Optimum Plant Population for Fresh-market Sweet Corn in the Northeastern United States

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SUMMARY. There is little published data to support current recommended plant populations of 11,500 to 17,500 plants/acre (28,600 to 34,600 plants/ha) for fresh market sweet corn (*Zea mays* L.) in the northeastern United States. The plant population likely affects marketable yield and recovery of nitrate. Residual soil nitrate is of concern because of the potential for nitrate contamination of water supplies. Our objectives were to determine the effect of plant population on the yield of sweet corn grown for fresh market without irrigation and on the amount of nitrate in the surface 1 ft (30 cm) of soil at harvest. Seven main-season sweet corn varieties were planted in a total of eight experiments in 1995, 1996, and 1997. Seven experiments were in Connecticut and one was in New Hampshire. All but one of the varieties were standard (*su*) or sugary enhanced (*se*) varieties. The experimental design was a randomized complete block with four replications, and the treatments consisted of 12,000, 16,000, 20,000, 24,000, and 28,000 plants/acre (29,600, 39,500, 49,400, 59,300, and 69,200 plants/ha). The yield of marketable ears was classified based on the length of the ears. The results suggest that the current recommendations for plant population in the Northeast US may be too low. Populations of 20,000 and 24,000 plants/acre produced consistently greater yields of ears greater than 7.0 inches (178 mm) long. Soil nitrate-N concentrations at harvest were about 8 $mg \cdot kg^{-1}$ lower with 16,000 plants/acre or greater, compared with 12,000 plants/acre, which suggests that populations of 16,000/acre or greater should decrease the potential for nitrate contamination of water supplies in the fall, winter, and early spring.

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The recommended seeding rate for main-season sweet corn (*Zea mays*) planted for fresh market in New England is 14,500 to 17,500 seeds/acre (35,800 to 43,200 seeds/ha) (Ferro et al., 1998). Harvest populations at these seeding rates would range from 11,600 to 14,000 plants/acre (28,700 to 34,600 plants/ha) if a 20% reduction in the population occurs due to nonviable seed and environmental factors. This recommendation has remained unchanged for at least 15 years (Ferro et al., 1983). Three states in the northeastern United States that grow large acreages of sweet corn for fresh market, Pennsylvania, New Jersey, and New York, recommend almost the same plant population for main-season sweet corn as the New England extension systems (Cornell Cooperative Extension, 1994; Garrison, 1999; Pennsylvania State Cooperative Extension, 1998). Research data to support these recommendations, to our knowledge, have not been published in scientific journals.

There is one recently published paper about optimal plant populations for sweet corn grown for fresh market in Louisiana (Hanna and Story, 1992). This experiment reported an optimal population of 34,600 plants/acre (86,100 plants/ha) for two super sweet varieties (sh_2) planted on 60-inch (1.52-m) beds with 18 inches (46 cm) between rows and drip irrigation. This optimal population is almost three times greater than the recommended population for fresh-market sweet corn in the northeastern United States, but the data likely are not applicable because of climate differences and because the row spacing is not commonly used there.

The sweet corn varieties grown in the northeastern United States are similar to the recommended varieties for fresh market in Oregon and Minnesota. The plant populations at harvest recommended by the Extension Services in these states are 20,000 to 25,000 plants/acre (49,400 to 61,750 plants/ha) (Oregon State Univ., 1999; Univ. of Minnesota, 1999), which is about 60% greater than the recommended harvest population in the Northeast. Research data to support the Minnesota and Oregon recommendations for fresh market sweet corn, to our knowledge, have not been published in scientific journals.

