THE CULTIVATION OF NATIVE FOOD CROPS.

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1. Taro.

Taro cultivation, especially of the native varieties, is a most important part of native food production, for taro is, by far, the most commonly cultivated of all native foods. There are two kinds of taro cultivated in this Territory—*Colocasio* spp. and *Xanthosoma* spp. The former embrace the commonly cultivated types which are generally referred to as "native taro", and the latter the Kong-kong type.

In this Territory there is a large number of varieties of native taro, probably many hundreds, and during the past five years no less than 67 varieties have been tested at the Demonstration Plantation at Keravat. As far as the writer is aware, there are only two varieties of Kong-kong taro, one a green stem and the other a blue stem, although it has been reported that a red stem variety is grown in the Talasea District.

Native Taro.

Soil.—Native taro requires a well-drained soil rich in organic matter, for it will not produce on badly drained, impoverished soils. In native gardens the site generally selected is rising ground, or hillsides, wherever possible, and wet or swampy areas are always carefully avoided.

Preparation of the Land.—Taro land should, even where virgin ground is to be planted (i.e., following clearing), be hoed to a depth of 6 to 9 inches, and in heavy soils the ground should be worked down as finely as possible. This hoeing prior to planting assists drainage and aeration, and experiments at Keravat have shown it to give a great improvement in yield.

Planting.—The land should be lined and the taro planted in rows 2 feet apart, with a space of 2 feet to 2 ft. 6 in. between the plants in the row. Either suckers or tops (i.e., the extreme top of the tuber, plus the stem) are used as planting material, and these are planted in holes 9 inches deep. The holes are quickly made by means of a pointed stick about 6 feet long and 3 inches in diameter, and as taro grows upwards and not downwards it is essential that attention be paid to the depth of the hole. Shallow holes result in the tuber being formed and developed above ground, where it does not attain normal size, becomes very susceptible to beetle attack, and in many instances rots before reaching maturity.

The sucker or top is placed in the hole and the hole covered in with soil to a depth of 3 or 4 inches, the top portion of the hole remains open and gradually fills as the crop grows. The soil covering the sucker or top should not be pressed down around the plant.

After Cultivation.—Weed and grass growth is controlled until the plants have made sufficient growth to form a complete canopy over the soil. In some districts of New Guinea it is the practice to reduce the number of suckers that are formed around the plant from time to time, but this is not necessary, and results at Keravat have not shown any significant differences in yield.

Harvesting.—The period to maturity depends on the variety, and is usually between six and nine months after planting. The plant is generally considered as having reached maturity when the leaves (except the very young ones) are dry or badly spotted, and the top of the tuber is firm and brown in colour.

The yield per acre varies according to the variety, method of cultivation and planting. Taro grown on suitable land, and planted at the proper depth, should produce at least 5 tons of edible tubers per acre.

Kong-Kong Taro.

Soil.—Soil suitable for the cultivation of native taro is also suitable for Kong-kong taro; in fact, Kong-kong taro is more intolerant of wet soil than native taro.

Preparation of the Land.—The preparation of the land is the same as for native taro.

Planting.—Kong-kong taro should be planted in rows four feet apart, with the plants spaced four feet apart in the rows. The planting material consists of suckers, parent stem, or sections of the parent stem containing a number of "eyes" in each section. Holes at least 9 to 12 inches deep must be made if suckers or parent stems are planted, and if cut sections of the parent stem are used, then the holes should be no more than 4 inches deep, otherwise the sections rot.

Large, deep holes are necessary for Kong-kong taro cultivation, because the edible portion of the plant comprises the suckers, which are produced in radial formation around the parent stem. When cut sections are planted in the shallow holes it is necessary to "hill up" the crop before the formation of the suckers.

After Cultivation.—Grass and weed growth must be controlled until the plants have formed a canopy, which is usually about two months after planting in the case of suckers and parent stems, and some four months after planting cut sections. Where cut sections have been used for planting, hilling up is carried out in the fourth or fifth month.

