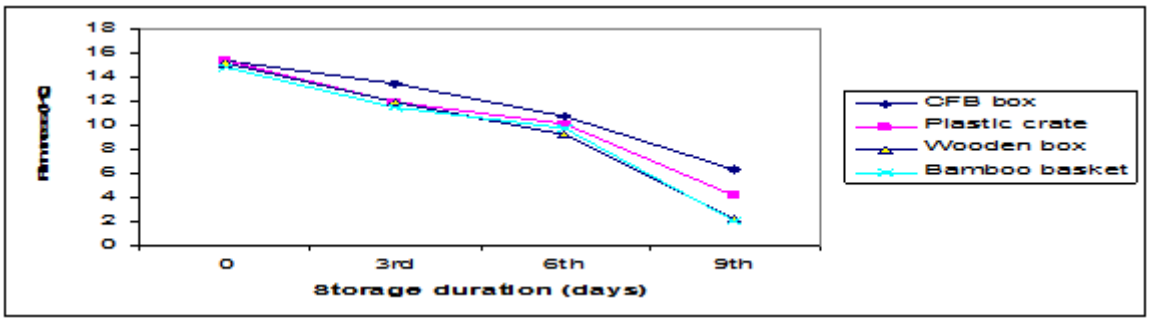

Figure 4: Firmness (kg) of guava fruits in different packages stored after vibration at 150 rpm for 3 hours

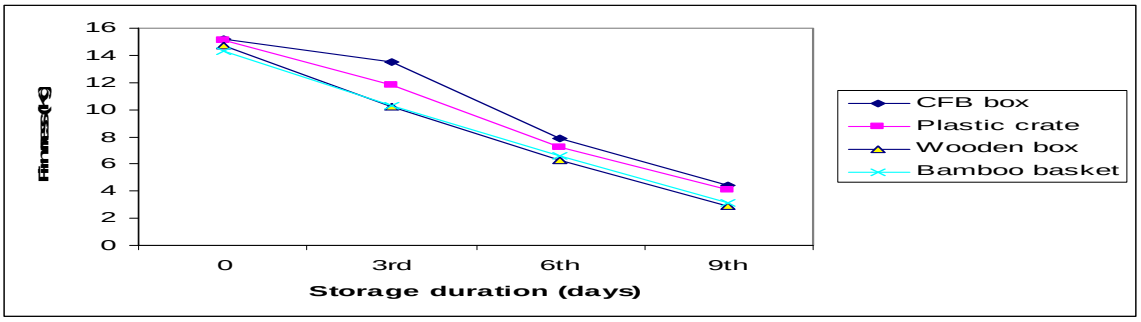

Figure 5: Firmness (kg) of guava fruits in different packages stored after vibration at 150 rpm for 6 hours

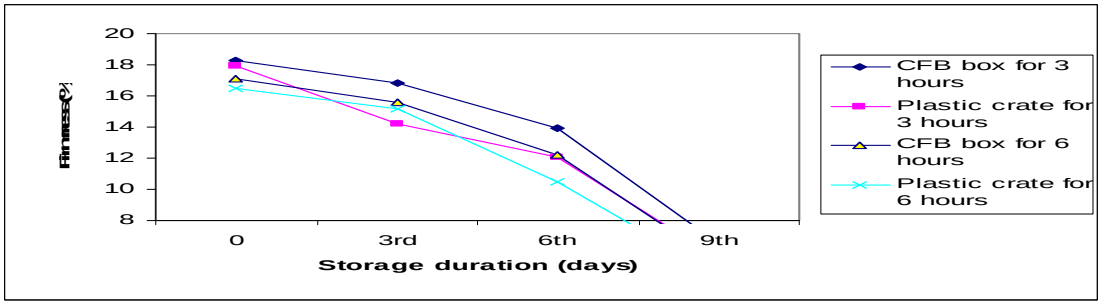

Figure 6: Firmness (kg) of guava fruits in different packages stored after vibration at 200 rpm for 3 hours & 6 hours

3.3 Total soluble solids (TSS)

Data on total soluble solids in fruits of guava cv. L-49 as affected by different treatments during different period of storage has been presented in Table 5 and Table 6. The trends of change in total soluble solids in all the treatments are shown in Fig. 7, Fig. 8 and Fig. 9. The TSS percentage increased in all the fruits samples with increase in the storage period (days) irrespective of the type of package and duration of vibration. It is clear from the figures that, the rate of change of total soluble solids in the guava fruits packed in the CFB box during the storage period was minimum followed by plastic crate, wooden box and bamboo basket. The values of the TSS of guava fruits packed in CFB box were 11.9, 12.0, 12.2 and 12.4% at the 0, 3rd, 6th and 9th day of storage respectively, with a mean of 12.1% after vibration treatment of 150 rpm for 3 hours.

