TECHNOGUIDE
IN PEST AND DISEASE MANAGEMENT AND RECIPES FOR
ROOTCROPS
CASSAVA & YAM
Root crops are the third most important crop in the Philippines, after rice and corn. They are traditional crops that are easy to cultivate and can easily adapt to a broad range of agro-ecological conditions.

The common root crops grown in the country are cassava, sweet potato, yam, ube, arrowroot, tugui, and singkamas. These crops have wide ecological adaptability, low input requirement and are planted extensively in marginal areas.

Of the above-mentioned common crops grown in the country, CHARM2 Project areas in the Cordillera have identified sweet potato, cassava, yam and taro as one of their priority commodities.

Consumption of root crops is closely related to the income levels, with the low income group having higher intake of root crops. It is probably due to the psychological biases that are associated to root crops (i.e. survival food, poor man’s food).

However, their contribution to world food security is essential, particularly in developing countries including the Philippines. The CHARM2 Project recognizes this; thus, among its goals are poverty alleviation, food security and increase in farm family income.

The Project also acknowledges the importance of root crops in their potential to substitute to rice, their use as source of starch, or an important ingredient for the yet untapped processing potential.

With the Scaling-Up of the CHARM2 Project, we would like to promote root crops beyond it being a “survival” food.

Thus, this technoguide in pest and disease management of root crops, particularly of Cassava and Yam, aims to guide farmers in the production of root crops and manage pest and disease of said crops to help them in the production of quality products.
ABOUT THE CROP

Cassava is the third-largest source of food carbohydrates in the tropics. Cassava is a major staple food in the developing world, providing a basic diet for around 502 million people. It is one of the most drought-tolerant crops, capable of growing on marginal soils. Nigeria is the world’s largest producer of cassava.

Cassava (Manihot esculentalin), also called yucca (Spanish), manioc (French), mandioca (Portuguese), and kamoteng kahoy (Filipino), a woody shrub of the Euphorbiaceae (spurge family) native to South America, is extensively cultivated as an annual crop in tropical and subtropical regions for its edible starchy, tuberous root, a major source of carbohydrates. Cassava, when dried to a starchy, powdery (or pearly) extract is called tapioca, while its fermented, flaky version is named garri.

Cassava is a perennial shrub, which can sometimes reach the size of a small tree. Its stems vary in color from pale to dirty white to brown marked by numerous nodes formed by scars left by fallen leaves. Pale to dark-green leaves are fan-shaped, with five to nine lobes.

Roots of cassava plants are few and shallow and some become storage roots. These are clustered around the base of the plant and extend about 60 cm on all sides. It is for these roots, which contain 15%-40% starch, that the crop is cultivated.

Under favorable conditions, a single root may weigh as much as four kilograms. The number of roots per plant at harvest varies from two to seven each averaging 27.7 cm to 43.3 cm long and 4.5 cm to 7.4 cm in diameter.

Cassava root is a good source of carbohydrates, but a poor source of protein. A predominantly cassava root diet can cause protein-energy malnutrition.
PEST AND DISEASES MANAGEMENT

There is no serious pest and disease that attack the cassava plant. The use of chemicals is not practical, or economical. To avoid the attack of pests, apply crop rotation or burn all the infested or infected plants. However the following major pests and diseases are found attacking cassava plant.

PESTS

1. TWO-SPOTTED SPIDER MITES
   (*Tetranychus kanzawai Kishida*)
   **Damages**
   a. Yellow stipplings or tiny dots on the surface of the leaves.
   b. Dots spread and later coalesce resulting in complete yellowing and gradual browning.
   c. Defoliation occurs during heavy infestation
   **Control**
   a. Use biological control by releasing predatory mites (*Amblyseius longispinosus* and *A. semiregularis* in infested area
   b. Use resistant or tolerant varieties like Vassourinha and CMC40

2. SCALE INSECTS
   **Damages**
   a. Grayish brown circular or ovoid discs on the stem surface.
   b. Presence of cottony substance during heavy infestation.
   c. Reduction in the germination rate of planting materials.
   **Control**
   a. Remove and burn infected plants.
   b. Use healthy planting materials.
1. **CERCOSPORA LEAF SPOT**  
(*Cercospora henningsii Allesch.*)

*Cercospora* spp. Induce leaf spot of cassava but the most important is the *Cercospora henningsii*. It occurs in the lower canopy of crops more than five months old. The disease is favored by high temperature and humidity. *Cercospora* leaf spot complex can cause yield loss up to 20%.

**Symptoms**
Symptoms are visible on both sides of the lamina but are more pronounce on the upper surface where the spots are uniform brown with distinct brown borders. Spots are generally 3-12 mm diameter and roughly circular but becoming more irregular as they enlarge. A yellow halo around the spot is observed in some varieties. The leaves turn yellow, dry and eventually fall off as the disease progresses.

**Control**
- a. Cut and burn severely affected plants
- b. Use disease-free planting materials
- c. Wider spacing of planted cassava
2. CASSAVA BACTERIAL BLIGHT

[Xanthomonas camæstris pv. Manihotis (Berthet and Bondar) Dye]

Cassava bacterial blight (CCB) is the most serious bacterial disease of cassava. Strong genotype environment interaction occurs and losses varies with variety, ecozone and weather condition. Disease outbreaks and associated loss are unpredictable.

