QUANTITY AND QUALITY OF BALL COPRA IN RELATION TO THE AGE, SIZE AND SHAPE OF NUTS

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Ball copra is prepared on a commercial scale in Mysore State, parts of Malabar in Madras State and Godavari in Andhra State and in small quantities in Travancore-Cochin State. Generally mature nuts are utilised for the purpose. The nuts are stored for eight to twelve months in a suitable coconut store and frequently stirred or smoked till they are quite dry. The proper stage of drying is determined by shaking the dry nut when the detached kernel striking against the shell makes a peculiar *rattling* sound. The nuts are stored for some more time and then marketed. Though this process has been in vogue in several places from time immemorial, correct information about the proper maturity stage, size and shape, time of storage, etc., of the nuts, for conversion into ball copra of good quality, is not available. In this paper are reported the results of some preliminary observations on this subject, together with a note on the preparation, grading and marketing of ball copra.

Materials

Generally nuts which are 12 months in age from the time of stigmatic receptivity or opening of the female flower, are considered mature for copra production. For the present study, therefore, four bunches of 14, 13, 12 and 11 months old nuts were harvested from each tree from 24 trees of the Main Block of the Central Coconut Research Station, Kasaragod, Madras State. The nuts were separated into four shape groups, *viz.*, long, oblong, ovate and round. As far as possible these shape groups were further sub-divided into different size groups, *viz.*, big, medium and small. All told 448 nuts of 10 shapesize groups were studied.

Methods

The nuts were serially numbered and the following observations recorded for each nut:—

1. Weight,
2. Water content,
3. Condition of husk and
4. Presence or absence of perianth lobes.

The water content was judged approximately by sounding and shaking the nuts. The water in a nut that produced no sound on shaking the nut at the time of harvest was taken as 1.0, while the

same condition after storage for some weeks would be taken as zero. In between these limits it was possible by a little practice to judge the content of nut water as 0. 9, 0. 8, 0. 7 and so on.

The condition of the husk was recorded as falling under any one of the four groups: dry, almost dry, almost green and green.

The nuts were then stored in a seed-nut store. They were not smoked or given any other treatment. Every week they were taken out of the store and data for the above characters recorded. The week of dropping of the perianth lobes, drying of the nut water and the week of *rattling* were also recorded.

These observations were continued for 36 weeks after which time, the nuts were husked and the ball copra studed for (1) Size, (2) Shape, (3) Colour of outside skin, (4) Condition of skin, (5) Volume, (6) Height, and (7) Diameter. The copra balls were then cut open horizontally into two exact halves and studied for (1) Mould attack, if any, (2) Colour inside, (3) Colour at cross-section, (4) Thickness, (5) Crispness, and (6) Taste. Representative samples were also analysed for moisture and oil content.

Shape.—The shape of the ball copra was recorded as long, oblong or round and the size as big, medium or small.

Colour—The outside colour of the copra was described as dark, oily tan, tan, sand coloured or yellowish tan, the inside colour of copra not spoiled by mould attack, as oily brown, glassy white or pearly white and the colour at cross-section as oily brown, glassy white or pearly white.

Crispness.— The split halves of the copra was squeezed in the palm of the hand and if it was easily pliable and had a rubbery quality, it was grouped under "flexible" and if it gave a cracking noise, characteristic of dry copra it was classified as "crisp".

Outside skin or coat.—This was described as smooth, uneven or wrinkled.

Mouldiness. — This was described according to the degree of mould attack as free, trace, mild or intense.

Oil and moisture contents.—These were determined by standard methods.

Taste.—This was described as sweet bland, neutral bland or nutty bland.

Volume.—This was measured in a specially constructed volumenometer.

Height.—The maxinum distance at the perpendicular axis of the ball, *i. e.*, the diameter passing through the apex was taken as height.

Diameter.—The maximum distance at the axis perpendicular to the height was taken as diameter.

Thickness.—This was measured as the thickness of the kernel at the circular cut of the split halves of the ball copra. Each value represented the average of readings taken in quadruplicate.

The height, diameter and thickness were measured by means of a micrometer slide calliper.

Observations

Size, shape and maturity in relation to loss of moisture from nuts.—Data in respect of the loss of moisture from the nuts judged by the loss of moisture at two specified intervals, *viz.*, the time of complete drying-up of nut water and the time of *rattling* for the ten shape-size groups for the nuts of different maturity stages revealed the following trends.

(*i*) The percentage loss in moisture undergone by the nuts during the interval between complete disappearance of nut water and the commencement of *rattling*, was more or less constant. This is reasonable to expect, as, by the time the nut water becomes zero, the husk will be more or less dry and there-after it is only a slow dessication of the kernel, which may be uniform in all the nuts.

