On-Farm Evaluation of Twin-Row Corn in Southern Minnesota - 2010.

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INTRODUCTION AND OBJECTIVES

Growers are continually striving to increase corn yield and profits and planting corn in narrow rows is one potential way to do this. University of Minnesota research in southern and central Minnesota indicates that yields can be increased 7 to 9 percent by planting corn in 20-inch rows compared to 30 inch rows, but increases have not been consistently observed (1). Twin-row corn, a system where corn is planted in row pairs 6 to 8 inches apart with 30 inches between the center of row pairs, is a variation of narrow-row corn. A major advantage of planting corn in twin rows versus 15- or 22-inch rows is that no additional major equipment modifications are needed beyond modifications to the planter (i.e. a standard combine head can harvest the crop and narrow row tires, which can be very costly compared to standard tires, are not essential). Anecdotal reports from growers in southern Minnesota currently planting corn in twin rows indicate a potential for increased yields in twin rows compared to 30-inch rows. It is also hypothesized that yields may be optimized at higher populations when corn is planted in twin rows compared to narrow rows, in part due to less competition among plants in twin rows and/or better light interception.

This study was initiated in 2010 at two on-farm locations to determine 1) If row width (30-inch vs. 22-/8-inch twin rows) influences corn grain yield, harvest moisture, stalk lodging, and economic return and 2) If corn planted in twin-rows has a greater response to an increased seeding rate than corn planted in 30-inch rows.

MATERIALS AND METHODS

On-farm trials were initiated the spring of 2010 in southern Minnesota with two farmer cooperators by Welcome and Wilmont who have been planting corn in twin rows for a number of years. Fertilizer was applied according to soil test recommendations and herbicides were applied to control weeds at each site. Both sites have a long-term history of manure use. Further details regarding the field history at each site are listed in Table 1. The planter used at Wilmont was designed by a manufacturer for twin-row corn production, while the planter used at the Welcome location was modified by the farmer to plant twin rows.

Treatments were arranged in a randomized complete block design with four replications, in a factorial arrangement of 2 row widths (30-inch vs. 22-/8-inch twin rows) and 3 plant populations (33,000, 38,000, and 43,000 plants per acre (ppa)) for a total of 6 treatments. Plot length was 400 feet and individual plot width was 30 feet (Welcome) or 40 feet (Wilmont). The same planter was used for all treatments within a site. Each planter had dual toolbars and planting units were tuned off on one tool bar for the 30-inch rows. Planter seeding rates were adjusted according to planter manual guidelines for each population by row spacing combination. At the Welcome site, the seeding rate was slightly higher for planter units on one tool bar than the other to help prevent seeds from being planted next to each other in the twin-row plots. At the Wilmont site, planting rates were first tested in the field using planter monitor readings in order to try and match target populations as closely as possible.

When corn was V4 to V8, stand counts were taken by counting the number of plants in 100 feet of each harvest row (6/9/10 at Wilmont and 6/17-6/18/10 at Welcome).

Stalk lodging was determined prior to harvest by counting the number of stalk-lodged plants in 100 foot of row at two locations within each plot. Grain yield, moisture, and test weight was determined by harvesting the center 6 (Welcome) or 8 rows (Wilmont) of each plot. A weigh wagon was used at each site to determine plot weight. Grain moisture was adjusted for 15% moisture in yield calculations. ANOVA was used for statistical analysis and means compared using Fisher's Protected LSD at the 0.05 and 0.10 significance levels. Covariate analysis was initially used to account for variability in population across row spacing within a site, but this factor was not significant and results using standard ANOVA are presented below.

RESULTS AND DISCUSSION

Table 1 shows the field background for each site. Sites were planted in a timely manner on April 28 and 29 (Wilmont and Welcome, respectively) with the hybrid DKC 48-37, which has resistance to European corn borer, corn rootworm and glyphosate. Figures 1 & 2 show the planters used at each site. When setting planting populations, care was taken to reach the target populations as closely as possible but settings were also selected so that populations could be matched as closely as possible between row spacings.

Population:

Stands were closer to target populations at the Welcome site (differed +730 to -1,662 ppa from target populations) than at the Wilmont site (differed -2,473 to -3631 ppa from target populations) (Table 2). Equipment limitations influenced how closely target populations could be reached at each site, and at Wilmont, the highest possible setting according to the planter manual was used in the 43,000 target population in 30" rows. At Welcome, stands significantly differed among treatments and were consistently lower in the twin rows than the 30-inch rows at each target population by 1,117 to 1,183 ppa. At the Wilmont site, populations did not differ across row spacings at the 33,000 and 43,000 target populations, while stands were significantly higher in 30-inch rows at the 38,000 target population.

Figures 3 through 8 are pictures taken of the three planting population in twin-rows and 30-inch rows, respectively at the Wilmont location during the growing season in 2010.

Stalk Lodging:

In twin rows at Welcome, stalk lodging was greater in the mid and high populations compared to the low population, but not in 30-inch rows where no lodging was detected (Table 3). At Wilmont, stalk lodging was greater in the highest population in 30-inch rows compared to the lowest population, while stalk lodging was greater in both the 38,000 and 43,000 populations than the lowest population in twin rows. Although differences were found, overall stalk lodging was minimal at each site.

Grain Moisture, Test Weight, and Yield:

Grain was very dry by harvest time in 2010, and ranged from 14.1 to 15.3 % across sites (Table 4). Grain moisture was greater in 30-inch rows at the highest population compared to all other treatments at Welcome, while no differences were found among treatments at Wilmont. There was no effect of treatment on test weight (Table 5).

Yields were significantly lower at the lowest population at Welcome, regardless of row spacing (Table 6). Yield did not differ among treatments at higher populations and no difference was found across row spacings. At Wilmont, yield was greatest at the highest population in twin rows. At this site, increasing population from the middle to the high population resulted in a yield increase in the twin rows, but a yield decrease in the 30-inch rows.

