The Effect of Planting Date on Irrigated Corn in Southeastern North Dakota

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Corn is the predominant crop grown under irrigation in North Dakota. According to "Irrigation Journal" (6) 48 percent of the 202,100 acres under irrigation in North Dakota were planted to corn in 1988. Corn accounted for about 75 percent of the irrigated acres in southeastern North Dakota.

Corn growers need to continue developing more efficient cropping systems if corn prices remain relatively low and input costs continue to rise. Early planting is a technique which can increase yields. The majority of irrigated corn in North Dakota is grown on well-drained, coarse-textured soils that warm up rapidly in the spring. Growers need to know how early corn can be planted, the risks involved and the penalty for delayed plantings.

Under dryland conditions at Morris, Minnesota, Hicks (5) found that yields varied little between April 24 and May 9 planting dates, but substantial yield declines were noted as planting was delayed beyond May 9 in 1967 and 1969. The growing seasons at Morris and Oakes, North Dakota are similar.

Records at the University of Minnesota North Central Experiment Station at Morris (J. Wright personal communication) show growing degree units (G.D.U.)[1] averaging 2,255 from May 3 to September 25. North Dakota data (7) show an average accumulation of 2,256 G.D.U. at Oakes from May 3 to September 26.

Studies were conducted at the Oakes Irrigation Field Trials from 1977-86 to determine the effects of planting dates on yield and other agronomic traits of irrigated corn in southeastern North Dakota.

METHODS

Ten years of data from irrigated corn planting date studies at Oakes are contained in four data sets; Sayfikar (8) 1977-79, Albus (1) 1980-82, Albus (2) 1983, and Albus and Weigel (3) 1984-86. All data sets were combined to form a long term data base (1977-86) to study the effect of planting date and hybrid maturity on yield. The fourth data set (1984-86) was studied to determine the effect of hybrid maturity and planting date on silking date, G.D.U. at silking, maturity date and G.D.U. at maturity, as well as grain yield.

Field plots were managed for maximum production for the duration of these studies. Irrigations were scheduled to prevent root zone moisture depletions from falling below 40 percent using the Jensen-Haise equation as outlined in North Dakota Research Report 66 (9). The plots were soil sampled and fertility managed for a 225 bushels per acre yield goal. Phosphorus, potassium and micronutrients were applied prior to planting. Nitrogen (N) was applied in split applications to reduce potential losses to deep percolation and to insure N availabilty throughout the growing season. Yield data was compiled from 20 and 30-inch rows from 1977-82 and 30-inch rows from 1983-86. Weeds were controlled with appropriate herbicide applications, cultivation and hand weeding. The plots were over-planted and thinned to target populations of 25,000, 27,000 and 28,000, from 1977-79, 1980-81 and 1982-86, respectively.

Six hybrids, Top Farm TFsx78, Pioneer 3978, Dekalb-Pfizer XL-8, Pioneer 3906, REA 1001 and Stauffer S5602, were used from 1984-86. These hybrids had relative maturities (R.M.) of 76-102 days and were planted at 10-day intervals on four planting dates with the first planting targeted for April 26-30. The average planting dates for the three years were April 28, May 7, May 18 and May 29. Yield, silking date and maturity date means were calculated for each hybrid and planting date. Growing degree units means for silking and maturity for each hybrid were calculated from the April 28 and May 7 planting dates.

Data from 1977-86 was broken down into early hybrids (80 R.M.), intermediate hybrids (90 R.M.) and late hybrids (100 R.M.). Analysis was run on these means for all planting dates and years to show the relationship between planting date and yield. In another approach, 10-year means were computed for early, intermediate and late hybrids for May 2, May 16, and May 28 planting dates.

