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Effect of Soil and Foliar Application of Multi Micronutrients on Fruit Yield and Physical Parameters of Fruit of Mango (*Mangifera indica* L.) var. Amrapali

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A B S T R A C T

The present investigation was carried out at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during the year 2014-15to study the effect of soil and foliar application of multi micronutrients on fruit yield and physical parameters of fruits of mango (*Mangifera indica* L.) var. Amrapali. The experiment was laid out in Randomized Block Design with factorial concept with three levels of soil application viz., S_1 (control), S_2 (200 g/tree multi micronutrient Grade-V) and S_3 (400 g/tree multi micronutrient Grade-V) and three level of foliar application *viz.*, F_1 (control), F_2 (1% Spray of multi micronutrient Grade-IV) and F_3 (2% Spray of multi micronutrient Grade-IV) and replicated thrice. Multi micronutrients were sprayed at three stages *i.e.*at flower bud initiation, at full bloom stage and at pea stage. In present investigation significantly maximum fruit weight (186.38 g), fruit volume (162.86 cc), numbers of fruits per tree (353.00), fruit yield of fruits per tree (62.99 kg), fruit yield per hectare (9.84 tonne) and fruit retention per panicle (4.00) were recorded under the treatment F_2 (1% spray of multi micronutrient Grade-IV).

Introduction

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae. Among the various varieties of mango Amrapali is the better in taste, appearance and colour and boon for the farmers due to its dwarf nature. Iron is necessary for many enzymatic functions and acts as a catalyst for the synthesis of chlorophyll, protein and regulates the respiration. It is essential for the development of young growing parts of the plant. Manganese (Mn) is regarded as an activator of many different enzymatic reactions and takes part in photosynthesis. Manganese activates decarboxylase and dehydrogenase and is a constituent of complex PSII-protein, SOD and phosphatase. It plays an important role in carbohydrate metabolism, protein synthesis and internodes elongation. Its deficiency produces small and narrow leaves, shorter shoot internodes and terminal dieback (Ryugo, 1988).

Copper is essential for plant growth and activation of many enzymes. A copper deficiency interferes with protein synthesis and causes a build-up of soluble nitrogen compounds. Boron deficiencies are mainly found in acid soils, sandy soils in regions of

high rainfall or under irrigation and those soils with low soil organic matter (Brown *et al.,* 1995).

Materials and Methods

The experiment was conducted at Horticultural Research Farm and P. G. Laboratory, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during *Rabi-Summer* season of the year 2014-15. There were nine treatments embedded in Randomized Block Design with factorial concept replicated thrice with two trees selected per treatment. Fifty four uniform size tree of mango var. Amrapali were selected and laid out in Randomized Block Design with factorial concept with three levels of soil application viz., S_1 (control), S_2 (200 g/tree multi micronutrient Grade-V) and S_3 (400 g/tree multi micronutrient Grade-V) and three level of foliar application *viz.,* F_1 (control), F_2 (1% Spray of multi micronutrient Grade-IV) and F_3 (2% Spray of multi micronutrient Grade-IV).

There were nine treatments combinations, 3 of soil applications and 3 of foliar applications of multi micronutrients. In Grade IV available nutrients in percent 4.0 (Fe), 1.0 (Mn), 6.0 (Zn), 0.5 (Cu), 0.5 (B) and in Grade V available nutrients in percent 2.0 (Fe), 0.5 (Mn), 5.0 (Zn), 0.2 (Cu), 0.5 (B). Multi micronutrients were sprayed at three stages i.e.at flower bud initiation (26th January, 2015), at full bloom stage (15 February, 2015) and at pea stage (5th March, 2015) whereas soil application of multi micronutrients was done on 12th March 2015. In yield parameters, number of fruits retention per panicle was worked out on the basis of number of mature fruits retained per panicle, number of fruits were recorded from fruit setting to fruit maturity stage from tagged panicle in four side of the canopy and their average value was worked out and the fruits harvested from each tree were weighted in kilogram during all the harvesting and then sum up and expressed as yield per tree (kg) and (tonne per hectare). Then mature (tapka stage) and uniform sized fruits were harvested from the respective trees and observations was recorded regarding the physical parameters of the fruits *i.e.* fruit weight, fruit volume and fruit diameter.

