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COCONUT CULTURE

BY

O. W. BARRETT

SUPERINTENDENT OF EXPERIMENT STATIONS

FARMERS' BULLETIN NO. 17.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF PUBLIC INSTRUCTION
BUREAU OF AGRICULTURE

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COCONUT CULTURE.

INTRODUCTION.

As the third most important crop in the Philippine Islands the coconut deserves more and better attention from the planter than it now receives. It is safe to say that our production of copra could be augmented by one-third without increasing the crop area if the present cultural methods were duly improved; this means that some five million pesos are lost every year through carelessness and bad practice. To assist the planter in avoiding some of the common mistakes and hence to increase the profits of this crop the following recommendations are offered.

SEED.

In the selection of the seed for the nursery three points must be borne in mind: first, the seeds should be taken only from such trees in the plantation as are known to bear *well* and *regularly* and to be of the very best variety; second, the nuts should be completely matured; third, the nuts should be so picked as to avoid the danger of cracking the shell or injuring the embryo, or "eye." It is not necessarily the tree which happens to have the most fruits at the moment, but the one which always has a large number of bunches in various stages of growth that should be selected for propagation; in this respect there is a greater amount of individuality in coconut trees than is generally believed. The ripe bunch of seed nuts should be lowered to the ground with a cord instead of allowing them to fall. One or two at the tip of the bunch are usually unfit for seed. A roundish nut is preferable to an oblong one. The largest nuts do not always contain the most "meat." In short, then, the planter should be as cautious in selecting his seed as he would be in choosing animals for breeding purposes.

There are two or three distinct varieties of coconuts cultivated—usually intermingled—on most of the plantations. Several others occur here and there about the Islands. Each estate should have a few trees of every variety procurable growing in a sort of experimental field where the comparative merits of each kind can be studied.

NURSERY.

After the seeds are duly selected they should be "cured" in a dry place (not on the ground) for a few weeks to insure the full ripening of the germ and the "meat."

The seed bed or nursery should be located in partial shade (for instance, under tall coconut trees on the edge of the plantation) so that the germinating nuts and young plants will be protected from the drying action of the hot sun during the middle of the day. The soil should be sandy or at least well drained; richness is not of much importance. In low, wet locations the nuts may be laid (40 or 50 centimeters apart) on the ground in rows, and earth thrown over them; these ridges should be 1.5 meters apart. In dryer places, especially if the seedlings are to remain several months in the nursery, the nuts should be planted in regular rows about 1 meter to 1.25 meters each way. The soil should be free from decaying wood and grass roots. The nuts should be laid *on the side* and just covered with earth; they should never be planted *on end*.

A blanket of rice straw, grass, or coconut leaves placed over the germinating nuts will hasten the sprouting; this covering should be removed, however, as soon as the leaves appear.

The seed bed should be watered frequently during dry weather so that the young roots shall receive no check. From the beginning of the process to the end, the husk of the nut should not be exposed to drying winds; hence the sprouting of nuts in heaps or rows on the ground is dangerous.

No weeds or grass should be allowed to grow in the nursery. It is well to plant beans between the rows of nuts.

TRANSPLANTING.

The time when coconut plants should be removed from the nursery depends largely upon two factors: the size of the plant and the condition of the plantation.

It must be remembered that there is a critical stage in the early life of the plant, at which it is dangerous to move it—as long as the young plant is subsisting on the nutriment contained in the seed nut it can safely endure rough handling and even the loss of its roots, but at the period when the supply of food in the nut is exhausted and before the plant has sufficient roots and a "heart," or stem, of its own (with a quantity of reserve sap) the vitality is low and hence a large percentage of the plants may die if transplanted at that time. This period usually occurs between five and eight months after the appearance of the leaf bud and lasts for some three to five months.

After the appearance of the leaf bud on the seed nut some two to four months should elapse before the plant is set out; and if not transplanted

PLATE I.—TYPICAL PLANTATION NEAR LILIO, LA LAGUNA, SHOWING
EXTREME UNPRODUCTIVENESS.

