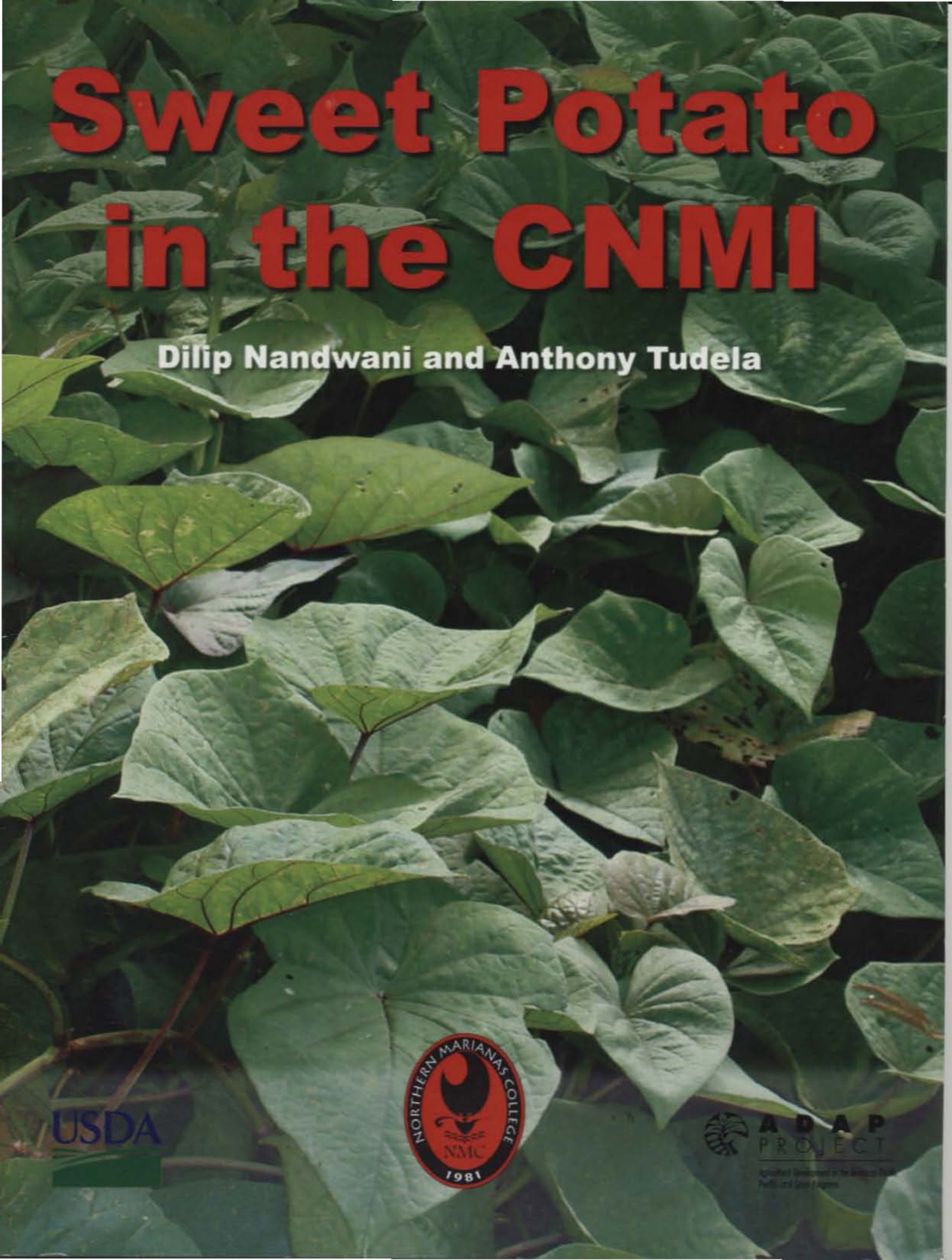
Sweet Potato in the CNMI

Dilip Nandwani and Anthony Tudela



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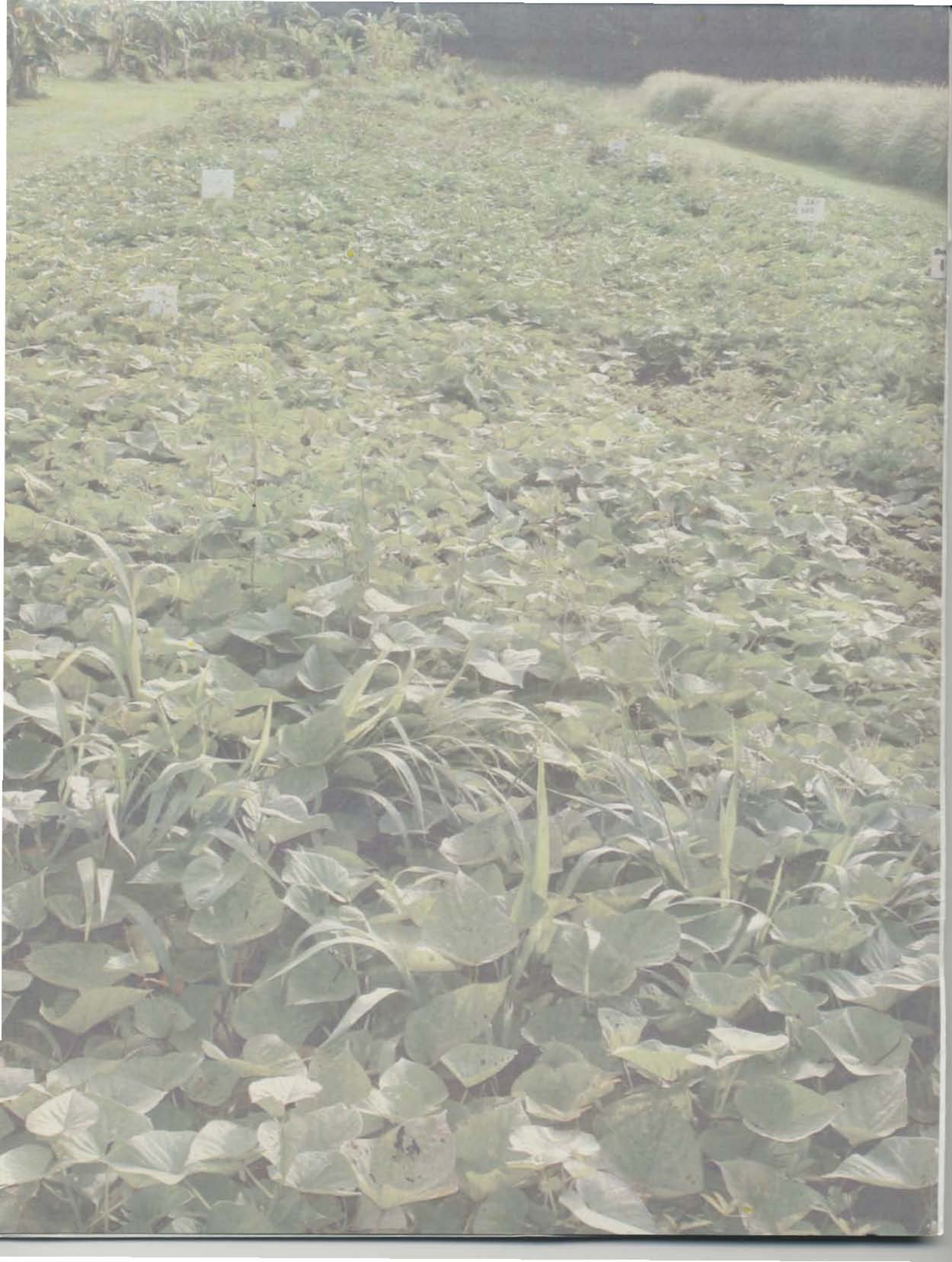

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Information in this booklet is provided as general advice only.
For application in specific cases, contact your
NMC-CREES Extension Agent

