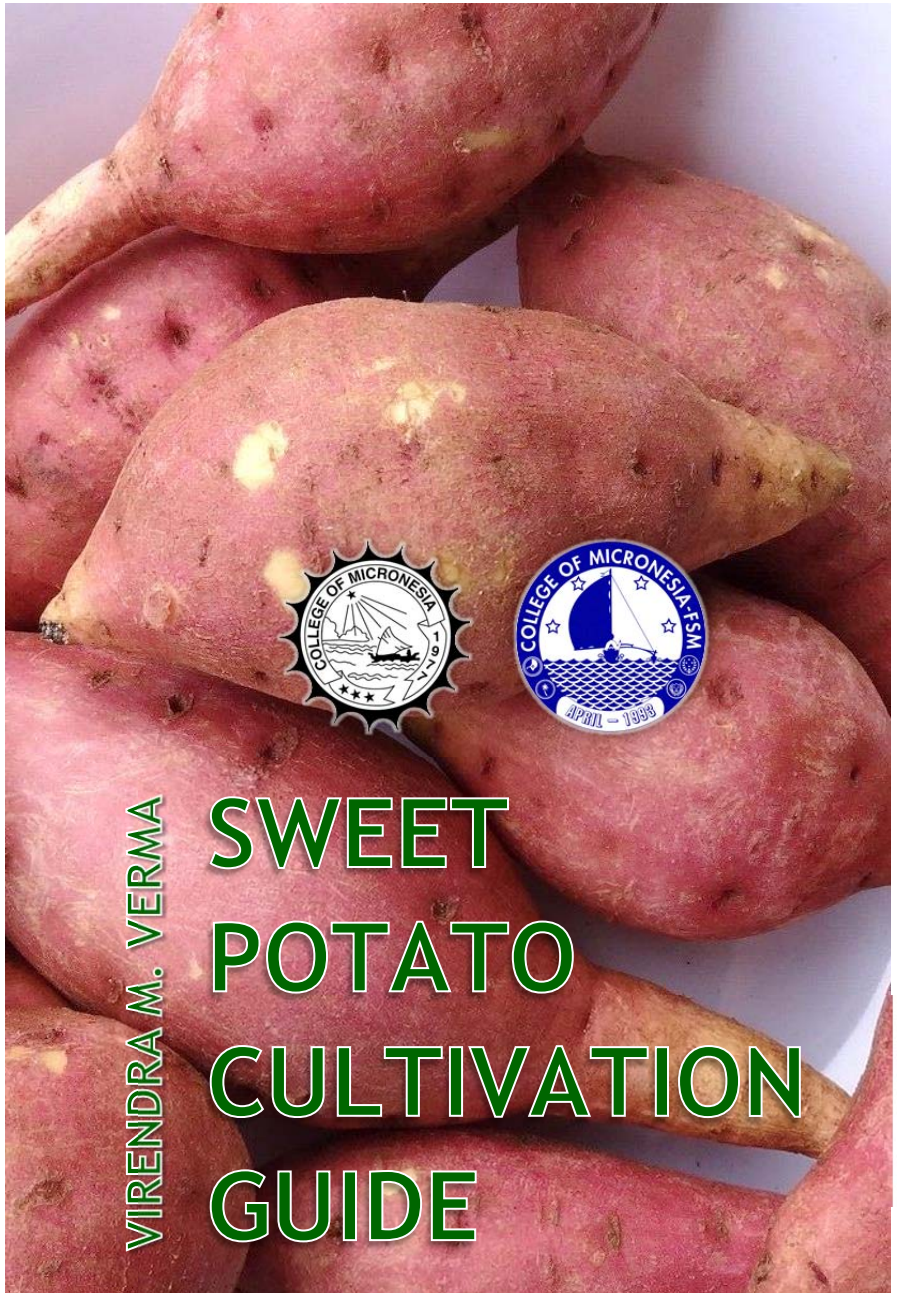

VIRENDRA M. VERMA

SWEET POTATO CULTIVATION GUIDE

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MICRONESIA PLANT PROPAGATION RESEARCH CENTER
KOSRAE AGRICULTURAL EXPERIMENT STATION
COOPERATIVE RESEARCH AND EXTENSION
COLLEGE OF MICRONESIA-FSM

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Cover Photograph

Harvested storage roots of sweet potato (SP-04) from the demonstration plot.

