
Root and Tuber Crops

- Sweet Potato Crop Production Bulletin
(<https://www.echocommunity.org/resources/111ed94b-7995-49d1-8334-c434f353f5a2#Swee>)
- Sweet Potato Cultivars Available
(<https://www.echocommunity.org/resources/111ed94b-7995-49d1-8334-c434f353f5a2#Pota>)
- Sweet Potato Cookbook
(<https://www.echocommunity.org/resources/111ed94b-7995-49d1-8334-c434f353f5a2#Cook>)
- Living Support Poles for Yams
(<https://www.echocommunity.org/resources/111ed94b-7995-49d1-8334-c434f353f5a2#Livi>)

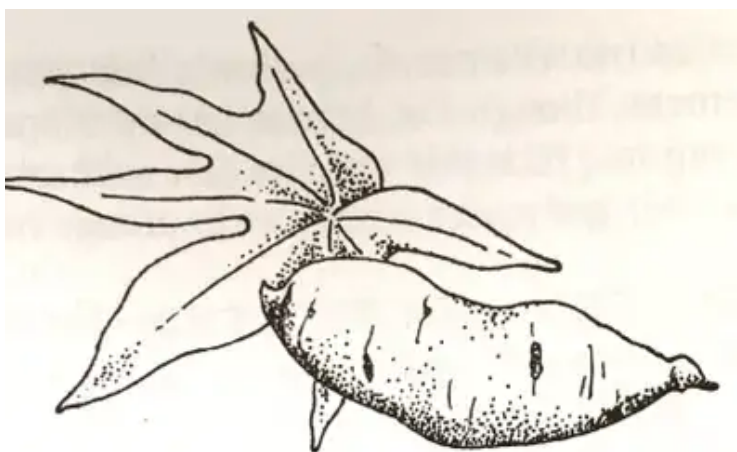
SWEET POTATO CROP PRODUCTION BULLETIN, by Dr. Frank Martin. Dr. Martin is one of the leading sweet potato breeders, so it is fitting that he treat the subject of his first scientific love. The following is a condensed version; write ECHO for the complete bulletin.

Sweet potatoes (*Ipomoea batatas*) are the sixth or seventh most-produced food crop in the world. What makes it such a great crop? It is relatively easy to grow, is relatively free of pests and diseases, has relatively high productivity, and is always good food, principally starch, some protein and vitamin C, and, in orange varieties, rich in vitamin A. In addition, the young leaves, rich in protein and most vitamins, are also good food. Furthermore, both sweet potato tubers and vines are excellent animal food.

Its ability to produce in poor soils make it an especially good crop for poor tropical soils where fertilizer is not available. If the leaves are also used as food, sweet potato will probably produce more nutrients per acre than any other crop under those conditions. (Cassava also produces well on poor soils and also has both edible roots and leaves. Its main advantage over sweet potato is drought tolerance. Sweet potato has the advantage in nutrients because polyphenolics in the cassava leaf combine with protein during cooking and reduce the amount of protein that is digestible.)

PRINCIPLE USES OF SWEET POTATOES. Leaves can be harvested during the second and third months of production. Only the tender stem and young, not-fully-
(/resources/429b41de-61ea-4a2b-a581-f1f6c03cfa64)developed leaves should be taken. The leaves and stems are boiled for 15-20 minutes. You are already familiar with recipes for boiled or baked sweet potatoes. (By the way, baking converts part of the starch to the sugar maltose, thus increasing sweetness.) There are other, less

familiar, uses. The mashed pulp of boiled sweet potato can also be used as a partial substitute for wheat flour in baked products such as pancakes, cakes, flat breads, cookies, pies, fritters, or even bread. It can also be processed further, as you will see.



To make osmotically modified boiled sweet potato, the peeled and trimmed sweet potatoes are cut into thin (1/8") slices, placed in water 2 hours (moved once in a while) and then boiled. The products will be clearer, less sweet, and milder than those made from untreated sweet potatoes. (What is happening chemically is that the enzymes and substrates responsible for polyphenolic oxidation are partially lost, as well as some of the sugars.)

