

GROWING TAROES IN AMERICAN SAMOA

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INTRODUCTION

If we plant troes at a spacing of 4 feet by 1½ feet, or 6 square feet per plant, we get 7,260 taroes per acre. Assuming 10% damages or 726 taroes damaged, the net harvest per acre would be 6,534 taroes.

The table below shows the relationship between the average weight per taro, the total yield per acre, and the corresponding gross income from sales at 35¢ per pound of taro, *etc.*

TABLE 1

| Levels of Production | Ave. wt. per taro | Total Yield per Acre - 6,534 taros | Gross Inc. 35¢/lb. | Gross Inc. 40¢/lb. | Gross Inc. 45¢/lb. |
|----------------------|-------------------|------------------------------------|--------------------|--------------------|--------------------|
| First | 1-lb | 6,534 - lb | \$ 2,287.90 | \$ 2,613.60 | \$ 2,940.30 |
| Second | 2-lb | 13,068 - lb | 4,573.80 | 5,227.20 | 5,880.60 |
| Third | 3-lb | 19,602 - lb | 6,860.70 | 7,840.80 | 8,820.90 |
| Fourth | 4-lb | 26,136 - lb | 9,147.60 | 10,454.40 | 11,761.20 |
| Fifth | 5-lb | 32,670 - lb | 11,434.50 | 13,068.00 | 14,701.50 |
| Sixth | 6-lb | 39,204 - lb | 13,721.40 | 15,681.80 | 17,641.80 |

The most interesting relationship that the table points out is the possibility of increasing our taro production without increasing the acreage that is planted. If we can increase the average yield per taro, the yield per acre increases correspondingly and dramatically without the need to cultivate additional land. For example, if we can increase the average yield per taro from 1-lb to 5-lb, we increase the yield per acre from 6,534 lb. to 32,670 lb.

The lesson we must learn from the above discussion is this: Increased agricultural production for American Samoa does not necessarily mean increasing the acreage under cultivation. Our primary objective is to maximize the productivity of each plant in order to maximize the yield of every square foot of land we put under cultivation.

Our measure of productivity is not how many acres of land we have under cultivation but how much yield do we get out of each acre of land we cultivate.

If Farmer A cultivates 3 acres of taroes and harvests only 19,602 lb. and Farmer B cultivates only 1 acre and harvests 26,136 lb; Farmer A may have a bigger farm, but Farmer B is the more successful of the two.

TARO PRODUCTION

I. The Demand for Taro in American Samoa

A. Taro Imports from Western Samoa

According to statistics compiled by the Quarantine Division of the Agriculture Department, taro imports from Western Samoa vary from 70,000 to 120,000 pounds per month. The fluctuation occurs primarily because of insufficient supply of taroes available from Western Samoa, and not because the market demand in American Samoa has decreased.

B. High Prices and Reduced Demand

Compared to the prices for rice and potatoes, the price for taro is higher. Many American Samoan families do not eat taro everyday because they cannot afford to do so. Many families cook rice or buy bread for their children; taro is reserved for the old people. Only on Sunday is taro generally eaten.

There is a real possibility that in the very near future, the young people that are now fed rice and bread will reject taro as an integral part of their diet. When that happens, taro will have been priced out of existence as a daily component of the Samoan diet.

II. The Need to Improve the Productivity of Taro Plantations

There are important reasons why we must improve the productivity of our taro plantations:

A. Our Land Area is Limited

The land area of American Samoa is only 76 square miles, and more than 80% of that area is steeply mountains terrain that is unsuitable for food crop production.

Of the less than 20% cultivable land, more than half will be used for residential and other non-agricultural purposes, leaving less than 5% of the cultivable land area for food production and other agricultural activities.

It should, therefore, be the concern of everyone involved with agriculture to strive to maximize food production from every square foot of land that is put under cultivation.

B. Greater Productivity Means Lower Prices

We need to bring down the price of taro from 50¢ and more per pound to about 30¢ per pound.

We can do this by improving the cultural methods we use to produce taroes. These improved methods would not only increase the average yield per taro, but would also result, either in reducing the costs of production, or keeping these costs low.

The ultimate aim is to make the taro affordable to every consumer so that it can become once more an integral part of our diet, and consequently, an important economic product that we can produce.

C. Potential for Export

The more efficient and economical we become in producing taroes, the greater is the possibility for American Samoan farmers to participate in the export of taroes to the U.S. ✓

Western Samoa is exporting taroes to the U.S., and has done so for the past several years.

We can do as the Western Samoans are doing and ship fresh taroes in cooler containers or by air freight. Shipping fresh taroes, however, has inevitably resulted in spoilage because taro has a very short shelf life. Such spoilage makes the importation of fresh taro a high risk undertaking and requires a highly effective and efficient distribution system to market the taro before it spoils.

