Effect of some nutrient elements on nutritional and physiological status of mango plants

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V. SUMMARY AND CONCLUSIONThis work was conducted on 6-month-old potted mango seedlings Hindi Bi-Sinera (cv.) in the greenhouse of the Plant Res. Dept., Nuclear Res. Center, Atomic Energy Authority at Inshas region, Sharkia Governorate. It aimed to investigate effect of some nutrient elements on plant growth, nutritional andphysiological status of mango plants.In this regard, vegetative growth, dry matter accumulation, leaf chlorophyll content, stem total carbohydrates content and nutritional status ”N, P, K and Mn” of mango seedlings were studied. Moreover, radioactive isotope of manganese (Mn-54) was used to study foliar absorption, translocation, distribution and utilization of Mn in combination with P soil application.This study was achieved through four potted experiments during 2003 and 2004 seasons as follows:V.1.Experiment, I: Effect of N and/or Mn soil aookued rates on plant growth, nutritional and physiologicalstatus of mango seedlings :In this experiment, 16 treatments represented the various combinations between 4 rates of N (0.0, 50, 100 and 200 ppm) in the form of (NH4)2SO4 and 4 rates of Mn (0.0, 5, 10 and 20 ppm) as MnSO4 were soil applied to mango seedlings grown in plastic containers filled with 10 kg of sandy clay loam soil.V.2.Experiment, II: Effect of P and/or Mn soil applied rates on plant growth, nutritional and physiologicalstatus of mango seedlings :This experiment was carried out using 4 rates of P (0.0, 25, 50 and 100 ppm) in the form of KH2PO4 in combination with 4 rates of Mn (0.0, 5, 10 and 20 ppm) as MnSO4. These 16 fertilization treatments (4 Px4 Mn) were soil applied to mango seedlings grown in plastic containers filled with 10 kg of sandy clay loamsoil.V.3. Experiment, III : Effect of P soil applied rates in combination with Mn foliar application on plantgrowth, nutritional and physiological status of mango seedlings :In this experiment, 4 rates of P (0.0, 25, 50 and 100 ppm) as soil application in combination with 4 rates of Mn (0.0, 0.125,0.25 and 0.50%) as spraying were applied to mango seedlings as previously mentioned in 1St and 2?d experiments.V.4. Experiment IV: Foliar absorption, translocation, distribution and utilization of Mn-54 by mangoseedlings as influenced by both Mn foliar and P soil application rates :In this study, three rates of Mn (0.125, 0.25 and 0.50%) solutions were prepared using MnSO4 which foliar applied in combination with 4 rates of P (0.0, 25, 50 and 100 ppm) as soil application. Manganese solutions were prepared using MnSO4, pH value was adjusted to 6.0 and Tween — 20 at 0.5% (v/v) was added as surfactant agent. These solutions were labeled with Mn-54 carrier - free to give 250 000, 500 000 and 1000 000 cpm (count/min.) for Mn at 0.125, 0.25 and 0.50%, respectively.Generally, it can be noticed that these four factorial experiments were conducted under greenhouse conditions. Acomplete randomized block design was employed for arranging the treatments of each experiment. Recommended rates of P and K fertilizers were added to mango seedlings of the 1st experiment, N and K fertilizers were added to those of 2nd and 3rd experiments, and N, P and K fertilizers to those of 4th experiment. Normal agricultural practices were also carried out during twoseasons (2003 & 2004) of this study. The important results obtained could be summarized as follows:V.1. Experiment, I :? Soil application of N and / or Mn to mango seedlings considerably and significantly stimulated plant growth causing a great increase in leaves number / plant, plantheight, stem thickness, leaf area and assimilation area. These growth parameters were positively related to the rate of N or Mn fertilizers. Moreover, combination treatments, particularly 200 ppm Nx20 ppm Mn, were more effective than single treatments of both

in this concern.?Application of N and / or Mn, in particular at 200 ppm N and 20 ppm Mn, to mango seedlings significantly increased leaf area and assimilation area, but increasing rate was more pronounced with N than with Mn. Moreover, combined treatments of N and Mn were more effective than their single treatments in this concern.?Dry matter accumulation of different plant organs was positively responded to fertilization rates of N or Mn. Highest increase in dry weight of leaves, stems and roots was occurred at 200 ppm N (33-67% over control) and at 20 ppm Mn (37-57%). Moreover, their combination ”200 ppm Nx20 ppm Mn” increased total dry weightof whole plant by 116 — 120% over the control. However, top / root ratio was slightly affected by N and / or Mn soil application.?Leaf content of chlorophyll (a & b) was markedly increased by supplying mango seedlings with N and / or Mn and this increase was related to the rate of both nutrients but the beneficial effect of N was more than that of Mn. In addition, combinations of them seemed to be more effective than single treatments of N or Mn.?Total carbohydrates in mango stern as affected by N and / or Mn followed the same trend of leaf chlorophyll content which was closely related to these pigments.?Supplying mango seedlings with N and / or Mn fertilizers, in particular at 200 ppm N or 20 ppm Mn, markedly and significantly encouraged N uptake which increased its levels in different plant organs. Maximum increases in N levels of leaves, stem and roots were obtained bycombined treatment of 200 ppm Nx20 ppm Mn. Respose of plant N level was