TECHNOGUIDE
IN PEST AND DISEASE MANAGEMENT AND RECIPES FOR
ROOTCROPS
SWEETPOTATO & TARO
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

In Cordillera, sweetpotato is locally known as *bayading, ubi, dokto, lokto, and lapne.*

It ranks 13th among the root crops used as a major food and agricultural crop locally and internationally in terms of dry matter production.

It is also the staple food of most villagers, especially those living far from the provincial centers.

Sweetpotato (*Ipomoea batatas L.*) is still a staple food in the Cordillera especially in places where road is inaccessible. It is a food in line in case of food scarcity due to famine, drought, flood, etc.

It can be recalled that our forefathers had survived because of sweet potato during the Second World War. Thus, most of the time, sweet potato is remembered when food is scarce.

Sweetpotato has been named in many ways such as musical fruit, flatulence food, poor man’s food, hunger food, famine food, underutilized crop and many more.

In the Cordillera it is also termed in many ethnic languages; such as *lokto, dokto, ubi, bayading, lapne,* among others.

In many ways, sweet potato is the cheapest yet nutritious food, a versatile crop in which all plant parts are very useful to mankind.
1 **Fusarium Wilt**: Caused by the fungus *Fusarium oxysporum f. sp. batatas*. The disease is also called stem or vine wilt. The fungus is soil-borne and specific to sweetpotato.

2 **Scab**: Caused by *Elisinoe batatas*, sometimes known by the name *Sphaceloma batatas*. The major disease that infects sweet potato is scab. It attacks mainly the leaves and the vines of the plant, thus, resulting to a stunted growth. Its effect on the stems and leaves is reflected in the severe stunting and reduction in yield of both vines and roots.

3 **Sweet Potato Weevil**: The major insect pest that damages the plant is sweet potato weevil or *Cyclas formicarius elegantulus Fabricius*. Its larvae and adults attack both roots and older stems of the crop. Enlarged roots bear the marks of the heavy infestation of the insect or on their skins and have malodorous flesh.

4 **Imok, Utut, Tupling**: Imok is a mosquito-like insect that feeds on leaves and damages the skins of the roots. *Utot* (rat) feeds on leaves and roots. Tupling is a bird that scratches the soil and eats the roots. This bird usually feeds during early morning.

5 **Butong**: The only disease reported by farmers is *butong* which is characterized by the browning of the flesh. It was claimed by most farmers in Tuba, Benguet that infestation by the abovementioned pests and rats and affliction of butong disease occur particularly when there is continuous rain/shower for about a week followed by a dry week.
Management

BIOLOGICAL, CULTURAL AND PHYSICAL CONTROL METHODS

Cultural methods can significantly contribute in controlling or reducing damage caused by pests and diseases in the sweet potato crop. These include the following:

1. Selection of cultivars/varieties. Use cultivars which are resistant or tolerant to pests and diseases and with high marketability.

2. Clean planting materials. Planting material is often the primary source of pest infestation or disease. Select vine cuttings that are free of soil, insects, insect eggs or any sign of insect presence, and any disease symptoms. Establish a nursery for production of planting materials to provide continuous source of more disease-free and insect-free mother roots or cuttings.

3. Field sanitation. Removal of all crop residues is recommended.

4. Crop rotation. Continuous planting of sweet potato will encourage population build up of the pests and inoculum of disease-causing pathogens. Planting sweet potato before or after vegetables or cereals may reduce incidence of insect and mite pests and diseases attacking sweet potato.

5. Mulching. Use of rice straw or plastic mulch helps reduce weevil and weed infestation.

6. Timely harvesting. This is especially true for sweet potato weevil management since weevil populations build up when harvesting is delayed, especially during the dry season.

7. Indigenous knowledge (IK) in disease and pest control. The IK in sweet potato weevil is to harvest the roots one at a time. Allowing the roots to stay longer underground makes them vulnerable to weevil damage and can lead to poor eating quality such as fibrousness and crunchiness. This is called naga-es in Southern Kankana-ey.

8. Application of Lime (CaO). Lower pH values are significantly related with high incidence of fusarium wilt. So pH values close to 7 are less optimal for the disease. Increase lime content to suppress Fusarium in the soil by reducing the germination of the fungal spores called chlamydomospores.

9. Microbial agents. Use mycorrhizal fungi as bio-control agents. These fungi grow on and in the roots of plants and act as a protective barrier against infection by disease-causing fungi like Pythium, Phytophthora, Fusarium and other soil pathogens.
CROPPING SYSTEM

a) Crop rotation.
Rotating sweet potato with legumes increase soil organic matter content, maintain supply of nitrogen in the soil and increase crop yield. By using peanut or legumes as a rotation crop, yield is increased by 80%. Ploughing legumes under the soil before planting sweet potato increases yield of marketable roots.

b) Intercropping.
Generally, yield of sweet potato decreases when intercropping is practiced; however, the decrease is compensated by the return from the intercrops and in the case of legumes, the maintenance of sufficient Nitrogen level in the soil. Sweet potato can also be planted under plantation crops to maximize land utilization.
In the Philippines, taro is called gabi and it is referred to as the “true taro”. Cordillera terms for taro are gamey/pising (Kankana-ey and Ibaloi), and aba (Ilocano).

