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Influence of foliar application of chemicals and anti-transpirants on black tip incidence, yield and physico-chemical characteristics of mango cv. DASHEHARI

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ABSTRACT : An experiment was conducted at the orchard of Division of Fruit Science, SKUAST-J for the study of chemical control of black tip in mango cv. Dashehari. The trial was laid out in randomized block design with three replications. Five chemicals/antitranspirants *viz*., borex, washing soda, caustic soda, phenyl mercuric acetate (PMA) and kalonite were sprayed at different concentrations. The pooled data of two years revealed that the application of washing soda and caustic soda with 1.0 per cent concentration at flowering and fruiting stage significantly reduced the incidence of black tip as compared to control. Application of borex at 1.0 per cent significantly increased the fruit yield (15.42 kg/tree), fruit length (9.91 cm), fruit breadth (5.95 cm), fruit weight (153.79 g), fruit volume (151.99 cc), pulp weight (103.78 g), stone weight (28.55 g), flesh firmness (57.74 N) and TSS (17.57 %) in comparison to control.

KEY WORDS : Mango, Chemicals, Anti-transpirants, Black tip, Yield, Quality

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Mango (*Mangifera indica* L.) is the most important fruit of India belonging to Anacardiaceae family. It is rightly titled as "king of fruits" due to its wide adaptability, high nutritive value, richness in variety, delicious taste, excellent flavor, attractive appearance and popularity among the masses. It is one of the choicest and most ancient fruit known to mankind. It occupies the same position in tropical region as is enjoyed by apple in temperate regions. In India, mango is cultivated in an area of 2.29 million ha with an annual production of 15.19 million MT (Anonymous, 2011). Major mango growing states of India are Uttar Pradesh, Andhra Pradesh, Bihar, Karnataka, Tamil Nadu, West Bengal, Kerela, Maharashtra and Gujarat. In J&K, Jammu province occupies an area of 0.11 lakh ha under mango cultivation with an annual production of 1.24 lakh tones (Anonymous, 2009). The major mango growing areas are Jammu, Samba, Kathua, Poonch, Udhampur and Reasi. Inadequate shape, colour, quality and low yields in mango have more recently been attributed to exposure of mango fruit to deleterious environmental and cultural situations that often lead to tissue abnormality which are quite distinctive from those induced due to biotic stresses and are generally

referred as physiological disorders. The black tip is a serious disorder of mango fruit observed in most of the commercial cultivars in orchards located in the vicinity of brick kilns. Among the various physiological disorders, black tip adversely affects the productivity and quality of mango causing considerable economic loss to the growers. All the commercial cultivars of mango are not affected by black tip disorder to the same magnitude and the extent of damage ranges from 10 to 75 per cent. It has long been established that the mango cultivar Dashehari is highly susceptible to this disorder and several workers have suggested that been made to overcome this malady, the use of chemicals and anti-transpirants are most effective (Pal and Chadha, 1993). Keeping in view the extent of seriousness of black tip disorder which has assumed to be alarming in the mango orchards of Jammu regions, a study was undertaken to overcome this malady with the use of chemicals and anti-transpirants.

RESEARCH METHODS

Fifteen year old, forty eight trees of mango cv. Dashehari were selected in the orchard of Division of Fruit Science of Sher-e-Kashmir University of Agricultural Sciences and Technology- Jammu, Udheywalla for the study of chemical control. The experiment was laid out in randomized block design with one tree per treatment and replicated three times. During the entire course of investigation, uniform schedule of cultural operations was adopted. Different concentrations of chemicals and anti-transpirants namely borex (0.6%, 0.8% and 1.0%), washing soda (0.6%, 0.8% and 1.0%), caustic soda (0.6%, 0.8% and 1.0%), phenyl mercuric acetate (50ppm, 100ppm and 150ppm) and kalonite (4.0%, 6.0% and 8.0%) were sprayed. Borex, washing soda and caustic soda were given as foliar sprays at full bloom and pea stage. Phenyl mercuric acetate (PMA) was applied at fruit set and 15 days after fruit set, while only one spray of kalonite was given at fruit set stage. The per cent incidence of black tip was worked out for the individual tree using the formula proposed by Khader *et al*. (1988). Yield was recorded by weighing all the fruits of the treatments at the time of harvest and expressed as kg/tree. Fruit length (cm) and fruit breadth (cm) was measured with the help of Vernier's caliper. Fruit weight (g) was obtained by directly weighing fruit on top pan balance. Fruit volume(cc) was determined by water displacement method. Fruit firmness (N) was measured with an effegi penetrometer F1 327. Total soluble solids (%) and sugars (%) were estimated as per the method given by A.O.A.C (1990). Titratable acidity (%) was determined by the method given by Ranganna (1986). Standard methods of analysis were used for analyzing the data appropriate to the design of the experiment. The data recorded were analysed as per Panse and Sukhtame (1985) method.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Incidence of black tip:

