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Effect of Foliar Application of Micronutrients on Retention, Yield and Quality of Fruit in Litchi cv Bombai

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Abstract

Effect of exogenous application of micronutrients in improving growth, retention, yield and quality of fruit in litchi cv Bombai was studied at farmers field, Beniagram, Farakka, West Bengal, India during 2005—2007. Micronutrients viz. borax at 0.25 and 0.50% and zinc sulfate at 0.50 and 1.0% were sprayed twice, once at pea and again at marble stage (15 days after first spray). Maximum retention of fruit (40.08%) and yield (4,110.50 fruits) per plant was recorded from the plant sprayed with zinc sulfate at 0.50%. Highest fruit weight (22.96 g), TSS (20.88^{0}B), total sugar (16.09%), reducing sugar (14.77%) with excellent color due to high anthocyanin content (65.89 mg/100g peel) and reduced acidity (0.456%) were noted by spraying of borax at 0.50%. $ZnSO_4$ at 1.0% increased the ascorbic acid content (53.04 mg/100 g pulp) of fruit.

Key words : Litchi, Foliar application, Micronutrients, Yield, Quality.

The litchi (*Litchi chinensis* Sonn.), the queen of fruits, is one of the most important evergreen sub-tropical fruit plant of family Sapindaceae having excellent fruit quality, pleasant flavor, juicy flesh (aril) and attractive appearance. India ranks second in the world next to China in litchi production. Fruit drop is one of the most wide spread problem of litchi in tropical and sub-tropical areas. It has been observed that most of the fruits drop off in the first 2–4 weeks and only a small proportion of it reach to maturity. So the present investigation was carried out by application of micronutrients to minimize the fruit drop with quality litchi production.

Methods

The experiments were studied at the farmer's field, Beniagram, New Farakka, Murshidabad, West Bengal during 2005 to 2007. The experiment was conducted in a randomized block design with four replications and five treatments viz. T_1 : Borax at 0.25%, T_2 : Borax at 0.50%, T_3 : Zinc sulfate at 0.50%, T_4 : Zinc sulfate at 1.0%, T_5 : Control (water spray). The experiment was done on 25-year old plant at spacing of 10 m × 10 m. All the micronutrients were sprayed twice, first spray at 15 days after fruit set (pea stage) and second spray 30 days after fruit set (marble stage) by foot sprayer. The micronutrient boron as borax ($Na_2B_4O_7$, 10 H_2O) and zinc as zinc sulfate ($ZnSO_4$, 7H_2O) were sprayed by adding required amount of lime to neutralize the solution. A sticker agent Indtron AE (non-ionic surfactant) was dissolved in the solution of micronutrients for increasing residence time of the droplets onto the leaves. A nutrient mixture of 100 kg FYM + 1,000 g N_2 + 700 g P_2O_5 + 1,000 g K_2O per plant per year were applied in two split doses. Full amount of FYM + P_2O_5 and half of N_2 and K_2O were given after fruit harvest (July). Rest N_2 and K_2O were applied 15 days after fruit set during March followed by irrigation with ring and basin method. The plant nutrients were supplied in the form of urea, single super phosphate and muriate of potash. Fruit set, fruit size, fruit weight, fruit size, pulp weight, juice content were also measured. Fully ripen fruits were taken for estimation of biochemical constituents of fruits like TSS by hand refractometer in ^{0}Brix, total sugar, reducing sugar, ascorbic acid, titrateable acidity were determined by standard procedure of AOAC (1) and anthocyanin content in peel as described by Ranganna (2).

Results and Discussion

Fruits per panicle varied between 58.61 and 67.00

Table 1. Effect of micronutrients on fruit retention percentage and fruit set per panicle at harvest in litchi cv Bombai. NS = Non-significant.