DISCUSSION

1984-86 Data Set

All data analyzed in this set are based on means from 1984-86. Top Farm TFsx78 and Pioneer 3978 represent early hybrids (80 R.M.), Dekalb-Pfizer XL-8 and Pioneer 3906 represent intermediate hybrids (90 R.M.), and REA 1001 and Stauffer S5602 represent late hybrids (100 R.M.). The effect of four planting dates on the yield of the six hybrids is shown in Figure 1. Corn grain averaged 195.9,

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[1]Growing Degree Units = (Temp. Max + Temp. Min)/2 - 50. If Temp. Max is over 86°, Temp. Max = 86°. If Temp. Min is under 50°, Temp. Min. = 50°.

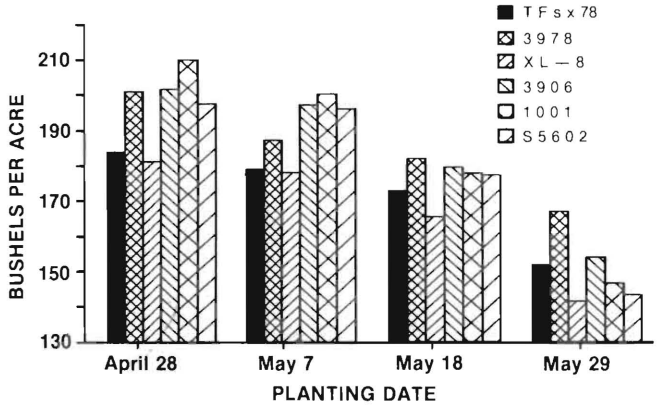

Figure 1. The effect of four planting dates on the yield of six corn hybrids at Oakes, N.D., from 1984-86.

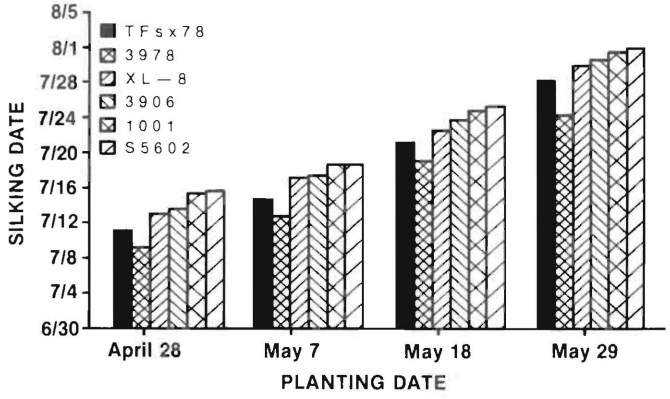

Figure 2. The effect of four planting dates on the silking dates of six corn hybrids at Oakes, N.D., from 1984-86.

189.7, 175.7 and 150.6 bushels per acre on the April 28, May 7, May 18 and May 29 planting dates, respectively. When planting was delayed from April 28 to May 18, yields of early, intermediate and late hybrids were reduced 8, 10 and 13 percent, respectively. When planting was delayed from April 28 to May 29, yields of early, intermediate and late hybrids were reduced 17, 23 and 29 percent, respectively.

Planting date had little effect on the number of G.D.U. required from planting to emergence. Corn required 123, 112, 124 and 114 G.D.U. to emerge if planted on April 28, May 7, May 18 and May 29, respectively.

The effect of planting date on the silking dates of six corn hybrids is represented in Figure 2. The effect of planting date on silking was the same for all hybrids.

Silking was delayed 4, 10, and 17 days if corn planting was delayed to May 7, May 18 and May 29, respectively. Figure 3 shows the relationship between silking date and yield. Yield levels were stable on silking dates from July 9-19. Yield levels dropped 13 bushels per acre if silking was delayed from July 19 to 24, and another 18 bushels per acre if silking was delayed from July 24 to 29. Figure 4 shows the G.D.U. accumulated at silking for the six hybrids averaged across the late April 28 and May 7 planting dates. Early, intermediate and late hybrids accumulated 991, 1,053 and 1,085 G.D.U. at silking, respectively.