A perusal of the data (Table 1) on the incidence of black tip revealed that all the treatments were significantly superior over the control in reducing the incidence of black tip per cent in mango fruits. However, application of two sprays of washing soda (at full bloom and pea stage) at a concentration of 1.0 per cent significantly reduced the black tip incidence to 3.15 per cent as compared to control (14.27%). Yamdagni and Chandra (1985) observed the reduction of black tip incidence in mango from 57.69 per cent to 3.41 per cent with the application of washing soda at 2 per cent concentration. Present studies also resulted in the control of black tip incidence from 14.27 per cent in control to 4.24 per cent with the application of caustic soda at full bloom and pea stage. These findings are in accordance with the findings of Khader (1991) who observed the control of black tip by applying 0.8 per cent caustic soda sprays to the mango trees as caustic soda was helpful in neutralizing the incoming fumes from brick kilns. Fruit yield per tree was significantly effected by the foliar sprays of various chemicals and antitranspirants. The application of higher concentrations of borex (after full bloom and fruit set) resulted in significantly higher fruit yield per tree as compared to the rest of the treatments (Table 1). Higher yields of 15.42 kg per tree was obtained by application of 1.0 per cent borex as compared

Table 1 : Effect of foliar sprays of chemicals and antitranspirants on incidence of black tip and yield of mango cv. DASHEHARI (Pooled data of 2 years)

Treatments	Per cent black tip	Yield/tree (kg)
Borax (0.6%)	9.84 (18.24)*	13.54
Borax (0.8%)	8.12 (16.54)	14.24
Borax (1.0%)	7.14 (16.54)	15.42
Washing soda (0.6%)	4.29 (11.68)	12.71
Washing soda (0.8%)	3.44 (10.63)	13.61
Washing soda (1.0%)	3.15 (10.14)	13.95
Caustic soda (0.6%)	5.19 (13.05)	12.75
Caustic soda (0.8%)	4.79 (16.11)	13.83
Caustic soda (1.0%)	4.24 (11.83)	13.79
PMA (50 ppm)	9.84 (18.24)	11.89
PMA (100 ppm)	8.68 (17.05)	11.93
PMA (150 ppm)	8.18 (16.54)	12.04
Kalonite (4.0%)	7.18 (15.45)	12.20
Kalonite (6.0%)	4.83 (12.66)	12.77
Kalonite (8.0%)	5.39 (13.31)	12.23
Control	14.27 (22.14)	11.88
CD (P=0.05)	2.56	0.96

* Figure in parenthesis are transformed values

to control (11.88 kg/tree). These findings are in line with Babu and Singh (1985) who reported that fruit yield considerably increased with the application of borex.

Physical characters:

The pre-harvest application of various chemicals and antitranspirants significantly affected the physical characteristics of Dashehari mango fruits at the time of commercial harvest (Table 2). Application of borex at 1.0 per cent concentration twice (one at full bloom and other at pea stage) produced significantly larger fruits of Dashehari mango. Those chemical did not differ significantly with washing soda 0.8 per cent application at the same stage. Application of all concentrations of kalonite and 100ppm PMA did not change the length of fruits of mango whereas lower concentrations of PMA resulted in lesser fruit length. Boron application increases the nitrogen uptake. This higher nitrogen content increases the size of the fruit, which in turn

Table 2 : Effect of foliar sprays of chemicals and anti-transpirants on physical characteristics of mango cv. Dashehari (Pooled data of 2 years)

