

STORAGE LIFE OF THE BETEL LEAVES (*Piper betle*) IN BAMBOO BASKETS

S.A.M.C. Senevirathne, H.K.L.K. Gunasekera, and H.A.Ratnasoma

Department of Agricultural and Plantation Engineering, OUSL and
Inter cropping and Betel Research Station, Narammala

Introduction

Betel (*Piper betle* L.) is a popular cash crop grown in Sri Lanka; cultivated in all districts for local consumption and in some districts such as Kurunegala, Gampaha, Colombo for export (Sumanasena and Chandana, 2005). The postharvest losses of Betel are reported to be approximately 35-70% and so far there has not been any attempt to improve the packing system or containers to extend the storage life of Betel leaves (Das, 1999). Generally, betel is exported having packed in specially designed bamboo-baskets inner-lined with papers, However, 35% -70% of post -harvest losses have been recorded with this packing system (Anon, 2002). At present, some farmers have been forced to give up betel cultivation due to disease occurrence, high cost of production and market fluctuation (Nasahir, *et al.*, 2007). Therefore, changes in packing materials or methods to improve and minimize the postharvest losses seem to be an important and timely need. In the light of this situation, it is important to investigate any non toxic preservatives to be used to extend the storage life of betel leaves and to investigate for any suitable material that could lower the heat development inside the bamboo basket.

Objectives of the Study

This study investigates different packaging methods for Betel leaves to lower the deterioration level in the bamboo baskets in the process of exporting.

Methodology

This experiment was carried out at Intercropping and Betel Research Station (Department of Export Agriculture), Narammala from November 2007 to March 2008. The experimental design was Randomized Complete Block Design (RCBD) with four treatments and three replicates are listed as below.

Treatment 1 (T₁) - Normal packing system (A complete lining of newspaper would be made as an inner layer between the bamboo basket wall and packed Betel bundles (Control).

Treatment 2 (T₂) - Each bundle of betel leaves was dipped in 100 ppm Citric acid solution and then packed in Bamboo basket.

Treatment 3 (T₃) - Similar to T₁. But for this treatment inner lining was made with fresh banana leaves instead of news paper layer. (Das, 1999)

Treatment 4 (T₄) - Same as T₁. Inner lining was made with "MADU WEL" (*Marremia umbellate* L.) (Personal communication)

Observations were made in 3-days intervals up to 9 days after packing as indicated below. Data were tabulated and analyzed by using Analysis of Variance (ANOVA) procedure of Statistical Analysis System (SAS). Duncan's New Multiple Range Test (DNMRT) was used to compare differences among the means at P=0.05.

Results and Findings

According to the analyzed data, as shown in Table 1, it was found that deterioration of Betel leaves, when examined after the third day of packing was five percent in the Bamboo baskets lined with fresh banana leaves. That level was increased up to ten percent with standard practice having paper inner lining, and with betel leaves treated with Citric acid and more than ten percent betel leaves were deteriorated with *MADU WEL* inner lining. Up to the sixth day betel leaves packed with fresh banana leaves inner lining showed only 11% deterioration but in all other treatments exceeded 15 %. Nearly 50% of deteriorated betel leaves were observed in all the treatments after the ninth day of packing.

Table 1 Number of non-deteriorated leaves in Bamboo basket with time

| Treatments | After 3 days D3 | | After 6 days D6 | | After 9 days D9 | |
|------------|--|----|--|----|--|----|
| | no. of non deteriorated leaves (out of 1600) | % | no. of non deteriorated leaves (out of 1600) | % | no. of non deteriorated leaves (out of 1600) | % |
| 1 Normal | 1437 ^b | 90 | 1344 ^c | 84 | 835.67 ^f | 52 |
| 2 Citric | 1434.33 ^b | 90 | 1304.33 ^{cd} | 81 | 823.33 ^f | 51 |
| 3 Banana | 1526.7 ^a | 95 | 1422 ^b | 89 | 924 ^e | 57 |
| 4 Madu wel | 1397.67 ^b | 87 | 1283.67 ^d | 80 | 798 ^f | 49 |
| LSD | 45.04 | | | | | |

Note: Means with same letters along the columns are not significantly different by LSD (Least Significant Difference) procedure at $p < 0.05$

The colour changes of the betel leaves were inspected and grouped into three categories by using the arbitrary colour index. All betel leaves under the three categories were counted and colour changes were recorded.



Plate Arbitrary colour category Index

According to this arbitrary colour index, category 1 and category 2 were considered as export quality betel leaves. Category 3 was rejected. By using the above arbitrary colour index the packed betel leaves were sorted in time period of 3, 6 and 9 days after packing and categorized.

Among different treatments tested, there is no significant difference in weight loss of betel with fresh banana leaves on third, sixth and ninth day after packing (Table 2). Betel leaves treated with citric would par with banana inner lining only up to the 3rd day.

