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Short communication

Response of pre-harvest foliar application of zinc and boron on mango cv. Amrapali under New Alluvial Zone of West Bengal

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ABSTRACT

The influence of zinc sulphate and borax (as foliar application) on fruit retention, yield and physico-chemical properties of mango cv. Amrapali were evaluated for consecutive two years at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya under the new alluvial zone of West Bengal, India. The chemicals, *i.e.*, zinc sulphate (0.5, 1.0 & 1.5%) and borax (0.25, 0.5 & 0.75%) were sprayed at pea and marble stages of fruit growth and development. The pooled data from the consecutive two years experiment reveals that the maximum fruit retention at marble stage (40.95%), at harvest stage (7.66%), maximum number of fruits per plant (170), and maximum yield per tree (36.00 kg) was obtained with borax 0.5%. Whereas, average maximum fruit length (10.33 cm), breadth (6.33 cm), were recorded with borax 0.25% and maximum pulp content (73.57%) was obtained from the treatment with borax 0.75%. Regarding quality parameters, maximum TSS (20.75°brix), total sugars (17.08%), non reducing sugar (12.32%), ascorbic acid (41.62 mg/100 g of fruit pulp), TSS/acid ratio (115.11) and lowest acidity (0.18%) were recorded with 1.0% zinc sulphate.

Key words: Foliar application, zinc sulphate, borax, Amrapali mango.

Mango (*Mangifera indica* L.) is a premier fruit crop of India considering its acreage, production, popularity among the people and designated as the 'National Fruit of India'. Among the different constraints, a high fruit drop is a major problem of mango cultivation in India. In general, only 0.1 per cent or less hermaphrodite flowers along with young fruits amounting to 99 percent or even more (Mukherjee, 7). The consumer acceptability of mango is greatly depends on its physico-chemical properties such as pulp content, total soluble solids, total sugar, reducing sugar, acidity, TSS: acid ratio. Pre-harvest foliar spray of zinc sulphate improves the fruit quality of mango cv. Dashehari (Daulata *et al.*, 5). Singh and Dhillon (11) reported that application of boric acid (500 - 5000 ppm) improves the fruit retention and most of the desirable physico-chemical traits of mango. Keeping in view the foregoing consideration the present experiment was conducted to study the effect of micronutrients (zinc sulphate and borax) on fruit retention, yield, and physico-chemical properties of mango cv. Amrapali grown under the new alluvial zone of West Bengal, India.

The present trial was conducted at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, West Bengal, India for two years on a popular mango cv. Amrapali. The selected trees are uniform in size and of 9-years-old with 5 m × 5 m of planting distance. The chemicals; *i.e.*, zinc sulphate (T_1 = 0.5%, T_2 = 1%, T_3 = 1.5%) and borax (T_4 = 0.25%, T_5 = 0.5%, T_6 = 0.75%) along with water spray/control (T_7) were applied as foliar spray at pea stage and marble stage of fruit growth. The experiment was carried out in Randomized Block Design with three replications. From each of the three replicated trees, four branches were taken and each of four branches, two panicles, involving twenty four panicles under same treatment were selected and counting of fruits started from pea stage of fruit growth. Whereas, to study the fruit physico-chemical properties, four fruits (per replication) from each of the treatments were collected randomly at maturity. After proper ripening of fruits, the physical and bio-chemical properties were recorded gradually. Total sugars, reducing sugar and acidity were estimated by the methods described in AOAC (1). Total soluble solids, non-reducing sugar and ascorbic acid were estimated by the method mentioned by of Ranganna (10), Mazumder and Majumder (6), and statistical analysis were done through the method described by Panse and Sukhatme (8), respectively.

The maximum percentage of fruit retention (7.66%) during harvest was recorded with borax 0.5% (Table 1). It is revealed from Table 1 that, borax at 0.25% and $ZnSO_4$ at 0.5% also showed higher fruit retention (7.00 and 6.79%, respectively) than the water spray (control) (3.96%). The maximum

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number of fruits (170) harvested with borax 0.5%, which was closely followed by (168) borax 0.25% and zinc sulphate 0.5%. Highest yield (14.40 t/ha) was obtained with borax at 0.5% and lowest yield was recorded with control (8.72 t/ha).The pooled data of Table 2 reveals that maximum length (10.33 cm) and breadth (6.33 cm) were recorded with borax at 0.25%. The statistical at par value for length was recorded with $ZnSO_4$ at 0.5, 1% and borax 0.5%. Fruit weight was recorded maximum with borax 0.5%. The lowest values for length, breadth, and weight were recorded with control. The maximum fruit pulp content (73.57%), and lowest peel (11.49%) and stone (14.95%) were recorded with borax 0.75%. Lowest stone content was recorded with $ZnSO_4$ at 0.5%. The pooled data of Table 3 indicates that highest total soluble solids (20.75°Brix), total sugars (17.08%), non reducing sugar (12.32%) were obtained with the $ZnSO_4$ at 0.5%, whereas, maximum reducing sugar (5.10%) was recorded with borax at 0.5%. Lowest TSS, total sugars and non reducing sugar recorded lowest for both 2003 and 2004 with control/water spray. The low acid content, high ascorbic acid content and high TSS: acid ratios are the important traits for judging the fruit quality. From the pooled data of Table 6 it is clear that the lowest acidity (0.180%), highest ascorbic acid content (41.62 mg/100 g of fruit pulp) and highest TSS: acid ratios (115.11) were recorded with $ZnSO_4$ at 1%.