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Introduction

The sweet potato has been a staple food for Pacific islanders for centuries, and is the most widely produced crop in the CNMI. It is very important to a healthy nutrition based on its high contents of fibrous starches, potassium, iron, calcium, and several vitamins. Being ingrained into the islands' culture for so long, there are many ways to prepare a meal from sweet potato. The tubers are baked, roasted or boiled. The leaves are also a significant source of vitamins, especially folic acid. Leaves, especially trilobed ones, like from the IB 234 variety, are well suited to be cooked in a soup. Sweet potato can be grown in a back yard, as well as on a commercial farm. Major producer in the CNMI is the island of Rota. Due to the small population, not much is consumed on Rota, and over 50% of commercially produced sweet potato is exported to Guam. The balance is shipped to Saipan.

Traditional planting methods using shoot tips for Sweet Potato are time consuming and labor intensive. If the parent plant is infected with diseases, they are transmissible to the next generation, in spite of the application of fungicide or insecticide. Most commonly, diseases spread to new crops when infected cuttings are used as propagating material . Tissue culture is considered the most potential system to achieve the goals of producing quality and disease-free planting material. High production costs due to increased labor and management, spread of soil-born diseases and pests, limited genetic diversity and shortage of quality planting material are the major constraints of Sweet Potato production in the CNMI. Among the diseases, Bacterial wilt, Scab, Anthracnose, Stem and Root rot are the common in the CNMI. To meet the challenges in sweet potato cultivation, Northern Marianas College's Cooperative Research, Extension and Education Service (NMC-CREES) initiated a tissue culture program on sweet potato in 2006 for the production of disease-free and quality propagating materials. After screening new varieties of the materials obtained from CePCT (SPC, Fiji) on the Agriculture Experiment Station and on-farm trials. Selected varieties propagated through tissue culture were distributed to the local farming community. This publication reports the results of field evaluations of intoduced sweet potato varieties (tissue cultured) in the local soil and climatic conditions of the CNMI.

Sweet potato variety trial on Tinian

Growing Sweet Potato

Being a tropical Root Crop, sweet potato is perfectly suited to be grown in the CNMI. Its production, however, requires a great deal of effort and good cultural practices for high yields and quality. Using good seed stocks, suitable soil and careful harvesting will yield approximately 2-3 pounds per plant on average.

Sweet potato grows best in well drained, sandy loam or silt loam soil with surface and internal drainage for aeration. Optimum soil pH is 5.7-6.0, though the crop tolerates pH between 5.0 and 6.8. Plants grown in poor soil produce large, misshapen, cracked and rough skinned tubers. To reduce soil born diseases, the crops should be rotated every three years.

Sweet potoato doesn't need too much water. Rainfalls during the rainig season in the CNMI are adequate. Only during dry season they should be irrigated.

Local varieties are well adapted to the CNMI's soil and climate conditions. NMC-CREES has been testing introduced varieties throughout the islands of Saipan, Tinian and Rota to find the most suitable variety in regards to market preference.

However, the producer still has to choose the best planting material from disease-free soil to obtain maximum yields and profits. Only through maintenance of seed stock, one will achieve a sustainable harvest year after year.

Jumbo tubers with deformities

Prior to planting, new bedding material should be sterilized with an approved fumigant. Beds should be fertilized with a complete fertilizer, like 10-10-10 or 12-12-12, 2 pounds per 100 square feet. The fertilizer should be mixed into the soil.

Slips should be set deep, with at least three nodes (joints where leaves attach) below ground level. Spacing between plants should be approximately one foot, with 3 feet between rows. Too wide or too close a spacing result in stucture deformities in tubers, such as excessive size (jumbo), rough tubers with cracked skin or undersized roots.

Depending on variety and marketable size, sweet potato can be harvested after three to five months. Sweet potato can be stored for storage and curing in the same containers that were used for harvest. Harvested roots can be stored without wahing them for later marketing or seed stock in a proper ventilated and humid place at about 60˚F.