Table 2 Percentage of Weight loss in the Betel leaves in the Bamboo baskets

| Treatments | After 3 days (D3) | After 6 days (D6) | After 9 days (D9) |
|------------|----------------------|----------------------|----------------------|
| 1 Normal | 2.82 ^{dc} | 3 ^{dce} | 3.11 ^{dc} |
| 2 Citric | 2.24 ^f | 2.77 ^e | 3.21 ^c |
| 3 Banana | 2.23 ^f | 2.31 ^f | 2.44 ^f |
| 4 Madu wel | 3.66 ^b | 3.95 ^{ab} | 4.23 ^a |
| LSD | 0.2996 | | |

Note: Means with same letters along the columns are not significantly different by LSD (Least Significant Difference) procedure at $p < 0.05$.

When correlation analysis was performed for different parameters, the weight loss in percentage was highly significant with non- deteriorated Betel leaves at 0.05 level (Table 3). Export quality betel leaves (non-deteriorated) have a negative relationship with weight loss percentage. When the leaves deteriorate with time, the weight of the leaves also decreases.

Table 3 Linear Correlation Coefficients between Time (days after storage), Export quality (EQ) and Weight Loss (WL%) parameters for the overall data set

| | Times (days) | EQ | WL |
|------|--------------|------------|----------------------|
| Time | - | -0.9198*** | 0.3158 ^{ns} |
| EQ | - | - | -0.4264** |
| WL | - | - | - |

Note: ns - non significant at $P = 0.05$; * Significant at 0.05 level; ** - Significant at 0.01 level; *** - Significant at 0.001 level.

Chemical composition of betel leaves subjected to study under different treatments had no significant difference when considering the major components of betel oil; Safrole, Eugenol, Chavibitol and Allypyrocatechol diacitate (Table 4).

Table 4 Chemical Composition of Different Treatments

| Treatments | Safrole (%) | Eugenol (%) | Chavibitol(%) | Ally. Diaci. (%) |
|------------|----------------------|----------------------|---------------------|---------------------|
| 1 | 27.8167 ^a | 14.7933 ^a | 3.5400 ^a | 3.5200 ^a |
| 2 | 26.4467 ^a | 13.3000 ^a | 4.2833 ^a | 3.5233 ^a |
| 3 | 26.7433 ^a | 13.8433 ^a | 4.7633 ^a | 3.6567 ^a |
| 4 | 26.4800 ^a | 14.0167 ^a | 4.7600 ^a | 4.7133 ^a |
| LSD | 1.73 | 2.07 | 1.32 | 2.09 |

Note: Means with same letters along the columns are not significantly different by LSD (Least Significant Difference) procedure at $p < 0.05$

Results revealed that the Safrole content of betel could be affected with the time factor (Table 5). Sri Lankan betel is preferred by Pakistan consumers for its specific taste and pungency. Safrole is reported to play a major role in betel taste and pungency.

Table 5 Variation of Chemical composition with days

| Days (Time) | Safrole | Euginol | Chavibitol | Ally. Diaci. |
|-------------|----------------------|----------------------|---------------------|---------------------|
| 3 | 39.2950 ^a | 17.0375 ^a | 5.5450 ^a | 4.5700 ^a |
| 6 | 22.4875 ^b | 12.5250 ^b | 3.7425 ^b | 3.5400 ^a |
| 9 | 18.8325 ^c | 12.4025 ^b | 3.7225 ^b | 3.4500 ^a |
| LSD | 1.49 | 1.79 | 1.14 | 1.81 |

Note: Means with same letters along the columns are not significantly different by LSD (Least Significant Difference) procedure at $p < 0.05$

Conclusions and Recommendations

It was observed that color change of betel began to increase with time in all the treatments but significantly less in baskets inner-lined with fresh banana leaves, indicating that the deterioration level in respect to color change would be reduced, if, fresh banana leaves are used as an inner lining. As far as the weight loss of betel with time is concerned, the banana leaves proved to be more superior than any other treatments. However, leaves treated with citric acid had similar results up to 3 days but with time an increase of weight loss was observed. Volatile oil content of fresh betel was around 1%. None of the treatments had significant influence on the oil content, but a remarkable effect was observed after 3 days. Hence, when all the criteria are taken into account baskets inner lined with banana leaves minimized the deterioration of betel and proved to be the best among other treatments. However, another study with an array of citric acid concentrations and or with different inner-lining materials merit for further investigations.

References

- Anonymous. (2002). Technical bulletin on Betel cultivation. Department of Export Agriculture, 1095, Kandy road , Peradeniya. 1-18.
- Das,J.N.,(1999), Studies on the effect of storage temperature on the shelf life of betel leave (*Piper betle L.*), Orissa Journal of Horticulture, 27(1),48-50.
- Nasahir M.C.M., Rathnasoma H.A. and Fernanopulle M.N.D.(2007). Effect of Nodal Number and Composition of Potting Medium and sprouting and Growth of Betel (*Piper betle*) Stem cuttings Raised in Poly Bags, 7th Agricultural Symposium, 23rd – 24th October 2007, Faculty of Agricultural and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila,125-129.
- Sumanasena, H.A., and Chandana, G.A., (2005).Effect of Irrigation and Fertilizer on Leaf Production of Betel vine (*Piper betle L.*), Tropical Agricultural Research and Extention , Faculty of Agriculture, University of Ruhuna, 8, 113- 114.