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RESEARCH ARTICLE

RESPONSE OF QUALITY ATTRIBUTES OF LITCHI CV. DEHRADUN TO FOLIAR APPLICATION OF ZINC AND BORON

Navjot Singh and Amarjeet Kaur.
Department of Horticulture, Faculty of Agriculture, Khalsa College, Amritsar-143001, India.

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Abstract

The influence of foliar application of zinc and boron on the fruit quality of litchi cv. Dehradun was conducted in the litchi orchard of Sh. S.S. Parmar Nangal, Pathankot and chemical analysis of the fruit was done in the laboratory of department of Horticulture, Khalsa College, Amritsar in the year 2015.Zinc sulphate and boron both was applied @ 0.3 %, 0.6% and 0.9% as foliar spray at pea stage (2nd fortnight of April) and at active growth stage (1st week of May) on the same trees. The results of the study indicated that the application of boron 0.9% resulted in maximum fruit volume (23.59 cc),specific gravity (1.02 g/cc), TSS (19.47%), TSS/acid ratio (57.39), reducing sugars(11.33%), total sugars (17.41%), maximum ascorbic acid (33.18 mg/100g)a while minimum acidity (0.33%) was observed in the plants under control.

Introduction:-

Litchi (*Litchi chinensis* Sonn.) is one of the most popular sub-tropical edible fruits of the family sapindaceae. It is a nut fruit widely known as litchi and regionally as lichi, lichee, laichi, leechee or lychee (Haq and Rab, 2012 and Hossain *et al* 2014).Litchi fruits are delicious and luscious having attractive red colour, good taste and sweet aroma. It is an arillate fruit with sweet white, translucent, juicy flesh and one large seed. The flavour of the fresh pulp is musky. When dried, it is acidic and very sweet. It is a rich source of sugars, vitamins and minerals like Magnesium, Iron, Calcium, Copper, Phosphorous and Potassium (Marisa, 2006). It can be processed into juice, wine, pickles, jam, jelly, ice cream and yoghurt (Huang *et al*., 2005). It comes to the market in the months of May- June when the market is full of other fresh fruits. But, inspite of the availability of different types of fruit in the market, the demand for fresh litchi is always very high due to its unique taste, flavour and colour (Hossain*et al.*, 2014). However, to stay in the global market, which is turning more and more competitive day by day, it is of paramount importance to maintain high standard in the quality of fruits produced, besides imparting fascinating appearance to them and providing longer shelf life. Zinc plays a vital role in the metabolic activities of plants. It is a activator of enzymes like dehydrogenase (Pyridine nucleotide, glucose-6, phosphodiesterase, carbonic anhydrase etc). It synthesis tryptophane, a precursor of IAA (Kumar *et al* 2009).Boron, is necessary for hormone metabolism, photosynthetic activities, cellular differentiation and water absorption in plant parts. It leads to lesser flower production and sterility if deficit in Litchi plants. Application of boron increases yield and fruit quality (Ruby *et al*. 2001). Therefore, the present study was designed to determine the influence of foliar application of boron and zinc on the fruit yield and quality of litchi.

Corresponding Author:- Navjot Singh.
Address:- Department of Horticulture, Faculty of Agriculture, Khalsa College, Amritsar-143001, India.

Materials and methods:-

The study on the effect of foliar application of zinc and boron on yield and fruit quality of litchi cv.Dehradun was conducted in the litchi orchard of Sh. S.S. Parmar Nangal, Pathankot and analysis was done in the laboratory of department of horticulture, Khalsa College, Amritsar in the year 2015. $ZnSO_4$ and Borax both at 0.3%, 0.6% and 0.9% were sprayed on new growth flushes before flower initiation. The variety of litchi used for experimentation was Dehradun. The sprays were tested in Randomized Block Design replicated thrice. The litchi trees were 7.50m apart in both directions i.e. between the rows and within the rows having an average height of 7.3 m.