There are published studies from Minnesota and Oregon for optimal plant populations for sweet corn used for processing. Mack (1972) in Oregon showed that a harvest population of 39,500 to 54,300 plants/acre (97,600 to 134,200 plants/ha) (plant populations multiplied by correction factor 6.1, Mack, 1973) produced more yield compared with a population of 14,800 to 19,800 plants/acre (36,600 to 48,800 plants/ha) for the 'Jubilee' and 'Golden Cross Bantam' varieties, in 36-inch (91-cm) wide rows and irrigated conditions. In another study in Oregon (Moss and Mack, 1979), the optimal plant population was 25,700 to 44,500 plants/acre (63,400 to 109,800 plants/ha) for irrigated conditions and the Jubilee variety. In Minnesota, a 1-year study using three plant populations, 17,000, 22,000, and 27,000 plants/acre, (42,000, 54,340, and 66,700 plants/ha) with 'Jubilee' and dryland conditions showed that 22,000 plants/acre provided the greatest number of usable ears (Rosen and Fritz, 1987). These three studies evaluated only two processing varieties, and it is unknown what effect plant population would have on varieties used for fresh market.

Sweet corn varieties for fresh market have changed considerably in the past 20 years. The varieties 'Silver Queen' and 'Sweet Sue' probably are the only two varieties planted in the past that are commonly planted today. The recommendations for plant population in the northeastern United States might be correct for these old varieties

Table 1. Selected information about the sweet corn varieties, locations, and years of the eight plant population experiments.

Location[z]	Year	Variety	Hybrid[y] type	Kernel color	Relative maturity (d)
CT	1995	Sweet Sue	*su*	Bicolor	88
NH	1996	Twilight	*se*	Bicolor	78
CT	1996	Sweet Ice	SB	White	74
CT	1996	Silver Queen	*su*	White	92
CT	1996	Lancelot	*se*	Bicolor	82
CT	1997	Silver King	*se*	White	82
CT	1997	Twilight	*se*	Bicolor	78
CT	1997	Bodacious	*se*	Yellow	72

[z]CT = University of Connecticut Plant Science Research and Teaching Facility; NH = a grower's field in Hollis, N.H.
[y]*su* = standard; *se* = sugary enhanced; SB = Sweet Breed hybrid from Harris Seeds, Rochester, N.Y.

if we assume the recommendations are based on valid but unpublished data. Information about the effect of plant population on the yield of the new generation of sweet corn varieties grown for fresh market is needed to maximize the profitability of sweet corn production. Harvesting the optimal plant population is a critical factor affecting the profitability of sweet corn because the number of marketable ears directly affects the grower's gross return.

Harvesting the optimal plant population may reduce the potential for loss of nitrate from sweet corn fields because of increased removal of nitrate. In the studies with processing varieties of sweet corn in Oregon (Mack, 1972; Moss and Mack, 1979), the total plant dry matter yield increased with increasing plant population. Because the accumulation of more dry matter likely would result in the removal of more nitrate from the field and the sequestration of much of the nitrate as organically-bound nitrogen, increasing the plant population should reduce the amount of nitrate available for leaching during the fall, winter and early spring. Research with field corn in Connecticut (Guillard et al., 1995) indicates that nitrate is most susceptible to leaching during this time period.

The objectives of this study were to determine the effect of plant population on 1) the yield of sweet corn grown for fresh market without irrigation and 2) the amount of nitrate in the surface 1 ft (30 cm) of soil at harvest.

