Optimal Plant Spacings for Late Season Tropical Corn Production

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ABSTRACT

Management of late-season tropical corn *(Zea mays* L.) for silage is of concern to producers in the southeastern US. The objectives of this research were to determine late-season tropical corn yield responses to equidistant plant spacings using regression, calculate theoretical maximum grain and whole plant yields, and compare yields of two control treatments (double row and conventional single row). This late-season, irrigated field study was conducted in 1989 and 1990 on an Arredondo fine sand in north-central Florida. Yield response of an open-pollinated tropical corn synthetic ('FL SYN-1-2') to six equidistant plant-spacing (15, 30, 45, 60, 75, and 90 cm) and two row-spacing treatments (75 cm and alternating 30:60 cm rows) was observed. Quadratic and nonlinear regression equations were fitted to grain and DM yield responses, respectively. Maximum DM yields in 1989 of 879 and in 1990 of 1263 $g\,m^{-2}$ were predicted. Maximum grain yields in 1989 of 515 and in 1990 of 582 $g\,m^{-2}$ were predicted at 22 plants m^2. No differences in grain yield between single 75 cm row and alternate 30:60 cm row treatments were observed either year. The alternate 30:60 cm row treatment produced more DM than the single 75 cm row treatment in 1989.

INTRODUCTION

Tropical corn **is** helping to fulfill the demand for high quality silage by the dairy industry in Florida. Proper management of the crop in the late-season environment is critical to produce high silage yields. Gonzalez (1990) reported that late-season tropical corn requires higher plant densities for optimum grain and silage yields compared to spring season corn. Grain and whole plant yields were highest at the highest plant population (10 plant m^{-2}). Spring season corn grain yields of a temperate hybrid grown in an equidistant study conducted in Florida (Tetio-Khago and Gardner, 1988) maximized at 10 plants m^{-2}; whole plant yields maximized at 12.5 plants m^{-2}. The objectives of this research were to determine late-season grain and whole plant yield responses to equidistant plant spacings using regression, calculate theoretical maximum grain and whole plant yields, and compare yields of two control treatments (double row and conventional single row).

MATERIALS AND METHODS

This 2 yr field study was conducted on an Arredondo fine sand (sandy, siliceous, thermic, Grossarenic Paleudult) at the Green Acres Agronomy Research Farm in Gainesville, FL. The open-pollinated tropical corn synthetic Syn-1-2 was planted on 5 Aug 1989 and 8 Aug 1990 at six equidistant plant-to-plant spacings (15, 30, 45, 60, 75, and 90 cm) and two check row spacings (75 and alternating 30:60 cm rows). Fertilizer of 168:80:120 (N-P-K kg ha^{-1}) was applied at planting, except for N which was applied in three equal split applications (planting, eight-leaf stage, and twelve-leaf stage). The herbicides atrazine (at planting) and paraquat (postdirected) were applied at labeled rates. Carbofuran was banded-in-the-row at planting to control lesser cornstalk borer (Elasmopalpus lignosellus); methomyl was sprayed three times to control fall armyworm (Spodoptera frugiperda). Irrigation of 2.5 to 3.5 cm $week^{-1}$ was provided. Grain and whole plant yields were sampled at black-layer; LAI measurements were taken at mid-silk in 1989 only. Design of the experiment was RCB with

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four replications. Prediction equations were derived from equidistant spacing yield data using SAS regression and non-linear procedures (SAS, 1987); check row treatment means were compared using LSD ($P=0.05$) means separation.

RESULTS *AND* DISCUSSION

Total DM yield responded asymptotically both years to increasing plant density. Separate, yearly nonlinear prediction equations were derived due to a significant year effect (Wiley and Heath, 1970). Maximum TDM yields of 879 and 1263 g m^{-2} were predicted for 1989 and 1990, respectively (Fig. 1). The predicted maximum for 1990 of 1263 g m^{-2} corresponds to a silage yield at 35% DM of 3.5 kg m^{-2} (16 T A^{-1}). The alternate **30:60** cm row treatment yielded more TDM than the single 75 cm row treatment in 1989. No differences in TDM were found between the row treatments in 1990 (Table 1).