About the Author

Virendra M. Verma, Ph.D., is a Researcher, Extension Specialist and Project Director at the Kosrae Agricultural Experiment Station, Cooperative Research and Extension, College of Micronesia-FSM. The College of Micronesia-FSM is a land grant institution and the Kosrae Agricultural Experiment Station is financially supported by the United States Department of Agriculture - National Institute of Food and Agriculture (USDA-NIFA).

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SWEET POTATO CULTIVATION GUIDE

DR. VIRENDRA M. VERMA

Micronesia Plant Propagation Research Center ● Kosrae Agricultural Experiment Station ● Cooperative Research and Extension ● College of Micronesia-FSM

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Figure 19 Storage root of sweet potato (SP-03); and cooked sweet potato storage root

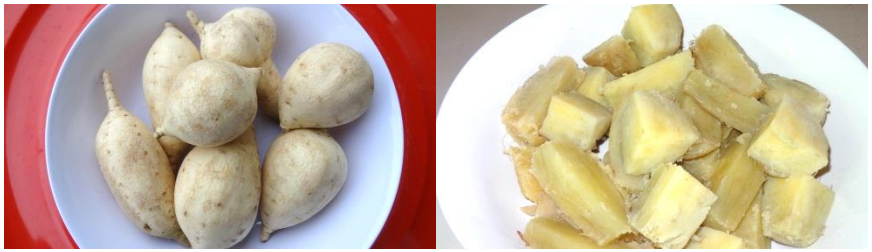

Figure 20 Storage root of sweet potato (SP-02); and cooked sweet potato storage root

Figure 21 Storage root of sweet potato (SP-01); and cooked sweet potato storage root

Figure 16 Storage root of sweet potato (SP-06); and Cooked sweet potato storage root

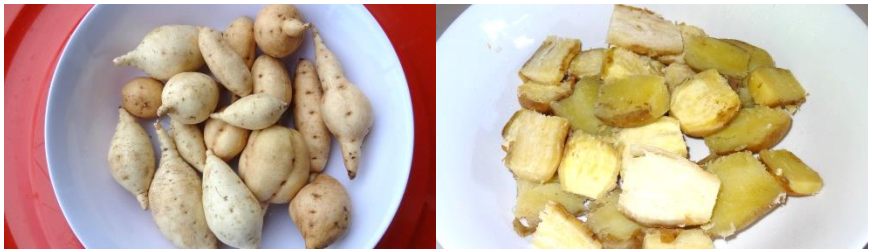

Figure 17 Storage root of sweet potato (SP-05); and cooked sweet potato storage root

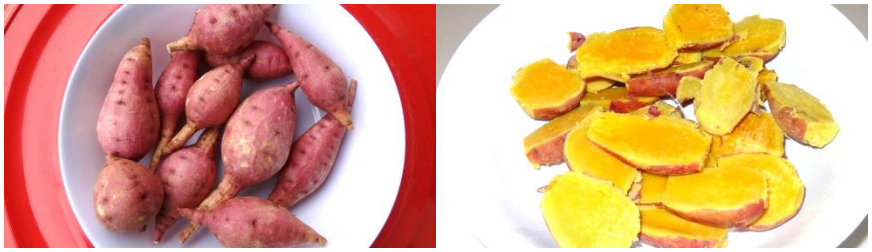

Figure 18 Storage root of sweet potato (SP-04); and cooked sweet potato storage root

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 help greatly in the economic development and growth through bringing food self-sufficiency in Micronesia. However, current agricultural programs in the country are mostly on a subsistence level, and economic development is largely dependent on the outside world. Serious damage caused by natural calamities such as wave surges, salt water flooding, and drought, continually pose challenge for the local farmers. Moreover, lack of technical know-how and changing life style along with the food habits of islanders, leading to an increase in the consumption of imported foodstuff; have led to an overall decline in local agricultural production.

With the effects of global climate change and the increasing occurrence of natural disasters, farmers must be aware of these disasters and adopt preventative measures to minimize their impact of on agricultural operations. Of all the cultivated root and tuber crops, sweet potato is probably the best at adapting quickly to new conditions. But still, its growth and development can be affected by adverse environmental conditions.

This extension publication is intended to provide farmers and producers with guidelines for cultivating sweet potato, *Ipomoea batatas* (L.) Lam. Recently, many countries have embraced sweet potato as a substitute for imported carbohydrates and for attaining national food security goals. The crop is also an important income earner for many small-scale producers and a foreign exchange earner for many countries. As such, there is a growing demand for sweet potato.

It is our hope that this publication will provide current and potential farmers and producers with practical information that will assist in increasing crop production and productivity of sweet potato.

