Construction of An Experimental Rattan Dryer and Artificial Drying of Rattan

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INTRODUCTION

Importance of the study

Seasoning of rattan for commercial purposes has been a problem for many years. Air drying is extremely slow and is often accompanied by attack of fungi thus causing degrade of the canes and losses on the part of the rattan dealers.

Air seasoning of rattan is dependent upon weather conditions and this system is only feasible during dry weather. Demand for properly seasoned rattan is great, especially for furniture for domestic and foreign markets. Properly seasoned rattan is strong and possesses a bright color. Only high quality rattan free from fungal stain can be used for the manufacture of high class furniture and other products.

Review of literature

Cortes, R. T. (4) found that by air seasoning it took five weeks to dry scraped palasan (*Calamus maximums* Merr.) and limuran (*C. ornatus Decc.*) to their minimum moisture content of 13.1 and 12.5 per cent, respectively. Unscraped palasan and limuran required, at least 26 weeks to attain their minimum moisture content of 19.5 and 23.1 per cent, respectively. In the case of unscraped biri (*Calamus ziphonosphatus* Merr.) and ditaen (*Daemonrops mollis* [Blanco] Merr.) they required 18 and 19 weeks to attain their minimum moisture content of 17.0 and 17.4 per cent, respectively.

In the scraped pieces the active growth of fungi-producing stain was noted, when the moisture content of the pieces was approximately 100 per cent, the temperaure 76°F and the relative humidity, 84 per cent. While in the unscraped pieces, the stain was observed when the moisture content was 143 per cent, temperature 76°F and relative humidity, 85 per cent.

The occurrence of stains as a result of fungi growth is highly objectionable in rattan used in the manufacture of furniture and other products.

Aguilar, L. (1) asserted that scraped rattan lends itself easily to varnishing or polishing, because the silicious coating of the stem is removed. This advantage, however, may be lost if the canes are not dried sufficiently fast, for they are liable to the attack of fungi which causes staining and rotting, hence the lowering of the grades of the canes.

Ticman (8) stated that "the earliest kilns for drying by the use of heat, consisted of little else than a room in which a wood fire was built in such a way that sacks and heated gases were made to pass through the materials to be dried".

Objects of the study

The study has the underlying objectives:

1. To ascertain the cost of the construction of an experimental dryer.
2. To determine the minimum length

of time to dry commercial rattan artificially.

3. To determine the suitable temperature for drying rattan artificially.

Time and place of the study

The experiment was conducted on the Forestry Campus, College, Laguna, from August 22, 1950 to February 4, 1951.

METHOD AND PROCEDURE

a. LOCATION:

The site selected was on a ground with good drainage. In commercial scale it should be located near a place where there is an abundant supply of rattan, and also where there is plenty of firewood, for fuel of the dryer.

A shed was constructed, roofed with nipa and had open side as well as front and rear. Its dimensions were as follows: 24 feet long and 14 feet wide and a height of 11 feet. It was first constructed in order to give protection to the dryer against heavy rain.

b. PREPARATION OF CLAY USED:

The materials needed for the construction of the dryer were collected. Cinders or burned clay of an old Japanese oven were used. In case burnt clay is not available, one must burn the clay following the procedure, as described by Ompad (7) in his paper.

"Lay billets or split wood on the ground. The amount of firewood depends upon the quantity* of burned clay needed. The clay is made into balls of 4-6 inches diameter. The billets of 3-5 inches in diameter are laid in a circular figure with a diameter depending upon the amount of clay to be burned, usually from 14-16 feet. An open space is left in the center with a diameter of 2 feet. Over the first layer, billets are laid crosswise; on the third layer, the billets are laid in the same manner as those of the first, and so on alternately. When the height of 1½ feet is attained, one layer of balls of clay is laid side by side on top of the billets. Over the layers of the balls of clay, billets are laid again. This procedure is continued until the right amount of clay is balled and laid in the manner stated. On the last layer of clay, it is advisable to cover the balls, with 1-foot thick of billets laid as described. The pile is then ready to be burned. The burning should be started early in the morning, about five-thirty o'clock, and by six o'clock in the evening the burning is over. After a day or two the burnt clay is ready to be pounded. The pounded burnt clay should readily pass through an eight wire mesh before it should be mixed with unburned clay."

c. DESIGN OF THE DRYER:

The design of the dryer is based on the principle that hot air rises. The heated gas passes through the canes to be dried and goes out to the open air through the vents above. The smoke is kept out of the dryer but is allowed to pass through the stock.

