

Effect of Neem Leaf Extract and Benzyladenine on Post-Harvest Shelf Life of Orange (*Citrus reticulata* Blanco)

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Abstract

Present investigation was carried out in the Department of Horticulture, Rajasthan College of Agriculture, Udaipur. Nine treatment combinations consisting three levels of neem leaf extract (0, 10 and 20%) and three levels of benzyladenine (0, 50 and 100 ppm) were used for the experimentation. Freshly fully mature and uniform fruits were packed in 0.5 per cent perforated polyethylene bags after giving the different neem leaf extract and benzyladenine treatments and stored at room temperature. The stored fruits were examined for the physico-nutritional changes during storage at 9, 18, 27 and 36 day of storage. The results at end of storage period revealed that the minimum losses of various physico-chemical characteristics of orange fruit was under dip treatment of 20 per cent neem leaf extract combined with 100 ppm benzyladenine (N₂B₂). Under this treatment, minimum physiological loss in weight (21.64%), fruit rotting (16.27%), minimum reduction in diameter (14.81%), minimum decrease (0.695 to 4.466 %) in acidity and ascorbic acid (36.65 to 25.92 mg 100 mL⁻¹ juice) were recorded. The maximum juice content (39.25%) and highest organoleptic score (6.86 out of 10 mark) at end of storage (36 days) was also recorded in the same treatment. The total soluble solids and total sugar content were increased with the advancement of storage period but minimum increase (10.15⁰ Brix to 12.48⁰ Brix) in total soluble solids and total sugar content (5.65 to 7.21 per cent) in stored fruit at the end storage was recorded in 20 per cent neem leaf extract with 100 ppm benzyladenine treatment.

Key words: Organoleptic, ascorbic acid, shelf life, mandarin orange, total soluble solids

Introduction

Mandarin orange (*Citrus reticulata* Blanco) is most common among citrus fruits grown in India. It occupies nearly 50 per cent of the total citrus area

and maximum production in India. Mandarin orange is grown in various states of India like Maharashtra, Punjab, Haryana, Himachal Pradesh and Rajasthan etc. The high acceptability of mandarin orange among the citrus fruits is due to its attractive color, distinctive flavor and their being rich source of vitamin 'C'. Mandarin orange is a seasonal and perishable in nature, so 20-30 per cent of total fruits are lost at the post harvest stage. This loss is mainly due to microbial and fungal infection on the fruits. A number of post harvest treatments like waxing fungicidal dip and polyethylene film etc. have been used to extend the shelf life of fruits. However, the environmental consciousness among the scientists and a layman has drawn attention towards increasing the use of chemicals on foodstuff and their deleterious effects on the environment and on human being. There is need to find the suitable eco-friendly and minimal risk agents for extending the storage life of fruits. In view of the above fact that the use of neem leaf extracts and benzyladenine are residues free and safe from consumption point of view as compared to fungicides or other chemicals. It is well known that the use of neem leaf extract and benzyladenine acts as antisenescence and arrest the metabolic break down deterioration caused by various bio-chemical activities in fruits. Keeping in view the aforesaid facts this experiment was undertaken to observe the effect of neem leaf extract and benzyladenine on the self-life of mandarin orange.

Experimental

Freshly harvested, uniform fruits of orange were purchased from the farmer's field and brought to the laboratory in the department of Horticulture, Rajasthan College of Agriculture, Udaipur. Nine treatment combination consisting three levels of neem leaf extract (0, 10 and 20%) and three levels of benzyl adenine (0, 50 and 100 ppm) were used for the experimentation. The treated fruits kept at room temperature i.e. 16.7 to 31.8°C with a relative humidity



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of 20-57 per cent. The above treatments were replicated thrice having 25 kg fruits in each treatment. Periodical observations with regard to physical characteristics (physiological loss in weight, rotting per cent, juice content and reduction in diameter) and chemical characteristics (organoleptic taste, total soluble solids, acidity, ascorbic acid and total sugars) were recorded on 9, 18, 27 and 36 day of storage. The estimation of physiological loss in weight by periodical weighing of fruits and the differential weight loss was expressed in per cent with respect to storage time and pre treatments. Rotting of fruits was visually counted out of total fruits and fruit rotting was also expressed on percentage basis. The juice of fruits was extracted by screw type juice extractor. It was strained, weighted and expressed in term of percentage. For determination of reduction in diameter it was measured with vernier caliper and organoleptic evaluation of fruit juice was evaluated by a panel of ten judges using Hedonic rating test¹ on the basis of sweetness, blend and aroma. The total soluble solids content of the fruit juice was determined by using Zeiss Hand Refractometer and values corrected to 20°C. The titrable acidity was determined by using standard N/10 NaOH in the presence of phenolphthalein indicator. The vitamin C content of the juice was estimated by visual titration method with 2,6- dichlorophenol indophinol dye solution². The sugar in the fruit was determined³ and the results were statistically analyzed in completed randomized design⁴.

