International Journal of Bio-resource and Stress Management 2016, 7(4) Special:641-647 DOI: 10.5958/0976-4038.2016.00099.3

Full Research Article

Response of Micronutrient on Ber Fruit Quality During Storage in cv. Banarasi Karaka under Ambient Condition

Vikas Kumar Singh[1], Karuna Shanker[2*], N. K. Tiwari[3] and O. P. Rao[1]

[1]College of Horticulture & Forestry, N.D.A.U.&T.. Kumarganj, Faizabad, U.P. (224 229), India
[2]Birsa Agricultural University, Kanke, Ranchi, Jharkhand (834 006), India
[3]Dept. of Agriculture Science & Engineering, IFTM University, Moradabad, U.P. (244 102), India

Article History

Manuscript No. ARISE 93
Received in 4th May, 2016
Received in revised form 30th July, 2016
Accepted in final form 31st July, 2016

Correspondence to

E-mail: karunaflory@gmail.com

Keywords

Ber, $FeSO_4$, K_2SO_4, borax, fruit quality

Abstract

A field experiment was conducted to find out the effect of micronutrient on ber fruit quality during storage in cv. Banarasi Karaka under ambient condition, laid out at main experiment station department of horticulture, Narendra Deva University of Agriculture and Technology Kumarganj, Faizabad (U.P.) during the years 2008−2009. Plants received uniform cultural operations throughout the experimental period. Treatments included control, ferrous sulphate ($FeSO_4$) @ 0.3%, ferrous sulphate @ 0.6%, potassium sulphate (K_2SO_4) @ 1.0%, potassium sulphate @ 2.0%, borax ($Na_2B_4O_7$ $10H_2O$) @ 0.5%, borax @ 1.0%, $FeSO_4$ @ 0.3%+K_2SO_4 @ 1.0%+borax @ 0.5%, $FeSO_4$ @ 0.6%)+K_2SO_4 @ 2.0%)+Borax @ 1.0%. The nutrients were sprayed as aqueous solutions using Tween-20 as a surfactant. First spray was done in month of September just before flowering and second spray was done after fruit setting. The result were found that the fruit quality with respect of highest TSS. sugar, ascorbic acid, lowest acidity was obtained with spray of $FeSO_4$ @ 0.6%+K_2SO_4 @ 2.0%+borax @ 1.0% followed by treatment and consisting 0.3% ferrous sulphate+1.0% potassium sulphate+0.5% borax and $FeSO_4$ @ 0.6%. While minimum physiological weigh loss was recorded (6.53%) with the treatment $FeSO_4$ @ 2.0%+borax 1.0%+K_2SO_4 @ 2.0% followed by treatment borax @ 1.0%, minimum decay loss recorded 8.83% with the treatment borax @ 0.5% followed by treatment $FeSO_4$ @ 0.3%+K_2SO_4 @ 1.0%+borax @ 0.5%.

1. Introduction

The ber, Chinese date or Chinese fig (*Zizyphus mauritana* Lamk.) is an ancient fruit tree of India and China. In fact, it was one of the prominent fruits on which sages in ancient India lived during Vedic ages. There is a reference to ber in *Yajur Veda*, written not later than 1000 B.C. It is said to be indigenous to the area stretching from India to the South Western Asia up to Malaya. The Indian ber (*Zizyphus Mauritana* Lamk.) belongs to family Rhamnaceae and genus Zizyphus. It is a tetraploid (2n=48) in nature. It is cultivated widely for its resistance to grow in drought and diversified soil and climatic conditions, and is known as "King of Arid Fruits". It requires less care and even in neglected condition. However, produces sufficient fruits and can be successfully grown under the most unfavorable conditions of the soil, water and climate. It grows even on the marginal soil and various kinds of wasteland situations such as sodic saline soil, ravines, arid semi-arid region including plateau area of Bundelkhand and South India.

The beneficial effect of foliar application of chemicals is based on the fact that nutrients reach directly to leaves which are the site of metabolism. In spite of this, they are made available to plants at the proper time when it is needed. However, responses to these nutrients may vary depending upon the soil and agro-climatic conditions. Singh et al. (2007) reported that the application of borax @ 0.2%, zinc sulphate @ 0.6% on aonla and found that zinc @ 0.6% was most effective in increasing the TSS. ascorbic acid content.

