

EFFECT OF N AND K FERTILLIZATION ON THE YIELD OF A MAIZE-TOMATO SEQUENTIAL CROPPING SYSTEM IN NICARAGUA.

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Introduction

In Matagalpa, Nicaragua the most common cropping system practiced by farmers is maize (Zea mays L.) followed by bean (Phaseolous vulgaris L.) in sequence, this system generates little income. Previous research carried out by CATIE (1, 2), has demonstrated the feasibility of substituting tomato (Lycopersicum sculentum L.) for beans, which has resulted in a significant increase in farmer's income.

Research conducted in Matagalpa by CATIE in 1980, and 1981 (1, 2) determined that one of the most critical factors affecting tomato yields in the area was the amount of N available. The objective of this research was to develop a fertilizer program for a maize-tomato relay system under minimum tillage management.

Materials and Methods

Five N rates (0, 60, 120, 180, and 240 kg/ha) and two K rates (60 and 90 kg/ha) were compared, during the 1982 growing season. The experiment was conducted at three sites under a completely randomized block design with four replications at each site. The experimental plot consisted of four rows 5 m long and 0.8 m wide, all measurements were taken in the two central rows.

On June 1, 1982, maize (cultivar "NB-3") was planted under conventional tillage (three passes with an Egyptian wooden plow), leaving two plants every 0.5 m. At planting, all maize plots were fertilized with 132 kg/ha of the formula 17-45-2 (N-P-K, respectively) and 25 days after planting side dressed with 98 kg/ha of urea.

On September 13, tomato plants (cultivar "Tropic") were transplanted within the rows of corn, leaving one plant every 0.50 m (at the midpoint between maize hills). Corn plants were completely defoliated 15 days after tomatoes were transplanted. The N fertilization program for the tomato was as follows: one half of the amounts of N, and all the P and K were applied at the time of transplant; except for the 60 kg N/ha where all the N was applied at transplant. Thirty days after transplant the N rates were completed by side dressing.

Make plots were kept free of weeds with post-directed applications of Paraquat (1 or 2 l/ha, depending on the site). Thirty days after the tomato

plants were transplanted the field was covered with an application of 0.5 kg/ha of Sencor product (Metrabuzin). Diseases and insects were controlled with alternate applications of labeled rates of Metamidophos, Decamethrine, Chlorothalonil, and Propineb.

Results and Discussion

Maize

In all three sites there were no differences between maize treatments for number of plants per plot, number of ears, and number of damaged ears. Differences in sites 1 and 3 were found between treatments. For yield, none were found in site 2 (table 1). The lowest (4940 kg/ha) and highest (7557 kg/ha) corn grain yield were observed at sites 2 and 1, respectively. Both of these yields are well above the area's average for farmer's (1900 kg/ha) that has been reported in the literature (2).

Tomato

In site 1, statistical differences ($p=0.01$) were found between N treatments for number of plants at harvest, number of fruits, number of healthy fruits, and yield (Table 2). The highest yields (21,688 kg/ha) were obtained with 180-60-90 kg/ha of N-P-K. Comparing K rates, no differences ($p=0.01$) were found between 60 and 90 kg K/ha (Table 3).

Site 2 was severely affected by dry period 35 days after planting, causing a reduction in yield in comparison to site one (Table 3). The highest yields (13,405 kg/ha) were obtained with 240 kg N/ha, but there was no difference between this treatment and 180 kg N/ha. As in site 1, K did not affect yield (Table 3).

Site 3 was also severely affected by drought, this may have prevented any treatment effects. Nevertheless, the results follow a similar trend as those observed in sites 1 and 2 (Tables 2 and 3). The highest yields (16,531 kg/ha) were obtained with 240 kg N/ha. Again, as in the other two sites K did not affect yield (Table 3).

The results in all three sites indicate a tendency for increases in number of fruits and yield (Tables 2 and 3) as the rate of N increased. It is also apparent that the point of diminishing returns is located somewhere between 180 and 240 kg N/ha.

A partial analysis of costs indicated that costs increased as fertilizer rates increased. In sites 1 and 3 the highest net income per hectare was obtained with 180 kg N/ha, and in site 2 with 240 kg N/ha. A similar tendency was observed for the benefit/cost ratio, cash return per dollar invested in fertilizers and pesticides, and cash return per hour of labor input.

Bibliography

1. CATIE. 1981. Informe Anual De Labores Desarrolladas Por El Programa De Produccion Vegetal Del CATIE En Nicaragua. CATIE, Turrialba, Costa Rica.
2. CATIE. 1982. Informe Anual De Labores Desarrolladas Por El Programa De Produccion Vegetal Del CATIE En Nicaragua. CATIE, Turrialba, Costa Rica.

TABLE 1. Corn Grain Yield in a Maize-Tomato Sequential Cropping System in Yatagalpa, Nicaragua, 1982.

PLOT NO	TREATMENT N-P-K	CORN GRAIN		
		SITE 1	SITE 2	SITE 3
		kg/ha		
1	60-60-0	6524 ah	5069 a	6158 ah
2	60-60-0	6111 b	5914 a	5911 ab
3	60-60-0	7093 ab	4947 a	5325 a
4	60-60-0	6649 ab	6164 a	5847 ab
5	60-60-0	7156 ab	4940 a	5447 ba
6	60-60-0	6509 ab	6840 a	5436 ab
7	60-60-0	7557 a	6952 a	6533 a
8	60-60-0	6989 ab	5744 a	5515 ab
9	60-60-0	6992 ab	4976 a	5859 ab

* Values within a column followed by the same letter are not statistically different.

TABLE 2. Effect of N and K Rates on the Aeronomic Traits of Tomato in a Maize-Tomato Sequential Cropping System. Matagalpa, Nicaragua, 1982.

PLOT NO	TREATMENT N-P-K	POPULATION * Plants/ha	DAMAGED Fruits/ha	# FRUITS* Fruits/ha
1	0-0-0	16875 b **	5000 d	77625 e
2	60-60-60	20750 a	12250 ab	116000 abc
3	60-60-90	20500 a	10000 abc	196875 bcd
4	120-60-60	19750 ab	7625 bcd	92125 cde
5	120-60-90	19500 bc	5500 cd	85625 de
6	180-60-60	29875 a	10875 ah	123250 ah
7	130-65-60	21375 a	13625 a	134000 ab
8	240-60-60	20375 a	9125 abcd	133000 ab
9	240-60-90	20250 a	13875 a	137750 a

* Average of three sites

** Values within a column followed by the same letter are not statistically different

TABLE 3. EFFECT OF N AND K RATES ON TOMATO YIELD IN THREE SITES IN MATAGALPA, NICARAGUA, 1982.

PLOT No	TREATMENT N-P-K	YIELD			
		SITE 1	SITE 2	SITE 3	
----- kg/ha -----					
1	0-0-0	8219 c*	5188 c	10609 a	
2	60-60-60	14250 bc	10313 ab	11313 a	
3	60-60-90	12573 bc	7750 bc	12047 a	
4	120-60-60	10484 c	3734 abc	10484 a	
5	120-60-90	9453 c	7094 bc	11140 a	
6	180-60 -60	16563 ab	10953 ab	13500 a	
7	180-60-90	21688 a	9609 abc	15031 a	
8	240-60-60	17719 ab	11094 ab	16531 a	
9	240-60-90	15656 ab	13406 a	14719 a	

* Values within a column followed by the same letter are not statistically different.