

PRACTICAL SEED SELECTION OF COCONUTS*

IN the past the selection of seed for the planting of the main commercial areas of tall coconuts in Malaya appears to have been carried out on what, at the best, must be termed haphazard lines. This grants that, in most cases, planters have done their utmost with existing facilities to obtain the best planting material on offer.

In no branch of agriculture is good seed expensive, betimes good or bad, and this is particularly the case with perennial crops with a long economic life—coconuts for example which normally remain profitable for a period of 30 to 60 years. In a crop of this nature planting is done once and for all, the use of poor material cannot be rectified in the following year as is the case with annual crops. The planter must stand upon the seed he provides in the first instance, therefore the expenditure of a few dollars more per acre on the best possible material is of little moment. Expressed in terms of cash one looks upon the difference between seed cost of \$5 and \$25 per acre on a 1,000 acre estate as vast, but if by provision of improved seed, yields can be obtained only 10 per cent. above average, say from 10 to 11 piculs of copra per acre, the cost plus interest is fully recouped in 7 or 8 years—less than one-quarter of the economic life of the palm—even with copra at \$5 per picul.

Three methods of seed selection appear to have been used on the European owned coconut areas of Malaya.

- (1) In the older (pre-1,900) plantings, by purchase from any mature estates or kampongs which had some reputation for yields and which were so situated as to afford reasonably cheap transport.
- (2) By mass collection from known high yielding estates or areas.
- (3) In a few cases from selected heavy cropping palms in known high yielding areas.

Each method marks a definite step forward but it cannot be said that great progress has been made. It cannot be denied that in respect of this problem the coconut industry lags behind most other large scale tropical products. Rubber, a much newer commercial agricultural proposition, has made enormous strides during the past 10 to 12 years, whereas coconuts have practically nothing to record. The reason for this is undoubtedly the time involved in evolving and proving a pure strain—probably two generations or about 25 years. There is unfortunately, no short cut by vegetative propagation as in the case of rubber, but as coconuts have been established as a commercial proposition for upwards of thirty years in Malaya, the industry should by now be far ahead of where it actually is, and it must be admitted that very little energy has been applied to this most important yield factor.

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Of the methods enumerated above, (2) is that most frequently used but at best it can only be expected to provide plants which will return good average yields. Examination of any high yielding area will establish the fact that the variation in yield per palm is from 0 to over 120 nuts per annum, with more than 50 per cent. of palms below average.

(3) is an improvement upon (2) but in most cases selection is confined to palms carrying heavy heads of nuts without due regard to copra content. Even where selection is carried a step further to handling and opening nuts from such palms for inspection of meat content, the margin of error is very large. Detailed examination of ripe nuts from 47 palms, all with a wet meat content of over 600 grammes, showed a variation in meat thickness between 10.5 and 15.5 mm. with the main group lying between 12.5 and 13.5 mm. Inspection of two nuts of approximately equal size with meat thickness of 12.5 and 13.5 mm. will indicate the difficulty of judging meat content by casual observation, yet the difference is no less than 8 per cent. An increase or decrease of 1 mm., although it has a very large bearing upon copra yield, is almost impossible to detect by eye alone.

Very detailed examination of palms and their nuts for seed purposes is, although laborious, well within the capabilities of any planter, and it requires no scientific training or special plant. From the writer's experience 600-700 palms can be examined and possible marked in two to two and a half hours, and this is about as much as should be attempted at any one time; it is very tiring and one's power of observation flags towards the end. Where an area of palms returning yields well above average is available on an estate, the advantages of taking seed from such an area for extensions or re-planting are manifest. The primary advantage is that environmental conditions are suitable, palms doing well on one part of an estate should do well elsewhere in the same area, assuming that there is no great difference in soil and drainage conditions. There is no guarantee that seed from high yielding palms on the free undulating soils of say Penang Island would do equally well on the flat alluvial clays of the Lower Perak District.

If seed is required for a small area, close selection is a simple matter, but, if a clearing no larger than 100 acres is to be planted, it will be necessary to scour a fairly wide area to obtain a sufficient quantity of the required standard. Seedlings are usually planted out fairly early in the rainy season, and to obtain sturdy plants of even growth at this time necessitates the laying down of seed for the whole area more or less simultaneously. There is undoubtedly a tendency towards economising in the number of seed nuts purchased or laid down, and in consequence one frequently notices that the last portion of a clearing contains a proportion of poor and weakly seedlings. The total seed laid down should not fall far short of 100 per cent. in excess of the number of plants required. For 100 acres planted 30 ft. x 30 ft. and, allowing for first supplying, 5,000 plants are required; 9,000 seed is none too many. With germination of 85 per cent. which is rarely exceeded, the margin is only some 2,500 plants, or in other words two in every three have to fulfil ideal conditions as regards growth. Using seed from palms yielding not less than 100 nuts per annum with a satisfactory copra content, not more than 35 suitable nuts will be obtained from each palm during the three heaviest cropping months. This necessitates not less than 250 selected parent palms, and as such palms, even in a very

high yielding area, only amount to 3 to 5 per cent. of the whole stand, it entails the examination of 6,000 to 7,000 palms, or an area of 120 to 150 acres. If planting can be spread over a whole year it should be possible to obtain an average of about 150 nuts per acre from the selected area, or sufficient to plant up rather more than $1\frac{1}{2}$ acres per acre of the selected area.