Sweet potato flour is much more difficult to make than potato flour because the reducing sugars readily released from the starch combine with free amino acids to produce disagreeable colors, odors, and flavors. To avoid this the peeled sweet potato can be shredded, and the shreds immersed in water 2 hours. This process works better if the water is changed 2-3 times. The shreds are drained and then dried, first in the shade (with air movement or wind) and later in the sun (in some cases, drying over the stove or in an oven will be necessary). The brittle shreds are easily crushed to flour, or this can be done rapidly in a household blender. The flour can be stored for 6 months or more in sealed containers. It can be used as a substitute for wheat flour in the following amounts: 100% in white sauces, 25-50% in cookies, cakes and flat breads, and 15-20% in breads. From the water, starch can be recovered (see below).

Starch can be produced by grinding the peeled sweet potato in a mill or blender as finely as possible, and mixing with 5-10 times its weight in water. The starch settles out, and the water is carefully poured away (this can be used as pig feed). The starch is then mixed with water 1-3 times more and the process is repeated. After the last settling the water is carefully drained and the starch is dried on a metal surface in the sun. It can be used as is any starch, such as corn or potato starch, and can be stored in sealed containers for a year or more.

A breakfast food similar to "cereal" can be made from any sweet potato. The sweet potato is grated (not as finely ground as for starch), suspended in water, and filtered through a cloth. The liquid is saved for starch, the residue is suspended 1-3 times more in water, and filtering is repeated. The portion of the sweet potato that does not pass through the filter is then dried and lightly toasted on a hot plate (over the fire). The toasting is very delicate. The product must be stirred and turned almost continuously, and should not become sticky and jellified. The toasted product can be stored in sealed containers and eaten with milk without further cooking, or can be used much like starch or flour, imparting its characteristic flavor.

CULTURE OF THE SWEET POTATO. Sweet potato is a hot weather crop. It is difficult to imagine an earthly environment that is too hot for sweet potato. In general, hot temperatures only speed up its growth. On the other hand sweet potatoes will survive at any temperature above freezing, and are very productive at temperatures that are comfortable for humans as well.

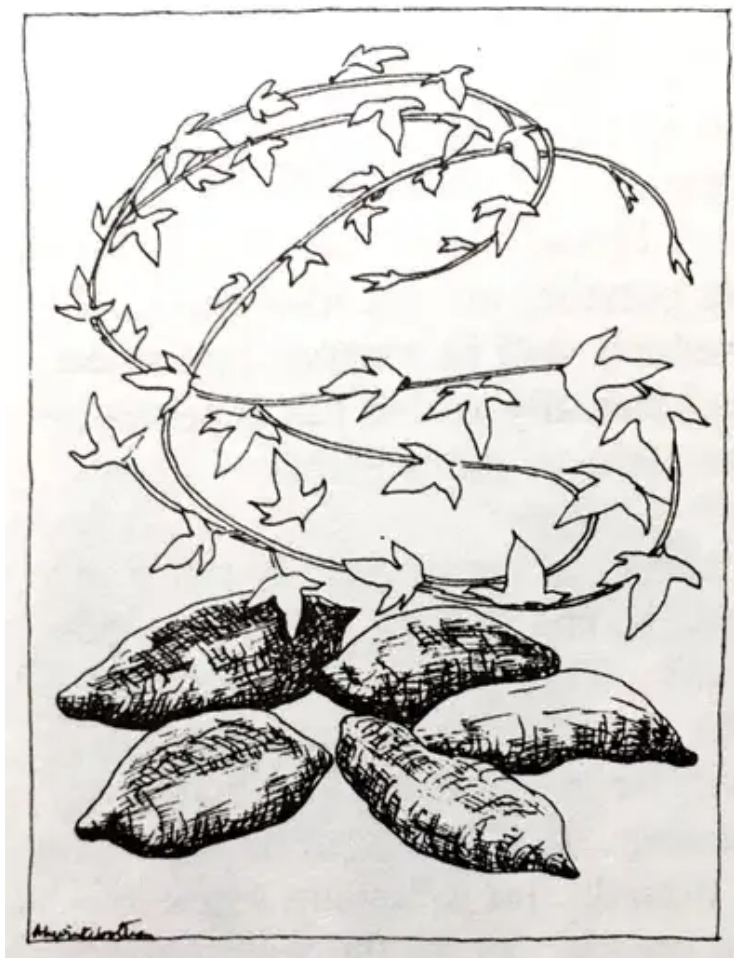
Depending upon variety, sweet potatoes may be ready for harvest after 10 weeks or may require up to 9 months in the field. The majority of the varieties can be harvested after 4 1/2 months in the field. Cool conditions can extend the needed growth period to 8-9 months. Early varieties (10 weeks) are in the process of development. Sweet potatoes from an individual planting may be harvested as needed over a three to four month harvest season.