The rate of change in the TSS of fruits packed in the bamboo basket was the highest. From the results obtained as shown in Table 4.6, the CFB box as a packaging material regards the minimum increase in TSS than plastic crate with increase in duration and intensity of vibration. The increase in percent TSS in fruit samples may be due to hydrolysis of polysaccharides and concentration of juice as the result of dehydration, Das and Dash (1967) and Bhullar et al. (1985).

3.4 Ascorbic acid

Data on ascorbic acid content of guava fruits cv. L-49 as affected by different types of packages during transportation and different period of storage has been presented in Table 4.7 and Table 4.8 and the trends of change in fruits acidity as affected by all the treatments are shown in Fig. 4.10, Fig. 4.11 and Fig. 4.12. From the results obtained it is clear that, there was higher retention of ascorbic acid during storage in fruits packed with CFB box. While there was highest reduction in ascorbic acid of fruits packed in bamboo basket. The values of the ascorbic acid of guava fruits packed in CFB box during the storage period, after vibration treatment at 150 rpm for 3 hours, at the 0.3rd, 6th and 9th day of storage were 203, 194, 185 and 175 mg/100 gm with a mean of 189 mg/100 gm. Also, in comparison between CFB box and plastic crate (Table 4.8), there was higher retention of ascorbic acid with slower rate of change in ascorbic acid content in the fruit packed in CFB box than in plastic crate.

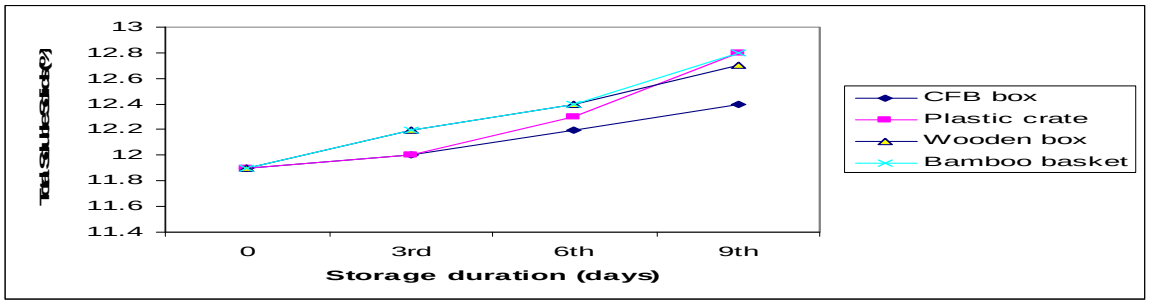

Figure 7: Total soluble solids (%) of guava fruits in different packages stored after vibration at 150 rpm for 3 hours

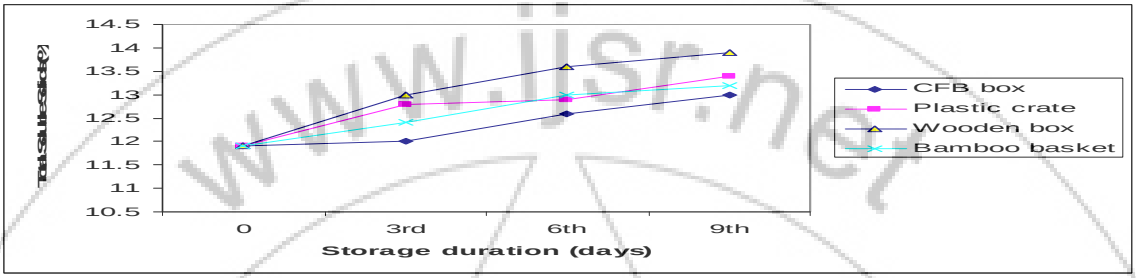

Figure 8: Total soluble solids (%) of guava fruits in different packages stored after vibration at 150 rpm for 6 hours

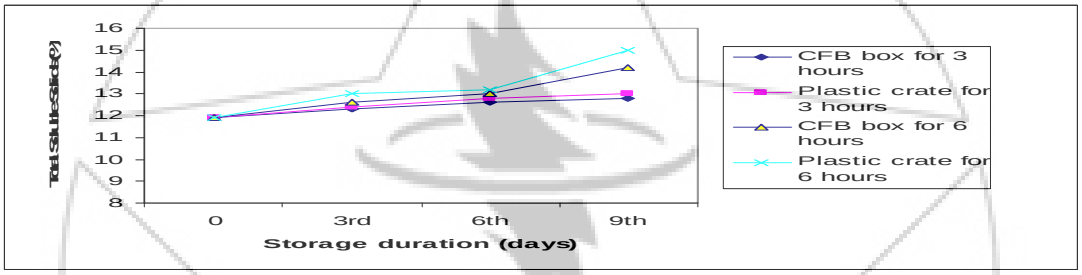

Figure 9: Total soluble solids (%) of guava fruits in different packages stored after vibration at 200 rpm for 3 hours & 6 hours.

