

## Research Notes

### RESPONSE OF PLANTAINS TO MAGNESIUM FERTILIZER IN AN ULTISOL<sup>1</sup>

Most plantains (*Musa paradisiaca*) in Puerto Rico are grown in the humid mountain regions on highly leached, acid clay soils (Ultisols). Farmers normally fertilize these soils heavily to get good yields. Their attention has been devoted, mainly however, to the major element fertilizers containing nitrogen, phosphorus, and potassium. Previous research showed that other crops have responded additionally to magnesium in these humid mountain soils.<sup>2</sup> Recent findings show that plantains also respond to magnesium applications<sup>3,4</sup>. This paper furnishes data from an experiment indicating the degree of increased response obtained in plantain production due to two levels of magnesium fertilizer in an Ultisol.

The experiment was conducted at the Corozal Substation. The soil was a Humatas clay (Ultisol), a red acid clay (pH 5.1), with a cation exchange capacity of 10.5 meq/100g. The plots consisted of 4 rows of plantains (cultivar Maricongo) 1.83 m (6 ft) apart in the row and between rows giving 16 plants per plot of which 8 were harvested leaving 8 plants as buffer rows between plots. The field was not plowed prior to planting according to soil conservation practices in this region. Instead, 30 × 30 × 30 cm (18 in) planting holes were made. Lime was not applied as pH values above 5 were not considered sufficiently acid to warrant liming for plantains.

There were three MgO levels: 0, 67, 202 kg/ha (0, 60 and 180 lbs/acre) with six replications in a randomized block design. All treatments received 448 N, 224 P<sub>2</sub>O<sub>5</sub>, and 440 K<sub>2</sub>O kg/ha (400-200-400 lbs/acre) divided into three equal applications including the MgO; 1) at planting, 2) at 4 months, and 3) at flowering. Leaf samples of the plant were taken at 4, 8, and 11 months of age selecting the center third portion, without midrib, of the third fully expanded leaf. Growth measurements were taken at 7.5 months, measuring from the soil level to the point where the first fully expanded leaf emerged from the trunk.

The experiment was planted March 30, 1971 and harvested February

<sup>1</sup> Manuscript submitted to the Editorial Board May 21, 1974.

<sup>2</sup> Landrau, Jr., P. and Samuels, G., The effect of fertilizers on the yield and quality of sweet potatoes, J. Agr. Univ. P. R. 35(2): 71-87, 1951.

<sup>3</sup> Hernández-Medina, E. and Lugo-López, M. A., Effect of minor nutrient elements and magnesium upon the growth, development, and yields of plantains, J. Agr. Univ. P. R. 53(1): 33-40, 1969.

<sup>4</sup> Vicente-Chandler, J. and Figarella, J., Experiments on plantain production with conservation in the mountain regions of Puerto Rico, J. Agr. Univ. P. R. 46(3): 226-236, 1962.

22 to September 9, 1972. Several applications of water were made to the plots by portable overhead irrigation to keep the crop growing during the first four months because of an unseasonable drought.

The results of the magnesium treatments on plantain production are given in table 1. The 202 kg/ha (180 lbs/acre) MgO treatment gave highly significant production over the 0 and 67 kg/ha MgO treatments in number and total weight of plantains per ha. The growth in the 0 and 67 kg/ha MgO treatments was poor throughout the experiment, worsened in part by the deficiency of water due to the drought. Growth measurements

TABLE 1.—*The influence of magnesium fertilizer on the growth, leaf-nutrient content, and production of plantains*

Item	MgO applied kg/hg (lbs/acre)		
	0	67 (60)	202 (180)
Number of plantains per ha (acre)	6,325 (2,530) <sup>a1</sup>	13,455 (5,382) <sup>b</sup>	56,925 (22,770) <sup>c</sup>
Quintals of plantains per ha (cwt/acre) <sup>2</sup>	17.4 (15.4) <sup>a</sup>	34.4 (30.4) <sup>b</sup>	159.9 (140.8) <sup>c</sup>
Weight per plantain g (lb)	245 (0.56) <sup>a</sup>	277 (0.61) <sup>a</sup>	281 (0.62) <sup>a</sup>
Plant height cm (in)	67.5 (27.0) <sup>a</sup>	68.6 (27.4) <sup>a</sup>	94.0 (37.6) <sup>b</sup>
Leaf-Mg values, percent dry weight, 4 months	.29 a	0.28 a	0.29 a
Leaf-Mg values, percent dry weight, 8 months	.12 a	.12 a	.21 b
Leaf-Mg values, percent dry weight, 11 months	.24 a	.24 a	.35 b
Soil-Mg values, p/m	100	75	100

<sup>1</sup> Treatments with different letters are significantly different at the 1-percent level.

<sup>2</sup> Based on 3,025 plants per hectare or 1,210 trees per acre.

(table 1) reflected this poor growth. Yet, the high MgO application of 202 kg/ha gave good growth and production for this region despite the setback from the dry weather. It appears that perhaps the magnesium deficiency on the Humatas clay was increased by the water deficit. It is evident that 76 kg/ha MgO was not sufficient to produce good yields, although the production was double that of the no MgO treatment (table 1).

The weight per plantain showed no significant difference due to magnesium levels used (table 1).

Leaf-Mg values reflected responses to the magnesium applications at the 8 and 11 months of age sampling, but not at 4 months. The similar values at 4 months may have been due to the drought. Leaf-Mg values of 0.21 and 0.35 percent dry weight at 8 and 11 months appear to be associated with

good plantain production. Caro Costas et al.<sup>5</sup> reported leaf-Mg values of 0.38 per cent at 7 months after planting for applications of 175 kg/ha MgO on a Cialitos clay (Ultisol) in an area similar and near this experiment.

As expected from previous experience, available soil-Mg values as determined by soil analysis showed no differences for magnesium treatment levels. The Ca:Mg ratio for the experiment averaged 16:1 indicating low soil-Mg levels in relation to soil-Ca levels.

The results obtained from this experiment confirm a previous research finding that the use of MgO at rates to about 200 kg/ha (180 lbs/acre) is needed for correction of magnesium deficiencies in plantains in an Ultisol of the humid mountain areas of Puerto Rico.

Leaf-Mg values of 0.35 percent and above of plantains at 11 months of age are associated with high yields.

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<sup>5</sup> Caro-Costas, R., Abruña, 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.