RUBBERWOOD HARDBOARD AS PANELS FOR TEA CHESTS

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This experiment was designed to test rubberwood hardboard, imported hardboard, local plywood and imported plywood, both unlined, and lined with metal foil for each of the following characteristics :

1 – the possibility of absorbing a taint over a storage period ranging from 3 to 14 weeks,

2 – moisture absorption by tea during storage,

3 – keeping properties of tea in relation to made tea characteristics.

None of these materials showed any tendency to taint when they were lined with metal foil. After a period exceeding ten weeks of storage, teas packed in some of the unlined chests were frequently reported as plain and soft and some tasters in London have even reported slight cardboard or woody taints. All four materials were equally good in keeping out moisture absorption. In every instance the unlined chests contained 1 – 2% extra moisture than their lined counterparts. It can, therefore, be concluded that all four materials are equally suitable for tea chest panels with regard to the above mentioned properties.

Introduction

Panels made of plywood are normally used for the construction of tea chests. A small proportion of chests, however, are also made of locally available light timbers, especially for the packing of teas intended for the local market. On the one hand, the quantity of plywood turned out in Ceylon is insufficient to cope with the demand, and on the other, the available plywood could be utilized for other purposes.

Ceylon today imports about 80% of her total requirements of plywood, because of the inadequate supply of local plywood. This involves a considerable amount of foreign exchange per annum. If a local inexpensive substitute could be found for plywood tea chests, the saving in foreign exchange alone would, therefore, warrant the promotion of the new industry. As an alternative, plywood production must be stepped up to meet the demand, and the quality of the plywood turned out must be up to acceptable standards.

In order to find better and/or cheaper substitutes for plywood, as a construction material for tea chests, various packing materials have been tested earlier. Tea chests from local woods, such as *Grevillea robusta*, Ululu and Namada have been tested to determine their suitability for the packing of teas. *G. robusta* was found to be suitable (Norris 1943) while Ululu and Namada were found to be unsuitable, because of their susceptibility to borer attack (Norris 1944). Teas stored in Coconite tea chests were found to be free from taint (Norris 1944).

In addition to chests, investigations were carried out with paper bags and corrugated cardboard cases (Keegel 1958 ; 1959 ; 1960). In general, these paper bags and cardboard packs were not found to be as suitable as wooden or plywood chests because of difficulties associated with sampling, risk of damage during handling and transit, danger of leafy grades being crushed, the bulging of the sides, resale value, easier pilferage and the likelihood of teas packed in such containers being sold at a discount.

Our investigation (T17) was carried out in collaboration with the Ceylon Hardboard Corporation to determine the suitability of introducing into the market, chests made of rubberwood hardboard. Experiments were carried out comparing rubberwood hardboard chests with three other varieties. The object of the experiments was to determine whether any taints are imparted to teas stored in chests made of rubberwood hardboard, as compared with chests made of imported plywood, local plywood and imported hardboard. Keeping properties of teas stored in these chests in relation to made tea characteristics which are known to be closely related to moisture levels of the teas, were also investigated.

Experimental work

A split-plot experimental design with nominated comparisons was used. The main effect was due to the variation between the different panel materials employed in the construction of the chests. Each of the main treatments were split into two sub-treatments corresponding to lined and unlined chests. These eight treatment combinations are indicated below :

Panel material	Thickness (mm)	No of Ply
1 – Lined imported plywood	4	3
2 – Unlined imported plywood	4	3
3 – Lined local plywood	4	3
4 – Unlined local plywood	4	3
5 – Lined imported hardboard	5	–
6 – Unlined imported hardboard	5	–
7 – Lined rubberwood hardboard	3	–
8 – Unlined rubberwood hardboard	3	–

Twelve chests of external dimensions $5\frac{1}{2}'' \times 5\frac{1}{2}'' \times 5\frac{1}{2}''$ of each material — 6 lined with aluminium foil (0.025 mm gauge) and 6 unlined were constructed, making a total of 48 chests. The use of these miniature tea chests with a higher surface to volume ratio than in the conventional chests would result in a higher rate of moisture absorption, over the same period of storage, and would tend to aggravate tainting tendencies if any. Each of these chests were filled with St Coombs BOP manufactured on a mixed rotorvane orthodox rolling programme. All teas were packed on the 28th August 1965. The quantity of tea required per chest was about two pounds. The moisture content of the tea at the time of packing was 4.0%.

Eight chests corresponding to the eight treatment combinations selected at random were opened at a time, after periods of storage corresponding to 3, 6, 8, 10, 12 and 14 weeks. On each occasion, moisture contents of teas stored in different chests were determined, the teas were evaluated and any taints reported on by a panel of tasters in Colombo and by the TRI tea taster. In addition, a panel of tasters in London evaluated and reported on taints of teas stored for periods of 3, 12 and 14 weeks. Names of tea tasting organizations who assisted in tasting experimental samples are given below.

TRI Taster — Mr C. H. Wickremesinghe
Colombo Tasting Organizations — Forbes & Walker Ltd , George Steuart & Co. Ltd., Heath & Co. (Ceylon) Ltd., Lipton Ltd. and Mackwoods Ltd.
London Tasting Organizations — Ewart, Kerr, Hope & Sons Ltd., George White, Sanderson & Co., J. Lyons & Co. Ltd., Meriden Tea Co. Ltd., W. J. & Henry Thompson, Wilson, Smithett & Co.