Mabesa, C. (6) in his paper, found that kiln drying of rattan canes in a lumber dryer with a very low relative humidity had no deleterious effects on rattan canes. Based on this fact the dryer was designed.

d. CONSTRUCTION:

A plan of the dryer was prepared and served as the guide in the construction. Pegs were driven into the ground to mark the outline of its fireplace, and the path of smoke to the stack. This outline has the following measurements, 18 feet and 6 inches long and 5 feet wide from the front, up to 11 feet long and thence tapering to 2 feet wide towards the back and or the place where the chimney is located.

The ground was excavated 5 feet deep at the front and gradually sloping upward so that at the back, the depth was only one foot (See Fig. 6). This upward slope of the floor was to facilitate the flow of the smoke to the chimney.

* In this experiment (28-42) about 29 cubic feet of clay was used.

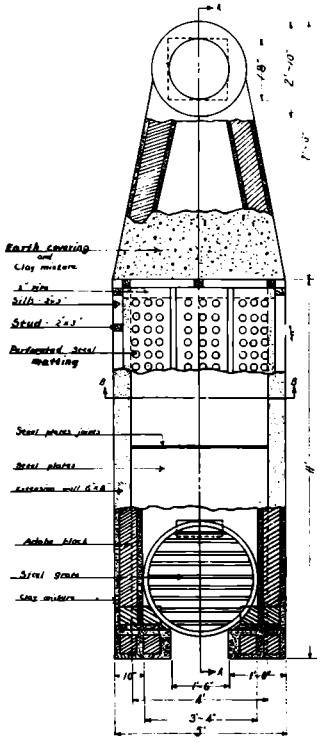

Fig 5 FLOOR PLAN

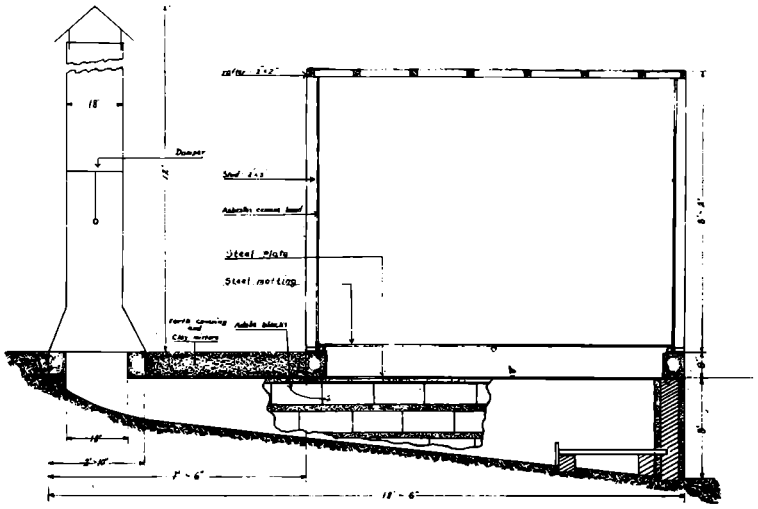

Fig. 6 Section AA'

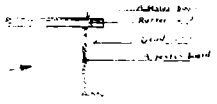

Fig 7-a

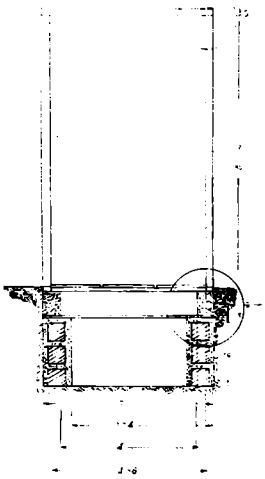

Fig 7 Section BB'

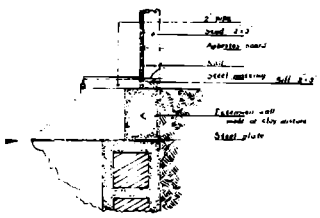

Fig 7-b

PLAN
OF
A RATTAN DRYER

SCALE: 1":24"