Results and Discussion:-

The Maximum fruit volume (23.59 cc) was recorded in fruits harvested from plants treated with boron 0.9 per cent followed by (22.73 cc) and (22.06 cc) with boron 0.6 per cent and zinc sulphate 0.9 per cent with 18.47 cc under controlled conditions. Yadav (1998) also found similar results with the borax spray in guava. The increase in fruit volume is due to increase in volume of intercellular spaces in the mesocarpic cells. It could also be due to higher mobilization of food and minerals from the other parts of the plant towards the developing fruits. The findings of Singh (2007) in litchi are also in agreement with the present studies.

The data pertaining to specific gravity of litchi fruits cv. Dehradun as affected by Zinc sulphate and boron depicts that the specific gravity showed statistically significant differences between various concentrations of Zn and B with maximum specific gravity of (1.02 g/cc) recorded in the fruits harvested from the trees under control. Minimum specific gravity of (0.93g/cc) was observed in fruits treated with boron 0.9% followed by its 0.6 and 0.3 per cent concentration with specific gravity of (0.94 g/cc) and (0.95 g/cc). These results are in accordance with the findings of Singh (2007) in litchi respectively.

It is evident from the data that all the treatments significantly affected the fruit TSS. Maximum TSS (19.47%) was recorded in boron 0.9 per cent treatment and it was followed by zinc sulphate 0.9 per cent (19.34%) and boron 0.6 per cent (18.94%) TSS respectively. All the treatments increased the TSS content to (16.80%) as compared to control. The results of the present study are in agreement with the findings of Singh and Phogat (1984); Jain *et al* (1985); Brahmachari and Rani (2001); Sharma *et al* (2005) and Singh (2009) who reported similar type of TSS encouragement in litchi with the application of micronutrients. The increase in TSS content with boron and zinc was also reported by Brahmachari *et al* (1996), Babu and Singh (2001) and Dutta *et al* (2000). Increase in TSS content with these micronutrients may be attributed to the quick metabolic transformation of starch and pectin into soluble compounds and rapid translocation of sugars from leaves to developing fruits (Brahmachari and Rani, 2001).

Minimum acidity (0.33%) was recorded in the fruits picked from plants treated with boron 0.6 per cent treatment followed by boron 0.9 per cent which produced acidity of (0.34%) and boron 0.3 per cent with (0.35%) acidity. The treatment of zinc sulphate 0.9 per cent gave acidity of (0.45%) which was followed by zinc sulphate 0.3 per cent (0.41%) and zinc sulphate 0.6 per cent with acidity of (0.36%). All other treatments also resulted in low fruit acidity as compared to control which recorded maximum acidity of (0.47%).

The TSS:acid ratio is the ratio between the percentage of total soluble solids (TSS) and acidity. Significantly higher TSS/acid ratio (57.39) was found with boron 0.6 per cent treatment which was followed by boron 0.9 per cent (57.26) and boron 0.3 per cent (51.65) treatments. Zinc sulphate 0.6 per cent registered TSS/acid ratio of (50.69) which was followed by (42.97) and (41.56) with Zinc sulphate 0.9 per cent treatment and 0.3 per cent treatments. All the treatments significantly increased the TSS/acid ratio as compared to control which gave (35.74) TSS/acid ratio. Similar observations were recorded by Sharma *et al* (2005) in litchi. The application of boron enhanced TSS level and reduced acidity level, there by resulting in high TSS/acid ratio fruits. The findings of Singh (2009) are also in support with the present findings.

The highest percentage (11.33%) was recorded in the fruits treated with boron 0.9 per cent followed by zinc sulphate 0.9 per cent with (11.25%) and boron 0.6 per cent with (9.84%) reducing sugars respectively.However the lowest of reducing sugars (8.45%) concentration was recorded from the fruits under control. Similar results were also reported by Singh and Phogat (1984); Ghosh *et al* (1987); Brahmachari *et al* (1997) and Babu and Singh (2001) in litchi fruits. The increase in the sugar content might be due to the more rapid translocation of sugars from leaves to developing fruits. Boron facilitated sugar transport within the plant. It was also reported that borate reacted with sugar to form a sugar-borate complex, which was more easy to transverse membrane. Boron acted as a switcher in

the degradation of glucose either by glycolysis or by pentose shunt path way. It has also been reported that there is greater conversion of starch into sugars in various fruits following boron feeding (Sarkar *et al* 1984). Singh (2009) and Haq *et al* (2013) also reported an increase in reducing sugars with the application of borax in litchi. These results are also in accordance with the findings of Sachindra *et al* (2012) in litchi fruits respectively. The increased content of sugars was also attributed to the accumulation of oligosaccharides and polysaccharides in higher amounts with the application of micronutrients (Sharma *et al* 2005).

