COPRA DRYERS - VERSATILE MACHINES FOR THE MONSOON PERIODS

A.R. S. MENON AND K. MADHAVAN
Central Plantation Crops Research Institute, Kasaragod 671 124, Kerala

India, the third largest producer of coconut in the world, produces about 8160 million coconuts every year. Commercially copra is the most important produce of the coconut palm. It is estimated that about 40% of the coconuts produced in the country is converted into copra, mainly for the extraction of edible oil. Since copra is exported and imported in large quantities, it is a produce that has to withstand the alterations occurring during the storage for considerable time. The quality of the copra is mainly judged by its crispness. It should be also very clean. On the contrary copra on storage is found to be deteriorating because of various reasons like bacteria, insects or moisture. To a greater extent, the spoilage in copra can be avoided, if the nuts are promptly and properly dried, once it is broken open. This important operation of drying should be continued till the 45-55% moisture content in the fresh coconut is brought down to 6%. In India, the hot, sunny months of the year makes it feasible, but it really becomes a problem during monsoon period. During rainy season, with restricted sunshine, drying by artificial method is the only possible solution. The existing artificial kiln driers are of direct types and these are not desirable for copra drying since the product becomes inferior in quality due to smoking and improper drying. Keeping this in mind, the Central Plantation Crops Research Institute has developed copra dryers of different capacities using the following sources of heat :

a. Coconut husk, shell or any agricultural waste,

b. Solar energy, and

c. Electricity.

1. Small holder's dryer using agricultural waste as fuel

The dryer is of 'batch type' having indirect heating and natural air convection arrangements. It can be constructed from locally available materials like asbestos cement sheet, G.I. sheet, MS angles and flats, wire mesh, asbestos, etc. (Fig. 1)

The main parts of the dryer are (a) drying chamber, (b) plenum chamber, (c) burning-cum-heat exchanging unit, and (d) chimney with regulators. The drying chamber is the upper portion of the dryer which has a wiremesh tray at the base constitut-