If the soil is well aerated with medium texture the sweet potatoes need not be planted on ridges. They can be produced in heavy soils if formed into ridges for drainage and increased aeration. Sweet potatoes are often grown in sandy soils. Too much nitrogen results in abundant foliage and low and/or late yields. They can tolerate light drought in the second and third month of growth, and often fairly severe drought in the fourth or fifth month.

There are too many varieties to try to describe them all. Because of all this variation it may well be worth your while to collect several varieties within your country for local variety trials and preference tests. It is probably more useful to talk about some of the differences found. Internal color is the first difference you will see: white varieties (no vitamin A), yellow (little vitamin A) and orange (high vitamin A). Most varieties are chosen for sweetness, though Dr. Martin has developed non-sweet varieties which people that do not care for sweet potatoes may enjoy. [Ed: this was the case with me.] Texture ranges from dry (least preferred) to intermediate (often preferred) and moist (common in orange roots). Most plants are running (vining), a few are bunch varieties.

(/resources/76f99553-d5cf-4627-8a05-1c872b7029ae)For practical purposes, in the tropics sweet potatoes are produced from cuttings of existing vines. (Only in the temperate zone is it necessary to conserve storage roots during the winter and stimulate them to grow in the spring as a source of sprouts for planting.) Where sweet potatoes are not grown year round, special plantings will have to be made as sources of cuttings, in which case it may be possible to obtain as many as 30 cuttings per plant. Usually best results are obtained by planting cuttings at an angle with about 2/3 of the cutting below the soil.

Cuttings should be 12-18 inches long. Shorter cuttings can be used if the distance between nodes is not excessive. The vines should be vigorous but not too soft and succulent. Old thickened, diseased, and leafless cuttings should be avoided. It is not necessary to remove any leaves from the cuttings. Cuttings should be gathered together in convenient-sized bundles, tied, or wrapped in burlap. These bundles should be held 1-3 days in a shady, protected area and maintained moist. This will stimulate root production, and even though the initial roots may be broken on transplanting the cutting will be more ready to establish itself if allowed to pre-root as described. If weevils are a problem, immerse cuttings for 5 minutes in a drum containing 0.1% carbofuran. Use gloves. Plant within 24 hours. This treatment eliminates weevils within the cuttings.



The area selected for planting should be as far from previous sweet potato plantings and its morning glory relatives as possible. One foot (30cm) between plants in a row is a minimum. Individual plants will yield more if given up to 1 square yard (meter) of space, but many roots will be excessively large. These large roots are edible but likely to be irregular in shape and unsightly. The layout of rows or beds will depend on the machinery or methods used for soil preparation.

Newly planted cuttings need watering frequently for 1-3 weeks. Once new growth begins water only when visible wilting is seen. Very little water will be necessary the fourth and fifth months. Remember, too much foliage means poor or late storage-root growth. Excessive foliage with poor yields is usually due to too heavy fertilization, especially with nitrogen. Any method that destroys part of the foliage tends to decrease this problem. Try feeding a portion of the vines to animals. [Dr. Martin told me of seeing men drag thorn bushes through the patch to tear up some of the leaves.]

There is no perfect time for harvests. Early harvest results in less yield, smaller roots, less insect damage, less cracking, milder flavors, and poor storeability. Late harvest results in the reverse. If insects are not a problem, partial or periodic harvest from 3 to 8 months may be possible. Cut away the vines before harvest. These can be fed to animals. As soon as possible after digging, remove the sweet potatoes from the sun. The roots should be sorted. Very small roots can be fed to animals. Damaged roots can be used immediately or processed as previously described. Sound roots can be stored at cool temperatures (minimum 55 deg.F, 13 deg.C) for 2-8 weeks. Rot of roots in storage is reduced by curing at high (80-90%) humidity and high (90-95 deg.F) temperature for 4-5 days. Cured roots can be stored at the recommended temperature for up to 1 year. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch3roo.htm#Table)

SWEET POTATO CULTIVARS AVAILABLE. We grew and compared several of Dr. Frank Martin's sweet potatoes, both the non-sweet and sweet varieties. We selected six superior cultivars based on a combination of traits, including: uniqueness (not available elsewhere), yield, sugar content, ease of processing, texture, shape, color, time to maturity and reliable yield. These are the ones we will distribute from now on.

