The Basics Of Getting A Good Corn Stand

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First Question: How many seeds do we drop? Before we talk about how to get a "perfect" stand of corn, it helps to know what stand, in terms of plant number, we are trying to establish. This has been a moving target for corn, but mostly, and appropriately, the direction of that movement is up. The average plant stand recorded in Illinois by the Agricultural Statistics Reporting Service in 2006 was 28,000 plants per acre, up about 10% since 2002 (NASS). Many producers have increased their targeted plant population in corn in recent years, yet still wonder, after a year with good weather and good yields, if thy should have set the planter for higher populations than they did. We know that yield response to plant population will vary depending on conditions. Figure 1 shows, as an example, the population responses from several Illinois locations in 2006. Such a range of responses is fairly typical, with yield continuing to increase up to 40,000 plants per acre under very good conditions, to top out in the mid-30s and sometimes drop off at higher populations under occasionally dry conditions, and to remain relatively flat over a wide range under very dry conditions. In general, though there is a risk of losing seed cost and even some yield when conditions are poor, there seems to be little risk, and some reward, in raising plant populations into the mid-30,000s in productive soils.

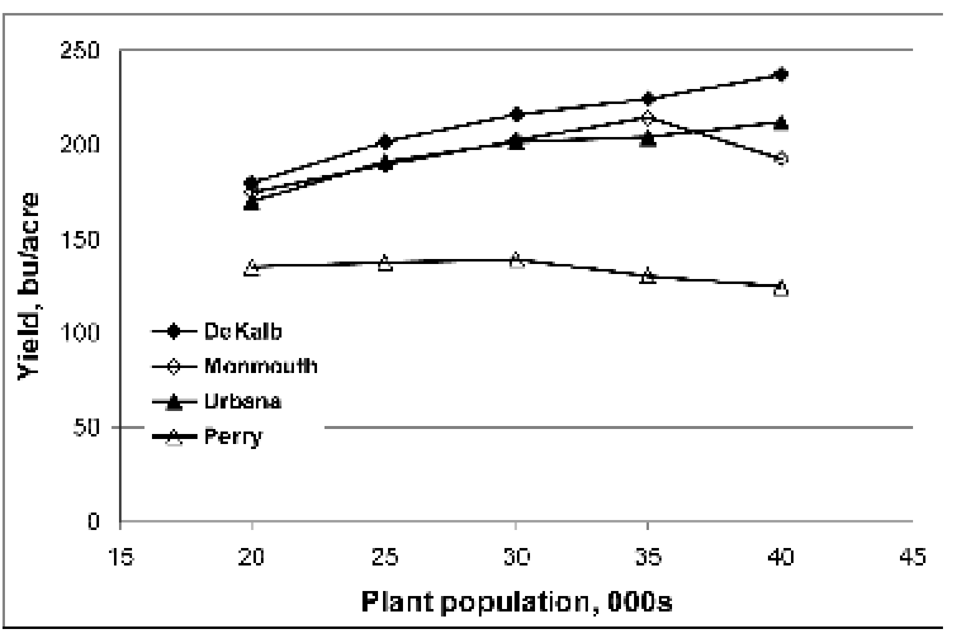

Figure 1. Corn plant population responses at four Illinois locations, 2006. The same corn hybrid (Pioneer® 34A18) was used at each location.

Table 1. Effect of planting speed on plant spacing and yield, averaged over on-farm trials in Illinois, 1996-98.

Planting speed, mph	Standard deviation	Plant population	Yield
	in.	/acre	bu/ac
3	2.87	27231	152.5
5	2.99	27373	152.2
7	3.22	26996	153.1
LSD 0.05	0.33	NS	NS

Second Question: How uniform does plant spacing need to be?

One of the longest-running debates in corn production has been on the effect of uneven plant spacing on corn yields. This began in the 1980s, when Bob Nielsen at Purdue University started some innovative work in which he created very uneven stands and found that this reduced yields. He chose to measure plant spacing variability using the statistic "standard deviation" (SD), which increases from zero with a perfect stand to as much as 6 to 8 inches when stands are very uneven—for example, when many of the plants are present as doubles (two plants very close together) or there are many skips (missing plants) down the row. Measuring the SD requires measuring the spaces between individual plants, so it is not a quick and easy measurement.

