

DEPARTMENT OF AGRICULTURE,  
FIJI.

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**Bulletin No. 8.**

COCONUT EXPERIMENTS

BY

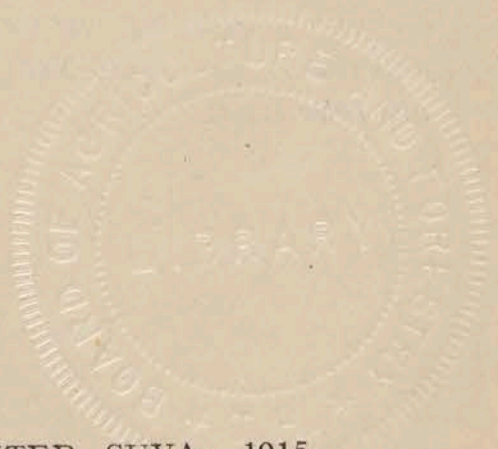
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SUPERINTENDENT OF AGRICULTURE.

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# COCONUT EXPERIMENTS.

EXPERIMENTS WITH COCONUTS ON VITILEVU AND NOTES ON THE METHODS USED IN SELECTING SEED-NUTS AND BRIEF DESCRIPTIONS OF THE VARIETIES SELECTED.

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## INTRODUCTION.

Coconut palms in Vitilevu do not bear good crops of nuts as a rule. Occasionally fair crops are given by palms in isolated places while some seasons good returns are more general. Owing to the poor returns, this island cannot be regarded as suitable for coconut growing. The reason which has been advanced, and generally accepted, for this unsatisfactory state of affairs is the presence in the island of a small moth (*Levuana iridescens*) the larva or caterpillar of which feeds on the leaves of the coconut palm (amongst others). The attacks of the larvae commence about August and increase up to the end of the year when the moths become plentiful. Then they gradually decrease and the insects finally disappear entirely.

The attacks vary to some extent in severity and when they are very bad, the larvae consume the green cellular matter of nearly all the leaflets on each tree. The attacked leaves, consisting of the midribs with the upper epidermis of the leaflets, take finally a brownish-white colour. Viewed from some distance, the whole "head" of the palm has this brownish-white appearance, and sometimes only the very centre leaves will show any green at all. The attacks of these moths practically amount to defoliation of the palms and it will readily be understood that palms subject to such defoliation each year cannot bear a satisfactory crop and indeed generally it may be said that they do not bear at all.

## FIRST EXPERIMENTS.

Experiments have been in progress at Laucala Point in Vitilevu since 1913. Laucala Point consists of a narrow stretch of land about two miles long and half mile wide between the main mouth of the river and Laucala Bay. It consists of very sandy soil and carries some thousands of old coconut palms. The experiments referred to consisted of treating small blocks of these palms in different ways to try whether they could be got to bear satisfactory crops in spite of the moth. The experiments have served to show that by cultivation and the use of artificial manures the palms do give crops, but so far as the experiments have gone, the crops cannot be said to be sufficiently satisfactory to enable recommendations to be made as to the cultivation of coconuts in Vitilevu. At one time according to the natives sufficient coconuts were obtained from the palms to pay the taxes of the natives living here, under the present conditions this would be impossible so that either the moths were not always present or the attacks have gradually increased in severity, which has resulted in diminished crops or perhaps owing to the continuous attacks, the palms have lost the power of bearing and even if the pest could be successfully dealt with, it may be that the palms would be incapable of producing good crops.

## FURTHER EXPERIMENTS.

It has therefore seemed desirable to conduct experiments on rather different lines and to commence them by planting proper seed-nuts in small plots at certain suitable centres.

It will be some years before the results will be obtained and in the meantime investigation of the moth will be continued in the hope that some method may be found for dealing with it. The life history of the insect has been described,\* but nothing is at

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\* Jepson, F. P., 1911. *Report on Economic Entomology*. Department of Agriculture. Fiji Council Paper 25, page 37.

present known as to where, and in what form, it spends the time between two consecutive attacks. Particular attention is being paid to this point as it may be that the insect may pass its resting period in some form or place which admits of simpler methods for its eradication. It was found that the larvae are readily killed by arsenate of lead sprayed on the leaves of the palms, in water. The cost of such treatment however, is prohibitive since either motor sprayers must be used with the consequent waste of spraying liquid or expensive stages must be provided to enable the operators to reach the leaves readily. This method however, will be made use of for keeping the experimental plots clear of the moth pest whenever necessary, during the earlier stages of the experiments.

