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INFLUENCE OF SOURCE OF N, P AND K ON ABSORPTION OF NUTRIENTS IN THE LEAVES OF MANGO CV. DUSEHRI

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ABSTRACT

Investigations were carried-out to study the effect of source of N, P and K on absorption of macro and micro-nutrients in the leaves of mango cv. Dusehri at PAU- Fruit Research Station, Gangian (Hoshiarpur). The sources viz Urea (2 and 4%), H₃PO₄ (1 and 2%) and KNO₃ (2 and 3%) were sprayed in the first fortnight of February during the years 1999 and 2000. The absorption of nutrients was studied before the start of foliar nutrition experiment and subsequently at the intervals of 72 and 168 hrs after the spray. Foliar feeding of these sources increased the leaf N, P and K contents. The rate of absorption of nutrients depends upon the concentration of nutrients used in the spray solution. Trees sprayed with urea and KNO₃ absorbed most of the N within 72 hrs. The higher doses of these chemicals helped the leaves to absorb more N. Maximum absorption of P was observed in trees received H₃PO₄ especially at 2 % concentration. With the increase in urea dose from 2 to 4 %, there was a gradual decline in the potassium content of the leaves within 168 hrs of spray. Higher K absorption was recorded after 72 hrs of the spray in plants treated with KNO₃ at 3 %. Depletion in leaf N, P and K content was noted after 72 hrs of spray due to the translocation of these nutrients to the developing organ sites within the plant system. Foliar spray of various nutrients drastically interfered the leaf Mg and Ca content. Application of urea at 2 and 4 % substantially increased Mg and Ca content in 168 hrs after spray, however; KNO₃ and H₃PO₄ treatments reduced these nutrients when compared with initial values. The level of micro-nutrients (Fe, Cu, Zn and Mn) in leaves did not vary significantly, except Fe content which was increased with the application of urea at 2 and 4 % as compared to the control.

Keywords: Urea, H₃PO₄, KNO₃, macro-nutrients, micro-nutrients.

INTRODUCTION

The nutrients play a vital role in fruit growth and development. Synthesis of metabolites is not all that it required but their translocation to other parts indicating the fruit is considered to be strongest sink for photosynthates and other metabolites. Foliar application of nutrients can supply essential elements directly to the foliage and fruits any time when rapid responses may be desired. Nitrogen controls the uptake of P and K and beyond a certain level of N, plants develop deficiency of K, but not P in “Langra” mango trees (Sen et al., 1947). The accumulation of K, Ca and Mg especially at higher concentration leads to Mn deficiency (Shear and Crane, 1953). Shim et al. (1972) noted that senescing apple leaves absorb 75% of the foliar applied urea at 5% solution within 24 hrs. The P concentration in apple leaves increased within 6 to 24 hrs after shoots were dipped in phosphate solution (Yogarathnam et al., 1981). The foliar application of urea enhanced the absorption of N, Ca and Mg within 24 hrs after spray in one year old “Starking Delicious” apples, whereas, leaf P and K contents decreased considerably. A similar promotive effect of urea on the absorption of nutrients by “Santa Rosa” plum on wild apricot rootstock was observed by Sharma et al. (1976). These observations prompted us to feed N, P and K nutrients through foliar application and study their effect on absorption of different nutrients in the leaves of mango cv. Dusehri.

MATERIALS AND METHODS

The present investigations were carried- out at Punjab Agricultural University (PAU)–Fruit Research Station, Gangian, during the years 1999 and 2000 on 25 years old plants of “Dusehri” mango. The place is situated at 31.32°N latitude and 75.57°E longitude. The nutrient chemicals like Urea (2 and 4%), H_3PO_4 (1 and 2%), KNO_3 (2 and 3%) and water spray (control) were applied during the panicle emergence (first fortnight of February). To determine nutrient status, the leaf samples were collected from middle of each shoot in February, before and after sprays at 3 and 7 days interval. Each sample consisted of 25-30 leaves taken at random from all sides of the plant and was put into paper bags. Samples were washed in running tap water, followed by rinsing in acidified deionized water and finally in deionized water. Leaves after drying in shade, were finally dried at 68°C in a hot air oven for 48 hrs. These were ground in stainless steel Willey Mill having 0.02 mm sieve. The ground samples were sealed in moisture proof butter paper bags for nutrients analysis.