Harvesting.—Kong-kong taro is ready for harvest about nine months after planting, in the case of suckers or parent stems, and twelve months after the planting of cut sections. However, it is not necessary, as in the case of native taro, to harvest Kong-kong immediately it is mature; in fact, higher yields are generally obtained between twelve and fifteen months, and even as high as eighteen months after planting.

There are two methods of harvesting, the whole plant can be removed from the ground and the edible suckers taken from the parent stem, or the soil can be removed from around the parent in order to expose the suckers which are harvested, and the soil hilled up again around the parent. This latter method of harvest cannot be recommended for general practice, as Kong-kong taro, like all other roots crops, is a heavy feeder, and to grow two crops in succession on the one area of land would materially affect the soil for future crops; further, experiments at Keravat have shown that this second or ratoon crop is much smaller than the main crop.

Kong-kong taro is a heavy producer, recorded yields of more than 15 tons per acre have been obtained on many occasions at Keravat, and an average of 10 tons per acre has been obtained during the past four years.

In comparing Native taro and Kong-kong taro, it might be stated that Kong-kong taro yields more than native taro, does not deteriorate if allowed to remain in the ground for months after maturity, is not so susceptible to beetle attack, and after removal from the ground will store for at least a week longer. On the other hand, native taro is quicker maturing, more palatable to the native, can be used as native food continuously without the native becoming tired of it, and surplus stems and suckers are less trouble to remove and destroy.

2. Sweet Potatoes.

The sweet potato is grown throughout the tropics and also to some extent in non-tropical countries.

Soil.—Sweet potatoes need a fairly loose, well-drained soil; heavy or wet soils produce very small crops, and the tubers are of poor quality.

Preparation of the Land, Lining.—There are two methods of preparing the land for sweet potato cultivation, namely, ridges and hills. The ridging system consists of making long, continuous ridges, whilst the hill system is one in which single or individual hills are made.

It is important to note that in each method the ridges or hills must be large; low ridges or small hills produce only small crops, as the tubers do not get a chance to reach full size, their growth being stopped by the hard ground under the hills or ridges.

The ridges or hills are spaced 4–5 feet apart and made as high as possible. At a 4-5 feet spacing the ridges or hills should be about 2 feet above ground level, and by previously hoeing the land to a depth of 9 inches, the depth of loosened soil in which the crop is to be grown is about 2 ft. 9 in. The importance of a previous turning of the soil to a depth of at least 9 inches must not be forgotten, as this allows for a maximum depth of well-worked soil in which the tubers can grow and develop.

Planting Material.—The best planting material consists of runners, or slips, or "ropes", as they are called here; these runners may be described as the vine of the plant. Runners for planting should always be taken from a bearing crop, or from an area that has been dug up and in which a certain number of tubers have been allowed to remain in the soil to provide runners. The use of runners from such sources ensures that the runners are always strong and healthy.

Planting.—Having gathered the runners, or slips, or ropes, they should be cut into lengths about 2 feet long; two or three of these short cuttings are then placed together, bent in the middle, and this central elbow, containing at least two nodes or eyes to each cutting, is planted about 6 inches deep in the soil.

Where ridges are used the cuttings are spaced about 2 ft. 6 in. apart along the top of the ridge, and on each side of the ridge about 1 foot above the ground. Where hills are used the cuttings are planted at the top of the hill and in about five or six places around the sides. The reason why some cuttings are planted low down in the ridges or hills provides for a certain amount of the crop being obtained in the space between the ridges or hills.

After Cultivation.—Weed and grass control is maintained until the runners have grown and are effectively covering the ground.

Harvesting.—The period of maturity varies according to the variety, but is generally between five and seven months. A purple fleshed variety in cultivation at Keravat can be harvested at 4½ months, although if allowed to remain until 6–7 months old the yield is almost double.

