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PLANTAIN PRODUCTION AS INFLUENCED BY MAGNESIUM AND MINOR ELEMENTS

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INTRODUCTION

Minor nutrients, in addition to secondary nutrients and the long recognized major (NPK) elements, play very important roles in plant metabolism. The major elements are used by crops in relatively large amounts, while the so-called secondary and minor elements are used in rather small amounts. However, all are essential for normal plant growth. Secondary and minor elements are not currently used in crop fertilization in Puerto Rico. Perhaps, the use of iron sprays in pineapple fields is about the only exception.

This paper reports on experimental work under field conditions to evaluate the effect of soil and foliar applications of minor elements and magnesium, a secondary element, upon the growth and production of plantains (*Musa paradisiaca*, L.)

MATERIALS AND METHODS

A field experiment was laid in the spring in a Lares clay soil at the Corozal Substation farm to determine the response of plantains to minor elements and magnesium when supplied to the soil or applied as sprays.

The experimental layout for a combined NPK and secondary-minor nutrients study followed a 4×5 nearly balanced rectangular lattice design with twenty treatments and five replications. Plots were 18 feet $\times$ 18 feet with four plants each. Planting holes were 18 inches $\times$ 18 inches. Limestone was applied to all plots at the rate of $3\frac{1}{2}$ tons to the acre so as to raise the soil pH to 6.0. The soil was treated with Aldrin at the rate of 1 gal. (25 per cent concentrate) per 100 gallons of water per acre. Both limestone and Aldrin were worked into the topmost 4 to 6 inches of soil. Planting material of the Enano cultivar was used after selecting 400 suckers for uniformity as to size and weight.

The magnesium and minor nutrient study included 10 treatments. Table I indicates the various fertilizer sources supplying a particular nutrient with rates used as soil or foliar treatments.

Hydrated lime was added to the spray solution to maintain the required pH control. Nu Film at the rate of 250 c was used as a sticker and spreader.

All plots received NPK at the rate of 200 pounds of each major nutrient. In the plots requiring soil applications one third of the total nutrients was applied each in the spring, summer and fall.

For the spray treatments the following schedule was followed:—

1st spray in the summer when plants were 3 months old

2nd spray in the summer when plants were 4 months old

3rd spray in the fall when plants were 6 months old

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4th spray in the fall when plants were 7 months old
5th spray in the fall when plants were 7 months old
6th spray in the fall when plants were 7 months old

After the third spray there were heavy rains, thus the 4th spray followed six days afterwards. The same situation occurred after the 5th spray with the 6th following after two weeks.

All the data obtained were statistically analyzed and the least significant difference calculated for comparing the means of each treatment for the various growth, development and yield criteria.

RESULTS AND DISCUSSION

As shown in Table 2 the omission of secondary and minor elements from the fertilizer mixture applied to the soil caused highly significant reductions in the yield of plantains grown in a Lares clay of the Corozal area. The three yield criteria, namely, hundredweights of plantains per acre, number of fruits per acre and number of hands per acre, were all significantly affected. There was a tendency for a reduction in yields when all the nutrients were applied as foliar rather than as soil applications, but in this instance only the measurement of hands per acre revealed highly significant differences between means.

In the foliar sprays, the omission of both Fe and Zn caused significant reductions in the yield of plantains. A highly significant reduction in number of fruits per acre was measured when Zn was omitted from the spray while significant reductions were measured with omissions of Fe, B, Mo, and Mn. No significant differences attributable to treatments were measured as to hands per acre obtained. Thus, the effect of the omission of some elements is evident upon the size and number of plantains rather than upon the number of hands.

An overall examination of the data obtained points out to the need of fertilization with some of the minor elements for the production of plantains in Lares clay and/or similarly related soils of the Corozal and other regions of similar ecological conditions. The information presented indicates that under the conditions prevailing where the experiment herein reported was conducted, the application of some of the minor elements is as essential for higher production as that of the well known major nutrients. It has been shown, furthermore, that the application of these minor elements as foliar sprays at the rate used is not as effective as the application to the soil under the aforementioned conditions. The necessity of applying minor elements, particularly Zn and Fe, is quite clear.

There is a possibility that in our study the possible extreme differentials were not reached, thus no sufficiency or deficiency levels could be established. Perhaps response to a given element may have been possible at higher levels. Caro-Costas, *et al* obtained a yield increase when fertilizing plantains with 100 pounds of magnesium in the Orocovis are A where Cialitos soils are predominant. In our experiment only 50 pounds were used. Perhaps, a higher level of magnesium might have affected yields. There is currently underway a field experiment at Corozal (on the same Lares clay) to evaluate the effect of magnesium on plantains. Treatments range from 0 to 400 pounds per acre of magnesium.

The potentialities of secondary and minor elements for becoming important items in the fertilization of tropical crops merits further study.

TABLE I

Minor elements and magnesium applied to soil and foliage of plantains grown in Lares clay, Corosal, P. R.

Nutrient Supplied	Source	Soil application	Spray application
		lb./A	Lb./100 gal
Boron	Borax	50	2
Copper	Copper sulfate	50	1
Zinc	Zinc sulfate	50	2
Iron	Chelated iron (FeEDTA)	25	1
Manganese	Manganese sulfate	50	2
Molybdenum	Sodium molybdate	25	5
Magnesium	Magnesium sulfate (Epsom salt)	500	5

TABLE II

Effect of minor elements and magnesium on the yield of plantains

Treatment	Mean yield per acre	Fruit per acre	Hands per acre
	Cwt.	No.	No.
Soil Application			
Complete fertilizer (NPK, minor elements and magnesium)	166.9	26028	4141
NPK only	107.2	18930	3227
Foliar sprays			
Complete fertilizer (as abeve)	147.6	25114	3549
Id. except Mg.	137.1	22210	3603
Id. except Fe	111.8	21081	3388
Id. except Mn	126.7	21619	3496
Id. except B	124.9	21135	3711
Id. except Zn	109.8	18446	3280
Id. except Cu	141.1	23447	3711
Id. except Mc	134.4	21511	3711
L.S.D. at			
5—percent level	32.2	3173	376
1—percent level	42.9	4248	484

REFERENCES

1. Caro-Costas, R., Abruna, F. and Vicente-Chandler, J., "Response to fertilization of strip-cultivated plantains growing on a steep latosol in the humid mountain region of Puerto Rico." *J. Agr. Univ. P. R.* 48(4): 312—17, 1964.