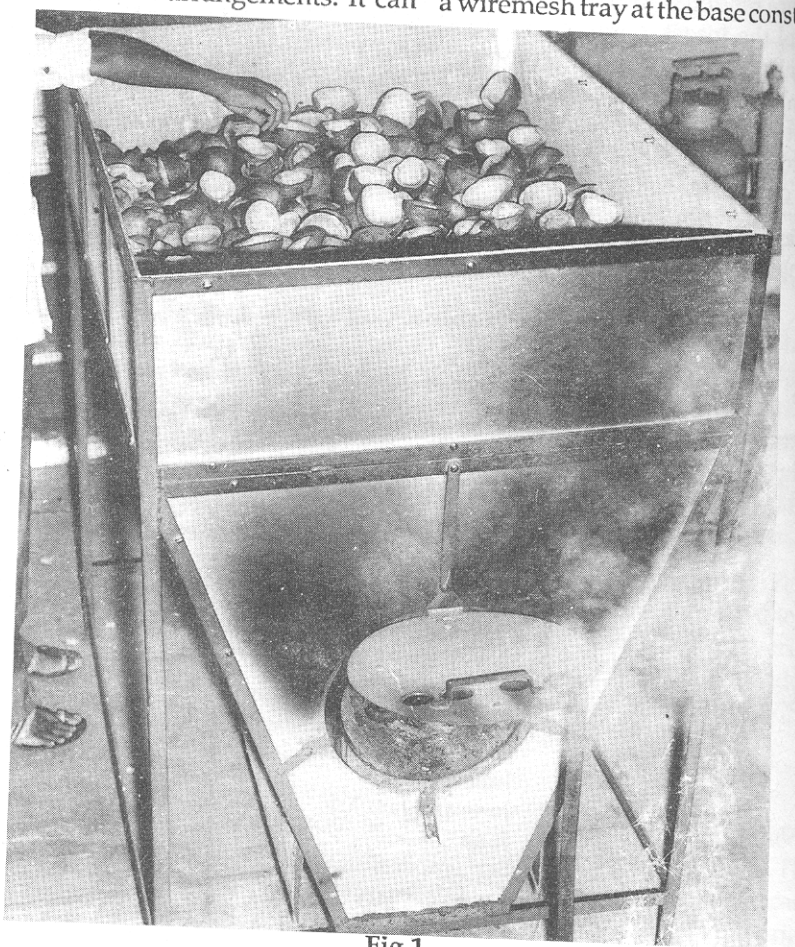

Fig.1

ing the drying platform. The air gets heated up in the plenum chamber situated below the drying chamber. Fresh air enters the chamber through the adjustable opening at the bottom. The burning-cum-heat exchange unit in the centre of the plenum chamber is a cylinder made up of corrugated sheet. The agricultural waste fuel is burnt in a weldmesh tray inside this chamber. The cylinder is also connected to a chimney. The butterfly valves on the chimney regulates the entry of air into the cylinder for combustion and thus controls the rate of burning of fuel.

The produce to be dried is kept in the dryer. As the fuel is burnt in the burning chamber, the flue gases heat the GI sheet surface by conduction. The heat from GI sheet is transferred by radiation and convection to the surrounding fresh air entering from the bottom, generating a convection air current. The hot air moves up through the wet produce in the drying chamber and the hot air mixed up with moisture escapes through the top of the drying chamber.

The coconut to be dried is to be split into two halves. The nut water is drained off and the split cups are loaded in the drying chamber in brick fashion. The fuel is fed with occasional refilling. After 8 to 10 hrs of drying the shells from which kernels have loosened can be removed. All the shells can be separated within 12-15 hrs. of drying. The copra cups are to be raked every two hours for uniform drying. Generally the drying is carried out over four days with overnight breaks till the moisture content of copra reached 6% for safe storage.

This versatile dryer can also be used to dry many plantation crop produces like cocoa, arecanut, etc.

2. Large size copra dryer

Based on the same principle as that of small holders dryer, recently a low cost copra dryer with larger capacity of about 3,000 to 4,500 coconuts per batch was also developed (Fig.2). This permanent structure has an overall dimension of 4m x 2m x 3.6m. It mainly consists of two brick masonary side walls and angle iron frames and asbestos sheets.

In this dryer also coconut husk or any other dried organic material can be used as fuel. When coconut husk is used as fuel, about 800 to 1000 husks (approximately 200 to 250 kg) are required for one charge. Drying time is between 34 and 36 hours to produce quality copra. The cost of manufacturing the dryer is approximately Rs. 12,000 and the cost of drying is worked out to be Rs. 1.18/ kg of copra.

3. Solar Cabinet Dryer

This 'chamber type' dryer is having direct heating and natural air convection arrangements. The main parts of the dryer are : (A) Cabinet frame with caster wheels for mobility, (b) transparent covers on the four sides of the frame with 3 mm glass pane and on top with 3 mm acrylic plastic sheet, (c) drying surface of area 1.06 m^2 inside the cabinet frame, (d) insulation between the drying surface and wooden frame, (e) reflectors on the three sides outside the frame (f) suntracting arrangement, (g) air inlet on the front side at the bottom, (h) exhaust outlet at the rear side on the top (Fig.3).

The top cover on hinges facilitates opening of the dryer. The 22 guage corrugated GI sheet used as the drying surface enable to get 10% more area per unit space. Heat loss is prevented by coir fibre insulation between the GI sheet and wooden planks. The reflectors are made of 22 guage aluminium foil. The reflectors help in concentrating the solar radiation on the drying surface itself. The indicator rod and castor wheels help in keeping the drying surface always facing the sun.