It is therefore, essential to evaluate the effect of various chemicals and their concentrations under different locations for their practical recommendations. Meena et al. (2008) observed that application of Ferrous sulphate and borax @ 0.6% fruit setting time increased the TSS. and total sugar and decreased the acidity content in ber fruit cv. Gola.

Nutrients play an important role in many physiological phenomena like vegetative propagation, induction of seedlessness, increase fruit set prevention of pre-harvest fruit

drop, regulation of flowering, fruit size, thinning of flower and fruits. Various types of nutrients like Fe, K, borax, Zn, Ca. Fe and boron are used for improving the flowering, fruit set, size and quality of fruit as well as yield in many tree crops. Boron has been mainly used for manipulating many physiological events and is commercially used to improve the quality of fruit in crops like grapes, citrus, cherries and apples. In case of grape, it has manipulated three physiological events i.e., rachis cell elongation, flower thinning and berry enlargement.

Potassium is a major nutrient and necessary to all the plants. It provides shinning to the fruit and increases resistance against diseases, good size of fruit, sugar content and less fruit drop. It helps in protein synthesis, in transformation of carbohydrate, and promotes the formation of sugar and starch in leaves. It checks transpiration thereby regulate the water losses, it also prevents premature leaf fall. The ber fruits are perishable in nature and cannot be stored for longer period under normal conditions but can be easily transported to distant places. It therefore, can be sold in different markets. During peak season there is glut in the market and hence the prices go down. Some nutrients sparing have been reported to increase the shelf-life of various fruits besides improving their quality yield. Calcium chloride, K_2SO_4 (Potassium sulphate) borax and Ferrous sulphate are being used in certain fruit crops to improve their quality, yield and maturity as well as storage life. Long storage life along with high quality of ber fruits are needed for enriching human diet and increasing availability for internal as well as external trade.

2. Materials and Methods

An investigation was carried out at main experiment station, Department of Horticulture, NDUA&T, Kumarganj, Faizabad during the year 2008–2009. To find out response of micronutrient on ber fruit quality during storage in cv. Banarasi Karaka under ambient condition. Twenty-five year old plants of ber cultivar Banarasi Karaka, uniform in vigour and productivity were taken as experimental material the nutrient used in experiment were $FeSO_4$ @ 0.3% and 1.0%, K_2SO_4 @ 1.0% and 2.0%, borax @ 0.5 and borax @ 1.0%, $FeSO_4$ @ 0.3% along with K_2SO_4 @ 1.0%+borax @ 0.5% and $FeSO_4$ @ 0.6% along with K_2SO_4 @ 2.0%+borax @ 1.0% with one control treatment. Total number of plant 27, in three replications. The nutrients were sprayed as aqueous solutions using Tween-20 as a surfactant. First spray was done in month of September Just before flowering and second spray was done after fruit setting (10 days). Total soluble solids (TSS) of ripe fruits was estimated by Digital model pocket refractometer of 0 to 53% range at 20 °C. The total titratable acidity was determined by titrating five-ml fruit juice against N/10 Sodium hydroxide (NaOH) to pH 8.1, using phenolphthalein indicator. The titratable acidity results represented citric acid content expressed as a percentage (AOAC, 1990). The ascorbic acid of guava fruit was determined by diluting the known volume of juice with 3% metaphosphoric acid and titrating with 2, 6 dichlorophenol indophenols dye solution. The result was expressed as mg of ascorbic acid 100 g^{-1} of fruit juice (AOAC, 1990).

2.1. Statistical analysis

The data generated were subjected to analysis of variance (ANOVA) and separation of means was obtained using Randomized Block Design (RBD), according to the methods described by Gomez and Gomez (1984).