In one of our early studies done by cooperating farmers in field-scale strips in Illinois, we found that faster planting speeds increased plant spacing variability slightly, but had no effect on yield (Table 1). Others have reported SD values ranging from 2 to more than 4 inches, and in a few cases SD values as high as 6 to 8 inches have been reported. Because SD values are influenced by plant population (and vice versa), SD values above 4 or 5 inches are almost always associated with low stands, with a lot of missing plants. Exceptions to this might be when a serious planting malfunction occurs, with a large number of doubles and skips, even at a high population. Table 1. Effect of planting speed on plant spacing and yield, averaged over on-farm trials in Illinois, 1996-98.

In a more recent study, we found that thinning plants to an even stand compared to an uneven stand had little effect on yield, except at the intermediate population (24,000 per acre) where high plant spacing variability cost some yield (Fig. 2). We think this happened because nearness of neighbors has little effect at both low populations, where plants have all the room they need, or at high populations, where plants are crowded no matter how close their neighbors are. After a number of such investigations, most agronomists now believe that, while perfectly-spaced plants down the row is the ideal, there is likely to be little yield loss under the small amount of variability (SD values less than 3 inches or so) in plant spacing that is present in most fields. Modern planters do a very good job of seed distribution and placement, and this has led to a reduction in the problem of uneven spacing, though mistakes are still possible. As a general rule, spending money to try to improve on a stand that is less than perfect but within an acceptable range probably will not increase profits much if any.

Third Question: How uniform is emergence and early growth, and does seed matter?

In many fields, uniformity of emergence and plant size early in the season probably reduce yields more than does non-uniformity of plant spacing. Planting depth is one factor that affects uniformity of emergence. The ideal depth may vary some depending on soil conditions, but in most cases planting 1.5 to 1.75 inches deep is likely to provide the best results. Both deeper and shallower planting tend to place seed in less-uniform conditions, which can contribute to unevenness in emergence time or stand loss.

If planting is done under reasonably good conditions, emergence in a field should normally take place over a period of less than 48 hours. In a study we did using a seed coating designed to delay emergence, yield decreased when the time to emergence was delayed and the number of days between first and last emergence was increased (table 2). It is not possible to separate the effects of emergence timing and uniformity in this study, but there is other evidence that non-uniform emergence results in plants that are not uniform in size, and that this can result in yield loss. Such yield loss probably occurs when late-developing plants undergo more intense competition from adjoining (larger) plants, and so lose more yield than the earlier-emerging, larger plants can compensate.

The ability of seed to emerge quickly and uniformly is another factor that could affect emergence and yield. While there have been assertions that certain seed grades or seed lots might have problems with emergence, such problems are rarely seen. Over two years and two locations in Illinois, different seed grades have performed almost equally well (Table 3). Thus we have little basis for using seed grade as a performance factor. Some planters may distribute certain seed sizes or grades better than others, but it's unlikely that seed once in the ground differs in performance according to size.

