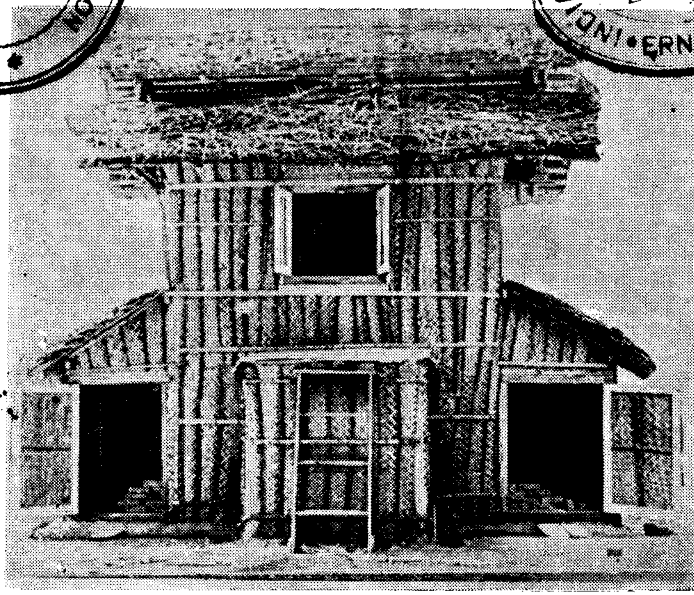
COCONUT RESEARCH INSTITUTE

SMALLHOLDERS COPRA KILN

Capacity : 1,500 nuts, dried in two days



It is essential that all coconut growers should be in a position either to produce copra or to sell nuts, according to which is in greater demand (see *Ceylon Coconut Quarterly*, Vol. V, No. 4, page 233). It is also necessary to re-establish the high reputation of Ceylon copra so that the best possible prices may be obtained for Ceylon copra during the difficult times that may be ahead.

The small copra kiln, described below, provides the answer. While it has been primarily designed for use in small holdings of 20 acres or under, it can also be used with advantage for decentralised

production on estates, since the cost of carting whole nuts to a central copra yard is saved, and the husk and coconut milk is left in the field and returned to the soil (see Advisory Leaflet No. 5).

SPECIFICATIONS

The new kiln is a Ceylon type drier (see Advisory Leaflet No. 15), reduced in size and with improvements in design and operation, so that a better quality of copra is produced in half the normal time, but without in any way forcing the drying and so producing case-hardened, burnt, and irregularly dried copra.

The design of the kiln is based on the travelling cone of heat which is produced at the end of a double chain of coconut shells, 12 feet in length, lit at one end and burning at the rate of about 2 feet per hour, depending on whether they are large or small shells.

When the copra grill or platform is 7 feet above the fire point, the effective heating area of the cone is a circle 5 feet in diameter. This determines the width of the copra platform and of the kiln itself.

Fresh coconut meat will begin to deteriorate through the action of decomposing bacteria, if heat is not applied within four hours of splitting. This fixes the length of the copra grill at 10 feet, the length of the hearth at 12 feet and the overall length of the kiln at 16 feet.

A heat spreader consisting of a piece of flat galvanised iron, 20 inches wide and 10 feet long is nailed to the rafters over the area occupied by the hearth to prevent overheating the copra immediately over the fire. The cadjan roof of the two wings is protected from sparks by two flat sheets of galvanised iron on the underside.

General Remarks

Although the kiln is made of inflammable materials, there is absolutely no risk of fire, providing the kiln is built and operated exactly as described. This is because there is no fire disturbance in the fire-pit and because there is no heat outside of the zone of the travelling cone of heat. The copra is of uniformly good quality, because of the uniformly warm conditions within the kiln, because the fires are undisturbed and do not smoke, and because the shells are preheated and dried by the reverbatory action of the hearth of loose serrated bricks. Storms outside make no difference to conditions within the kiln.

Cadjan construction for the walls of such a kiln is to be much preferred to sheet iron or brickwork, because air can filter evenly into the fire-pit without any of the wind disturbance which is associated with ventilation holes. This material also keeps the air inside the kiln warm so that there is none of the moisture condensation and chilling which occurs on cold nights with galvanised iron. When hot humid air is chilled, undesirable

convection currents throw the cold water-laden air back on to the copra and produce chilled copra due to the deposition of cold condensed water.

It can thus be seen that the Ceylon type of drier, particularly if it is of brick and galvanised iron construction is not as efficient as many people imagine. The copra is irregularly dried and both scorched and chilled red pieces are produced. Furthermore, the drying time is more prolonged because only half of the copra is being heated at any one time.

