TANIER: INTEGRATED MANAGEMENT OF AN ANCESTRAL CROP





One of our allies in the Caribbean for a healthy life



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Tanier, *Xanthosoma* spp.

Tanier originates from the american tropics (1) and is an ancestral edible tuber. In Puerto Rico, it is one of the oldest crops inherited from the first inhabitants approximately 5,000 years ago (2).

In the Caribbean, it's known by various names: yautía (Puerto Rico and the Dominican Republic), otoe (Panamá), malanga (Cuba), chow caribe (French Antilles), and tanier (British Antilles).

Tanier is a hardy plant, affected by very few pests and diseases. It possesses notable nutritional content (3), high digestibility (3), a small starch granule (4) with slow-absorbing carbohydrates, and functional properties (5) that make it suitable for feeding both the elderly and children.

Among roots and tubers, it's preferred in both Cuba and Puerto Rico.

Scientifically, tanier is classified by its color as follows: Xanthosoma sagittifolium: White tanier Xanthosoma violaceum: Lilac tanier Xanthosoma atrovirens: Yellow tanier



Morphology of tanier

Tanier is a perennial herbaceous plant from the Araceae family, which farmers manage to turn into an annual plant. It has an underground stem from which succulent leaves emerge.

In this underground stem, the lateral and horizontal edible corms develop.

The corms can have white, cream, yellow, or lilac flesh, with rings on the skin where the buds or future plants are inserted.

The leaves are sagittate, large, and heart-shaped. Mature plants can reach up to two meters in height.



They have inflorescences where the male and female parts are covered.

How to differentiate tanier from taro?

Yautía -Tanier *Xanthosoma* spp. Malanga -Taro Colocasia esculenta



Tanier has a large sagittate leaf, shaped like an open heart from the stem, behind the leaf, resembling a Y. In contrast, the taro leaf is a closed heart with the stem in the center behind the leaf, resembling an M, with a dot in the center of the leaf that can be purple if it's purple taro or white if it is white taro.





Commercially, the edible tuber in tanier is the cormel, while in taro it is the corm.

Why plant tanier?

Advantages over other crops:

Tanier is recognized as a staple or subsistence crop that, for over millennia, has withstood extreme weather events that we face in the Caribbean such as hurricanes, droughts, and floods. It can be planted and harvested year-round, ensuring continuous food source availability that nourishes us and helps improve our health. Its harvest cycle (depending on the variety) can range from 8 to 16 months, providing a wider time frame for its market. Investment in pest and disease control products is minimal in tanier cultivation. As for fertilization, it requires one to two applications during the cycle, depending on soil fertility.



In summary, the advantages include:

- Resistance to abrupt weather changes
- Continuous access to food and food security
- Nutritional and functional benefits
- Low investment crop
- Source of secure income



Tanier, a tropical crop

It's planted in warm climates with high relative humidity. Due to its drought resistance and yield, it has displaced the production of malanga or taro in some countries, which require more water during their growing cycle.



It's a crop that tolerates a certain degree of soil salinity and periods of drought during its cycle. It prefers loose soils with good drainage, but in Puerto Rico, commercial production can be found in clayey soils and calcareous areas, where there is no irrigation system, and the soils retain moisture for longer periods.

Tanier is a hardy and robust crop that can be planted at any time of the year if supplementary irrigation is available.



Nutritional value of tanier g / 100 g dry weight + S.D. (7)

Table 1. Nutritional Profile of Raw Cormels from Six TanierCultivars Harvested in Isabela, Puerto Rico.

