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# STUDY ON MINERAL NUTRIENT IN MANGO ORCHARD IN IRAN

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## ABSTRACT

Area under mango is increasing each year in Iran but the basic information regarding the uptake of mineral nutrients and their concentration, by the mango plant are lacking. An experiment was carried out to determine concentration of mineral nutrients in leaf and fruit of mango and depletion of these nutrients by mango fruit from soil. Samples were collected from soil (0-30 and 30-60 cm), leaf (5-7 age month from upper, middle, lower of non-fruiting flush trees) and fruit (ripened) and analyzed for concentration of mineral nutrients and results are presented here.

**Keyword:** *Mangifera indica,* fruit, leaf, soil, nutrient loss.

## INTRODUCTION

Mango (*Mangifera indica* L.) is cultivated in Iran on an area of 1331 ha, with the total production of 13310 tones; production is mainly concentrated in Hormozgan, Sistan and Balouchistan. Nevertheless, in other countries, required concentration of mineral nutrients is determined in mango but the same is not done yet, in Iran. Soil testing as the basis for making fertilizer recommendations has limited applicability with fruit trees due to their specific root distribution, perennial habit, rootstock effects, differential fruiting (alternate bearing) and marked specific ion effects. Soil and leaf analysis should be complementary; however, leaf analysis is generally more useful (Bhargava and Chadha, 1988). Leaf is the center for physiological activity of plant. Besides being the site for production of carbohydrates in photosynthesis, leaf plays a vital role in metabolism of many other plant constituents. Nutrient deficiency and toxicity are usually expressed by the leaves. Nutrients absorbed in excess amounts generally accumulated in the leaves. Leaf also reflects the net effects of solidest, implications of root soil- interphases, translocation, antagonistic as well as protagonist effects and physiological conditions; thus, a leaf is an ideal plant part for nutrient diagnosis. Leaf nutrient concentration differs depending on age, position on branch, aspect, season (flushes), position in the canopy, cultivars, on off cycles, size of sample micronutrient spray, etc. Young and Koo (1971) reported that the age of the leaf for sampling should be in between fourth and seventh month. Rameshvar and Sultan (1981) suggested that nitrogen, phosphorous and potassium standards should be in the broad ranges of 1-1.2, 0.07- 0.10 and 0.60- 0.74% respectively. Kumar and Nauriyal (1977), however, reported some variation in the nitrogen, phosphorous and potassium levels of 5-12- month – old leaves from non- fruiting twigs.

Thakur et al. (1981) recommended that 6-7-month- old- leaves from the middle of non-fruiting shoots from any side and tree height were suitable for analysis. Chadha et al. (1980) also concluded that 6-7-month-old leaves from the middle of non-fruiting shoots sampled from all

directions and tree height were the most suitable for assessing nutritional concentration. Kumar and Nauriyal (1977) reported that 20-30 leaves randomly taken from all sides of a tree is an adequate sample size, although Rajput et al. (1985) recommended 30-40 leaves as the optimum sample should be taken from all directions and tree heights. Scientist recommended standard leaf nutrient content ranges for mature mango trees in different area in the world (Table 1 and 2). Bopaiah and Srivastava (1984) observed no significant correlation between soil and leaf nitrogen and potassium. However, they noted a significant correlation between available phosphorous in the deeper soil layer (60-90 cm) and leaf phosphorous. Dhillon et al. (1991) observed a significant correlation between leaf nitrogen and soil nitrogen at 0-30 and 30-60 cm depths. Therefore, an experiment with the aims to determine of mineral nutrients concentration in mango and mineral nutrition loss by mango fruit from soil was carried out in Iran.

## MATERIALS AND METHODS

Twenty mango trees, about 30-year-old, were used in this study. About 30 leaves sampled between sixth and seventh month were sampled from the middle of non-fruiting shoots from all directions and tree height randomly. Three fruit samples were taken from each tree. The samples were placed in polythene bags in icebox and transported from the orchard to the laboratory. Collected fruits and leaves were washed in a detergent solution, rinsed in water, washed in 0.6 M hydrochloric acid, and rinsed twice in distilled water. After washing, the fruits and leaves were weighed and oven dried for 72 h. Dried samples were ground in a cyclone mill. For nutrient determination, 0.2g of ground tissue was weighed and placed in a 100 ml digestion tube in which 2g of kjeldahl mixture and 5 ml $H_2SO_4$ were added. Glass funnels were placed on the tubes, and the tubes and funnels were placed on a preheated aluminum digestion block at 250ºC for 1 h. Then, concentrations of mineral nutrients (N, P, K, Ca, Fe, Mn, Cu and Zn in the leaves and N, P, K, pH, Brix, titratable acidity, sugar, wet and dry matter in the fruits) were analyzed. Soil sampled from depth 0-30, 30-60 cm was analyzed for EC, pH, %T.N.V, %O.C, total N, P, K, Ca, Mg, Cu, Mn, Fe and Zn.