The fully matured coconuts after harvesting is to be stored for 4 to 6 weeks. After dehusking the coconuts, the nuts are split into two halves and the water is drained off. The dryer with the split nuts loaded on the drying surface with cups facing up, is moved to track the sun twice

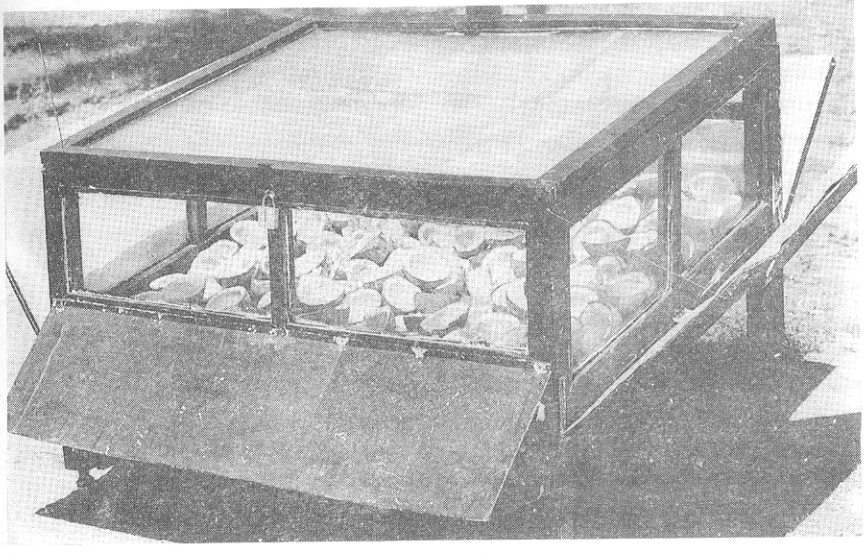

Fig. 2

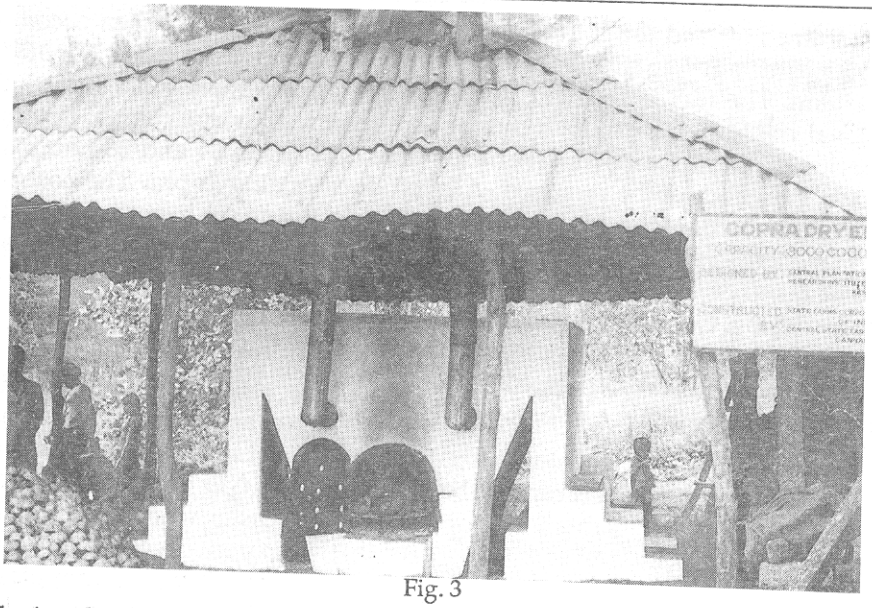

Fig. 3

during the day for effective trapping of solar energy. The heat generated due to absorption of solar radiation helps the moisture in the copra to evaporate quickly. The next day the kernels can be detached from the shell and can be further dried.

In the dryer about 80 to 100 coconuts can be dried per batch within a period of $3^1/_2$ to 4 days. The temperature and relative humidity inside the dryer during drying was found 17°C more and 22% less, respectively compared to respective ambient factors. The dryer costs about Rs. 3,200 and the cost of drying is 1.20 Ps. per kg.