D. Potential for Processing

1. Production of Taro Flour

From 1984 to 1986, the DEPARTMENT OF FOOD SCIENCE AND HUMAN NUTRITION of the University of Hawaii at Manoa, Honolulu, conducted a study to develop taro products from indigenous taro

from American Samoa. The activities of the taro project include (1) the completion of the analysis of the nutritive and non-nutritive components in six varieties of taro corms from American Samoa; (2) the use of precooked (pregelatinized) taro flour in the manufacturing of tropical fruit sorbet and taro sorbet; (3) test baking of taro bread; (4) preliminary trials on canning of taro patties; (5) trials on the alcoholic fermentation of cooked taro.

All these potential commercial uses of the taro depend on the economy and effectiveness of taro production. In the test-baking of taro bread, for example, the results indicated that taro flour can replace 30% of the regular wheat flour (Baker's special) without losing the loaf volume. A level of 50% taro flour can be used if supplemented with gluten and sodium stearoyl lactate. The HFM Co. in Honolulu which did the test-baking, is interested in further investigation of this opportunity if a stable supply of taro flour with consistent quality is available.

2. Processing Taro Leaves

Traditionally taro leaves have always been an important food in the Samoan diet. It is used to make palusami, lu'au ulo or pot lu'au, lu'au pua'a and lu'au lupe.

If these traditional foods can be processed commercially for local consumption and for export, taro production could become a significant small industry for American Samoa.

Cooking and freezing could be the most appropriate technology we can use to process taro products.

3. Processing Taro Corms

a. Baking and Freezing Taro

One way to export taro and avoid this risk of spoilage is to bake the taro first and then freeze it in evacuated plastic bags. With the general availability of microwave ovens, preparing the taro for meals would require only a few minutes of heating in the oven.

D. fa'alifu

"Fa'alifu" could be cooked and packed in plastic containers (about 2 liters) and frozen. The frozen "fa'alifu" could then be marketed locally and overseas. And as with the frozen baked taro, the consumer simply puts the frozen fa'alifu in the microwave oven and heats it for 20 to 25 minutes and it is ready to be eaten.

NOTE: Baking and freezing could also be applied to the breadfruit.

III. CULTURAL PRACTICES FOR HIGH TARO YIELDS

A. The Important Stages of Taro Growth

1. The First Two Months of Growth (first stage)

During this stage, the most important objective is to promote the leaf and root development of the taro. Our primary interest is to maximize the leaf area of each plant in the shortest possible time. Maximum leaf area is important for the following reasons:

- a. maximum leaf area shades out weeds, thus aiding in weed control;
- b. maximum leaf area shades the soil, thus reducing the evaporation of soil moisture; and
- c. since leaves are the factories in which the plant manufactures carbohydrates through the process of photosynthesis, the sooner the plant attains a large leaf area, the sooner it will achieve the capacity to produce carbohydrates which are then stored in the corm of the plant.

Therefore, to promote rapid leaf and root development during the first two months, the taro plant should be fertilized with a high Nitrogen (N) and Phosphate (P_2O_5) fertilizer. Ammonium Phosphate, with N-P-K analyses of 16-20-0 or 18-46-0, is an example of "first stage" fertilizer.

2. The Next Four to Five Months of Taro Growth (second stage)

During this second stage of Taro growth, the objective is the promotion of carbohydrate production, and the translocation

of these carbohydrates to the corm (i'o) where they are stored.

To achieve this objective, a high potash (K_2O) fertilizer is used, such as the compound fertilizer, 10-5-48.

But before we can proceed to fertilization, there are important steps that we must first go through.

3. The Third Stage (Post-Harvest Operations)

Present thinking about taro production seems to be that upon harvesting of the main taro (the top that was planted), the production process comes to an end. The young suckers produced by the main taro are not regarded as significant in the calculation of the total yield of corms by the plot.

Young taro suckers are regarded primarily as planting material for the next plot of taroes.

In the interest of higher yields, the production period and process must go beyond the usual six or seven months and the total harvest must also include the yield contributed by the suckers, instead of just the mother taro.

More will be said about this Third Stage of Taro growth in Section III E3. But before we can reach that stage, there are important steps that we must first go through.

B. Land Selection

1. Land Should be Well Drained

The land on which taro is to be planted must be well drained. It is necessary that there be good drainage, otherwise, the taroes will not grow well. Water-logged soil will not allow air to enter into it; consequently, plant roots and beneficial organisms in water-logged soil will drown for lack of oxygen.

Drainage ditches must be built if better drained land is not available.

