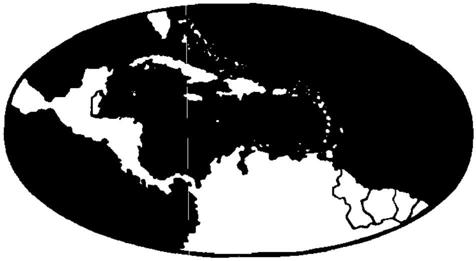
CARIBBEAN FOOD CROPS SOCIETY



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YIELD RESPONSE OF MAIZE (*ZEA MAYS* L.) TO VARYING PLANT DENSITIES AND TIMING OF APPLICATION OF DIFFERENT LEVELS OF NITROGEN

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INTRODUCTION

Several workers (Baynes, 1969, 1972; Baynes and Walmsley, 1973; Gooding and Hoad, 1968; Sargeant, 1968, 1969) have reported on experiments conducted on plant density effects on maize in various parts of the Eastern Caribbean. Similarly, Cross (1969), Gooding and Hoad (1968), Sargeant (1969), Sehgal (1969), reported on the effects of fertilizers on maize production in the areas mentioned.

In Trinidad and Tobago, yields of maize tend to be relatively low even though there is increasing use of some tropical hybrids. However, recommendations on optimum plant densities, adequate availability of nutrients especially nitrogen and adequate soil water which are known to contribute to maximum yields (Bondavalli *et al.*, 1970; Hunter *et al.*, 1970; Vasquex, 1960; Ramirez and Laird, 1960) are somewhat arbitrary.

The experiment reported here is one of a series being undertaken to determine optimum plant densities, the optimum levels of nitrogen and the effect of different timing of applications of nitrogen on several soil types in Trinidad.

The experiment was conducted at Central Experiment Station, Centeno, on Las Lomas Sandy Loam Soil. The design used was a split plot design wherein fertilizer levels and time of applications formed the main plots, and plant densities the sub-plots. The arrangement was a randomised complete design with treatments being replicated three times.

Treatments were

I. Fertilizer Levels and time of application on main plots as follows:

N	P	K		Timing
68.18 kg/ha	90.90 kg/ha	90.90 kg/ha		All at planting
136.36 "	90.90 "	90.90 "		" " "
204.54 "	90.90 "	90.90 "		" " "
272.72 "	90.90 "	90.90 "		" " "
68.18 "	90.90 "	90.90 "	)	P and K applied at planting
136.36 "	90.90 "	90.90 "	)	Nitrogen split into three
204.54 "	90.90 "	90.90 "	)	and applied at planting,
272.72 "	90.90 "	90.90 "	)	four weeks after and at tasselling.

II. Spacing on Sub-plots as follows:

(a) 30 cm x 30 cm (1' x 1') or 107,593 plants/ha.
(b) 60 cm x 30 cm (2' x 1') or 53,796 " "
(c) 90 cm x 30 cm (3' x 1') or 35,865 " "
(d) 120 cm x 30 cm (4' x 1') or 26,898 " "

Main plot size was 16 metres x 3 metres while sub-plots were 3.5 metres x 3 metres. Approximately 0.5 metres separated each sub-plot. Three seeds were sown per hole and thinned out to one. All fertilizer applications were side-dressed about 5 cms away from the plant rows. The cultivar used was X 304, a tropical hybrid. All other operations done in the crop were standard practices.

Soil sampling at the 15 cm and 30 cm depth were taken before setting down the experiment (composite sampling) and on individual plots at the end of the experiment and analysed for N, P and K.

Leaf sampling according to the method used by Chapman (1960) were taken for determining nutrient status.

Harvesting was done when the plants were completely dry. Grain moisture content was determined by oven dry method from random samples taken just before harvest. Total number of cobs were counted and weighed for each plot. After shelling, weight of grain per plot was determined. Results of grain weight were expressed on a per hectare basis.

RESULTS AND DISCUSSION

The results of the treatments on cob and grain yields are presented in Table 1.

Nitrogen fertilizers, where split into three applications (except that of 272.72/3 kg/ha Level) gave significantly higher yields than those levels applied all at one time (Table 3). These results are similar to those obtained by Singh (1966). The level of 272.72 kg/ha applied at 3 times did not give any significant results over the same quantity applied all at once, neither was there any significance at the level of 204.54/3. This indicates that for this experiment on this soil type, 204. 54 kg/ha (180 lb/acre) of nitrogen is the optimium. It also indicates that best results could be obtained by splitting the quantities of nitrogen applied and applying such at the critical stages as observed by Sayre (1948), Singh (1966).