**Symptoms**

Infected plants show typical water-soaked angular spots, leaf blight, leaf fall and formation of cankers on the stem. In severe cases, shoot die-back and typical candle sticks symptoms are observed. The pathogen invades the plant system and the seed but often producing no symptom initially. The bacterium may survive for a considerable period within the seed.

**Control**

a. Practice crop sanitation.
b. Plant resistant varieties or cultivars.
c. Crop rotation method to completely break the life of the pathogen.
d. Cut and burn infected plants.
e. Apply potash to reduce the severity of the disease.

Sample layout for crop rotation
3. WITCHES BROOM
(*Phytoplasma candidates asteris*)

Cassava Witches’ Broom is the most destructive new systemic disease of cassava. It is caused by specialized bacteria, *Phytoplasma*. The disease reduces root yield and starch content significantly. Total yield loss may occur if symptoms appear on the onset of crop establishment.

**Symptoms**
Infected plants show wide range of symptoms. Symptomatic indications are stunted growth and general plant decay. Visible symptoms include yellowing and purpling of leaves, shortening of internodes resulting to bouquet-like appearance of top portion of the plant. Profuse lateral branches are produced in highly susceptible varieties. White pith turn brownish and water- soaked in infected stem.

**Control**
a. Use healthy planting materials, restrict movement.
b. Treat planting materials with antibiotics.
c. Uproot infected plants, dry and burn.
Yam is a tubular starchy root crop that is closely related to lilies and grasses. Yams are very long tubers, cylindrical, has rough, scaly skin and a light colored flesh. The flesh tends to be dry and starchy and must be cooked prior to eating. Yams can grow up to five feet long and weigh up to 150 pounds.

Depending on the demographics, as well as the variety of this crop, yam can grow to varied sizes from being as small as potatoes to almost seven feet. Generally, the skin color of the root ranges from light cream to dark brown. The flesh of yams can also vary in color from off-white to yellow and even pink and purple.

In the Philippines, the most common yam variety is the water yam or ubi (*Dioscorea alata*). This is also known as purple yam, because of its color. It is native to Southeast Asia; however, grown in Africa, Pacific Islands, West Indies and also Hawaii where the vegetable was brought in by Polynesian settlers. The variety of yam is also available in Vietnam and India where it is called “ratalu”.

Yams are an important staple food in many parts of Africa, where they are most often boiled, fried, or roasted. The ability of yams to be stored for up to six months at a time allows for a dependable food source during rainy seasons or other poor growing conditions. It is for this reason that yams have become a prominent staple food in this region of the world.

Yams also have many other good qualities. They are very nutritious, and can be cooked in a variety of ways. Yams maybe mixed with many foods to make tasty dishes. In some cultures, special varieties are known to be a valuable food for ceremonial occasions.
Insect Pest

A. GOLDEN TORTOISE BEETLES
-the adult feed on the yam leaves and the larva feeds on the tubers

B. KATYDID
-they feed on young leaves

C. GRASSHOPPERS
- these feed on the leaves from emergence to full vegetation

D. APHIDS
-these attack the plants by sucking the underneath tissues, resulting in the curling of the leaves which later fall-off.

E. TERMITES, SCEARUS FLIES AND WEEVILS OF VARIOUS KINDS
-these damage the upper and underground parts of the plants.

F. NEMATODES
-these attack only the underground parts especially the tubers at any stage.
Major Diseases

A. FUNGAL DISEASE
-is known to do great damage in the Philippines

B. LEAF SPOT/ANTHRACNOSE
-can cause very serious damage to plants. Usually starting in July or August, they appear as angular or circular dark brown spots on the leaves, some spots may coalesce to form larger spots. In severe cases, stem are also affected, thereby causing the entire foliage to dry up prematurely.

C. ORANGE GALLS
-appear as thickened orange specks on the leaves. Like leaf spot and anthracnose disease, it is usually observed during rainy season.

D. TUBERS ROTs
-may be observed in the field or during storage, but are usually more common and serious in the latter. They observed as dark brown or decayed black portion of the tuber. The disease part may either be dry and moist.
Control measures of Insect Pests

Crop rotation, use of resistant cultivars, rouging or removing from the field all plants showing severe infection and by spraying with any systemic and contact insecticide except for nematodes which may be controlled by the use of nematocide mixed with the soil at planting or to be applied side dressing.

Control Measures of Diseases

A. Fungal disease
-use only sets obtained from healthy tubers of healthy plants and always burn residues of infested plants.

B. Leaf Spot/Anthracnose and Orange Galls
-if uncontrolled spray the plants with a fungicide every two weeks.

C. Tubers Rots
-cut away the rotten portions of diseased tubers and treat the cuts with wood ash or fungicide.

DID YOU KNOW?