Methods and materials

Seven different main-season sweet corn hybrids were planted. Five of the seven varieties were newer releases and two, 'Silver Queen' and 'Sweet Sue', are commonly planted older releases. We planted a wide diversity of varieties because we wanted to test the response of many varieties to changes in plant population. All the varieties, except 'Sweet Ice', were standard (*su*) or sugary enhanced (*se*) varieties. Selected information about the varieties, and the years and locations of the experiments is shown in Table 1. The experimental design was a randomized complete block, and the treatments were five plant populations ranging from 12,000 to 28,000 plants / acre (29,600, to 69,200 plants / ha) in increments of 4,000 plants / acre (9,900 plants / ha). Each treatment was replicated four times. The treatments were established in Connecticut by seeding about 40,000 seeds / acre (99,000 seeds / ha) in 30-inch (76-cm) rows, and the plants were hand-thinned to the desired populations when corn plants were 6 to 10 inches (15 to 25 cm) tall. Plots were 4 rows wide and 20 ft (6.1 m) long. In New Hampshire, the correct populations were seeded in 36-inch (91-cm) wide rows by a hand planter in plots that were 8 rows wide and 40 ft (12.2 m) long. All experiments were planted in the first half of June in each year. All mature ears that met the USDA standard for Fancy grade (USDA, 1954) were harvested from 10-ft (3.0-m) sections of the center two rows of each plot. The ears were weighed, husked, and the shank was cut flush with the ear to ensure accurate measurement of ear length. Each ear was measured for ear length, and the yields are reported as the number of ears per acre for various lengths. In 1995, the only year when there were unfilled ear tips, unfilled tips greater than 0.5 inch (13 mm) were measured. The stalks in the harvest area were cut and weighed. Eight stalks and eight ears were randomly chosen for dry matter determination, and the yields are reported as total plant dry matter in tons / acre. Lodging was not observed in the experiments. Corn in all the experiments was not irrigated, except in the New Hampshire experiment in August.

The soil in Connecticut was a Woodbridge fine sandy loam (coarse-loamy, mixed, mesic, Aquic Dystrochrept). This soil is widely used for agricultural production in New England. The rooting depth and sampling depth in the Woodbridge soil are restricted to about 2 ft (61 cm) because of the presence of compact basal till that begins at a depth of 20 to 24 inches (51 to 60 cm). The soil in New Hampshire was a Canton fine sandy loam (coarse-loamy over sandy or sandy-skeletal, mixed, mesic, Typic Dystrochrept). Phosphorus and potassium were broadcast before planting according to soil test results. The soil pH in the experiments varied from 6.1 to 6.8. No manure had been applied to the fields for at least 10 years. The crops grown in the year before establishment of the experiments were Sudax (variety 'Ciba FP-5'), a sorghum-sudangrass hybrid [*Sorghum bicolor* (L.) x *Sorghum sudanense* (Piper) Stapf] or sweet corn. Nitrogen as urea was broadcast and immediately incorporated before planting at 175 lb / acre (196 $kg \cdot ha^{-1}$) for all the experiments in Connecticut. The New Hampshire experiment received 128 lb / acre (143 $kg \cdot ha^{-1}$) of N as ammonium nitrate before planting. Weeds were controlled in Connecticut using

Table 2. Rainfall data for each year from May through August.

Year	Deviation[y]	Rainfall (inches)[z] May	June	July	August	Total
1995	–4.0	3.3	1.8	4.0	2.2	11.4
1996	0.1	3.1	2.8	7.3	2.2	15.5
1996NH[x]	–2.0	4.8	3.0	5.2	0.1	13.1
1997	–3.5	3.0	1.6	2.5	4.8	11.9

[z]1.0 inch = 25.4 mm.
[y]Total deviation from 100-year mean rainfall for Storrs, Conn., and 30-year mean rainfall for New Hampshire.
[x]Data for experiment in Hollis, N.H., in 1996.

preemergence broadcast applications (a.i.) of atrazine [2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine] at 1.0 lb / acre (1.12 $kg \cdot ha^{-1}$) and metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide] at 2 lb / acre (2.24 $kg \cdot ha^{-1}$); in New Hampshire preemergence broadcast applications of atrazine at 1.0 lb / acre (1.12 $kg \cdot ha^{-1}$) and alachlor [2-chloro-2', 6'-diethyl-N-(methoxmethyl)-acetanilide] at 1.5 lb / acre (1.68 $kg \cdot ha^{-1}$) were used.