For the estimation of N, 1 g of ground leaf sample was digested in 25 ml of concentrated H_2SO_4 alongwith digestion mixture and the total N in leaf samples was determined by Kjeldahl’s method. For the estimation of macro- nutrients including P and K, 0.5g of leaf sample was digested in 10 ml of HNO_3 and $HClO_4$ used in the ratio of 3:1. The value of total P in leaf samples was determined by Vanadomolybdo phosphoric yellow colour method (Chapman and Pratt, 1961), while total K and Ca were estimated by Flame Photometer (Model CL 26 D) and Cu, Zn, Fe, Mn and Mg were determined with Atomic Absorption Spectrophotometer.

RESULTS AND DISCUSSION

Effect of NPK on absorption of nutrients in leaves

Nitrogen

The results (Fig. 1a) reveal that foliar application of urea; H_3PO_4 and KNO_3 influenced the absorption of N by leaves at different intervals. Trees sprayed with urea and KNO_3 absorbed most of the N within 72 hrs, however, in case of H_3PO_4 treatment, foliar N content increased negligibly. After 72 hrs a gradual fall in leaves-N was noted that was higher under urea treatments. Higher doses of urea and KNO_3 increased foliar –N content more significantly as compared to control. Earlier studies too reported the absorbance of N from urea within 24 to 72 hrs after its application (Shim et al., 1972; Sharma et al., 1997a). In the present studies the foliar application of nutrients was given at active vegetative and panicle growth, which might have

resulted into faster translocation of absorbed N to these organs. Rosecrane et al. (1998) supported these findings.

Phosphorus

The maximum absorption of P was observed in trees sprayed with H_3PO_4 , especially at higher concentrations (Fig. 1b). However, the P content in leaves decreased with urea application. The urea application also decreased the P content within 72 hrs in “Santa Rosa” plum (Sharma et al., 1997b) the leaves assimilate foliar applied P within 6 to 48 hrs (Yogaratnam et al., 1981). The decline in leaf-P content after rapid absorption was due to earlier translocation to other perennial tree parts (Narwadkar and Pandey, 1989). The level of P in leaves sprayed with H_3PO_4 at 1 and 2% declines within 168 hrs after spray.

Potassium

The enhanced application of urea from 2 to 4% significantly reduced the foliar-K content after 168 hrs (Fig. 1c). After 72 hrs, plants treated with KNO_3 at 2 and 3% absorbed maximum K. Leaf K content in KNO_3 treated trees decreased after 168 hrs except with KNO_3 at 3% during 2000, but the level of Leaf-K was higher than other treatments. During 2000, before spray, leaf-K was higher in KNO_3 at 3% treated leaves, hence this might be the reason of lower absorption after 72 hrs and thereafter it showed an increase in leaf-K content within 168 hrs. The spray of urea decreased the leaf-K within 72 hours in apple and plums leaves (Sharma et al., 1977 a, b). Leaves absorbed higher K within 24 to 72 hrs after the spray of various potassium compounds (Sulladmath and Singh, 1982).

Calcium and magnesium

The foliar spray of various nutrients significantly affects the Ca and Mg (Figs. 2a and b) contents in mango leaves. Application of urea at 2 or 4% significantly increased the leaf-Ca and Mg content within 168 hrs after various treatments; however, KNO_3 and H_3PO_4 treatments reduced leaf Mg and Ca contents as compared to initial levels i.e. before spray. Malhi (1982) observed that high N level increased the absorption of Ca and Mg content in mango leaves. The level of Ca and Mg content in arial parts of the plants was increased due to synergistic effect of N with Ca and Mg (Sharma et al., 1997 a & b).