PLATE II.—RAFTS OF UNHUSKED COCONUTS FLOATING DOWN THE RIVER AT PAGSANJAN, LA LAGUNA.

at this time the plant should remain in the nursery for, say, six months longer.

Transplanting should be done, if possible, only during the rainy season. Large plants should not be exposed to the sun during the process of removal to the field and the setting into the holes.

A bolo or very sharp broad spade should be used in taking up the plants from the nursery. Though it is seldom practicable to take up the plants with the earth adhering to the roots, it must be remembered that every injury to a root means delay in the income from the plant; i. e., a few centavos' worth of care at this point may repay the planter in as many pesos' worth of future crops from the tree. In handling small plants great care should be taken to prevent breaking or even straining the navel, or point of union between the plant and the mother nut; a large percentage of the plants are injured in this manner in removing them from the nursery.

When large (10 to 18 months old) plants are set out, especially if many of their roots are broken in handling, it is well to cut off about one-half or one-third of each of the larger leaves; this prevents excessive evaporation (and possible wind damage) before new roots are formed.

Holes for the plants should be made at least a month before the transplanting; shortly before the plant is set in, the hole may be loosely filled with "surface soil" from around the hole. The holes should be at least 1 meter in diameter and at least 50 centimeters deep.

The nut should be set a few centimeters below the level of the ground; and the earth may be heaped up slightly around the base of the stem. The distance between the trees should be *never less than 8 meters*; on alluvial soil it should be 10 meters. The quincunx system is commonly used; i. e., each tree is set opposite the interspaces of the adjacent rows on either side of it; this allows each tree a little more room than does the "square planting" arrangement. The following plan is recommended as the best, especially for large plantations on level land: Blocks of 4 trees are set at 8 meters apart and around this block extends a space 10 meters wide; in other words, the rows alternate 8 and 10 meters in each direction. This induces a slight leaning of the tree, which facilitates climbing; it also leaves partially open a considerable space which may be planted with beans and other crops, especially during the first eight or ten years. Unless at least 8 meters distance is allowed between the rows of coconuts the yield is seriously affected; indeed, it is believed that the yield of many plantations in the Philippine Islands is fully 50 per cent below normal, due largely to the excessively close planting. The error of too close planting is on a par with the mistake of planting a dozen grains of corn in a "hill;" if only *foliage* is desired the idea is not so very bad, but if *seed* is the object the plants must be given a chance to attain a normal healthy development.

CULTIVATION.

So long as the soil is not too clayey or too wet to prevent proper ventilation and root growth the chemical constituents are of but little account. In many countries it is believed that the coconut can be successfully grown only near the seaboard, and in some places salt is applied broadcast or around the roots at the time of transplanting, in the belief that the tree requires the presence of salt in the soil; this salt-loving habit of the coconut is a myth. It is believed the original home of the species was the mountains of Colombia in South America.

The economy of plowing and harrowing a field before setting out the young plants depends largely upon local conditions. If the holes are wide and deep and filled with "live" soil from the surface, and if all cogon grass and weeds are thoroughly removed from the interspaces within the first year or two after the plants are set out, plowing would be in most cases, perhaps, an unnecessary expense. In this connection it must be remembered that the excretions from the grass roots are poisonous to most of the higher plants and trees, and, therefore, the planter who allows the roots of cogon to mingle with the roots of his coconuts is certainly robbing his own pocket.

During the first few years it is permissible to plant catch crops like beans, peanuts, pineapples, cassava, or sweet potatoes between the rows of the young coconuts.

The amount of cultivation, hoeing and weed cutting which will be required in the grove depends on local conditions to a great extent. All kinds of grass are detrimental to coconut roots. The feeding space of the roots, especially of the young plants, therefore, must be kept either clean or planted with some kind of beans or similar leguminous plants; these legumes not only help to prevent the growth of grass and weeds, but also supply nitrogen (through the bacteria in their root nodules) to the soil and help to ventilate the soil and to keep its surface cool and moist.