3. Results and Discussion

The data on the TSS of the fruit sprayed with different treatments are presented in Table 1. The highest TSS @

Table 1: Response of micronutrients on TSS (°Brix) in ber fruit cv. Banarasi Karaka during storage

	Days of storage					
	0	3	6	9	12	Mean
T_1 (Control)	10.75	11.70	12.30	12.60	12.90	12.05
T_2 ($FeSO_4$ @ 0.3%)	11.96	11.99	12.38	12.42	13.00	12.35
T_3 ($FeSO_4$ @ 0.6%)	12.47	12.50	12.62	12.88	12.95	12.68
T_4 (K_2SO_4 @ 1.0%)	13.37	13.48	14.00	14.15	14.25	13.84
T_5 (K_2SO_4 @ 2.0%)	12.72	14.63	14.82	14.88	14.98	14.41
T_6 (Borax @ 0.5%)	12.81	12.99	13.11	13.19	14.13	13.25
T_7 (Borax @ 1.0%)	13.09	14.25	14.75	14.98	15.25	14.06
T_8 ($FeSO_4$ @ 0.3%+K_2SO_4 @ 1.0%+Borax @ 0.5%)	13.30	15.37	15.45	15.85	16.02	15.21
T_9 ($FeSO_4$ @ 0.6%+K_2SO_4 @ 2.0%+Borax @ 1.0%)	14.13	16.22	16.38	16.43	17.11	16.05
Mean	12.73	13.68	13.76	14.15	14.51	
SEm±	T-0.047		D-0.035		T×D=0.10	
CD (p=0.05)	T-0.133		D-0.099		T×D=0.297	

16.05% content was recorded with the spray of ferrous sulphate+potassium sulphate borax @ 0.6, 2.0, 1.0%, which was at par with borax @ 1.0% and potassium sulphate @ 2.0%. TSS increases with the increasing days of storage and interaction effect of days of storage was found significant. The borax also stimulates the functioning of number of enzymes in the physiological process which probably cause an increase in TSS content. These results are enclose confirmation to findings of Ravel and Leela (1985); Branmachari and Kumar (1997). The data with respect to acidity presented in Table 2 revealed that there was no significant difference obtained under different treatments. However, the minimum acidity (0.12%) was found with the spray of ferrous sulphate+potassium sulphate+borax @ 0.6, 2.0, and 1.0% and at par with borax @ 1.0% (T_7) and potassium sulphate @ 1.0% (T_4). Interaction effect of days of storage and different treatments was found non-significant. In potassium sulphate treated fruits might be due to early ripening induced by this treatment in which degradation of acids may occur. The acids under the influence of nutrient spray might have either been fastly converted into sugar and their derivative by the reaction involving reversal of glycolytic path way. The above findings are in the line with the findings of Hasan et al. (2000); Meena et al. (2008).

Data regarding ascorbic acid content of fruit are presented in Table 3. The highest (68.25 mg 100 g^{-1} pulp) ascorbic acid content was recorded with the spray of ferrous sulphate+potassium sulphate+borax @ 0.6, 2.0 and 1.0% which was at par with ferrous sulphate+potassium sulphate+borax @

Table 2: Response of micronutrients on acidity (%) in ber fruit cv. Banarasi Karaka during storage

	Days of storage					
	0	3	6	9	12	Mean
T_1 (Control)	0.23	0.22	0.21	0.21	0.20	0.21
T_2 ($FeSO_4$ @ 0.3%)	0.21	0.21	0.20	0.17	0.18	0.18
T_3 ($FeSO_4$ @ 0.6%)	0.20	0.19	0.19	0.17	0.17	0.18
T_4 (K_2SO_4 @ 1.0%)	0.18	0.18	0.17	0.14	0.13	0.16
T_5 (K_2SO_4 @ 2.0%)	0.22	0.15	0.16	0.13	0.14	0.17
T_6 (Borax @ 0.5%)	0.17	0.19	0.14	0.17	0.18	0.18
T_7 (Borax @ 1.0%)	0.18	0.17	0.15	0.12	0.13	0.15
T_8 ($FeSO_4$ @ 0.3%+K_2SO_4 @ 1.0%+Borax @ 0.5%)	0.16	0.17	0.18	0.16	0.15	0.17
T_9 ($FeSO_4$ @ 0.6%+K_2SO_4 @ 2.0%+Borax @ 1.0%)	0.15	0.13	0.11	0.11	0.10	0.12
Mean	0.19	0.18	0.17	0.17	0.15	
SEm±	T-0.03		D-0.02		T×D=0.07	
CD (*p*=0.05)	T-0.09		D-0.20		T×D=0.06	

Table 3: Response of micronutrients on ascorbic acid (mg 100 g^{-1} pulp) in ber fruit cv Banarasi Karaka during storage