Treatments	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Fruit volume (cc)
Borax (0.6%)	9.26	5.69	147.26	145.27
Borax (0.8%)	9.19	5.83	152.96	151.01
Borax (1.0%)	9.91	5.95	153.79	151.99
Washing soda (0.6%)	9.10	5.60	142.98	141.31
Washing soda (0.8%)	9.40	5.78	144.75	143.99
Washing soda (1.0%)	9.54	5.85	145.73	144.04
Caustic soda (0.6%)	9.12	5.59	142.04	140.66
Caustic soda (0.8%)	9.44	5.73	142.92	141.24
Caustic soda (1.0%)	9.46	5.80	145.74	143.94
PMA (50 ppm)	8.69	5.37	135.38	134.25
PMA (100 ppm)	8.76	5.39	139.76	138.94
PMA (150 ppm)	8.61	5.41	142.39	141.20
Kalonite (4.0%)	8.85	5.42	137.97	136.67
Kalonite (6.0%)	9.01	5.54	138.80	137.68
Kalonite (8.0%)	8.82	5.42	141.86	140.58
Control	8.75	5.36	134.14	134.25
C.D. (P=0.05)	0.91	0.29	2.57	1.60

Table 3 : Effect of foliar sprays of chemicals and anti-transpirants on pulp weight, stone weight and flesh firmness of mango cv. DASHEHARI (Pooled data of 2 years)

Treatments	Pulp weight (g)	Stone weight (g)	Flesh firmness (N)
Borax (0.6%)	99.68	27.88	45.12
Borax (0.8%)	103.26	28.25	50.73
Borax (1.0%)	103.78	28.55	57.74
Washing Soda (0.6%)	97.29	27.10	46.12
Washing Soda (0.8%)	98.87	27.41	55.50
Washing Soda (1.0%)	99.81	28.29	59.88
Caustic Soda (0.6%)	96.50	26.89	44.29
Caustic Soda (0.8%)	97.28	27.00	47.90
Caustic Soda (1.0%)	99.55	28.00	59.25
PMA (50 ppm)	90.26	25.69	43.13
PMA (100 ppm)	94.52	26.44	44.39
PMA (150 ppm)	95.87	26.59	45.78
Kalonite (4.0%)	93.40	26.25	42.88
Kalonite (6.0%)	94.34	26.81	45.35
Kalonite (8.0%)	94.84	26.60	49.92
Control	92.02	25.91	43.12
C.D. (P=0.05)	2.03	0.29	2.34

Table 4 : Effect of foliar sprays of chemicals and anti-transpirants on biochemical characteristics of mango cv. Dashehari (Pooled data of 2 years)

Treatments	TSS (%)	Acidity (%)	TSS/acid ratio	Total sugar (%)	Reducing sugar (%)	Non-reducing sugars (%)
Borax (0.6%)	17.00	0.37	46.61	12.28	3.11	9.16
Borax (0.8%)	17.45	0.34	50.13	12.96	3.43	9.53
Borax (1.0%)	17.57	0.33	52.74	12.61	3.59	9.11
Washing Soda (0.6%)	16.30	0.22	72.56	11.86	3.02	8.85
Washing Soda (0.8%)	16.93	0.21	78.90	12.25	3.27	8.97
Washing Soda (1.0%)	17.33	0.24	71.50	12.47	3.35	9.15
Caustic Soda (0.6%)	15.13	0.31	48.08	12.14	2.94	9.20
Caustic Soda (0.8%)	15.50	0.30	50.38	12.28	3.12	9.16
Caustic Soda (1.0%)	16.12	0.30	52.67	12.39	2.76	9.44
PMA (50 ppm)	15.09	0.22	67.07	12.01	2.83	9.17
PMA (100 ppm)	15.67	0.22	69.89	11.30	2.95	8.34
PMA (150 ppm)	14.69	0.32	46.01	11.00	3.15	7.84
Kalonite (4.0%)	15.68	0.27	56.64	11.10	3.05	8.05
Kalonite (6.0%)	15.87	0.27	58.15	11.17	3.39	7.78
Kalonite (8.0%)	16.94	0.21	78.94	12.34	3.44	8.91
Control	14.72	0.33	44.92	10.93	2.89	8.04
C.D. (P=0.05)	0.53	0.06	5.24	0.23	0.22	0.17

leads to an increases in fruit length. Similar findings were also made by Balkrishanan *et al* (1996). Increase in size of individual fruit is expected following a spray of boric acid as it is instrumental in cell division, cell elongation process. Application of antitranspirants were not effective in increasing the length significantly. The highest fruit weight was noticed with 1.0 per cent borex applied at full bloom and pea stage. This increase in fruit weight in response to the application of borex is attributed to its effect on increase in fruit size and mobilization of food material thereby converting the fruit into a strong sink (Babu and Singh, 1985). The highest pulp weight (103.78 g) was observed with the application of borex 1.0 per cent (Table 3). Borex is instrumental in cell division and cell elongation that in turn leads to increase in fruit/pulp weight. The highest retention of flesh firmness was recorded in fruits from the trees that had received the application of washing soda at a concentration of 1.0 per cent at full bloom and pea stage. Bakshi *et al.* (2000) advocated that the washing soda spray could increase firmness of grape berries.