Pests and Dieseases on Sweet Potato

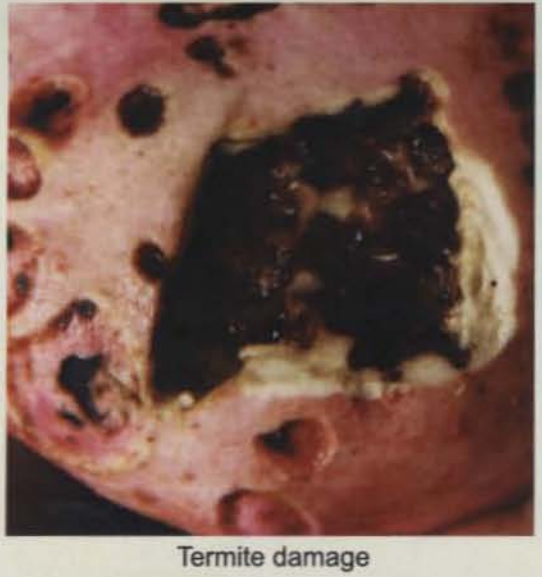
Sweet Potato Weevil (*Cylas formicarius elegantulus*), West Indian Sweet Potato Weevil (*Euscepsis postfaciatus*), Flee Beetle (*Chaetocnema affinis*), Katydid (Phaneroptera furifera), Grasshopper (*Locusta migratoria manilensis*), and Rodents were the main pests causing damage to the crops.

Bacterial stem and Root rot (*Erwinia chrysanthemi*), Leaf spot and Stem blight (*Alternaria* spp.), Scab (*Elsinoe batatas*) and Anthracnose (*Collectrotrichum* spp.) were observed among the diseases.

Effective disease control:
- Proper maintenance, harvesting, and storage methods prevent diseases.
- Crop rotation: Sweet potatoes should be rotated with other crops on a 3- or 4-year cycle, so that soil-borne pathogens do not progress.
- Use of disease-free planting material (tissue culture). Inspect transplants and/or roots for disease symptoms (soft rot, dry rot, discolored lesions) and discard all diseased planting material.
- Use resistant/disease-tolerant cultivars.

Weed control: By maintaining ridge height and shape, shallow cultivation or mulch. In large plantings, herbicides can be used with the latest recommendations. Insect pest control needed particularly on young plants. Severe damage may necessitate replanting.
After harvest, crops can be treated with chemical fumigants or irradiation to prevent damage in storage. When potatoes are stored in atmospheres with low oxygen and high carbon dioxide, the weevils will perish.

Before you use any chemicals, make sure you have read and understand the instructions on the labels. If you have any questions in regards to treatment of pests and diseases, contact your NMC-CREES Extension Agent or call the NMC Entomology Lab at 234-5498 x1432.



Termite damage

Black rot

Bacterial wilt damage

Flea beetle damage

Rodent damage

Structural deformities (cracked skin)

Sweet potato weevil damage

Root knot blisters

Tissue Culture
(Micro Propagation)

To obtain the best results, NMC-CREES used tissue culture plants of 17 varieties obtained from the Center of Pacific Crops and Trees (CePCT) of the Secretariat of the Pacific Community (SPC). These varieties proved to be disease free and tolerant to insect pests, and to have superior agronomic characteristics.

Tissue Culture involves four steps: Sweet potato shoot tips (~ 1/2" long) collected from field-grown plants, washed with running tap water in the lab, are dipped into chlorox solution for about ten minutes. Then the shoot tips (explants) are transferred onto a growth medium in a clean, microbe-free environment in sterilized containers, kept in a controlled environment. Over a few weeks, the shoot tips produce tiny buds which develop into plants with roots. After a while, these sweet potato shoots will be hardened in a greenhouse to be finally transplanted in the field.

For their variety trials, NMC-CREES multiplied tissue cultured plants in its lab, and sent these plants to Tinian and Rota for preliminary trials.