	Days of storage					
	0	3	6	9	12	Mean
T_1 (Control)	63.80	61.20	61.00	59.70	57.81	60.70
T_2 ($FeSO_4$ @ 0.3%)	65.27	63.17	62.19	60.23	58.93	61.96
T_3 ($FeSO_4$ @ 0.6%)	67.17	64.17	62.17	60.19	58.72	62.48
T_4 (K_2SO_4 @ 1.0%)	66.89	64.12	61.40	60.05	57.08	61.91
T_5 (K_2SO_4 @ 2.0%)	69.01	66.38	63.43	61.29	59.30	63.88
T_6 (Borax @ 0.5%)	67.03	64.78	61.55	59.96	57.43	62.15
T_7 (Borax @ 1.0%)	69.33	66.35	64.12	62.24	60.43	64.49
T_8 ($FeSO_4$ @ 0.3%+K_2SO_4 @ 1.0%+Borax @ 0.5%)	71.58	68.79	66.32	63.17	61.29	66.22
T_9 ($FeSO_4$ @ 0.6%+K_2SO_4 @ 2.0%+Borax @ 1.0%)	75.68	71.18	68.90	65.42	63.56	68.25
Mean	68.42	65.57	63.43	61.36	59.39	
SEm±	T-0.002		D-0.001		T×D=0.004	
CD (*p*=0.05)	T-0.005		D-0.004		T×D=0.011	

0.3, 1.0 and 0.5%. Ascorbic acid content decreases up to 12 days of storage. Interaction effect of days of storage was found significant. Borax also stimulate the functioning of number of enzyme in the physiological process which probably increases the ascorbic acid physiological process which probably increase the ascorbic acid content of ber fruit. These findings are in agreement with the findings of Singh et al. (2005); Sirag Ram and Prabhu (2001); Singh et al. (2002).

It is apparent from data (Table 4) that the maximum reducing sugar content (4.55) was obtained by foliar spray ferrous sulphate @ 0.6% along with potassium sulphate @ 2.0% and borax @ 1.0% (T_9), while minimum reducing sugars @ 3.81% was recorded in control. All the treatments considerably increased the reducing sugar as compared to control. The maximum reducing sugar recorded 12 days storage. Due to improvement in sugar content of fruit potassium spray was helpful in the process of photosynthesis which ultimately lead to the accumulation of carbohydrates which help in increasing the sugar content of fruits. The results are close conformity with findings of Singh and Vishistha (1997), Chaitanya et al. (1997); Ghanta and Dwivedi (1993); Hasan Jana (2000).

Data presented in Table 5 indicated that the highest non-reducing sugar @ 5.18% was measured in treatment receiving ferrous sulphate @ 0.6% (T_9) along with potassium sulphate @ 2.0% and borax @ 1.0% and at par value was recorded potassium sulphate @ 2.0% (T_5) and ferrous sulphate+potassium sulphate+borax @ 0.3+1.0+0.5% (T_8), while minimum (4.41%) non-reducing sugar was observed in control and highest

Table 4: Response of micronutrients on reducing sugar (%) in ber fruit cv. Banarasi Karaka during storage

	Days of storage					
	0	3	6	9	12	Mean
T_1 (Control)	3.63	3.69	3.88	3.90	3.93	3.81
T_2 ($FeSO_4$ @ 0.3%)	3.98	4.12	4.13	4.19	4.20	4.12
T_3 ($FeSO_4$ @ 0.6%)	4.05	4.16	4.18	4.21	4.25	4.15
T_4 (K_2SO_4 @ 1.0%)	4.07	4.12	4.13	4.19	4.20	4.14
T_5 (K_2SO_4 @ 2.0%)	4.27	4.29	4.35	4.37	4.38	4.33
T_6 (Borax @ 0.5%)	4.09	4.15	4.16	4.21	4.23	4.17
T_7 (Borax @ 1.0%)	4.33	4.34	4.38	4.42	4.44	4.18
T_8 ($FeSO_4$ @ 0.3%+K_2SO_4 @ 1.0%+Borax @ 0.5%)	4.29	4.31	4.34	4.35	4.40	4.34
T_9 ($FeSO_4$ @ 0.6%+K_2SO_4 @ 2.0%+Borax @ 1.0%)	4.51	4.53	4.54	4.58	4.60	4.55
Mean	4.13	4.19	4.23	4.23	4.29	
SEm±	T-0.05		D-0.03		T×D=0.11	
CD (p=0.05)	T-0.14		D-0.10		T×D=0.32	