COLLEGE FORESTRY
COLLEGE, LAGUNA

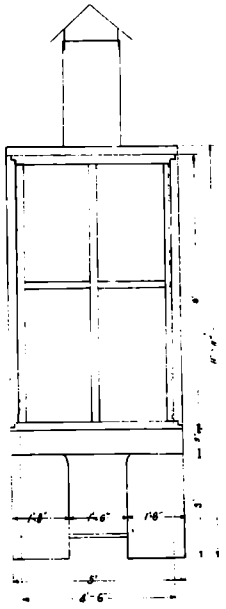

Fig. 8
Front elevation

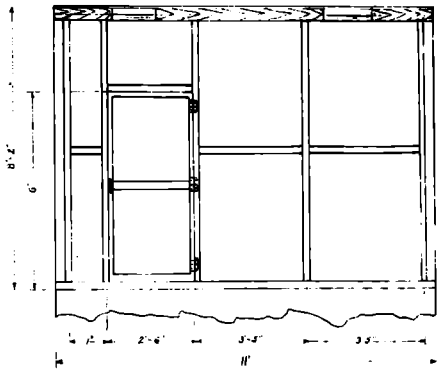

Fig. 9
Side elevation

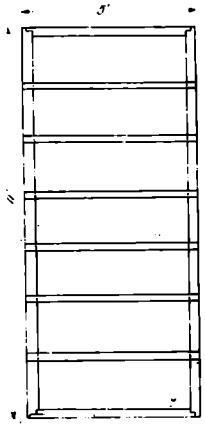

Fig 10 Roof Plan

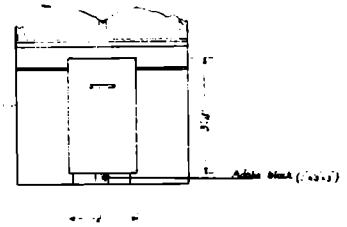

Fig 11 Figure showing size and position of the door of the fire place

When the excavation was completed, adobe blocks were placed in a manner shown in Fig. 6. These blocks were so held as to leave a two-inch space between the blocks and the earth wall. This space was then filled with a paste formed by thoroughly mixing two parts of powdered burnt clay and one part of raw clay with water. The same paste was used as mortar to join the adobe blocks together. Towards the outer side of this wall a plaster, two inches thick, of the same paste was coated over it, to protect the adobe wall from direct exposure to fire which may result in their rapid disintegration.

The walls of the fireplace were built flush with the ground. While waiting for the stone wall plaster to dry, they were tamped everyday to make the particles of the mixture as compact as possible so as to close the cracks resulting from the shrinkage of the paste materials. When the walls hardened, the cracks that did not close were filled with a paste mixture of fine ash and burnt clay. The cementing material was throughly mixed by adding sufficient water and then stumped on and then turned over with a spade several times until it became a uniform paste.

When the walls had dried, old steel plates (Fig. 5) were placed over the pit serving to cover the fireplace, absorb heat and prevent the smoke from entering into the dryer. The steel plates were placed edge to edge and their joints plastered with asbestos. Over these steel plates, extension walls 6 inches wide and 9 inches high and enclosing a rectangular space of 10 feet long and 4 feet 6 inches wide was built. They held the steel plates in place and served at the same time as the base on which the still of the walls of the dryer rested. Eleven inches above the steel plates was placed another floor of perforated steel matting serving as the floor for the canes to stand on thus preventing them from coming in contact with the steel plates which were exposed directly to the fire. The steel matting were allowed to rest on three pieces of two-inch pipe placed across the width of the dryer (Fig. 5).

The walls of the dryer are of asbestos-cement boards, nailed to the inner side of 2 x 3 inches bagtikan studs, 8 feet high (Fig. 6). the idea being to prevent any wooden parts to be exposed directly to heat. At the top of the side-wall are three vents on one side and two on the other all running horizontally and each two inches wide by 15 inches long (Fig. 9). These vents were made adjustable, i.e. the length could be increased or decreased, as desired. The ceiling was made of the same materials (asbestos-cement) nailed to, and supported by 2" x 2" joist spaced at intervals of 1-1/2 feet on centers.