more pronounced to N fertilizer than to Mn treatments.?Phosphorus level in various organs tended to decline due to N rates, particularly at 100and 200 ppm N, whereas Mn addition, in particular at 20 ppm, increased P levels in mango leaves, stem and roots. Generally, P levels in mango seedlings exhibited slight response to N and Mn treatments.?Potassium content in leaves, stem and roots of mango seedlings was gradually decreased by increasing application rate of N up to 200 ppm. The reverse trend could be observed with Mn supplying where K levels in plant organs were gradually increased as the rate of Mn raised up to 20 ppm.?Decreases in P and K levels of mango seedlings due to soil application of N, particularly at 100 and 200 ppm, could be attributed to dilution effect on plant P and k where N fertilizer at 100or 200 ppm greatly stimulated plant growth and in turn increased dry matter yield of fertilized plants.?Manganese levels in various organs were positively related to soil application rate of N and Mn with two peaks at 200 ppm N or 20 ppm Mn, but response rate due to 20 ppm Mn was more than 6 times as much as that of 200 ppm N. Moreover, combined treatment of them ”200 ppm Nx20 ppm Mn” greatly increased plant Mn level more than that of each one suggesting the possibility of interaction or additive effect of both. In general, Mn levels in different organs of mango seedlings supplied with 20 ppm Mn were about 2.0 — 2.5 times as much as those of control ”no fertilizers”.V.2. Experiment, II :?Vegetative growth measurements, i.e. leaves number, plant height, stem thickness, leaf area and assimilation area of mango seedlings were significantly increased by soil application of P and / or Mn. Moreover, increasing rates of them were positively related to fertilization rate of P or Mn where highest increase was obtained by combined treatment of (100 ppm Px20 ppm Mn) followed by 100 ppm P and 20 ppm Mn.?Soil application of P and / or Mn to mango seedlings markedly stimulated dry matter accumulation which in turn significantly increased dry weight of different plant organs, i.e. leaves, stems and roots. Highest increase in dry weight was observed with leaves followed by roots and then by sterns. Maximum accumulation of dry matter of the whole plant was produced due to ”100 ppm Px20 ppm Mn” for combined treatments, 100 ppm P for single treatments of P and 20 ppm Mn for single treatments of it.?Top / root ratio of mango seedlings was increased by increasing P up to 50 ppm or Mn up to 10 ppm, then it was declined with high rate of P and Mn. Average of top / root ratio was decreased significantly by P at 50 and 100 ppm, whereas it was increased significantly by Mn at 5 and 10 ppm.?Leaf content of chlorophyll ”a” and ”b” was increased significantly due to P and / or Mn addition, but increasing of chlorophyll ”b” was more pronounced than that of chlorophyll ”a”.?Total carbohydrates content in stein was markedly and significantly increased by supplying mango seedlings with P and / or Mn and this increase was highly related to application rate of both nutrients. However, beneficial effect of P on total carbohydrates was more than that of Mn.?Nitrogen content (%) in different plant organs was gradually increased as application rate of P and Mn raised, however the rate of increase of N % in stem and roots due to P fertilizer was more pronounced than that of Mn. Moreover, plant N levels were markedly increased as a result of combined treatment of ”100 ppm Px20 ppm Mn” where this

increase ranged from 15-35% over the control depending on plant organ.?Soil application of P to mango seedlings remarkably and significantly increased P levels in different organs and these increases were positively correlated to rate of P fertilizer. Similar trends were also occurred with Mn application but with different magnitude. Furthermore, combined treatments, particularly 100 ppm Px20 ppm Mn, were more effective on plant P content than single element of P or Mn.?Plant K content (%) was positively related to soil application rate of P or Mn with highest value at 100 ppm for P and at 20 ppm for Mn, but increasing rate as a result of P was higher than that of Mn. In addition, P at 100 ppm in combination with 20 ppm Mn resulted in a maximum value of K in different plant organs.?Manganese content (ppm) in various organs of mango seedlings was gradually and significantly increased by increasing soil application rate of P or Mn. But increasing rate of plant Mn due to its addition was more pronounced than that of P. Moreover, combined treatment of 100 ppm Px20 ppm Mn is considered the most effective one for increasing Mn levels in different plant organs but with different magnitude.V.3. Experiment, III :?Growth of mango seedlings was greatly encouraged by soil application of P and / or spraying with Mn where leaves number, plant height, stem thickness, leaf area and assimilation area were increased significantly. Phosphorus at 100 ppm x0.5% Mn was the effective treatment for combined treatments and P at 100 ppm and Mn at 0.5% were effective rates for single treatments of both.In addition, highest response to the used treatments was occurred with assimilation area followed by leaves number, stem thickness, leaf area and plant height.?Dry matter production of mango seedlings was positively responded to soil application of P and / or spraying with Mn. Dry weight of leaves stems, roots and consequently the whole plant was significantly and gradually increased as rates of P or Mn raised. Combined