Table 5: Response of micronutrients on non-reducing sugar (%) in ber fruit cv Banarasi Karaka during storage

	Days of storage					
	0	3	6	9	12	Mean
T_1 (Control)	4.32	4.38	4.42	4.46	4.47	4.41
T_2 ($FeSO_4$ @ 0.3%)	4.63	4.67	4.73	4.75	4.77	4.70
T_3 ($FeSO_4$ @ 0.6%)	4.78	4.80	4.81	4.83	4.86	4.81
T_4 (K_2SO_4 @ 1.0%)	4.64	4.69	4.72	4.77	4.81	4.73
T_5 (K_2SO_4 @ 2.0%)	4.94	4.98	5.01	5.06	5.11	5.02
T_6 (Borax @ 0.5%)	4.76	4.79	4.82	4.86	4.92	4.83
T_7 (Borax @ 1.0%)	4.84	4.87	4.91	4.93	4.94	4.90
T_8 ($FeSO_4$ @ 0.3%+K_2SO_4 @ 1.0%+Borax @ 0.5%)	4.93	4.95	4.97	5.01	5.03	4.98
T_9 ($FeSO_4$ @ 0.6%+K_2SO_4 @ 2.0%+Borax @ 1.0%)	5.13	5.16	5.18	5.19	5.22	5.18
Mean	4.77	4.81	4.84	4.87	4.90	
SEm±	T-0.05		D-0.03		T×D=0.11	
CD (p=0.05)	T-0.14		D-0.10		T×D=0.32	

reducing. sugar recorded as 5.22% at 12 days storage. Boron proves to be very effective in translocation of more sugar in fruits. These findings are in complete conformity with those of Chaitanya et al. (1997); Hasan Jana (2000).

It is evident from the data presented in Table 6 that spraying of all the chemical markedly increased the total sugar content of fruits over control. The maximum value (9.70%) of total sugar content recorded by the foliar application of ferrous sulphate @ 0.6% along with potassium sulphate @ 2.0% and borax @ 1.0% (T_9). The spray of 2.0% potassium sulphate which proved to be the next best treatment in this respect also proved considerably better to rest of the treatments. The minimum value (8.10) was found in control. The maximum sugars recorded 9.85% at 12 days storage. This improvement in sugar content of fruit potassium spray was helpful in the process of photosynthesis which ultimately leads to the accumulation of carbohydrates which help in increasing the sugar content of fruits. Boron proves to be very effective in translocation of more sugar in fruits. These findings are in complete conformity with those of Chaitanya et al. (1997); Ghanta and Dwivedi (1993); Stamper et al. (1999); Hasan Jana (2000).

Investigation on physiological weight loss of ber cv. Banarasi Karaka reveal little weight loss in all the treatments in respect to days of storage and its interactions (Table 7). Least physiological weigh loss was recorded (6.53%) with the treatment ferrous sulphate+borax+potassium sulphate @ 2.0%+1.0%+2.0% (T_9) followed by treatment borax @ 1.0% (T_7). Maximum physiological weight loss was increased after

Table 6: Response of micronutrients on total sugar (%) in ber fruit cv. Banarasi Karaka during storage

	Days of storage					
	0	3	6	9	12	Mean
T_1 (Control)	7.45	8.01	8.30	8.36	8.40	8.10
T_2 ($FeSO_4$ @ 0.3%)	8.61	8.74	8.86	8.94	8.70	8.83
T_3 ($FeSO_4$ @ 0.6%)	8.83	8.96	8.99	9.04	9.11	8.98
T_4 (K_2SO_4 @ 1.0%)	8.71	8.88	8.85	8.96	9.01	8.86
T_5 (K_2SO_4 @ 2.0%)	9.21	9.27	9.36	9.43	9.49	9.35
T_6 (Borax @ 0.5%)	8.85	9.21	8.98	9.07	9.15	9.05
T_7 (Borax @ 1.0%)	9.10	9.26	9.29	9.35	9.38	9.27
T_8 ($FeSO_4$ @ 0.3%+K_2SO_4 @ 1.0%+Borax @ 0.5%)	9.22	9.66	9.12	9.55	9.43	9.51
T_9 ($FeSO_4$ @ 0.6%+K_2SO_4 @ 2.0%+Borax @ 1.0%)	9.64	9.64	9.69	9.72	9.85	9.70
Mean	8.85	9.07	9.05	9.16	9.17	
SEm±	T-0.05		D-0.03		T×D=0.11	
CD (p=0.05)	T-0.14		D-0.10		T×D=0.32	