Grain yield responded quadratically to plant density; there was a significant year effect (Fig. 2). Maximum grain DM yields in 1989 of 515 and in 1990 of 582 g m^{-2} were predicted at 22 plants m^{-2}. Due to the large interval between the highest two plant densities, predicted grain yields and corresponding plant densities are likely higher than expected. Actual grain yields from a range of densities above and below the predicted optimum plant density are needed to verify the predictions of the quadratic equations. No differences in grain yield between the alternate 30:60 cm row and 75cm row treatments were observed either year Fable 1).

Leaf area index measured at anthesis in 1989 responded quadratically to plant density ($R^2=0.97$); optimum LA1 range of 3.5 to 4.0 was achieved with 15 to 20 plants m^{-2} density (not shown). Alternate 30:60 cm row treatment had higher LA1 than the single 75 cm row treatment (Table 1).

LITERATURE CITED

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Table 1. Yield means at harvest and LA1 means at mid-silk of single and double row treatments.

Treatment	LAI	Grain DM 1889	Grain DM 1990	Total DM 1989	Total DM 1990
75 cm rows	2.05	189	211	670	794
30~60 cm rows	3.61	180	186	831	801
LSD (0.05)	0.43	ns	ns	158	ns

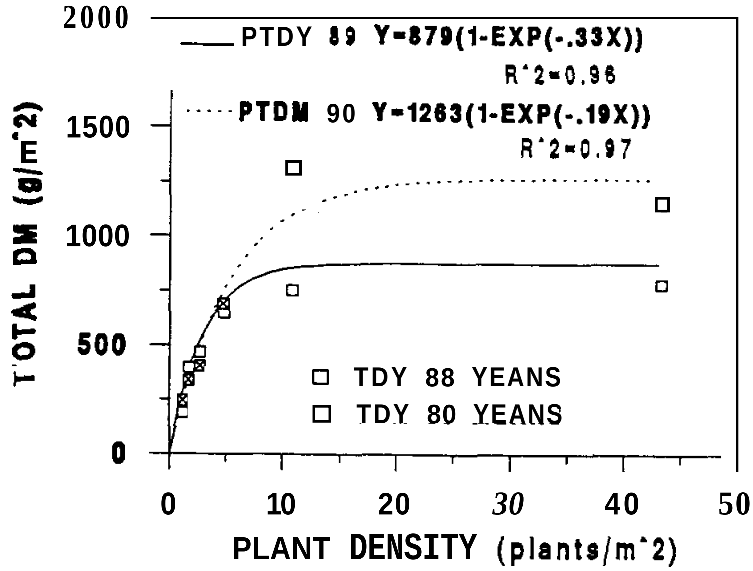

Fig. 1. Total DM yield response to plant density, 1989-90.

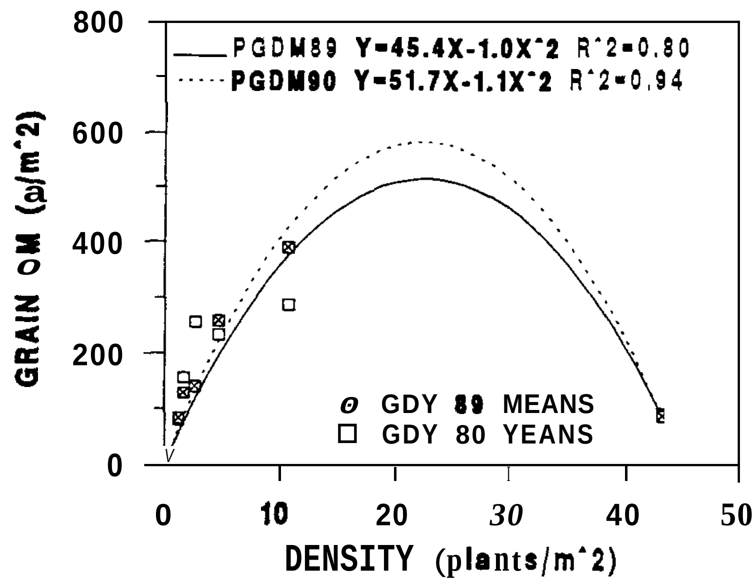

Fig. 2. Grain yield response to plant density, 1989-90.