#### SITUATION OF PLOTS.

In the new experiments, sixteen seed-nuts are to be planted in plots at the following places:—Suva in Government House grounds, Samabula (Mr. L. E. Brown), Tailevu Coast (Mr. J. L. Hunt), Caboni (Mr. T. Burness), Lautoka (Experimental Station), Sigatoka (District Commissioner), Nadi (District Commissioner), and Nasinu (Experimental Station). Plots at other places may be arranged later. A plot will also be planted at Vuna Estate, Taviuni (Mr. H. V. Tarte) from which estate the seed-nuts were taken. The records will contain references as to cost of all the work done on the plot, notes on the growth of each variety and later on as to flowering and fruiting and the crop.

#### SELECTION.

Sixteen palms were selected in the coconut blocks on Vuna Estate, Taviuni, and one nut from each tree will be planted in each plot so that all the plots will be alike, as far as the origin of the seed goes. This is regarded as an important point as it will be possible to trace whether the results of the seed from any one palm are due to local conditions or to the characters of the plant. The whole series of plots will also show to what extent coconuts keep true to type.

In selecting the parent trees, the aim has been to get palms of several distinct and well-marked varieties which have been observed to be good bearers. Other well defined varieties are to be met with, but as they were not known to be good bearers, or were in some cases known to be poor bearers, they have been avoided.

A knowledge of the average results of the palms, from which the selection was made, over a series of years was essential and on this point the advice given by Mr. H. V. Tarte, of the Vuna Estate, Taviuni, was invaluable so that there can be no doubt that the selected palms are all good bearers.

The points usually recommended for the selection of coconuts have been amended in accordance with suggestions of Mr. H. V. Tarte whose observations as to the bearing powers of varieties of coconuts is of the greatest value.

The chief points to be considered are of course the amount of kernel in each nut and the number of nuts borne each year. Both these characters are found to be associated with certain features more readily observed by inspection and it is upon these "outside" features that the selection is based.

Besides any special characters the tree must be in a healthy condition and of vigorous appearance with deep green leaflets. The leaf-stalks may be either green or have a red colour of varying degrees of intensity, the mature nuts having the same colour as the leaf-stalks. Palms with light green leaflets should always be avoided. The age of the tree is not considered very important so long as the palm is bearing well. The plants should be taken from the general cultivation rather than from some particular spot where the conditions may be considerably more favourable than the average. The plant should have a good "head." Sometimes leaves are to be seen occupying only the upper half of the sphere of which the "cabbage" is the centre and the tips of the leaves the circumference. In other cases leaves occupy practically the whole of the sphere. In the former case the effect would be caused by the leaves dropping off at a comparatively early stage while in the latter case they persist for a long time. Since the leaves are responsible for the work of converting the material taken up by the roots

and from the air, into material suitable for use by the growing parts of the plant, it is reasonable to suppose that where a tree carries a better "head" of leaves it will give a better crop. It may be argued that such trees are more likely to damage by storm; this is however a risk that must be taken. Those palms having slender stems are to be preferred as they are found to give more to the wind and so escape being broken off or blown over as may be the case with the unyielding stout tree. The tree must be satisfactory as regards health and vigour otherwise the slenderness may be a sign of poor nutrition. The stem should be uniform and not rapidly tapering.

Some variation is seen in the length of the stalk of the bunch. It is not certain whether this is a permanent character or not, but observation has shown that plants showing this character are often good bearers.

The nuts should be narrow at the stalk end. Nuts wide at this point tend to squeeze one another out of the bunch. In order to compare one strain with another as regards this point, the method used was to measure the distance between two blocks, one inch high, the edges of which just touched the nut placed upright with the stalk end on a table. The husk should be thin. Whatever variety is being chosen, medium-sized nuts should be selected. The characters of the selected nuts are given in the following table.