The following leguminous species are recommended as cover crops or live mulches in coconut plantations: Centrosema beans (*C. plumieri*), Lyon bean (*Mucuna lyoni*), velvet bean (*Stizolobium deeringianum*), yam bean (*Pachyrhizus* spp.), sword bean (*Canavalia* spp.), and any similar native species; cowpeas, peanuts, mani-maníhan (*Alysicarpus* spp.), cacahuete (*Gliricidia maculata*), and ipil (*Lucana glauca*).

The cacahuete, or madre de cacao, is a shrub or small tree especially recommended as it may readily be grown from cuttings stuck in the ground and it can be cut back whenever its height exceeds 1.5 or 2 meters; the removed branches help to increase the humus layer on the ground; its habit of shedding the leaves for a few weeks in the dry season is a disadvantage. The ipil, or datels, is never deciduous but may be raised only from seeds. Both these trees grow very rapidly and

if properly managed will not only shade the ground around the young coconuts, but will ventilate and enrich the soil, prevent fires, and, when necessary, furnish a moderate supply of salable firewood.

The cleaned area around the base of the tree for the first four or five years should be at least equal in diameter to the length of the longest leaf; if the soil is heavy and inclined to "pack" in the rainy season or to crack in dry weather, it should be loosened up around the trees by the vertical forking method or by a strong steel-toothed rake; spading or ordinary forking would break too many roots of the plant.

If no secondary crops are grown between the rows of coconuts, the disk harrow is a very good implement for keeping down the weeds and grass. Shallow plowing between the trees is in some cases advisable, but there is some danger of injuring the roots of the palms; the plow should never pass nearer than 1.5 meters to the base of the tree.

During the dry season in all soils and during all times in very sandy soils the young plants should be mulched either with a live legume cover crop or with some kind of straw, grass, or chopped-up coconut leaves; the purpose of this blanket is to keep the sun from overheating the soil surface (which would check the root growth) and to prevent excessive evaporation from the otherwise bare ground. It should be borne in mind that even apparently slight influences upon the vigor of the young roots really amount to serious losses through retarding the time of profitable yield, diminishing the productiveness, and shortening the life of the tree.

It is questionable whether the fallen leaves in a plantation should ever be burned; in case of any fungus disease appearing on the older leaves, or in case the ground is too hard to permit "trenching," it would be advisable, perhaps. But, ordinarily, the fallen leaves should be collected every few months and "stripped;" i. e., the leaflets cut off by running a bolo down each side of the midrib, then the midribs should be buried in a shallow trench so that being slightly covered with earth they will quickly decay to form humus without danger of furnishing a breeding place for small beetles which might spread to the living trees. (Small trunk-boring beetles do exist in live coconuts in the Philippines as well as in most other coconut countries.) The trenches should be only as long as the midribs; they may be made in the middle of the interspace between the trees, taking care that successive trenches do not cross each other before the material has rotted.

The coconut being a shallow-rooting tree having no taproot whatever, it is possible to grow this crop in soil but 60 to 80 centimeters above the water-table even in plantations where high tides occasionally bring salt water to within 30 centimeters or so of the surface of the adjacent ground. Although coconuts are killed by salt water covering the "feeding area," as well as by stagnant fresh water over their roots, they may

be planted without much danger close to salt-water lagoons (especially if low earth dikes are thrown up along the margin of the lagoon, or *estero*, to hold back the highest tides); but it should be remembered that in a country having a comparatively heavy rainfall there is a constant movement of water through the soil toward the sea, so that the roots of trees growing close to salt water, and extending much below the level of the sea, are really within the fresh-water zone.

HARVESTING.