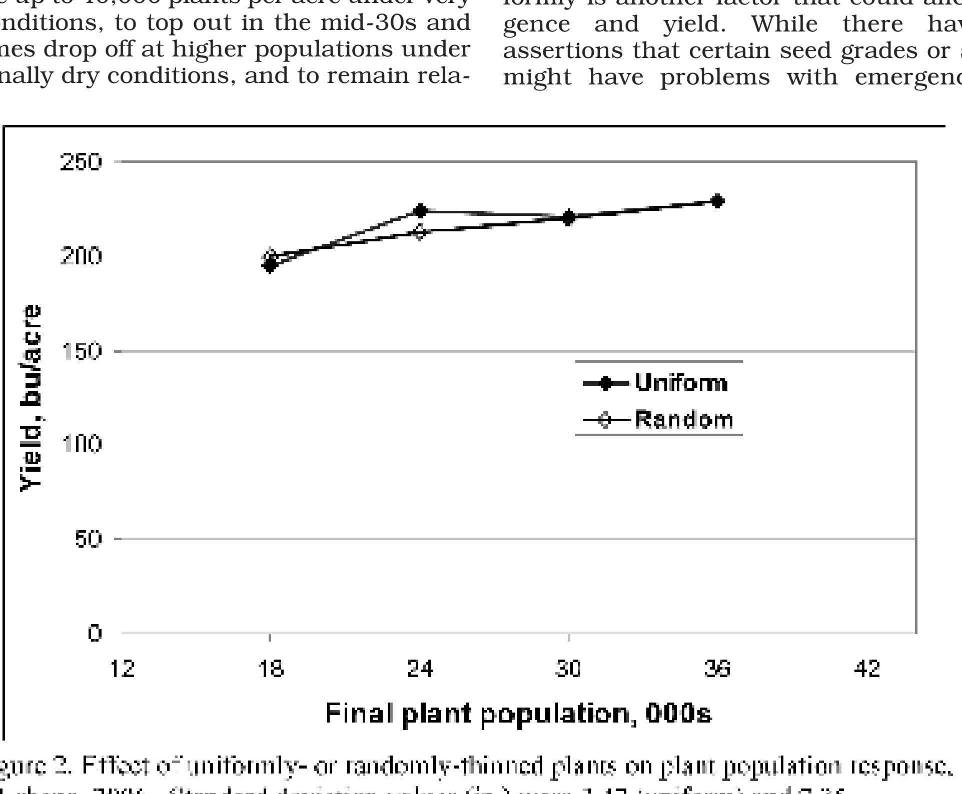

Figure 2. Effect of uniformly- or randomly-thinned plants on plant population response, Urbana, 2006. Standard deviation values (in.) were 3.47 (uniform) and 7.35 (random) at 18,000. 2.43 (U) and 4.42 (R) at 24,000, 2.44 (U) and 3.57 (R) at 30,000, and 2.45 in. at 36,000.

Table 2. Effect of seed coating on timing and uniformity of emergence and on grain yield, Urbana, 1999.

Seed	Days to 90% emergence	Duration of emergence	Yield	Stand
		days	bu/ac	pl/ac
Untreated	7	2	208.7	33189
1/2 coated	17	17	185.7	33686
Coated	20	11	176.4	32110
LSD 0.05			20.1	NS

Table 3. Corn yield from different seed grades. Data are averages over two Illinois locations (DeKalb and Urbana) and two years (2005-06).

Seed grade	Yield
	bu/ac
Small flat	184.7
Medium flat	185.5
Large flat	190.1
Small round	188.7
Medium round	188.2
Large round	186.7

Fourth Question: Are you giving the plant its best chance at planting?

The cardinal rule of planting, regardless of tillage, is to plant the seed into soil that is in condition to provide the seed its best chance of germinating and emerging as fast as temperatures allow, and as uniformly down the row as possible. But there's more: we need to keep in mind how the roots of the plant will grow, and we need to manage soil conditions so that established plants have the best chance to grow a root system that will both anchor the plant well and help it to tap soil water and nutrients that it needs.

The obvious first step is to make sure that seed is planted into soil that is loose enough to provide good seed-soil contact, and that seed is covered with enough soil to allow normal development. These are critically important regardless of tillage system, but there is a tendency in tilled soils to bury seed too deep and to press soil too firmly around the seed, while in no-till the failure to cover seed adequately is a common problem. It is important to prevent sidewall compaction and other planter issues that can prevent full establishment of the nodal root system—the root system the plant comes to depend on.

Even after plants are established, with the nodal root system growing out into the bulk soil, zones of soil compaction can negatively affect root system size and shape. If the weather turns dry, this can become a critical limitation to the ability of the plant to take up enough water. For example, even in the "forgiving" soils of eastern Illinois in 2007, many producers found lower yields in the lower-lying parts of fields. The season was marginally dry, so we would normally expect the lower parts of fields, with higher organic matter, to yield more. The only plausible reason they did the opposite was that the lower areas were slightly wetter at planting, and that more compaction slightly limited the ability of the roots to take up enough water.

Summary: Getting it right

In summary, seed placement both horizontally and vertically, into a soil environment that provides good seed-soil contact, a good rooting medium, and adequate plant nutrients and water is vitally important in producing top corn yields. Seed companies compete to develop and deliver seed with genetic ability to emerge well under a range of conditions, with good uniformity and protection against soil pathogens and insects. Equipment companies have worked to produce planters better able to place seed at uniform depth and to distribute seed uniformly, and producers take care to assure that planting takes place under good soil conditions. These factors have combined to reduce the problem of getting a good stand, even as planting has moved earlier, and thus into soils that are colder on average. Still, limitations caused at planting time often become yield-limiting when other factors such as weather and pests are less limiting. This means that the need to pay attention to every detail at planting has not diminished at all. Δ