	Alela	Estela	Kelly	Super Kelly	Nazarer	no Vinola
Flesh Color	white	white	yellow	yellow	yellow	lilac
Moisture %						
(g/100g fresh weight + S.E	D.)					
	71.21 <u>+</u> 0.65	72.32 <u>+</u> 0.16	76.85 <u>+</u> 0.45	64.77 <u>+</u> 0.57	74.38 <u>+</u> 0.35	76.91 <u>+</u> 0.52
Macronutrients						
(g/100g dry weight + S.D.)						
Protein (a)	4.03 <u>+</u> 0.00	4.95 <u>+</u> 0.00	5.21 <u>+</u> 0.12	3.82 <u>+</u> 0.16	6.71 <u>+</u> 0.25	5.16 <u>+</u> 0.16
Total Fats	1.28 <u>+</u> 0.05	1.30 <u>+</u> 0.06	1.47 <u>+</u> 0.08	1.28 <u>+</u> 0.10	1.55 <u>+</u> 0.07	1.32 <u>+</u> 0.08
Ash	4.01 <u>+</u> 0.03	4.26 <u>+</u> 0.02	4.19 <u>+</u> 0.09	3.62 <u>+</u> 0.06	5.12 <u>+</u> 0.09	4.27 <u>+</u> 0.09
Raw Fiber	1.76 <u>+</u> 0.08	2.44 <u>+</u> 0.41	2.95 <u>+</u> 0.54	1.68 <u>+</u> 0.36	2.27 <u>+</u> 0.17	3.32 <u>+</u> 0.34
Carbohidrates (b)	88.93	87.05	86.18	89.60	84.35	85.93
Minerals						
(mg/100 g dry weight)						
Aluminum	0.70	1.20	6.90	0.80	0.80	0.70
Boron	0.40	0.40	0.30	0.30	0.30	0.20
Calcium	ND	10.70	3.30	ND	ND	2.70
Copper	0.40	0.40	0.80	0.60	0.40	0.50
Iron	0.20	0.20	1.00	0.30	0.40	0.40
Potasium	2207.30	2050	1927	1505	1578	1839
Magnesium	67.7	63.0	88.3	65.0	51.7	70.7
Manganese	0.40	0.70	0.70	0.50	0.40	0.60
Sodium	12.10	19.50	7.90	11.50	12.90	11.10
Phosphorus	229.70	204.30	237.70	183.30	158.70	185.00
Sulfur	25.10	23.70	36.80	23.10	21.20	27.80
Zinc	1.50	1.30	1.80	1.40	1.20	1.90
Oxalate						
(mg/g dry weight)						
Corm	21.85 <u>+</u> 0.86	20.23 <u>+</u> 0.91	22.77 <u>+</u> 1.05	15.27 <u>+</u> 0.58	9.25 <u>+</u> 0.32 14	4.66 <u>+</u> 0.67
Cormels	3.83 <u>+</u> 0.17	3.80 <u>+</u> 0.15	3.86 <u>+</u> 0.15	2.69 <u>+</u> 0.11	2.42 <u>+</u> 0.10 3.	80 <u>+</u> 0.16

(a) Protein (N x 6.25; %).

(b) Carbohydrates calculated as 100 - [protein + fat + ash + fiber].

ND: not detected. Report from the Agricultural Experiment Station, University of Puerto Rico, Mayagüez.

Nutritional value of one cup of chopped tanier (135 g). (8)

Nutrition Facts/Datos de Nutrición

1 servings per container / raciones por envas Serving size / Tamaño por ración	^e 1 cup/ taza	a (135g) / chopped product / producto cortado	
Amount per serving / Cantidad por ración Calories / Calorías		140	
		% Daily Value*/% Valor Diario	
Total Fat / Grasa Total 0.59		1%	
Saturated Fat / Grasa Saturada 0g		0%	
Trans Fat / Grasa Trans 0g			
Cholesterol / Colesterol Omg		0%	
Sodium / Sodio 30mg		1%	
Total Carbohydrate / Carbohidrato Total	32g	12%	
Dietary Fiber / Fibra Dietética 2g		7%	
Total Sugars / Azúcares Totales 0g			
Includes 0g Added Sugars / Incluye 0g Azúcar	0%		
Protein / Proteínas 2g			
Vitamin D / Vitamina D 0mcg 0%	•	Calcium / Calcio 10mg 0%	
Iron / Hierro 1.3mg 8%		Potassium / Potasio 810mg 15%	
*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.	* El % de valor porción de cor calorías al dia nutrición.	diario indica cuánto un nutriente en una nida contribuye a una dieta diaria. 2,000 se utiliza para el consejo general de la	



Functional and subsistence food

Some yellow-fleshed cultivars are rich in carotenoids (9), with a pleasant and unique flavor, being considered a culinary delicacy.