#### MEASUREMENTS OF SEED-NUTS.

The figures have been obtained by measuring each individual nut as indicated in the heading of the columns 6—10; the averages so obtained are given in the table and the one nut which came closest to the average was picked out. A photograph was taken of the whole nut after which each nut was split open, the weight of "water" noted and the half nut again photographed. The kernel was then weighed. These weights are shown in columns 11 and 12. The photographs are to be found in plates I and II.

The figures from a single nut may not be reliable as an accurate index to the amount of copra that may be obtained from a large area, but since the measurements of girth, length and thickness of the husk of the coconuts of any one variety varied to so slight an extent, there is reason for considering that the weight of the kernels would also vary very little. The nut nearest to the average of the above measurements may be taken for the purpose of comparing one variety with another. To illustrate how close all the various measurements of individual nuts came to one another, it may be remarked that the extremes of length of No. V. were 7.9 inches and 8.5 inches, of No. X 8.0 and 8.9 inches, of No. XIII 7.3 and 9.1 inches, and of No. XV 6.2 and 7.5 inches. In girth the extremes were—of No. XII 15.1 and 16.8 inches, of No. XIII 19.2 and 20.5 inches. The extremes of diameter at stalk end were—of No. IV 4.3 and 4.9 inches, and of No. VII 2.4 and 3.0 inches.

#### COPRA FROM SAMPLE SEED-NUTS.

The kernels of the first eight varieties were exposed to the sun with the idea of preparing copra, but two rainy days set in and the copra became very mouldy. In addition to this there was some uncertainty as to whether some of the copra from two particular nuts had not been mixed together. The total weight of copra amounted to 57.1 per cent. of the kernels. The kernels of Nos. 9—16 were set out in separate lots on a table in the large insect room, which has an iron roof, the sides being made of copper gauze. The weather for five days was fine and dry with fairly strong south-east winds; the kernels were not exposed to the sun at all. Drying proceeded very well and during that time 37 per cent. of the kernels dried out. In five more days excellent samples of copra were obtained from all the kernels, no signs of mould being seen. Each lot of copra was carefully weighed, the percentages of copra in the kernel being from 58.8 to 61.3, the average being 59.9. The amounts of copra in the following table are calculated as 60 per cent. of the weight of kernels and the figures so obtained have been used in calculating the number of nuts required to form one ton of copra. Analysis of a sample taken from the copra made from Nos. 9—16 shows that the average content of oil is 60 per cent.

TABLE OF MEASUREMENTS, &amp;C.

The following table shows the character of the various varieties selected:—

PALM.				NUTS.		
No.	Age.	Site of parent tree on estate.	Girth at 5 feet.	Colour of mature nuts.	Girth of nut at centre.	Diameter at stalk end.
	Years.		Inches.		Inches.	Inches.
I	35	Hospital paddock	41	Green .. ..	20.0	4.5
II	35	" "	43	Green .. ..	18.7	3.9
III	35	" "	37	Green .. ..	18.0	3.6
IV	35	" "	38	Reddish yellow	20.7	4.6
V	35	Gingi .. ..	34	Reddish yellow	19.4	4.0
VI	35	" .. ..	48	Reddish yellow	16.3	3.7
VII	14	Vujune No. I ..	42	Greenish yellow	16.1	2.8
VIII	14	" "	50	Greenish yellow	19.0	3.7
IX	14	" "	34½	Green .. ..	20.1	3.7
X	14	" "	34	Green .. ..	21.5	4.5
XI	14	" "	43	Red .. ..	19.6	3.8
XII	30	Korovou .. ..	36	Red .. ..	18.7	3.4
XIII	30	" .. ..	33	Green .. ..	20.0	3.7
XIV	30	" .. ..	38½	Bright yellowish red.	20.0	4.3
XV	17	Lower Mill pad'ck	45½	Green .. ..	18.9	4.0
XVI	35	Hospital paddock	39	Green .. ..	21.1	4.6