2. Tractor Should be Able to Work the Land

Not only should the proposed site be well drained, it should also be level enough to enable a tractor to work it. Since

traditional taro production is labor intensive, and since good agricultural labor is scarce, we should make every effort to introduce as much mechanization as possible into the production process.

C. Land Preparation

1. Green Manure

The incorporation of organic matter into the soil should be one of the main objectives of land preparation. It is essential for high productivity that adequate organic matter be added to the soil before any planting takes place.

The most economical and efficient way to do this is through the use of green manure. This consists of planting a leguminous cover crop on the land to be planted with taro. When the cover crop reaches a certain height or state of maturity, it is then thoroughly disked and plowed under. Sunn Hemp will most likely be the green manure crop we will use in connection with taro production.

Most unused lands in the Territory are covered with a thick layer of mixed vegetation. Disking and plowing under this vegetation would provide sufficient organic matter for the first crop of taroes.

When the first crop of taroes is harvested, the plot is first disked and then sown with the "green manure" crop. Upon reaching the appropriate height, the crop is first thoroughly disked and then plowed under. The plot is disked again, first to break up the big clods, and secondly, to smooth the surface in preparation for making furrows.

2. Preparing the Furrows

Equipped with a furrowing implement that can make two or three furrows at one pass, preparing furrows in which taro-tops are planted (see Figure 1) can be carried out quickly and easily with the tractor.

D. Planting

1. Spacing

As shown in Figure 1, the distance between the rows is four (4) feet; the distance between the plants in the row is $1\frac{1}{2}$ feet; each furrow is about 15 to 18 inches wide at the top and at least 12 inches deep.

2. Planting

Figure 1 shows approximately how the taro-top is planted. The tool used to cover the base of the taro-top with soil is a short handled hoe. A regular long-handled hoe is converted simply by shortening its handle so that the distance from the blade to the tip of the shortened handle measures 18 inches. The tool is, therefore, also used to measure the distance between the taro-tops in the row.

To plant the taro-top, it is held up straight with one hand, and with the hoe in the other hand, soil is scraped from the sides of the furrow and piled around the base (of the taro top). Usually 3 to 4 inches of soil should be sufficient to hold up the taro-top and keep it from falling down.

E. Fertilizing

1. First Stage Fertilizer

As discussed previously in Section IIIA, during the first two months of growth, the taro is fertilized with either the 16-20-0 or the 18-46-0 compound fertilizers, whichever is available. In either case, there will be four (4) applications of the fertilizer, once every two weeks, the first one to be done after planting.

Application is simple. A container is used to carry a manageable quantity of the fertilizer, and as the farmer walks along the rows, he simply drops the required amount of fertilizer between the taroes. After the fourth application, the first stage fertilization is complete.

2. Second Stage Fertilizer

On the eighth (8th) week, the first application of the compound

fertilizer 10-5-48 is made and the amount applied is two (2) ounces. There will be a total of six (6) applications, at two (2) week intervals, and two (2) ounces per application.

3. Third Stage Fertilizer

As was discussed briefly in Section IIIA3, the Third Stage of Taro Growth could be very critical in the production process. By considering the taro suckers, not simply as planting materials for the next crop, but as potential yielders of additional taro corms, we can then begin to see how we can further increase taro yields without the need to increase acreage.

It should not be a difficult problem to determine accurately the fertilizer treatment to be given to the suckers after the harvest of the mother taro. If they appear to require additional and healthier foliage, then they should be given one month of First Stage fertilizer (16-20-0 or 18-46-0). After that, the suckers should be given Second Stage fertilizer (10-5-48), at bi-weekly intervals until they are ready for harvest.

F. Irrigation

1. The Importance of Water

Water is not only important for the chemical and other processes that take place within the plant, but also for those processes that take place outside the plant. For example, when we apply fertilizer to the taroes, it will be of no value to the taro if that fertilizer sits high and dry on top of the soil. The fertilizer must be dissolved in water before the plant can use it.

2. The Wet Season: October to May

In Samoa, we have two distinct seasons: the wet and dry season. During the wet season, there is more than enough rainfall to irrigate the taro crops. Generally, taroes do well during the wet season.

3. The Dry Season. June to September

In spite of our high rainfall per year, it is during the wet season that most of the rains fall. The months from June to September are cool and dry, with a lot of sunshine, ideal conditions for growing crops. However, the scarcity of rain makes it difficult to grow anything without artificial irrigation.

To maximize taro production, therefore, during the dry season, some artificial irrigation system must be considered.

G. Weed Control

In using the furrow method of taro production, it has been found that weed control can be done more efficiently. First, because the rows are straight and uniformly spaced, the applicator can move along the rows quickly. Secondly, if the herbicide is applied when the weeds are less than one-half inch high, the spraying can be done quickly and very little chemical is used. Thirdly, only two sprayings were necessary. By the end of the first 2½ months, the taro leaves are large enough to begin shading the soil, thus assisting in weed control.