Results and Discussion

It is obvious from the data presented in Table 1 and 2, that there was the percent physiological loss in weight and rotting per cent of fruits increased continuously with advancement of storage period irrespective of the treatments. The increase in physiological loss in weight and rotting per cent was found to be very slow in fruits treated with 20 per cent neem leaf extract and 100 ppm benzyladenine as compared to control and other treatments. Hence, the physiological loss in weight and rotting was significantly reduced by neem leaf extract and benzyladenine treatment. This may be due to the fact that neem leaf extract check the growth of microbes that are responsible for rotting and higher metabolic rate, which cause loss in weight through transpiration.

Effectiveness of plant leaf extracts in reducing the physiological loss in weight and prolonging the shelf life of fruits in comparison to control as found in present study can be corroborated by previous findings in various fruits, like mango, guava, banana and tomato⁵⁻⁸. The benzyladenine reduce senescence, rate of respiration, and ripening of fruits^{9,10} as in present study. The maximum retention of juice content (39.25%) and minimum reduction in fruit diameter (14.81%) on 36 days of storage was found with 20 per cent neem leaf extract and 100 ppm benzyladenine treatment. A possible explanation for minimum reduction in juice content and diameter of fruits under this treatment was because of reduced moisture loss and maintaining proper shape of fruits. Similar results were reported earlier^{11,12}. From the consumer's point of view, organoleptic taste of fruits is very important which determines the marketability of fruits. In the present study result indicate that the organoleptic scoring of fruits decreased with advancement of storage period. However, higher organoleptic score (6.86 out of 10.0 marks) of mandarin fruits was obtained under the fruits, were treated with 20 per cent neem leaf extract and 100 ppm benzyladenine. Possible explanation for good organoleptic taste of fruits under this treatment combination might be due to no change in quality characters and palatability of the fruits, which resulted in minimum physiological loss in weight and help in maintain acidity, total soluble solid and sugars due to the neem leaf extract and benzyladenine checking decay losses in fruits that are caused by metabolic change and fungal infestation. Results are in line with previous studies¹³. The maximum retention of acidity (0.466%) on 36 days of storage was found to be in fruits, treated with 20 per cent neem leaf extract and 100 ppm benzyladenine. Decline in acidity during storage was due to the utilization of acids in respiration process and conversion in sugar and salts¹⁴. Whereas, fruits treated with neem leaf extract and benzyladenine showed higher retention of acidity during storage. This could be due to the treatment delay in physiological ageing and alteration in metabolism, which ultimately resulted in higher retention of acidity. Similar results were observed previously^{13, 15-17}. The ascorbic acid (vitamin C) content of the fruit during storage reduced with





Table-2 Effect of various treatments on the physico-chemical characteristics of orange

