International Journal of Organic Agriculture Research and Development Vol. 2 (2010).

Assessment of wood types and conversion efficiency of Associated Match in Ibadan, Nigeria

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ABSTRACT

This study examined the assessment of wood types at Associated Match in Nigeria and the research was designed to identify commonly used tree species for splint production, to assess the wood volume consumption pattern of the firm and to analyse the conversion efficiency of logs to splint in the firm. Newton's formula of wood volume estimation was used to get conversion efficiency. The result showed that the only two tree species used in the firm are; *Triplochyton scleroxylon* (Obeche) and *Gmelina arborea*. The source of wood waste includes barks, core, veneer clippings and unused splints. In wood volume estimation, the highest value of wood fed into the machine is recorded in log 13 (*T. scleroxylon*) with a value of 0.240m^3 Log 2 (*G. arborea*) had the lowest volume value of 0.087m^3. In wood recovery measurement, log 12 (*T. scleroxylon*) had the highest recovery value of 0.971m^3 while log 2 had the lowest recovery value of 0.0091m^3. In conversion efficiency measurement, log 13 (*T. scleroxylon*) recorded the highest with 73% while log 2 (*G. arborea*) recorded the lowest conversion efficiency of 10.46%.The average conversion efficiency for the firm is 55.27% making the firm to lose an average of 44.73% of valuable cellulose as wastes. Further research is advised so that an industry within or outside the company would be able to convert the waste products into revenue yielding ventures and minimize loss of cellulose resources.

Keywords: Splint, Conversion efficiency, Veneer clippings, Volume estimation.

Received: 12 February 2009
Accepted: 5 December 2010

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INTRODUCTION

Match splint production has a major part in a match splint industry. These major parts are one splint line and four match production lines. This is the section where logs of wood are converted into splints. There are various machines involved which are Cross cut saw, Debarking machine, Splint peeling machine, Chopping machine, Impregnating machine, Drying machine, Polishing drum and sieving machine (NFAP, 1995). The first matchbook matches were patented in the United States by Joshua Pussey in 1892. The Diamond Match Company purchased the rights to this patent in 1894. At first, these new matches were not well accepted, but when a brewing company bought 10 million matchbooks to advertise their product, sales soared. Early match manufacturing was mainly a manual operation (Enabor, 1971). Mechanization slowly took over portions of the operation until the first automatic match machine was patented by Ebenezer Beecher (1888). Modern match manufacturing is a highly automated process using continuous-operation machines that can produce as many as 10 million matches in an eight-hour shift with only a few people to monitor the operation.

METHODOLOGY

The site of the study is the factory site of the Associated Match Company, Makers of Three Crown Match in Ibadan, Oyo State, Nigeria. The materials used were:
(i) Measuring tape/Girthing tape.
(ii) Stationeries.
Twenty logs of the only two species of trees in use by the company were studied and measured for volume estimation. This was done to ascertain the volume of wood use per production shift and to eventually determine the wood conversion efficiency of the firm. The research achieved
(i) identification of commonly used tree species for match splint production in the firm.
(ii) assessed the wood volume consumption pattern of the firm. The use of Newton's formula was engaged to achieve this objective.

Newton's equation states:
V = h/6 (Ab + Am + Au) where:
V = total volume of log
h = total log length
Ab = basal area of log at the base

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Am = basal area of log in the middle
Au = basal area of log at the upper part of the log
Basal area = (ðd)^2/4
(iii) analyzed the conversion efficiency of logs to match splint in the firm with the use of Lumber Recovery Factor (LRF); given as;

$$LRF = \frac{\text{Volume of splint produced}}{\text{Volume of log used up in production}} \times 100$$

Source: Westoby, 1962

RESULTS AND DISCUSSION

Species of wood in use: There were only two species of wood indentified in the firm for the production of splints, the tree species were: *Triplochyton scleroxylon* (Obeche) and *Gmelina arborea* (what is the common name?).
Assessment of wood consumption pattern. This section looked at the volume of each log (in BILLETS form) of the twenty logs set aside for this study. Newton's formula of wood volume estimation was used.