H. Pest Control

1. Army Worm

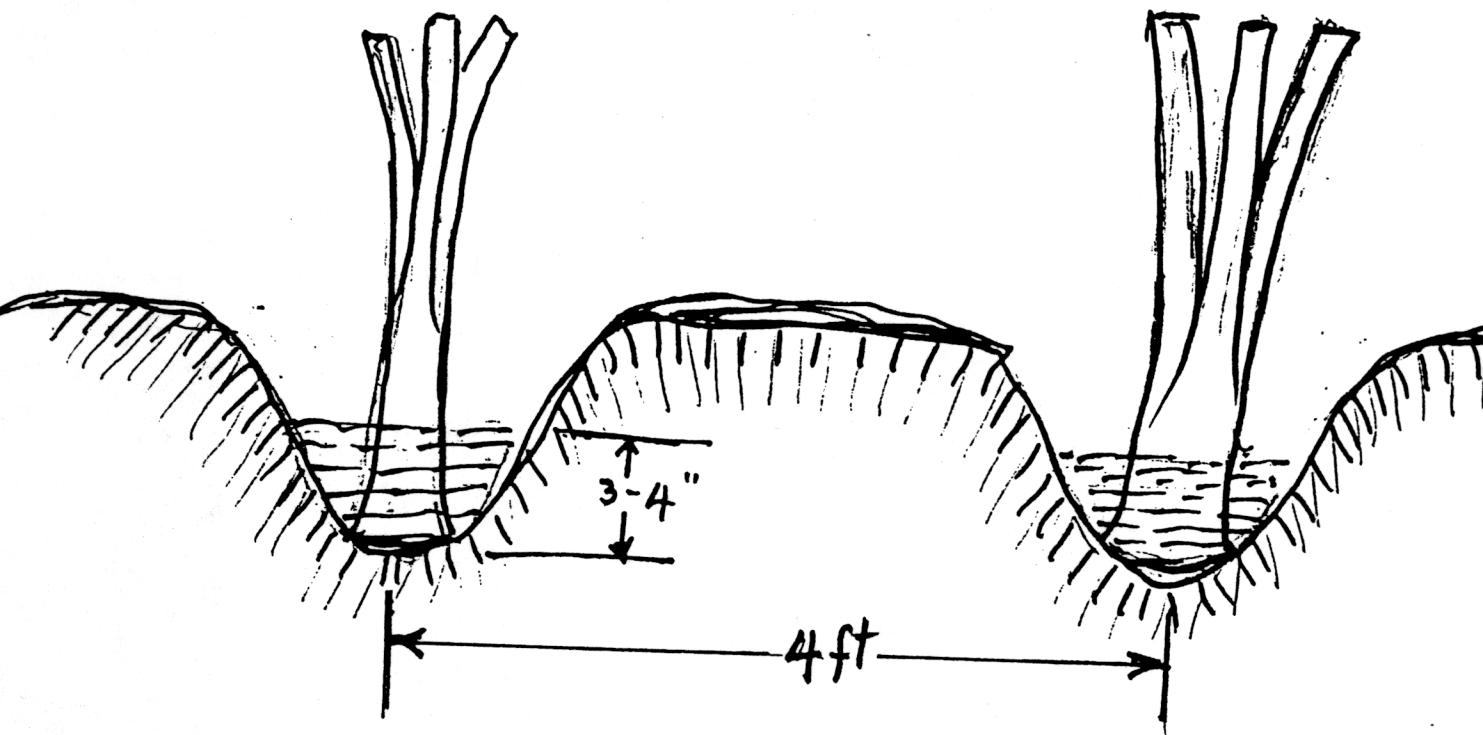
This is often a serious threat to the taro. Sometimes the infestation is so great that only the stalks are left standing after an attack. Chemical control of the army worm and other caterpillars can be effective if carried out early enough. For example, when the spraying is done at the time when the caterpillars have just hatched and are still clustered around the egg case, spot spraying would be most effective. There would be no need for mass spraying. However, the avoidance of mass spraying is very much dependent on the frequent inspection of the taro plot, and a good hand-held sprayer would facilitate the destruction of the young caterpillars.

It is only when the taro plot is left uninspected and caterpillar population build-up is left unchecked and permitted to grow to

maturity that real and serious damage is done to the taro crop and even if mass spraying is carried out at that late stage, the damage already done is often times irreparable.

If there is to be effective caterpillar control, it must be started early, even at the egg stage before the insects are hatched.

Figure 1



Cross-section of furrows prepared by tractor.

Furrows are 4 feet apart.