A door used for loading and unloading the rattan canes, as well as for inspection and for reading the temperature during the operations, was located on one side near the rear end. Its location was governed by the conveniences of operation and away from the prevailing wind. The materials used were the same as those of the walls and operated by swinging outwardly (Fig. 9).

f. CHIMNEY:

The laying of steel plates under the dryer was extended towards the chimney (Fig. 6) but on this section the plate was covered by a thin coating of the cementing mixture. When it became dry, the whole area was covered further by ordinary clay.

The opening for the chimney was 18" square as it was more convenient to have a square than a circular one. Both areas, however, are the same. The chimney was an old one, salvaged from an old boiler. Its height was 12 feet from the ground level. The height and diameter gave a good draft.

A damper was placed in the chimney so that the draft as well as the heat could be controlled to a certain exent (Fig. 6). The top of the chimney was provided with a hood to keep out the rain water. The bot-

tom of the chimney, being flared, rested on a wet cementing mixture and when dried, any opening on contact points was sealed.

g. DOOR OF THE FIREPLACE:

A door 3 feet 4 inches long and 2 feet wide was made out of a plain galvanized iron sheet and is provided with a handle. It is detachable so that it can be removed when firing, and placed back when needed. When the door is closed, it rests on an adobe blocks 3 x 3 x 3 inches (Fig. 11).

h. TEMPERATURE TESTS:

Preparatory to actual operation, tests on the distribution of heat were made. Thermometers were hung from the ceiling at point midway between the floor and the ceiling, one near the front, about two feet away from the front wall, the second, in the middle of the chamber, and the third two feet away from the rear wall. Readings were taken for five hours at half-four intervals. The tests showed that the readings 2 feet from the front wall were higher by 3-4 degrees than those near the rear. This was overcome by covering the steel plates with sand about one inch thick at the front and gradually thinning towards the middle. When the temperature was increased to 76.6°0 (180°F) — 87.3°C (190°F), the plates directly above the fire, buckled at the joints and some sand slid down as the buckling was towards the fire place below. By placing a narrow piece of galvanized iron, 2 feet wide and 4 feet long, over the joints near the front walls, the effect, after another series of temperature tests, was that the distribution of heat was practically equal, the difference being one degree centigrade between the rear and the front readings.

i. PREPARATION AND DRYING OF RATTAN:

Rattans used in these experiments were taken from the Makiling National Park and were cut into lengths of 3 meters for the first and third trials and 4 meters long for the second. The length of rattan in the second run is the commercial length as sold in the market.

The canes were scraped to remove the silicious coating by means of a bolo and precautions taken not to damage them during the operation.

The scraped rattans were palasan and and limuran, while the unscraped rattans were ditaan and biri. The scraped canes had an average diameter of slightly over one inch, while the latter, were only about 1/2 inch in diameter.

Drying samples were selected as much as possible from the biggest and the wettest canes for determining the moisture content from time to time during the progress of drying.

The test pieces were cut from the sample pieces two feet away from the ends and 1/2 inch long. After sawing, the slivers were removed, the samples weighed, numbered and dried in an oven at a temperature of 100°C (212°F) until the weight of each became constant.

After cutting the test pieces from those selected as drying samples, the later were not end-coated, unlike the drying of wood, the reason being, that they were as long as the rest of the canes being dried. The U.S. Forest Product Laboratory (9) formula for the determination of the moisture content was used.

$$\text{Moisture content (Percent) of test pieces} = \frac{\text{Original weight} - \text{oven dry weight}}{\text{Oven dry weight}} \times 100 \quad (1)$$

The calculated oven dry weight of the drying samples was determined from the available moisture content of the test pieces and the green weight of the latter by the use of the formula of I. H. Boss (3) of the Division of Forest Products, C.S.I.R.O.:

$$\text{Calculated oven dry weight of samples} = \frac{\text{Original weight of sample}}{100 + \text{Moisture content of test pieces}} \times 100 \quad (2)$$

The scraped and unscraped canes were bundled separately, the bundles, being of convenient sizes, were placed in an standing position inside the dryer (Plate III). As soon as the canes were all placed in the dryer, the drying samples were distributed at different places inside the dryer.