(*ii*) 97 out of the 448 nuts taken for the study representing 21·7%, remained unrattled after 36 weeks of storage. Out of the 117 nuts of the 14 months age, *i. e.*, the over-mature group, only five remained unrattled.

(*iii*) Oblong nuts, irrespective of size differences took the maximum time for the nut water to become zero and to rattle.

(*iv*) Generally small sized nuts, excepting the small oblong, are better suited for ball copra making than big-sized nuts. From the small long, small ovate or small round nuts, ball-copra can be made on storage for 24 to 29 weeks or roughly 6 to 7 months. Small round nuts have a further advantage that even 11 month old nuts can be included in the preparation. The number of nuts taken for the study from the small long, small ovate and small round groups are respectively 21, 16, and 69 and the number of unrattled nuts nil, seven and three. Of the 69 nuts of the small round size, 52 are from the 13 to 11 month age group.

Small sized round nuts 11 to 14 month old are therefore preferable for ball copra making.

It may be stated here that enquiries made in ball copra producing centres in North Malabar and Mysore have shown that small sized nuts which are fully mature are generally preferred for the preparation of ball copra. The results of the above studies are thus in harmony with actual trade practice. The enquiries have also revealed that the small sized ball copra fetch a premium if not fancy price.

Characters of Ball Copra

Results obtained in these studies for the characters of the copra such as weight, volume, diameter, height and tickness of kernel, of nuts of different size, shape and maturity groups are given in Table I.

TABLE I

Characters of Ball Copra from nuts of different sizes, shapes and stages of maturity

Size and Shape	14 months					13 months					12 months					11 months					Average for size groups				
	Vol. (cc.)	Wt. (gms.)	Ht. (mm.)	Diam (mm.)	Thickness (mm.)	Vol.	Wt.	Ht.	Diam	Thickness	Vol.	Wt.	Ht.	Diam	Thickness	Vol.	Wt.	Ht.	Diam	Thickness	Vol.	Wt.	Ht.	Diam.	Thickness
Medium long ..	337	178	11·47	7·65	0·94	346	186	11·60	7·86	0·99	394	203	11·95	8·54	0·98	..	..	Spoiled	..	..	359	189	11·67	8·02	0·97
Small long ..	233	130	9·30	7·53	0·96	286	132	10·20	7·46	1·00	310	142	10·39	7·69	0·92	287	135	9·96	7·59	0 87	279	135	9·94	7·57	0·94
Big oblong ..	407	207	11·82	8·63	1·00	426	209	11·32	8·99	0·97	390	189	11·19	8·86	0·93	302	155	9·32	8·20	1·00	381	190	10·66	8·67	0·98
Small oblong ..	252	130	8·46	8·10	0·93	286	140	8·70	8·51	0·84	302	139	8·87	8·70	0·84	..	..	Spoiled	..	..	280	136	8·68	8·44	0·87
Big ovate ..	279	153	10·08	7·69	1·12	283	156	9·92	7·89	1·04	323	181	10·29	7·90	1·09	..	..	Spoiled	..	..	295	163	10·10	7·83	1·98
Medium ovate ..	276	150	9·22	8·04	1·01	278	157	9·56	7·83	1·03	292	160	9·67	8·06	1·01	272	154	9·11	7·98	1·01	280	155	9·39	7·98	1·02
Small ovate	284	136	9·75	7·67	0·90	281	152	10·05	7·68	0·96	294	165	10·40	7·95	0·90	282	161	9·95	7·91	0·97	285	154	10·04	7·80	0·93
Big round ..	371	190	0·09	9·41	1·03	389	192	9·19	9·32	1·01	393	195	8·83	9·68	1·02	375	186	8·54	9·61	0·98	382	191	8·91	9·51	1·01
Medium round ..	345	172	9·49	8·93	1·01	373	187	9·64	9·12	0·98	380	183	9·82	9·12	0·92	380	178	9·86	9·12	0·95	370	180	9·70	9·07	0·97
Small round ..	302	154	8·83	8·36	0·99	257	151	9·03	8·46	0·93	287	148	8·72	8·54	0·92	292	152	8·52	8·46	0·94	285	151	8·78	8·46	0·95

From the data presented in Table I it may be seen that the differences in the quantitative characters of the ball copra, brought about by the differences in the stage of maturity of nuts are not so prominent as those induced by differences in size and shape.

Volume.—A big sized nut generally produces ball copra of greater volume than the small sized nuts. Among the sizes and shapes studied, the big round and big oblong nuts gave ball copra of the maximum volume, *viz.*, 382 and 381 c. c. respectively. Small long, small oblong and medium ovate nuts gave lower values, *viz.*, 279 and 280 c. c.

