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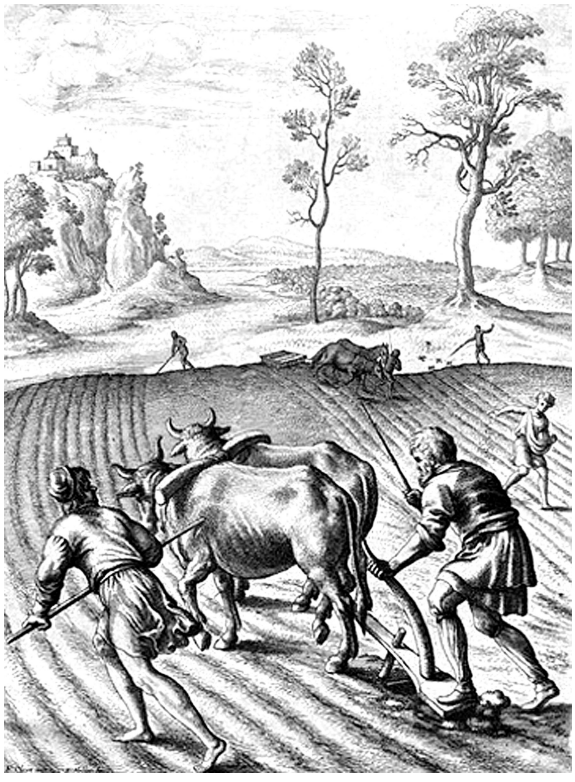

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Effects of Adding Compost to Fertilization Programs on 'Keitt' Mango

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Abstract: Studies were conducted in the Dominican Republic during two years on adult 'Keitt' mango (*Mangifera indica* L.) fields to examine the long-term effect of chemical and organic fertilization programs on marketable fruit yield. The treatments were (a) 1.8 kg 15-15-15 (N-P-K)/tree, once a year (b) 1.1 kg 15-15-15/tree, twice a year (c) 1.4 kg 15-15-15/tree, once a year (d) 1.8 kg 15-15-15/tree, once a year, plus 13.6 kg compost/tree (e) 1.1 kg 15-15-15/tree, twice a year, plus 13.6 kg compost/tree and (f) 1.4 kg 15-15-15/tree, once a year, plus 13.6 kg compost/tree. The results indicate that the application of 1.8 kg 15-15-15/tree, once a year, plus 13.6 kg compost/tree and 1.3 kg 15-15-15/tree, twice a year, plus 13.6 kg compost/tree improved marketable fruit number during both harvest years. The addition of compost for two years increased fruit number by averages of 17 and 24% in comparison with the same treatments without compost.

Key words: *Mangifera indica*, compost, soil nutrients, organic production

INTRODUCTION

Mango is one of the main fruit crops in tropical regions. The leading mango producers in the world are India (12,000 t), China (2,150 t), Mexico (1,550 t) and Thailand (1,250 t) (FAO, 2003). In the Caribbean and Central America, there is extraordinary potential for mango production, because of the environmental and edafic conditions within that subregion. Although, most of the mango imports in the United States come from Mexico, there are significant production areas concentrated in Hawaii and south Florida.

Fertilization is critical to obtain satisfactory mango yield. Recommendations for N supply indicate that 400 g N/plant/year are needed for acceptable commercial yields (Chia *et al*., 1988; Wanitprapha *et al*., 1991; Xiuchong *et al*., 2001). Crane and Campbell (1994) suggested that N amounts could be increased depending on tree size and site conditions. In sandy soils, current fertilization practices raise environmental concerns about rapid N leaching to ground waters. Therefore, the determination of appropriate N application regimes is critical to reduce production costs and increase mango yield.

It has been widely known that organic matter content improves nutrient retention. Composts are defined as organic matter that has undergone partial thermophilic and aerobic decomposition (Raviv, 2005). These materials have shown to be an important component in both conventional and organic crop production and contribute with waste recycling (Chong, 2005; Mikkelsen and Bruulsema, 2005). Its continuous use has shown to improve N supply by acting as a slow-release agent (Hartz, 2006; Raviv, 2005), organic matter content and water holding capacity (Litvany and Ozores-Hampton, 2002) and soil biological activity and physical properties (Garciay and Hernandez, 1997; Jordahl and Karlen, 1993). Cattle manure is considered to have moderate to excellent characteristics for composting and it is frequently used in fruit crops, such as citrus (Litvany and Ozores-Hampton, 2002; Raviv, 2005). However, there is scarce information about the combined effect of fertilization and compost on mango. Thus, the objective of this study was to examine the influence of chemical and organic fertilization programs on 'Keitt' mango yield.