Soil samples were collected from the experiments in Connecticut in 1996 and 1997 from the harvest area in each plot immediately after harvest. Each sample was composed of six cores 7 / 8 inch (2.2 cm) in diameter collected from the surface 1 ft (30 cm) of soil. The samples were spread to air-dry in a thin layer within 1 h of collection. The dried samples were sieved to pass a 0.08-inch (2-mm) screen, extracted with 0.01 M $CaCl_2$, and the nitrate-N concentrations were determined by using a Scientific Instruments (WESTCO, Danbury, Conn.) segmented-flow analyzer.

Statistical analysis involved the use of orthogonal contrasts to test for the linear and quadratic effects of plant population on ear numbers, dry matter yield, and soil nitrate-N concentrations in the fall. The plant populations where there were no further significant increases in ear numbers and dry matter yield or significant decreases in soil nitrate-N concentrations were delineated by using orthogonal single-degree-of-freedom contrasts. The contrasts were the yields or the soil nitrate-N concentrations from the plant populations at 12,000 plants / acre ($P_{12,000}$) vs the average of the yields at the higher plant populations ($P_{16,000}$, $P_{20,000}$, $P_{24,000}$, $P_{28,000}$); and $P_{16,000}$ vs ($P_{20,000,}$ $P_{24,000,}$ $P_{28,000}$), etc. All statistical analyses were performed in the GLM procedure of SAS (SAS Institute, 1993), and an alpha level of 0.05 was used to declare significance for all analyses.

Results and discussion

Rainfall during the growing season was below-average for all years except for 1996 in Connecticut, when rainfall was average (Table 2). Visual inspection of the corn plants in the 1995 and 1997 experiments indicated drought stress during the vegetative stage of growth, but no visible drought stress during the reproductive stage of growth.

Drought stress and higher than recommended plant populations are thought to greatly increase the chances of producing many small, unmarketable ears and many ears with unfilled tips. In 1995, when the variety ‘Sweet Sue’ was planted, higher than recommended plant populations and drought stress during vegetative growth did not cause a significant decrease (linear or quadratic) in the number of ears with filled tips (Table 3). There was a significant linear increase in the number of ears with unfilled tips and in the average length of the unfilled tips as the plant population increased (Table 3). These results suggest that high plant populations and early-season drought stress will not always result in substantial reductions in the yield of the ears. Further evidence that higher than recommended plant populations and drought stress do not always reduce yield is shown by the yields of varieties ‘Silver King’, ‘Twilight’ and ‘Bodacious’ in 1997 (Fig. 1), when there was drought stress. Drought stress increased the coefficients of variation for the yield of these varieties compared with the coefficients for the yields of the varieties planted in 1996 (Table 4), which was a year with average rainfall. It is unknown whether a more severe drought, especially dur-

Table 3. Number of ears and the length of ears for ‘Sweet Sue’ variety in 1995 at various plant populations in Storrs, Connecticut.

Plants/acre	Plants/ha	Filled ears[y]	Unfilled ears[z] (ears/acre)	Total ears	Avg length of unfilled ear tip (inches)[x]
12,000	29,600	7,840	3,700	11,540	0.55
16,000	39,500	8,280	7,400	15,680	0.87
20,000	49,400	7,620	8,900	16,540	0.87
24,000	59,300	7,400	13,500	20,910	0.98
28,000	69,200	5,660	12,200	17,860	1.14
Significance		NS	L	L,Q	L

[z]Ears with unfilled tips greater than 0.5-inches (13 mm) long.
[y]Ears filled to within 0.5 inches of the end of the ear, 1 ear / acre = 2.47 ears / ha.
[x]1.0 inch = 25.4 mm.
[NS,*]Nonsignificant or significant response to plant population at $P \leq 0.05$; L = linear and Q = quadratic.

Table 4. Probability (*P*) of a greater F value for the interaction term variety by plant population for the combined ANOVA for the variable ear length and the coefficient of variation values (CV) for the ANOVAs.