Weight.—The weight follows the same trend as the volume, the big round and the big oblong nuts giving ball copra weighing on an average 191 gms. and 190 gms. respectively while the small long nuts gave the lowest weight of 135 gms. On the basis of these figures 5333 big round or big oblong nuts, 7526 small long nuts and 6728 small round nuts are required to produce one ton of ball copra. It may be added that big sized nuts are generally produced in small numbers, take longer time for the nut water to dry and for the nut to rattle.

Longer interval of time might probably result in greater spoilage of nuts brought about by unfavourable weather conditions and would involve extra cost in manufacture, in the form of greater number of smokings to be given, delay in the sale of ball-copra and in other ways. Small sized nuts may therefore be recommended for ball copra making.

Enquiries have shown that the number of nuts for producing one ton of ball copra ranges from 6,800 to 8,800 in Mysore State and 5,800 to 6,400 in Malabar.

Height.—The height of the ball copra ranges from 8·68 cms. in the small oblong nuts to 11·67 cms. in the medium long nuts.

Diameter.—Big round nuts give ball copra of maximum diameter while the small long nuts give the lowest, *viz.*, 7 57 cms.

Thickness.—Ovate and round nuts have thicker kernel than nuts of other shapes. Small oblong nuts have the lowest thickness for kernel, *viz.*, 0·87 cm.

Other characters.—A study of the data for 448 nuts for the other characters such as colour—outside, inside and cross-section—condition of outside and inside skin, crispness, taste, moisture and oil content indicated that individual tree and nut differences were more prominent than either shape or size of the nut. It was found however that more nuts of the less mature group, particularly the 11 month old group were damaged by mould attack. The spoilage was greater in the nuts of the long oblong and ovate shapes than in the round nuts.

Summary

Preliminary studies on the preparation of ball copra revealed that small sized nuts are best suited for ball copra manufacture, as it takes less time for conversion into ball copra. The spoilage is also found to be very little. While only over-mature nuts of the big size groups are suitable for copra making, in the case of small nuts, 11 to 13 month old nuts can be utilised for their preparation.

Acknowledgment

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A NOTE ON THE PREPARATION, GRADING AND MARKETING OF BALL COPRA

Preparation of Ball Copra

Generally nuts harvested throughout the year are utilised for making ball copra, but in certain localities depending on local conditions and practices, market demand, etc., some special seasons have come into existence, for instance in Channerayapatana area of the Mysore State nuts harvested in one season only, *viz.*, April to July are taken for ball copra making, while in Tiptur and Arasikere area of this State harvests of two seasons, *viz.*, the main season (April to August) and the "Koole" season (November to March) are utilised for the purpose, September and October months being the 'Yede' or interval or off season.

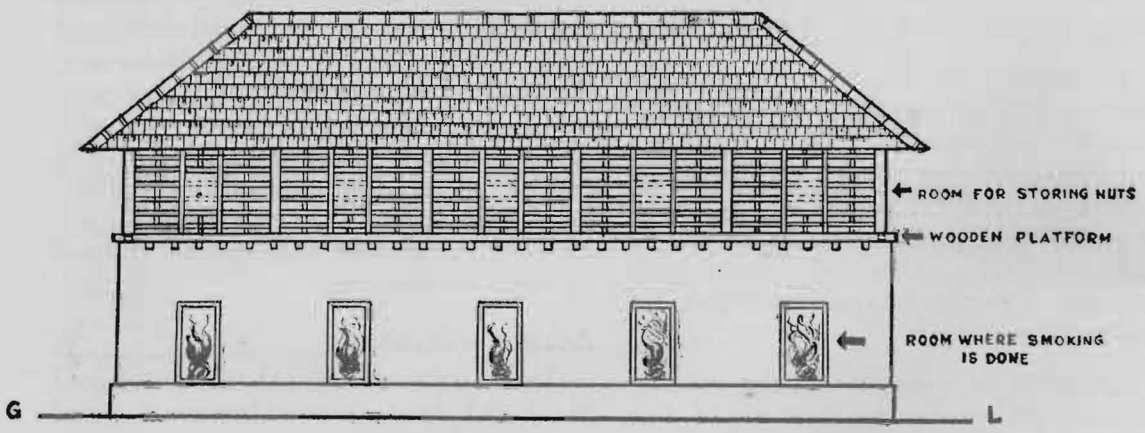
Selection of Nuts

Generally fully ripe nuts, 12 to 14 months old are harvested for ball copra making. In some places the test of ripeness is that one or two nuts from the bunch must fall of their own accord. The husks will usually be dry. Generally nuts are not selected on the basis of size or shape. Immature nuts, if any, determined by shaking and sounding the nuts, are rejected.