J. OPERATION OF THE DRYER:

When the thermometer was hung midway the height of, and half way the length of the dryer, the oven was fired leaving the damper in the chimney fully open and the door of the fire place closed. A hand controlled draft is also provided for, below the fire door. When the fire was well started the damper was half-closed, the idea being to conserve heat and to economize fuel. If all the fuel had turned to embers, the damper was closed; and the draft below the door of the fire place was also closed, if a higher temperature was desired.

The firing was done during the day time. from seven o'clock in the morning till six o'clock in the evening, allowing the fire to die during the night. The operation required 52 — 70.6 cubic feet (1-1/2 — 2 cu. m.) of wood, stacked volume to dry an average load of 37 pieces of scraped canes and 26 unscraped to their minimum moisture content during the four days in the dryer or during forty-four hours of actual firing.

Every morning before firing, the drying samples were weighed until the desired moisture content of 10-13 per cent was reached.

In the determination of the current moisture of the load during the period of drying, formula 1 was used, but using the calculated oven dry weight for divisor.

The results of the drying are shown in Tables 3, 4a, 4b and 5.

DISCUSSION OF RESULTS

Table 1 shows the cost of materials used in the construction of the experimental dryer with a capacity of 150 pieces of canes, which cost amounted to ₱447.29. The cost of labor to build it was ₱473.32, as shown in Table 2, totalling ₱880.61 for both labor and materials.

Table 2 further shows the length of time it took to construct the experimental dryer i.e. 42 days with 2-5 men working or 132 one-man days.

The length of time to construct the dryer might have been shortened, if all the necessary materials for the construction had been available at the start. The cost of labor might be lowered if the work were done on a contract basis.

In table 3 and Figs. 1, 2 and 3, which represent the trials made in the experiment, it took forty-four actual drying hours or ninety-six hours' stay in the dryer to dry scraped rattan from 121.7, 156.4, 136.6 to 5.8, 8.7 and 7.9 per cent moisture content for the first. second and third trials, respectively. On the other hand the unscraped pieces, having smaller diameters than those of scraped (being mostly 1/2"), dried down to 6.5, 16.1 and 16.2 from 175.6, 170.5 and 184.2 per cent, respectively, during the same period of time, for the first, second and third trials. Actually the firing period was only 11 hours for every 24-hour period. It was probable that after six o'clock in the evening, when the tending of the fire was stopped, drying might logically have continued until the embers died out. The checking of this factor was not feasible on account of local conditions, especially after dark.

It was further found that in the first trial where 51 places of scrapped rattan and 30 unscraped were dried, there were 9 collapsed pieces among the scraped or 17.7 per cent, of which 3 were total collapse, 6 partial or 5.9 and 11.8 per cent, respectively. While in the unscraped, 2 pieces were partially collapsed and 3 totally or 6.6 and 10.0 per cent, respectively, or a total of 16.6 per cent. The temperatures maintained for the first trial were from 60°C (140°F) to 80°C (176°F).

In the second trial 3 pieces of scraped rattan and 36 pieces of unscraped were dried at a temperature of 30°C (86°F) to 60°C (140°F) for the first 11 drying hours and 70°C (158°F) to 85°C (185°F) for the next 33 drying hours. At the end of the drying period, there were 7 total collapse and 3 partial collapse in the scraped rattan or 23.3 and 10.0 per cent, respectively, or a total of 33.3 per cent. Of the unscraped rattan, there were 7 collapse and 4 partial or 19.4 and 11.1 per cent respectively, or a total of 30.5 per cent.

In the third trial 31 pieces of unscraped were dried in a temperature of 60°C (140°F) to 65°C (169°F). The results at the end of the drying period were 1 totally collapsed and 2 pieces partially or 3.2 and 6.5 per cent, respectively, or a total of 9.7 per cent for scraped rattan. No collapse was observed in the unscraped rattan.

It will be noted that where the temperature was lower the collapsed pieces were fewer, so that there seems to be a relation between the percentage of pieces collapsed and the temperature used, i.e. the higher the temperature the greater the numbers of canes that collapsed (Fig. 4). So that a temperature of 60°C (140°F) at the start and gradually increased to 65°C (149°F) when nearing the end of the drying period would be the more suitable.

Another factor noted was the fact that canes which were white in color indicating that they were cut near the growing tops, were the ones that invariably collapsed. This characteristic may be a good way of segregating young canes from the mature ones, as they are undesirable and are supposed to be readily infested by insects.

