Report on Jaggery Making from Sugar Cane Juice.

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THE growing of sugar-cane and the manufacture of jaggery from the juice was tried on this station for the first time during the year 1926. When the canes showed signs of maturity, samples were sent for analysis to the Agricultural Chemist and he reported thus:—

	Variety.	Gms. juice % Gms. Cane	Specific Gravity of juice at 25 C.	Brix. Tot. Solids Gms. % Gms. Juice.	Sucrose Gms. % cc. Juice.	Glucose Gms. % cc Juice.	Glucose Gms. (Glucose % sucrose)	Extracted Sucrose Gms. % Gms. Cane	Purity (Sucrose % Total solids).
1	55P	73·5	1·059	14·2	12·3	·6	4·9	9·0	86·6
2	Striped Tanna	67·7	1·070	16·4	12·5	1·0	8·0	8·5	76 2
3	Sin Nombre	63·9	1·067	16·0	11·75	·8	6·8	7·5	73·5
4	D. K. 74.	71·1	1·059	14·2	12·45	·55	4·4	8·0	87·6
5	Sealy's Seedling	64·3	1·059	14·2	10·5	1·45	13·8	7·5	74·0
6	Mauritius	63·9	1·063	14·4	11·8	1·15	10·0	7·5	86·8
7	Barbados	62·0	1·067	16·0	14·2	9	6·3	8·8	88·8
8	131 P	67·2	1·070	16·4	14·5	1·0	6 9	9·7	88·4

The following is the remark made by the Director of Agriculture on the above figures:—

" (1) These analyses show a low sucrose content, a high glucose ratio and generally poor purities.

(2) These figures indicate one or several of the following :—

Either the canes were not fully ripe or they were overripe and part of the sucrose had become inverted into invert sugar. This happens in all the lower portions of canes which are allowed to become overripe. On the other hand they may have been cut too long before they were analysed and the analyses do not represent the true value of the canes. Canes should be analysed within 2 4 hours of their cutting. Otherwise inversion begins to takes place

(3) Purities should reach 90 per cent. and I am interested to note that the purities of Barbados 208 and 131 P are the highest. These canes generally have good juices and are easy of manufacture in a factory."

Extraction of the Juice.

The canes were cut and crushed in the " Hathi " mill imported from Burn & Co. of Calcutta. It is a three-roller iron mill worked by a pair of bulls. It is capable of expressing 200 lbs. of juice in one hour, on an average. The efficiency of the mill as shown by the average of extracted juice is about 65 per cent. The cost of the mill is Rs. 154·92 and the cost of erecting it is Rs. 4·00.

Erection of the Furnace, Boiling the Juice, and the Manufacture of Jaggery.

After the erection of the cane-mill the first thing attended to was the furnace. The furnace is partly excavated, and partly built up. It is an improved furnace and built up in the Indian single-furnace model. It is provided with an ash chamber and a fire pit. It is a raised structure 3 feet high and the four sides of it are made almost vertical. From one of the sides an opening 14 inches wide and 2 feet high leads into the fire-pit formed in the centre of the structure. It has sloping sides towards the middle and is in the form of a cup. At the bottom of the fire-pit an iron grating about 21 inches square is placed through which ashes fall into the ash chamber. The above opening is situated on the windward side and fuel is fed from this opening. A tunnel passes out of the ash chamber at right angles to the opening of the fire-pit above, through which deposits of ashes can be removed by means of a mamoty or a small shovel whenever required. This is placed in the windward side to admit good draught into the fire-pit through the grating and facilitate complete burning of the fuel. The ash chamber is circular about 4 feet at the base and ending at 1½ feet at the top and 4 feet deep. It is in the form of an inverted cup. The grating has 10 holes each 3 inches in diameter. The top of the furnace is somewhat smaller than the bottom of the pan and the bottom of the pan rests on the edge of the oven exposing the maximum surface to the fire.