No.	Thickness of husk at place of greatest girth.		Length.	Weight of dry nuts.	Weight of "water."	Weight of kernel.	Calculated weight of copra.	Calculated number of nuts per ton of copra.
	At "ridges."	In between "ridges."						
	Inches.	Inches.	Inches.	lb.	ozs.	ozs.	ozs.	
I	.83	.55	7.8	2.47	5.9	12.0	7.2	4,978
II	.79	.49	8.2	2.34	6.0	13.6	8.2	4,371
III	.55	.26	7.3	2.27	6.5	14.7	8.8	4,073
IV	.89	.53	9.0	2.75	6.8	15.3	9.2	3,896
V	.72	.45	8.3	2.56	6.4	15.6	9.4	3,813
VI	.57	.36	8.7	2.18	4.8	14.1	8.5	4,216
VII	.47	.27	9.8	2.09	4.6	13.4	8.0	4,480
VIII	.84	.45	10.1	2.81	6.3	7.3	10.4	3,446
IX	.71	.51	8.9	2.83	7.5	18.3	11.0	3,258
X	.91	.59	8.4	2.47	5.1	15.5	9.3	3,854
XI	.75	.43	9.4	2.51	6.0	16.0	9.6	3,733
XII	.63	.39	11.4	3.11	8.6	18.1	10.9	3,288
XIII	.79	.43	8.6	3.56	9.6	15.7	9.4	3,813
XIV	.92	.55	9.1	3.82	7.9	18.7	11.2	3,200
XV	.55	.31	6.8	2.14	4.3	13.8	8.3	4,318
XVI	.75	.51	7.9	3.09	8.1	17.6	10.6	3,381
Avergs.	...	....	....	....	....	15.5	9.3	3,854

## CROPS.

It may be remarked that with 3,854 nuts to make 1 ton of copra or 193 to make 1 cwt., four nuts per tree per annum will give 1 cwt. of copra per acre with trees set 30 feet by 30 feet apart.

In considering this point it must be borne in mind that the figures are obtained from 16 nuts only, they were, however, the nuts which came nearest to the average measurement of each kind, the kernels were most carefully weighed to the nearest gram (.0022 of 1 lb.). It is true that they were selected nuts to start with, but as the improvement of coconut cultivation, as in most other agricultural industries, depends largely on careful selection, the figures may be taken as indicating what should be possible.

## REMARKS.

No. I.—A round nut with a small kernel. It does not compare very favourably with some of the nuts, but it is a good bearer.

No. II.—Longer than No. I and rather a better kernel.

No. III.—Good type of nut for copra, thin husk.

No. IV.—Rather a large nut. Fair-sized kernel; the palm has a very good "head."

No. V.—Medium nut; kernel is just about the average of the whole series.

No. VI.—Rather small nut. Its native name "Niu drau" meaning tree with 100 nuts has reference to its comparatively heavy bearing and such nuts are as a rule small. The kernel is rather below the average, but it is a good copra nut.

No. VII.—The shape of this nut is very characteristic and reminds one of a Criollo cacao pod. The very narrow base is well shown. The palm carries a very good "head."

No. VIII.—A large nut of the same type as No. VII, the stalk end showing a very well-defined constriction just above the "shell." The kernel is much above the average of the series.

No. IX.—An excellent nut; the three ridges at the free end of the nut are well marked. The kernel comes second in weight, being beaten only by No. XIV.

No. X.—A medium nut, with an average weight of kernel. The husk is rather thick, this, however, is counter-balanced by the kernel being remarkably thick. The copra from this nut appeared to be the best of the whole series.

No. XI.—This is rather a long nut with a medium sized kernel. The stalk of the bunch is particularly long and the ridges at the free end of the nut are very prominent.

No. XII.—A very large nut with a pronounced constriction just above the shell. It is therefore of the same type as VII and VIII only very much larger. The kernel is large and it is a good copra nut, while it is also a satisfactory fibre nut, and is prized by the natives for making "magi-magi" as sinnet is called in Fijian. The palm carries a good "head."

No. XIII.—This is round nut a of average kernel and medium husk, and it is regarded as the best individual tree on the Vuna Estate. The palm always has borne a very large crop of nuts. The "head" of leaves is remarkably heavy. The nuts all show corrugations running parallel to the length of the nut. It may be regarded perhaps as a variety of the "Niu drau," No. VI, but, unlike the latter, is a large nut.