Shoot bud induction on growth medium

Shoots multiplication (left)
well developed shoots with roots (right)

Hardening of tissue culture plants in the greenhouse

Tissue cultured plants transferred to the experimental field after hardening

Taste testing

All the effort one puts into farming would make no sense if the products weren't marketable. Appearance and taste are most important factors for consumers. Therefore, the new varieties were evaluated for eating quality by taste testing after harvesting. Tubers of all 17 varieties were harvested, cleaned, washed and prepared for the taste testing (sensory evaluation). Tubers were boiled, peeled off and cut into small pieces. All the varieties were displayed in aluminum foil trays and labeled.

Five taste testings events were conducted; two on the island of Saipan in January 2008 and January 2009, two on Rota in August and November 2008, and one on Tinian in August 2008.

A survey form was prepared for the participants to fill out during each taste testing. Participants of ages from 18 to 65 years (male and female both) including youths, students, faculty, researchers and extension agents, farmers, in the community participated in the testing.

Around 80 participants evaluated the cooked tubers in the events held on Saipan in January 2008 during a field day held on the NMC-CREES Agriculture Experiment Station in As Perdido.

Approximately 35 participants, mainly students, faculty, staff and administrators took part in the testing event held on NMC's campus in January 2009 in Saipan. The two events on Rota had over 100 participants, students, manamko, ADAP summer interns, NMC-CREES staff and local farmers. 15 people participated in the Tinian taste testing event.

Data were collected on taste, texture and acceptability of tubers through survey form and interviewing the people.

The following pages will show the results of the taste testing events. The data on agronomic characteristics are the average of at least 12 plants of each variety. Results may vary with farm location, soil and other conditions.

var. IB 083 (IGI)

Ipomea batata (L.) Lam.

Origin:	**Solomon Islands**
Avg. Tuber Weight (lb):	**0.15**
Yield/Plant (lb):	**1.5**
Tuber Size:	**3.5"**
Maturing:	**3-5 mo.**

Skin Color:	**Light Purple**
Flesh Color:	**White/Pale Yellow**
Color Cooked:	**Yellow**
Texture:	**Soft**
Taste:	**Best**

Pests and Diseases:	**Katydid** **Short Horn-Grasshopper** **Rodents**
Resistance:	**Highly Tolerant**
Weevil Damage:	**None**

var. IB 087 (WV5)

Ipomea batata (L.) Lam.

Origin:	**Solomon Islands**
Avg. Tuber Weight (lb):	**0.80**
Yield/Plant (lb):	**1.8**
Tuber Size:	**6.0"**
Maturing:	**3-5 mo.**

Skin Color:	**White**
Flesh Color:	**Pale Yellow**
Color Cooked:	**White**
Texture:	**Soft, Moist**
Taste:	**Best**

Pests and Diseases:	**Katydid**
	Grasshopper
	Rodents
	Flee Beetle
Resistance:	**Tolerant**
Weevil Damage:	**Low**

var. IB 195 (Kuma 2)

Ipomea batata (L.) Lam.

Origin:	Solomon Islands
Avg. Tuber Weight (lb):	1.12
Yield/Plant (lb):	3.2
Tuber Size:	6.0"
Maturing:	3-5 mo.

Skin Color:	Purple
Flesh Color:	White
Color Cooked:	White
Texture:	Hard, Dry
Taste:	Good

Pests and Diseases: N/A

Resistance:	Tolerant
Weevil Damage:	High

var. IB 197 (Toni)

Ipomea batata (L.) Lam.

Origin:	**Solomon Islands**
Avg. Tuber Weight (lb):	**0.44**
Yield/Plant (lb):	**1.9**
Tuber Size:	**4.0"**
Maturing:	**3-5 mo.**

Skin Color:	**White**
Flesh Color:	**White**
Color Cooked:	**Yellow**
Texture:	**Soft, Dry**
Taste:	**Good**

Pests and Diseases: **N/A**

Resistance:	**Tolerant**
Weevil Damage:	**None**

var. IB 216 (Anuta 2)

Ipomea batata (L.) Lam.

