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PC Haldavnekar
Regional Fruit Research Station, Vengurla, Maharashtra, India

SB Baviskar
Regional Fruit Research Station, Vengurla, Maharashtra, India

RA Raut
Regional Fruit Research Station, Vengurla, Maharashtra, India

AY Munj
Regional Fruit Research Station, Vengurla, Maharashtra, India

MS Shedge
Regional Fruit Research Station, Vengurla, Maharashtra, India

MP Sanas
Regional Fruit Research Station, Vengurla, Maharashtra, India

Correspondence
PC Haldavnekar
Regional Fruit Research Station, Vengurla, Maharashtra, India

Effect of micronutrient on yield and physico-chemical composition of alphonso mango under Konkan agro-climatic conditions

PC Haldavnekar, SB Baviskar, RA Raut, AY Munj, MS Shedge and MP Sanas

Abstract
Alphonso is one of the choicest varieties grown in the Konkan region of Maharashtra. However, it has some inherited physiological disorders. Among them heavy fruit drop occurs at different stages of fruit growth, which ultimately affects the crop yield. To overcome the fruit drop in Alphonso mango; the field experiment entitled "Effect of micronutrient on yield and physico-chemical composition of Alphonso mango under Konkan agro-climatic conditions" was conducted at Regional Fruit Research Station, Vengurle to determine the effect of micronutrients (RDF with combination of zinc sulphate, boric acid, copper sulphate, borax) on the yield and quality of mango cv. Alphonso. Results revealed that the treatment T_5 (RDF + foliar spray of 0.4% zinc sulphate + copper sulphate (0.2%) + Borax (0.2%), spraying at just before flowering and marble stage of fruit growth recorded the highest number of fruits/tree (240.67) and fruit yield (6.41 t./ha). Further, the treatment T_4 (RDF + foliar spray of 0.4% zinc sulphate + boric acid (0.2%) spraying at just before flowering and marble stage of fruit growth recorded the highest T.S.S (19.35 ^{0}B) and lowest acidity (0.13%).

Keywords: Mango, micronutrients, quality, yield

Introduction
Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae originated in Indo-Burma region. The fruit has been in cultivation in Indian sub-continental for well over 4000 years and has been the favourite of the kings and commoners. Alphonso is one of the most popular varieties of India. The fruits are very attractive, large in size having a prominent ventral shoulder and attractive pinkish flush toward the basal end. The taste is superb with an excellent sugar: acid blend and captivating flavour besides being a Table cultivar, much in demand it is a favoured fruits of the processing industry because it remains its characteristics flavour even during processing. But Alphonso has a problem of alternate bearing which is considered as one of the long standing unresolved problems, directly and substantially contributing to poor production. In order to improve the yield of the crop several micronutrients studied were conducted. The food supplements, multivitamins and mineral supplements are necessary for the healthy crops. According to horticulturists, only application of primary nutrients could not prove successful to produce high quality fruit in mango trees, the application of micronutrients is compulsory as well. Major elements/ macronutrients are quickly taken up and utilized by the tissues of the plants by the catalyzing effect of micronutrients (Phillips, 2004) [2]. Micronutrients play a vital role in various enzymatic activities and synthesis of assimilates and hormones. Their acute deficiencies some time poses the problem of incurable nature (Kumar, 2002) [10]. These micronutrients also play an active role in the plant metabolism process starting from cell wall development to respiration, photosynthesis, chlorophyll formation, enzymatic activity, hormone synthesis, nitrogen fixation and reduction etc., (Das, 2003) [3]. Various experiments have been conducted earlier on foliar spray of micro-nutrients in different fruit crops (e.g. in mango, Nehete *et al.*, 2011) [11] and vegetables (e.g. in okra, Dalal and Nandkar, 2010) [2] and shown significant response to improve yield of fruits. Thus keeping above facts in view the present investigation was undertaken with objectives such as to see the influences of micronutrients on flowering and fruiting on Alphonso mango.

Materials and Methods
The experiment was conducted at Regional Fruit Research Station, Vengurle, Dr., B.S.K.K.V., Dapoli 416 516, Maharashtra, during the year 2016-17.
The investigation was conducted on 30 years old mango trees planted at 10 × 10 m apart under square system of planting.

In order to assess the effects of various treatments, all the trees were managed with uniform cultural practices as per the standard recommendations with respect to manures and fertilizers, irrigation, plant protection measures etc. The experiment was laid out in Randomized Block Design with eight treatments combinations and replicated thrice. The treatment details are as follows.

