The Pharma Innovation Journal 2021; 10(11): 475-478

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(11): 475-478

www.thepharmajournal.com
Received: 08-08-2021
Accepted: 22-10-2021

Ashok Meena
Department of Horticulture, College of Agriculture, Agriculture University, Kota, Rajasthan, India

BL Nagar
Department of Horticulture, College of Agriculture, Agriculture University, Kota, Rajasthan, India

MC Jain
Department of Horticulture, College of Agriculture, Agriculture University, Kota, Rajasthan, India

RS Naroliya
Department of Agronomy, College of Agriculture, Agriculture University, Kota, Rajasthan, India

Manoj Kumar
Department of Genetics & Plant Breeding, College of Agriculture, Agriculture University, Kota, Rajasthan, India

Corresponding Author:
Ashok Meena
Department of Horticulture, College of Agriculture, Agriculture University, Kota, Rajasthan, India

Response of pre-harvest spray of GA_3 and boron on storability and quality of Ber (*Ziziphus mauritiana* L.) cv. Banarasi Karaka

Ashok Meena, BL Nagar, MC Jain, RS Naroliya and Manoj Kumar

Abstract
The present investigation was conducted at the Instructional Farm, Department of Horticulture, College of Agriculture, Ummedganj, Kota during October, 2020 to March, 2021. The experiment was consisting of 16 treatment combinations with two factors *i.e.* GA_3 with four levels (0, 25, 50 and 75 ppm) and boron with four levels (0, 0.2, 0.4 and 0.6 per cent) was laid out in Factorial Randomized Block design with three replications. After harvesting, fruits were kept in brown paper bag and stored at ambient room temperature and relative humidity. The treated fruits were analyzed for (PLW) physiological loss weight the minimum (16.67%) during storage was recorded with T_{15} (GA_3 @75 ppm + B @0.6%), which was statistically at par with treatment T_{10} (GA_3 @50 ppm + B @0.4%) and T_{14} (GA_3 @75 ppm + B @0.4%) against the maximum (26.17%) physiological loss in weight under control. Rotting (%) at 0, 3rd, 6th and 9th day of storage among the various treatments, the minimum percentage of rotting (67.80%) was recorded with T_{10} (GA_3 @50 ppm + B @0.4%) which was statistically at par with treatment T_{11} (GA_3 @50 ppm + B @0.6%) at the end of storage period against the maximum (79.23%) under control. During storage maximum reduction in dry matter content (28.47%) observed in T_{15} (GA_3 @75 ppm + B @0.6%), which was statistically at par with treatment T_{10} (GA_3 @50 ppm + B @0.4%) and minimum in T_0 (control) and storage period ascorbic acid content of ber fruits (92.33 mg) was recorded maximum with treatment T_{11} (GA_3 @50 ppm + B @0.6%), which was statistically at par with treatment T_{15} (GA_3 @75 ppm + B @0.6%) and T_{10} (GA_3 @50 ppm + B @0.4%) minimum in T_0 (control). It may therefore, be recommended that the pre-harvesting application of (GA_3 @50 ppm + B @0.4%) is statistically improve the storage life and quality at ambient room temperature.

Keywords: Ascorbic acid, Ber, boron, dry matter, GA_3, Pre-harvest sprays, PLW, quality, shelf life, storability, rotting