The effect of planting date on the maturity dates of six corn hybrids is represented in Figure 5. The average dates for frost (32 degrees Fahrenheit) and killing frost (28 F) at Oakes are September 17 and 26, respectively. Except for S5602, all hybrids planted on April 28 reached maturity before September 26. When planted on May 7, 1001 didn't reach maturity by September 26. Only TFsx78 and 3978 matured by September 26 when planted on May 18. No hybrid matured by September 26 when planted on May 29.

Corn belt recommendations (4) suggest that corn should mature two weeks prior to the average killing frost date. Only TFsx78 planted on April 28 would have met this criteria. Producers on the northern fringe of corn production are forced to stretch their short growing season, but there are limits. Hybrids should be mature by the average killing frost date to maximize yield and quality.

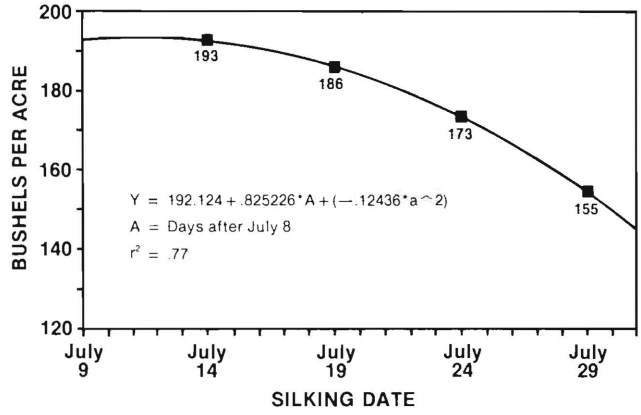

Figure 3. The relationship between silking date and the yield of six corn hybrids at Oakes, N.D., from 1984-86.

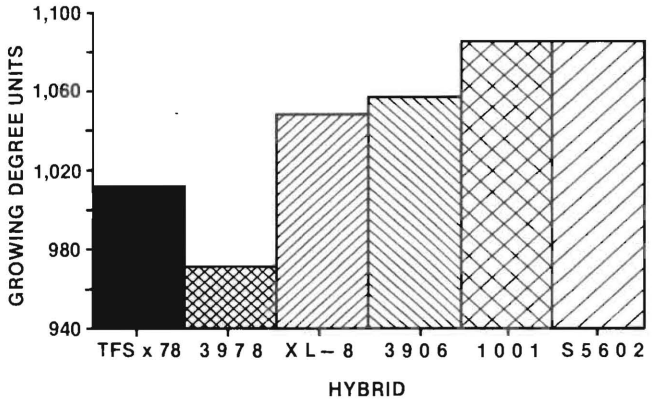

Figure 4. Growing Degree Units accumulated at the silking dates of six corn hybrids, averaged across April 28 and May 7 planting dates at Oakes, N.D., from 1984-86.

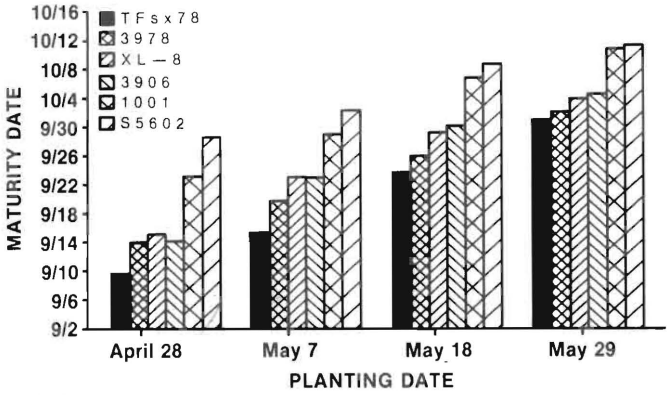

Figure 5. The effect of four planting dates on the maturity dates of six corn hybrids at Oakes, N.D., from 1984-86.

