. Agric.* Vol. 9, No. 2.

Nielsen, R. L. 1995. Planting Speed Effects on Stand Establishment and Grain Yield of Corn. *J Prod. Agric.* Vol. 8, No. 3.

Nielson, R. L. 1997. *Stand Establishment Variability in Corn.* AGRY-91-01. Purdue University.

Rankin, M., and Lauer, J. 2000. Corn Stand Uniformity in Wisconsin. Paper presentation at North Central Region ASA meetings, Des Moines, Iowa.

2/2002-jaf