Ear length[z] [inches (mm)]	1996 *P* > F	1996 CV (%)	1997 *P* > F	1997 CV (%)	1995, 1996 and 1997 *P* > F	1995, 1996 and 1997 CV (%)
6.0 (15.2)	0.33	9.8	0.06	11.7	0.001	10.7
6.5 (16.5)	0.54	8.4	0.09	12.4	0.01	11.3
7.0 (17.8)	0.03	10.9	0.40	17.9	0.03	15.1
7.5 (19.1)	0.26	22.2	0.60	41.2	0.40	32.8

[z]6.0-inch data for all varieties; 6.5- and 7.5-inch data for all varieties except 'Sweet Sue', 'Twilight' in 1997, and 'Sweet Ice'; 7.0-inch data for all varieties except 'Sweet Sue' and 'Twilight' in 1997.

ing the reproductive stage of growth, would cause large reductions in ear numbers and size at higher than recommended plant populations.

The varieties planted in these experiments had different yield responses to increases in plant population (Fig. 1). When the varieties are combined across all three years for an analysis of variance there was a significant interaction between variety and plant population for all ear lengths, except for the 7.5-inch (190-mm) length (Table 4). In 1996, the interaction of variety with population for the ear yield was significant for the 7.0-inch (178-mm) ear length. In 1997, the interactions for the four ear lengths were not significant, but two of the ear lengths, the 6.0-inch (152-mm) and the 6.5-inch (165-mm) lengths, had *P* values close to the 0.05 significance level (Table 4). These differences in the yield responses likely were due to the different genetic backgrounds of the varieties, as shown by their different colors and maturities. The nonuniform yield response across the varieties suggests that growers will need to plant different populations for different varieties if they want to maximize the yield of sweet corn. Because of the nonuniform yield response to population, the results for ear yield for each variety were examined separately.

The yield of ears greater than 6 inches long for 'Twilight' in 1996 significantly increased with increasing plant population up to 28,000 plants/acre (Fig. 1; Table 5). These results and the results for 'Sweet Sue' in 1995 (Table 3) suggest that the recommended plant population at harvest in the Northeast of about 12,000 plants/acre for main-season sweet corn is too

