Growth and Partitioning of Dry Matter Between Temperate and Tropical Corn

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Abstract

The objective of this research was to determine corn (Zea mays L.) dry matter (DM) and grain yield differences among a temperate hybrid (Pioneer 3320), a tropical hybrid (Pioneer X304C) and 'FLOPUP' (FI. open pollinated upright ear experimental of the 8th selection), as affected by cultivar and planting date. The experiment was conducted at two locations at Green Acres Agronomy Farm near Gainesville, FI., in 1988. There were three planting dates -March, May, and August. Twelve harvest samplings for each crop were made beginning at 35 days after planting (DAP) and ending at 150 DAP. In the March planting, total plant DM reached a maximum about 112 to 120 DAP. Maximum whole plant DM was 9.8, 8.5, and 8.3tons A^{-1} for Pioneer 3320, Pioneer X304C and FLOPUP, respectively. Grain yield was 207, 150, and 114 bu A^{-1} for Pioneer 3320, Pioneer X304C, and FLOPUP, respectively. Grain yield was 93, 114, and 86 A^{-1} for Pioneer 3320, Pioneer X304C, and FLOPUP, respectively. For the August planting, total plant DM reached a maximum about 88 lo 112 DAP. Maximum whole plant DM was 3.3, 3.8, and 4.6 tons A^{-1} for Pioneer 3320, Pioneer, X304C, and FLOPUP, respectively. Grain yields were 64,78, and 78 A^{-1} for Pioneer 3320, Pioneer X304C, and FLOPUP, respectively.

Introduction

In recent years some effort has been made to evaluate and develop genotypes and to determine the proper management required to grow corn *(Zea mays* L.) in the late spring or fall of the year (Baldwin and Gallaher, 1984; Bustillo and Gallaher, 1988; Gallaher and Horner, 1983; Gallaher, 1986). If this possibility were to exist, spring corn farmers and winter

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wheat *(Triticum aestivum* L.) fanners could grow an additional crop of corn succeeding these crops in the subtropical climate of the southeastern U.S.(Nelson et al., 1977). Research regarding planting dates, row spacing and plant populations is also relevant to an understanding of growing double-crop corn and the environmental factors involved (Eckert, 1984; Imholte and Carter, 1987; Wright et al., 1987).

Genetics and management for top corn yield is a fall crop may be quite different from that of a spring crop. It is unlikely that fall planted corn will partition dry matter in vegetative and reproductive tissues in the same manner as spring planted corn. For optimiizing dry matter and grain yield, genetic requirements of fall planted corn is also likely to be different from spring planted corn.

The objective of this research was to determine corn dry matter and grain yield differences among a temperate hybrid, a tropical hybrid, and an open-pollinated experimental cultivar, as affected by planting date and cultivar.

Materials and Methods

The experiment was conducted at two locations with two different cropping histories at the Green Acres Agronomy Farm near Gainesville, Florida in 1988. The experimental sites were dominated by Arenic and Grossarenic Paleudult soils (Soil Survey Staff, 1984). 'Pioneer 3320' (temperate corn hybrid), 'Pioneer X304C' (tropical corn hybrid) and FLOPUP (Florida open-pollinated upright ear experimental of the 8th selection) were the three cultivars used.

Conventional tillage seedbeds were prepared for planting each crop with a Brown-Harden in-row subsoil no-tillage planter. Plots were planted at about 60,700 seed A^{-1} and thinned to the desired population of 34,400 plants A^{-1} two weeks after seedling emergence. Anhydrous ammonia (89 N A^{-1} was injected 10 inches under the row during the planting operation. Ammonium nitrate (67 lb N A^{-1} Muriate of potash (100 lb K A^{-1} Triple super phosphate (21 lb P A^{-1} Sulfate of potash magnesia (11 lb Mg A 22 lb K A^{-1} 23 lb S A^{-1} and Perk (25 lb A^{-1} containing the following percentage soluble elements: 5% S, 5% Mg, 0.02% B, 0.50% Cu, 9% Fe, 2% Mn, 0.003% Mo., and 1% Zn) was broadcast immediately after planting. Sidedress applications of ammonium nitrate (31 lb N A^{-1} each time) were applied at 40 and 60 days after planting.