Tanier is another subsistence agricultural plant with leaves rich in fiber that can have a protective effect against cardiovascular diseases and intestinal cancer (10). It also has a high concentration of oxalate, alkaloids and latex, which is why it's important to cook it very well before consuming it (11). It has complex carbohydrates that are easy to digest and have a low glycemic load, it has antihyperglycemic, hypoglycemic and prebiotic properties (5).

In the Caribbean we find tanier with white, yellow, cream and lilac flesh.





It's easy to eat healthy

Although it is commonly boiled, the way tanier is consumed is very diverse, especially in West Africa and the Caribbean (2, 3, 4); sancochos, roasted, fried in flakes, soups, creams, puddings, cakes or tamales, fermented among others. It's used as a main dish, as a side dish or to make desserts.

The leaves can be consumed as a vegetable and salad or used as forage. The pulp, due to its fiber content, is ideal for good digestion. In addition to having a high content of potassium, phosphorus and magnesium (7).

Compounds that fight cancer

Research has shown that compounds found in tanier leaves have anti-cancer properties (5). Both the flesh and leaf contain dietary fiber that maintains a healthier digestive process, helping to reduce cholesterol and the binding of bile acids in the liver, resulting in a better reduction of fats (10). Its dietary fiber content favors phenomena associated with the prevention of colon cancer and obesity (10).

Taniers are rich in potassium and phosphorus



High potassium levels help control blood pressure, as potassium decreases the effects of sodium. The more potassium, the more sodium is eliminated through the urine. Potassium also helps decrease the tension on blood vessel walls, which helps lower blood pressure even further. Increasing potassium through diet is recommended for adults with blood pressure greater than 120/80 who do not have other health problems. The recommended potassium intake for an average adult is 4,700 milligrams (mg) per day, approximately 200 to 300 g of tanier (7 to 11 onz).

While phosphorus helps the body produce ATP, a molecule that the body uses to store energy. The recommended daily allowance, or the average daily intake level that is sufficient to meet the nutrient needs of almost all healthy people (97% to 98%), for adults: 700 mg/day, approximately 400 to 500 g of tanier (14 to 18 onz).

How does tanier reproduce?

Tanier reproduces asexually or vegetatively, which means that the "seed" that comes from a plant is genetically identical, a clone, of the original plant.

It's a very versatile crop because different types of "seed" can be used from one plant:





The small cormels, which do not reach commercial size. You can obtain more than one per plant and they're planted lying down.



The sprouted cormels or suckers, more than one can be obtained per plant and they're planted lying down.



The "palmillo" is the upper part of the main corm stem. You only get one per plant and it's planted lying down.



Pieces of the main corm stem. You can obtain more than one per plant, they're planted with the cut area facing up and the skin facing down, with at least one sprout.

Before planting



The soil suitable for tanier production must have a pH between 5.5 and 7.0 (12).

It requires well-prepared, loose soil, with good drainage and water for its development. When the area is prepared and ready for planting, the "seed" is cut or prepared.

It's advisable to have a drip irrigation system to avoid the uncertainty of rainy or dry seasons due to climate change.

The most important thing before planting is to make a good selection of planting material, you should use material from plants that had good yield and are healthy.

The optimal piece size and weight of the "seed" selected will ensure rapid germination with vigor, the weight should be between 6 ounces (170 g) to 9 ounces (256 g) and pieces 1.5 to 2 inches wide (13).

The homogeneous selection of the "seed" material and its disinfection will help to have a homogeneous crop during the harvest and production date.



For planting

Select a "seed" of uniform weight and size for planting. This will allow a more homogeneous harvest. If "palmillo" is used, it will germinate first than the other types of "seed", then the suckers will sprout and finally the corm pieces will germinate, depending on the size used.