Table 1: Dimensional characteristics of individual Log in the form of Billets

S/N	Base diameter (m)	Middle diameter (m)	Upper diameter (m)	Total height (m)
Log 1	0.8	0.705	0.706	0.604
Log 2	0.601	0.606	0.606	0.607
Log 3	0.909	0.909	0.908	0.607
Log 4	0.909	1.002	1.003	0.604
Log 5	1.003	1.002	1.002	0.605
Log 6	0.907	1	1	0.607
Log 7	0.906	0.905	0.904	0.605
Log 8	0.902	0.905	1	0.604
Log 9	0.908	0.909	0.908	0.606
Log 10	0.903	0.901	0.901	0.605
Log 11	0.924	0.926	0.926	0.606
Log 12	0.802	0.801	0.804	0.607
Log 13	1.006	1.004	1.004	0.606
Log 14	0.908	0.901	0.902	0.606
Log 15	0.914	0.916	0.914	0.604
Log 16	0.806	0.804	0.805	0.607
Log 17	0.857	0.854	0.803	0.605
Log 18	0.901	0.901	0.902	0.607
Log 19	0.906	0.905	0.903	0.605
Log 20	0.928	0.924	0.913	0.607

Source: Dimensional measurement of Billets used up in the firm (2010)

Table 1 above shows the dimensional characteristics of logs in the form of BILLETS used to manufacture splints in the firm. A billet is defined as a short thick piece of wood. The billet with the highest basal diameter is log 13 with 1.006m; it is also the one with highest middle value of 1.004m as well as the highest upper value of 1.004m. The log is of *Triplochyton scleroxylon* species. Log 2 with a basal diameter value of 0.601m, middle diameter value of 0.606 and upper diameter value of 0.606m is the lowest in the park. The log is of *Gmelina arborea* species. Log height varies considerably but the range is between 0.604m the shortest and 0.607m, the longest.

Table 2: Wood volume estimation

S/N of log	Tree species	Volume of wood fed into machine (m^3)	Volume of wood recovered after production (m^3)	Conversion Efficiency (%)
1.	*G. arborea*	0.127	0.0812	63.94
2.	"	0.087	0.0091	10.46
3.	"	0.197	0.0976	49.54
4.	"	0.225	0.137	60.89
5.	"	0.237	0.159	67.09
6.	"	0.224	0.135	60.27
7.	"	0.195	0.0965	49.49
8.	"	0.207	0.128	61.84
9.	"	0.196	0.0977	49.85
10.	"	0.192	0.0981	51.09
11.	*T. Scleroxylon*	0.203	0.126	62.07
12.	"	0.154	0.971	63.05
13.	"	0.240	0.177	73.75
14.	"	0.194	0.0963	49.64
15.	"	0.198	0.0974	49.19
16.	"	0.155	0.0975	62.90
17.	"	0.167	0.0996	59.64
18.	"	0.194	0.0962	49.59
19.	"	0.194	0.0964	49.69
20.	"	0.202	0.124	61.38

Source: Tree volume estimate of the firm (2010)

Average conversion efficiency for the firm = **55.27%.** Table 2 above shows the wood volume estimate of the firm where the highest value of wood fed into the machine is recorded in log 13 (*T. scleroxylon*) with a value of $0.240m^3$. Log 2 (*G. arborea*) had the lowest volume value of $0.087m^3$. In wood recovery measurement, log 12 (*T. scleroxylon*) had the highest recovery value of $0.971m^3$ while log 2 had the lowest recovery value of $0.0091m^3$. In conversion efficiency measurement, log 13 (*T. scleroxylon*) recorded the height with 73% while log 2 (*G. arborea*) recorded the lowest conversion efficiency of 10.46%.The average conversion efficiency for the firm is 55.27% making the firm to lose an average of 44.73% of valuable cellulose as wastes.

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CONCLUSION

An assessment of wood types and conversion efficiency of Associated Match Industries producers of Three Crown Match was made between April 2010 and February 2011.The tree species commonly used was found to be *Triplochyton scleroxylon* (Obeche) and *Gmelina arborea*. The logs are converted to billets before being turned to splints. The result also showed that, the quantity of wood fed into the machine is not a true measure of wood recovered after production. The conversion efficiency of the firm is 55.27%, the remaining 44.73% is considered waste products. Conclusively, the firm just like any other in Nigeria needs to research into the use of other tree species so as to increase the volume of production. It is recommended that the 44.73% seen as wastes could be converted into other materials for a maximum use of forest resources.

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