There are over 600 varieties of yams and 95% of these are grown in Africa.
SPECIAL RECIPES FOR CASSAVA

Upside Down Cake

INGREDIENTS
1-1/2 cup cassava flour
¼ cup butter and 1 cup brown sugar
6 pieces eggs
1 cup brown sugar
1 cup sugar
6 slices canned pineapples
6 halves canned peaches or mongo
2 tbsp water laced with calamansi juice

PROCEDURE:

1. Place butter, brown sugar and ½ cup syrup of the canned fruits in deep baking pan.
2. Place over slow fire until brown sugar is melted then remove from fire.
3. Arrange fruits in the pan.
4. Separate the yolks from whites of the eggs and beat egg whites with ½ cup of sugar until stiff.
5. Beat egg yolk until fluffy adding the other half of the sugar and two tablespoons of water with calamansi juice.
6. Beat both mixture together.
7. Fold in flour. Pour butter over fruit in pan.
8. Bake in moderate oven.
9. When done, turn upside down on cake plate.
**Butter Cake**

**INGREDIENTS**

- 3 cups cassava flour
- 3 cups white sugar
- 1 tsp salt
- 1 tsp baking soda
- 1 cup butter milk
- 1 cup butter
- 1 tsp vanilla extract
- 1 tsp baking powder
- 4 eggs

**Butter Sauce:**

- 3/4 cup white sugar
- 1/3 cup butter
- 3 tbsp water
- 2 tsp vanilla extract

**PROCEDURE**

1. Preheat oven to 325°F (165°C). Grease and flour a 10 inch pan.
2. In a large bowl, mix the flour, sugar, salt, baking powder and baking soda. Blend in butter milk, butter, vanilla and eggs. Beat for 3 minutes at medium speed. Pour butter into prepared pan.
3. Bake in preheated oven for 60 minutes, or until wooden toothpick inserted into the center of the cake comes out clean. Slowly pour sauce over cake. Let the cake cool before removing from pan.
4. To make butter sauce: in a saucepan combine the sugar, butter, vanilla and water. Cook over medium heat, until fully melted and combined, but do not boil.

---

**Sweet Cassava Bread with coconut & raisin**

**INGREDIENTS:**

- 2 cups frozen, grated cassava
- 1 cup frozen, grated coconut
- ¾ cup margarine
- 3 eggs
- 2 cups sugar
- 1 cup all-purpose flour
- 1 cup milk
- 2 tsp baking powder
- 1 tsp salt
- 1 tsp vanilla
- 1 cup raisin (optional)

**PROCEDURE:**

1. Preheat oven to 350°F. Grease and flour an 11x8-inch pan or a loaf pan. Defrost the grated cassava and coconut at room temperature, or use a microwave oven to defrost.
2. Set the electric mixer on low for one minute and mix the following ingredients in a bowl: margarine, eggs and sugar, then add the remaining ingredients. Mix on high for two more minutes, scraping the bowl frequently.
3. Pour the mixture into a greased pan. Bake for 40-45 minutes. Bread is ready when it detaches from the sides of the pan or a wooden toothpick stuck at the center comes out clean.
YAM SALAD

INGREDIENTS:
5 cups cooked yam
2 onions, chopped
1 cup salad cream
1 lettuce
2 medium tomatoes
2 hard-boiled eggs
Six servings

PROCEDURE:
1. Cut the cooked yam into cubes.
2. Mix together in a dish the yam, onion, and salad cream.
3. Serve cold with lettuce and tomatoes and sliced hard-boiled eggs.

FOR THE SALAD CREAM:
(One cup)

INGREDIENTS:
2 hard-boiled egg yolks
½ cup instant skim or full-cream milk powder
4 teaspoons sugar (optional)
5 teaspoons lemon juice
½ cup water
4 teaspoons cooking oil

PROCEDURE:
1. Mash the cooked egg yolk with the instant milk powder.
2. Add the sugar.
3. Add the lemon juice and water very slowly. Mix well.
4. Slowly add the cooking oil.
5. Serve with yam salad or any fresh green salad.
STUFFED YAM WITH CHEESE
(Four servings)

INGREDIENTS:

1 small yam
1 cup flaked cooked fish
1 large tomato, chopped
1 cup milk or coconut cream
½ cup grated cheese

PROCEDURE:

1. Bake the yam with the skin on until cooked.
2. Cut it into half while still hot. Take out the flesh, leaving the skin whole in the shape of a boat, and mash it with a fork.
3. Mix the flesh with the flaked fish, chopped tomato, and milk or coconut cream.
4. Put the yam mixture back into the skin.
5. Sprinkle grated cheese on top.
6. Bake for about 15 - 20 minutes or until the cheese melts.
7. Serve hot.

References


*Some of the photos used were lifted from the internet.

*This technoguide has undergone technical review by Mr. Arnel T. Manuel (Root Crops Protection Center -Integrated Laboratory Division) of the Department of Agriculture-RFO-CAR
ROOTCROPS
CASSAVA & YAM

Department of Agriculture
Regional Field Office-Cordillera Administrative Region
Scaling Up of the Second Cordillera Highland Agricultural
Resource Management Project (CHARMP2 Scale-up)
BPI Compound, Guisad Rd., Baguio City
(074) 444-7991/ 444-8329

Printed and Published by: DA-CHARMP2 Scale-up, 2019