Once the "seed" is selected, it must be disinfected in a solution that has fungicidal-bactericidal action. The solution can be a chemical or organic product, as long as it is registered for use in tanier. The area must be rotate and amended to reduce phytoparasitic nematodes. Rotate with beens or other cover crops such as Velvet bean (Mucuna), Crotalaria and Cowpea suppress nematodes, and their incorporation into the soil improves its fertility.

The "seed" should be planted 3 or 4 feet between rows, 1.5 or 2 feet between plants, and at a depth between 4 to 6 inches. If corm pieces are used, the cutting should go upwards, and should be planted lying down.



It is recommended to have a drip irrigation system, which provides 1 to 1.5 inches of water weekly. In cases where there is no supplementary irrigation, planting should be done during the rainy season and wider banks should be used for greater moisture retention.

During the crop cycle

During cultivation, removing weeds must be done with care to avoid injuring roots. The roots tend to grow shallow and distant. At the time of weed removal, you should take advantage of the time to soil. This practice of grounding or hilling is very important to prevent the proliferation of suckers and reduce the size of the underground cormels. Generally, during the cycle, 2-3 hillings can be carried out depending on the planting distance and the time it takes for the leaves to cover the planting area.



Limitations or pests

One of the most limiting pests at the beginning of plant growth is the Iguana (*Iguana iguana*), which if there's a growing population, devour the crops and don't allow the crop to develop. Furthermore, recently in municipalities of the central mountain range in Puerto Rico, there is problems with wild pigs, which destroy plants without distinction in growth stages.



Limiting diseases

The most limiting diseases in tanier cultivation can be observed at different stages of cultivation.

- Dry disease or dry rot is caused by a complex of fungi that attack the roots, presenting symptoms of wilting of leaves, rot and necrosis of the roots, affecting the absorption of nutrients (photo 1.).
- Bacterial spot caused by *Xanthomonas* spp. is observed on the leaves. This bacteria stays in the seed and moves towards the leaves, coming out through pores on the edge of the leaves or in the stomata through which the plant transpires. It affects its photosynthetic capacity (photo 2.).
- The taro virus or Dasheen Mosaic Virus (DsMV) is transmitted to tanier by aphids. It produces mosaics and deformation of the leaves and a characteristic feather-shaped pattern (photo3). This virus reduces the vigor of the plants and the quality of the seed (photo 3.).







Fertilization

Fertilization should be done when the plant sprouts. This normally occurs between 35 to 45 days and three months. 1.5 ounces (43 gr) per plant of the recommended fertilizers for roots and tubers will be applied each time. The following fertilizer formulations can be applied: 12-6-16-3 Magnesium (Mg) + Minor Elements (ME) 12-5-15-3 Mg+EM, 8-8-13-3 Mg+EM, or 10-5-15-3 Mg+EM. Organic amendments may also be used, depending on soil test results.



Harvest



The harvest months depend on the variety, some early varieties can be harvested from 8 months such as the Kelly variety, in purple-type varieties up to 12 months. Research by prof. Angel Bosques at the EEA-Isabela has shown that the Nazareno variety can remain without sprouting for up to 16 months in the field with supplementary irrigation.

Storage

Store indoors in boxes or plastic bags that allow free air circulation. In a natural environment at 26°C (79°F) and 76% relative humidity, cormels begin to germinate after six weeks. At a temperature of 7°C (45°F) they remain ungerminated and in good culinary condition for up to 18 weeks.