Cuttings are typically available July through October. Please send \$5 to help with postage and handling if that is possible. Since the danger of introducing a new disease or insect is so much greater with fresh plant tissue than with seeds, we will only send them after receiving a government plant import permit from you. Be sure to designate which varieties you would like. If a phytosanitary certificate (certified disease and insect free) is required by the permit, enclose an additional \$20 per order. If you use a USA address, check with us first. Many states in the US have restrictions on shipping sweet potatoes into the state. It is much better to pick up the cuttings on a visit to ECHO en route to your country, as cuttings may not survive very well in shipping.

Varieties selected were: "Topaz" (orange and sweet, closest to typical US varieties but 50% higher yielding for us, somewhat less uniform, some drought resistance; "Ivoire" (non-sweet, "Irish" potato substitute, very dry if harvested after 12 weeks); "Viola" (purple skin, white flesh, sweet, good flavor, has done well everywhere); "Colorette" (low in sweetness, high yielding, light orange flesh, light purple outside); "Suabor" (large, sweet, smooth, early maturing, yellow when cooked); and "Toquecita" (good yield, white skin and flesh, sweet, large tuber, but highly lobed, excellent for processing). (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch3roo.htm#Table)

SWEET POTATO COOKBOOK. We have appreciated contributions from Dr. Frank Martin on many topics over the years. His main professional interest, however, is the breeding of sweet potatoes. When his technical expertise and personal interest in (/resources/68aeb7f0-ead7-40be-b031-1aa14d31e4bb)cooking was teamed with the skills of writer and agriculturalist Ruth Rubert, and amateur gourmet cook (and professional engineer) Jos, Herrera, this unique and valuable cookbook resulted.

Frank's personal acquaintance with scientists and sweet potato enthusiasts from many countries has made him aware of many delightful recipes that make this book an outstanding addition to the kitchen library. But it is his familiarity with the different kinds of sweet potatoes that makes the book especially unique. The type of sweet potato influences its cooking. Each type is better for some purposes than for others. The cookbook includes recipes designed to take advantage of these different types: dessert, tropical, white staple or orange staple types.

Dessert type sweet potatoes are very sweet, usually moist in the mouth, and almost always orange. On cooking in any manner, sweetness increases markedly. The flavor may seem carrot-like or even oily to some people. Tropical type sweet potatoes are less sweet, often dry in the mouth, and white, cream or yellow. Flavor is highly variable. These are the kinds of sweet potatoes most often found in the tropics, but a few are grown in the USA (Yellow Jersey, Rojoblanca and the Cuban boniatos of Florida). Cooking in any form increases sweetness. White staple "non-sweet" types were developed by Frank just before he retired. They are not sweet or are only very slightly sweet. Sweetness does not increase, or increases only slightly,

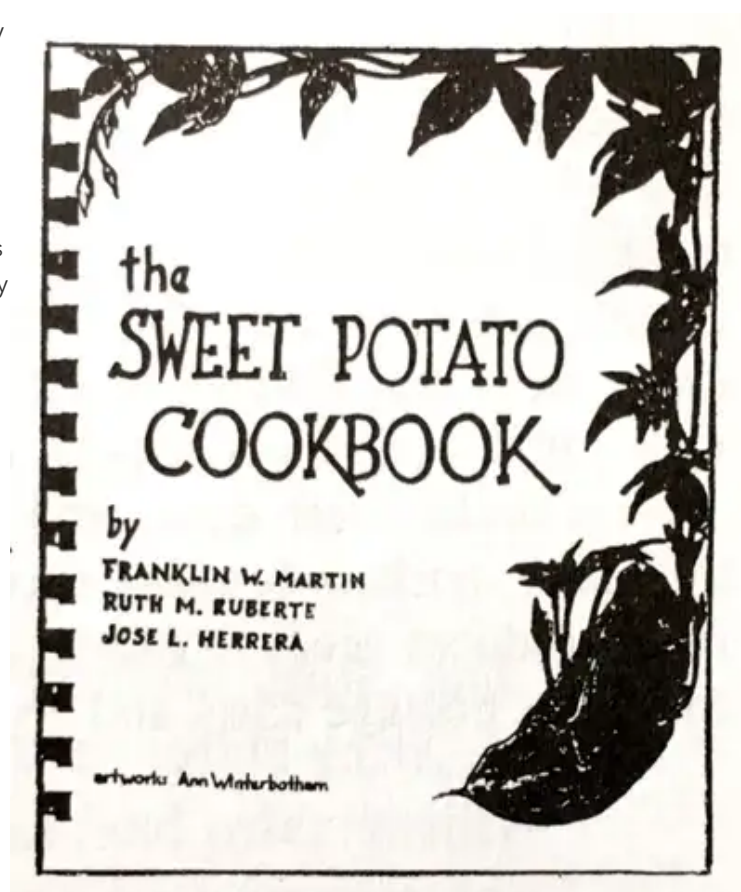
upon cooking. They are often, but not necessarily, dry and need to be mashed to make them attractive to most palates. The flavor is usually neutral. They are white, whitish, cream, or pale yellow in color. Yellow staple type sweet potatoes is the orange-colored equivalent of the white staple type. They have a large amount of provitamin A and may taste like a carrot to some people.