## RESULTS

Mineral nutrient concentration in the leaf of mango, fruit quality analysis, soil analysis and analysis of mineral nutrients lost per 100 kg of mango fruit, are shown in table 4, 5, 6 and 7, respectively. Correlation test between soil samples (0-30 and 30-60 cm), leaf and fruit nitrogen, phosphorous and potassium showed a significant correlation between available phosphorous in the deep soil layer (30-60 cm) and leaf phosphorous ($P<0.01$), leaf phosphorous and fruit phosphorous ($P<0.01$), leaf nitrogen and fruit phosphorous ($P<0.01$) and the other case observed no significant correlation.

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## TABLES

**Table 1:** Range and mean of mineral nutrients in leaves of mango (cv. Dashehari)

| Mineral nutrients | Range | Mean |
|---|---|---|
| %N | 0.95-1.45 | 1.23 |
| %P | 0.04-0.12 | 0.06 |
| %K | 0.45-0.78 | 0.539 |
| %Ca | 1.16-2.3 | 1.71 |
| %Mg | 0.54-1.25 | 0.91 |
| %S | 0.064-0.156 | 0.121 |
| Zn(ppm) | 0-233 | 166 |
| Cu(ppm) | 1-33 | 12 |
| Mn(ppm) | 30-110 | 66 |
| Fe(ppm) | 67-333 | 171 |

**Table 2:** Standard leaf nutrient content ranges for mature mango trees in Australia and Florida

| Minéral nutrients | Australia | USA (Florida) |
|---|---|---|
| N (%) | 1-1.5 | 1-1.5 |
| P (%) | 0.08-0.18 | 0.09-0.18 |
| K (%) | 0.3-1.2 | 0.5-1 |
| Ca (%) | Acid soil(2-3.5)<br>Alkali soil(3-5) | 3-5 |
| Mg (%) | 0.2-0.4 | 0.15-0.47 |
| S (%) | 0.2-0.6 | - |
| B (ppm) | 70-200 | 24-54 |
| Fe (ppm) | 50-100 | 38-120 |
| Mn (ppm) | 60-500 | 92-182 |
| Zn (ppm) | 20-150 | 101-119 |
| Cu (ppm) | 10-20 | 28-35 |

**Table 3:** Suggested critical leaf nutrient concentrations for mango

| Mineral nutrients (%) | Smith and Scudder (1951) | Kumar and Naurial (1977) | Biswas et al. (1989) | Bhargava and Chadha (1988) |
|---|---|---|---|---|
| N | 1.54 | 1.0 | 1.23 | 1.18 |
| P | 0.05 | 0.1 | 0.06 | 0.08 |
| K | 0.97 | 0.5 | 0.54 | 0.52 |
| Ca | 0.91 | 1.5 | 0.71 | - |
| Mg | 0.26 | 0.15 | 0.91 | - |
| S | - | 0.5 | 0.12 | - |

**Table 6:** Range and mean of mango fruit chemical characteristics

| Trait | Range | Mean |
|---|---|---|
| pH | 3.35-5.04 | 3.92 |
| Brix (%) | 12.4-17.5 | 14.11 |
| Titratable acidity (%) | 0.23-1.86 | 0.95 |
| Sugar (%) | 7.23-15.5 | 9.68 |
| Wet (%) | 75.1-90.2 | 81.82 |
| Dry matter (%) | 9.8-24.9 | 18.18 |
| N (%) | 3.03-6.53 | 4.63 |
| P (%) | 0.33-0.91 | 0.55 |
| K (%) | 3.51-9.43 | 5.23 |
| Na (%) | 0.497-5.36 | 2.11 |

**Table 7:** Mineral nutrients loss per 100 kg mango fruit

| Mineral nutrients | N | P | K |
|---|---|---|---|
| Loss/100 kg fruit/year (kg) | 4.63 | 0.55 | 5.23 |