Biochemical characters:

Foliar sprays of chemicals and anti-transpirants significantly influenced the biochemical composition of mango fruit. The data in Table 4 predict that total soluble solids and sugar content of mango fruits were significantly affected by application of borex at higher concentrations. Increase in TSS content and sugars by the application of borex may be due to increased photosynthesis activity which might have resulted in the production of more sugars. Application of boron plays a significant role in the synthesis of pectin substance in the cell wall (Singh, 1986). Increase in TSS with borax sprays may be due to the increased mobilization of sugars by boron from source (Balkrishan *et al.*, 1996). Favourable effects of boron have been suggested by Rajput and Chand (1976). According to these workers, it is possible due to increased photosynthetic activity and chlorophyll content of leaves. Activity of enzyme catalase, peroxidase and polyphenol oxidase might have increased which ultimately led to higher accumulation of sugars in fruit. The increase in these biochemical constituent *i.e.* TSS and sugars in mango may be due to conversion of complex polymers into simpler substances (Kaushik and Kumar, 1992). Washing soda application proved to be effective in reducing the acidity content of mango fruits. A decline in titratable acidity during ripening of mango has been reported by Kaushik and Kumar (1992).

REFERENCES

A.O.A.C. (1990). *Official method of analysis.* 15th Ed. Association of official Agriculture Chemists, Washington D.C., U.S.A.

Anonymous (2009). Statement of J&K, Department of Horticulture, Jammu

Anonymous (2011). *Indian Horticulture Database* pp 87-90. National Horticulture Board, Gurgoan, HARYANA (INDIA).

Babu, N. and Singh, A.R. (1985). Effect of boron, zinc and copper sprays on growth and development of litchi fruits. *Punjab Hort. J.*, **25**: 75-80.

Bakshi, K.K., Pandita, M.K. and Tiku, A.K. (2000). Regulation of perlette grapes with GA3, NAA, and Na_2CO_3. *Life Sci. Reporter,* 1&2: 6-10.

Balkrishnan, K., Venketashan, K. and Sambandamurthi, S. (1996). Effect of foliar application of Zn, Fe, Mn and B on yield and quality of pomegranate cv. GANESH. *Orisa J. Hort*., **24** (1) : 33-35.

Kaushik, R.A. and Kumar, R. (1992). Physico-chemical changes in different mango cultivars during storage. *Haryana J. Hort. Sci*., **21** (3-4) : 166-173

Khader, S.E.S.A. (1991). Physiological anomalies in mango yet to be understood. *Indian Hort.*. Jan- March pp. 4-5.

Khader, S.E.S.A., Rajput, M.S. and Biswas, P.P. (1988). Index to qualifying black tip disorder of mango (*Mangifera indica* L.) in orchards and its relationship with brick kilns. *Indian J. Agric. Sci*., **58** (7) : 593-595.

Pal, R.N. and Chadha, K.L. (1993). Black tip and internal necrosis of mango. In: *Advances in horticulture Vol. 4. Fruit crops* eds. K.L. Chadha and O.P. Pareek pp. 2081-2093 Malhotra Publishing House, New Delhi (INDIA).

Panse, V.G. and Sukhatame, P.V. (1985). *Statistical methods for agriculture workers*. Indian Council of Agriculture Research, New Delhi (INDIA).

Rajput, C.B.S. and Chand, S. (1976). Effect of boron and zinc on phsico-chemical composition of guava. *National Agric. Soc. Cyelone,* **13**: 49-54.

Ranganna, S. (1986). *Mannual of analysis of fruits and vegetable products*. Tata Mc Graw Hill Co. Ltd., New Delhi (INDIA).

Singh, A.K. (1986). Effect of plant growth regulators, nutrients and various soil moisture regimes on fruit cracking, fruit quality of lemon. M.Sc. Thesis, G.B. Pant Agriculture University and Technology, Pantnagar, U.S. Nagar, UTTARAKHAND (INDIA).

Yamdagni, R. and Chandra, A. (1985). Effect of borex and sodium carbonate on the incidence of black tip of mango. IInd International Symposium on mango, Bangalore. 94 pp.