No method of seed selection which has to contend with open pollination, and consequent hybridisation, can be described as ideal, but so far there is no available supply of seed coconuts of pure strain, at least not on the scale applicable to estate requirements when planting up large areas. Work of this nature is now being carried out by officers of the Department of Agriculture at the Klang Experimental Station, but it will be long before a pure line is evolved and proved, two generations of coconuts or about 25 years, and then in all probability seed will not be available in large quantities. Beyond the fact that under normal conditions the tall coconut rarely if ever "selfs", and that therefore all seed must be cross pollinated, little is known of its genetics and hereditary traits. The best that can be done is to commence with an area containing a large percentage of palms yielding well above average, the chances of fertilization from a high yielding parent being distinctly favourable. The methods adopted by the writer and described below should be the most satisfactory in the light of present knowledge and applicable on a commercial scale. Selection method (2) is fully complied with in that the area from which seed is taken returns yields far above average, and (3) is fulfilled by the close examination of individual palms, thus as far as possible ensuring good female stock.

Selected area. 80 acres.

Age. 27 years. Planted 1906.

Planting. 30 ft. \times 30 ft. = 48 palms per acre.

Yields.—Average 13 years 1920-1932, 3,860 nuts per acre. Conversion approximately 235 nuts per picul copra = 16.3 piculs per acre. Actual stand of bearing palms 45.5 per acre = 82 nuts per palm.

Situation.—All mature areas within approximately half mile radius return average yields of 3,300 to 3,500 nuts per acre.

Soil.—Flat alluvial clay.

Total palms examined.—3,875. Vacancies, supplies and non-bearers 153, bearing palms 3,722.

Method of selection.—Only palms carrying 100 nuts or more are selected as possible parents, all ripe nuts are collected from such palms and one typical specimen is selected for examination and weighing of wet meat.

Details of Palms

Total examined	...	3,875
„ 100 nuts and over	...	690 = 17.8 per cent.
„ 50 nuts and under	...	1,109 = 28.6 „
Average of "100 nut" palms		117.23 nuts

Having thus arrived at exceptionally high yielding palms as regards number of nuts, the selected nut from each was then weighed for wet meat content. The following table gives the weight out-turns in grammes wet meat per nut.

Table I

Over 700 grammes	...	3 = 0.4 per cent.
600/700	„	47 = 6.8 „
500/600	„	191 = 27.7 „
400/500	„	307 = 44.5 „
300/400	„	128 = 18.6 „
Under 300	„	14 = 2.0 „
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		690 100.0 per cent.

These figures necessarily refer only to the 690 selected palms. That there would have been nuts from the palms carrying under 100 nuts returning both larger and smaller wet meat yields cannot be doubted. They further emphasise that the proportion of really high grade palms in a very high yielding area is very small, and that mass seed collection from such areas is unsound. Only 241 palms of the 3,875 examined returned 100 nuts of 500 grammes or more wet meat, equal to 6 per cent. In any system of close selection one would never go below 500 grammes. The general yield of estate grade copra is 50 per cent. to 53 per cent. of the wet meat content of nuts dealt with. Taking the lower figure, the approximate number of nuts required per picul of copra from the several categories is therefore :

(453.59 grammes = 1 lb. 60,479 grammes = 1 picul = 133.33 lb.)	
700 grammes	= 173 nuts per picul.
600 „	= 201 „ „ „
500 „	= 242 „ „ „
400 „	= 302 „ „ „
300 „	= 403 „ „ „

A small variation in size will be found in nuts from the same palm and even from the same bunch. One nut cannot therefore be taken as a definite determination but it is the best that can be done under normal estate conditions, and if care is taken in selection, is accurate within practical limits.

The selection of nuts on wet meat content merely denotes working to a standard, dependent almost entirely upon the area available for selection and the number of seed required. If a large clearing is to be planted up, it will probably be necessary to modify the standard; if a very small area, selection can be very close and high grade planting material can be secured. In the writer's case two small clearings totalling only 15 acres were planted with nothing under 575 gramme seed, but where nuts were supplied for a 50 acres clearing in one delivery the standard had to be scaled down to 500 grammes.

It is frequently asserted that nuts of pronounced ovoidal shape should not be used as seed. Details of shape of the whole 690 nuts were recorded and it was found that there was no practical difference in meat content between oval and round specimens. Neither did colour appear to have any

bearing upon the value of the nut. Red, yellow and green types all show more or less the same percentage of good and poor yielders and high and low meat contents.

Further points emerged when approximately 500 nuts from 66 palms, all over 575 grammes, were laid down in the nursery. Wide variations in germination and growth were to be expected and careful notes were kept of the behaviour of seed from each palm. These were of such interest that a second batch was laid down as a check. In almost every case the general characteristics of seed from the same mother palm were identical in both batches. The first lot was laid down in July and notes taken in November, after four months. The second batch was laid down in November and notes taken in February, also after four months. Weather conditions in each case were favourable to germination and growth. The following examples of results from the two batches may be taken as typical of the whole.