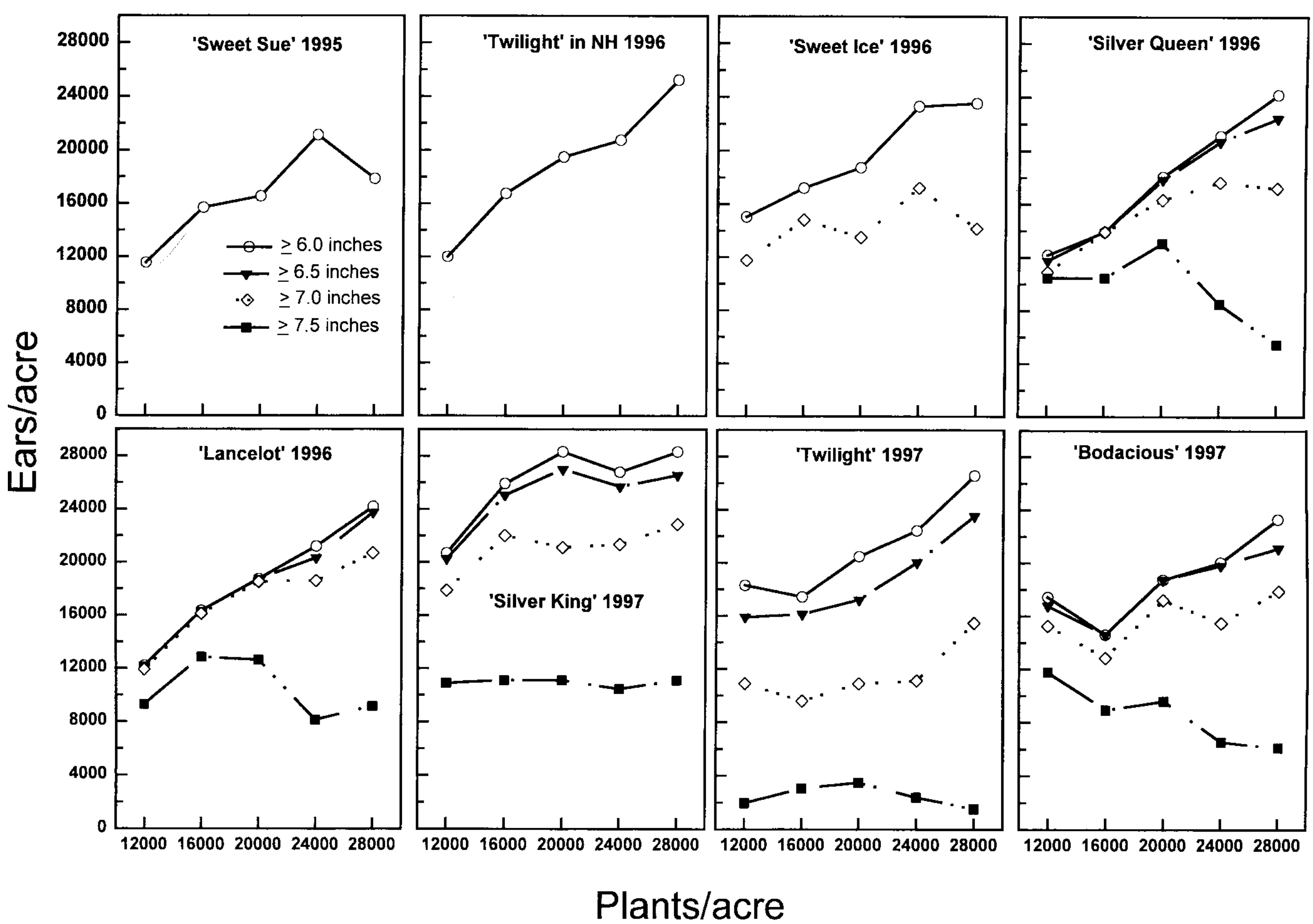

Fig. 1. Relationship between ear yield of seven sweet corn varieties and five plant populations at four ear lengths (1 ear or plant/acre = 2.47 ears or plants/ha; 1.0 inch = 25.4 mm).

Table 5. The plant population for each variety and ear length at which there was no further significant yield increase in ear number based on orthogonal single-degree-of-freedom contrasts.[z] Letters indicate a linear response (L) or a quadratic response (Q) to plant population.

	Plant population at which the ear yield stopped increasing for each variety (plants/acre)[y]							
Ear length [inches (mm)]	Sweet Sue	Twilight in NH	Sweet Ice	Silver Queen	Lancelot	Silver King	Twilight in CT	Bodacious
6.0 (15.2)	24,000[L]	28,000[L]	24,000[L]	28,000[L]	24,000[L]	16,000[L,Q]	28,000[L]	20,000[L]
6.5 (16.5)	ND[x]	ND	ND	28,000[L]	24,000[L]	16,000[L,Q]	24,000[L]	20,000[L]
7.0 (17.8)	ND	ND	16,000[L,Q]	20,000[L,Q]	20,000[L]	16,000[L]	NS	NS
7.5 (19.1)	ND	ND	ND	16,000[L,Q]	16,000[NS]	NS	NS	12,000[L]

[z]Plant population at which a significant increase in ear yield stopped based on orthogonal single-degree-of-freedom contrasts ($P \leq 0.05$) where the contrasts are the yields from the populations at 12,000 plants / acre ($P_{12,000}$) vs the average of the yields at the higher plant populations ($P_{16,000}$, $P_{20,000}$, $P_{24,000}$, $P_{28,000}$); and $P_{16,000}$ vs ($P_{20,000}$, $P_{24,000}$, $P_{28,000}$), etc., except for 'Silver Queen' and 'Lancelot' at 7.5 inches where the contrasts were calculated using only the first three plant populations.
[y]1 plant / acre = 2.47 plants / ha.
[x]ND = not determined.
[NS]Nonsignificant for linear (L) and quadratic (Q) terms at $P \leq 0.05$.