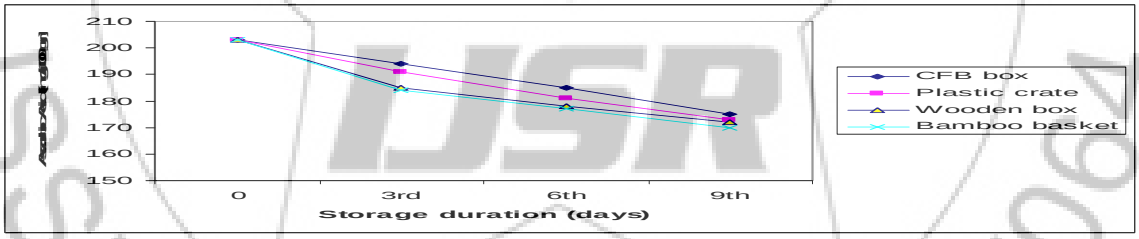

Figure 10: Ascorbic acid (mg/100 gm) of guava fruits in different packages stored after vibration at 150 rpm for 3 hours

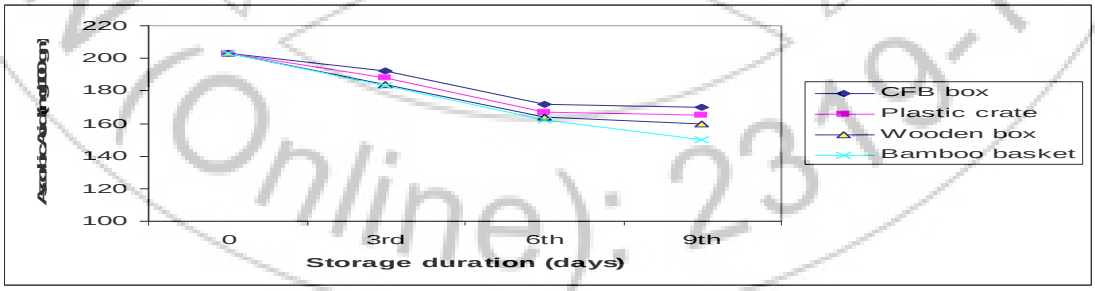

Figure 11: Ascorbic acid (mg/100 gm) of guava fruits in different packages stored after vibration at 150 rpm for 6 hours

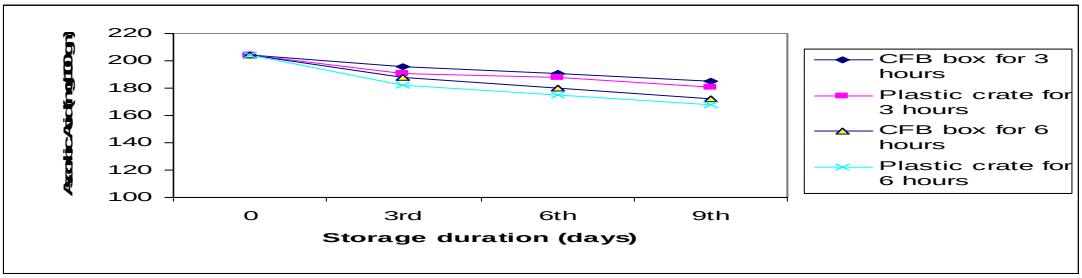

Figure 12: Ascorbic acid (mg/100 gm) of guava fruits in different packages stored after vibration at 200 rpm for 3 hours & 6 hours

3.5 Acidity

Data on acidity content of guava fruits cv. L-49 as affected by different types of packages during different period of storage has been presented in Table 4.9 and Table 4.10 and trends of change in fruits acidity as affected by all the treatments are shown in fig. 4.13, fig. 4.14 and fig. 4.15. The acidity of the guava fruits decreased slowly during the time of storage. During the storage it was observed that, the acidity of guava fruit significantly decreased in the different types of packages. The vibration level and vibration period does not affect the acidity content of the fruit. The guava fruits packed in the CFB box found lowest rate of change of acidity during storage period as compared to plastic crate, wooden box and the bamboo basket. The values of the acidity of guava fruits packed in the CFB box during storage period of 0, 3rd, 6th and 9th day were 0.62, 0.56, 0.42 and 0.33% respectively after the vibration treatment of 150 rpm for 3 hours.

