Initial Results --- Stand Uniformity, Planter Performance Impact Corn Yield

As you drive down the road in early summer, most corn fields look pretty darn uniform. However, often a closer examination reveals a wide variation in how evenly plants are spaced within the row. When planters are not functioning properly, a high number of doubles or gaps may occur. To quantify how this might impact yield, a research project was initiated in 1998.

Methods

The study involved several levels of data collection. On two Fond du Lac County farms, corn was planted at 4, 6, and 8 MPH in an effort to force differences in stand uniformity. These replicated trials were characterized in early summer for stand uniformity by measuring standard deviation (S.D.), plant population, gaps, and doubles. Grain yields were then measured in the fall. In four other fields (one in Fond du Lac Co. and three at other Wisconsin locations) the same treatments were imposed and data collected with the exception of grain yield. Finally, in forty-two Wisconsin corn fields (17 in Fond du Lac Co.) corn stands were characterized for stand uniformity at two locations in each field. In each of these situations, an effort was made to collect data in fields where emergence was excellent so that most differences could be attributed to planter performance rather than other environmental factors that may impede plant emergence. Plant-to-plant spacing uniformity was quantified by measuring the distance between 30 corn plants for each row unit of the planter.

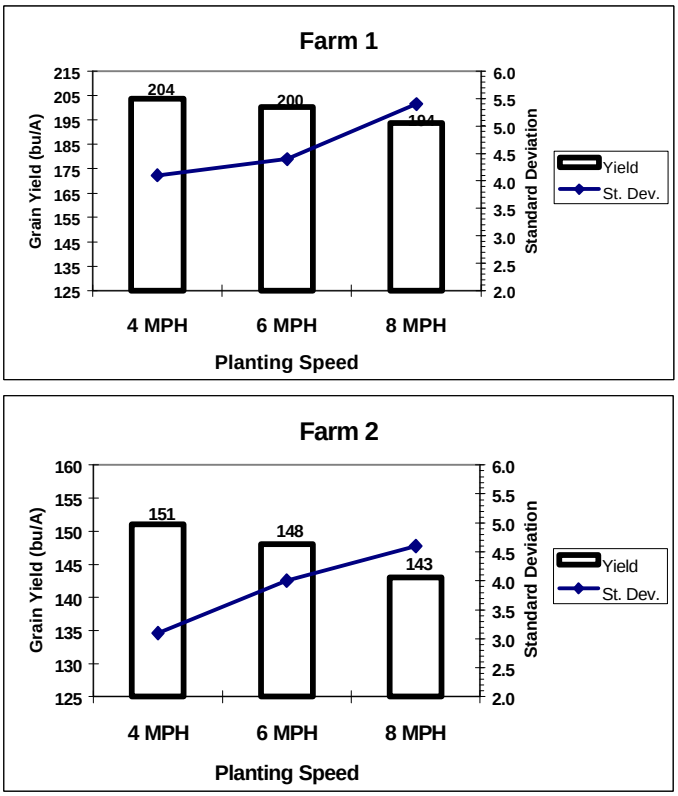

Figure 1. Effect of planting speed on corn grain yield and stand uniformity as measured by standard deviation for two Fond du Lac Co. farms.

What is standard deviation?

Calculating S.D. was a key component of this study. S.D. is a mathematical measure of variability. The larger the value, the greater the variability (more doubles and gaps). A "perfect" stand with all plants exactly the same distance apart from each other would have a S.D. of "0". Although this would be desirable, in the real world the best we can probably hope for is a S.D. of 2 inches. Researchers at Purdue University have suggested that corn grain yield declines about 2.5 bu/a for each 1 point increase in standard deviation above a value of "2". On the other hand, Illinois research has seen very little impact of corn spacing S.D. on final grain yield.

Did planting speed impact grain yield and stand uniformity?

In both locations where yields were measured, planting speed influenced both grain yield and stand uniformity as measured by S.D. (Figure 1). On both farms, yield declined by about 5 percent as planting speed was increased from 4 to 8 MPH. Additionally, S.D. increased (stand uniformity decreased) by about 1.5 units across the range of planting speeds. Because these fields had good initial emergence, and changes in plant population were not large enough to explain the yield reductions (data not shown), it can be assumed that yield declines were primarily attributed to differences in plant-to-plant spacing uniformity. At the four other locations where planting speed treatments were imposed, S.D. also increased as planting speed increased (data not shown). Keep in mind that the purpose of this portion of the study was not to prove you shouldn't plant corn at 8 MPH but rather to induce variations in plant-to-plant spacing by varying planting speed and measuring subsequent yield response. A fair question to ask is why did we see a much larger response in yield decline relative to increased S.D. than has been documented in other Midwestern states. Perhaps it is simply a function of the type of growing season we had. For this reason, we will repeat these experiments again in 1999. Another possible reason is that we may see more response to uniform stands in the northern states where growing seasons are shorter. Certainly it appears this is the case with narrowing corn row spacing to attain more equidistant plant spacing. Until more data is collected, we will reserve further judgement other than the fact that it appears growers would be well served to strive for uniform stands.