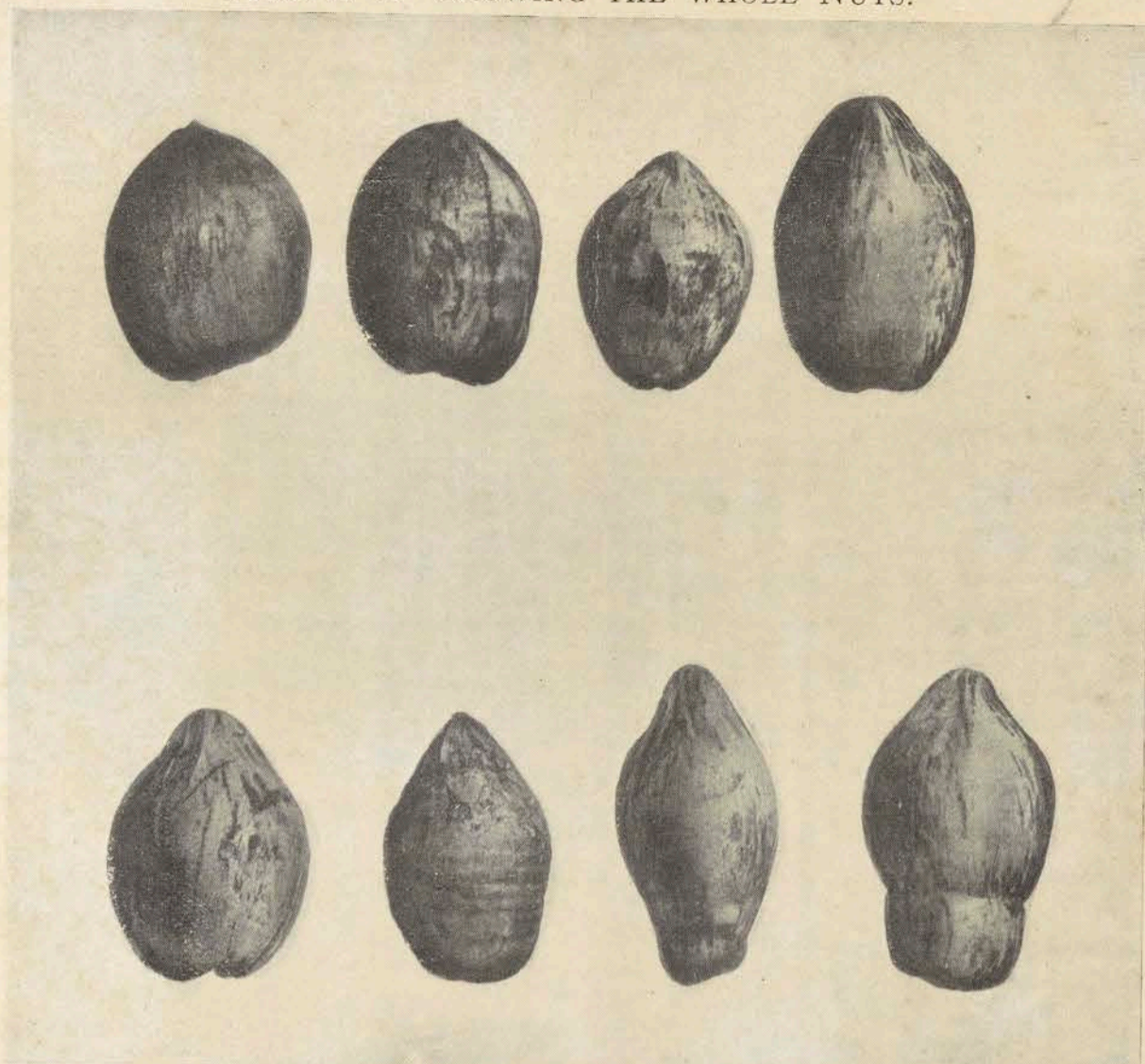
No. XIV.—A very large nut, with a large kernel making it a satisfactory copra nut. The kernel is the heaviest of the whole series. The tree bears well and the large size is not due to there being only a few nuts borne. Natives use the shells of this nut for holding drinking water.

No. XV.—A small round nut. The reason for including this was because the plant bore at a very early age, and has continued to give good crops since arriving at maturity.