Micro-nutrients

Various treatments at N, P and K sources did not show a significant effect on leaf-Fe, Mn, Cu and Zn contents (Figs. 2c, 3a, b and c). Foliar application of urea at 2 and 4% increased the absorption of micro-nutrients, except in case of Fe during 2000. In 2000, the level of leaf-Fe decreased after 168 hrs with foliar spray of urea. Possibly urea increased the vegetative growth which caused the dilution effect, this lower values of Fe were recorded during subsequent sampling. However, the values were above the optimum level under all the treatments in both the years. Mn also ranged between the optimum levels due to better Fe uptake, thus leaf-Mn content remained on the lower side. Level of Cu in 1999 touched the lowest level with urea 4%, although it was in the satisfactory range. Leaf- Zn content was found to be lower in plants treated with KNO_3 and higher in H_3PO_4 treatments. This low Zn level might be due to the presence of higher amount of Ca that in turn reduces the retention of Zn by the leaves (Labanaskas et al., 1958).

CONCLUSION

Foliar application of urea, H_3PO_4 and KNO_3 increased N, P and N and K status of leaves, respectively. Increase in foliar Mg and Ca content was observed with urea treatments, while leaf Ca was decreased with KNO_3 treatments. The level of micro- nutrients (Fe, Cu, Zn and Mn) in leaves did not vary significantly, except Fe content that increased with urea (2 and 4%) as compared to the control.

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FIGURES

◆ Urea 2% ■ Urea 4% ▲ H3PO4 1%
× H3PO4 2% ✱ KNO3 2% ● KNO3 3%
+ Control

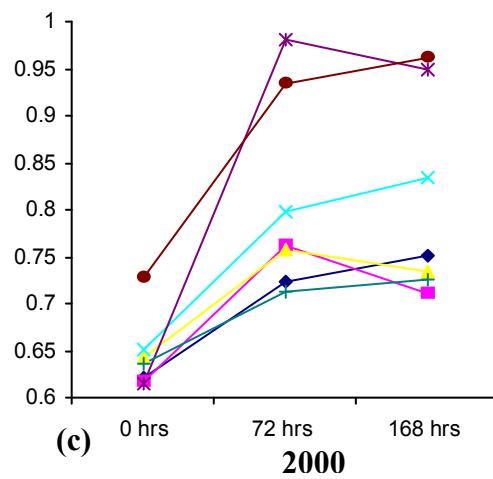
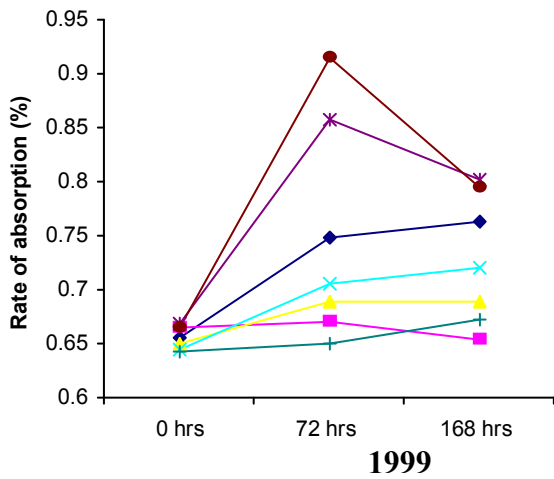
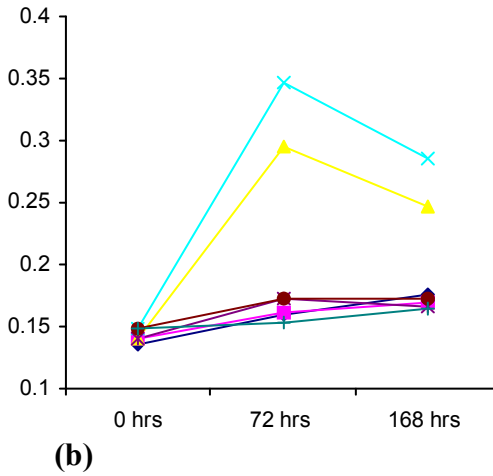
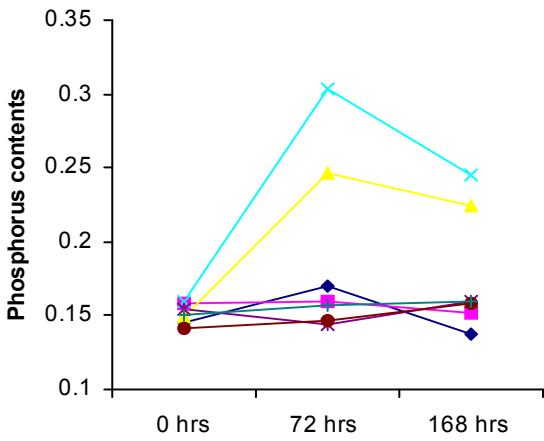
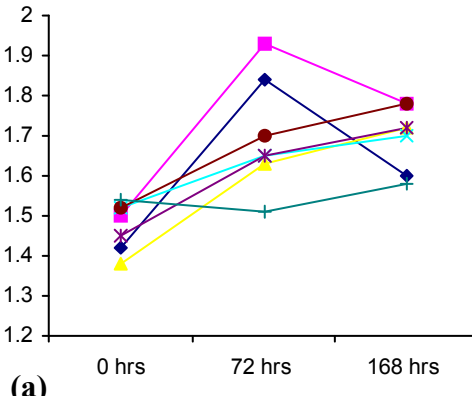
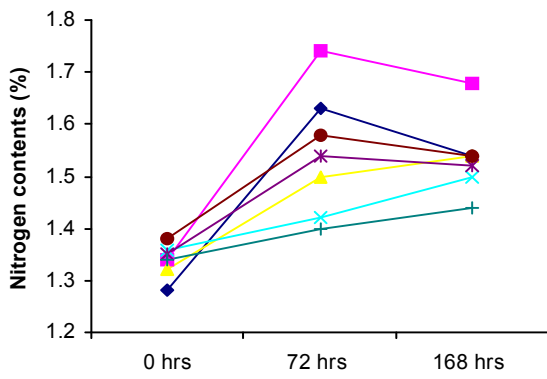


