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#### Cover Photograph

Harvested corms of soft taro (Kosraean Red) from the demonstration plot.

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# SOFT TARO CULTIVATION GUIDE



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## PREFACE

The Federated States of Micronesia is made up of 607 small islands spread over a million square miles of the Western Pacific Ocean with a total land area of only about 271 square miles. Agriculture is an important industry that could greatly help in the economic development and growth through bringing food self-sufficiency in Micronesia. However, economic development of the country is largely dependent on the outside world as the current agricultural programs are mostly on a subsistence level. Serious damage caused by natural calamities such as wave surges, salt water flooding, and drought continually pose challenge for the local farmers. Lack of technical know-how to adopt preventive measures to minimize the impact of natural calamities on agricultural operations have led to an overall decline in local agricultural production forcing increased reliance on foodstuff imported from the United States and China.

However, most of the imported food stuff is unaffordable by the general population. Even after paying high prices people are not able to get fresh produce due to long transportation time. All these factors have resulted in high rates of malnutrition and continued food scarcity among local people indicating the crucial need to promote local agricultural operations. Educating and training local farmers in sustainable agricultural production of food crops such as taro that are of great socio-cultural importance and could be grown successfully in island conditions, could greatly help in bringing food self-sufficiency and overcoming nutritional deficiency in Micronesia.

This extension publication is intended to provide local farmers and producers with guidelines for sustainable cultivation of soft taro, *Colocasia esculenta* L. Schott. Taro has great socio-cultural significance as it is part of many traditional and cultural practices in Micronesia. As such, there is a growing demand for soft taro and its value is closely related with demands during funerals, annual feasts and daily community functions and activities. Thus, the crop could be an important income earner for many small-scale producers.

It is our hope that this publication will provide current and potential farmers and producers with practical information that will assist in sustainable taro cultivation and increased taro production in Micronesia ultimately leading to help in improved health and better economic status of local people.