Origin:	**Solomon Islands**
Avg. Tuber Weight (lb):	**0.46**
Yield/Plant (lb):	**3.1**
Tuber Size:	**4.0"**
Maturing:	**3-5 mo.**

Skin Color:	**Light Purple**
Flesh Color:	**White**
Color Cooked:	**Yellow**
Texture:	**Semi-Hard, Dry**
Taste:	**Acceptable**

Pests and Diseases: **N/A**

Resistance:	**Tolerant**
Weevil Damage:	**High**

var. IB 218 (Dorio)

Ipomea batata (L.) Lam.

Origin:	**Solomon Islands**
Avg. Tuber Weight (lb):	**0.50**
Yield/Plant (lb):	**2.4**
Tuber Size:	**4.0"**
Maturing:	**3-5 mo.**

Skin Color:	**White**
Flesh Color:	**White**
Color Cooked:	**Yellow**
Texture:	**Soft**
Taste:	**Best**

Pests and Diseases: **N/A**

Resistance:	**Tolerant**
Weevil Damage:	**None**

var. IB 234 (Jimi)

Ipomea batata (L.) Lam.

Origin:	**Solomon Islands**
Avg. Tuber Weight (lb):	**0.57**
Yield/Plant (lb):	**1.6**
Tuber Size:	**7.0"**
Maturing:	**3-5 mo.**

Skin Color:	**White**
Flesh Color:	**White**
Color Cooked:	**White**
Texture:	**Hard, Moist**
Taste:	**Best**

Pests and Diseases: N/A

Resistance:	**Tolerant**
Weevil Damage:	**Low**

var. IB 285 (SI 267)

Ipomea batata (L.) Lam.

Origin:	**Solomon Islands**
Avg. Tuber Weight (lb):	**1.32**
Yield/Plant (lb):	**2.9**
Tuber Size:	**7.0"**
Maturing:	**3-5 mo.**

Skin Color:	**Light Purple**
Flesh Color:	**White**
Color Cooked:	**White**
Texture:	**Soft**
Taste:	**Best**

Pests and Diseases: N/A

Resistance:	**Highly Tolerant**
Weevil Damage:	**Low**

var. IB 17-01 (ACC 213)

Ipomea batata (L.) Lam.

Origin:	**Solomon Islands**
Avg. Tuber Weight (lb):	**0.56**
Yield/Plant (lb):	**3.2**
Tuber Size:	**5.0"**
Maturing:	**3-5 mo.**

Skin Color:	**Purple**
Flesh Color:	**White**
Color Cooked:	**Yellow**
Texture:	**Hard, Moist**
Taste:	**Best**

Pests and Diseases: **Bacterial Wilt**

Resistance:	**Tolerant**
Weevil Damage:	**Low**

var. IB 17-02 (ACC 268)

Ipomea batata (L.) Lam.

Origin: Solomon Islands
Avg. Tuber Weight (lb): 0.47
Yield/Plant (lb): 3.1
Tuber Size: 5.0"
Maturing: 3-5 mo.

Skin Color: Purple
Flesh Color: Pale Yellow
Color Cooked: Yellow
Texture: Hard, Moist
Taste: Best

Pests and Diseases: N/A

Resistance: Highly Tolerant
Weevil Damage: None

var. IB 098

Ipomea batata (L.) Lam.

Origin:	**PNG**
Avg. Tuber Weight (lb):	**0.33**
Yield/Plant (lb):	**2.0**
Tuber Size:	**5.5"**
Maturing:	**3-5 mo.**

Skin Color:	**Purple**
Flesh Color:	**Pale Yellow/Orange**
Color Cooked:	**White**
Texture:	**Semi-Hard**
Taste:	**Good**

Pests and Diseases: Rodents

Resistance:	**Suspectible (Rot)**
Weevil Damage:	**High**

var. IB 111 (Kekori)

Ipomea batata (L.) Lam.