It is a herbaceous perennial of about 0.5 to 2 meters tall, with an underground starchy corm which produces at its apex a whorl of large leaves with long robust petioles. The leaves are heart shaped, 20 – 50 cm long, with rounded basal lobes; the leaf stalk joins the blade some distance inward from the notch plant between the lobes.

Taro is a tropical plant grown primarily as a root vegetable for its edible corm, and secondarily as a leaf vegetable. It is considered a staple in Oceanic cultures and is believed as one of the earliest cultivated plants. Having some similarities with sweet potato, it is sometimes called “the potato of the tropics,” and is also known as “kalo” in Hawaiian, and dasheen in some other parts of the world.

The corms vary greatly in size and 20 cm long; shorter than the leaf stalks, with a pale spathe about 20 cm long; and the seeds are extremely rare. The corms vary greatly in size and are round/cylindrical, up to 35 cm long and 15 cm in diameter, and are surrounded by a number of secondary corms (cormels); the root system is superficial and fibrous.

There are about 1,000 recognized cultivars, but these fall mainly into two groups; the eddoe type of taro, which has relatively small corm surrounded by large well-developed cormels; and the dasheen, which has a large central corm and numerous but small cormels arising from its surface.
Pest Management

COMMON INSECT PESTS.

The most common insect pest of taro are spiraling whitefly (*Aleurodicus disperses*), aphids (*Aphis gossypii*), horn worm (*Hippotioncelerio*), mealybugs (family *Pseudococcidae*), taro beetles (*Papuana spp.*), armyworm (*Spodoptera litura*), and taro plant hoppers (*tarophagus spp.*)

HOW TO CONTROL PESTS: DO IT THE NATURAL WAY

Spraying insecticides to control pests is not allowed. The use of botanical pesticides and Oriental Herbal Nutrient (OHN) are recommended in controlling pests like aphids, army worms, hornworms and grasshoppers.

Oriental Herb Nutrient (OHN) is a natural pest repellant. It is used throughout the early, vegetative and change over period and fruiting stages. It is a very important input in natural farming as it helps develop the immune system of plants and animals.

HOW TO MAKE THE CONCOCTION

In making the concoction, one needs the following ingredients:
- 8 kilos crushed ginger for plants/garlic for animals
- 2 kilos muscovado sugar
- 10 liters of liquor (gin) of 30-40 proof
- Use of ceramic or glass jar

Procedure:

1. Divide the container into three parts. Mix the ginger/garlic and muscovado sugar together preferably by hand, then put inside the jar. Cover and seal, ferment for seven days.

2. After seven days, add 10 liters of gin. Cover and seal. Decant liquid after 10 days. First extraction is good for animals. Second extraction is good for plants. Just add the same amount of gin taken from the first extraction. You may add fresh or dry chili, neem fruit, curry fruit, marigold for stronger potency and repeat the same process the third time. Then continue to ferment for 10 days.

3. Together with other mixtures, spray on plants every week when they weaken or start to flower.
Disease Management

There are taro diseases which have been recorded in researches however most common disease occurring in highland farms includes the following:

A. BACTERIAL SOFT ROT

Cause: *Erwinia chrysanthemi*
Symptom: foul smell, creamy-white corm soft rot and plants wilt suddenly.

Control measures:
There are no specific measures to prevent field infections of *Erwinia chrysanthemi*. However, the ‘tops’ - the petiole base with corm piece from corm-rot affected plants should not be used as propagating material.

B. CORM ROT

Cause: *Athelia rolfsii*, a soil-borne fungus that infects taro at the soil level, causing corms and roots to rot and leaves to wilt.
Symptom: Stunted leaves becomes curled and yellowish, rotted area of corm is separated from the healthy part, and has foul odor.

Control measures:
1. Removing and destroying infected plants by burning
2. Applying good cultural practices, e.g. deep ploughing and encouraging the growth of micro-organisms (especially Trichoderma spp.) that inhibit fungal growth.
3. Liming
4. Crop rotation with non-host or tolerant hosts
C. Taro Leaf blight

Cause: *Phytophthora colocasiae*
Symptom: a small circular speck, brown on the upper surface of the leaf and water soaked below. The spots enlarge, become irregular in shape, and are dark brown with yellow margins. Spores are produced at night and can be seen around the spots in the morning. Clear yellow-to-red droplets ooze from the spots and develop into dark brown, hard pellets as they dry.

Control measures: selection of sites away from already infected crops, regular removal of diseased leaves and wide spacings between plants are recommended.

