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Sweet Corn Growth and Yield Responses to Planting Dates of the North Central United States

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***Abstract*. Sweet corn is planted over a 3-month period in the north central United States to extend availability for fresh market and processing; however, the extent to which development and growth of sweet corn changes during this period is unreported. Field experiments were conducted in 2006 and 2007 to determine the effect of five planting dates, ranging from mid-April to early July, on sweet corn establishment, growth, and yield components. Day length at the time of silking decreased from 15.1 h in the mid-April planting to 13.7 h in the early July planting. Development took 13 to 25 fewer days from emergence to silking for the hybrid 'BC0805', an 82-day augmented sugar enhancer endosperm type, as planting was delayed from mid-April to early July. Maximum height generally increased through planting dates with as much as 23% taller plants in early July versus mid-April planted sweet corn. While leaf mass was unaffected by planting date, maximum leaf number and rate of leaf appearance steadily decreased with later planting dates. Lower reproductive and total biomass at silking as well as marketable ear yield components were lowest in the early July planting date and were associated with presence of maize dwarf mosaic virus in leaf samples. In response to environmental conditions, the crop canopy undergoes distinct morphological changes as planting is delayed, and those changes may have implications for crop production.**

Although sweet corn must be harvested during optimal maturity to obtain best eating quality, a finite capacity of vegetable processing facilities and steady demand for fresh produce necessitate an elongated harvest period. Producers extend harvest by staggering planting dates and planting hybrids with different maturity dates. In the north central United States, sweet corn is planted from 1 or 2 weeks before the frost-free date until the first week of July (Anonymous, 2003). A range of planting dates results in crop exposure to different stress factors with later plantings generally being subjected to more diseases and insects. In addition, cold soils at early plantings and cooler late-season growing conditions at later plantings broaden abiotic stresses to the crop.

Knowledge of sweet corn response to environmental conditions has led to improvements in crop production. Work by Arnold and others (Arnold, 1960, 1974; Hortik and Arnold, 1965) identified relationships between air temperature and sweet corn development. Lass et al. (1993) reported several regression models that improved prediction of harvest date from environmental conditions after planting. More recently, several authors have demonstrated that negative impacts of adverse environmental conditions can be dampened by transplanting (Welbaum et al., 2001), adjusting plant population density (Rangarajan et al., 2002) or seeding depth (Barr et al., 2000), and mulching (Kwabiah, 2004). Management of pests is affected by the environmental conditions associated with different planting dates (Malvar et al., 2002; Williams, 2006). Advances in crop management coupled with improved stress tolerance and efficiency in plant growth accounts for the nearly sixfold increase in hybrid maize yield over the last 75 years (Duvick, 2005).

Although sweet corn is planted across a range of dates, most research on planting date effects on maize growth and yield response have been conducted in dent corn. In comparison of dent corn hybrids differing in relative maturity, phenological development of late-maturing hybrids was affected most by delayed planting (Nielsen et al., 2002) and photoperiod (Hunter et al., 1974). Maximum yield was achieved by planting dent corn ≈10 May near Lincoln, NE, whereas planting earlier or later reduced leaf area index, leaf area duration, total biomass, and grain yield (Swanson and Willhelm, 1996). Dent corn germplasm and agronomic practices differ starkly from sweet corn production. This includes a much narrower planting window, a longer time to maturity, and later physiological growth stage at the time of harvest for dent corn compared with sweet corn.

The few published reports on sweet corn suggest crop growth may not be uniform across planting dates. Planting dates separated by 3 weeks in Wisconsin had no effect on plant height, but did influence days to silking and yield components of crosses of several open-pollinated sweet corn cultivars (Revilla and Tracy, 1997). From research in Newfoundland, where conditions permit only short-season (62- to 67-d) hybrids to be grown, days from planting to emergence decreased some 50% through May because of cold soils early in the month (Kwabiah, 2004). In addition, sweet corn yield increased as planting was delayed through May, presumably as stand establishment improved. An 82-d hybrid in Illinois grew on average 22 cm taller with 18% more total shoot biomass and 43% less leaf area index (LAI) when planted in late June compared with early May (Williams and Lindquist, 2007). Few, if any, studies have characterized sweet corn growth and yield in response to the changing environmental conditions resulting from a complete range of planting dates used by growers. If indeed sweet corn growth responses vary systematically with planting date, thorough knowledge of the phenomenon may yield new opportunities for advancing crop management.