Tr. No.	Treatment details
T_1	Control as per RDF (after harvest) in basin after harvest
T_2	RDF + 200 g Zinc sulphate + 100 g Boric acid (Soil application) in basin after harvest
T_3	RDF + 200 g Zinc sulphate + 100 g Copper sulphate + 100 g Borax (Soil application) in basin after harvest
T_4	RDF + Foliar spray of 0.4% Zinc sulphate + Boric acid (0.2%) [2 sprays at just before flowering and marble stage]
T_5	RDF + Foliar spray of 0.4% Zinc sulphate + Copper sulphate (0.2%) + Borax (0.2%) [2 sprays at just before flowering and marble stage]
T_6	RDF + 100 g Zinc sulphate + 50 g Copper sulphate + 50 g Boric acid (Soil application) in basin after harvest + Foliar spray of 0.2% Zinc sulphate + 0.1% Boric acid [2 sprays at just before flowering and marble stage]
T_7	RDF + 100 g Zinc sulphate + 50 g Copper sulphate + 50 g Boric acid (Soil application) in basin after harvest + Foliar spray of 0.2% Zinc sulphate + 0.1% Copper sulphate + 0.1% Boric acid [2 sprays at just before flowering and marble stage]
T_8	Mango special (IIHR) + RDF [2 months before flowering and fruits of 2-4 cm diameter stage]

Results and Discussion

Number of fruits per tree

Data presented in Table 1 revealed that, the treatment T_5 (RDF + Foliar spray of 0.4% zinc sulphate + copper sulphate (0.2%) + Borax (0.2%)), spraying at just before flowering and marble stage of fruit growth recorded the highest number of fruits/tree (240.67). The micronutrients when sprayed alone or in combination involved directly in various physiological processes and enzymatic activity. This might have resulted into better photosynthesis, greater accumulation of starch in fruits. The involvement of Zn in auxin synthesis and B in translocation of starch to fruits. The balance of auxin in plant regulates the fruit drop or retention in plants, which altered the control of fruit drop and increased the total number of fruits per tree. Similar results were observed by Singh *et al*. (2003) [17] and Dutta (2004) [4] in mango and Jeyabaskaran and Pandey (2008) [8] in banana, Kavitha *et al*. (2000) [9] in papaya and Sarolia *et al*. (2007) [14] in guava supported the present findings.

Yield (kg/tree)

Significantly the maximum yield (64.04 kg/tree) was obtained from the trees treated with combination of RDF + Foliar spray of 0.4% zinc sulphate + copper sulphate (0.2%) + Borax (0.2%)), spraying at just before flowering and marble stage compared to other treatments. The significant increase in fruit yield (kg/tree) is a cumulative effect of increase in number of fruits because of reduction in fruit drop vis-a-vis higher fruit weight by the direct and indirect effect of foliar spray of micronutrients in mango cv. Alphonso. Promotion of starch formation followed by rapid transportation of carbohydrates in plants activated by micronutrients like Zn and B are well established. In the present experiment, foliar spray of micronutrient might have affected the physiological processes resulting into higher production of mango cv. Alphonso. This indicated that single chemical or combination of low dose of chemical nutrient did not influence on fruit yield. The results are in conformity with those of Banik and Sen (1997) [1], Dutta and Dhua (2002) [5] and Singh *et al*. (2003) [17] in mango, Ghanta and Mitra (1993) [7] in banana, Sarolia *et al*. (2007) [14] and Gaur *et al*. (2014) [6] in guava and Kavitha *et al*. (2000) [9] in papaya.

Table 1: Flowering, fruiting and physico - chemical properties of Alphonso mango.

Treatments	No. of fruits/tree	Weight of fruit (g)	Fruit yield (kg/tree)	Fruit Yield (t/ha)	T.S.S. (^{0}B)	Acidity (%)
T_1	123.17	260.33	32.04	3.20	18.67	0.20
T_2	67.67	264.67	17.92	1.79	18.97	0.18
T_3	96.17	262.33	25.43	2.54	17.98	0.20
T_4	85.67	258.33	22.07	2.21	19.35	0.13
T_5	240.67	264.00	64.06	6.41	19.23	0.30
T_6	98.67	270.50	26.54	2.65	18.97	0.20
T_7	91.67	267.67	24.45	2.45	18.22	0.20
T_8	73.83	272.67	20.13	2.01	18.58	0.20
SEm±	29.24	2.54	7.68	0.90	0.58	0.05
CD at 5%	88.70	7.70	23.30	2.65	NS	NS

TSS and Acidity

Amongst the different treatments, the maximum total soluble solids (19.35°) and low acidity (0.13%) were found in T_4 (RDF + foliar spray of 0.4% zinc sulphate + boric acid (0.2%) [2 sprays at just before flowering and marble stage) in comparison to rest of treatments and control. These observations were supported by the previous findings by various eminent workers (Singh and Rajput, 1977; Rath *et al*., 1980; Syamal and Mishra, 1989) [15, 13, 18]. The enhancement in quality of fruit could be due to the catalytic action of micronutrients particularly at higher concentration. Hence, the foliar application of micronutrients quickly increased the uptake of macronutrients in the tissues and organs of the mango plants, decreased the nutritional deficiencies and improved the fruit quality.

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