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STORAGE STUDY OF BAEI (*AEGLE MARMELOS CORREA*) FRUIT AND PULP OF CV. PANT SUJATA

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ABSTRACT

Storage study of bael fruit and pulp were conducted at ICAR-RCER, Research Centre Ranchi to find out suitable storage life to extent the availability of the fruit and produce the value added product in form of fruit. The cultivar under storage is Pant Sujata. CFB box packing resulted in minimum 21 % PLW during 2010-11 during its 28-35 days storage under ambient temperature. CFB box and Gunny bag retains maximum total sugar (17.3-17.4⁰B) after 28 days storage. Bael pulp of cultivar Pant Sujata can be stored up to 2 months at 4⁰C with good quality condition. Treatments were highly significant in the characters such as T.S.S., acidity, reducing sugar and total sugar. Storage conditions and treatments interaction were insignificant in all characters except acidity. The maximum T.S.S. of 21.87 ⁰B has been found in sample treated with 800 ppm benzoic acid when kept for two months at 4⁰C temperature. This treatment also resulted in retaining the maximum reducing sugar (8.09 %) and total sugar content (9.52 %) at same storage condition than other treatments. From the present experiments it is concluded that CFB box packing and pulp storage with 800 ppm benzoic acid at 4 ⁰C are important to extent the availability of bael for two months.

Keywords: Bael fruit, pulp, packaging, storage

INTRODUCTION

Bael (*Aegle marmelos* Correa.) is one of the most important nutritious and medicinal fruit grown in India and its surrounding countries (Gupta and Tanndon, 2004). It is believed to be originated in South East Asia (Sarkar et al., 2015). It is valued for its vitamin A, riboflavin and fiber and mucilage content. In summer it is used as fresh juice for laxative and cooling effect (Sharma et al., 2007). Bael contains good amount of carbohydrates, Ca, magnesium other minor important elements which is very important for human health. It is also good for diabetic patient due to having more mucilage and medicinal contents like caumarin and mamalosin (Prajapat et al., 2012). For growth and development bael fruit requires about 10-11 months from pollination to harvest therefore it is hardy and can be stored for long time. It is rainfed tree commonly used for orcharding and wasteland development. For production of tender bael powder which is stored for long time can be harvested on 2-3 month of age. At this age bael fruit fly causes maximum damage by oviposition on smooth green surface and in storage *Aspergillus niger* causes blackening of the fruits if any crack happened during harvesting. Bael fruits are hardy and get matured after 10-11 months growing on the tree (Singh 2007). Storage life of matured bael can be increased upto 24 days if bael are package and bagged with polyethylene (Bhadra and Sen, 1998). The

composition of fruits ripened artificially or naturally, did not vary much, (Roy and Singh, 1981) Bael pulp storage by giving Benzoic acid treatments and storage at low temperature (4⁰ C) is essential to protect the color of the product. Therefore, present studies have been conducted for storage of bael fruits and pulp and quality after storage. It has immense value and very important for student and researcher across the country and across the globe.

MATERIALS AND METHODS

After the harvesting bael are stored in room temperature for selling. Storage life of the bael fruit depends upon the stage of harvesting. Generally, 10-11 months growing on tree and having hard pericarp bael fruit can be stored up to 10-15 days at room temperature Singh (2007). To increase the storage life of bael fruit and pulp different experiment were taken at ICAR-RCER, Research Centre Ranchi. The treatments were, T1=Open crate stacking, T2=News Paper Wrapping of individual fruits, T3= CFB box packing and T4=gunny bag packing. And the experiment is followed by Randomized block design. Ambient storage temperature was 32°C and 80-85 relative Humidity. Bael pulps were extracted from ripe bael after 15 days storage when surface colour became yellow. Cultivar Pant Sujata was taken for study. Seed and fibrous portion of bael were removed and 5-10% water with benzoic acid solution of 200, 400, 600, 800 and 1000 ppm

were treated in different treatments. Treatments were imposed in two different temperature conditions viz. 4°C and ambient temperature (32°C). The experiment was laid out in a Factorial RBD with four replications. TSS was measured by Atago Digital Refractometer whereas reducing sugar and total sugar were calculated by Lane and Eynon methods (Rangann 1997). Data were taken at 7 days interval for fruit storage study whereas one month interval in case of pulp storage study.