No. XVI.—A medium nut with a good kernel. The native name "Niu leka" refers to the dwarf habit of the palm. The "rings" or scars formed at the places from which leaves have fallen are very near together.

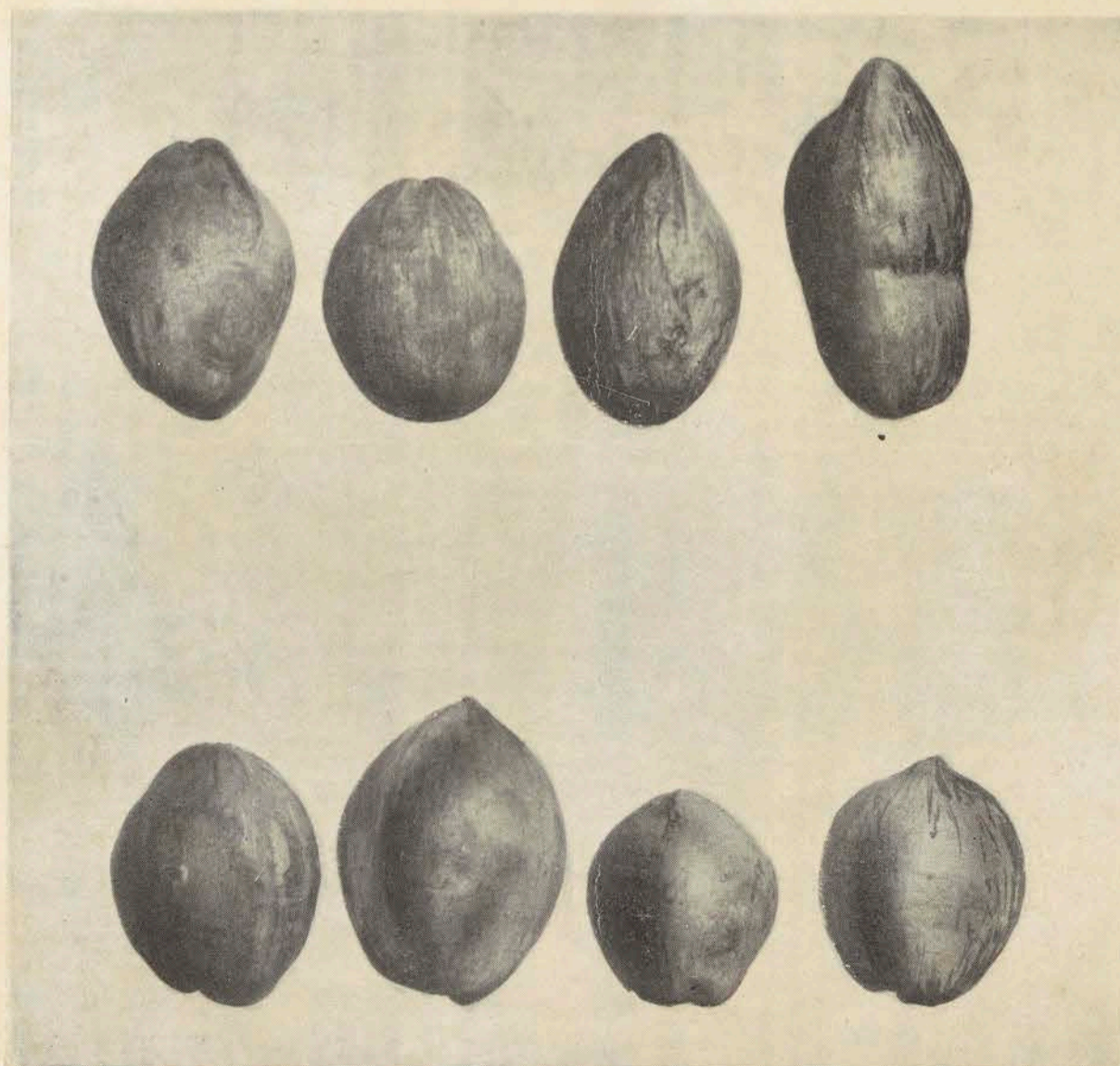
C. H. KNOWLES,  
Superintendent of Agriculture.