On the other hand, in the case of palasan and limuran, the latter whether mature or not had a greater tendency to collapse than the former, as shown in Table 5. It will be noted that in the first trial, there were 51 scraped canes that were dried: 43 pieces were palasan and 8 limuran. Two of the former and 7 of the latter or 4.4 and 87.5 per cent, respectively, collapsed. In the second trial 7 out of the 25 pieces of palasan and 3 out of 5 of limuran, or 28 and 60 per cent, respectively, collapsed; and for the third trial, 1 out of 27 of the former and 2 out of 4 of the latter or 3.7 and 50 per cent, respectively, collapsed.

The color of the scraped rattan became white after coming out of the dryer, especially when the scraping was well done. It was noted that wherever portions of the silicious substance on the rind is not entirely removed there is a tendency for the canes to appear slightly dull or somewhat dirty white, while those well scraped became clean white. On the other hand, among the unscraped canes after coming out of the dryer, the light colored ones became a light straw to a light orange and the green ones became dull green or a dark dull green. (Table 4a and 4b).

SUMMARY

1. It was found that it cost ₱880.61 and 42 days or 132 one-man days to construct an experimental dryer with a capacity of 150 cases with average diameter of one inch and 3 meters long or 450 linear meters.

2. That the minimum length of time to dry scraped palasan and limuran of slightly over one inch in diameter to their minimum moisture content of 5.8, 8.7 and 7.9 from 121.7, 156.4 and 136.6 per cent moisture content in the first, second and third trials, respectively, was found to be at least 44 actual drying hours or 4 days (96 hours actually inside the dryer). Unscraped rattan of about 1/2 inch in diameter, required the same length of time to attain 6.4, 16.1 and 16.2 from 175.6, 170.5 and 164.2 per cen moisture content, respectively.

3. A desirable temperature for drying to minimize collapse was found to be around 60°C (140°F) at the start and gradually increased to 65°C (149°F) when nearing the end of the period of drying.

4. Pieces cut near the growing tips or young canes which are usually white in color are liable to collapse during the drying.

5. Scraped canes of limuran have a greater tendency to collapse whether matured or young than scraped palasan.

6. Well scraped green rattan after coming out from the dryer appeared clear white in color, while the unscraped ones turned dull green or dull dark green. Young canes usually in smaller diameter which are light colored became light straw or light orange in color after coming out of the dryer.

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TABLE 1. COST AND AMOUNT OF MATERIALS USED IN THE CONSTRUCTION.

Materials	*Quantity*	*Unit*	*Cost*
Asbestos board # (4' x 8')	12	pieces	₱ 96.00
Ash #	1	cu. ft.	
Blocks, adobe #	72	pieces	12.24
Cinders #	28.42	cu. ft.	1.00
Clay #	14.21	cu. ft.	
Galvanized iron #	3	shts.	
Lumber #	747.5	bd. ft.	224.25
Nails	6	kilos	4.80
Nipa shingles	550	pieces	28.90
Perforated steel matting #	3	pieces	13.50
Steel plates #			25.00
Thermometer # (100°C)	1	piece	4.50
TOTAL			₱ 407.29

Materials secured free of charge for the experiment. Cost are those prevailing in the market.

TABLE 2. SHOWING THE DIFFERENT PARTS AND THE LENGTH OF TIME TO FINISH.

PARTS	*No. of days For one man to do*	*No. of men working*	*No. of days to finish*	*Cost 13.08/day*
Shed	21	5	7	₱ 64.68
Bigging of the Ground	5	5	1	15.40
Walls	80	5	16	246.40
Dryer	18	3	6	92.40
Miscellaneous work	6	1	6	18.48
Testing and improvement	12	2	6	36.96
TOTAL	132		42	₱ 473.32

TABLE 4a. SHOWING RELATION OF COLLAPSE WITH THE TEMPERATURE OF THE DRYER (SCRAPED RATTAN).