Origin:	**PNG**
Avg. Tuber Weight (lb):	**0.24**
Yield/Plant (lb):	**2.1**
Tuber Size:	**4.5"**
Maturing:	**3-5 mo.**

Skin Color:	**White**
Flesh Color:	**White**
Color Cooked:	**Yellow**
Texture:	**Soft, Dry**
Taste:	**Acceptable**

Pests and Diseases: Katydid
Short Horn Grasshopper
Rodents
Flea Beetle

Resistance: Tolerant

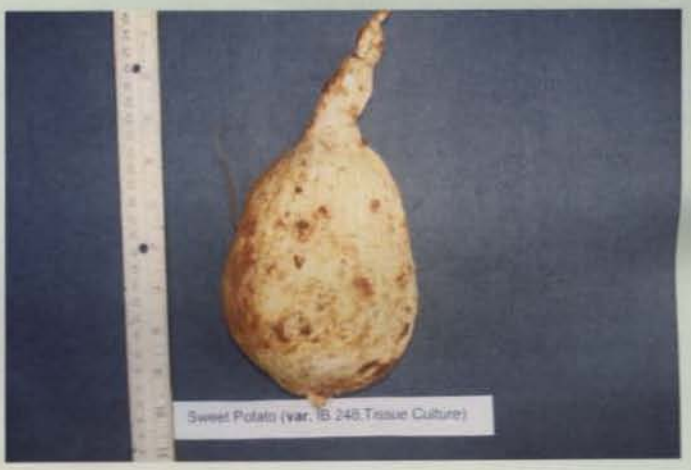
Weevil Damage: None

var. IB 248 (PO16)

Ipomea batata (L.) Lam.

Origin:	**PNG**
Avg. Tuber Weight (lb):	**1.02**
Yield/Plant (lb):	**2.3**
Tuber Size:	**5.5"**
Maturing:	**3-5 mo.**

Skin Color:	**White**
Flesh Color:	**Pale Yellow**
Color Cooked:	**White**
Texture:	**Semi-Hard**
Taste:	**Best**



Pests and Diseases: **N/A**

Resistance:	**Highly Tolerant**
Weevil Damage:	**Low**

var. IB 283 (PNG 1164)

Ipomea batata (L.) Lam.

Origin:	**PNG**
Avg. Tuber Weight (lb):	**1.00**
Yield/Plant (lb):	**1.7**
Tuber Size:	**7.0"**
Maturing:	**3-5 mo.**

Skin Color:	**White**
Flesh Color:	**Pale White**
Color Cooked:	**Yellow**
Texture:	**Soft**
Taste:	**Acceptable**

Pests and Diseases: Leaf Miner

Resistance:	**Suspectible (Root Rot)**
Weevil Damage:	**Low**

var. IB 288 (RB 455)

Ipomea batata (L.) Lam.

Origin:	N/A
Avg. Tuber Weight (lb):	0.58
Yield/Plant (lb):	1.6
Tuber Size:	6.0"
Maturing:	3-5 mo.

Skin Color:	Purple
Flesh Color:	Pale Yellow
Color Cooked:	Yellow
Texture:	Soft, Dry
Taste:	Good

Pests and Diseases: N/A

Resistance:	Suspectible (Root Rot)
Weevil Damage:	None

var. IB 294 (G 214)

Ipomea batata (L.) Lam.

Origin:	**N/A**
Avg. Tuber Weight (lb):	**0.66**
Yield/Plant (lb):	**1.4**
Tuber Size:	**6.5"**
Maturing:	**3-5 mo.**

Skin Color:	**Light Purple**
Flesh Color:	**Yellow**
Color Cooked:	**Yellow**
Texture:	**Soft**
Taste:	**Best**

Pests and Diseases: **N/A**

Resistance:	**Tolerant**
Weevil Damage:	**Moderate**

var. IB 291 (RB 3570)

Ipomea batata (L.) Lam.