3.6 Mechanical injury

Mechanical injury of the fruits was mainly due to the intensity and the duration of vibration. From the results obtained (Table 4.11 and Table 4.12), it is clear that there was a progressive increase in mechanical injury of fruits during simulated transportation in different packages, however, the magnitude of mechanical injury was the lowest in CFB box as compared to other three types of packages followed by plastic crates, wooden box and bamboo basket The effect of different durations and level of vibration treatments also gave the same results. From the table 4.12, it can be cleared that, among plastic crates and CFB boxes, the CFB boxes shows the minimum mechanical injury in fruits than plastic crates, also CFB boxes gave the best results when the fruits were packed with cushioning material as paper cuttings.

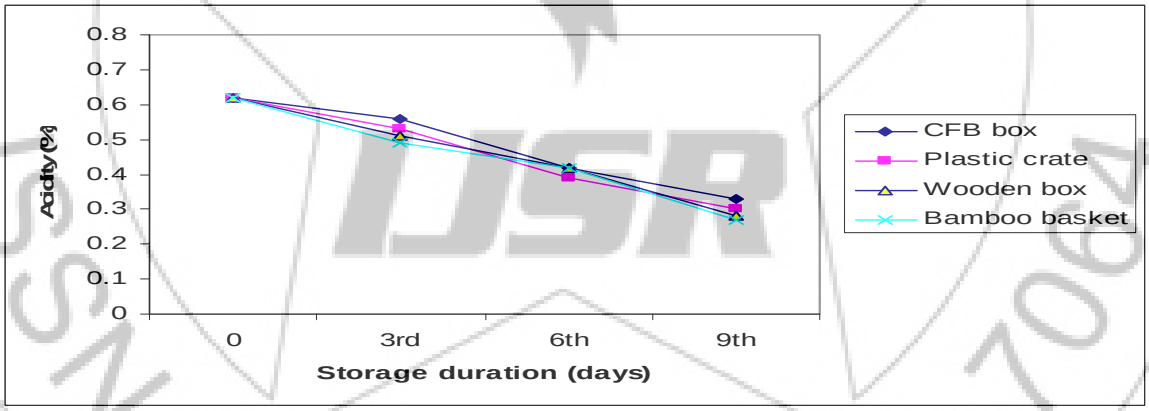

Figure 13: Acidity (%) of guava fruits in different packages stored after vibration at 150 rpm for 3 hours

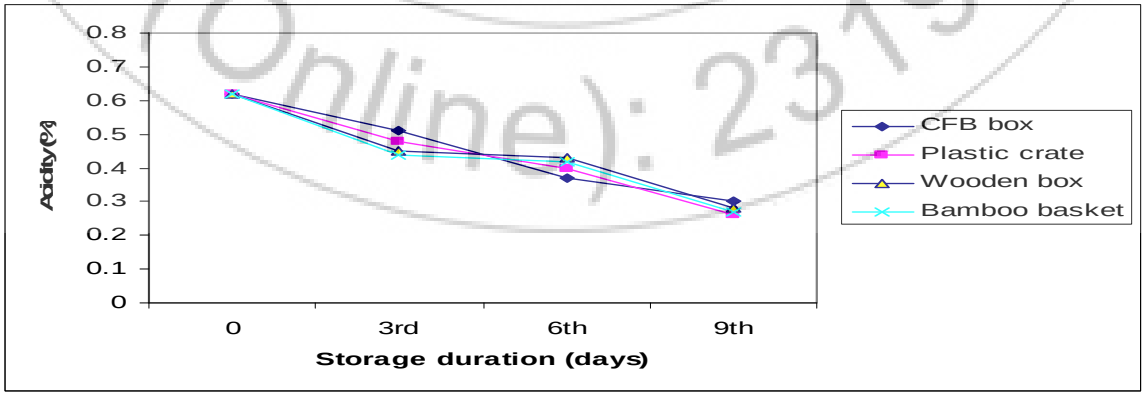

Figure 14: Acidity (%) of guava fruits in different packages stored after vibration at 150 rpm for 6 hours