Results and discussion

Taint Tests

The TRI tea taster did not detect any unusual character or taint in any of the teas stored both in lined and unlined chests. He stated, however, that the teas from both lined and unlined chests tended to be soft after ten weeks of storage. Tasters from the Colombo and London panels considered that teas stored in lined hardboard chests were taint free and devoid of any unusual character, and that these teas were not significantly different from the standard teas stored in conventional lined plywood chests. Tea stores in unlined chests of all four materials were described by certain Colombo tasters as possessing taints and by London tasters as possessing slight cardboard or woody taints, but this effect was not statistically significant.

Absorption of moisture

The variation between percentage moisture absorbed by teas stored in chests made of the four different materials were not significantly different. The percentage moisture absorbed by teas stored in unlined chests were significantly greater ($P<0.01$) than that absorbed by teas stored in lined chests. The interaction between the effect of percentage moisture absorbed by teas stored in chests of different materials and the effect of lining with aluminium foil was not significant. It is, therefore, concluded that tea stored in chests made of all four materials absorb moisture more or less to the same extent and that lining of chests made of these materials reduces moisture absorption to the same extent in each case.

It was also found that the percentage moisture absorbed increased up to a period of storage of 12 weeks and thereafter the indications are that it appears to have reached equilibrium. The interaction between the effect of period of storage and the effect of lining was non-significant. Absorption of moisture during storage is, therefore, independent of whether the chests are lined or not, if observations are made between 3 to 14 weeks of storage. Higher percentage moisture content in teas stored in unlined chests could, therefore, be attributed to a higher rate of moisture absorption by these teas during the first three weeks of storage.

The results discussed with respect to absorption of moisture are presented in Table 1.

TABLE 1—*Average moisture contents of teas stored in miniature chests, of imported plywood, local plywood, imported hardboard and local hardboard in relation to period of storage and effect of lining—(The moisture content at packing was 4.0%)*

Period of storage in weeks	3	6	8	10	12	14	Significant difference P=0.05	P=0.01
% moisture content	7.4	7.6	8.3	9.0	8.7	8.6	0.34	0.47
		Lined		Unlined				
% moisture content		7.6		8.9			0.65	0.84

Characteristics of made tea

The characteristics of made tea evaluated on the basis suggested by Keegel (1961) were the brightness of the infused leaf, colour, strength and quality of liquors and the market valuations. The effect of the materials used for the construction of

chests, the effect of the period of storage and the effect of lining of chests on made tea characteristics were studied. Statistical analysis was carried out using evaluations given by the TRI taster and tasters from the Colombo panel.

1 — *Effect of materials used for the panels*

It was found that the different materials used for the panels in the construction of the miniature chests did not significantly affect the made tea characteristics of teas stored in these chests. Evaluations given by the TRI taster as well as by the panel of tasters in Colombo did not differ significantly. Moreover, there was close agreement between the opinions of the different tasters. These results were supported by the London panel of tasters.

2 — *Effect of lining chests*

Valuations given by the TRI taster for teas stored in lined and unlined for any particular characteristic were not significantly different. The Colombo panel of tasters reported, however, that teas stored in lined chests were significantly superior ($P < 0.01$) to those stored in unlined chests. These observations are presented in Table 2.

TABLE 2—*Average evaluations given by the Colombo panel of tasters for quality and market valuations of teas stored in lined and unlined chests for periods ranging from 3 to 14 weeks*

	Lined	Unlined	Significant differences P=0.05	P=0.01
Quality	4.76	4.38	0.246	0.341
Valuations (cents)	209.4	203.8	2.33	3.22

The interaction between the effect of lining chests and the effect of materials used for their construction were not significant for all characteristics, the same result being obtained from both the TRI and the Colombo panel of tasters. The interaction of the effect of lining with the period of storage was also not significant.

3 — *Effect of the period of storage*

Average evaluations given by the TRI taster and the Colombo panel of tasters for the different characteristics of made tea are presented in Table 3.

TABLE 3—*Average evaluations given by the TRI taster and by the Colombo panel of tasters for teas stored for periods ranging from 3 to 14 weeks*

Characteristic	Tasters	Period of storage in weeks 3	6	8	10	12	14	Significant differences P=0.05	P=0.01
Brightness of infused leaf	TRI	5.00	4.62	5. 0	4.50	4.88	3.96	0.196	0. 27
	Colombo	5.06	5.75	4.26	4.75	5.09	4.31	0. 36	0. 49
Colour	TRI	6.00	5.00	5.08	5.12	5.21	5.33	0.328	0.454
	Colombo	5.66	5.48	5.58	5.05	5.47	5.31	0. 32	0. 44
Strength	TRI	5.21	5.54	5.33	4.08	4.92	5.21	0.301	0.417
	Colombo	5.70	5.24	5.36	5.00	4.88	4.56	0. 44	0. 61
Quality	TRI	5.00	5.21	5.00	5.00	5.04	5.00	0.106	0.146
	Colombo	5.04	4.56	4.69	4.42	4.72	3.88	0. 30	0. 41
Market valuations (cents)	TRI	242.1	249.4	237.9	182.8	189.6	204.2	6. 86	9. 48
	Colombo	238.8	206.4	200.0	196.7	195.8	198.1	3. 9	5. 4

From Table 3, it is seen that the brightness of the infused leaf has deteriorated considerably after 14 weeks of storage. Quality also deteriorated after the same period.

Summary and conclusions

From the results of this experiment, it is seen that rubberwood hardboard and imported hardboard are as suitable materials as plywood for the construction of tea chests, in relation to the keeping properties of tea. Using plywood as a standard, it was found that hardboard did not taint teas. Lining of chests minimizes absorption of moisture during storage of tea in chests. Tea stored in unlined chests tends to deteriorate more rapidly and as a result, the quality of the teas is impaired and they were valued at a discount.

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