Table 7: Response of micronutrients on physiological weight loss (%) in ber fruit cv. Banarasi Karaka during storage

Treatments	Days of storage					
	3	6	9	12	15	Mean
T_1 (Control)	1.61	5.25	7.35	10.35	15.68	7.24
T_2 ($FeSO_4$ @ 0.3%)	1.46	5.15	7.15	9.36	15.55	6.90
T_3 ($FeSO_4$ @ 0.6%)	1.39	4.85	7.0	9.11	15.49	6.79
T_4 (K_2SO_4 @ 1.0%)	1.41	5.0	7.09	9.24	15.60	6.86
T_5 (K_2SO_4 @ 2.0%)	1.17	4.78	6.78	8.90	15.50	6.68
T_6 (Borax @ 0.5%)	1.39	5.1	7.07	9.15	15.61	6.83
T_7 (Borax @ 1.0%)	1.23	4.8	6.87	8.79	15.39	6.64
T_8 ($FeSO_4$ @ 0.3%+K_2SO_4 @ 1.0%+Borax @ 0.5%)	1.32	4.83	6.82	9.0	15.30	6.66
T_9 ($FeSO_4$ @ 0.6%+K_2SO_4 @ 2.0%+Borax @ 1.0%)	1.20	4.67	6.48	8.75	15.15	6.53
Mean	1.35	4.94	6.96	9.19	15.47	6.79
SEm±	T-0.143		D-0.116		T×D=0.349	
CD (p=0.05)	T-0.399		D -0.326		T×D=0.978	

15 days of storage and least with after 3 days of storage. Physiological weight loss was found significantly with increasing days of storage and different treatments. After 9 days of storage all the treatment found unstable due to more than 10.0% physiological weight loss. The above findings are in line with the findings of Siddiqui et al. (1989); Gupta et al. (1994); Tomar et al. (1999). Investigation on the decay loss of ber cv. Banarasi Karaka indicated that minimum decay loss recorded 8.83% with the treatment borax @ 0.5% (T_6) followed by treatment T_8 details (Table 8). Highest decay loss (20.56%) was recorded after 15 days of storage and least with 3 days of storage. Decay loss was found significantly increased with increasing days of storage, interaction effect of days of storage and different treatment was found significant. After 9 days of storage all the treatment was found unstable due to high decay loss. The above findings are in line with the findings of Siddiqui et al. (1989); Gupta et al. (1984).

Table 8: Response of micronutrients on decay loss (%) in ber fruit CV. Banarasi Karaka during storage

Treatment	Days of storage						
	0	3	6	9	12	15	Mean
T_1 (Control)	0	3.15	9.0	12.32	17.5	22.12	10.72
T_2 ($FeSO_4$ @ 0.3%)	0	2.88	7.35	10.25	15.82	20.16	9.46
T_3 ($FeSO_4$ @ 0.6%)	0	2.98	7.35	10.28	14.75	21.0	9.38
T_4 (K_2SO_4 @ 1.0%)	0	2.8	8.05	10.57	17	22.0	10.10
T_5 (K_2SO_4 @ 2.0%)	0	2.87	7.90	10.69	15.98	20.35	9.62
T_6 (Borax @ 0.5%)	0	2.84	6.54	9.69	13.88	20.0	8.83
T_7 (Borax @ 1.0%)	0	2.6	7.58	10.23	15.15	20.57	9.40
T_8 ($FeSO_4$ @ 0.3%+K_2SO_4 @ 1.0%+Borax @ 0.5%)	0	2.96	7.15	9.23	15.56	18.56	8.85
T_9 ($FeSO_4$ @ 0.6%+K_2SO_4 @ 2.0%+Borax @ 1.0%)	0	2.94	5.65	10.45	16.09	20.31	9.24
Mean	0.00	2.94	7.40	10.41	15.75	20.56	9.51
SEm±	T-0.103		D-0.084		T×D=0.253		
CD (p=0.05)	T-0.289		D -0.236		T×D=0.709		

4. Conclusion

Experimental trial showed that the combined foliar application of $FeSO_4$ @ 0.6% along with K_2SO_4 @ 2.0% and borax @ 1.0% before flowering and after fruit setting result were found the better fruit quality with the respect of highest TSS, sugar, ascorbic acid and lowest acidity. This finding may be exploited on commercial scale for letter productivity of quality fruits by growers.