Is it economically profitable to plant tanier? You decide



Prof. Mildred Cortes Department of Agricultural Economics and Rural Sociology, CCA. University of Puerto Rico Mayaguez Campus

The cultivation of tanier enjoys the preference of consumers and is of economic importance for both farmers in the plains and those in the highlands. The reduction in the producing sector is explained by various factors such as: incidence of pests and diseases, weather events, decrease in population and changes in tastes and preferences. Within farinaceous crops, we can mention data from Depto. of Agriculture from 1980-81 where a production of 230,000 quintals was reported, all for local consumption. Currently, we only produce 6-7% of local consumption, which is 180,316 gg. At the College of Agricultural Sciences, we work to replace imports of tanier and other crops. Teachers from the College of Agricultural Sciences have continued doing research to counteract the effect of pests and diseases and achieve production by hectares that make it a competitive crop. High quality varieties, such as the Nazareno Tanier, have been developed at the Agricultural Experimental Station by Professor Ángel Bosques. This has a greater production of cormels and is the only one with yellow flesh that remains soft after cooking (4). Currently, the price per pound in the markets fluctuates between 2.50 to 3.50 dollars.

Fried tanier dough balls (14)

By: Giovannie Soto-Torres, 2023

Servings per preparation: 5 servings Serving size: 3 units Preparation time: 50 minutes

Ingredients:

7 ounces (200 grams) of tanier 2 tablespoons of fresh sofrito Salt to taste



Recipe:

- Clean and disinfect food preparation surfaces. Wash your hands with soap and water for 20 seconds, rinse, and dry with a paper towel or clean kitchen towel.
- Wash the taniers with water and remove the peel with a peeler or clean knife. Rinse the peeled taniers.
- With a grater, grate the taniers and place them in a clean container.
- Add the two tablespoons of fresh sofrito and salt to taste. Mix the ingredients until you reach a uniform dough.
- Cover the container with the dough and place it in the refrigerator. Let it rest for at least 30 minutes, so the flavors incorporate and acquires greater consistency.
- In a deep-frying pan, place enough oil to cover the dough balls. Heat the oil to a temperature suitable for frying (about 350°F or 175°C).
- With two spoons, form small oval balls with the yautia dough. Carefully place the balls in the hot oil.
- Fry until the balls turn golden brown, turning them if necessary for even cooking and to avoid overcooking.
- Remove the fried balls from the oil and place them on absorbent paper to remove excess oil.
- Serve the fried tanier balls immediately to enjoy their pleasant flavor and crispy on the outside and soft on the inside texture.

Observations:

The technique for forming an oval shape with two spoons of the same size is known as "quenelle". Pressing the dough with two spoons of the same size creates three edges, giving the frying a crispier consistency.

Tanier Smoothie (14)

By: Giovannie Soto-Torres, 2023

Servings per preparation: 1 cup Serving size: 8 ounces Preparation time: 45 minutes

Ingredients:

3.5 ounces (100 grams) of tanier 8 ounces(237 ml) of fresh milk 1/2 teaspoon of vanilla extract Honey or sweetener to taste Pinch of ground cinnamon Pinch of salt Ice cubes (improves consistency) Cinnamon stick for garnish (optional)



Recipe:

- Clean and disinfect the surfaces for food preparation. Wash your hands with soap and water, scrubbing for 20 seconds, then rinse and dry with a paper towel or clean kitchen towel.
- Wash the taniers with water and peel them using a peeler or clean knife. Rinse the peeled taniers and cut them into small pieces.
- In a pot, boil water with salt to taste and cook the tanier over medium-high heat until tender.
- Once tender, remove the tanier from the water and place it in a container to cool.
- In a blender, place the cooked and cooled tanier, add the milk, vanilla extract, honey, and cinnamon.
- Blend the ingredients until you reach the desired consistency.
- Serve in a glass and sprinkle with ground cinnamon or garnish with a cinnamon stick, and enjoy the pleasant flavor.

Variations

For those who are lactose intolerant, you can use lactose-free milk or substitute the milk with soy, almond, coconut, or another preferred beverage. The combination of almond and coconut milk works very well in this recipe. A pinch of salt will enhance the flavors. Particularly, if you boil the tanier with salt, the contrast with the honey gives it a more intense flavor. You can substitute honey with brown sugar or any other sweetener. Also, if you place the tanier smoothie in a saucepan over medium-low heat, stirring with a whisk until it boils and reaches a creamy consistency, you will turn the smoothie into a hot tanier cream, which can be enjoyed for breakfast, as an appetizer, or cold as a dessert.