Storage

The nuts after harvest are stored in suitable ball copra stores. The store is usually a two-storied one, the ground floor being built of laterite stones and the top floor completely wooden. The floor and the four sides of the top floor are made of wooden bars spaced 3 to 4 inches. The roof is made of plaited coconut leaves or country tiles. The size of the shed varies according to the requirements of the producers. Usually there are 5 to 6 compartments $12' \times 12' \times 6'$, each compartment holding 4,000 to 5,000 nuts. A smoke store commonly used in North Malabar is illustrated in Fig. 1. The nuts are just thrown into the shore, a wooden or bamboo ladder being used, if necessary, for reaching it. Small scale manufacturers also use a wooden platform over the kitchen fire place.

Fig. 1.



A SKETCH OF A STORE FOR PRODUCING BALL COPRA

In some places particularly in Mysore, where smoking of nuts during storage is not practised, nuts are even stored on the upper portion of the producer's house which is generally made of wood. The construction is such that the nuts are fully aerated during storage.

Smoking

During the entire period of storage the nuts are smoked three or four days per week, preferably daily. Paddy husk, coconut husk, dry leaves and any cheap firewood are burnt to produce the smoke. This is the common practice in North Malabar. But in Mysore and other places, no smoking is done. Producers in these areas are of the view that smoking results in bad quality ball copra.

Care of Nuts in the Store

Nuts of different harvests are kept separately. In the smoke stores separate compartments are used for the purpose. Where no smoking is done separate lots are distinguished by means of wooden beams placed between lots. In the smoke stores the nuts are undisturbed; it is feared that stirring of nuts will result in poor quality copra. The practice in Mysore is however the reverse. The producers think that if the nuts are allowed to remain undisturbed, the water inside the nuts will remain in the same position throughout the entire period of storage and the drying will consequently be slow and improper. Stirring will also induce better aeration. Another advantage of stirring the nuts is that during the frequent stirrings it will be possible to give attention to individual nuts and pick out and reject any nut that might have been spoiled. Ordinarily three to four stirrings are given before the nuts are taken out.

Marketing

After the top-most layers of nuts in the store have begun to rattle, the nuts are kept in the store for some more time and then the entire lot of nuts are taken out and depending on market trends the nuts are partially husked and sold as such or converted into ball copra or cup copra. For making ball copra the stored nuts are husked, the shells broken with a heavy iron knife (Fig. 2) and the copra ball removed. The balls are then sorted into different grades. In Badagara, North Malabar, Madras State, the following grades are usually obtained:—

Grade I	known as	O Small size.
Grade II	,,	A Slightly bigger.
Grade III	,,	Bigger than A.
Grade IV	,,	Biggest size.
Grade V	,,	'Kaidipi'.

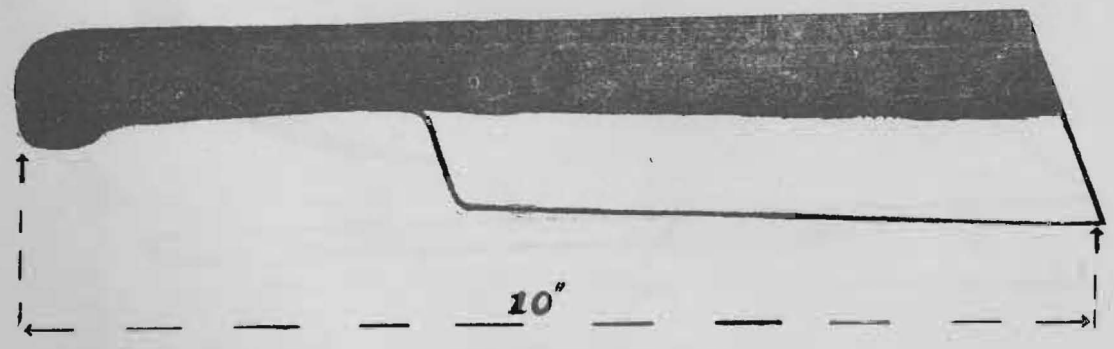


Fig. 2. Knife for breaking coconut shells for removing copra balls

The last grade is of the smallest size. The size is so small that the copra ball falls through the circle formed by holding together the thumb and third finger. This grade is usually rejected. The four commercial grades are illustrated in Fig. 3.