Maximum yields, both in terms of cob and grain were obtained using the closest spacing or highest density of 107,600 plants per hectare (Table 2). The usual recommended spacing of 90 cm x 30 cm or 35,800 plants/ha gave significantly lower yields than the 107,600 plants/ha.

At very high densities, even though the cob yields were greater, the cobs were comparatively smaller and the increase in yields were attributed to the greater number of cobs obtained, though they were smalller in size.

In interactions, it was observed that spacing had a greater effect on cob yields while fertilizer had a greater effect on grain weight. This indicates that even though high plant densities contribute to a greater number of cobs, it does not necessarily contribute to proportionately greater grain yields. Apparently high nitrogen levels contribute much more to greater grain yields.

This is a preliminary report on the first of the series of experiments being conducted on plant densities and nitrogen fertilizer effects on maize and hence no definite recommendations could be made until the experiments have been repeated on several soil types common to maize production in Trinidad and Tobago.

TABLE 1. Nitrogen Fertilizer and Plant Density Effects on Maize Cob and Grain Yields

Nitrogen Levels and Timing of Applications		Plant Density (103) per ha 30 cm x 30 cm (107.6)		60 cm x 30 cm (53.8)		90 cm x 30 cm		120 cm x 30 cm (26.9)	
		Mean No. of cobs	Mean Grain Weight kg/ha	Mean No. of cobs	Mean Grain Weight kg/ha	Mean No. of cobs	Mean Grain Weight kg/ha	Mean No. of cobs	Mean Grain Weight kg/ha
0	kg/ha	9044.0	845.83	6804.0	374.33	12482.0	620.99	1134.0	117.73
68.18	" "	82.80	374.73	5634.0	396.15	14750.0	674.52	39690.0	364.03
136.36	" "	18144.10	835.12	31374.0	2494.65	23058.0	2869.39	13230.0	920.77
204.54	" "	73710.0	4827.70	44604.0	4603.87	38178.0	4891.94	28728.0	3126.35
272.72	" "	54810.0	5139.20	51030.0	5385.45	47250.0	5010.72	32886.0	5663.83
68.18/3	" "	27972.0	1284.80	18908.0	910.06	15876.0	1038.55	16632.0	1370.45
136.36/3	" "	79002.0	5364.04	32886.0	2826.56	25704.0	2044.97	16250.0	877.95
204.54/3	" "	82782.0	7205.59	39690	5867.25	43092.0	5278.39	21546.0	3366.17
272.72/3	" "	82404.0	6494.67	51408.0	5256.97	35910.0	5910.08	20034.0	4775.17

60/3, 120/3, 160/3 and 240/3 denotes 3 split applications of N

	Grain wt.	No. of Cobs
SE. Horizontal Comparisons	± 387.62	± 4345/31
SE. Other Comparisons	± 433.99	± 4521.04

TABLE 2. Spacing Effect of Maize Cob Yield and Grain Yield

Spacing		Meat Grain Weight	Mean No. Cobs
(1' x 1')	30 cm x 30 cm	3596.85	48460.9
(2' x 1')	60 cm x 30 cm	3123.97	31370.9
(3' x 1')	90 cm x 30 cm	3148.84	28477.8
(4' x 1')	120 cm x 30 cm	2286.94	21126.0
		SE± 129.21	SE± 1448.44
		CV = 22.03%	CV = 23.19%
		LSD 579.33	LSD 6498.59

TABLE 3. Nitrogen Fertilizer Effect on Maize Cob Yeild and Grain Yield

Nitrogen Levels and Timing of Applications					Mean Grain in kg/ha Weight	Mean No. of Cobs
1.	0	lbs/acre		kg/ha	489.83	7366.0
2.	60	" "	68.18	" "	452.36	17088.5
3.	120	" "	136.36	" "	1779.98	21451.5
4.	180	" "	204.54	" "	4362.46	46305.0
5.	240	" "	272.72	" "	5299.80	46494.0
6.	60/3	" "	68.13/3	" "	1150.97	19847.0
7.	120/3	" "	136.36/3	" "	2778.38	38461.5
8.	180/3	" "	204.54/3	" "	5429.35	46777.5
9.	240/3	" "	272.72/3	" "	5609.22	47439.0
					SE ± 277.11	SE± 2529.99
					CV = 31.49%	CV = 27%
					LSD 898.68	LSD 8322.17

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