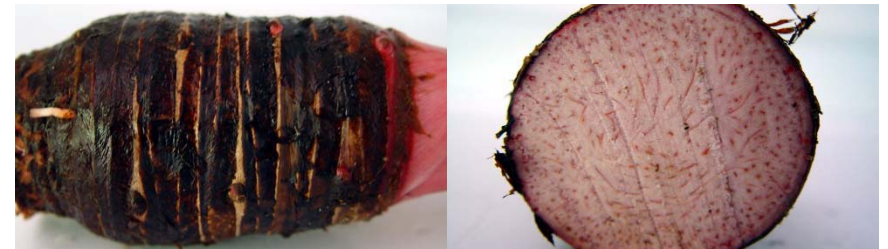


Figure 40 Corm of soft taro (ST-17) and transverse section of corm

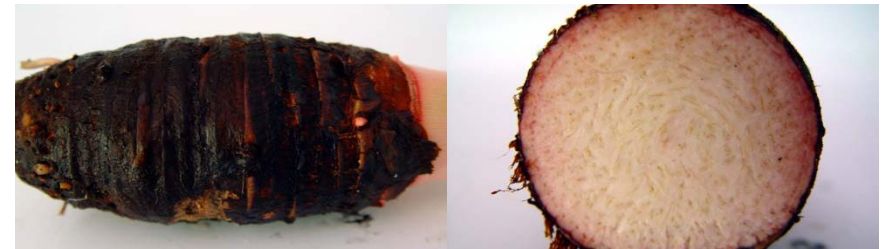


Figure 41 Corm of soft taro (ST-18) and transverse section of corm



Figure 42 Corm of soft taro (ST-19) and transverse section of corm

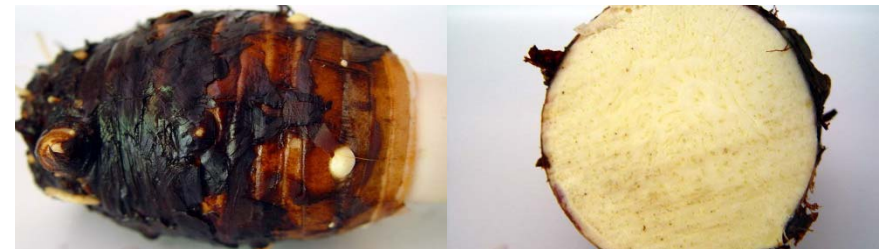


Figure 43 Corm of soft taro (ST-20) and transverse section of corm

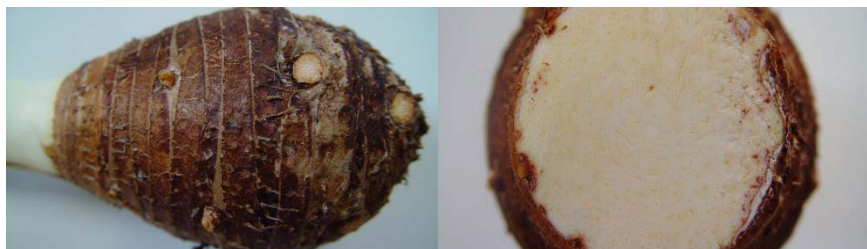


Figure 36 Corm of soft taro (ST-13) and transverse section of corm



Figure 37 Corm of soft taro (ST-14) and transverse section of corm



Figure 38 Corm of soft taro (ST-15) and transverse section of corm



Figure 39 Corm of soft taro (ST-16) and transverse section of corm

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## INTRODUCTION

The Federated States of Micronesia (FSM), lying just above the Equator, enjoys a tropical climate, with relatively even, warm temperatures throughout the year. Rainfall is generally plentiful. With up to 330 inches of rain per year, Pohnpei, the capital state, is one of the wettest places on Earth. Tropical typhoons constitute an annual threat, particularly to the low-lying islands. In addition, drought conditions also occur periodically throughout FSM, especially when the El Niño condition moves into the Western Pacific. At these times groundwater supplies dwindle up to emergency proportions.

*Colocasia esculenta* (L.) Schott (soft taro), member of the family Araceae is an ancient crop that is grown throughout the humid tropics for edible corms, leaves and petioles as well as for other traditional uses. In the Pacific, the crop has attained supreme importance in the diets of the inhabitants. Nutritionally, taro is rich in fiber, calcium, potassium, iron, vitamin A, vitamin B1, vitamin B2, and vitamin C. The corms of taro are superior to potatoes in nutritional value, containing a higher proportion of proteins, calcium and phosphorus. The vitamin B content in taro corms is equivalent to that of cabbage and twice that of potato. Taro also contains greater amounts of vitamin B-complex than whole milk. In corms, the main bulk is starch. The presence of starch in form of very fine grains makes the corms easily digestible. The corms can be boiled, roasted, fried as chips or cooked in curries. The young leaves and petioles of soft taro are also used as food and cooked like any other green vegetable. The cooked leaves of soft taro have the same nutritional value of spinach.



Figure 32 Corm of soft taro (ST-09) and transverse section of corm



Figure 33 Corm of soft taro (ST-10) and transverse section of corm



Figure 34 Corm of soft taro (ST-11) and transverse section of corm



Figure 35 Corm of soft taro (ST-12) and transverse section of corm





Figure 28 Corm of soft taro (ST-05) and transverse section of corm



Figure 29 Corm of soft taro (ST-06) and transverse section of corm



Figure 30 Corm of soft taro (ST-07) and transverse section of corm



Figure 31 Corm of soft taro (ST-08) and transverse section of corm



Figure 1 Kosrae Agricultural Experiment Station

## SOFT TARO CULTIVATION

### 1. Climatic Conditions

Soft taro can be grown throughout the year in the Micronesia. It is best adapted to a warm, moist environment. Evenly distributed rainfall is ideal. Supplemental irrigation is necessary in dry, low-rainfall areas.

### 2. Soil Characteristics

Soft taro (*Colocasia esculenta* L.) can be grown on a wide range of soil types, but best results are obtained on deep, well drained, friable loams with pH 5.5-6.5. Rocky or stony soils should be avoided to prevent deformed corms and difficult harvesting.

### 3. Field Preparation

Soil preparation for soft taro is similar to that for most dry land crops such as corn. Existing vegetation is turned under with a moldboard or disc plow, or by spading. Most soils benefit from adding compost at this stage. During cultivation phosphate fertilizer can also be added, if required. After turning, leave the soil for a few days to allow for decomposition, and then break soil clods by harrowing or rotovating or, with a hoe or rake in small gardens. After the soil has been pulverized, the surface should be smoothed in preparation for soft taro planting. Soft taro can be planted on ridges, in furrows, or on flat ground.

Prepare rows 45-60 cm apart, and use a guide string to plant taro acclimatized plantlets 60-90 cm apart within each row.