Water was applied by overhead sprinkler in addition to rainfall to insure at least 1 inch per four to seven days until early tassel, increasing to a maximum of 1.5 inches per four days during rapid seed fill and decreasing to 1 inch per four to seven days during late seed fill. Counter [Terbufos: S-((1, 1-Dimethylethyl)thio) methyl)0,0-diethly phosphorodithionate] at 2 lb ai A^{-1} was banded over the row before emergence. The August planted corn received two applications of lannate 1Methomyl:S-Methy 1-N-((methyl carbamoyl)oxy) thioacetimedate] (one pint product A-1each time) sprayed directly in the whorl at 30 and 45 days after planting (DAP)to control fall army worm. Dual [Metolachlor:2-chloro-N-(2-ethly-6-methylphenyl)-N-(2-methoxy-1methylethyl) acetamide] at 2 lb ai A^{-1} was sprayed pre-emergence each time. Post direct applications of gramoxone [Paraquat: 1, I'-DimethyI-4,4'-bipyridinium ion] plus X77 non-toxic surfactant were applied as needed after corn reached about 30 inches height. Additional weed control was by hand.

Results and Discussion

The tropical cultivars (Pioneer X304C and FLOPUP) were expected to produce better in the late spring and summer plantings than the temperate cultivar (Pioneer 3320). which would be expected to produce better in the early spring plantings. This is shown in Table 1. Dry matter yield for Pioneer 3320 in the March planting was approximately 17% greater than the yields of Pioneer X304C and FLOPUP. The peak accumulation was about I12 to 120 DAP, with Pioneer 3320 reaching the peak earlier. In the May planting, the DM yield of Pioneer X304C was approximately 38% and 29% greater than the yields of Pioneer 3320 and FLOPUP, respectively. The maximum DM accumulation occurred about 84 to 100 DAP; Pioneer 3320 reached the maximum about two weeks earlier than the other cultivars. Dry matter yield for FLOPUP in the August crop was approximately 39% and 21% greater than the yields of Pioneer 3320 and Pioneer X304C, respectively. The maximum DM accumulation was about 88 to 112 DAP; Pioneer 3320 reached maximum production about one week before Pioneer X304C, and two weeks before FLOPUP. The tropical cultivars produced more dry matter in the May and August plantings than the temperate hybrid, as would be expected.

Grain yield for the three crops in shown in Table 1. Pioneer 3320 had the highest grain yield in the March planting, 207 bu A^{-1}, which is approximately 39% and 82% greater than the yield of Pioneer X304C and FLOPUP, respectively. In the May planting, Pioneer X304C had the highest grain yield, I14 bu A^{-1} approximately 23% and 33% greater than the yield of Pioneer 3320 and FLOPUP, respectively. For the August crop, FLOPUP and Pioneer X304C each had maximum grain yields of 78 bu A^{-1} approximately 22% greater than the yield for Pioneer 3320.

Table 1. Maximum whole plant dry matter and grain yield by three corn cultivars affected by planting date.

Cultivar	Month of Planting		
	March	May	August
	---------- Ton A^{-1} ----------		
Pioneer 3320	9.9	5.5	3.3
Pioneer X304C	8.5	7.6	3.8
FLOPUP	8.3	5.9	4.6
Average	8.9	6.3	3.9
	---------- Bu A^{-1} ----------		
Pioneer 3320	207	93	64
Pioneer X304C	150	114	78
FLOPUP	114	86	78
Average	157	98	73

The rate of total DM loss (from the time of maximum yield until the end of the season) is shown in Table 2. This illustrates the importance of harvesting in a timely manner.

Table 2. Rate of total dry matter loss following peak near black layer formation.

Planting month	Cultivar Pioneer 3320	Cultivar Pioneer X304C	FLOPUP
	---------- Bu A^{-1} ----------		
March	214	151	160
May	71	80	80
August	9	< 9	53

The rate of deterioration is greater in the March and May plantings when there are higher temperatures and rainfall than in the fall. Information was not available that had compared planting dates from early spring to late summer. Research on the effect of planting dates, photoperiod, and temperature include Imholte and Carter (1987), and Warrington and Kansmasu (1983).

Spring corn grain-fill occurs during increasing day lengths and temperatures. The May planted corn developed and reproduced during the maximum day length and temperatures. There are potential problems for the August crop due to decreasing day length, temperature, and natural rainfall in Florida, as well as increased pest problems (Bustillo and Gallaher, 1988; Gallaher and Homer, 1983).

Summary

Temperate hybrids such as Pioneer 3320 that were developed for early planting do not perform well when planted in late summer. In total DM and grain yield, Pioneer 3320 produced the highest yields in the March planting. The highest yields in the May and August plantings were produced by Pioneer X304C and FLOPUP, respectively. The rate of total DM loss or deterioration was greater in the early planting. Genetic potential exists for reasonable corn yields in mid to late summer plantings.

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