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PROCEEDINGS

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THE RESPONSE OF PLANTAINS TO MAGNESIUM FERTILIZERS IN PUERTO RICO

By

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INTRODUCTION

Plantains *(Musa paradisiaca)* are one of the principal starchy crops consumed in Puerto Rico. In 1961-62, the production was 191 million Plantains, and this increased to 240 millions in 1970-71 (2). The value of the crop has increased rapidly from $27.35 per thousand in 1961-62 to $65.00 per thousand in 1971-72. The increase in both production and farm price has placed the value of the plantain crop at $14 million for 1971-72 which represents 4.7% of the gross agricultural income.

A majority of the plantains are planted in the humid mountain regions in highly leached, acid, clay soils with low to moderate cation exchange capacities. Farmers have fertilized these soils heavily. A recent survey (2) indicates that farmers are using an average of 19 quintals/ha (21 cwt/A) of mixed NPK fertilizer for this crop usually at the rate of 340 gm (12 oz.) per plant with 2130 plants/ha (850/A). However, such high fertilizer rates do not always include magnesium. Previous work has shown that these humid mountain soils respond to magnesium for other crops

(4). Recent research findings have shown that plantains also respond to magnesium applications (1, 3,5). It is the purpose of this paper to report on an experiment on the response of plantains to various levels of magnesium fertilizer in the humid mountain soils of Puerto Rico.

MATERIALS AND METHODS

The magnesium fertilizer experiment was done at the Corozal Substation of University of Puerto Rico, Agricultural Experiment Station. The soil used was a Humatas clay (Ultisol), a red acid clay (pH5.1) with a cation exchange capacity of 10.5 m.e./100g. The plots consisted of 4 rows of plants 1.83 m. (6 ft.) apart in the row and also between rows giving 16 plants per plot of which 9 were harvested leaving 6 plants as buffer rows between plots for the various fertilizer treatments. The field was not ploughed prior to planting according to soil conservation practices in this region. Instead planting holes were made 31 x 31 x 31 cm (18 in.). Lime was not applied as pH values above 5 were not considered sufficiently acid to warrant liming for plantains.

There were 3MgO levels: O, 55, and 165 Kg/ha (O, 60 and 120 lbs/A) with 6 replications in a randomized block design. All treatments received 360 N, 180 P_2O_5, and 360 K_2O in Kg/ha (400-200-400 lbs/A) divided into 3 applications including MgO at planting, 4 mo., and at flowering. Growth measurements were taken at 7.5 months measuring from the soil level to the point on the trunk where the first fully expanded leaf emerged. Leaf samples were taken at 4, 8, and 11 months of age of the crop using the center 1/3 portion, without midrib, of the third expanded leaf.

The experiment was planted on March 30, 1971 and harvested from Feb. 22 to September 9, 1972. The experiment suffered from the very start from a lack of water due to an unseasonal drought. A few applications of water were applied by portable overhead irrigation to keep the crop growing.

RESULTS AND DISCUSSION

The results of the various magnesium treatments on plantain yields are given in table 1. The 165 kg/ha MgO treatment gave highly significant yields over the O and 55 kg/ha MgO treatments in number and total weight of plantains per hectare. The 55 kg/ha MgO level did not appear to supply sufficient magnesium. The deficiency of water due to the drought was reflected in the poor production obtained in the O and 55 kg/ha MgO treatments despite the high fertilizer level used. It appears that magnesium deficiency on the Humatas clay is increased by a water deficit.

Growth measurements reflected the responses to the magnesium applications (table 2). The 165 Kg/ha MgO treatment had a growth increase by 37 percent as compared to the O and 55 kg/ga treatments.

Leaf-Mg values reflected responses to magnesium application at 8 and 11 months of age samplings, but not at 4 months. The similar values at 4 months may have been due to the drought. Caro-Costas *et al* (1) reported leaf-Mg values of 0.38 percent at 7 months after planting for applications of 160 kg/ha (165 lbs/A) MgO on a Cialitos clay in an area similar and nearby this experiment.

Unfortunately, available soil-Mg values showed no differences for Mg-treatment levels with the O and 165 Kg/ha MgO treatments both having 100 ppm. Mg. The Ca: Mg ratio for the same treatments averaged 16:1 indicating low soil-Mg levels in relation to soil-Ca levels.

At present some growers in the humid mountain region are just beginning to use magnesium in their fertilizer mixtures usually at the rate of 3% MgO per ton. Even with the reported use (2) of 19 quintals/ha (21 cwt/A), the use of a 3% MgO mixture per ton of fertilizer would only supply 48 kg/ha (53 lbs/A) MgO. This amount does not appear to be sufficient to supply the magnesium needs of plantains on these soils. A recommendation of 165 kg/ha (180 lbs/A) MgO would require a plantain fertilizer formula to have a 10% MgO content. This could be done by

using sulfate of potash-magnesia instead of muriate of potash as the potash source in mixing the fertilizer formulas such as 10-5-20 or 12-6-16 used for plantains. Of course the use of dolomitic limestone would be a very good source of magnesium, and it could be supplied in the liming program. Unfortunately dolomitic limestone is found in very limited quantities in Puerto Rico, and the small deposits have never been commercially exploited.

CONCLUSION

For the humid mountain soils of Puerto Rico, the use of 165 kg/ha (180lbs/A) MgO is recommended for correcting magnesium deficiencies in plantains. Leaf-Mg values of 0.35% Mg at 11 months are associated with high yields of plantains.

SUMMARY

An experiment of levels of magnesium fertilizer on plantains was conducted on a Humatas clay at the Corozal Substation in the humid mountain region of Puerto Rico. Yields of plantains were sharply increased by the application of 165 kg/ha (180 lbs/A) MgO as compared to O and 55 kg/ha (60 lbs/A) MgO. Leaf-Mg value of 0.35% at 11 months was associated with the highest yields of plantains. Soil-Mg values did not show any relationship to MgO applications. It was suggested that a 10% MgO per ton of mix fertilizer be used for fertilizing plantains inasmuch as no local commercial source of dolomitic lime is available.

LITERATURE CITED

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Table 1

THE INFLUENCE OF MAGNESIUM APPLICATION ON PLANTAIN PRODUCTION, COROZAL SUBSTATION 1971-72

MgO applied Kg/ha (lbs/A)[1]	Number of plantains per ha. (acre)[2]	Quintals of plantains per ha. (cwt/A)[2]	Weight per plantain grams (lbs)
0	6,325 (2,530)	13.5 (15.4)	254 (0.56)
55 (60)	13,455 (5,382)	26.8 (30.4)	277 (0.61)
165 (120)	56,925 (22,770)**[3]	123.9 (140.8)**	281 (0.62)

[1] Numbers in parenthesis refer to units indicated in parenthesis in the column heading.

[2] Based on 3025 trees per hectare or 1210 trees per acre.

[3] ** Significantly different than other treatments at the 1% level.

Table 2

LEVELS OF SOIL AND LEAF MAGNESIUM ASSOCIATE WITH VARIOUS MAGNESIUM FERTILIZER APPLICATIONS

MgO Kg/ha (lbs/A)	Plant height, Cm	Leaf-Mg values, % dry weight for months after planting of: 4	8	11	Soil-Mg ppm
0	67.5	0.29	0.12	0.24	100
55 (60)	68.6	.28	.12	.24	75
165 (180)	94.0	.29	.21	.35	100