Figure 2 Soft taro leaf view from lower surface (left) and petiole; and upper surface (right)



Figure 3 Inflorescence of soft taro

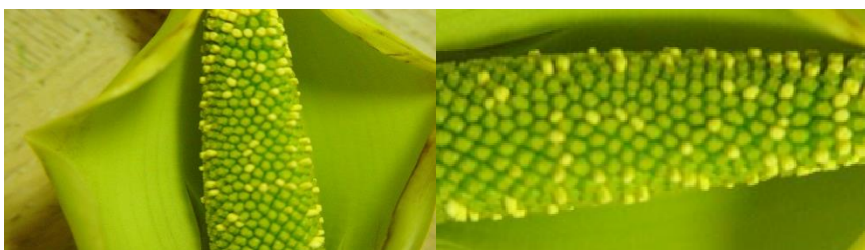


Figure 4 Close-up view inflorescence of soft taro; and flowers of soft taro

#### 4. Preparation of Planting Material

Traditionally taro has been propagated through cuttings that are prepared from suckers or main plants. The cuttings consist of the upper



Figure 24 Corm of soft taro (ST-01) and transverse section of corm



Figure 25 Corm of soft taro (ST-02) and transverse section of corm



Figure 26 Corm of soft taro (ST-03) and transverse section of corm

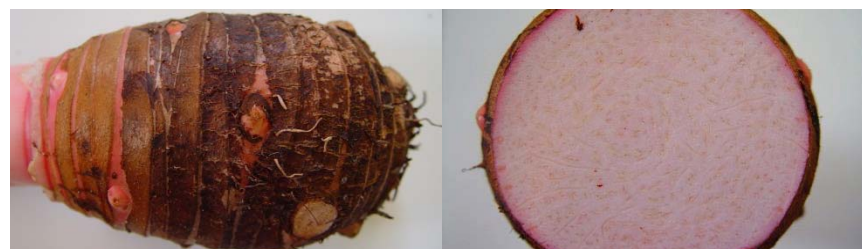


Figure 27 Corm of soft taro (ST-04) and transverse section of corm

with location, varieties used, soil fertility, and water availability. Soft taro can be harvested and stored for a considerable length of time. However, the corms should be thoroughly cleaned, washed, and drained before storage. Storage under refrigerated conditions will prolong the life of the corms. For home use, taro may be harvested as required over a period of several weeks. Leaves can be harvested at any time during the growth of the crop. Only the young leaves are harvested, and the taro is allowed to continue to grow. Taro leaves cannot be stored for any considerable length of time without seriously impairing its quality, whether for leaf or table use.



Figure 22 Harvested corms of soft taro



Figure 23 Display of harvested corms of soft taro

### 10. Texture and Color

Corms of soft taro varieties harvested from demonstration plots and transverse section of taro corm.

0.5 cm section of the corms or cormels and the first 25-30 cm of the petioles. In the recent years, owing to the advantages of disease free planting material along with uniformity in growth and higher yields, the use of tissue cultured plantlets as the planting material for taro has become increasingly popular among the farmers.



Figure 5 Multiplication of taro through tissue culture.



Figure 6 Tissue culture multiplication of soft taro; and soft taro plantlets for acclimatization



Figure 7 Acclimatization of soft taro plantlets; and acclimatized soft taro seedlings in nursery

### 5. Irrigation

Water availability can drastically affect the yield of taro. Taro thrives under moist soil conditions and can withstand prolonged water logging. However, soils growing soft taro should not be allowed to become waterlogged for any extended length of time. For best results, maintain soil moisture at or near field capacity (moist but fully drained) throughout the growing period. Irrigation water can be applied by furrow, sprinkler, or drip irrigation.



Figure 8 Soft taro seedlings; and soft taro planting on beds



Figure 9 Close-up views of soft taro plants in field

### 6. Fertilizer Application

In a tropical climate it is better to apply small quantities of fertilizer often, rather than to add a large quantity in one treatment. This makes the fertilizer application more profitable and prevents too rapid growth. Soft taro requires good soil fertility. For home gardens, apply a 7-30-20, 10-20-20 (NPK), or similar analysis fertilizer at 1.25-1.50 kg per 30 square meter before planting. Broadcast the fertilizer over the soil surface and work it into the soil by harrowing, rotovating, or raking. At two, four, and six months after planting, apply 450 gm per



Figure 19 Taro leaf showing feathery mosaic pattern caused by infection with the small bacilliform particle (Advanced stage)



Figure 20 Dying leave of taro due to feathery mosaic caused by infection with the small bacilliform particle; and upper surface of diseased taro leaf showing shot hole leaf spot



Figure 21 Lower surface of diseased taro leaf showing taro leaf blight caused by *Phytophthora colocasiae*

### 9. Harvesting

Taro is ready for harvest 10-12 months after planting. The crop is ready for harvest when all or most of the cormels have become dormant; that is, when the leaves have dried. As harvest time approaches, the leaves turn yellowish and the petioles become short, usually less than 60 cm long. The corms protrude from the ground. Time of maturity varies