TRIALS	No. of Pcs.	Total No. of Pieces	Collapse Per Cent	Partial No. of Pieces	Collapse Per Cent	TOTAL Total Pieces	TOTAL Per Cent	Range of Temperature	Color of Canes
1st . .	51	3	5.9	6	11.8	9	17.7	60°C (140°F) to (176.6/F)	White to yellowish White
2nd . .	30	7	23.3	3	10.0	10	23.3	80°C (86°F) to 30°C (140°F) /1	White to dull white
3rd . .	31	7	3.2	2	6.5	3	9.7	60°C (140°F) to 65°C (149°F)	Clear White

/1 30°F (86°F) to 60°C (140°F) for the first 11 hours and 70°C (158°F) to 85°C (185°F) for the next 33 hours.

TABLE 4b. SHOWING RELATION OF COLLAPSE WITH THE TEMPERATURE OF THE DRYER (UNSCRAPED RATTAN).

TRIALS	No. of Pcs.	Total No. of Pieces	Collapse Per Cent	Partial No. of Pieces	Collapse Per Cent	TOTAL Total Pieces	TOTAL Per Cent	Range of Temperature	Color of Canes
1st . .	30	3	10.0	2	6.6	5	16.6	60°C (140°F) to 80°C (176.6°F)	Light straw to dull orange
2nd . .	36	7	19.4	4	11.1	11	30.55	30°C (86°F) to 60°C (140°F)/1	Dull orange
3rd . .	14	—	—	—	—	—	—	30°C (140°F) to 65°C (149°F)	Light straw

/1 30°F (86°F) to 60°C (140°F) for the first 11 hours and 70°C (158°F) to 85°C (185°F) for the next 33 hours.

TABLE 5. SHOWING THE RELATION OF COLLAPSED CANES BY SPECIES.

	PALASAN					LIMURAN					GRAND TOTAL		
RIALS	No. of Collapse	Total No.	%	Partial No.	%	No. of Collapse	Total No.	%	Partial No.	%	Palasan Dried	Limuran Dried	Total Dried
1st	2	0	0	2	4.41	7	3	37.5	4	50	43	8	51
2nd	7	5	20	2	0	3	2	40	1	20	25	5	30
3rd	1	1	3.70	0	0	2	1	25	1	25	27	4	31

TABLE 3. AVERAGE TEMPERATURE AND MOISTURE CONTENT OF RATTAN CANES FOR THE DURATION OF DRYING.

FIRST TRIAL					SECOND TRIAL					THIRD TRIAL				
Date and Actual hours in the kiln	Actual hours of firing	Temp. °C	MOISTURE CONTENT Scraped	MOISTURE CONTENT Unscraped	Date and Actual hours in the kiln	Actual hours of firing	Temp. °C	MOISTURE CONTENT Scraped	MOISTURE CONTENT Unscraped	Date and Actual hours in the kiln	Actual hours of firing	Temp. °C	MOISTURE CONTENT Scraped	MOISTURE CONTENT Unscraped
Jan 11— 0	0	23	121.7	175.7	Jan. 21— (0	0	26	146.4	170.5	Jan. 30— (0	0	23	136.6	184.2
(3	3	39	—	—	(3	3	33	—	—	(3	3	37	—	—
Day . . . . (6	6	74	—	—	Day . . . . (6	6	59	—	—	Day . . (6	6	59	—	—
(9	9	77	—	—	(9	9	54	—	—	(9	9	63	—	—
(11	11	88	—	—	(11	11	52	—	—	(11	11	62	—	—
Night . . . 24#	11	—	62.1	83.5	Night . . 24#	11	—	99.1	150.0	Night . . . 24#	11	—	68.7	94.1
Jan. 12— (27	14	41	—	—	Jan. 22 — (27	14	44	—	—	Jan. 31— (27	14	37	—	—
(30	17	59	—	—	(30	17	89	—	—	(30	17	58	—	—
Day . . . . (33	20	73	—	—	Day . . . (33	20	89	—	—	Day . . (33	26	63	—	—
(35	22	68	—	—	(35	22	74	—	—	(35	22	62	—	—
Night . . . 48#	22	—	31.9	36.4	Night . . . 48#	22	—	53.8	78.7	Night . . . 40#	22	—	37.1	61.4
Jan. 13— (51	25	36	—	—	Jan. 23— (51	25	48	—	—	Feb. 1— (51	25	49	—	—
(54	28	68	—	—	(54	28	77	—	—	(54	28	57	—	—
Day . . . . (57	31	77	—	—	Day . . . (57	31	79	—	—	Day . . . (57	31	57	—	—
(59	33	88	—	—	(59	33	73	—	—	(59	33	62	—	—
Night . . . 72#	33	—	14.3	13.4	Night . . . 72#	33	—	21.9	48.6	Night . . . 72#	33	—	30.0	46.8
Jan. 24— (75	36	49	—	—	Jan. 14— (75	36	36	—	—	Feb. 2— (75	36	43	—	—
(76	39	78	—	—	(78	39	54	—	—	(78	39	64	—	—
Day . . . (81	42	84	—	—	Day . . . . (81	42	77	—	—	Day . . . (81	42	66	—	—
(83	44	76	—	—	(83	44	79	—	—	(83	44	51	—	—
Night . . . 96#	44	—	8.7	16.1	Night . . . 96#	44	—	5.6	6.4	Night . . . 96#	44	—	7.9	16.2