The data on effect of foliar application of Zn and B on total sugars of fruits in litchi cv. Dehradun depicted that significantly higher total sugars (17.41%) were analysed from the fruits treated with boron 0.9 per cent followed by zinc sulphate 0.9 per cent with (16.65%) and boron 0.6 per cent with (16.08%) total sugars. These treatments were further followed by boron 0.3 per cent with (14.89%), zinc sulphate 0.6 per cent with total sugars of (14.23%) and zinc sulphate 0.3 per cent treatment with total sugars of (13.12%) respectively. All the treatments significantly increased the total sugar content as compared to control (12.68%) which is considered the minimum throughout the whole research.Similar results were also reported by Brahmachari *et al* (1997) and Babu and Singh (2001) in litchi. The increase in the sugar content might be due to the more rapid translocation of sugars from leaves to developing fruits. Boron facilitated sugar transport within the plant. It was also reported that borate reacted with sugar to form a sugar-borate complex, which was more easy to transverse membrane. Boron acted as a switcher in the degradation of glucose either by glycolysis or by pentose sugar path way. These results also collaborates the findings of Haq *et al* (2013) and Sachindra *et al* (2012) in litchi. Singh (2009) also reported the same in litchi cv. Dehradun.

From the perusal of data it is clear that the different concentrations of Zn and B exerted a significant influence on vitamin C. Significantly higher vitamin C content (33.18 mg/100g) was obtained from the plants treated with boron 0.9 per cent which was followed by (31.58 mg/100g) with zinc sulphate 0.9 per cent and (30.47 mg/100g) with boron 0.6 per cent. These treatments are further followed by boron 0.3 per cent with (29.65 mg/100g) and zinc sulphate 0.6 per cent with (28.81 mg/100g) and zinc sulpahte 0.3 per cent with vitamin C of (28.49 mg/100g) respectively.

Table 1:- Effect of foliar application of Zn and B on physical characteristics of litchi cv. Dehradun.

Treatments	**Fruit volume (cc)**	**Specific gravity (g /cc)**
T_1 - Zinc sulphate 0.3%	20.87	0.98
T_2 - Zinc sulphate 0.6%	21.96	0.97
T_3 - Zinc sulphate 0.9%	22.06	0.96
T_4 - Boron 0. 3%	21.93	0.95
T_5 - Boron 0.6%	22.73	0.94
T_6 - Boron 0.9%	23.59	0.93
T_7 - Control	18.47	1.02
Mean	**21.658**	**0.964**
CD at 5% Level	**1.319**	**0.029**

Table 2:- Effect of foliar application of Zn and B on Bio- chemical characteristics of litchi cv. Dehradun.

Treatments	**TSS (%)**	**Acidity (%)**	**TSS : Acid Ratio**	**Reducing sugars (%)**	**Total sugars (%)**	**Ascorbic acid (mg/100g)**
T_1 - Zinc sulphate 0.3%	17.04	0.41	41.56	8.84	13.12	28.49
T_2 - Zinc sulphate 0.6%	18.25	0.36	50.69	9.19	14.23	28.81
T_3 - Zinc sulphate 0.9%	19.34	0.45	42.97	11.25	16.65	31.58
T_4 - Boron 0. 3%	18.08	0.35	51.65	9.25	14.89	29.65
T_5 - Boron 0.6%	18.94	0.33	57.39	9.84	16.08	30.47
T_6 - Boron 0.9%	19.47	0.34	57.26	11.33	17.41	33.18
T_7 - Control	16.80	0.47	35.74	8.45	12.68	25.52
Mean	**18.274**	**0.387**	**48.180**	**9.735**	**15.008**	**29.671**
CD at 5% Level	**1.238**	**NS**	**1.656**	**0.605**	**1.665**	**2.213**

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