D. Aphids (*Aphis gossypii*)

Aphids are small, pear-shaped insects with soft, fragile bodies. These are often present in large numbers and they pierce leaves to obtain sap.

Cultural control: If taro plants are heavily infested, avoid planting new crops downwind- aphids are not strong fliers and are readily blown in the wind so the new planting is likely to become contaminated. It is also good practice to destroy leaves by removing heavily infested plants with aphids.

It is rarely necessary to use pesticides to control aphids on taro: populations are normally controlled by predators-ladybird beetles, aphids and lacewings, in particular. Horticultural oils and insecticidal soaps may be considered as alternatives for synthetic pesticides. If ants are present, the best solution may be to destroy the ant colony so that predators and parasites can go about their beneficial acts unhindered.
E. Hornworm (*Hippotion celerio*)

Hornworm (Hawk moth) caterpillars consume large amounts of leaf, causing conspicuous damage. Hawk moths are the adult stage of the hornworm.

**Recommended control/management measure:** removal of disease leaves and wide spacing between plants are recommended. Sanitation and burning of infected plants can be done to control the spread of diseases.

F. Taro beetle (*Pappuana spp.*)

Adults of taro beetles damage corms of taro and other aroids (all plants belonging to the Araceae family) and, less seriously, a range of other crops in five countries in the South Pacific.

It feeds on underground taro corms, creating tunnels while feeding. Damage may be such that the corms cannot be used for home consumption or livestock feed. Above ground, symptoms vary with the age of the plants: young plants may be killed as the beetle invades the shoot, while plants grow more slowly and a few or all of the leaves will wilt.

**Control measures**-strict quarantine measures must be observed to prevent the spread of taro beetles into new areas where they do not occur. Planting material, soil, taro and alternative hosts of the beetle must not be moved from infested areas to uninfested areas. A combination of measures should be used to manage populations of taro beetles.

**Cultural control**-crop rotation, clean planting material (i.e. free from soil) and destruction of breeding sites near farms

**Biological control**-Metarhizium anisopliae; Phytosanitary procedures.
SWEET PINEAPPLE CANDY

Ingredients:
1.5 kg pineapple fruit (crushed)
1 kg mashed camote
1.5 kg brown sugar
¼ bar dairy cream
1 cup ordinary flour

Procedure:
1. Mix all ingredients
2. Cook in low fire with constant stirring to avoid scorching until it reaches its consistenc.
3. Pour in tray then level
4. Cut into desired sizes
5. Wrap in yema wrapper
6. Pack
CAMOTE MAJA

**Ingredients:**
- 6 cups mashed camote
- 4 cups cornstarch
- 3 cups white sugar
- 12 cups coconut milk

**Procedure:**
1. Blend mashed camote with coconut milk
2. Strain
3. Add and mix the remaining ingredients
4. Cook in medium flame while stirring
5. Level in tray
6. Cool and slice into desired sizes

SWEET POTATO MEAT LUMPIA

**Ingredients:**
- 1 kg ground meat
- 750 grams grated camote
- 250 grams carrots (grated/optional)
- Onions, minced
- Pepper (ground)
- Salt
- Garlic, minced

**Procedure:**
1. Squeeze out water from camote
2. Mix all ingredients
3. Wrap in lumpia wrapper
4. Dip fry until golden brown
GABI PUDDING

**Ingredients:**
- 1 kg gabi, boiled and mashed
- 1 cup white sugar
- ½ cup evaporated milk
- 1/3 cup dairy cream
- 2 pieces Eggs, beaten

**Procedure:**

Blend dairy cream into mashed gabi. Combine sugar, milk and eggs. Stir to dissolve sugar. Thoroughly mix liquid mixture with mashed gabi. Place the mixture in greased pan. Bake in moderate temperature till cooked.

TARO AND BOK CHOY

**Ingredients:**
- 1 piece taro root, about 6 to 7 inches long
- 3 cups bok choy
- 1 tbsp soy sauce
- 1 tbsp dark rice vinegar
- 1 tbsp fresh ginger root

**Procedure:**

1. Wash and peel the taro root with a vegetable peeler. Make sure to remove all dark patches of left over skin layers. Cube flesh into 1 inch cubes.
2. Bring two pots of water to a boil, and then add taro root cubes to one. Boil over medium heat for 15 minutes until flesh gets soft.
3. Boil bok choy for 3 minutes – do not overcook or the leaves will wilt too much.
4. Drain both taro and bok choy. Heat a sprayed pan, brown ginger and add taro and bok choy. Stir in soy sauce and vinegar and cook for two to three more minutes.
REFERENCE


Department of Agriculture-Regional Crop Protection Center (RCPC). Common Fungal Diseases of root crops leaflet. Baguio City.

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

*This technoguide has undergone technical review by Mr. Frederick A. Sabaway, Agriculturist II (Root Crops Protection Center -Integrated Laboratory Division) of the Department of Agriculture-RFO-CAR