The goal of this work was to identify the significance of the planting date effects on sweet corn. A popular sweet corn hybrid grown over a complete range of planting dates of the north central United States was used to quantify the effect of planting date on sweet corn establishment, growth, and yield components.

Materials and Methods

Experimental approach. Field experiments were conducted in 2006 and 2007 at the University of Illinois Vegetable Crop Research Farm near Urbana, IL. Experiments were located in different fields in each year. Soil was Flanagan silt loam (fine, smectitic, mesic Aquic Argiudolls) averaging 3.2% organic matter and pH of 5.2. The previous crop was soybean. Fields received nitrogen at 129 $kg \cdot ha^{-1}$, phosphorus at 113 $kg \cdot ha^{-1}$, and potassium at 135 $kg \cdot ha^{-1}$ on 12 Apr. 2006 and 10 Apr. 2007. The entire experimental area was chisel-plowed in the fall and field-cultivated after fertilization in the spring followed by a second field cultivation immediately before planting.

The experimental design was a randomized complete block with four replications. Five planting date treatments were tested: mid-April, early May, late May, mid-June, and early July (Table 1). After the mid-April planting date, succeeding treatments were planted when the previously planted sweet corn had two visible leaf collars. 'BC0805' is an 82-d augmented sugar enhancer (se)

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Table 1. Planting information, water supply, and time to several developmental stages for five sweet corn planting dates in 2006 and 2007 near Urbana, IL.

Year	Planting date	Date of planting	Soil temp at planting[z] (°C)	Time from planting to emergence (d)	Water supply[y] (mm)	Daylength at silking (hours)	Time from emergence to silking		Time from silking to harvest	
							GDD[x]	Days	GDD[y]	Days
2006	Mid-April	12 Apr	18.3	7	348	15.1	628	71	271	19
	Early May	8 May	15.6	13	377	14.9	673	60	298	13
	Late May	30 May	24.4	5	321	14.6	701	53	239	15
	Mid-June	14 June	21.1	4	324	14.4	671	46	277	21
	Early July	3 July	25.6	5	316	13.6	667	46	250	23
2007	Mid-April	20 Apr	10.1	8	275	15.1	649	57	239	18
	Early May	3 May	15.6	7	315	15.0	655	55	266	21
	Late May	23 May	27.8	6	303	14.8	648	49	287	21
	Mid-June	13 June	35.0	6	270	14.3	627	48	309	19
	Early July	3 July	32.2	6	192	13.7	624	44	288	20

[z]Soil temperature over 0- to 10-cm depth.

[y]Water supply includes rainfall and irrigation from planting to harvest.

[x]Growing degree days in degrees °C for soil temperature at planting, time from emergence to silking, and time from silking to harvest.

endosperm type and has been among the most popular selling fresh market hybrids in recent years (Derrill Kriegel, personal communication). 'BC0805' was planted in 76-cm rows with a four-row planter at a seeding rate of 83,300 seeds/ha. Plots were 12.2 m long × 3.0 m wide.

A pre-emergent application of *S*-metolachlor at 1.78 kg·ha^{-1} a.i. and atrazine at 2.2 kg·ha^{-1} a.i. was applied to plots the day of planting. Weeds emerging in unplanted plots were controlled postemergence as needed with 0.47 kg·ha^{-1} glufosinate plus 5% (v/v) ammonium sulfate. Weed escapes in planted plots were removed by hand. Tefluthrin was applied as an in-furrow treatment at planting at a rate of 14 g/100 m^{-1} of row to control Western corn rootworm (*Diabrotica virgifera* LeConte) larvae. Bifenthrin at 53 g·ha^{-1} a.i. was applied as needed during silking to control Japanese beetles (*Popillia japonica* Newman) and Western corn rootworm beetles. The experimental sites were sprinkler-irrigated three times in 2006 (75 mm total) and four times in 2007 (95 mm total) to offset abnormally low rainfall.

Data collection. Data were collected from the center two rows of plots. Soil temperature at the 0- to 10-cm depth was measured at the time of each planting. The number of days until 50% crop emergence, 50% silking, and harvest were recorded. Crop stand was evaluated 3 to 4 weeks after planting. Height of three plants per plot and number of visible leaf collars (i.e., leaf number) were measured weekly from emergence to silking. Within 3 d after silking, two plants per plot were cut at the soil surface and separated into leaf, stalk, and reproductive tissues. Leaf area per plant was measured using an area meter (LI-3100C Area Meter; LI-COR, Lincoln, NE). Leaf area index at each sampling date was estimated as the product of mean leaf area per plant and number of plants per square meter. An indexed metric of chlorophyll content of five plants per plot was measured within 3 d of silking using a chlorophyll meter (Minolta SPAD 502 Meter; Spectrum Technologies, Plainfield, IL).