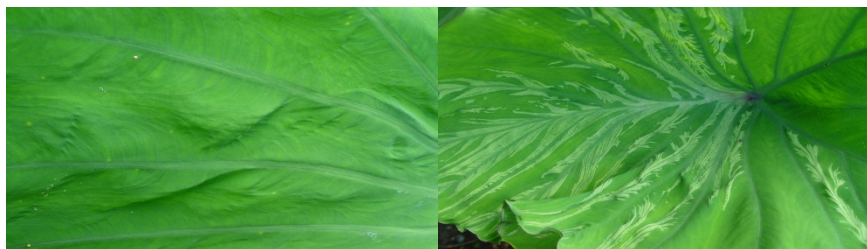


Figure 16 Taro leaf showing scarring and wrinkling caused by infection with the large bacilliform particle; and taro leaf showing feathery mosaic pattern caused by infection with the small bacilliform particle (Early stage)

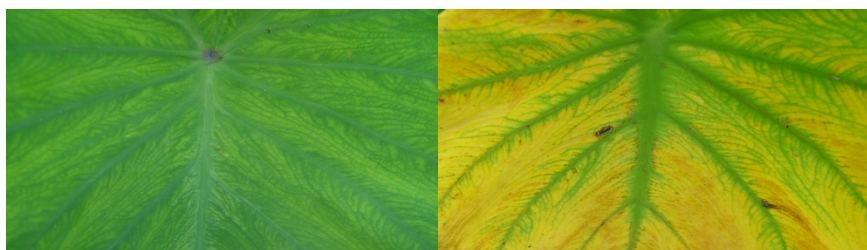


Figure 17 Taro leaf showing feathery mosaic pattern caused by infection with the small bacilliform particle (Early stage); and taro leaf showing feathery mosaic pattern caused by infection with the small bacilliform particle (Intermediate stage)



Figure 18 Taro leaves showing feathery mosaic pattern caused by infection with the small bacilliform particle (Early, intermediate, and advanced stages)

30 square meter area of 16-16-16 or similar fertilizer as side-dressing. Alternatively, side-dress with 600 gm per 30 square meter three and six months after planting.



Figure 10 Close-up views of soft taro plants in field



Figure 11 Soft taro plants in field

### 7. Weed Control

Taro is very susceptible to weed competition, especially during the first 3-4 months after planting, when the leaf canopy is being formed. During this time, control weeds by hand pulling or cultivating with a hoe. After the crop has attained the maximum vegetative stage, the lush foliage will shade out weed growth, and cultivation for weed control should be minimized to avoid injuring the roots and the developing corms.

### 8. Insect-Pests and Diseases

Several insects attack on soft taro. The most common and important are the leafhoppers (*Tarophagus proserpina*) and aphids (*Aphis* spp.). These insects usually do not cause serious damage unless they are

present in large numbers. They damage the taro plants by sucking sap from the petioles and leaf blades. Leafhopper damage can be distinguished by the presence of numerous brown to black spots on the petioles that are caused by stains from sap that has oozed from puncture holes on the petioles. Aphids are easily observed on the young leaves. Most taro insect pests can be controlled by spraying with insecticides. However, the taro root aphid is difficult to control in this way because it is not easily observed and is mostly confined to the below ground parts of the plant.

Among the diseases that affect soft taro, leaf blight caused by *Phytophthora colocasiae* is the most prevalent. Its incidence is influenced greatly by the climatic conditions and is most serious during wet seasons. Its presence usually diminishes during the dry months of the year. Leaf blight can be recognized by the formation of purplish to brownish circular water-soaked spots on the surfaces of the leaves. A clear yellow liquid is exuded from the spot. This disease has devastated taro wherever it has occurred, the last outbreaks were in American Samoa and Samoa in 1993. To control leaf blight in taro, at present there is no fungicide cleared for commercial use. The only solution to control leaf blight is to cultivate leaf blight resistant taro varieties. Other diseases of soft taro are dry rot caused by *Sclerotium rolfsii* and *phyllosticta* leaf spot caused by *Phyllosticta colocasiophyla*. These can be serious in soft taro but seldom occur in well-managed and well drained fields.



Figure 12 Red spider mites (*Tetranychus* species) on taro leaf; and adult of taro leafhopper, *Tarophagus colocasiae* (Mats.)



Figure 13 Mealybug on taro leaf; and melon aphid, *Aphis gossypii* (Glov.) on taro petiole



Figure 14 Nymphs of taro leafhopper, *Tarophagus colocasiae* (Mats.); and adults of spiraling white flies (*Aleurodicus disperses* Russ.) on taro leaf



Figure 15 Red spider mites (*Tetranychus* species) on taro leaf, and newly hatched larva of taro hornworm, *Hippotion celerio* (Linn.)