Very recently the solar dryer was modified by replacing the galvanized iron sheet drying surface with a selectively coated solar aluminium absorber sheet which helps to raise the temperature inside dryer by 25° C higher than the ambient.

The insulation of drying surface was provided by lining with less hygroscopic thermocol instead of coir pith. Copra can be dried by about 20 hrs (2.5 to 3 days) and the cost of drying per kg of copra works out to be 0.85 Paise only.

4. Electrical dryer

This tray type dryer uses mixed flow and forced hot air circulation. The parts of the dryer are (a) drying chamber, (b) plenum chamber (c) heating unit, and (d) blower unit (Fig. 4).

The drying chamber of jackwood planks lined with 22 gauge GI sheet inside, can accommodate 10 welded wiremesh trays of 92 x 45 cm size. The air distribution chamber located vertically at the centre is made of GI sheet with perforation on both sides. The trays are kept on aluminium angle runners on both sides of the air distribution unit. The adjustable lid on the top of dryer serves as exhaust.

The plenum chamber connected to the air distribution unit and the heating unit is made of GI sheet and covered with asbestos sheet and rope.

The 20 air heaters of 400 watts each are arranged in a box of 3 mm thick MS sheet and are controlled by switches and energy regulators.

Blower unit consists of 1.5 HP, 2880 rpm motor which is used as prime mover with a capacity of 60 m^3/min. The air blown over the heaters gets heated up and distributed in the drying chamber by the air distribution unit. The motor operation is controlled by a direct on-line starter.

Hundred split nuts can be loaded in each tray with cups facing sideways. During loading, the blower is switched on with the exhaust lid partially opened. After loading, the heaters are switched on. The energy regulator inlet valve and exhaust lid opening enable to achieve the desired temperature. Normally the inlet air is kept at 60°C. After continu-

The performance data of the various types of dryers are summed up as below:

Dryer Model	Heat source	Capacity (coconut/batch)	Drying time (hours)	Approx. cost of dryer (Rs.)
1. Small holder's dryer	Coconut shell or any dried agricultural waste	400	36	1,200
2. Large size dryer	do	3000 to 4500	36	12,000/-
3. Solar Cabinet dryer	Solar energy	100	84 to 96	2,000/-
4. Electrical Dryer	Electricity	1000	30	12,000/-

Utilising any one of these models, quality copra can be produced without depending upon the mercy of weather.