Figure 1: Effect of foliar application of nutrients on absorption of (a) nitrogen (b) phosphorus and (c) potassium at different intervals in mango cv. Dusehri.

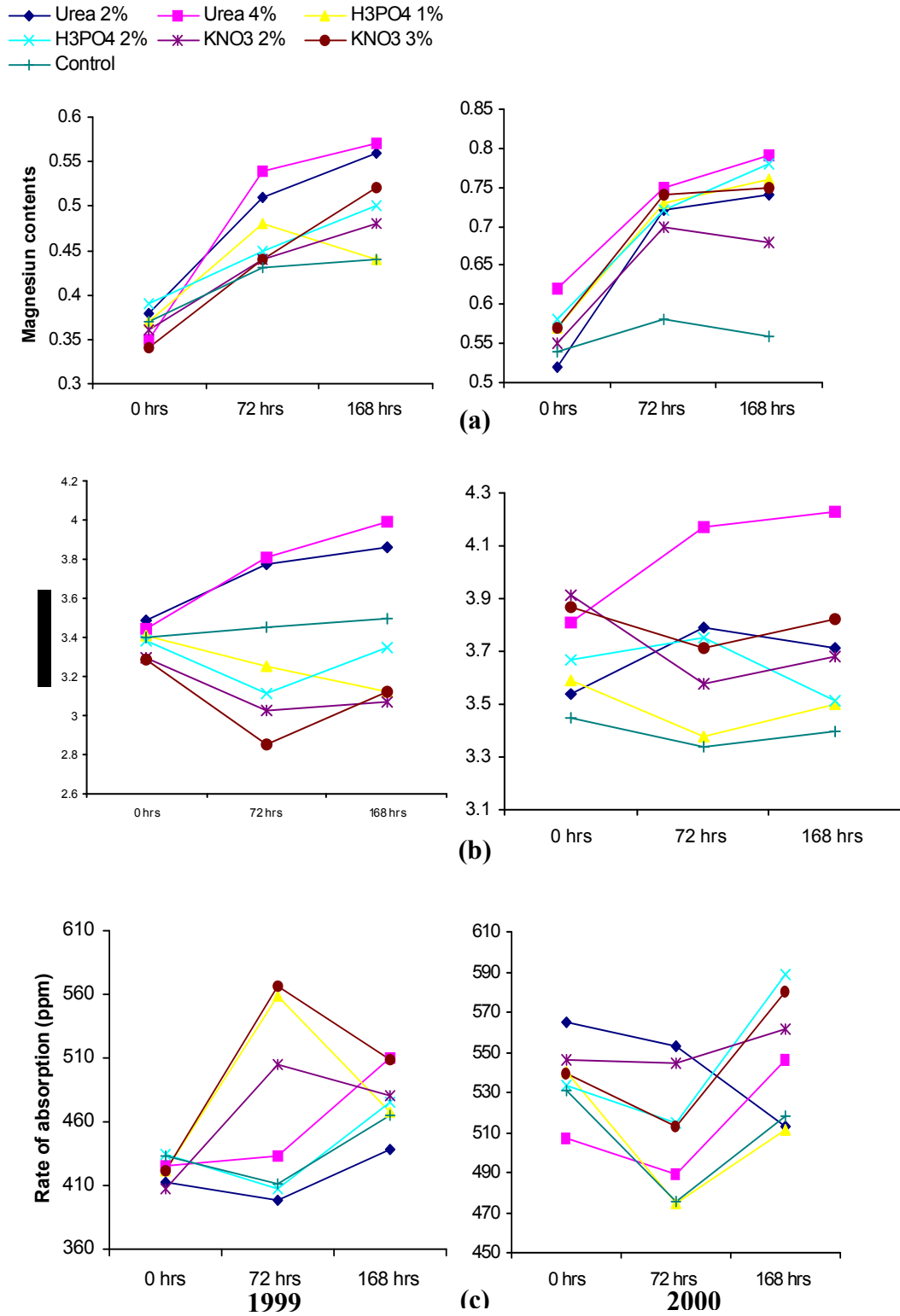


Figure 2: Effect of foliar application of nutrients on absorption of (a) magnesium (b) calcium and (c) iron at different intervals in mango cv. Dusehri.