Marketable ears were hand-picked near commercial maturity from 6.1 m of the center two rows. Ears were considered marketable if 90% of kernels were full and had a gravimetric moisture content of 75% ± 3%. Ears (including silks and husks) meeting these criteria exceeded 4.4 cm in diameter for the first four planting dates and 3.8 cm in diameter for the final planting date. Total number and mass (hereafter called green mass) of marketable ears were recorded. Number of ears per unit area was converted to boxes of ears assuming 50 ears per box. Fresh ears were immediately husked with a husking bed (Sweet Corn Husker; A&K Development Co., Eugene, OR) and kernels were removed from the cob with an industry-grade corn cutter (Power Corn Cutter; A&K Development Co.). Husked mass and kernel mass were recorded. A 20-g sample of fresh kernels from each plot was immediately ground with a mortar and pestle and gently squeezed through 0.5-mm nylon mesh. A digital refractometer (AR200 Digital Refractometer; Leica Microsystems, Buffalo, NY) was used to determine soluble solids concentration (SSC) of the extract.

Growing degree days (GDD) were determined using minimum and maximum air temperatures from a weather station within 1 km of experimental plots (Illinois State Water Survey, Champaign, IL). A base temperature of 10 °C was used as the minimum temperature for corn growth, and 30 °C was used as the air temperature associated with optimal growth. The time of crop emergence was used as the reference point for accumulation of GDD. Daylength was referenced at Urbana for dates of the experiments (Express Technologies Corporation, De Pere, WI).

Statistical analyses. Before analysis, all data were examined for homogeneity of variances using the modified Levene's test (Neter et al., 1996). Variances were found to be nonhomogeneous between years; therefore, analyses were performed within each year. Diagnostic tests of residuals indicated data complied with analysis of variance (ANOVA) assumptions of homoschedasticity and normality; therefore, data were not transformed.

Sweet corn growth in height and leaf number as a function of thermal time was determined for each plot. To quantify growth over time as influenced by planting date, leaf number and height data were regressed on GDD accumulated from emergence using linear and three-parameter logistic models, respectively. Summarizing leaf number and height data over time with mathematical functions reduces the impact of small deviations from the overall trend in growth (Hunt, 1978). The logistic model used was:

$$y = \frac{a}{1 + \left(\frac{GDD}{i}\right)^{b}} \quad [1]$$

where a represents maximum height, i represents thermal time to maximum absolute height growth rate (i.e., the inflection point), and b is the slope at i. Some caution is needed when interpreting b because its value also is highly correlated with a (i.e., taller plants will reach maximum absolute height growth later).

To evaluate the effect of planting date on height growth and leaf number, linear and logistic models were fitted to height and leaf number data, respectively, for each subplot using SYSTAT (SYSTAT Software, Inc., 2004). Parameter estimates obtained for each subplot were then subjected to ANOVA to determine treatment effects and compute least squares means (SYSTAT Software, Inc., 2004). Means were compared using protected, Bonferroni-corrected multiple comparisons at α = 0.05 (Neter et al., 1996). Because planting date effects were significant for most parameters, linear and logistic models were again fit to leaf number and height data, respectively, across all replicates within a treatment to obtain an approximate r^2 (calculated as 1 – residual sums of squares/corrected total sums of squares) for the treatment.

To evaluate the effect of planting date on sweet corn establishment, growth, and yield, the additional variables measured after crop emergence, near silk emergence, and at harvest were subjected to ANOVA and means separation as described previously.

Results and Discussion

Environmental conditions. The first planting dates were 12 Apr. 2006 and 20 Apr. 2007, and the last planting dates were 3 July of both years (Table 1). Soil temperature at planting ranged from 10.1 to 35 °C. More time was required for the crop to emerge from colder soils as evidenced by 7 d or more from planting to emergence when soil temperature at planting was below 20 °C (Table 1). Crop stand was similar across planting dates, averaging 8.8 and 7.9 plants/m² in 2006 and 2007, respectively (data not shown). The influence of temperature on sweet corn emergence reported in this investigation pertains to se endosperm type. Hassell et al. (2003) reported a cultivar × temperature interaction for sweet corn germination that varied among sugary (su), se, and shrunken-2 (sh_2) endosperm types. Generally, low-temperature germination was most rapid among su endosperm types and slowest among sh_2 endosperm types.