Origin:	**N/A**
Avg. Tuber Weight (lb):	**0.62**
Yield/Plant (lb):	**1.9**
Tuber Size:	**5.5"**
Maturing:	**3-5 mo.**

Skin Color:	**Purple**
Flesh Color:	**Pale Yellow**
Color Cooked:	**Yellow**
Texture:	**Soft, Moist**
Taste:	**Good**

Pests and Diseases: **N/A**

Resistance:	**N/A**
Weevil Damage:	**Low**

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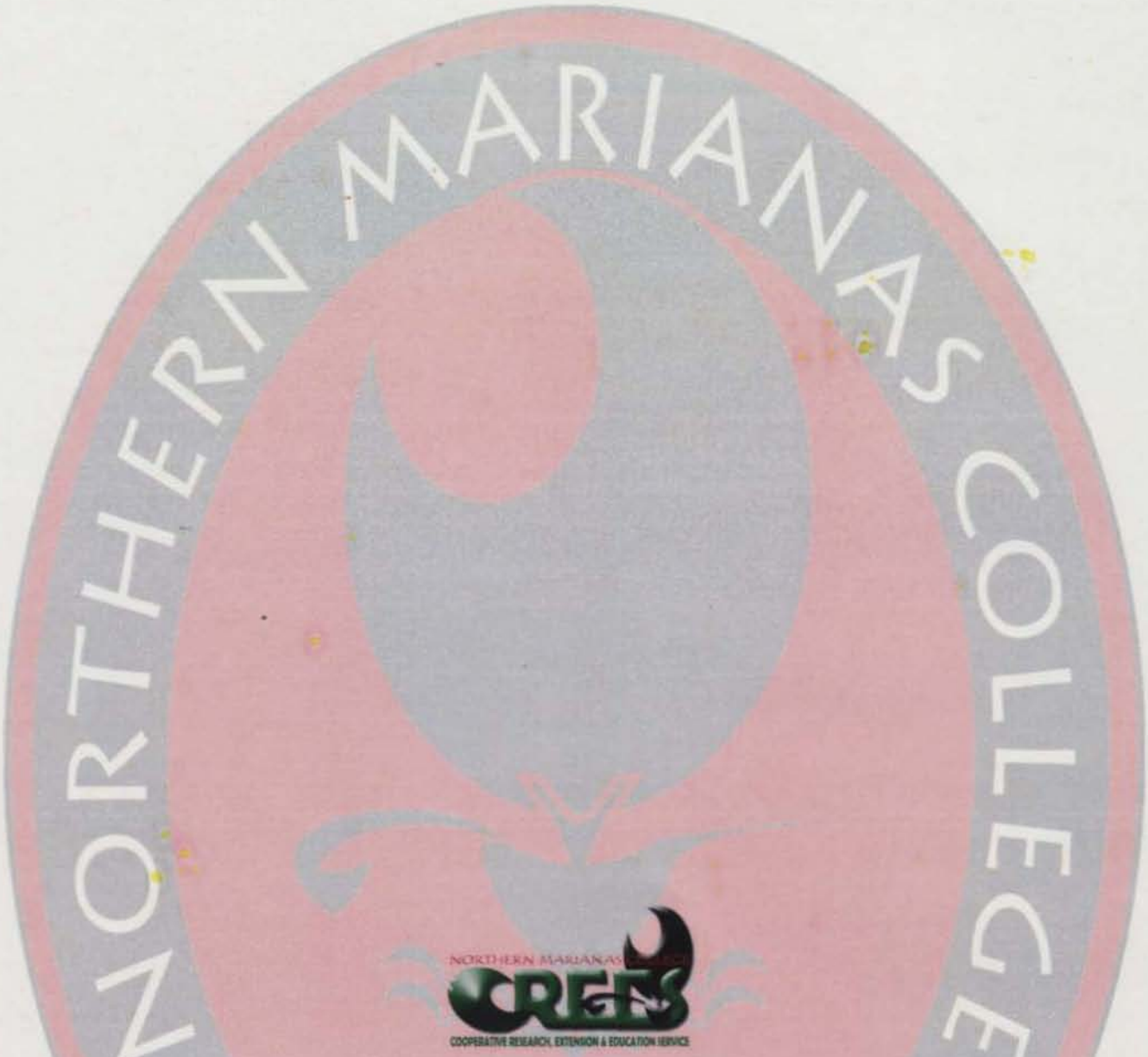

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