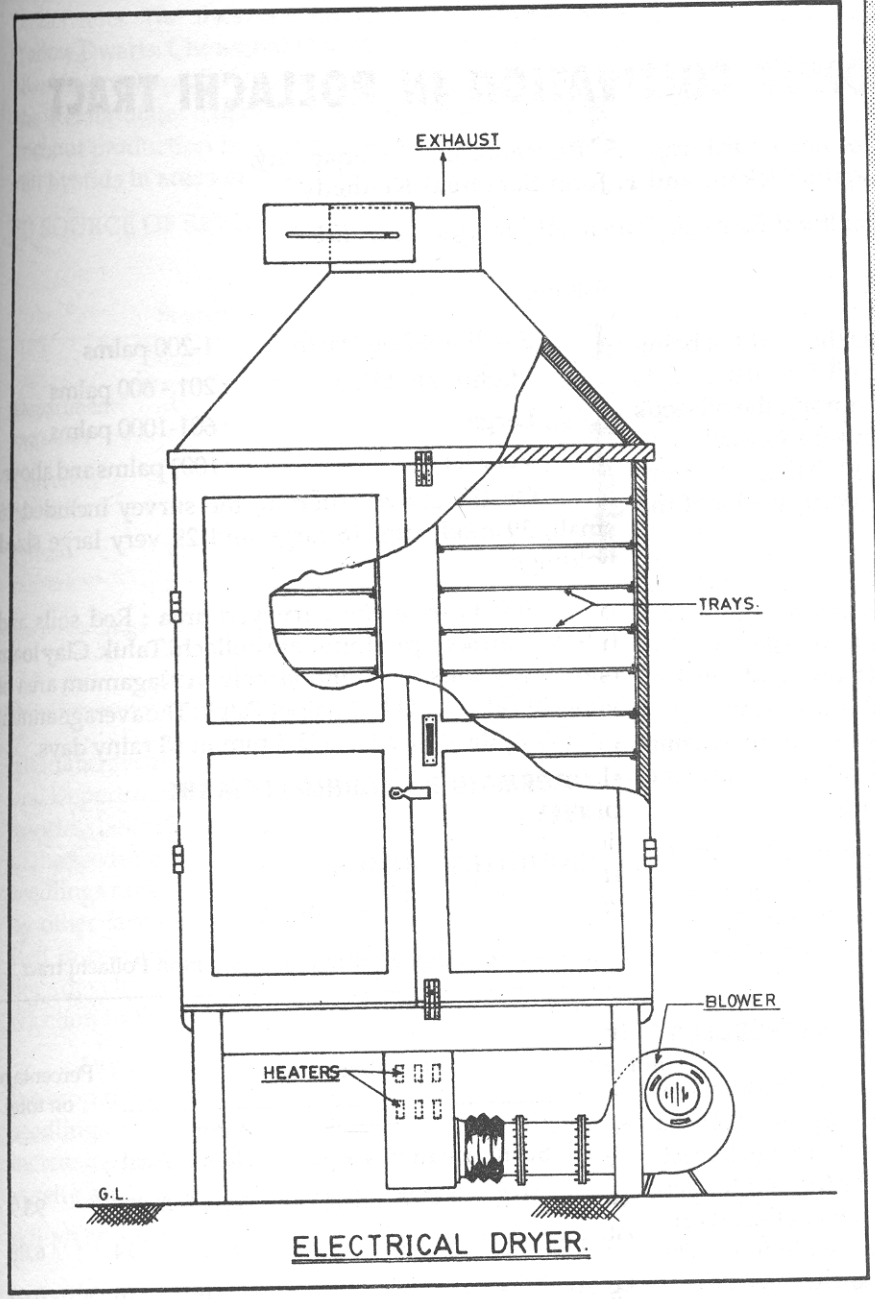

Fig . 4

ous operation for about 12 hours, the trays can be taken out and shells of the nuts can be separated.The trays with the cups can be reloaded and drying continued till the desired moisture level of 6% is attained.

The total capacity of the drier per batch is 1000 coconuts (about 160 kg of copra) and the time required for drying is about 30 hours. The cost of manufacturing the dryer will be about Rs. 12,000/- and the cost of drying works out to be 98 Ps. per kg. One added attraction of the dryer is that the location of the heating unit is outside the drying chamber. This renders the dryer free from fire hazards.

INTERNATIONAL SOCIETY FOR SPICES

A professional International scientific society of spices research and development workers was formed with NRCS (National Research Centre for Spices) as its headquarters. This society known as the International Society for Spices aims to provide a common forum for the workers of spices, aromatic crops and allied plants to come together for exchange of ideas and will try to develop the concept of a common brotherhood among research and developmental workers, producers, traders and users of spices and aromatic crops.

The Society will be publishing the *International Journal of Spices and Aromatic Crops* (IJOSAC), the first issue of which will be out in January 1992.

The ISS will be collaborating with other agencies for organising national and international seminars and symposia.

Membership in ISS is open to any one interested in research, development, trade, cultivation and use of spices and aromatic crops.

Contact : P.N. Ravindran, Secretary, ISS, National Research Centre for Spices, (NRCS), P.O. Box 1701, Calicut - 673 012, Kerala, India.