Table 6. Total plant dry matter yields of sweet corn varieties at different plant populations in Storrs, Conn., in 1996 and 1997.

	Variety (tons dry matter/acre)[z]						
Plants/acre[y]	Sweet Ice	Silver Queen	Lancelot	Silver King	Twilight	Bodacious	Mean
12,000	1.75	3.64	2.80	4.33	3.12	2.48	3.02
16,000	2.18	4.17	3.35	4.46	3.07	2.72	3.33
20,000	2.29	4.30	3.60	5.03[x]	3.67[x]	3.51[x]	3.74
24,000	2.62[x]	4.69[x]	3.89	5.34	3.74	3.41	3.95
28,000	2.79	4.90	4.41[x]	5.44	4.14	3.85	4.26[x]
CV (%)	7.0	6.4	7.2	6.6	10.1	7.8	8.7
	L[w]	L	L	L	L	L	L

[z]1 ton / acre = 2.24 $Mg \cdot ha^{-1}$.
[y]1 plant / acre = 2.47 plants / ha.
[x]Plant population at which a significant increase in ear yield stopped based on orthogonal single-degree-of-freedom contrasts ($P \leq 0.05$) where the contrasts are the yields from the populations at 12,000 plants / acre ($P_{12,000}$) vs the average of the yields at the higher plant populations ($P_{16,000}$, $P_{20,000}$, $P_{24,000}$, $P_{28,000}$); and $P_{16,000}$ vs ($P_{20,000}$, $P_{24,000}$, $P_{28,000}$) etc.
[w]L = linear increase in dry matter was significant at $P \leq 0.05$; quadratic term was not significant at all locations.

low. Because most buyers and consumers of fresh market sweet corn prefer ears that are at least 7.0 inches long, we grouped the ear yields of subsequent varieties into more ear-length categories to better estimate the effect of plant population on the marketability of sweet corn.

The variety 'Sweet Ice' had a significant increase in ear yield up to 24,000 plants / acre for ears equal to or greater than 6.0 inches long (Fig 1; Table 5). When ears equal to or greater than 7.0 inches long were measured, 16,000 plants / acre was the population where significant increases in ear yield stopped. This variety would produce 3,050 (7,530 ears / ha) more 7.0-inch ears from a plant population of 16,000 plants / acre compared with a population of 12,000 plants / acre.

The variety 'Silver Queen' is an old variety that often is planted in the northeastern United States because of its ability to produce large ears. Growers usually prefer a harvest plant population of about 12,000 plants / acre for this variety because it has a reputation for producing low yields of marketable ears at plant populations greater than 12,000 plants / acre. Our results suggest that 'Silver Queen' can produce a large number of 7.0-inch ears at a population of 20,000 plants / acre (Fig. 1; Table 5). If an ear length of 6.5 inches is marketable, 28,000 plants / acre, or more than double the recommended plant population in the northeastern United States, would produce the most ears. Many growers will hesitate to use a population this high because 'Silver Queen' produces a tall plant that is susceptible to lodging, but in this experiment 'Silver Queen' did not lodge. Our results for this variety

Table 7. Average soil nitrate-N concentrations in the surface 1 ft (30.5 cm) of soil at harvest for different plant populations when N was applied at 175 lb/acre (196 $kg \cdot ha^{-1}$) before planting in Connecticut in 1996 and 1997.