treatments, particularly ”100 ppm P x0.5% Mn” were more effective than single element in this concern. Moreover, leaves dry weight exhibited the highest response to P and / or Mn followed by roots and then by sterns.?Top / root ratio of mango seedlings as affected by P and / or Mn was changed slightly where its average was not significantly affected at Mn rates. But significant decrease was occurred at 50 and 100 ppm of P.?Leaf content of chlorophyll ”a” and ”b” was positively responded to soil application of P and / or spraying with Mn. Most effective treatments were 50 ppm P, 0.5% Mn and their combination. Response of chlorophyll ”b” to the used treatments was more pronounced than chlorophyll?Total carbohydrates content in mango stem was considerably and significantly increased by soil addition of P and / or spraying with Mn. Level of it was gradually increased as rates of P and / or Mn raised where highestlevel (%) was obtained by ”100 ppm Px0.5 % Mn” followed by 100 ppm P and then by 0.5% Mn.?Mango seedlings supplied with P as soil application and / or sprayed with Mn solutions contained more N in their different organs, comparing to control, with highest values at 100 ppm P or at 0.5% Mn. Interaction between P and Mn significant effect on N levels, where combined treatments, particularly 100 ppm P and 0.5% Mn, increased plant N level more than single element of both nutrients.?Soil application of P to mango seedlings markedly and significantly increased its content in different organs of plant and plant P level was positively related to application rate of it. Spraying with Mn, in particular at 0.5%, caused significant increase in plant P level, but rate of increase due to P fertilization was more than that of Mn.?Potassium content (%) in mango seedlings was increased significantly by increasing soil application rate of P and / or spraying rate of Mn, where highest K levels were occurred at 100 ppm P or at 0.5% Mn. Moreover, combined treatments, in particular 100 ppm Px0.5% Mn, increased plant K % in different organs more than single element of both nutrients.?Spraying mango seedlings with Mn solutions greatly and significantly increased its level in different plant organs reaching maximum increase at 0.5% Mn where plants sprayed with it contained more Mn ranged from 2.2 to 2.5 times as much as that of control. Similar trend was also obtained with P fertilization as far as Mn levels in different plant organs were concerned, but increasing rate of Mn due to P was lower than that of Mn spraying. In addition, interaction between P and Mn application had significant effect on plant Mn content where combined treatments, particularly 100 ppm Px0.5% Mn, were more effective on plant Mn than single element of P or Mn.V.4. Experiment, IV:?Total absorption of labeled manganese (Mn — 54) was gradually and significantly increased by increasing Mn rate in spraying solutions through the used rates ”0.125, 0.25 and 0.50% Mn”.?Retained Mn-54 in the sprayed leaves was highly related and was proportional to total absorption of it which represented about 81%

of its total absorption.?Increasing soil application rate of P ”25, 50 and 100 ppm” caused a gradual and significant increase in the total absorption of Mn-54 and it’s retained in treated leaves. But increasing rate of total absorption of Mn- 54 and its retained due to raising Mn rate in spraying solutions was more pronounced than that of P.?Translocation of absorbed Mn-54 within mango seedlings in both upward and downward directions was positively responded to Mn rate in spraying solutions and soil application rate of P. Also, translocation of Mn-54 in both directions was highly related to total absorption of it.?Upward translocation of absorbed Mn-54 was higher than downward direction, where the former ranged from 10.78 — 11.77% and the latter ranged from 7.63 — 8.12 of the total absorption of it.?In spite of foliar absorption of Mn-54 by mango leaves was greatly and significantly increased by raising Mn rate in spraying solutions, utilization percent of it was gradually and significantly declined where its average were 15.39, 11.95 and 8.50% for Mn rates at 0.125, 0.25 and 0.5%, respectively.?Soil application of P increased utilization percent of Mn-54 and the beneficial effect of P on Mn absorption was more pronounced with low rate of Mn”0.125%”, whereas this effect was declined as Mn rate increased.General conclusion :?Supplying mango plants with optimum rate of essential elements, in particular their combinations, markedly improved nutritional and physiological status of the treated plant.?from nutritional point of view, foliar application of most nutrients, particularly micronutrients, is considered successful method for supplying or correcting nutrients deficiency in fruit plants within a few days, maximizing the efficiency of application and minimizing the accumulation of elements as pollutants in the soil.?It could be recommended to the nersery men that application of three investigated nutrient elements i.e. N, P (soil applied) and Mn (soil/foliar application) were so beneficial for inducing standard mango transplant for being used as rootstook for (budding/grafting).?The two higher rates especially later one of each investigated fertilizer element were the most desired mean for achiving the above mentioned purposes.?Using radioactive isotopes of some nutrients, as a tracer technical, is considered the merely method for estimating the efficiency of fertilization with different applied nutrients to fruit plants.