RESULTS AND DISCUSSIONS

EXPRIMENT -1 STORAGE SUDY OF BAEL FRUITS

It has been found that bael can be stored up to 28 days in ambient temperature without spoilage in four treatments. Storage life can be extended up to 35 days with 40 percent spoilage. News paper wrapping and CFB box packing resulted in minimum 21 % PLW during 2010-11(fig-1). The T.S.S. content of the fruit was increased up to 21 days after that it was gradually decreased. The maximum T.S.S. of 35.8 °B was found when fruits were packed in CFB Boxes and placed in ambient temperature for 21 days (fig-2). Similar results were also observed by Bhadra and Sen (1998) when fruits wrapped with boxes and bagging increased the maximum extension of shelf life of 24 days. Roy and Singh, (1979) observed that shelf or storage life of bael fruit was 2 weeks at 30 °C to 12 weeks at 9 °C when relative humidity was 85-90%. Acidity was gradually decreased during storage. However incase of news paper wrapping and CFB box packing there were slow decrease in acidity. In case of fruit kept in open crates the acidity was minimum (0.13%) after 35 days of storage (fig-3). In case of treatment T3 and T4 reducing sugar continually increased up to 28 days of storage and it reached up to 9.92 percent (T4) which was at par with (T3) 9.58 per cent. This observation was corroborated by Roy and Singh (1981) showed that less sugar content in artificially ripened fruits. In case of treatment T1 and T2 reducing sugar content increased till 28 days after storage. However reducing sugar content decreased after 28 days of storage (fig-4). Regarding total sugar content, in open crate condition total sugar increased up to 15 days of storage but after that it is gradually decreased. Treatments T3(17.4 %) and T4 (17.3%)accounted for maximum total sugar content after 28 days of storage after that total sugar content decreased(fig-5).

From the above study it is evident that bael can be stored up to 35 days with minimum 40 per cent spoilage at ambient temperature. Bael can be stored up to 28 days at ambient temperature CFB box packing without spoilage and deterioration of nutritional quality. Gunny bag packing (T4) was also effective where changes in reducing sugar and total sugar relatively low. In these two treatments total sugar increased up to 17.3 to 17.4 % after 28 days of storage after that total sugar decreased. From overall performance CFB box packing(T3) was best to retard PLW and slow but highest increase in physicochemical characters up to 28 days storage.

EXPRIMENT-2 STORAGE STUDY OF BAEL PULP

Bael pulp can be storage up to 2 months at 4°C with good quality condition. Treatments were highly significant in the following characters such as T.S.S.

acidity, Reducing sugar and total sugar. Storage conditions and treatments interaction were insignificant in all characters. The maximum T.S.S. of 20.86 °B has been found in sample treated with 800 ppm benzoic acid and kept for two months at 4°C temperature. Roy and Singh, (1981) also reported that having less sugar content when fruits ripened artificially or naturally.. In bael pulp Chand and Gehlot (2006) added sugar to bael pulp for thick consistency as well as maintain quality of pulp by maintaining decreased sugar level. Sharma et al.(2007) reptred that application of 350ppmSO₂ +30% sugar with pulp increase the storability of the product (pulp0 up tp 3 months. This study corrorates the present study. In our experiment after two months ascorbic acid was 18.55 mg/gm incomarision to 66mg/100gm pulp (Sharma et al., 2007). This treatment also resulted in minimum acidity(0.44 %) and maximum reducing sugar(7.08 %) and total sugar content(8.49 %) at same storage condition than other treatments and storage atmosphere(ambient)(table 1and 2). Chand and Gehlot (2006) they use additional sugar and citric acid for storage bael pulp. The extracted bael pulp was improved by adjusting the TSS by addition of sugar and acidity by the addition of citric acid .It has been found that some samples were lost (spoilage) in case of storage at ambient temperature after two months. So in low temperature (4°C) bael pulp can be stored more than two months without spoilage.