PLATE I.—SHOWING THE WHOLE NUTS.



Top row.—I II III IV.

Bottom row.—V VI VII VIII.

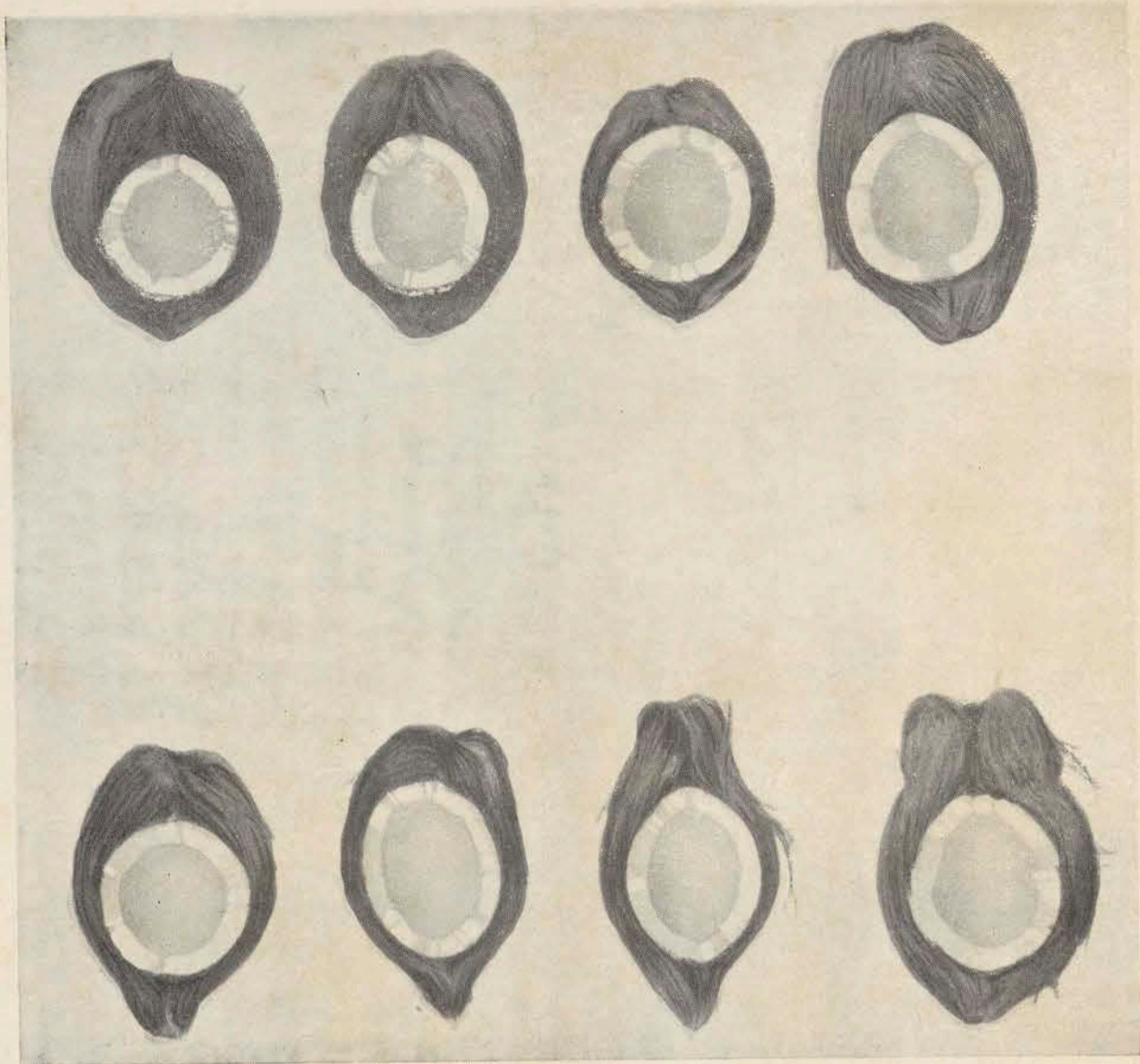


Top row.—IX X XI XII. Bottom row.—XIII XIV XV XVI.