CONTENTS

11. Storage

Only sound, whole roots that are free from disease and insect-pests are advised to be stored for long-term use. Framers are advised to wrap cured sweet potatoes in the newspapers and store them in a closet in which temperature should be between 13-16^{o}C as sweet potatoes are subject to chilling injuries below 10^{o}C. Outdoor pits are not ideal for storage due to dampness that becomes more aggravated in islands due to frequent rains.

12. Texture and Color

Storage roots of sweet potato varieties harvested from demonstration plots and steam cooked.

Figure 14 Storage root of sweet potato (SP-08); and cooked sweet potato storage root

Figure 15 Storage root of sweet potato (SP-07); and cooked sweet potato storage root

picked up simultaneously as they are dug.

Figure 11 Five-week old sweet potato plants showing healthy growth

Figure 12 Five-week old sweet potato plants showing healthy growth

Figure 13 Sweet potato storage roots; and Sweet potato storage roots, harvested from a single plant

10. Curing

Curing is essential to heal the wounds and improve the taste. After removing the excess soil, storage roots should be covered with newspaper to maintain required high humidity (85-90%) and should be packed in boxes. The boxes should be kept in shaded areas for 2-3 weeks where temperature should be maintained between 18-24^{o}C.

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, and Pohnpei reputedly is one of the wettest places on Earth, with up to 330 inches of rain per year. Tropical typhoons constitute an annual threat, particularly to the low-lying. 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 even dwindled up to emergency proportions.

Ipomoea batatas (L.) Lam. (sweet potato) ranks seventh in the world among food crops with respect to annual production. According to the International Potato Centre, today's inhabitants of the Pacific Islands are among the largest per capita consumers of sweet potato in the world. Sweet potato is a perennial, herbaceous plant of the family Convolvulaceae. It was probably originated in or near northwestern South America. Thousands of cultivars have been selected and cultivated in Latin America since ancient times. At the present time, it is cultivated throughout the tropics. However, the largest plantings of sweet potatoes are found in China and other countries of Asia. It is grown as an annual plant by vegetative propagation using either storage roots or stem cuttings. Sweet potato is an important food crop and is a highly functional low calorie food that contains various key nutrients. With growing concern among consumers about health and nature, the nutritional strengths of sweet potato are again attracting attention. Every sweet potato contains high levels of starch, along with abundant vitamins, minerals and dietary fiber. Indeed, sweet potato can be considered at least a semi-perfect food because it can provide an ideal meal when consumed in conjunction with proteins and fats. It is a hardy crop and can be grown in poor soils with little fertilizer.

Figure 1 Kosrae Agricultural Experiment Station

SWEET POTATO CULTIVATION

1. Climatic Conditions

Sweet potato requires both warm days and warm nights for a quality and quantity yield. Moist tropical environment of the islands with favorable abundant rain is suitable for cultivation throughout the year.

2. Soil Characteristics

To obtain maximum yield and better quality roots, well-drained soil is essential. Sandy-loam or slit-loam soils are best for growing sweet potatoes. Poor surface drainage and poor internal drainage will result in high moisture content and poor aeration, which will affect both quality and quantity of the yield. Poor surface drainage may cause wet spots while poor internal drainage could lead to large, misshapen, rough skinned cracked roots.

3. Field Preparation

It is ideal to prepare field at least two weeks before planting. The field should be cleared of trees, shrubs and grasses. It should be then dug 15-20 cm deep with a rototiller. Since the Micronesian islands have only 10-15 cm topsoil, it is highly recommended to prepare beds for sweet

Figure 9 Sweet potato green tortoise beetle, *Metriona circumdata* (Hbst.) feeds on the leaves, making large round/irregular holes and eventually skeletonizing the leaves (left); and close-up of sweet potato blue moon butterfly caterpillar *Hypolimnas bolina* (Linn.) (right)

Figure 10 Close-up of sweet potato hornworm, *Agrius convolvuli* (Linn.), larva of the Convolvulus hawkmoth; and close-up of sweet potato leaf, eaten by hornworm

9. Harvesting

Harvesting should be usually done 5-6 months after planting to obtain maximum yield, although smaller storage roots could be harvested up to a month earlier. Delayed digging is not advisable since excessive moisture of the wet soil can prevent digging injuries from healing eventually leading to decay of the roots. Digging should be done to remove the soil around the plant and expose the storage roots, which should be then pulled out gently avoiding skinning and bruising, otherwise, wounds can become easily infested with microorganisms. Harvested roots should be kept in baskets lined with rags to avoid scratching the roots. Roots should be allowed to dry and cure before removing excess soil to prevent damages in freshly dug sweet potatoes. Since, sunlight for over an hour can cause sunburns; the roots should be