Introduction
The Indian Ber (*Ziziphus mauritiana* L. Amk.), which is also known as Chinese date, Indian plum, Indian jujube or Chinese fig, belongs to the family Rhamnaceae and genus Ziziphus. It is a tetraploid with a chromosome number 2n=4x=48. Ber is an ancient fruit tree of India and China. Its tree is the hardiest, drought-tolerant plant. Ber fruit is more nutritive than apple because for its higher Protein (0.8 g), Beta carotene (70 IU) and Vitamin C (50-100 mg) contents.100 fresh fruit contains Moisture (81.6-83.0 g), Fat (0.07 g), Fiber (0.60 g), Carbohydrates (17.0 g), Ascorbic acid (66-110 mg/100 g), Total sugars (5.4-10.5%), Non reducing sugar (3.2-8.0%), Reducing sugar (1.4-6.2 g), Calcium (25.6 mg), Phosphorus (26.8 mg), Iron (0.76-1.8 mg), Ash (0.3-0.59 g), carotene (0.021 mg), Thiamine (0.02-0.024 mg), Riboflavin (0.02-0.038 mg), Niacin (0.7-0.873 mg), Citric Acid (0.2-1.1 mg), Fluoride (0.1-0.2 ppm), Pectin (dry basis) 2.2-3.4 per cent (Morton, 1987) [10]. India ranks first among the ber growing countries in the world. The total area under ber cultivation in India is 52,000 ha and total production is 5, 39,000 MT (Source: National Horticulture Board, Ministry of Agriculture & Farmers Welfare Govt. of India). The total area under ber cultivation in Rajasthan is 822 ha and total production is 7376 MT. (Source: Govt. of Rajasthan, Directorate of Horticulture). The storage life of ber fruit is very short; hardly 2-4 days at ambient conditions is that the greatest problem for its successful transportation and marketing. Limited study has been mode on the shelf life of ber with the exogenous application of micronutrients and plant growth regulators (Meena *et al*. 2013) [9]. However, the post-harvest ripening process can be delayed with the application of fruit ripening hindering hormones. Jawandha *et al.* (2012) [8] the application of growth regulators like gibberellic acid (GA_3) affects the physicochemical properties and is known to promote the shelf-life of ber fruits.

Gibberellins are increase to fruit set, size, retention and yield as well as improve fruit physicochemical characteristics and ripening (Rizk-Alla *et al.*, 2011) [13]. Boron is also a heavy metal micronutrient. It is absorbed by the plant in the form of boric acid (H_3BO_3). It is essential for translocation of sugar; involved in the reproduction of plants and germination of pollen grains (Chaturvedi *et al.*, 2007) [5]. Micronutrients (B, Fe and Zn) also have a positive effect on ber fruit set, yield, fruit quality and storage-life (Samant *et al.*, 2008) [15]. Therefore, an attempt has been made in the present study to prolong the storability and quality of ber fruit with the pre-harvest spray of GA_3 and boron on plant.

Materials and Methods

The present investigations were conducted in the Instructional Farm, Department of Horticulture, College of Agriculture, Ummedganj, Agriculture University, Kota (Raj.) during the year 2020-21. Three year old plants of Ber cv. Banarasi Karaka, uniform in vigor and productivity, were selected as experimental material to find out the response of foliar application of GA_3 and Boron on yield, quality and storability of Ber fruits. Total 16 Treatments of Factor A GA_3 with different Levels of 0 ppm, 25 ppm, 50 ppm and 75 ppm and Factor B Boron Levels 0%, 0.2%, 0.4% and 0.6% data is statically analyzed by Factorial RBD total Replication are 3 in number. T_0 served as control only water, T_1-0.2% Boron, T_2-0.4% Boron and T_3-0.6% Boron, T_4-25 ppm GA_3, T_5-25 ppm GA_3 + 0.2% Boron, T_6-25 ppm GA_3+ 0.4% Boron, T_7-25 ppm GA_3+ 0.6% Boron, T_8-50 ppm GA_3, T_9-50 ppm GA_3 + 0.2% Boron, T_{10}-50 ppm GA_3 + 0.4% Boron, T_{11}-50 ppm GA_3 + 0.6% Boron, T_{12}-75 ppm GA_3, T_{13}-75 ppm GA_3 + 0.2% Boron, T_{14}-75 ppm GA_3 + 0.4% Boron, T_{15}-75 ppm GA_3 + 0.6% Boron solution. Foliar spray of chemicals was done on 10 October 2020. After harvesting, fruits were kept in brown paper bag and stored at ambient room temperature and relative humidity. The treated fruits were analyzed for physiological loss in weight (PLW), rotting per cent, dry matter content and ascorbic acid, at 0, 3rd, 6th, 9th and 12th day of storage were estimated by standard method described in AOAC (1990).