5. References

AOAC, 1990. Official Methods of Analysis. Association of Agricultural Chemists, Washington D.C.

Brahmachari, V.S., Kumar, R.,1997. Effect of foliar application of nutrients on fruit set retention and cracking of litchi (*Litchi chinensis* Sonn.) fruits. Haryana Journal of Horticulture Science 26(3–4), 177–180.

Chaitanya, C.G., Kumar, G., Rana, B.L., Muthoo, A.K., 1997. Effect of foliar application of zinc and boron on yield and quality of guava cv. L. 49. Haryana Journal of Horticulture Science 26(1–2), 78–80.

Ghanta, P.K., Dwivedi, A.K., 1993. Effect of some micronutrients on yield and quality of banana cv- Giant, Environment and Ecology 11(2), 292–294.

Gomez, K.A., Gomez, A.A., 1984. Statistical procedures for Agricultural Research. John wiley and Sons, New York.

Gupta, O.P., Singh, B.P., Singh, S.P., Chauhan, K.S., 1994. Effect of calcium compounds as pre-harvest spray on the shelf-life of peach cv. Sharbati. Punjab Journal of Horticulture 24(1–4), 105–110.

Hasan, M.D.A., Jana, A., 2000. Folair feeding of potassium, zinc, copper and calcium improving the chemical composition of fruit in Litchi cv. Bombai. Environment and Ecology 10(2), 497–499.

Meena, V.S.,Yadav, P.K., Meena, P.K., 2008. Yield attributes of ber (*Zizyphus mauritina* Lamk.) cv. Gola as influenced by foliar application of ferrous sulphate and borox. Agriculture Science Digest 28, 3.

Ravel, P., Leela, D., 1985. Effect of boron and urea on the quality of grapes. Indian Journal of Horticulture 32 (1–2), 58–60.

Siddiqui, S., Gupta, O.P., Yamdagni, R., 1989. Effect of pre harvest sprays of chemicals on the shelf life of ver fruit cv. Umran. Haryana Journal of Horticulture Science 18(3–4), 177–178.

Singaram, P., Prabhu, P.C., 2001. Effect of zinc and born on growth and quality of grape cv. Muscat. Madras Agriculture Journal 88(4–6), 233–236.

Singh, D.K., Paul, P.K., Ghosh, S.K., 2005. Response of Papaya to foliar application of boron; zinc and their combinations. Research on Crops 6(2–8), 27.

Singh, P.C., Chaturvedi, O.P., Mishra, C.N., 2007. Effect of zinc boron and copper on physico-chemical characterstics and shelf life of aonla. National seminar on management of medicinal and aromatic plants in farming systems prospective 20–22 March, 2007. Directorate of extension C.S. Azad University of Agriculture & Technology, 161–162.

Singh, R.S., Vashistha, 1997. Effect of foliar spray of nutrient on fruit drop, yield and quality of ber cv. Seb. Haryana Journal of Horticulture Science 26(1–2), 20–24.

Singh, Rajpal., Godara, N.R., Ahlawal, V.P., 2002. qualitative attribute as affected by foliar sprays of nutrients and growth regulators in ber (*Zizyphus mauritianan* Lamk.) cv. Umran. Haryana Journal of Horticulture Science 31(1/2), 23–25.

Stamper, F., Hudina, M., Dolence, K., 1999. Influence of foliar nutrition with nitrogen, phosphorus and potassium on growth and cropping in Pusa seedless grape (*Vitis venifera*). IIIrd international sym. sub-tropical and tropical horticulture, held at Bangalore, abstract, 19.

Tomar, K.S., Tomar, R.S.S., Gurjan, B.S., 1999. Studies on the effect of foliar application of nitrogen and potassium level on physico-chemical composition of guava cv. Gwalior 27. Advances in Plant Science 12(2), 279–383.