Figure 8 Iron deficiency in sweet potato, causing symptoms varying from yellow interveinal chlorosis to complete bleaching of leaf blades, and necrosis on leaf blades and tip (left); and symptoms of zinc deficiency in sweet potato showing chlorosis and reduction in size of young leaves, narrowing of the leaf blade and a greater tendency of the lateral lobes to point more acutely towards the leaf tip. Internodes are also shortened below the tip (right)

7. Weed Control

Manual weeding could be done for initial 1 month and after this period; weeding is hardly needed since the veins cover the ground surface. If sweet potatoes of more than one variety are planted in the same field, to prevent mixing of the varieties veins are lifted to their original ridges, whenever the need arises.

8. Insect-Pests and Diseases

Three to five year rotation cycle is recommended to prevent soil-borne pathogens. Farmers are encouraged to use disease free planting material, such as slips from micropropagated plants and are advised to inspect transplants and/or roots for disease symptoms (soft rot, dry rot, discolored lesions) and should discard all diseased planting material. Cultivation of different varieties in a single farm also restricts the occurrence of insect-pest and diseases. Sweet potatoes in Micronesia have few insect-pests. The most common are sweet potato hornworm, *Agrius convolvuli* (Linn.); sweet potato blue moon butterfly caterpillar, *Hypolimnas bolina* (Linn.); and sweet potato tortoise beetle, *Metriona circumdata* (Hbst.).

potato cultivation. 20-25 cm high ridges are made spaced 150 cm apart. For making a 90 cm wider bed, 30 cm soil from each side should be lifted and placed on the bed to achieve required ridge height. The ridges should be allowed to settle for 7 days and then the tops should be flattened.

4. Preparation of Planting Material

To avoid disease transmission through roots and facilitate the availability of required number of plants, slips (transplants) should be used as planting material. These slips should be taken from hardened micropropagated plants that should be maintained in pots filled with mixture of fine sieved sand and compost in nursery cum greenhouse. Slips of 25-30 cm length with at least 5-6 leaves should be cut and planted immediately in a newly prepared field in case of local plantations. However, 1-2 days old slips that are packed carefully and kept moist could be used for outer island plantations.

Figure 2 Tissue culture multiplication of sweet potato

Figure 3 Tissue culture multiplied sweet potato plantlet; and acclimatized sweet potato seedlings in nursery

5. Planting

Plants should be set 30 cm apart in the row with one third of the basal portion covered with the soil. The plants should be watered immediately to establish good soil-to-root contact. A starter solution (1-2 tablespoons of low-analysis fertilizer such as 12-12-12 nitrogen, phosphorus, and potassium per 4 liter of water) could be used to water the plants.

Figure 4 Sweet potatoes planting on beds

Figure 5 Close-up views of sweet potato 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 more profitable and prevents too rapid growth. Considering the poor, nutrient deficient nature of the island soils, it is ideal to make first application of compost (5-7 cm layer all over the bed) along with fertilizer 5-10-10 (nitrogen, phosphorus, and potassium, at the rate of 1.25 kg per 30 square meter), two weeks prior to planting time, and few centimeters under the ridge. Application of only inorganic fertilizer is not rewarding because of

porous texture of island soils. Sweet potato requires only moderate amounts of nitrogen. Excessive nitrogen amounts may result in vigorous vine growth leading to cracked, misshapen roots of poor storage quality. To ensure good yield, second dose of compost (15 kg per 10 linear meter) and fertilizer 5-10-10 (nitrogen, phosphorus, and potassium; 400 gm per 10 linear meter) should be applied to both sides as side dressing with a distance of 15-20 cm from plants when plants attain an age of two weeks and fresh growth has begun.

Figure 6 Symptoms of magnesium deficiency in sweet potato, showing purple-red-brown pigmentation of the upper surface of interveinal tissue (left); and typical symptoms of phosphorus deficiency are evident, including purpling and subsequent yellowing of older leaves in sweet potato and interveinal chlorotic zones developing to necrosis on an older leaf (right)

Figure 7 Symptoms of magnesium deficiency, five-weeks-old sweet potato, showing purple-brown pigmentation of the upper surface of interveinal tissue. Pigmentation occurs initially near the leaf margin and later spreads over all interveinal zones