Table 1: Effect of Gibberellic acid (GA_3), Boron and their interaction on fruit storability and quality characters

Treatments		Physiological loss in weight (%)				Rotting (%)			
		At 3rd day	At 6th day	At 9th day	At 12th day	At 3rd day	At 6th day	At 9th day	At 12th day
GA_3 (0 ppm)		4.71	6.18	16.35	25.02	3.56	32.49	51.32	79.94
GA_3 (25 ppm)		4.29	5.82	15.35	23.69	1.89	24.40	38.03	75.48
GA_3 (50 ppm)		2.94	4.56	12.89	18.24	1.38	17.02	29.08	69.49
GA_3 (75 ppm)		2.84	4.45	12.67	17.78	1.73	17.12	30.42	69.67
S.Em+		0.04	0.04	0.11	0.17	0.03	0.24	0.27	0.21
CD at 5%		0.11	0.11	0.32	0.49	0.08	0.68	0.78	0.61
B (0%)		4.03	5.59	15.25	23.12	2.69	27.09	40.63	76.24
B (0.2%)		3.90	5.30	14.68	21.00	2.46	22.87	38.02	73.64
B (0.4%)		3.49	5.08	13.74	20.49	1.59	20.39	35.00	72.25
B (0.6%)		3.38	5.04	13.58	20.14	1.81	20.67	35.21	72.45
S.Em+		0.04	0.04	0.11	0.17	0.03	0.24	0.27	0.21
CD at 5%		0.11	0.11	0.32	0.49	0.08	0.68	0.78	0.61
T_0	GA_3 0 ppm + Boron (0%)	5.03	6.68	17.75	26.17	4.20	29.57	43.59	79.23
T_1	GA_3 0 ppm + Boron (0.2%)	4.81	6.11	16.50	24.24	2.70	26.81	40.81	77.15
T_2	GA_3 0 ppm + Boron (0.4%)	4.76	6.09	15.63	25.56	1.83	24.03	39.87	76.13
T_3	GA_3 0 ppm + Boron (0.6%)	4.24	5.82	15.51	24.10	2.50	24.52	39.34	75.24
T_4	GA_3 25 ppm + Boron (0%)	4.27	5.90	16.18	25.59	2.70	28.75	42.71	78.50
T_5	GA_3 25 ppm + Boron (0.2%)	4.09	5.71	15.47	23.90	2.60	25.12	39.25	75.06
T_6	GA_3 25 ppm + Boron (0.4%)	4.49	5.99	15.23	22.69	1.03	22.14	35.75	74.58
T_7	GA_3 25 ppm + Boron (0.6%)	4.32	5.69	14.51	22.60	1.22	21.57	36.42	75.79
T_8	GA_3 50 ppm + Boron (0%)	3.42	4.85	13.57	20.80	1.95	20.94	36.09	74.49
T_9	GA_3 50 ppm + Boron (0.2%)	3.35	4.70	13.42	18.20	1.71	17.21	31.13	70.77
T_{10}	GA_3 50 ppm + Boron (0.4%)	2.33	4.11	11.97	16.80	0.92	15.90	26.05	67.80
T_{11}	GA_3 50 ppm + Boron (0.6%)	2.67	4.57	12.58	17.17	0.94	16.04	27.04	67.91
T_{12}	GA_3 75 ppm + Boron (0%)	3.39	4.92	13.51	19.90	1.92	20.10	35.11	72.75
T_{13}	GA_3 75 ppm + Boron (0.2%)	3.33	4.67	13.31	17.66	1.84	17.35	30.89	69.99
T_{14}	GA_3 75 ppm + Boron (0.4%)	2.37	4.13	12.13	16.90	1.57	16.48	29.32	68.48
T_{15}	GA_3 75 ppm + Boron (0.6%)	2.28	4.08	11.72	16.67	1.59	16.53	30.35	69.85
	S.Em+	0.08	0.08	0.22	0.34	0.05	0.39	0.56	0.52
	CD at 5%	0.22	0.22	0.64	0.97	0.15	1.14	1.63	1.51