Sweet potato varieties, such as "Keravat Purple" and "Keravat White", can remain in the ground up to the end of the eighth or ninth month after planting without any serious loss in yield. Soft varieties, however, like the red-skinned yellow flesh type grown in many parts of New Guinea, must be harvested soon after maturity.

After harvest the tops should be removed and burnt, also tubers or pieces of tuber which are overlooked at the time of harvest should be dug out from time to time as they germinate. The removal of the entire crop, both tubers and vines after harvest is important in the control of the sweet potato weevil. Should planting be needed from a harvested area, then only a small section sufficient for requirements should be allowed to remain.

Yields.—The main factors affecting yield are—

1. Loose friable soil.
2. Type of planting material.
3. Large ridges or hills.
4. Allowing the crops to become fully mature.

Yields at Keravat during the year 1939 average between 7–9 tons per acre, but improved methods of cultivation adopted after experimentation towards the end of 1939, have resulted in maximum yields of up to 17¾ tons per acre being obtained, and average yields of 10–12 tons. Improvement in cultivation consisted of proper spacing, use of the correct planting material, control as far as possible of the sweet potato weevil, complete control of the sweet potato caterpillar by the giant toad (*Bufo marinus*), making of large hills, and allowing the crop to reach full maturity before harvest.

After harvest, sweet potato tubers may be stored up to ten days, providing that the skin of the tuber has not been damaged.

3. Yam.

The types of yams cultivated in the Territory of New Guinea may be divided into three groups, namely—

1. Common Yam.
2. Taitu Yam.
3. Mammee Yam.

The common yam is easily recognized by the leaf which is long and pointed, and by the thick, angular stem. The tubers are of varying shapes and the skin of the tuber may be white, cream, or red, the flesh of the tuber may be white, cream, or purple.

The Taitu yam, so called in the Territory because, under this name, the type was introduced from the Trobriand Islands. The leaf of the Taitu yam is best described as "heart shaped", the stem is round and may be smooth or covered with thorns. Three varieties are in cultivation here and the tubers are so characteristic that they are easily known from both the common yam and the mammee yam. The Taitu tuber is oval or pear-shaped, the oval type is either very hairy

(that is, entirely covered with a dense coarse mat of small rootlets), or has a large number of short hard spines up to ½ inch long; the pear-shaped type is most characteristic, the upper half, which corresponds to the neck, is covered with short sharp spines, whilst the lower half or bulbous portion is entirely smooth.

The mammee yam has heart-shaped leaves, round stems, which may be smooth or thorny, and in this respect resembles the Taitu yam. However, the similarity ends here. The mammee tuber is very much smaller, is smooth or covered with fine, soft, rootlets, and grows in clusters of as many as 40 small or medium-sized tubers. The flesh of the tuber may be white or purple.

Soil.—The yam requires a loose, well-drained soil containing a fairly high percentage of organic matter. If planted in heavy, wet, or badly drained soil, the parent tuber of "set" generally rots and dies before the vines have an opportunity to become established. Should favorable weather follow planting the vines become established quickly; but they die once the soil becomes too wet, and any small tubers that have formed rot away.

Preparation of the Land and Lining.—There are three methods of preparing the land for yams, namely—

1. Hills raised above the surface of the ground.
2. Deep holes in which loose surface soil has been thrown and a hill about 1 foot high built up over the hole.
3. Long ridges raised well above the surface of the ground.

Native yam cultivators usually adopt methods Nos. 1 and 2, chiefly because they grow their yams in conjunction with other food crops such as taro, bananas, ibeka, etc., and the hills or holes can be dotted around amongst the other crops. Other reasons for the use of these methods by the native are that in coral or stony country where good, deep soil is scarce, holes can be dug between the coral or rocks and a crop obtained, also in some districts the long tuber type of yam is grown and high hills or holes allow for maximum growth.