Depending largely upon the degree of cultivation given the young plants the production of nuts should begin anywhere between the fourth and tenth year from transplanting. In good alluvial soil a well-grown coconut should begin to flower during its fourth or fifth year (and cases are reported of ripe fruit being gathered in the fourth year); however, with the poisoning effect of cogon roots and difficulties in the line of soil ventilation the average bearing age of Philippine trees is probably not less than eight years, and in many estates no paying crop is gathered before the *twelfth year*.

Fertilizers both natural and artificial will, of course, hasten the bearing age, and careful attention to cultural operations will have the same desirable result. Unfortunately the average plantation in the principal coconut districts of the Philippines is so closely planted and so ill attended that not only is the economic stage of the plantations very materially delayed, but even before the trees have attained to normal size and productiveness each tree has begun to suffer severely by the encroachment of the roots of the surrounding trees into its own area as well as by the overshadowing injury from the leaves of contiguous crowns. The number of unproductive trees in average Philippine plantations is deploably and quite unreasonably large.

In the case of young trees having crowns not more than 5 meters above the ground it is permissible to use the curved knife on a bamboo pole for picking the ripe nuts; the principal objections to this method are: First, it is sometimes difficult to judge of the maturity of the bunch when standing on the ground (especially in the case of the so-called "red variety"); and second, because the distal two or three nuts of the cluster are usually not sufficiently ripe when the others are ready for picking. Hence, the better plan is for an experienced laborer to pick the nuts; i. e., to ascend to the crown and remove only thoroughly matured nuts from the usual two to four bunches ready for picking. From six to ten weeks may elapse between pickings, depending upon the weather, etc.

The loss through the picking of unripe nuts probably amounts, in the Philippines, to many thousand pesos annually; the copra from such nuts can not be readily dried, and, in fact, the "meat" of such nuts does not

PLATE III.—SUN-DRYING COPRA IN THE PLAZA AT SANTA CRUZ, LA LAGUNA.

PLATE IV.—PRIMITIVE COCONUT-OIL FACTORY AT PAGSANJAN, LA LAGUNA.

contain the maximum of oil, especially if they have not been cured before opening. All nuts should be cured for from one to three weeks immediately after picking; bamboo platforms raised about a meter above the ground should be used in "drying out" the nuts to be used for copra; there should be no danger of these nuts absorbing moisture from the ground (which would in time induce sprouting), but it is not necessary to build a roof over the drying platforms. The nuts may be arranged two or three deep over the curing platform, which should, of course, have raised sides. Each copra factory should have several of these long benches or platforms located preferably in the shade of old coconuts. It is a question how long nuts should be cured after removal from the tree before opening; however, it is certain that a certain percentage of the substance in the liquid inside the shell becomes solidified gradually if the nut is kept dry for a while before "breaking." The nuts may be husked at any time during the curing process, preferably as soon as convenient, since the moisture in the husks can do no good to the "meat" content; and it might do harm by inducing premature germination, which, of course, materially affects the oil content of the "meat." The only objection to husking without breaking the nuts at once thereafter is that, during the handling after husking, some of the shells may be more or less cracked, and, of course, fermentation and decay of the "meat" begins within a day or two after the shell is broken.

The question of transportation of the nuts from the tree to the curing and husking centers is one which depends largely upon local conditions for the details of its management; on large estates, however, the economy of narrow-gauge tram lines radiating into several sections of the plantation is unquestionable; racks to hold several hundred nuts can be cheaply made to fit the trucks running on the tramways; and the advantage of handling the crops of an entire plantation at one central plant is obvious.

Machine huskers can be obtained but are recommended only for large plantations or for oil mills handling large quantities of nuts.

The cutting of small steps in the trunk to facilitate climbing should not be permitted except, perhaps, in the case of old trees.

The production of tuba, or palm wine, in certain cases may be more remunerative and probably not more injurious to the trees than the production of copra. It is possible that the maturing of nuts draws upon the vitality of the young tree more severely than would the loss of the sap (tuba) from the flower buds.

COPRA.