Treatments	After 27 days of storage								
	PLW (%)	Rotting (%)	Juice content (%)	Reduction in diameter %	Organoleptic taste (10)	TSS (^o Brix)	Acidity (%)	Ascorbic acid (mg/100 ml juice)	Total sugars (%)
N ₀ B ₀	24.92 (17.76)	23.64 (16.08)	36.39 (35.20)	15.72(7.34)	6.41	13.11	0.505	22.03	8.25
N ₀ B ₁	24.54 (17.25)	21.64 (13.60)	37.21 (36.58)	15.58(7.22)	7.26	13.00	0.506	23.34	8.04
N ₀ B ₂	23.75 (16.22)	21.39 (13.30)	37.60 (37.22)	15.42(7.07)	7.48	12.83	0.508	23.87	7.64
N ₁ B ₀	22.98 (15.25)	18.21 (9.77)	37.86 (37.67)	15.09(6.77)	7.32	12.86	0.500	22.57	8.02
N ₁ B ₁	22.08 (14.13)	16.68 (8.24)	38.51 (38.77)	14.90(6.61)	7.64	12.68	0.511	25.15	7.65
N ₁ B ₂	21.60 (13.56)	14.89 (6.60)	39.48 (40.43)	14.61(5.99)	7.96	12.28	0.527	25.25	7.40
N ₂ B ₀	21.50 (13.44)	13.30 (5.29)	39.06 (39.71)	13.43(5.40)	7.64	12.53	0.506	24.95	7.62
N ₂ B ₁	20.18 (11.90)	11.17 (3.75)	39.70 (40.81)	13.21(5.22)	8.15	12.21	0.535	26.22	7.34
N ₂ B ₂	20.07 (11.78)	9.43 (2.68)	40.20 (41.66)	13.17(5.19)	7.81	11.96	0.533	26.82	7.15
SEm+	0.204	0.110	0.146	0.127	0.060	0.112	0.006	0.294	0.094
CD at 5%	0.540	0.314	0.390	0.365	0.180	0.300	0.018	0.670	0.270
	After 36 day of storage								
N ₀ B ₀	27.32 (21.07)	27.25 (20.975)	35.15 (33.147)	18.66 (10.24)	4.98	13.45	0.426	21.32	8.51
N ₀ B ₁	26.18 (19.46)	24.95 (17.79)	35.99 (34.544)	18.16 (9.72)	5.77	13.40	0.427	22.24	8.24
N ₀ B ₂	26.04 (19.28)	23.85 (16.35)	36.60 (35.555)	17.58 (9.12)	6.19	13.34	0.430	23.55	7.99
N ₁ B ₀	24.81 (17.61)	22.57 (14.734)	36.80 (35.884)	17.12 (8.67)	6.04	13.28	0.425	21.99	8.28
N ₁ B ₁	23.98 (16.52)	21.46 (13.387)	37.53 (37.109)	16.91 (8.46)	6.45	13.10	0.437	24.04	7.98
N ₁ B ₂	23.27 (15.61)	20.01 (11.711)	38.29 (38.395)	16.58 (8.14)	6.59	12.85	0.459	24.39	7.57
N ₂ B ₀	23.27 (15.61)	18.34 (9.902)	37.96 (37.837)	16.01 (7.61)	6.52	12.85	0.437	23.46	7.79
N ₂ B ₁	21.93 (13.95)	17.00 (8.55)	38.66 (39.018)	15.50 (7.14)	6.52	12.87	0.464	25.85	7.51
N ₂ B ₂	21.64 (13.60)	16.27 (7.853)	39.25 (40.039)	14.81 (6.54)	6.86	12.48	0.466	25.92	7.21
SEm+	0.163	0.107	0.179	0.106	0.060	0.133	0.008	0.211	0.109
CD at 5%	0.468	0.308	0.490	0.304	0.170	0.390	0.024	0.605	0.320
0 days	0.00	0.00	51.25	0.00	10.00	10.15	0.695	36.65	5.65

N₀ =0 % neem leaf extractN₁ =10 % neem leaf extractN₂ =20 % neem leaf extractB₀ = 0 ppm benzyladenineB₁ = 50 ppm benzyladenineB₂ = 100 ppm benzyladenine

Figures in parentheses are arc sine retransformed value

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the advancement of storage because it is highly sensitive to oxidation. The maximum retention of ascorbic acid (25.92 mg per/100 mL fruit juice) with 20 per cent neem leaf extract and 100 ppm benzyladenine treatment because the neem leaf extract and benzyladenine also reduces the respiration rate as well as oxidation in the fruits^{18,19}. The total soluble solids and sugar content of fruits increased with advancement of storage period. But it was observed that the fruits treated with 20 per cent neem leaf extract and 100 ppm benzyladenine have minimum increase in total soluble solids (12.48°Brix) and total sugars (7.21%) on 36 days of storage. The increase in total soluble solids and sugar content of fruit might be due to same acid being converted into sugars, during respiration on the other hand the neem leaf extract and benzyladenine reduced respiration rate and delay ripening. Further, conversion of polysaccharides into monosaccharide could have been reduced in neem leaf extract and benzyladenine treated fruits. The present findings are also supported by many workers previously in mango, tomato and orange fruits^{6,8,13,16,20}.

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