MATERIALS AND METHODS

Field trials were conducted during 2000 and 2001 in a mango grower field located near Baní, Peravia, Dominican Republic. The soil at the experimental site was a sandy loam inceptisol with pH 6.2. Average yearly rainfall and temperature were 900 mm and 27.3°C, respectively. 'Keitt' mango trees were in their fourth year in the field and were planted 4 m between plants and 8 m between planting rows.

Six treatments were arranged in a split-plot design with four replications, where the chemical fertilization programs were the main plots and the application of organic fertilizer (compost) were the subplots. Three chemical fertilization programs were established as follows: (a) 1.8 kg 15-15-15 N-P-K applied once a year (b)

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1.4 kg 15-15-15 applied once a year and (c) 1.1 kg 15-15-15 applied twice a year. Compost levels were 0 and 13.5 kg tree^{-1}. Nutritional composition of the compost was 1.2, 0.9 and 2.1% N-P-K, respectively. Both fertilizer types were incorporated to the soil 60 cm around each plant. The application of 15-15-15 and compost occurred one month after the previous harvest. In the case of the treatments with two 15-15-15 applications, the second fertilization was accomplished five months after the first one. Other crop management practices, such as irrigation, tree pruning and harvest, followed local mango recommendations.

Mango fruits were harvested during two seasons and classified into marketable (fruits with no blemishes and at least 0.75 kg) and non-marketable. The influence of chemical and organic fertilization programs on marketable fruit yield was examined with analysis of variance ($p = 0.05$) and treatment means were separated with a Fisher's protected least significant difference (LSD) procedure (SAS, 2000).

RESULTS AND DISCUSSION

During both seasons, there were significant treatment effects on mango fruit yield. In 2000, the highest marketable fruit numbers were found with the application of either 1.8 kg 15-15-15/tree once a year or 1.1 kg 15-15-15/tree twice a year, in combination with 13.6 kg compost/tree (Table 1). These treatments had 85 and 83 fruits/tree, respectively. There was an average 17% yield reduction when the same 15-15-15 fertilization programs were used without compost. The two lowest mango marketable yields occurred with 1.4 kg 15-15-15/tree once a year, regardless of the addition of organic fertilizer.

The advantage of applying compost in combination with chemical fertilizer was also observed in 2001, where the treatments with organic fertilizer averaged approximately 19% more fruit yield than those without compost (Table 1). The highest mango marketable yields were obtained with 1.8 kg 15-15-15/tree once a year and 13.6 kg compost/tree and 1.1 kg 15-15-15/tree twice a year and 13.6 kg compost/tree, with 112 and 118 fruits/tree, respectively. These treatments were 24% higher than when no compost was applied. Similarly to the previous season, the lowest marketable mango yields were found with the two treatments with 1.4 kg 15-15-15/tree once a year.

Because the nutritional contribution of compost is low (0.16, 0.12 and 0.28 kg N-P-K/tree), it is unlikely that the observed sharp yield increases were due to these nutritional characteristics. In turn, these findings suggested that the beneficial effect of adding compost to regular chemical fertilization programs in mango could be caused by improved fertilizer retention in the soil and reduced leaching, thus increasing nutrient absorption, as suggested by previous studies (Hartz, 2006; Raviv, 2005). Further studies need to be conducted to characterize the nature of this response and to determine whether adding compost of mango has a long-term effect on microbial activity, organic matter content and fertilizer retention.

Table 1: Effect of chemical (15N-15P-15K) and organic (compost) fertilization programs on mango marketable yield. 2000 and 2001 seasons, Baní, Dominican Republic

Chemical fertilization (kg plant^{-1})	Frequency	Compost* (kg plant^{-1})	Mango yield** Fruit No./tree
2000			
1.8	Once a year	0	71b
1.4	Once a year	0	48d
1.1	Twice a year	0	68b
1.8	Once a year	13.6	85a
1.4	Once a year	13.6	58c
1.1	Twice a year	13.6	83a
2001			
1.8	Once a year	0	98b
1.4	Once a year	0	74d
1.1	Twice a year	0	88c
1.8	Once a year	13.6	112a
1.4	Once a year	13.6	79d
1.1	Twice a year	13.6	118a

*Compost composition: 1.2, 0.9 and 2.1% N-P-K, respectively. **Yield values separated within columns by Fisher's protected LSD test. Values with the same letter within columns do not differ at the 5% significance level within each year

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