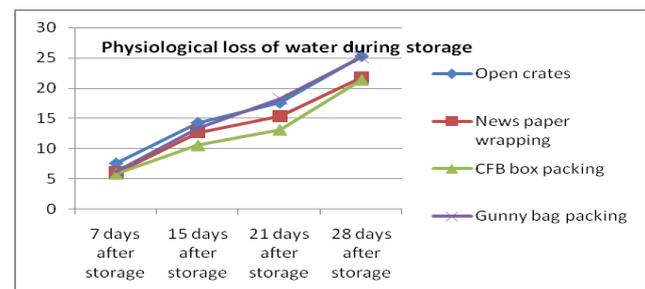


Fig -1. Physiological loss of water during storage of bael

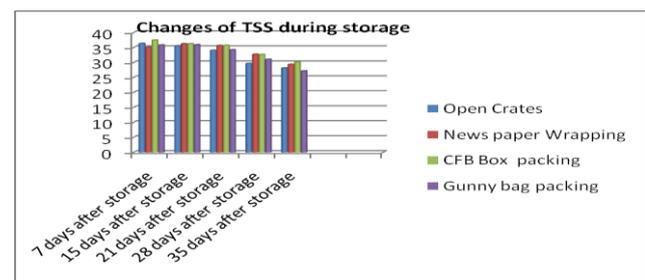


Figure-2 Changes of TSS during storage of bael

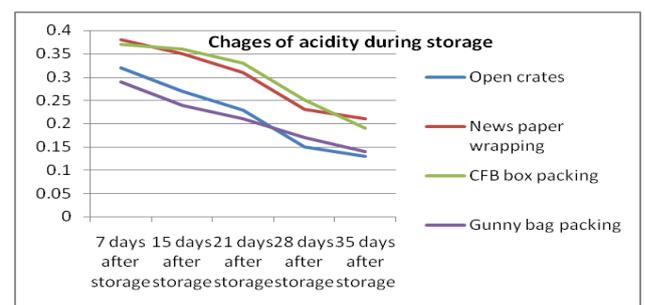


Fig-3 Changes of acidity during storage of bael

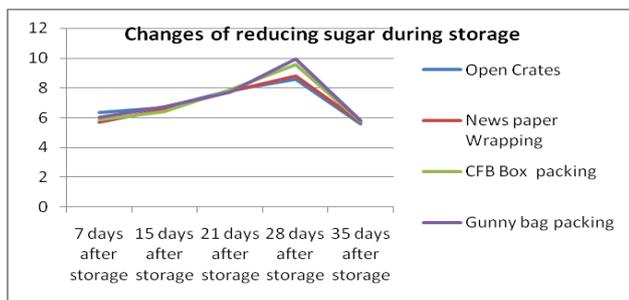


Fig-4 Changes of reducing sugar during storage of bael

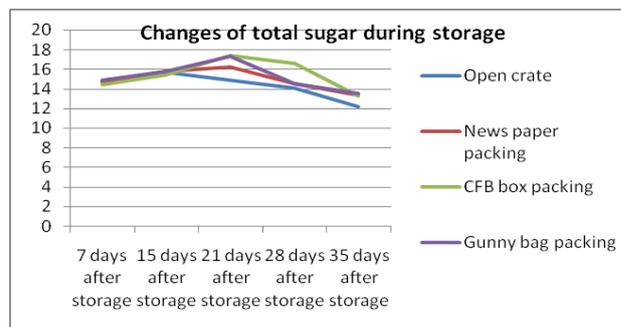


Fig-5: Changes of total sugar during storage of bael

Table-1: Bio-chemical changes of bael pulp during two months of storage during 2010

Treatments	Initial T.S.S.(⁰ B)	2 months Storage at room temp.	2 months storage at 4 ⁰ C	Initial Acidity (%)	2 months Storage at room temp	2 months storage at 4 ⁰ C	Initial Ascorbic Acid(mg /100g pulp)	2 months storage at room temp.	2 months storage at 4 ⁰ C
0 ppm Benzoic Acid	33.50	18.34	20.41	0.44	0.95	0.88	18.92	14.22	15.62
200 ppm Benzoic Acid		19.54	20.56		0.92	0.73		15.15	17.22
400 ppm Benzoic Acid		19.96	20.62		0.77	0.75		15.62	18.11
600 ppm Benzoic Acid		21.55	21.78		0.68	0.72		15.77	18.34
800 ppm Benzoic Acid		21.27	21.87		0.67	0.56		16.42	18.55
1000 ppm Benzoic Acid		19.33	19.25		1.10	0.59		16.33	16.75
CD at 5% for A(Temperature)		NS			NS			NS	
B(Treatment)		0.82			0.97			NS	
AxB (interaction)		NS			0.16			NS	

Table-2: Bio-chemical changes of bael pulp during two months of storage during 2010

Treatments	Initial Reducing Sugar (%)	2 months Storage at room temp.	2 months storage at 4 ⁰ C	Initial Total Sugar (%)	2 months Storage at room temp	2 months storage at 4 ⁰ C
0 ppm Benzoic Acid	9.29	4.14	6.34	13.82	4.75	7.65
200 ppm Benzoic Acid		4.25	6.52		4.95	8.12
400 ppm Benzoic Acid		4.99	6.95		5.13	8.40
600 ppm Benzoic Acid		5.62	7.15		6.44	8.69
800 ppm Benzoic Acid		5.51	8.09		6.82	9.52
1000 ppm Benzoic Acid		5.07	7.98		5.11	8.32
CD at 5% for A(Temperature)		0.075			0.284	
B(Treatment)		0.520			0.461	
AxB(interaction)		NS			NS	

POST HARVEST DISEASES

- 1 In bael storage common disease is blackening of the fruit due to injury or crack during storages. The causal organism is *Aspergillus niger* which develops black spore with in short time in the storage and entire bael fruit from inside and outside turned black.
2. When bael pulp stored for more than two months there is a chance of development of yeast colonies (*Saccharomyces sps*). Therefore, frequent checking is needed. Out of total 36 samples we found one colonies in one sample. Diseases incidence per cent is 2.5.



Plate-1: Storage of Bael pulp



Plate-2 (Treatment 3): CFB box packing of bael fruits and kept in storage for 28 days.



Plate-3 (Treatment 2): News paper wrapping of bael fruits and kept in storage for 28 days.



Plate-4. Aspergillus niger



Plate-5: Storage bael pulp was lost due to growing of yeast colonies (*Saccharomyces sps*)

CONCLUSION

Storage in CFB box packaging of bael fruits remain fresh for 28 days and bael pulp can be stored up to two months without any spoilage when treated with benzoic acid at 800ppm treatment and followed by lukewarm heating.

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