Tanier Mash

By: Giovannie Soto-Torres, 2024 In the photo, it was prepared with the local purple variety, served with tuna.

Servings per preparation: 5 portions Serving size: 3 ounces Preparation time: 40 minutes

Ingredients:

1 pound (0.45 kg) tanier 68 ounces of water (2 liters) Salt to taste Olive oil



Recipe:

- Clean and disinfect the surfaces for food preparation. Wash your hands with soap and water, scrubbing for 20 seconds, then rinse and dry with a paper towel or clean kitchen towel.
- In a pot, add enough water to cover the taniers twice. Add salt to taste and heat on medium-high.
- Wash the taniers with water and peel them using a peeler or clean knife. Rinse the peeled taniers and cut them into evenly sized cubes. Place these in a container with cold water to reduce possible color changes in the tanier and the mucilage.
- Drain and place the tanier cubes in the pot with hot water. Cook the tanier until tender. The cooking time will depend on the size of the tanier pieces; 25 to 30 minutes should be sufficient.
- In a container, place the cooked tanier cubes and mash them, gradually adding the water in which the tanier was cooked until you reach the desired consistency. The goal is to form a thick, lump-free cream.
- Once the mash reaches the desired consistency, add olive oil to taste.
- Serve hot, accompanied by some protein, and enjoy the smooth and delicious flavor.

Variations:

You can substitute olive oil with butter and add garlic, onion, bell pepper, and other spices to taste for seasoning.

Tanier with Garlic Mojo Sauce

By: Giovannie Soto-Torres, 2024

In the photo, it was prepared with the Nazareno variety (yellow flesh).

Servings per Preparation: 5 portions Serving Size: 3 ounces Preparation Time: 40 minutes

Ingredients:

1 pound (0.45 kg) tanier 51 ounces of water (1.5 liters) Salt to taste **For the Garlic Mojo Sauce:** 1/2 cup (118 ml) olive oil 6 medium garlic cloves, finely chopped 2 bay leaves 2 tablespoons (30 ml) vinegar Pepper to taste



Recipe:

- Clean and disinfect the surfaces for food preparation. Wash your hands with soap and water, scrubbing for 20 seconds, then rinse and dry with a paper towel or clean kitchen towel.
- In a pot, add enough water to cover the taniers twice. Add salt to taste and heat on medium-high.
- Wash the taniers with water and peel them using a peeler or clean knife.
- Rinse the peeled taniers and cut them into evenly sized cubes. Place these in a container with cold water to reduce possible color changes in the tanier and the mucilage.
- Drain and place the tanier cubes in the pot with hot water. Cook the tanier until tender. The cooking time will depend on the size of the tanier pieces; 25 to 30 minutes should be sufficient.
- In a pan, add the half cup of olive oil over low heat. Add the 6 finely chopped garlic cloves, the two bay leaves, and pepper to taste.
- Sauté until the garlic turns golden, avoiding overcooking (garlic turning brown). Turn off the heat and carefully pour in the two tablespoons of vinegar, stirring until it reaches a uniform consistency.
- Drain the previously boiled tanier and place it in a container where you will pour the garlic mojo sauce. Stir with a folding motion until all the tanier is coated with the garlic mojo sauce.
- Serve hot or cold and enjoy the delicious flavor on its own or accompanied by a
 protein.

Variations:

Add green bell pepper and chopped white onion to the mojo sauce to taste.











I have yellow, creamy flesh like my distant cousin, the super creamy sweet potato! I am local, just like her—I am BORICUA. My quality is exceptional, and I produce much more than the others. I provide you with provitamin A to improve your vision.

My body is lilaccolored, full of antioxidants and polyphenols, which help you prevent and stop cancer.

Like Nazareno, I am creamy.

My name is

Just so you know, our leaves are rich in fiber and polyphenols, which will help you maintain a healthy weight and a longer life.



۵ Farmer struggles with the overpopulation of wild pigs and iguanas. They have eaten a Lot and Left very Little of our J mm

crops.























Nazareno















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