The cost of constructing the furnace is as follows:—

(1)	1,000	Bricks	...	Rs. 18·00
(2)		Lime	...	,, 4·50
(3)		Iron grating	...	,, 1·00
(4)		Mason	...	,, 3 00
			Total ...	Rs. 26 50

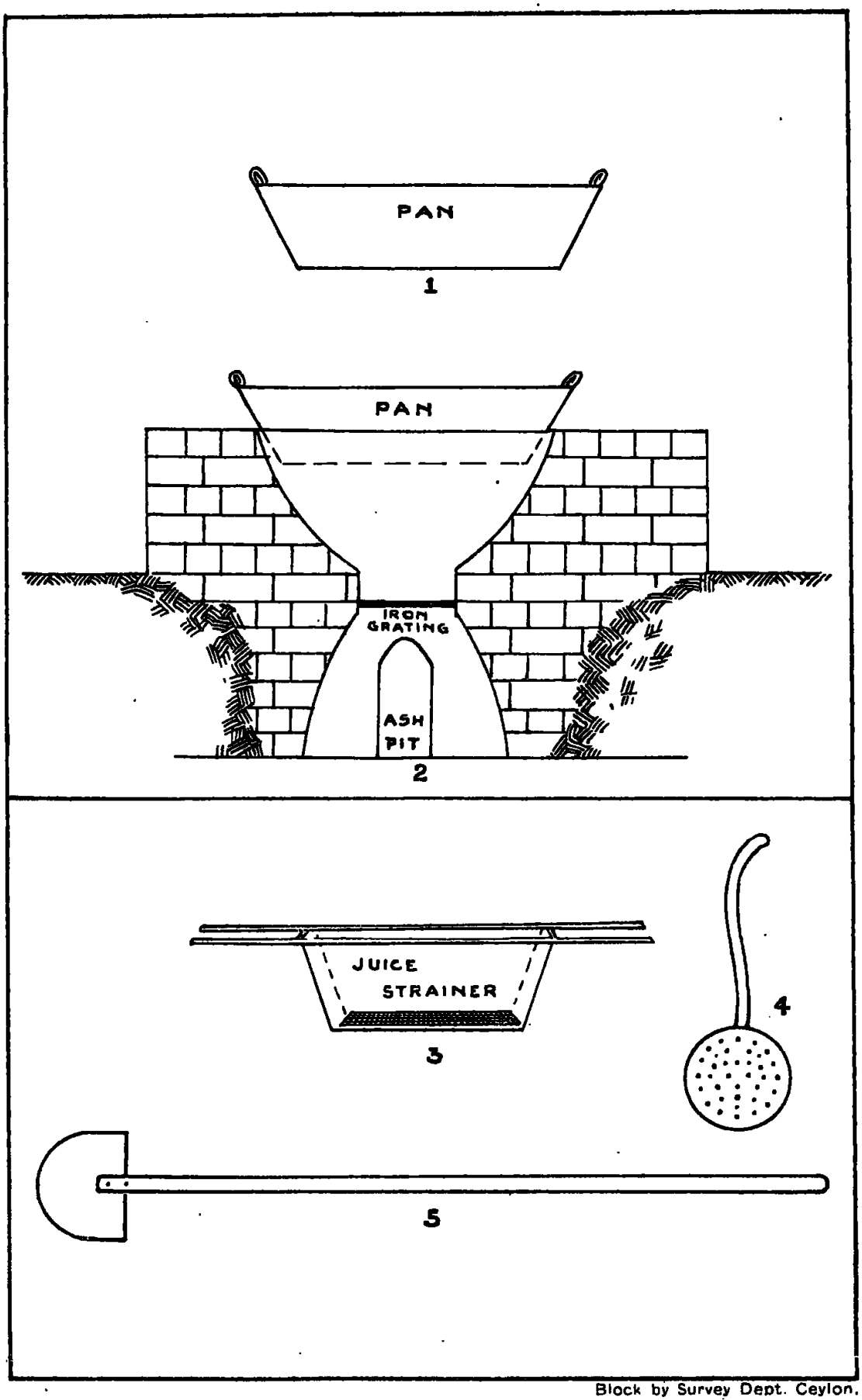
The plan of the furnace is annexed herewith (see Fig. 2.).