It is well known that micronutrients play important role in many plant metabolism processes. Zinc increases the synthesis of tryptophan that is a

Table 1. Response of zinc and boron on fruit retention and yield.

Treatment	% of fruit retained at harvest			No. of fruits/tree at harvest			Yield/ha (tonnes)		
	1st	2nd	Avg.	1st	2nd	Pooled	1st	2nd	Avg.
$ZnSO_4$ at 0.5% (T_1)	7.16 (2.68)	6.41 (2.53)	6.79 (2.61)	182.67	153.33	168.00	14.32	12.91	13.62
$ZnSO_4$ at 1% (T_2)	6.60 (2.57)	5.96 (2.44)	6.28 (2.51)	170.00	138.67	154.33	13.50	11.32	12.54
$ZnSO_4$ at 1.5% (T_3)	5.41 (2.33)	4.98 (2.23)	5.20 (2.28)	158.00	149.00	153.50	12.09	11.49	11.79
Borax at 0.25% (T_4)	7.45 (2.73)	6.55 (2.56)	7.00 (2.65)	175.33	160.67	168.00	14.04	13.49	13.95
Borax at 0.5% (T_5)	8.03 (2.83)	7.29 (2.70)	7.66 (2.77)	185.00	155.00	170.00	15.50	13.30	14.40
Borax at 0.75% (T_6)	5.29 (2.30)	5.03 (2.24)	5.16 (2.27)	165.33	152.33	158.83	11.80	10.21	11.01
Control (T_7)	4.06 (2.01)	3.85 (1.96)	3.96 (1.99)	128.00	125.33	126.67	9.25	8.05	8.72
CD at 5%	0.22	0.21	0.20	20.55	13.09	17.32	-	-	-

figures in the parentheses indicates square root transformed values.

Table 2. Response of zinc and boron on fruit physical properties (pooled data).

Treatment	Length (cm)	Breadth (cm)	Weight (g)	Pulp (%)	Peel (%)	Stone (%)
$ZnSO_4$ at 0.5% (T_1)	9.95	6.20	203.25	70.47	14.58	14.95
$ZnSO_4$ at 1% (T_2)	9.95	6.12	200.63	69.78	13.48	16.74
$ZnSO_4$ at 1.5% (T_3)	9.68	6.04	192.00	70.82	14.00	15.19
Borax at 0.25% (T_4)	10.33	6.33	207.88	71.38	12.85	15.77
Borax at 0.5% (T_5)	10.17	6.17	212.00	73.08	11.90	15.02
Borax at 0.75% (T_6)	9.26	5.90	173.00	73.57	11.49	14.95
Control (T_7)	9.13	5.89	169.25	67.58	14.30	18.12
CD at 5%	0.61	0.39	16.40	1.32	1.42	1.46

Table 3. Response of zinc and boron on bio-chemical properties of fruit.

Treatment	TSS (°Brix)	Total sugars (%)	Reducing sugar (%)	Non reducing sugar (%)	Acidity (%)	Ascorbic acid content (mg/100 g)	TSS : acid ratio
$ZnSO_4$ at 0.5% (T_1)	19.48	14.64	3.87	10.24	0.260	34.72	76.93
$ZnSO_4$ at 1% (T_2)	20.75	17.08	4.11	12.32	0.180	41.62	115.11
$ZnSO_4$ at 1.5% (T_3)	19.23	14.95	5.03	9.42	0.188	35.53	102.60
Borax at 0.25% (T_4)	19.45	15.18	4.08	10.55	0.226	36.27	86.38
Borax at 0.5% (T_5)	20.03	16.43	5.10	10.76	0.208	35.09	97.67
Borax at 0.75% (T_6)	19.48	14.76	4.69	9.56	0.228	33.71	89.01
Control (T_7)	18.70	13.80	4.82	8.38	0.264	34.42	78.13
CD at 5%	0.52	1.77	0.65	1.73	0.072	6.71	38.82

precursor of auxin. It plays key role in protein synthesis, maintain the integral component of enzyme structure and membrane integrity, essential for chlorophyll synthesis, RNA synthesis. Boron has various roles, *i.e.*, sugar transport, cell wall synthesis, lignifications of cell wall structure, carbohydrate, RNA, phenol metabolism, plasma membrane integrity, pollen germination and pollen tube growth (Bhowmick and Banik, 3). Pre-harvest spray of zinc sulphate at 0.8% enhances the fruit quality in cv. Chausa (Singh and Rajput ,12). Banik *et al.* (2) reported that boron at 0.4 percent plus urea at 1 percent enhanced the fruit quality of cv. Fazli. Daulta *et al.* (5) observed higher fruit retention (36.40%) in cv. Dashehari with 0.8 percent $ZnSO_4$. Bhowmick and Banik (3) reported that highest TSS, total sugars and non-reducing sugar content were recorded with $ZnSO_4$ at 1.5 percent. Rajput *et al.* (9) reported lowest (98.36%) fruit drop percentage with boric acid (0.8%) over control (99.13%). These previous studies were more or less similar trends with the present investigation.

Regarding conclusion part, it may be stated that spraying with borax at 0.25% (T_4) and borax at 0.5% (T_5) showed statistically at par result regarding yield and for most of the desirable bio-chemical parameters, except for TSS value, which is significantly higher with T_5. On the other hand, though at par result is observed for yield data and most of desirable bio-chemical traits with $ZnSO_4$ at 0.5% (T_1) and borax at 0.5% (T_5), the pulp percentage is statistically superior with borax 0.5% (T_5). So application of borax at 0.5% (T_5) may be recommended for this agro-ecological area.

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