MATERIALS OF CONSTRUCTION

Round Timber

4 ' Halmilla ' or strong wooden posts 13″ circumference, 12½ ft.long
2 ' Halmilla ' or strong wooden posts 13″ circumference, 7½ ft.long
4 ' Halmilla ' or strong wooden posts 13″ circumference, 6½ ft.long
2 ' Halmilla ' or strong wooden posts 13″ circumference, 6 ft.long
12 ' Mango ' or small rafters 7″ circumference, 8 ft.long

Coconut Rafters

9 coconut rafters, standard, 15 ft. long
1 ,, ,, standard, 12½ ft. long
2 ,, ,, standard, 10½ ft. long
4 ,, ,, standard, 9½ ft. long
12 ,, ,, standard, 6 ft. long
8 ,, ,, standard, 5 ft. long
5 ,, ,, standard, 4½ ft. long
6 ,, ,, standard, 3 ft. long
6 ,, ,, standard, 7 ft. long

Arecanut Reepers (slats)

3 lengths, 1½ ins. wide × 17 ft. long
13 ,, 1½ ins. wide × 15 ft. long
46 ,, 1½ ins. wide × 10½ ft. long
6 ,, 1½ ins. wide × 10 ft. long
8 ,, 1½ ins. wide × 9 ft. long
6 ,, 1½ ins. wide × 6½ ft. long
6 ,, 1½ ins. wide × 5½ ft. long
9 ,, 1½ ins. wide × 5 ft. long

Cadjans (Attaps or plaited coconut fronds)

325 double plaited cadjans.

Galvanised Iron Sheets

	Equivalent in Gauge 22 metal
1 piece of 20″ × 10′	
2 pieces of 6′ × 4′	4 sheets of 6′ × 3′
1 piece of 6′ × 5′	

Wooden Planks

2 planks, 1″ thick 1½ ft. × 10 ft.
2 ,, 1″ thick 1½ ft. × 5 ft.
5 ,, ½″ thick 1 ft. × 4½ ft.

Door Frames

2 doors, 3 ft. × 2 ft.
1 door, 2½ ft. × 3 ft.

Ladder

4 ft. high × 2 ft. wide, with four steps .. One

Other Requirements

Nails	2 lb.
Coir yarn	50 skeins
Galvanised wire (gauge 22)	2 lb.
Cement for corner posts	20 lb.
Hinges and screws	8 doors
Solignum	1 gallon
Bricks	80

COST

Materials				Rs.	Rs.
Timber (mango)	96	ft.	@	-/05 per foot	4.80
Timber 13″ girth	103	ft.	@	-/35 per foot	36.05
Coconut rafters	401	ft.	@	-/16 per foot	64.16
Arecanut reepers	978	ft.	@	-/03 per foot	29.34
Cadjans or attaps	325	double plait	@	5/00 per 100	16.25
G.I. sheets	4	sheets	@	15/00 per sheet	60.00
Wooden planks	67½	square feet	@	-/75 per square foot	50.62
Door frames	3	door frames	@	5/00 per frame	15.00
Ladder	4	ft. high	—	one	40.00
Wire nails	2	lb.	@	-/80 per pound	1.60
Coir yarn	50	skeins	@	-/15 per skein	7.50
G.I. wire	2	lb.	@	-/80 per pound	1.60
Cement	20	lb.	@	-/10 per pound	2.00
Door hinges	8	hinges	@	1/25 per hinge	10.00
Solignum	1	gallon	@	3/00 per gallon	3.00
Bricks	80	bricks	@	45/00 per 1,000	3.60
				Total .. Rs.	345.52

Labour

Erection of frame work, thatching and cutting 1′ × 6″ drain round the kiln and other incidentals

1 carpenter @ Rs. 5/- per day 2 labourers @ Rs. 3/- per day 14 days	154.00
Total all in cost	499.52

The kiln is cheap to make because most of the materials of construction are available in rural area, i.e. hardwood poles, coconut rafters, split areca palm, platted coconut leaves, coir string and old bricks. Only a few items need actually be purchased, i.e. nails, solignum, and galvanised wire and sheeting, costing in all Rs. 24 or £ 2 sterling. If the smallholder is able to do all the work himself, labour costs, amounting to Rs. 154/- are also saved.

OPERATION

Husking and Splitting

It is necessary to husk and split the nuts. Husking is done in the field by means of a sharp steel-pointed stake, which is rammed into the ground, and the husk is twisted off in four segments. An expert can husk 2,500 nuts in an 8 hour day.