Results and Discussion

The results obtained from the present investigation were conducted on the effect of soil and foliar application of multi micronutrientsinfluenced on yield and physical parameters of mango fruit are presented in Table 1.

The effect of soil application was found non-significant on retention of fruits per panicle and different levels of foliar application of micronutrients created their significant effect on retention of fruits per panicle. Significantly the highest retention of fruits per panicle (4.00) was observed in treatment F_2 (1% spray of multi micronutrient Grade-IV). It is might be due toboron which play important role in pollen germination and pollen tube growth which is associated with better pollination, fertilization and fruit setting (Thompson and Batjer, 1950). Application of zinc would have promoted the auxin synthesis in the plant system which might delayed the formation of abscission layer during early stage of fruit development (Nason and McElroy, 1963). The results were also in accordance with the findings of Dutta (2004), Bhowmick and Banik (2011) and Bhowmick *et al.,* (2012) in mango and Gaur *et al.,* (2014), Jat and Kacha (2014) in guava and Chandra and Singh (2015) in aonla. The interaction effect between soil and foliar application was found non-significant on retention of fruits per panicle.

The effect of soil application was found non-significant influenced on fruit weight and different levels of foliar application of multi micronutrients manifested their significant influence on fruit weight. Treatment F_2 (1% spray of multi micronutrient Grade-IV) gave the maximum fruit weight (186.38 g).). Increased in fruit weight might be due to the zinc which plays a vital role to promote starch formation, iron required for cell enlargement and cell division and boron actively involved in transportation of carbohydrates in plants. Thus, the cumulative effect of combined treatment of Fe + Mn + Zn + Cu + B might have resulted in higher fruit weight. The other possible reason for increase in fruit weight by the micronutrients might be due to faster loading and mobilization of photo assimilates to fruits and involvement in cell division and cell expansion which ultimately reflected into higher weight of fruit in treated plants. Similar results were also found by Dutta (2004), Vashistha *et al.,* (2010), Nehete *et al.,* (2011), Singh and Varma (2011) and Bhatt *et al.,* (2012) in mango and Chandra and Singh (2015) in aonla. While, interaction effect of soil and foliar application on fruit weight were found to be non-significant.

A perusal of data (Table 1) revealed that different level of soil application was found non-significant with respect to fruit volume. The significant variation in fruit volume due to foliar application was found. Whereas, in foliar application of multi micronutrients the highest fruit volume (162.86 cc) was registered with 1% spray of multi micronutrient Grade-IV (F_2). The increase in fruit volume with the spray of boron might be due to its involvement in hormonal metabolism which increased cell division and expansion of cell. The involvement of zinc directly in growth and boron is stimulate rapid mobilization of water and sugar in the fruit. Similar results were obtained by Bhatt *et al.,* (2012) in mango, Yadav *et al.,* (2013) in peach and Chandra and Singh (2015) in aonla and interaction effect of soil and foliar application on fruit volume was found to be non-significant.

Table.1 Effect of soil and foliar application of multi micronutrient on fruit retention, fruit weight, fruit volume, fruit diameter, number of fruit per tree and fruit yield of mango var. Amrapali