The 2007 season was drier than 2006 as evidenced by water supply at or below 315 mm for all planting dates in 2007 compared with water supply above 315 mm in 2006 (Table 1). The early July planting date in 2007 had the least amount of water at 192 mm. In contrast, photoperiod was very similar between years for each planting date. Daylength at the time of silking was within 12 min between years for each treatment with daylength decreasing on average from 15.1 h for the mid-April planting to 13.7 h for the early July planting (Table 1).

Phenological development. Days from crop emergence to silking varied with planting date. As planting was delayed from mid-April to early July, 23% to 35% fewer days until silking were observed (Table 1). Thermal time to silking appeared to change little through time. In growth chamber studies with three dent corn hybrids of differing maturity, Hunter et al. (1974) reported fewer days to tassel initiation as daylength decreased from 20 to 10 h. Our results were consistent with the observations of Nielsen et al. (2002) who showed that thermal time to silking changed little for three commonly grown dent corn hybrids of the north central United States as planting was delayed from early May to mid-June.

Sweet corn growth. Sweet corn often grew taller in later planting dates. Maximum height (a) increased from the mid-April planting to the early July planting (Table 2). In addition, thermal time to maximum absolute height growth rate (i) increased through the growing season with the exception of the last two planting dates of 2007. Hunter et al. (1974) reported shorter dent corn plants as photoperiod decreased; however, temperature was held constant and the same authors show interactions between photoperiod and temperature on crop development and growth. Williams and Lindquist (2007) showed that an 83-d su sweet corn hybrid grew 9% taller when planted the third week of June in Illinois compared with the first week of May. Data in the present study indicated that a popular sweet corn hybrid, 'BC0805', can grow 13% to 23% taller when planted near the end of the season compared with the earliest planting dates of the north central United States.

Delayed planting also resulted in plants with fewer leaves and slower rates of leaf appearance. Plants grown in the mid-June and early July planting dates averaged 11% to 25% fewer maximum leaves compared with earlier planting dates (Table 2). In addition, leaf appearance rate (m) generally decreased by as much as 22% with later planting dates.

Planting dates had no effect on leaf biomass; however, reproductive biomass and total biomass near silking were lower in the early July planting date compared with the May planting dates. Reproductive biomass near silking in the early July planting date average 41% less reproductive biomass than May planting dates (Table 3). The early July planting date also generally had the lowest stalk and total shoot biomass. By the time plants in this treatment had four visible leaf collars, plants were stunted and leaves had a mosaic of chlorotic flecks and streaks, symptoms not observed in the first four treatments. Leaf samples from the early July planting date submitted to Agdia Testing Services (Adgia Corporation, Elkhart, IN) tested positive for maize dwarf mosaic virus (MDMV). Maize dwarf mosaic virus is vectored by more than 20 species of aphids, some of which are common late in the season in central Illinois, and the hybrid 'BC0805' is highly susceptible to MDMV (Pataky et al., 2005). Leaf area per plant, LAI, and chlorophyll content were also lowest in the early July planting date, but only in a single year (Table 3).

Table 2. Maximum sweet corn height (a from Eq. 1 fitted to height on GDD), thermal time to maximum absolute height growth rate (i from Eq. 1 fitted to height on GDD), maximum leaf number, and leaf appearance rate (m from linear model fitted to leaf number on GDD) as influenced by five planting dates in 2006 and 2007[z].

		Height growth				Leaf appearance		
Year	Planting date	a (cm)	i (GDD)	b	$\approx r^2$	Maximum leaf no. (no./plant)	m	$\approx r^2$
2006	Mid-April	187 b	402 c	–3.85 a	0.96	11.9 ab	0.023 a	0.98
	Early May	194 b	417 bc	–4.05 a	0.97	12.1 ab	0.021 b	0.99
	Late May	204 ab	402 c	–4.38 a	0.99	12.9 a	0.021 b	0.99
	Mid-June	205 ab	432 b	–4.06 a	0.97	11.1 b	0.018 c	0.98
	Early July	215 a	486 a	–4.24 a	0.97	10.9 b	0.018 c	0.99
	Mean	201	428	–4.12		11.8	0.020	
2007	Mid-April	143 c	373 c	–3.27 a	0.97	14.5 a	0.021 b	0.99
	Early May	197 ab	439 a	–3.38 a	0.96	15.8 a	0.024 a	0.99
	Late May	186 ab	432 a	–4.77 b	0.97	12.3 b	0.018 c	0.99
	Mid-June	211 a	399 b	–5.33 b	0.97	10.8 c	0.021 b	0.99
	Early July	185 b	348 c	–3.24 a	0.97	10.5 c	0.021 b	0.99
	Mean	184	398	–4.00		12.8	0.021	

[z]Approximate r-square ($\approx r^2$) is from fit of regression models across all replicates of each treatment. Means followed by the same letter within a year and column are not significantly different at $P \leq 0.05$ based on protected, Bonferroni-corrected multiple comparisons.
GDD = growing degree days.