The nuts are split in halves with a machete, parang or chopper by giving each a sharp blow across the seam. This ensures a clean cut with no broken pieces. An expert can split about 10,000 nuts a day.

Sun-drying

The split nuts are carried to a clean barbeque made of concrete (Advisory Leaflet No. 20) or of rammed earth or gravel, dressed with ' Colas ' or a similar bituminous dressing. They are then laid out for sun-drying face upwards to the sun. This work is always done in the early morning, so that the half nuts receive about 8 hours drying in the sun before being put into the kiln.

The advantage of this preliminary drying is that the copra develops a dry smooth surface to which dirt and smoke does not adhere and about half the contained water is also removed. The disadvantage lies in the dependence on the weather, since little or no drying occurs when the sky is overcast and the humidity of the atmosphere can be nearly 100 per cent. Wetting by rain previous to or after kiln-drying is fatal to quality as the surface is pitted and bacterial decomposition sets in.

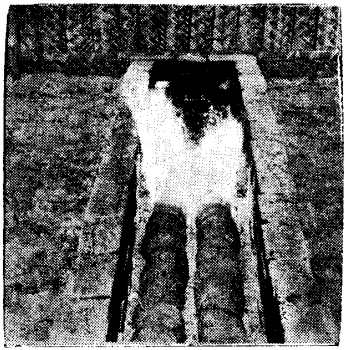
If two workers husk the nuts the day before, and split and lay them out the following morning, a fair daily task, covering transport, husking, splitting, sundrying and loading the kiln will be 1,500 nuts, which is the load for a single kiln.

Kiln Drying

It is important that the shells, used as fuel, should be from mature nuts, dry and free from husk. The fuel should be sorted into large and small shells to avoid the interlocking which occurs

when a small shell enters the cavity of a large shell, resulting in a period of smoking and smouldering. The line of shells should be loose to allow free ventilation and prompt ignition of a pre-heated shell. The large shells should provide the first fire.

The shells are laid in the serrated brick hearth in a parallel double row. In order to avoid any excessive production of smoke, when the chain is first lit, it is desirable to ignite some shells outside the kiln and bring them in when they are burning fiercely. The fire-pit doors must thereafter be kept closed to prevent any disturbance of the fires. By looking through the observation window at the end of the kiln it will be seen that the fires are smoke-free.



It has been found that 1,500 nuts which have been previously sundried can be dried with 8 double fires, allowing 2 hours' rest between fires. In rainy weather, the split halves have to be put straight on the kiln and the drying should be started with two fires, one at each end, separated by a temporary wall in the middle. An extra day's drying will also be necessary, i.e. 12 fires in all.

Fuel consumption, with sundrying : 60 per cent
without sundrying : 90 per cent

Even whiter copra can be obtained by burning a 1 inch layer of coconut charcoal in the hearth. A 12 foot length of charcoal ignited at one end takes 15 hours to burn away and gives radiant heat with no smoke (see Leaflet No. 6—Manufacture of Coconut Charcoal). The amount of charcoal required to dry 1,500 nuts is 250 lb. This amount of charcoal can, with careful burning, be obtained from the shells of 2,500 nuts. This means that additional charcoal must be purchased which is justified only if a premium is obtained for the resulting white copra.

Marketing

The dried copra should be sorted into the following grades before sale :

Edible White or Dried Coconut : Smooth, round, hard, crisp, white pieces, entirely free from smoke, colour or moulds

No. 1 Copra :	Smooth, hard, crisp and uniformly greyish-white
No. 2 Copra	(*a*) Distorted but thick copra from under-ripe nuts
	(*b*) Thin and broken copra from over-ripe nuts
	(*c*) Off-coloured copra—either scorched or chilled ' red '
No. 3 Copra :	(*a*) Distorted, corrugated thin copra from ' kalati ' or immature nuts
	(*b*) Discoloured or ragged copra from bad nuts.

Edible white copra could be sold as dried coconut and used as food (grated coconut, sweets, biscuits and cakes). Its appearance can be improved for purposes of retail sale by wiping the testa with an oily cloth and trimming the broken edges. The market for this product could be considerable but it would need to be sold within three months otherwise superficial moulds will spoil its appearance.

At present, sales are seasonal (May-June) and business is mostly with Pakistan. Possible new markets are Japan, China, South Africa and even the United States but the trade would need to be developed by demonstrations and effective salesmanship.

April 1st, 1956.