Treatment	Initial fruit set/panicle (before spraying)			Fruit retention (%)			No. of fruits/panicle (at harvest)			No. of fruits/plant (at harvest)		
	2006	2007	Pooled	2006	2007	Pooled	2006	2007	Pooled	2006	2007	Pooled
T_1 Borax at 0.25%	65.75	41.56	53.66	29.52 (32.88)	34.35 (35.86)	31.94 (34.37)	19.40	14.27	16.84	3822.00	2934.25	3378.13
T_2 Borax at 0.50%	63.35	39.09	51.22	35.82 (36.74)	40.96 (39.78)	38.39 (38.27)	22.69	16.01	19.35	4284.75	3328.50	3806.63
T_3 $ZnSO_4$ at 0.50%	66.10	40.85	53.48	37.12 (37.51)	43.04 (40.99)	40.08 (39.25)	24.54	17.58	21.06	4573.25	3647.75	4110.50
T_4 $ZnSO_4$ at 1.0%	65.35	45.31	55.33	32.44 (34.69)	37.66 (37.84)	35.05 (36.27)	21.20	17.06	19.13	4137.50	3240.25	3688.88
T_5 Control (water spray)	63.50	43.72	53.61	24.20 (29.45)	28.09 (31.99)	26.15 (30.72)	15.37	12.28	13.83	3459.25	2722.25	3090.75
SE (±)	1.31	1.62	2.08	1.15	0.78	1.39	1.08	0.76	1.32	149.26	78.53	168.65
CD (P = 0.05)	NS	NS	6.09	3.55	2.42	4.07	3.32	2.35	3.86	459.94	242.01	492.27

in 2006 i.e. in first year and between 39.09 and 45.31 in 2007 at beginning of experiment i.e. before spraying of micronutrients (Table 1). The plants sprayed with $ZnSO_4$ at 0.50% (T_3) showed the highest retention of 40.08% followed by 38.39% in borax at 0.50% (T_2) amongst the micronutrients in the pooled data of two years. The number of fruits per panicle at harvest was found to be maximum from the plants by spraying of zinc sulfate at 0.50% (21.06 fruits) followed by borax at 0.50% (19.35 fruits) and zinc sulfate at 1.0% (19.13 fruits) compared with 13.83 fruits per panicle in control (Table 1). Maximum yield of 93.83 kg per plant was obtained by spraying of $ZnSO_4$ at 0.50% followed by 87.28 kg per plant in borax at 0.50% compared to 59.95 kg in control (Table 2). The beneficial and pronounced effects of zinc sulfate ($ZnSO_4$) and borax (3–5) in increasing the fruit set and yield of litchi is further confirmed in this experiment. The plants sprayed with borax at 0.50% caused maximum fruit weight (22.96 g) and pulp weight (16.68 g) and juice content (62.82 ml/100 g of pulp) in fruit followed by 22.85 g, 16.58 g and 62.18 ml/100 g of pulp in $ZnSO_4$ at 0.50% compared to 19.42 g, 13.37 g and 50.44 ml/100 g of pulp in control plant, respectively (Table 2). A marked increase in TSS (20.88^{0}B), total sugar (16.09%), reducing sugar (14.77%), of fruit were observed by spraying with borax at 0.50% (Table 3). A decrease in fruit acidity (0.456%) by treatment with borax at 0.50% and increase in ascorbic acid content (53.04 mg/100 g of peel) with zinc sulfate at 0.50% are in agreement with the findings of Babu and Singh (6). Maximum decrease in fruit acidity due to borax spray might have either been fastly converted into sugars and their derivatives by the reaction involving reversal glycolytic pathway or might be used in respiration or both which was supported by earlier findings of Ruffiner et al. (7) and Misra and Khan (8). Anthocyanin content in fruit peel (65.89 mg/100 g of peel) was increased

Table 2. Effect of micronutrients on yield and physical characters of fruit cv Bombai.