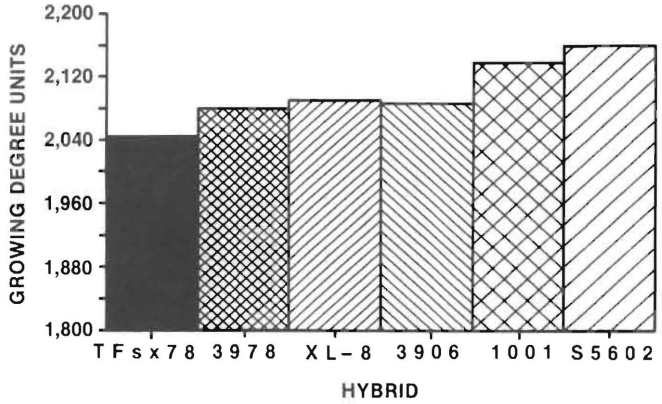

Figure 6. Growing Degree Units accumulated at the maturity dates of six corn hybrids, averaged across the April 28 and May 7 planting dates at Oakes, N.D., from 1984-86.

Figure 6 gives the hybrid means for G.D.U. accumulated at maturity averaged across the April 28 and May 7 planting dates. Growing degree units on the May 18 and May 29 planting dates are not discussed since frost date determined maturity. Early, intermediate and late hybrids accumulated 2,062, 2,089 and 2,149 G.D.U., respectively, from planting to physiological maturity. Early, intermediate and late hybrids accumulated 1,071, 1,037 and 1,064 G.D.U., respectively, from silking to maturity. Hybrid 3978 had an unusually long fill period, 1,109 G.D.U. from silking to maturity, whereas 3906 had an unusually short fill period of 1,030 G.D.U. If these are excluded, the trend is for G.D.U. accumulated from silking to maturity to increase from 1,033 for TFsx78 to 1,075 G.D.U. for S5602. Since S5602 required 74 more G.D.U. than TFxs78 to reach silking, this indicates that within the range of maturities tested, hybrid maturity has greater effect on the time period from planting to silking than from silking to maturity.

1977-86 Data Set

Results discussed in this data set are based on 10-year means.[2] Figure 7 gives the yield of early (80 R.M.), intermediate (90 R.M.) and late (100 R.M.) hybrids for May 2, 16 and 28 planting dates. Yields averaged across maturity groups were 179.5, 171.6 and 146.7 bushels per acre for May 2, 16 and 28 planting dates, respectively.

Late hybrids averaged 10.2 bushels per acre more than intermediate hybrids and intermediate hybrids averaged 6.3 bushels per acre more than early hybrids for the May 2 planting date. Early and intermediate hybrids yielded the same and late hybrids yielded 6.8 bushels per acre more for the May 16 planting date. Early, intermediate and late hybrids yielded about the same for the May 28 planting date. Delaying planting from May 2 to May 16 reduced yields of early, intermediate and late hybrids 1, 5 and 7 percent, respectively. Delaying planting from May 2 to May 28 reduced yields of early, intermediate and late hybrids 14, 19, and 22 percent, respectively.

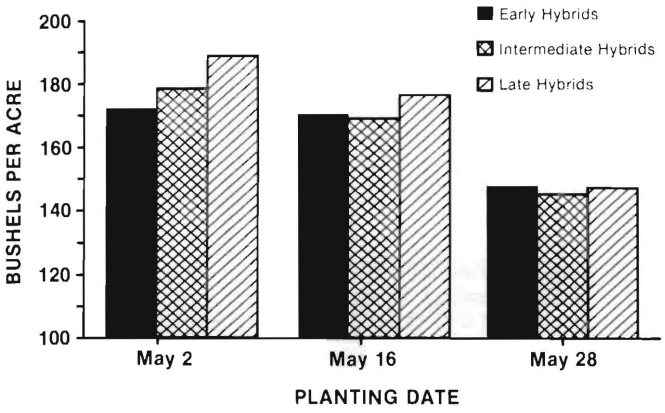

Figure 7. The effect of three planting dates on the yield of early, intermediate and late maturing corn hybrids at Oakes, N.D., from 1977-86.