Table 2: Effect of Gibberellic acid (GA_3), Boron and their interaction on fruit storability and quality characters

Treatments	Dry matter content (%)					Ascorbic Acid(mg/100g)				
	At 0 day	At 3rd day	At 6th day	At 9th day	At 12th day	At 0 day	At 3rd day	At 6th day	At 9th day	At 12th day
GA_3 (0 ppm)	21.68	20.51	19.02	17.05	15.45	83.15	78.17	68.75	60.65	51.29
GA_3 (25 ppm)	23.52	21.76	20.01	17.58	15.53	85.78	80.25	70.08	62.09	52.53
GA_3 (50 ppm)	26.46	24.05	22.32	20.42	17.99	88.57	86.85	73.74	64.15	55.84
GA_3 (75 ppm)	27.02	24.93	22.81	20.93	18.30	88.15	86.63	73.48	63.49	55.80
S.Em+	0.26	0.35	0.27	0.20	0.16	0.38	0.53	0.27	0.23	0.16
CD at 5%	0.74	1.01	0.79	0.56	0.45	1.11	1.53	0.77	0.67	0.45
B (0%)	22.24	20.81	19.13	16.96	14.87	83.28	78.26	68.18	59.59	51.25
B (0.2%)	24.63	22.34	20.83	18.84	16.69	85.60	81.90	71.53	62.91	53.81

B (0.4%)		25.92	24.32	22.19	20.10	17.88	87.95	85.32	72.51	63.53	54.65
B (0.6%)		25.89	23.78	22.01	20.08	17.83	88.81	86.42	73.83	64.35	55.74
S.Em+		0.26	0.35	0.27	0.20	0.16	0.38	0.53	0.27	0.23	0.16
CD at 5%		0.74	1.01	0.79	0.56	0.45	1.11	1.53	0.77	0.67	0.45
T_0	GA_3 0 ppm + Boron (0%)	16.10	15.67	14.10	12.01	10.91	80.92	75.92	66.40	57.56	48.14
T_1	GA_3 0 ppm + Boron (0.2%)	22.10	20.15	19.16	17.24	15.21	82.90	77.69	68.63	60.98	51.50
T_2	GA_3 0 ppm + Boron (0.4%)	24.20	23.01	21.33	19.05	17.68	83.84	79.45	69.25	61.78	52.56
T_3	GA_3 0 ppm + Boron (0.6%)	24.30	23.21	21.50	19.90	17.99	84.92	79.63	70.73	62.26	52.97
T_4	GA_3 25 ppm + Boron (0%)	22.15	21.20	20.11	17.36	14.83	83.53	76.24	67.32	59.50	50.51
T_5	GA_3 25 ppm + Boron (0.2%)	23.56	21.65	20.19	17.27	15.14	85.59	79.02	70.11	62.33	52.76
T_6	GA_3 25 ppm + Boron (0.4%)	24.44	22.40	20.30	17.58	15.81	87.12	82.13	71.32	63.02	53.05
T_7	GA_3 25 ppm + Boron (0.6%)	23.93	21.80	19.43	18.11	16.34	86.88	83.59	71.56	63.51	53.79
T_8	GA_3 50 ppm + Boron (0%)	25.40	23.02	21.10	19.15	16.97	83.42	79.62	68.96	61.87	53.02
T_9	GA_3 50 ppm + Boron (0.2%)	25.90	23.19	21.24	20.35	18.03	87.65	85.43	73.70	63.42	55.51
T_{10}	GA_3 50 ppm + Boron (0.4%)	27.70	25.95	23.94	21.92	19.79	90.90	90.82	75.37	65.10	56.59
T_{11}	GA_3 50 ppm + Boron (0.6%)	26.85	24.03	22.98	20.24	17.15	92.33	91.54	76.93	66.21	58.22
T_{12}	GA_3 75 ppm + Boron (0%)	25.31	23.36	21.20	19.32	16.75	85.26	81.25	70.04	59.43	53.34
T_{13}	GA_3 75 ppm + Boron (0.2%)	26.97	24.37	22.74	20.49	18.36	86.28	85.46	73.69	64.92	55.48
T_{14}	GA_3 75 ppm + Boron (0.4%)	27.33	25.92	23.17	21.84	18.25	89.93	88.88	74.10	64.20	56.41
T_{15}	GA_3 75 ppm + Boron (0.6%)	28.47	26.06	24.11	22.07	19.84	91.12	90.93	76.10	65.40	57.98
	S.Em+	0.51	0.70	0.55	0.39	0.31	0.77	1.06	0.54	0.46	0.31
	CD at 5%	1.48	2.01	1.58	1.13	0.90	2.22	3.06	1.55	1.34	0.91