6:00 P.M.—7:00 A.M.: No firing was made.

TABLE 3. AVERAGE TEMPERATURE AND MOISTURE CONTENT OF RATTAN CANES FOR THE DURATION OF DRYING.

FIRST TRIAL					SECOND TRIAL					THIRD TRIAL				
Date and Actual hours in the kiln	Actual hours of firing	Temp. °C	MOISTURE CONTENT Scraped	MOISTURE CONTENT Unscraped	Date and Actual hours in the kiln	Actual hours of firing	Temp. °C	MOISTURE CONTENT Scraped	MOISTURE CONTENT Unscraped	Date and Actual hours in the kiln	Actual hours of firing	Temp. °C	MOISTURE CONTENT Scraped	MOISTURE CONTENT Unscraped
Jan 11— 0	0	23	121.7	175.7	Jan. 21— (0	0	26	146.4	170.5	Jan. 30— (0	0	23	136.6	184.2
(3	3	39	—	—	(3	3	33	—	—	(3	3	37	—	—
Day . . . . (6	6	74	—	—	Day . . . . (6	6	59	—	—	Day . . (6	6	59	—	—
(9	9	77	—	—	(9	9	54	—	—	(9	9	63	—	—
(11	11	88	—	—	(11	11	52	—	—	(11	11	62	—	—
Night . . . 24#	11	—	62.1	83.5	Night . . 24#	11	—	99.1	150.0	Night . . . 24#	11	—	68.7	94.1
Jan. 12— (27	14	41	—	—	Jan. 22 — (27	14	44	—	—	Jan. 31— (27	14	37	—	—
(30	17	59	—	—	(30	17	89	—	—	(30	17	58	—	—
Day . . . . (33	20	73	—	—	Day (33	20	89	—	—	Day . . (33	26	63	—	—
(35	22	68	—	—	(35	22	74	—	—	(35	22	62	—	—
Night . . . 48#	22	—	31.9	36.4	Night . . . 48#	22	—	53.8	78.7	Night . . . 40#	22	—	37.1	61.4
Jan. 13— (51	25	36	—	—	Jan. 23— (51	25	48	—	—	Feb. 1— (51	25	49	—	—
(54	28	68	—	—	(54	28	77	—	—	(54	28	57	—	—
Day . . . . (57	31	77	—	—	Day . . . (57	31	79	—	—	Day . . . (57	31	57	—	—
(59	33	88	—	—	(59	33	73	—	—	(59	33	62	—	—
Night . . . 72#	33	—	14.3	13.4	Night . . . 72#	33	—	21.9	48.6	Night . . . 72#	33	—	30.0	46.8
Jan. 24— (75	36	49	—	—	Jan. 14— (75	36	36	—	—	Feb. 2— (75	36	43	—	—
(76	39	78	—	—	(78	39	54	—	—	(78	39	64	—	—
Day . . . (81	42	84	—	—	Day . . . . (81	42	77	—	—	Day . . . (81	42	66	—	—
(83	44	76	—	—	(83	44	79	—	—	(83	44	51	—	—
Night . . . 96#	44	—	8.7	16.1	Night . . . 96#	44	—	5.6	6.4	Night . . . 96#	44	—	7.9	16.2

6:00 P.M.—7:00 A.M.: No firing was made.