*Photos. by C. H. Knowles.*

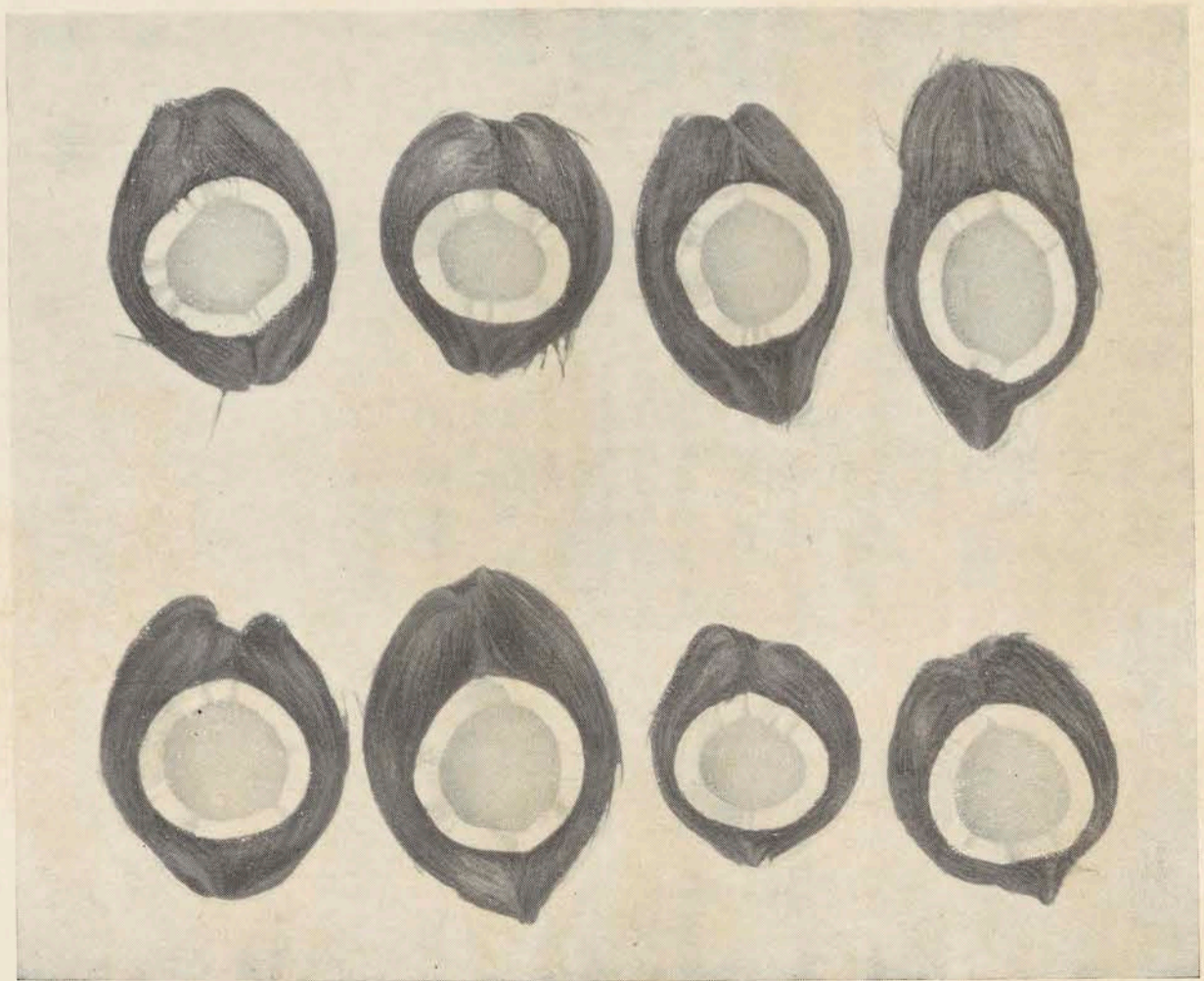
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PLATE II.—SHOWING COMPARATIVE THICKNESS OF HUSK AND KERNEL.



Top row.—I II III IV.

Bottom row.—V VI VII VIII.



Top row.—IX X XI XII. Bottom row.—XIII XIV XV XVI

*Photos. by C. H. Knowles.*