Grain moisture comparisons were not available from 1980-86 since the moisture content of late hybrids planted after May 15 and intermediate and late hybrids planted after May 27 were so high that the corn had to be dried before it could be shelled. It would not seem economically feasible to produce corn varieties with that high a moisture level at harvest.

Figure 8 represents the relationship between planting dates and yield of all hybrids for the 10-year period from 1977-86. The curve shows that yield dropped only one bushel per acre when planting was delayed from April 26 to May 7. Yields declined 5, 15 and 33 bushels per acre if planting was delayed from April 26 to May 14, 21 and 28, respectively.

SUMMARY

Grain yields of corn hybrids ranging in relative maturity from 75-102 days were optimum on April 26 to May 7

[2]In 1979 there was no planting date before May 14 and from 1980-82 there was no planting date after May 18.

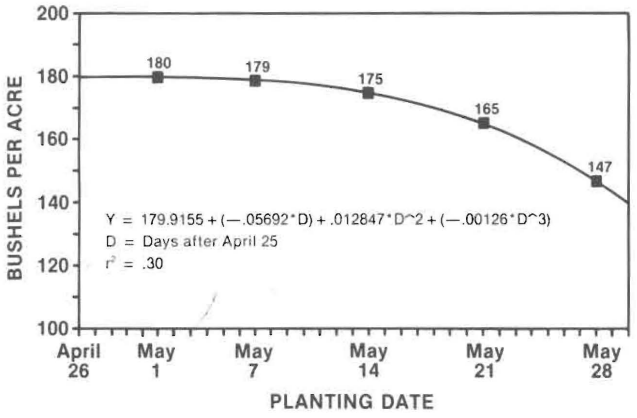

Figure 8. The effect of planting date on corn yield at Oakes, N.D., from 1977-86.

planting dates from 1977-86. Yields decreased four bushels per acre if planting was delayed a week, 14 bushels per acre if planting was delayed two weeks and 32 bushels per acre if planting was delayed three weeks past May 7. Late hybrids yielded 10.2 and 16.5 bushels per acre more than intermediate and early hybrids, respectively, on the May 2 planting date and 7.4 and 6.2 bushels per acre more than intermediate and early hybrids, respectively, on the May 16 planting date. Highest yield on the May 28 planting date was recorded in early hybrids.

Late hybrids planted on May 7 were immature at the average killing frost date, September 26, at Oakes from 1984-86. Intermediate hybrids planted May 18 were unable to reach maturity by September 26. Early hybrids failed to mature by September 26 when planted on May 29. Corn grain yields were maximized when corn silked between July 9-19 and dropped dramatically when corn silked after July 19. Seventy-three percent of the additional G.D.U. required by late and intermediate hybrids above that needed by early hybrids to reach maturity were accounted for at silking if hybrids 3978 and 3906 are excluded. Hybrids 3978 and 3906 have an atypical grain fill interval.

The following can be suggested for irrigated corn production in southeastern North Dakota from the results obtained from 1977-86:

1. Except for unusually cold and wet springs, grain corn can be planted as early as April 26 on well-drained coarse-textured soils with excellent results.
2. Corn grain yields were maximized if planted by May 7.
3. Planting late hybrids after May 2, intermediate hybrids after May 14 and early hybrids after May 20 substantially increased the risk of frost-damaged immature grain, late harvest and high drying costs.
4. Silking after July 25 resulted in wet corn, delayed harvest, and reduced test weights most years. Silking dates after August 1 in 1985, a cool growing season, resulted in severe yield reductions and extremely high moisture grain.
5. Ideally corn should mature by the average frost (32 F) date. If corn is consistently not mature by the average killing frost (28 F) date the planting date is too late and/or the hybrid maturity too late.

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