Experience at the Demonstration Plantation, Keravat, shows that when yams are grown as a sole crop, long high ridges are best. When making the ridges it is essential that they be as large and as high as possible, the land should be previously hoed to a depth of at least 9 inches, and by spacing the ridges 4 to 5 feet apart the completed ridges should be at least 2 feet above ground level with another 9 inches of tilled surface soil beneath. Thus there is about 2 ft. 9 in. of well-tilled, friable soil in which the yam can grow and develop. In districts of high rainfall, the top of the ridge should be flattened out to minimize as much as possible washing down of the soil and so lowering the height of the ridge and exposing the parent tuber or "set". This flattening out also allows for protection against heavy storms until the vines have grown and produced a protective covering.

Should single hills or hole and hill methods be used, then the hills should be made as high as possible. The hole and hill system is not recommended at any time unless the long type of yam is to be cultivated, also from the aspect of plantation native food production and cultivation, the hole and hill method is not so economic as the ridge method.

In the hill system two "sets" may be planted, and in the ridge system the "sets" are planted at intervals of 3 feet along the top of the ridge. The hills are spaced 4 feet apart from centre to centre.

Planting.—The material used for planting is known as a "set", and consists of either a section of cut tuber, or the top of the tuber, or a full tuber.

At harvest all damaged tubers are set aside for immediate consumption, whilst the undamaged tubers are stored in a well-ventilated place and allowed to "cure". During the curing process the crop should be carefully inspected and material selected for planting so that all tubers not needed for the next season's crop can be eaten.

The plant tubers are allowed to germinate, and when the shoot has reached a length of about 3 feet the tuber is ready for planting. Once the time for planting arrives these shoots are cut back until they are about 6 inches long and contain two or three nodes, and in the case of large tubers the germinated portion plus a section of the tuber is cut off and planted. The balance of the tuber can be eaten or the cut end rubbed in ashes, and the tuber returned to storage for further germination. With mammees the tubers are usually too small for cutting and are thus planted whole, whilst in the case of the Taitu yam the medium sized tubers are planted whole, and the large tubers are cut. In many of the common yam varieties, especially the "cluster" types further germination occurs when the cut yam is returned to storage; with Taitu yam, however, a second day germination does not readily occur.

The native cultivator usually retains all small tubers for planting, and when planting is carried out he uses two or three, or even more, "sets" at each planting point. This idea is quite wrong, especially in the case of mammees, Taitu yam, and "cluster" types of the common yam. Experiments during the past two years at Keravat have proved beyond doubt that small tubers produce much smaller crops than medium-sized tubers or the cut-off top section of a large tuber. Furthermore, the proportion of small and very small tubers obtained from plants raised from small "tuber sets" is far in excess of those obtained from medium or large "tuber sets".

After Cultivation.—At all time during the growth of the crop any soil washed down must be replaced to prevent exposure of the tubers.

In the case of the common yam and the Taitu yam it is essential that the crop be "staked". Once the vines have reached a length of 3 to 4 feet it is time to "stake". Cut bush timber in lengths about 6 feet long, 2 inches in diameter, and sharpen one end. Insert the stakes strongly in the ground near the base of each vine, and attach long sticks parallel to the ground and about 5 feet above so that fence is made, and the vines as they grow are able to trail up the stakes and along the central stick.

A series of experiments conducted at Keravat showed that with mammees, the extra yield obtained from staked plants was so small that staking was uneconomic, on the other hand, "staked" Taitu yam showed an increased yield of more than 30 per cent.

The hills and ridges, also the spaces between, must be kept free of grass and weed growth.

Harvesting.—The period of maturity varies according to the type from nine to eleven months, and the crop is ready for harvest when the leaves turn brown and drop off or are covered with brown spots and the bottom of the tuber has become hard.

Recently recorded yields from bulk plantings at Keravat were 9 tons per acre from Taitu yam, and 8 tons per acre from mammees.