The pan that is being used here is a shallow one and the dimensions are as follows:—

Length 4 ft. 3 inches
Breadth 3 ft. 3 inches
Depth 10 inches

The expressed juice is collected in kerosene tins and carefully strained through strainers (see Fig. 3) and poured into the pan which is now placed over the furnace. About 12 tinfuls or 480 lb. of juice is a fair charge. Small quantities of milk of lime is then added to the juice to neutralize the acidity. The quantity of lime to be used varies according to the variety of cane, richness of juice maturity, etc. The proper quantity to be added can be only judged by experience. But our experience shows that 1/8 measure of thick milk of lime is sufficient for a charge. An excess of lime deteriorates the colour and quality of the jaggery as seen from the trial boilings conducted here.

Every day care was taken to spread out in the sun the megass or the remains of the cane after the juice had been expressed out so that it can be used as fuel on the following day. Megass and trash formed the major part of the fuel while firewood was used sparingly. It was observed that very hot flames were required to make the juice boil. Then the fire must be lowered, especially so when the juice has begun to thicken. When the juice has begun to boil frothing is produced and the scum and other impurities come up to the surface. The scum should be removed without in any way disturbing the liquid down below and this is done by a scum remover (see Fig. 4). The scum could be profitably utilized in feeding cattle. After the removal of the first layer of scum the juice begins to boil briskly and a second layer appears. This must be carefully removed. Small quantities of scum are now observed to collect on the side of the pan and these too must be removed occasionally. In about 3 hours' time, the juice begins to rise almost to the top of the pan and again boils down forming large bubbles. At this stage a little ghee and gingelly oil is added to give some flavour to the jaggery as the consumers in Jaffna did not at first appreciate sugar-cane jaggery. At this stage the fire must be gradually lowered. At the completion of the evaporation the syrup assumes a yellow tint when it should be constantly stirred by means of a wooden hoe as shown in Fig. 5.



Block by Survey Dept. Ceylon.

1. Coimbatore Pan.
2. Furnace.
3. Juice Strainer (wire gauze sieve).
4. Scum Remover iron.
5. Wooden Paddle.

The following test is made to see whether the juice has come to the required consistency. Cold water is kept in an earthen tray and a few drops of the syrup are poured into it in the form of a circular thread. If this forms into a hard ball the pan must be immediately removed from the oven and contents cooled and stirred constantly with the wooden paddle.

The solidyfying juice is then run into the moulds which consists of a large log of wood on one side of which numerous square holes are made. The jaggery is thus produced in small cubes which are convenient for handling and marketing—4-6 cubes of this type weighed 1 lb. and could be sold at Rs. 3·00 per 100. When large quantities are available the juice is run into lined pits. Such lumps could be sold as they are or crushed into pieces before disposal.

The statement below shows the results of the different varieties of cane grown on this station.

Variety of cane.	Number of canes	Weight of canes	Weight of Juice	Weight of Jaggery	Sucrose percentage
		lb.	lb.	lb.	
55 P ...	504	1561	818	111	13·5
Red Mauritius ...	1050	1782	810	81	10
Barbados 208 ...	550	2024	1150	131	11·3
131 P ...	1560	3520	1752	239	13·41
Sealy's seedling ...	2100	2254	1270	111	8·6
Sin nombre ...	2000	3070	1300	120	9·2
Stripped Tanna ...	1000	1981	780	107	13·7
D. K. 74 ...	1600	3176	1280	80	6·25
Total	10.364	19 368	9160	980	

Cost of Manufacture.

(1)	Cost of labour for cutting canes, feeding the mill, etc. (45 hours) ...	Rs.	3·75
(2)	Extracting 9,160 lb. of juice (hire of bulls for 45 hours) ...	,,	7·50
(3)	Cost of lime ...	,,	·90
(4)	Cost of fuel ...	,,	11·70
(5)	Cost of labour and supervision of the work in the furnace ...	,,	15·75
	Cost of manufacture of 1 lb. Jaggery 4·7 cents		
	Outturn of sugar 980 lb. from 7/16 acre at 18 cents per lb. ...	,,	176·40