Results and Discussion

It is evident from the Statistical analysis of the data that the different levels of GA_3 and boron had significant effect on the storability and quality characters of ber *viz*. physiological loss in weight (PLW), rotting per cent, dry matter content and ascorbic acid, at 0, 3rd, 6th, 9th and 12th day of storage.

Physiological loss in weight (PLW)

The per cent PLW of ber fruits (16.67%) was recorded minimum with treatment T_{15} (GA_3 @75 ppm + B @0.6%), which was statistically at par with treatment T_{10} (GA_3 @50 ppm + B @0.4%) and T_{14} (GA_3 @75 ppm + B @0.4%) were recorded at 3rd, 6th, 9th and 12th day of storage against the maximum (26.17%) physiological loss in weight under control. The high concentration of GA_3 and boron proved to be most effective for reducing the loss in weight of fruits during storage at ambient temperature. The present finding and were also supported by Rajput *et al.* (2015) [12], Vishwakarma *et al.* (2014) [18], Jawanda *et al.* (2012) [8].

Rotting per cent

The minimum rotting (67.80%) was recorded with treatment T_{10} (GA_3 @50 ppm + B @0.4%) which was statistically at par with treatment T_{11} (GA_3 @50 ppm + B @0.6%) were recorded at 3rd, 6th, 9th and 12th day of storage against the maximum (79.23%) physiological loss in weight under control. The lesser rotting percentage in GA_3 treated fruits could be due to antisenesecent and antiperspirants properties of the gibberellins which prevent the cellar disintegration with enhancing resistance ability in the fruit (Rokaya *et al.* 2016) [14]. These findings are in general agreement with earlier findings with Dev *et al.* (2018) [6], Jawandha *et al.* (2009) [7] in ber, Brahmachari and Rani (2005) [6] in guava.

Dry matter content

The dry matter content of ber fruits (28.47%) was recorded maximum with treatment T_{15} (GA_3 @75 ppm + B @0.6%), which was statistically at par with treatment T_{10} (GA_3 @50 ppm + B @0.4%) were recorded at 0, 3rd, 6th, 9th and 12th day of storage against the minimum (16.10%) dry matter content under control. These results were conformity by Sanjay singh *et al.* (2010) [16] in ber.

Ascorbic acid

The ascorbic acid content of ber fruits (92.33 mg) was recorded maximum with treatment T_{11} (GA_3 @50 ppm + B @0.6%), which was statistically at par with treatment T_{15} (GA_3 @75 ppm + B @0.6%) and T_{10} (GA_3 @50 ppm + B @0.4%) were recorded at 0, 3rd, 6th, 9th and 12th day of storage at ambient temperature against the minimum (80.92%) ascorbic acid content under control. Variation in decreasing trend of ascorbic acid might be due to different levels of oxidation in different treatments. The increase in ascorbic acid might be due to the catalytic influence of growth regulators on its bio-synthesis from its precursor glucose-6 phosphates throughout the development of fruits which is thought to be a precursor of vitamin- C Dhillon and Singh (1968) in ber. This finding is in agreement with those of Obeed (2012) [1], Pandey *et al.* (2011) [11], Singh *et al.* (2010) [16], Singh *et al.* (2007b) [17] in ber.