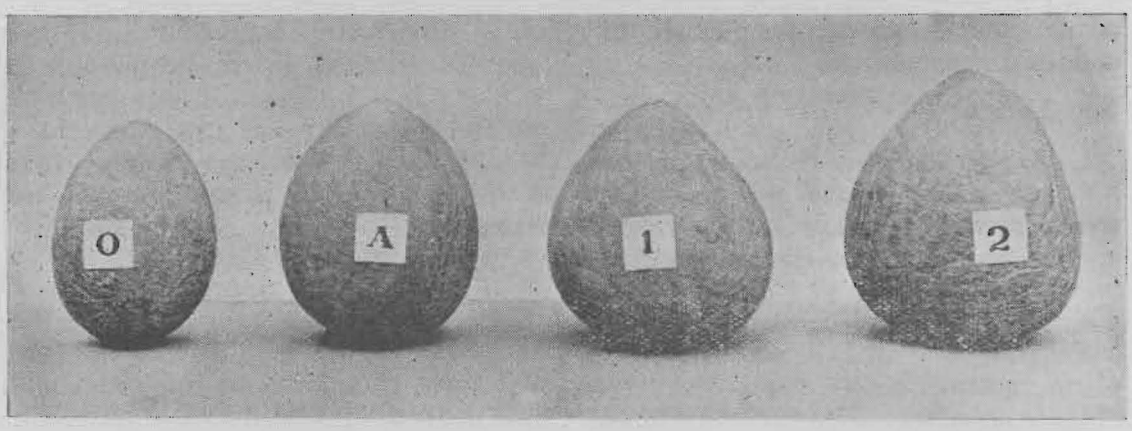


Fig. 3. Commercial grades of ball copra

In case the nuts have not sufficiently dried during storage and still contains water or when the ball copra is not sufficiently dry or when cup copra gets a better price, the ball copra is cut into halves on a bent knife (Fig. 4). The cuts are then dried in the sun and sorted into:—

Grade I known as Rajpur.
Grade II known as Malathi,
Grade III known as Office—nottam, and sold as cup copra.

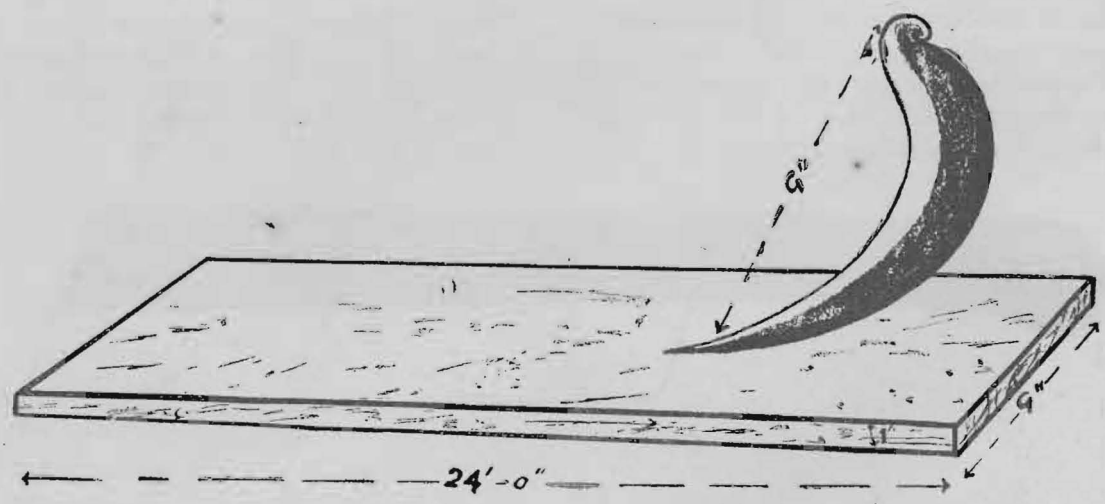


Fig. 4. Bent knife for cutting ball copra into cups

Packing for Export

Five or six layers of wild date palm (*Phoenix sylvestris*) are rolled circularly and placed inside a gunny bag. In the interior of this roll is placed one or two ordinary mats of screwpine leaves (*Pandanus Helicteres*) similarly rolled. The copra balls or cups are then filled in. The layers of mats are then folded over the copra and finally covered with the top layer of gunny which is then sewn. The gunny bag is then securely tied with coir ropes.

The ball copra is usually exported to Bombay from where it is sent to Delhi, Kanpur and other places.

Economics

It is reported that producers in Mysore and North Malabar get on an average an additional net profit of about Rs. 100 and Rs. 50 respectively for every 1000 coconuts converted into ball copra. The margin of profit is of course subject to variations as in the case of any other agricultural produce.

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