Table 3. Sweet corn biomass components, leaf area, leaf area index (LAI), and chlorophyll index at silking, and yield components as influenced by five planting dates in 2006 and 2007[z].

Year	Planting date	Leaf biomass (g/plant)	Stalk biomass (g/plant)	Reproductive biomass (g/plant)	Total shoot biomass (g/plant)	Leaf area per plant (cm²/plant)	LAI ($m^{-2}\cdot m^{-2}$)	Chlorophyll index	Box yield (boxes/ha)	Green mass yield ($Mg\cdot ha^{-1}$)	Husked mass yield ($Mg\cdot ha^{-1}$)	Kernel mass yield ($Mg\cdot ha^{-1}$)
2006	Mid-April	18.2 a	31.7 b	55.1 ab	105.0 b	2,560 ab	2.25 b	51.2 a	1,340 a	19.6 a	10.8 a	4.74 ab
	Early May	19.4 a	40.2 ab	80.7 a	140.3 a	2,702 ab	2.25 b	54.0 a	1,034 a	15.1 a	9.7 a	5.05 a
	Late May	21.7 a	49.9 a	78.5 a	150.1 a	3,193 a	2.85 a	54.4 a	1,012 a	14.5 a	8.7 a	4.42 ab
	Mid-June	21.3 a	40.3 ab	75.9 a	137.5 ab	2,509 b	2.20 b	53.4 a	1,028 a	14.4 a	9.3 a	4.89 ab
	Early July	18.6 a	33.1 b	46.4 b	98.1 b	1,707 c	1.48 c	49.4 a	528 b	6.2 b	3.8 b	1.81 b
	Mean	19.8	39.0	67.3	126.2	2,534	2.21	52.5	988	14.0	8.5	4.18
2007	Mid-April	24.7 a	97.8 a	43.1 b	165.5 a	3,668 a	2.78 a	58.0 a	1,315 ab	19.9 ab	12.1 bc	—[y]
	Early May	22.4 a	44.1 b	73.5 a	140.0 ab	3,450 a	3.28 a	57.1 a	1,742 a	26.9 a	17.3 a	9.22 a
	Late May	23.9 a	46.6 b	67.9 ab	138.3 ab	3,908 a	3.25 a	57.1 a	1,299 ab	21.3 a	14.0 ab	7.88 ab
	Mid-June	23.4 a	45.1 b	69.1 ab	137.6 ab	3,260 a	2.40 a	58.7 a	986 bc	14.0 b	9.6 c	5.37 b
	Early July	23.4 a	38.1 b	42.7 b	104.2 b	3,174 a	2.78 a	46.8 b	637 c	7.0 c	4.2 d	1.82 c
	Mean	23.6	54.3	59.3	137.1	3,492	2.90	55.5	1,196	17.8	11.4	6.07

[z]Means followed by the same letter within a year and column are not significantly different at $P \leq 0.05$ based on protected, Bonferroni-corrected multiple comparisons.
[y]Malfunction of sweet corn cutter prevented collection of kernel mass data for the first planting date of 2007.

Sweet corn yield. Sweet corn yields were higher in 2007 than in 2006. Averaged across planting dates, boxes, green mass, husked mass, and kernel mass yields were 21%, 27%, 34%, and 45% higher, respectively, in the second year of the study (Table 3). Yield differences were consistent with total shoot biomass and LAI differences observed both years. An overall smaller water supply in 2007, compared with 2006, did not account for higher yields the second year. However, monthly mean air temperature exceeded the 30-year average by 1.0 to 3.0 °C in May, June, August, and September of 2007. In contrast, mean monthly air temperature often was less than the 30-year average during 2006.