Plants/acre	Plants/ha	Soil nitrate N ($mg \cdot kg^{-1}$)
12,000	29,600	39.1
16,000	39,500	29.4[z]
20,000	49,400	33.3
24,000	59,300	30.0
28,000	69,200	31.4

[z]Plant population at which a significant decrease in soil nitrate-N concentrations stopped based on orthogonal single-degree-of-freedom contrasts ($P \leq 0.05$) where the contrasts are the average soil nitrate-N concentrations from the populations at 12,000 plants / acre ($P_{12,000}$) vs the average of the concentrations at the higher plant populations ($P_{16,000}$, $P_{20,000}$, $P_{24,000}$, $P_{28,000}$); and $P_{16,000}$ vs ($P_{20,000}$, $P_{24,000}$, $P_{28,000}$), etc.; 1 plant / acre = 2.47 plants / ha.

suggest that growers should experiment with higher populations than they traditionally use.

Another variety that is grown for its ability to produce large ears is 'Lancelot'. The results for this large-eared variety are similar to the results for 'Silver Queen'. The plant population at which there was no further significant yield increase was much higher than the recommended plant population of about 12,000 plants / acre for all ear lengths (Fig. 1; Table 5). A harvest population of 20,000 plants / acre for 'Lancelot' would produce 6,600 (16,300 ears / ha) more 7.0-inch ears compared with a population of 12,000 plants / acre.

A harvest population greater than 16,000 plants / acre did not significantly change the yield of the 'Silver King' variety for all ear-length categories except for the 7.5-inch ear length (Fig. 1; Table 5). The varieties 'Twilight' and 'Bodacious' in 1997 showed no significant increases in yield for the longer ear-length categories (Table 5). The 'Bodacious' variety had a significant decrease in yield at the 7.5-inch ear length. These results suggest that the benefits of higher than recommended plant populations would not be as great in years of low rainfall, but large reductions in yields also are not likely. Higher populations would produce more unmarketable ears in years of low rainfall, which would increase the cost of production due to greater labor costs for culling and sorting.

The total plant dry matter yield of each variety significantly increased with increasing plant population (Table 6). When the data are combined for the six varieties, the interaction of variety by plant population for the dry matter yield was not significant (P = 0.75). This lack of interaction for variety by population for the dry matter yield, and the significant interactions for variety by plant populations for ear yield (Table 5) indicates that the ear yield is more sensitive than the total dry matter yield to external factors, such as rainfall, that control yield.

The nitrate-N concentration in the surface 1 ft of soil in the fall has been shown to be a good predictor of the potential for leaching of nitrate from cornfields in Pennsylvania during the winter (Roth and Fox, 1990) The average nitrate-N concentrations in the surface 1 ft of soil at harvest in Connecticut in 1996 and 1997 did not dramatically decrease with increasing plant population (Table 7). The lowest population had a significantly greater nitrate-N concentration compared with the average of the higher populations, but the nitrate-N concentrations for plant populations of 16,000 / acre or greater were not significantly different from one another. The soil nitrate-N concentrations were quite variable (CV = 40.3%), which is not unusual for this nutrient (Meisinger, 1984). These results suggest that populations of 16,000 plants / acre or greater would reduce the potential for nitrate pollution of water bodies because lower concentrations of nitrate in the soil at harvest have been shown to result in less nitrate leaching from field corn during the fall and winter (Guillard et al., 1995).

Conclusions

Optimum plant populations for the varieties used in our experiments were almost always greater than the recommended plant populations in the northeastern United States. The optimum plant population changed with the variety and with the length of the ear. A range of plant populations at harvest of 20,000 to 24,000 plants / acre seems a reasonable recommendation based on the response of the varieties used in these experiments. This recommendation assumes adequate rainfall or irrigation at the time of ear development. We prefer to recommend a plant population at harvest instead of a rate of seeding because we believe growers have the best information about the expected survival rate for seeds planted in their fields. Because other varieties may respond differently to plant populations, growers should experiment with a few different plant populations before planting a large portion of their acreage to higher populations. Plant populations of 16,000 plants / acre or greater should decrease the potential for nitrate contamination of water supplies in the fall, winter, and early spring when sweet corn is fertilized with N at 175 lb / acre.

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