Sweet potatoes are one of the world's most important

food crops, surpassed only by wheat, rice, corn, Irish potato, and barley. Frank says they have the potential to be an even more important crop for peasant farmers (and the rest of us for that matter). The key to increasing their usefulness may surprise you--get rid of the sweetness! "Irish" potatoes (which really came from South America) are a temperate crop and poorly adapted to the hot, humid tropics. Yet their taste and cooking versatility are appreciated around the world. Dr. Martin believes that "bland" sweet potatoes, which could be used like Irish potatoes, could become a major part of tropical diets in a way more traditional varieties never could. These non-sweet or staple type sweet potatoes are almost a new crop. I have never cared much for sweet potatoes, but I very much enjoy the non-sweet varieties (with butter and chopped onion). Both taste and texture more similar to the potato, though still different.

Sweet potatoes are easy to grow, relatively free of pests, highly productive, and always good food. They produce in poor tropical soils without the benefit of fertilizers, tolerate drought once established, and thrive in tropical heat. Americans are often surprised to learn that sweet potato leaves are a popular vegetable in many countries. When both leaves and tubers are used for food, sweet potatoes will probably produce more nutrition per acre than any other crop. This all adds up to one fantastic crop for small land-holders in the tropics and sub-tropics. The cost of the book from ECHO is \$6.00 plus postage.

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LIVING SUPPORT POLES FOR YAMS (*Dioscorea spp.*). [From "The Garden to Kitchen Newsletter" quoting Mike Benge with USAID.] This process is being used by farmers near the University of the Philippines at Los Banos. Fast-growing, nitrogen-fixing trees such as leucaena, gliricidia, or calliandra are planted ahead of time to shade out grasses. Yams are planted near the base of the tree after weeds are controlled. When the tuber begins to form, the tree bark is removed about 40 cm from the ground. This causes leaves to drop, giving full sun, mulch, fertilizer and support for the vine and eventually provides firewood. One strong sucker is left from the new tree growth below the girdled area to produce another tree.

Peter Afekoro in Nigeria writes that a lot of farmers are now using the growing branches of the moringa tree as a source of stake material for yam vines. The interesting aspect to him is that when you cut the young tree for the stake, it sends up 6-10 new trunks for use next year. [It tends to be weak, fast-rotting wood, however.] We discovered quite by accident here at ECHO that yams love to grow right up living moringa trees. The light shade does not seem to harm them at all, nor do the vines seem to harm the moringa tree.

The April 1990 issue of Agroforestry Today reports that farmers in Kenya's eastern highlands are using a local tree, *Commiphora zimmermannii*, (local names: mutunguka, mururi, kitungati) as stakes for both yam and passion fruit. It is drought tolerant, easily rooted from green stakes, slow growing with few lateral roots that might compete with crops, has no large dense canopy to shade crops, and thrives under frequent pollarding. (Pollarding is cutting back severely to a certain height, then letting new branches form near the top.) "Heavy vines would kill many trees, but Kenyan farmers claim that the mururi, once established, is permanent." A picture shows a farmer with yams on living stakes that appear to be about head high and were planted 20 years ago. "Few species could survive under these dense and heavy vines." It is also popular as living fences and is legally recognized as boundary markers because it is so permanent. If any of our Kenyan readers can supply ECHO with enough seed (if it produces seed) to make up 30 or so packets to offer to our network in other countries, please send details including postage costs and any insights you may have about growing the tree.
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