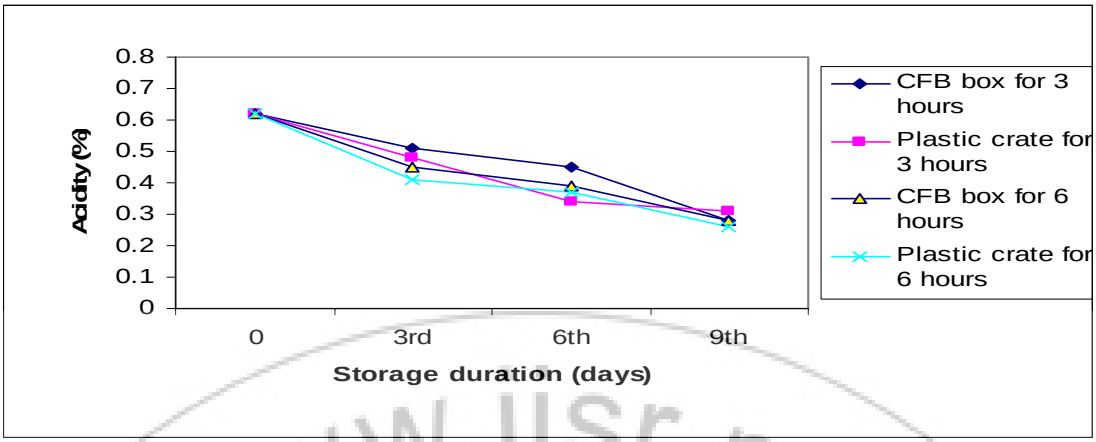

Figure15: Acidity (%) of guava fruits in different packages stored after vibration at 200 rpm for 3 hours and 6 hours.

4. Conclusions

The fruits were packed in four types of packages such as corrugated fibre board (CFB) box, plastic crate, wooden box and bamboo basket. The CFB box was punched with 0.1% of total area of package to make it perforated. All the four packages were tested for the simulated vibration at 150 rpm and 200 rpm vibration level for 3 hours and 6 hours each. The guava fruits were stored at room temperature (20 ± 2 °C) and relative humidity 50 to 75% and the different quality parameters were evaluated during the storage period up to 9 days with an interval of 3 days to optimize and develop the suitable package for guava among all the four packages. The different quality parameters evaluated during the storage were; physiological loss in weight (PLW), fruit firmness, total soluble solids (TSS), acidity and ascorbic acid content of the fruits. The following conclusions were drawn:

(1) The physiological loss in weight increased gradually and progressively with prolonged storage and increasing the duration and intensity of vibration.
(2) Fruits packed in corrugated fibre board (CFB) box found minimum physiological loss in weight whereas, the maximum loss in weight was recorded in fruit packed in bamboo basket.
(3) The firmness of the fruits subjected to simulated vibration was maintained for longer time when packed and stored in CFB box. However, maximum reduction in firmness during storage was observed in wooden box and bamboo basket.
(4) There was significant difference in firmness in the fruits packed in all four types of packages when the duration and intensity of vibration was increased.
(5) Fruit packed in corrugated fibre board box was best in terms of firmness, colour retention in keeping fruit more fresh and healthy after vibration and during storage period.
(6) The total soluble solids content of fruits was not affected after vibration but during storage period it was increased. During storage higher amount of total soluble solids were observed in fruit packed in bamboo basket.
(7) There was a significant effect of package on acidity and ascorbic acid content during storage. A decrease in acidity and ascorbic acid content was noted during storage period.
(8) The CFB box was found most effective in reducing the mechanical injury. The maximum mechanical injury was observed in fruits packed in bamboo basket. The fruit showed the higher mechanical injury when the duration of vibration and the level of intensity of vibration was increased.
(9) Among the various packages used, bamboo basket and wooden box may be cheapest for packaging of fruits but, were not found suitable for packing for transportation as the losses were more in these packages. The corrugated fibre board box held supremacy over other three packages (i.e. plastic crate, wooden box and bamboo basket) by reducing the losses in weight, loss in firmness, loss in colour and also by keeping the fruit quality acceptable.
(10) Cushioning material play a vital role in improving fruit quality during simulated vibration. As it absorbs the shocks.
(11) Duration of vibration, packaging material and cushioning material were found to affect the quality of fruits during storage at ambient conditions.

5. Acknowledgement

The author expresses his sincere thanks to Indian Council of Agricultural Research and Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut for providing financial assistance to conduct the experiment. The authors express his sincere thanks to Dr. Jaivir Singh & Dr. B.R. Singh (Prof. & Ex-HOD), Department of Agril. Engg. and Food Tech., at S.V.P.U.A.T., Modipuram, Meerut. (U.P.).

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