Considering the two grades of copra which the wholesale buyers can use in unlimited quantities, namely, the edible-food-product grade and the ordinary oil grade (utilizable in soap manufacture), two methods of drying copra may be employed in the Philippines. Thus far it appears

that the copra maker has not attempted to produce a superior article, preferring to receive a lower price for a product easily prepared with a very small outlay for apparatus. However, since the Philippines are now producing about one-third of the copra of the world, and since this percentage is likely to increase in the near future, it is highly advisable that steps should be taken at once toward the general adoption of artificial dryers in place of the present methods of sun-drying and smoking over the "tapahan."

The disadvantages of the sun-drying method are: It can be used only during the dry seasons which in most parts of the Philippines are uncertain and of more or less limited duration; the time required is excessive from an economic standpoint; the drying is not sufficiently rapid to prevent decay in the copra from the nuts that are more or less immature when picked; the space required for spreading out the copra during the drying is deplorably large; and the material required for constructing suitable drying areas is expensive.

The disadvantages of the *tapahan* process are: The creosote and other substances carried in the smoke from the husks and shells permeate the entire mass of the copra "meat" thus rendering it unfit for the higher purposes for which the *unsmoked* article may serve, such as butter, edible oils, etc.; the drying is always more or less uneven, some of the pieces being scorched while others are scarcely half dried at the time of removal; molding and decay, while en route in bags, is very likely to result from the half-dried copra pieces which are always sure to begin to decay within a few days after removal from the *tapahan*. A combination of these two methods, as is commonly practiced in the Provinces of Laguna, Tayabas, and others in Luzon, is undoubtedly better than the *tapahan* method and may be used, of course, during all but the rainiest season of the year, since the length of time during which the partially dried material from the *tapahan* must be spread out in the sun is reduced considerably.

The advantages of the modern artificial methods are: The absolutely smokeless quality of the ~~un~~finished product; the small amount of time required for turning out a completely desiccated article; the far better keeping qualities on board ship or in storage; the very superior appearance of the artificially dried material (in being free from mold, earth, etc.); the obviation of danger to grinding apparatus from gravel, sand, etc., which almost always is found adhering to the sun-dried product.

There are now several styles of artificial driers on the market; the capacity and system—that is, whether rotary cylinders or sliding trays—to be adopted on a plantation will depend upon the local conditions and inclination of the proprietors.

DISEASES AND ENEMIES.

Fortunately the coconut is possessed of an unusual amount of vitality as compared with most crops, and, generally speaking, the number of serious pests attacking it is small. However, in the first years of its life the young plant is exposed to many dangers, some of them causing very severe losses in the Philippines.

Among the fungus diseases it appears there are two or three well-recognized pests, the principal one being the so-called "bud-rot." This disease has at several periods spread over large areas of territory, decimating, in many cases, the plantations in its track. The same disease probably exists in other countries, especially in India, and it may be identical with one of the coconut diseases of the West Indies.

Since the disease appears to attack only the "heart" of the crown the symptoms are very readily noticed in the dying, or yellowing, of the leaves and the dropping of the fruits. As soon as these symptoms can be recognized as coming from this particular disease the planter should lose no time in felling the tree and in destroying the bud and leaves thereof. If it is impossible to burn a large heap of dead leaves or brush over the diseased crown, the bud itself and a meter or more of the upper portion of the trunk should be buried at least 40 centimeters below the surface of the ground.

There is no known empiric remedy for this disease, hence the only means of combating it is to check its spread by destroying all affected trees as soon as the attack is noticed and before the germs of the disease can mature and be transmitted to the surrounding trees.

The other fungus diseases attacking the coconut are of insufficient importance to require discussion here.