- Palm No. 12. 631 gr. November 8 nuts. Germination 8=100 per cent.
All strong healthy plants.
February 8 nuts. Germination 7=87 per cent.
All strong even plants.
- Palm No. 29. 588 gr. November 10 nuts. Germination 7=70 per cent.
Weak and irregular, only 2 good.
February 14 nuts. Germination 13=93 per cent.
Very slow and weak, only 4 fair.
- Palm No. 37. 575 gr. November 10 nuts. Germination 10=100 per cent.
All strong even plants.
February 25 nuts. Germination 24=96 per cent.
All strong even plants.
- Palm No. 51. 656 gr. November 14 nuts. Germination 9=65 per cent.
No good plants, irregular and poor.
February 9 nuts. Germination 1=11 per cent.
Useless.
- Palm No. 88. 585 gr. November 10 nuts. Germination 10=100 per cent.
All poor plants with malformed shoots.
February 8 nuts. Germination 5=62 per cent.
Poor, all shoots malformed.
- Palm No. 122. 575 gr. November 7 nuts. Germination 4=60 per cent.
Weak, irregular and poor.
February 10 nuts. Germination 6=60 per cent.
Weak, irregular and poor.

Palm No. 160. 630 gr. November 18 nuts. Germination 9=50 per cent.

All very poor plants.

February 8 nuts. Germination 2=25 per cent.

All very poor plants.

Palm No. 183. 588 gr. November 12 nuts. Germination 12=100 per cent.

Exceptionally strong even plants.

February 8 nuts. Germination 8=100 per cent.

Very good and even.

Palm No. 190. 594 gr. November 8 nuts. Germination 4=50 per cent.

Poor.

February 4 nuts. Germination 1=25 per cent.

Useless.

Palm No. 239. 605 gr. November 2 nuts. Germination 2=100 per cent.

Both malformed shoots.

February 12 nuts. Germination 10=83 per cent.

7 malformed shoots.

On the whole, the large nuts showed a small percentage of germination and less strong healthy plants than did those of more nearly average size. There was very little difference in total germination percentage between the two lots, and in each case almost exactly 60 per cent. good sturdy even plants were obtained after five and four and a half months respectively. This indicates that it is unsafe to lay down less than 80 per cent. to 90 per cent. seed in excess of actual requirements.

The data recorded in the foregoing shows that there is room for vast improvement in yields by careful seed selection provided that the female parental characteristics are transmitted in the majority of cases. As stated previously, little is known regarding this at present but at the worst one commences with female stock of high standard, and with the male parent also taken from a high yielding area, chances are greatly in favour of better yields than have hitherto been attained. Returns of over 15 piculs of copra per acre are now deemed almost phenomenal, yet with promiscuous seed supply a large area is capable of yielding over 16 piculs per acre for 13 years. This is undoubtedly due largely to environmental conditions but it indicates that potentialities are greatly in excess of standards hitherto accepted as high, if close seed selection is carried out in an area of this yielding capacity. Even if environment is rather less favourable, selection on these lines should outweigh this, and similar yields, which are much above average, should be obtainable from any area of good coconut land with reasonable drainage facilities and good cultivation. Under approximately similar environmental

conditions, with selection no closer than palms yielding 100 nuts per annum with a 550 grammes wet meat content, yields of over 20 piculs per acre should be attainable. (5,000 nuts per acre at 220 nuts per picul.) Of the 3,875 palms examined 123, or slightly over 3 per cent., reached this standard— $1\frac{1}{2}$ palms per acre. Any high yielding area,—3,500 nuts per acre or better—should return approximately similar figures, therefore, as noted earlier, each acre should be capable of providing seed for about $1\frac{1}{2}$ acres new planting each year. This by no means exhausts potentialities. Odd palms consistently returning over 800 grammes wet meat are met with. One in particular has so far averaged over 900 grammes and yields 70 to 80 nuts per annum or half a picul of copra from a relatively low nut output. The largest nut handled gave over 1,100 grammes wet meat, which equals 100 nuts per picul.

CONCLUSIONS

- (1) By seed selection it should be possible to increase copra output per acre to a figure considerably in excess of that now accepted as normal.
- (2) Examination of possible parent palms must cover both number of nuts and copra yield per nut. Also, having obtained seed of the required standard it is necessary to study nursery results in view of the fact that certain palms persistently yield nuts of low germination percentage and poor growth characteristics. Seed from high yielding palms is useless if it refuses to germinate, or having done so, produces progeny unfit to plant.
- (3) Close selection of seed calls for nothing which cannot be carried out in ordinary estate practice, and is a simple matter on estates which contain areas of high yielding palms.
- (4) With the standard scaled down to 100 nuts of 500 grammes palms, under 20 piculs per acre, only 6 per cent. of palms in a given area are fit for selection as mother palms.
- (5) In the light of (4) mass seed collection from the best known areas can only be termed crude and haphazard.

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