Sr. no.	Treatments	Fruit retention (Number/ panicle)	Fruit weight (g)	Fruit Volume (cc)	Fruit diameter (cm)	Number of fruits per tree	Fruit yield	
							Kg/tree	Tonne/ha
Soil application (S)								
S_1	Control	3.38	168.81	143.83	6.04	318.01	52.08	8.13
S_2	200 g/tree multi micronutrient (Grade-V)	3.47	170.41	146.57	6.07	324.94	54.06	8.44
S_3	400 g/tree multi micronutrient (Grade-V)	3.51	173.03	147.70	6.08	327.22	56.04	8.75
S.Em. ±		0.13	6.90	5.49	0.19	12.70	2.39	0.37
C.D. at 5%		NS	NS	NS	NS	NS	NS	NS
Foliar application (F)								
F_1	Control	2.98	155.12	129.66	5.69	295.92	45.05	7.03
F_2	1% Spray of multi micronutrient (Grade-IV)	4.00	186.38	162.86	6.43	353.00	62.99	9.84
F_3	2% Spray of multi micronutrient (Grade-IV)	3.38	170.75	145.59	6.06	321.25	54.15	8.46
S.Em. ±		0.13	6.90	5.49	0.19	12.70	2.39	0.37
C.D. at 5%		0.41	20.70	16.46	NS	38.10	7.17	1.12
S × F interaction								
S.Em.±		0.24	11.96	9.51	0.34	22.01	4.14	0.64
C.D. at 5%		NS	NS	NS	NS	NS	NS	NS
C.V. %		12.06	12.13	11.28	9.71	11.78	13.26	13.26

The perusal of data (Table 1) revealed that different levels of multi micronutrients of through soil and foliar application were unable to create any significant influence on diameter of fruit and the interaction between soil and foliar application was found also non-significant with respect to fruit diameter.

The effect of soil application was found non-significant influenced on numbers of fruits per tree and different levels of foliar application created their significant effect on number of fruits per tree. Significantly the highest number of fruits per tree (353.00) was observed in treatment F_2 (1% spray of multi micronutrient Grade-IV). It is might be due to an application of Zn, Fe and B. When micronutrients sprayed alone or in combination involved directly in various physiological processes and enzymatic activity for higher accumulation of food materials and thus, ultimately increased yield. Zinc responsible for auxin synthesis and boron involved in translocation of starch to fruit resulted into better photosynthesis and accumulation of starch in fruits. The balance of auxin in plant also regulates the fruits drop or retention in plants, which ultimately increased the total number of fruits per tree. The role of boron is also reported in fruit setting, which ultimately increase the number of fruits per tree (Thompson and Batjer, 1950). Whereas, the interaction effect between soil and foliar application on number of fruits per tree was found non-significant.

The effect of soil application of multi micronutrients with respect to yield of fruits per tree and fruit yield per hectare were found non-significant while, the effect of foliar application were found significant on yield of fruits per tree and fruit yield per hectare. The highest fruit yield per tree (62.99 kg) and fruit yield per hectare (9.84 tonne/ha.) were recorded in 1% spray of multi micronutrient Grade-IV (F_2). An increase in fruit yield per tree might be due to cumulative effect of number of fruits, reduction in fruit drop and higher fruit weight by effect of foliar spray of multi micronutrient in mango var. Amrapali. Promotion of starch formation followed by rapid transportation of carbohydrates in plants is activated by Mn, Zn and B is well established. Iron (Fe) is highly associated with chlorophyll synthesis which later on boosted up the photosynthesis. Foliar spray of micronutrients might have affected the physiological processes resulting into higher fruit yield. This observation is in agreement with findings of Sanna *et al.,* (2005), Hamdy *et al.,* (2007), Vashistha *et al.,* (2010), Nehete *et al.,* (2011), Singh and Varma (2011), Bhatt *et al.,* (2012) and Bhowmick *et al.,* (2012) in mango, Singh *et al.,* (2007) in Aonlaand Kumar and Shukla (2010) in ber. The interaction effect of soil and foliar application with respect to yield of fruits per tree and tonne per ha was found non-significant.

From the above results it can be concluded that three spray each of 1% multi micronutrient (Grade-IV) at flower bud initiation, at full bloom stage and at pea stage recorded maximum fruit weight, fruit volume, number of fruits per tree, fruit retention and fruit yield.

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