Treatment	Yield/plant (kg)			Fruit weight (g)			Pulp weight (g)			Juice (ml/100 g of edible pulp)		
	2006	2007	Pooled	2006	2007	Pooled	2006	2007	Pooled	2006	2007	Pooled
T_1 Borax at 0.25%	81.60	63.89	72.75	21.35	21.78	21.56	15.19	15.50	15.35	56.82	58.06	57.44
T_2 Borax at 0.50%	97.31	77.25	87.28	22.71	23.21	22.96	16.52	16.84	16.68	62.19	63.44	62.82
T_3 $ZnSO_4$ at 0.50%	103.58	84.08	93.83	22.65	23.05	22.85	16.40	16.75	16.58	61.43	62.93	62.18
T_4 $ZnSO_4$ at 1.0%	87.96	69.86	78.91	21.26	21.56	21.41	15.18	15.37	15.28	55.61	56.23	55.92
T_5 Control	66.52	53.38	59.95	19.23	19.61	19.42	13.19	13.55	13.37	49.70	51.18	50.44
SE (±)	1.51	1.89	2.42	0.56	0.58	0.81	0.34	0.45	0.56	0.73	1.16	1.37
CD (P = 0.05)	4.65	5.84	7.07	1.73	1.79	1.14	1.06	1.37	1.64	2.25	3.56	3.99

Table 3. Effect of chemicals on different bio-chemical composition of litchi fruits cv Bombai.

Treatment	TSS (^{0}Brix)			Total sugar (% fresh weight)			Reducing sugar (% fresh weight)		
	2006	2007	Pooled	2006	2007	Pooled	2006	2007	Pooled
T_1 Borax at 0.25%	19.55	20.05	19.80	14.96	14.82	14.89	13.97	14.12	14.05
T_2 Borax at 0.50%	20.65	21.10	20.88	16.03	16.14	16.09	14.71	14.83	14.77
T_3 $ZnSO_4$ at 0.50%	20.50	20.90	20.70	15.71	15.76	15.74	14.65	14.73	14.69
T_4 $ZnSO_4$ at 1.0%	19.55	19.88	19.71	14.92	14.63	14.78	13.93	14.02	13.98
T_5 Control	18.05	18.20	18.13	14.32	14.49	14.41	12.41	12.67	12.54
SE (±)	0.23	0.32	0.39	0.25	0.21	0.33	0.15	0.20	0.25
CD (P = 0.05)	0.70	0.97	1.14	0.78	0.65	0.96	0.46	0.62	0.73

Table 4. Effect of chemicals on different bio-chemical composition of litchi fruits cv Bombai.

Treatment	Acidity (%)			Ascorbic acid (mg/100 g of edible portion)			Anthocyanin (mg/100 g of peel)			TSS/acid ratio		
	2006	2007	Pooled	2006	2007	Pooled	2006	2007	Pooled	2006	2007	Pooled
T_1 Borax at 0.25%	0.467	0.498	0.483	45.13	46.87	46.00	51.68	56.35	54.02	41.86	40.26	41.04
T_2 Borax at 0.50%	0.449	0.462	0.456	47.76	49.45	48.61	63.47	68.31	65.89	45.99	45.67	45.83
T_3 $ZnSO_4$ at 0.50%	0.497	0.527	0.512	52.12	53.95	53.04	48.51	51.27	49.89	41.25	39.66	40.43
T_4 $ZnSO_4$ at 1.0%	0.516	0.548	0.532	46.33	48.20	47.27	46.33	47.63	46.98	37.89	36.27	37.05
T_5 Control	0.547	0.597	0.572	40.05	40.94	40.50	38.67	42.39	40.53	33.00	30.49	31.69
SE (±)	0.01	0.02	0.02	0.83	0.79	1.14	0.88	0.77	1.16	-	-	-
CD (P = 0.05)	0.03	0.05	0.06	2.55	2.44	3.34	2.70	2.36	3.40	-	-	-

progressively by spraying of borax at 0.50%. Fruits from borax treated trees showed the higher concentration of TSS and anthocyanin content than in control plant in sweet cherry (9). However, borax at 0.50% showed highest ratio of 45.83 which was due to high TSS content and low fruit acidity (Table 4). Rani and Brahmachari (10) showed the highest sugar/acid ratio by spraying boron at 0.40%.

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