How did planting speed impact the number of doubles and gaps?

In this study, plant doubles were defined as any plants within 2 inches of each other and gaps were defined as spaces of 12 inches or more without an emerged plant. Both doubles and gaps have a significant impact on stand S.D. but our studies would conclude that gaps have a much greater impact than doubles. Illinois research has has shown that doubles may actually have a positive impact on grain yield where plant populations are below optimum.

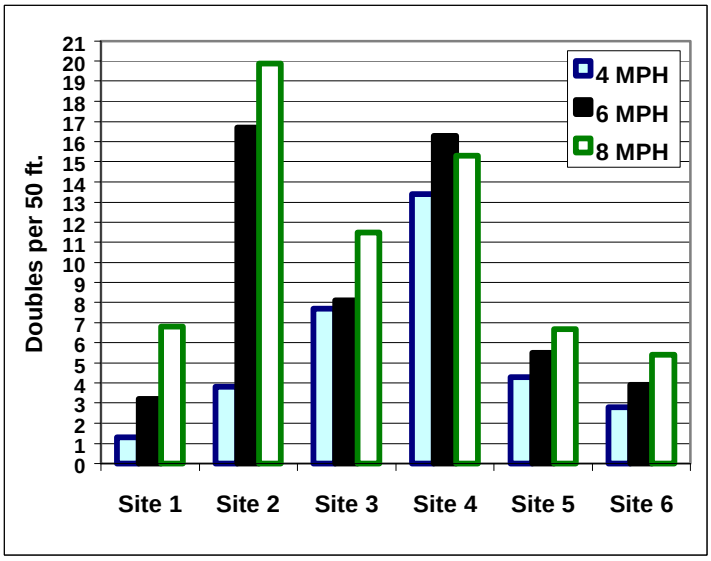

Figure 2. Planting speed effects on the number of doubles per 50 ft. of corn row

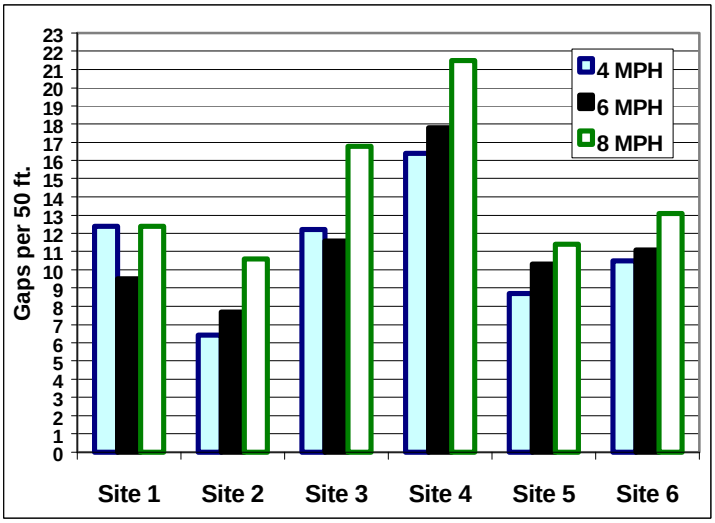

Figure 3. Planting speed effects on the number of gaps per 50 ft. of corn row

At most 1998 farm locations the number of doubles and gaps per 50 ft. of corn row increased as planting speed increased (see Figures 2 and 3). As might be expected, the most dramatic increase in doubles occurred with finger pick-up type planters (Sites 1 and 2). It also appears that planting speed and planter maintenance may be more critical for maintaining uniform stands where producers are trying to optimize yields with higher corn populations (28,000 to 32,000).

How did Wisconsin corn fields rate for uniformity in 1998?

Forty-two Wisconsin corn fields were evaluated for stand uniformity in 1998. Seventeen of these fields were in Fond du Lac County. Once again, it is important to remember that an attempt was made to select fields and areas within fields with good emergence so that planter performance was the primary criteria being evaluated. A summary of the results is presented in Table 1. Of the 42 fields evaluated, 30 were planted with a finger pick-up type planter, 10 had some type of air system (vacuum or pressure), and 2 were plate planters. Thirty-five of the 42 fields were planted in 30-inch rows (others were either 36 or 38 inches) and planter size ranged from 4-row to 16-row. Stand uniformity (as measured by S.D.) ranged from a very commendable 1.9 inches to an undesirable 5.9 inches. There were large differences in both the number of doubles and gaps per 50 ft. of corn row between fields. On average, most of these producers were planting just over 30,000 seeds per acre and final stands averaged about 95% of target populations. This helps to verify the fact that fields with good plant emergence were selected.

Table 1. Summary of 1998 Corn Stand Uniformity Project n=42

Measurement	All farm mean	All farm range
Standard Deviation (in.)	3.4	1.9 - 5.9
Doubles/50 ft.	4.1	0.2 - 13.5
Gaps/50 ft.	8.0	1.9 - 16.7
Avg. spacing	7.3	6.1 - 9.3
Target planting rate	30,216	24,000 - 35,600
Actual plant population	28,719	22,264 - 35,195
Stand as a % of target planting rate	95.2	78.7 - 113.5

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