The insect enemies of this crop are of comparatively little account, though the "uang," or black beetle (*Oryctes rhinoceros*), in certain districts seriously mutilates the young leaves and thus reduces the vitality of the tree. This beetle, which breeds in rubbish heaps and piles of decaying vegetation (especially that from sugar-cane fields), more frequently attacks coconuts in the lowlands and in the more or less isolated areas. The means of combating these insects are practically limited to hand-killing: a wire having a hook or barb at the end is thrust into the burrow suspected of containing a beetle and twisted about until the "uang" is withdrawn or until proof of its destruction is in evidence. In some cases it may be advisable to apply a small amount of wood tar or a mixture of resin, oil, and tar about the crown of trees in infested plantations even if it is impracticable to introduce this substance into the burrow; the mere odor of it would have considerable influence in keeping the pest from further depredations in those trees for several

weeks. In case the burrow is tortuous so that the wire can not reach the beetle a spoonful of bisulphide of carbon should be poured into the hole and the hole immediately closed by a handful of wet clay, or it may be applied to a wad of cotton which is immediately thrust into the burrow. This liquid should not be used except in cases where the wire will not suffice, and only when the insect is known to be in the burrow. Fine dry sand thrown into the crown may be of some use providing it can be made to enter into all parts of the leaf bases in the crown.

The red beetle (*Rhynchophorus* species) is fortunately of rare occurrence here. This beetle enters as a grub through wounds or cracks in the trunk, burrowing about in the softer tissues, and is difficult to combat on account of its habits. A tree becoming badly infested should be immediately cut down and burned.

A small trunk-boring species of beetle also attacks trees, especially those in a weak or diseased condition.

Scale insects sometimes attack the older leaves, but are by no means so common in general in the Philippines as they are in most other countries. In severe cases on young trees they can be controlled with kerosene emulsion.

The fruit bats which are believed to destroy a considerable number of small nuts in India and the East Indies apparently do little or no harm in the Philippines.

Rats undoubtedly injure a small percentage of the nuts in some districts; they may be prevented from climbing the trees by nailing strips of tin or zinc around the trunk of the trees at the height of 2 meters from the ground. Kerosene tins may be used for this purpose, but in the vicinity of the seacoast are effective for only about two years. Removing the dead leaf bases, fruit stems, and "strainer" cloth (at the time of picking the nuts) deprives them of shelter.

In many localities the white ants, or anay (*Termes* spp.), are very troublesome to young coconuts; in plantations located on newly cleared land, where there were numerous colonies of these insects before the jungle was removed, the pest is especially troublesome from the fact that, their original food material being removed, they are forced to eat even living vegetable matter. If their nests are not in evidence, it will be a difficult matter to exterminate them except by careful and constant attention; any of the arsenical poisons placed in the nests are usually effective. By constantly loosening the soil about the base of the young plant and by allowing no dead wood to accumulate in the vicinity of the young trees they can be gradually driven away or starved out. Keeping the crowns free from dead material deters them from working on old trees.

Wild pigs are probably the most destructive enemies of young coconuts, and where they are very troublesome, a fence may be absolutely

necessary for the safety of the grove. Strips of rags or fiber from the leaf bases of the coconut saturated with tar and tied either to the leaves of the young plants or to stakes stuck into the earth close about the base of the plant may serve to keep the pigs from injuring the plants; this method is advisable in plantations part of the trees of which have grown beyond the reach of pigs.

The practice of setting the young nuts in a deep depression is inadvisable in localities where heavy rains are frequent; furthermore, unless special attention is given the matter, the young plant roots are practically certain to meet with injurious influences from the subsoil in which they are set.

In the matter of fences the plan of planting buña palms at intervals of 30 to 50 centimeters distance is advised; when well grown this serves as a permanent living fence; bamboo or brush may be woven into the spaces between the palms, or maguey may be planted in the intervals or just inside the buña row.

IRRIGATION.

Like all shallow-rooted plants the coconut suffers more or less from prolonged periods of drought; hence irrigation, where it can be conveniently and cheaply had, is undoubtedly of much practical benefit to the plantation, especially during the first few years of the life of the trees.

FERTILIZERS.