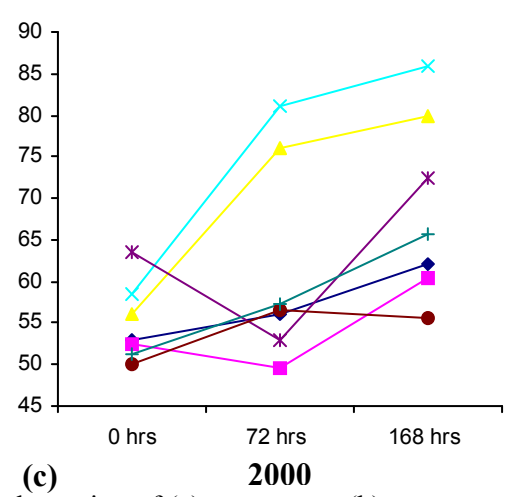
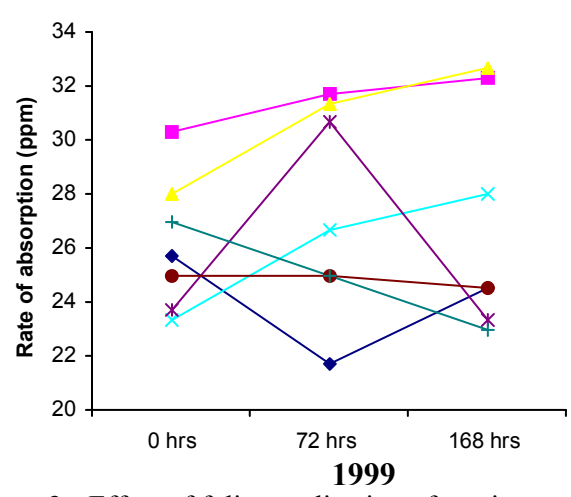
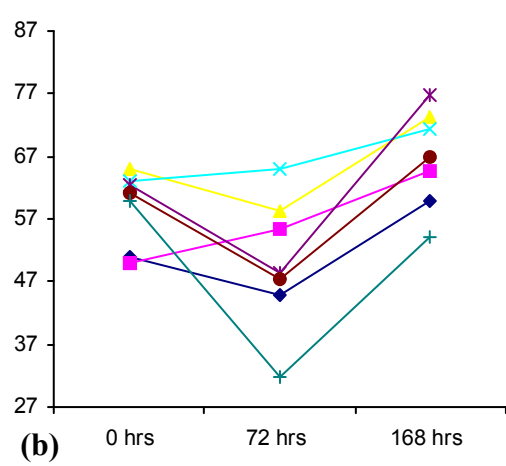
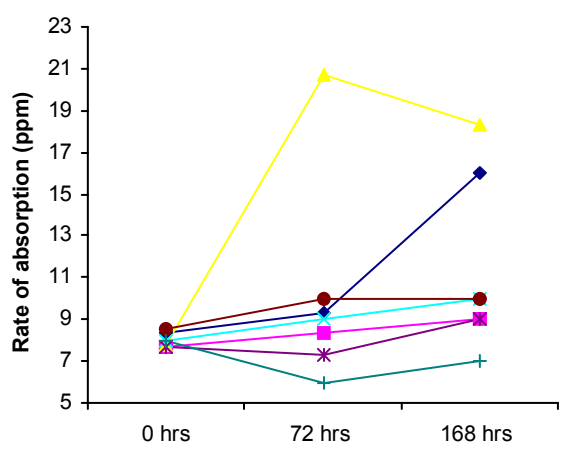
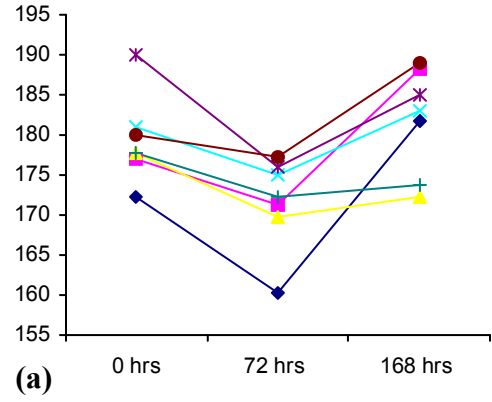
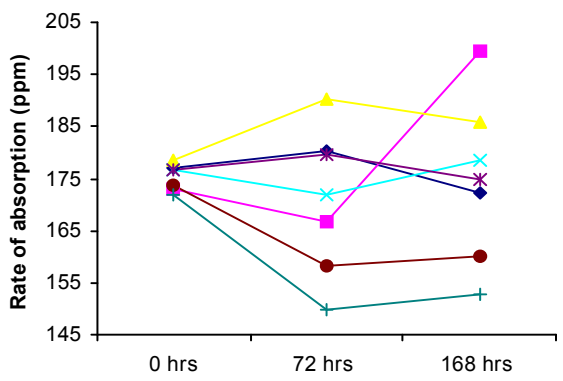
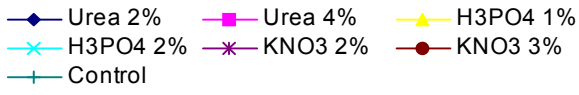


Figure 3: Effect of foliar application of nutrients on absorption of (a) manganese (b) copper and (c) zinc at different intervals in mango cv. Dusehri.