Although numerous factors influence crop yield, sweet corn yield components consistently decreased in the early July planting date. Number of ears and green mass were comparable among the first three planting dates, averaging 1290 boxes/ha and 19.6 mg·ha^{-1}, respectively (Table 3). In contrast, the early July planting date yielded on average 583 boxes/ha and 6.6 mg·ha^{-1} of green ears. Yield components for the mid-June planting date were comparable to earlier planting dates in 2006, but not in 2007. For instance, husked mass yield and kernel mass yield were 61% and 63%, respectively, of yields of May-planted plots in 2007 (Table 3). Kernel SSC was consistently highest in May and June planting dates and lowest in mid-April and early July planting dates (data not shown).

Yield loss from planting full-season dent corn hybrids after optimal dates is well known (Benson, 1990; Darby and Lauer, 2002; Lauer et al., 1999; Swanson and Willhelm, 1996). Considerably fewer reports are available on yield response of relatively short-maturing sweet corn hybrids to the wide range of planting dates common to sweet corn production. Per plant yield, of four short-season sweet corn hybrids, was unaffected by planting dates spread over more than 4 weeks in Newfoundland (Kwabiah, 2004). Yield of late June-planted sweet corn was comparable to early May planting in 1 year in Urbana, IL, but in another year, yield was reduced proportional to the lower water supply in the late June planting (Williams, 2006). Because hybrid 'BC0805' in this study was highly susceptible to MDMV and tested positive for MDMV symptoms observed only in the early July planting date, the effect of growth and yield losses resulting from viral infection from inherently poorer growing conditions of the last planting date could not be separated.

Implications. This work characterizes the changing environmental conditions associated with planting dates of the north central United States and their relation to sweet corn growth and development. Over the last five decades, optimal plant population densities have nearly doubled. The extent to which crop growth changes in later plantings suggests plant population density could be manipulated to maximize yield or maintain uniformity of important yield traits. For instance, reducing plant population densities as the season progresses is practiced among some growers in Minnesota (Paul Richter, personal communication). While optimal plant population density varies among hybrids, potentially useful interactions between plant population density and planting date appear unreported.

Colquhoun et al. (1999) and Gunsolus (1990) speculated later-planted dent corn may be more competitive with weeds and improve effectiveness of tillage for weed control. Late June-planted sweet corn growth was more resilient to interference from velvetleaf (*Abutilon theophrasti* Medicus) and lambsquarters (*Chenopodium album* L.) compared with an early May planting (Williams and Lindquist, 2007). Williams (2006) found the critical period of weed control in early May-planted sweet corn began considerably sooner and lasted longer compared with a late June planting. The long planting season could influence weed species composition and population density, favoring later-emerging species with delayed planting. The rapid and taller growth of late-planted sweet corn may bolster the crop's ability to tolerate weeds that escape control; however, more light would be available to weed escapes if the fewer, slower-emerging leaves of late-planted sweet corn resulted in a less dense crop canopy. Furthermore, organic products are growing in popularity among consumers, and organically grown sweet corn is on the rise. A heavier reliance on mechanical weed control, for instance, in early-planted sweet corn, might create additional stresses at that time, including physical damage and stand reduction.

Hybrids have different reactions to disease, insect, and abiotic stresses such that the results reported here offer an initial assessment of the effect of planting date on sweet corn. Arnold (1969) reported that development of cultivars adapted to tropical and subtropical regions were more responsive to photoperiod than cultivars of temperate regions. Growing degree days from planting to harvest steadily decreased 2.1 °C per calendar day in 'Golden Cross Bantam' (Arnold, 1974), an extensively studied hybrid derived from two strains of historically important cultivar Golden Bantam. Thermal time from emergence to harvest of 'BC0805' appeared to change little across planting date, which is consistent with response of temperature germplasm to photoperiod. A more comprehensive understanding of planting date effects on sweet corn will include tests on hybrids, which may have unique responses to environmental stresses.

In conclusion, sweet corn responded consistently to changing environmental conditions brought about by the long planting season. Crop development was more rapid as planting was delayed from mid-April to early July as evidenced by fewer days needed to achieve silking. As the season progressed, sweet corn also grew taller yet with fewer, slower-emerging leaves. Leaf biomass was unaffected by planting date; however, reproductive biomass and total biomass near silking were lower in the early July planting date compared with the May planting dates. Yield components consistently decreased in the early July planting date; however, variation in early- and late-season stress tolerances among hybrids merits further research. This work demonstrated that the crop canopy, the structural platform for capturing solar energy and driving photosynthesis, undergoes distinct morphological changes as planting date is delayed. The extent to which this information results in crop management improvements remains to be seen. Perhaps optimal level of certain crop management factors (e.g., plant population density or weed-related management issues) also is not uniform across planting dates; thus, more detailed research is warranted.

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