Conclusion

It can be concluded from the study that pre-harvest application of (GA_3 @75 ppm + B @0.6%), which was statistically at par with treatment (GA_3 @50 ppm + B @0.4%) is useful to prolong the storage life of ber fruits up to 12 days with very good fruit quality under ambient storage conditions.

References

1. Al-Obeed RS. Jujube post-harvest fruit quality and storability in response to agro-chemicals pre-harvest application. African Journal of Agricultural Research 2012;7:5099-5107.
2. Anonymous. Directorate of Horticulture Database-2019, Government of Rajasthan 2019.
3. Anonymous. Indian Horticulture Database-2019, National Horticulture Board, Gurgaon 2019.
4. Brahmachari VS, Rani R. Shelf life extension in guava with pre-harvest spray of certain growth substances and polyethylene wrapping. Haryana Journal of Horticulture Science 2005;34:36-38.
5. Chaturvedi RS, Gaur OP, Singh G. Effect of pre-harvest spray of zinc, calcium and boron on the storage behaviour of guava (*Psidium guajava* L.) fruits cv. Allahabad Safeda. Acta Horticulturae 2007;7(35):633-638.
6. Dev R, Sharma GK, Singh T. Effect of gibberellic acid

and oxalic acid on colour retention and storage quality of cold stored fruits of *ber* cv. Gola. Indian Journal of Horticulture 2018;75(1):124-129.
7. Jawandha, Kaur, Sukhjit, Mahajan BVC, Gill, Singh P. Effect of pre-harvest treatments on the cellulase activity and quality of ber fruit under cold storage conditions. *Notulae Scientia Biologicae* 2009;1(1):88-91.
8. Jawandha SK, Gupta N, Randhawa JS. Effect of post-harvest treatments on enzyme activity and quality of cold stored ber fruit. Notulae Scientia Biologicae 2012;4:86-89.
9. Meena VS, Nambi E, Kashyap, Poonam, Meena KK. Naphthalene acetic acid and ferrous sulphate induced changes in physico-chemical composition and shelf life of ber. International Journal of Horticulture, 2013;70(1):37-42.
10. Morton J. Fruits of warm climates. Julia F. Morton, Miami, *FL*. 1987, 272-275.
11. Pandey A, Tripathi V, Pandey M, Mishra A, Kumar D. Influence of NAA, GA_3 and zinc sulphate on fruit drop, growth, yield and quality of ber cv. Banarsi Karaka 2011.
12. Rajput RP, Senjaliya HJ, Vala GS, Mangroliya GS. Effect of various plant growth regulators on yield and quality of guava *(Psidium guajava* L.) cv. L-49. International Journal of Agricultural Science 2015;11(1):179-182.
13. Rizk-Alla MS, Abd El-Wahab MA, Fekry OM. Application of GA and NAA as a means for improving yield, fruit quality and storability of Black Monukka grape Cv. Nature and Science 2011;9(1):1-19.
14. Rokaya PR, Baral DR, Gautam DM, Shrestha AK, Paudyal KP. Effect of pre-harvest application of gibberellic acid on fruit quality and shelf life of mandarin (*Citrus reticulata* Blanco). American Journal of Plant Sciences 2016;7:1033-1039.
15. Samant D, Mishra NK, Singh AK, Lal RL. Effect of micronutrient sprays on fruit yield and quality during storage in ber cv. Umran under ambient conditions. Indian Journal of Horticulture 2008;65(4):399-404.
16. Singh S, Singh A, Joshi H, Lata K, Bagle B, More T. Effect of zero energy cool chamber and post-harvest treatments on shelf-life of fruits under semi-arid environment of Western India Part-1 ber fruits. Journal of Food Science and Technology 2010;47(4):446-449.
17. Singh S, Singh AK, Joshi HK, Bagle BG, More TA. Prolonging shelf life of ber under semi arid environment. Indian Journal of Arid Horticulture 2007b;2:40-44.
18. Vishwakarma SK, Ram RB, Kumar A. Effect of pre-harvest application of GA_3 and CA $(NO_3)_2$ on the shelf-life of ber fruits CV. Baranasi Karaka. Plant Archives 2014;14:1057-1059.