The application of commercial fertilizers to coconuts is a complicated question and one which the average Philippine planter naturally disregards. While the potash salts and phosphates undoubtedly always give good results and while the organic manures certainly assist the young trees to reach the bearing stage promptly, the use of commercial fertilizers is not absolutely necessary providing all the ashes from the shells (if burned) be returned to the soil and providing that all of the husks and dead leaves be utilized. The leaves should be treated as recommended under the topic of "Cultivation," and the husks be composted, except such as may be required occasionally for fuel. The compost pit should be of concrete or cement-lined stone or brick with a roof to prevent the entrance of too much rain; but since the construction of a large pit of this type is rather expensive the ordinary *heap* must serve, at least on small plantations; this should be so arranged that the fresh husks are deposited at one end of a long pile so that the decayed husks at the rear of the pile can be readily removed. Cogon grass or rice straw should be thrown over the heap and water should be applied occasionally in the dry season to accelerate the rotting process. This husk material should be used about the young plants at the time of planting or during the first few years of their growth.

The oil cake left after expressing the oil from the copra is not only an excellent fertilizer for young trees, but is one of the very best foods for domestic animals; it should be ground or broken into small pieces before applying as a fertilizer, and when used as a stock food it should be mixed with some other lighter food material. If only the oil is shipped away from the estate, and if all the by-products, such as cake, ashes from the shells, and compost material from the husks, are returned to the plantation, there should be no impoverishment of the soil, no matter how long this system be kept up, for the constituents of the oil are entirely organic materials (carbohydrates, etc.) derived from the air and water. This principle would hold true even if sugar were made from the tuba instead of copra from the nuts, both sugar and oil containing no ash whatever.

It should be remembered that any form of fertilizers, whether potash salts, acid phosphates, ammonia compounds, or organic manures, such as tankage, guano, or rotted husks, and even ashes, has special qualities and influences upon the growth of the coconut, especially in its early years; and that even slight improvements in the conditions affecting the roots of the young plants have a pronounced effect upon the vigor of its growth and shortness of its nonproductive period. In short, whether the planter can follow the system of constant manuring of his plantation or not, it is certain that he must pay strict attention to the sanitation and nutrition of his young trees in every way possible.

SUMMARY.

The export value of the copra as shipped from the Philippines is now about ₱20,000,000. By proper cultural methods this amount could be increased to at least ₱25,000,000 without increasing the area now under cultivation.

The seed nuts should be selected with reference to individual qualities of the parent tree. They should be hand picked, cured after picking, and so treated in the seed bed that the germinating parts do not receive any check from overheating or lack of moisture.

Transplanting should be done either before the nourishment in the seed nut is exhausted or not until the young plant has a small trunk.

The plantation rows should alternate 8 to 10 meters apart.

Secondary crops may be planted during the first few years. No plants except legumes should be allowed within 1 meter of the young plants and 2 meters of the older plants.

The surface of the soil around the young coconuts should be always covered by live leguminous mulches. The interspaces should be covered by some form of leguminous vines even in old plantations.

Fallen leaves should be stripped and the midribs buried in shallow trenches; the husks should be composted in a long heap; the decayed

husk material should be used about the young plants. Ashes from the shells should be used about the young plants.

Machine cultivation is recommended only for special cases; the disk harrow instead of the plow is advised whenever the soil surface must be lightened.

The nuts should be hand picked after the crown attains a height of 5 meters or more; the bamboo pole and knife may be used up to that stage. The nuts should be cured on a drying platform for one to three weeks after picking.

Artificial driers using coconut shells for fuel are recommended for the production of copra. The unsmoked copra made by this method should always bring a higher price in the world's markets.

Either woven wire or a line of reinforced buña trees is recommended for protecting the young plants against the depredations of pigs, deer, etc.

Burning or burying the bud and upper portion of the stem of trees believed to be affected with bud rot is strongly advised.

Commercial fertilizers, while moderately beneficial, are not necessary, providing that an adequate amount of leguminous cover crops are used.

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