CONCLUSIONS TO DATE

- A range of populations (low, medium and high) were achieved at each site although population was consistently lower in twin rows than in 30" rows at Welcome.
- Stalk lodging was slightly increased in twin rows at the mid and high population compared to the low population at both sites, while stalk lodging was only greater in the 30-inch rows at the high population compared to the low one at Wilmont. Stalk lodging, however, was low overall at both sites.
- Grain moisture was affected by population in 30-inch rows in Welcome, with the highest population resulting in the highest moisture compared to all other treatments, although differences were not great.
- Test weight was not affected by population or row spacing.
- Yield results at Welcome were consistent across row spacing, with the lowest population resulting in significantly lower yield. Results were confounded at this site by populations that were consistently lower in twin rows than 30-inch rows at each target population by about 1,500 ppa.
- Yield was maximized at Wilmont at the highest population in twin rows, indicating that corn had more potential to respond to higher populations in twin rows than 30-inch rows. Yields were actually lower at the highest population in 30-inch rows compared to the middle population.
- This study is planned to continue in 2011.

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REFERENCES

1) Stahl, L., J.A. Coulter, and D. Bau. 2009. Narrow-row corn production in Minnesota. Online. Univ., of MN, M1266-2009. http://www.extension.umn.edu/distribution/cropsystems/ M1266.html (posted 15 Jun. 2009). University of Minnesota, St. Paul.

Figure 1: Twin-row planter used at the Wilmont, MN site in 2010.

Figure 2: Twin-row planter used at the Welcome, MN site in 2010.

Figure 3: Twin-row corn at Wilmont, 33,000 ppa target population, 2010.

Figure 4: 30-inch corn at Wilmont, 33,000 ppa target population, 2010.

Figure 5: Twin-row corn at Wilmont, 38,000 ppa target population, 2010.

Figure 6: 30-inch row corn at Wilmont, 38,000 ppa target population, 2010.

Figure 7: Twin-row corn at Wilmont, 43,000 ppa target population, 2010.

Figure 8: 30-inch row corn at Wilmont, 43,000 ppa target population, 2010.

Table 1. Background information for Twin-Row Corn Sites in 2010.

	Welcome	Wilmont
Previous Crop	Soybean	Soybean
Tillage	Conventional	Conventional
Planter	White planter with dual toolbars	Kinzie Twin Row Planter, with auto guidance
Hybrid	DKC 48-37	DKC 48-37
Planting Date	4/29/10	4/28/10
Stand Counts	6/17 & 6/18/10 @ V8 corn	6/9/10 @ V4 corn
Lodging Ratings	10/12/10	10/14/10
Harvest Date	10/12/10	10/20/10

Table 2. Stand counts at Welcome and Wilmont compared to target populations, 2010.

	Welcome		Wilmont	
Target Population	**30" Rows**	**Twin Rows**	**30" Rows**	**Twin Rows**
(plants per acre)	---------- population (plants per acre) ----------			
33,000	33730	32547	30073	30606
38,000	37912	36765	35954	34369
43,000	42486	41338	40527	41023
P value	**0.0000**		**0.0000**	
LSD (.05) within a location	**768**		**846**	
C.V. (%)	**1.36**		**1.58**	

Table 3. Effect of row spacing and population on stalk lodging percent at Welcome and Wilmont, 2010.

	Welcome		Wilmont	
Target Population	**30" Rows**	**Twin Rows**	**30" Rows**	**Twin Rows**
(plants per acre)	---------- stalk lodging (%) ----------			
33,000	0.0	0.0	0.0	0.0
38,000	0.0	0.5	0.3	1.3
43,000	0.0	0.3	1.0	1.5
P value	**0.0138**		**0.0061**	
LSD (.05) within a location	**0.3**		**0.9**	
C.V. (%)	**163.3**		**88.03**	

Table 4. Effect of row spacing and population on grain moisture at Welcome and Wilmont, 2010.

	Welcome		Wilmont	
Target Population	**30" Rows**	**Twin Rows**	**30" Rows**	**Twin Rows**
(pants per acre)	---------- moisture (%) ----------			
33,000	14.7	14.5	14.3	14.4
38,000	14.5	14.7	14.1	14.7
43,000	15.0	14.6	15.3	14.1
P value	**0.0178**		**0.3317**	
LSD (.05) within a location	**0.3**		**NS**	
C.V. (%)	**1.24**		**5.56**	

Table 5. Effect of row spacing and population on test weight at Welcome and Wilmont, 2010.

	Welcome		Wilmont	
Target Population	**30" Rows**	**Twin Rows**	**30" Rows**	**Twin Rows**
(plants per acre)	**---------- test weight (#/bu) ----------**			
33,000	59.5	59.5	59.0	58.9
38,000	59.3	59.5	59.8	59.2
43,000	59.8	59.0	55.9	61.1
P value	**0.4929**		**0.2203**	
LSD (.05) within a location	**NS**		**NS**	
C.V. (%)	**0.9**		**4.61**	

Table 6. Effect of row spacing and population on yield at Welcome and Wilmont, 2010.

	Welcome		Wilmont	
Target Population	**30" Rows**	**Twin Rows**	**30" Rows**	**Twin Rows**
(plants per acre)	**---------- yield (bu/ac) ----------**			
33,000	222.9	221.4	211.8	215.7
38,000	227.1	226.5	215.6	217.1
43,000	226.6	225.8	209.4	223.1
P value	**0.0523**		**0.0001**	
LSD (.05) within a location	**NS**		**4.3**	
LSD (.10) within a location	**3.4**		**3.6**	
C.V. (%)	**1.22**		**1.33**	