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Sweetpotato: Organic Production

HORTICULTURAL CROPS

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Abstract: *This publication describes advances in organic sweetpotato production—propagation, soil fertility and fertilization, tillage and weed management, insect pest and disease management, and curing/handling—and includes an extensive assessment of current and future markets. Further resources include current research projects at the University of North Carolina, Web sites, and publications.*

Acknowledgement

I am deeply grateful for the professional insights offered by Danielle Treadwell, graduate research assistant in the Department of Horticultural Science at North Carolina State University (NCSU), growing out of her experience with management strategies for organic sweetpotato at the Center for Environmental Farming Systems. I am especially grateful for her sharing preliminary results of a three-year project, funded by USDA's Sustainable Agriculture Research and Education (SARE) program, as part of an ongoing study of organic production of various crops, under the direction of Prof. Nancy Creamer.

Introduction

The sweetpotato has a long history as a crop to stave off famine—especially as a cheap source of calories. Today, China cultivates more than 90% of world sweetpotato acreage. Sweetpotato has been grown in China since the late 16th century, and 40% of the Chinese harvest is used as animal feed to support a growing domestic demand for animal protein. (See *www.fao.org/DOCREP1003/TO554E13.htm* and *www.apcaem.org/postharvest*.) The International Potato Center (Centro Internacional de la Papa, CIP), Lima, Peru (*www.cipotato.org/sweetpotato/sweetpotato.htm*), maintains the largest sweetpotato genebank in the world, containing thousands of wild, traditional, and improved varieties. In contrast with China, 90% of production in South America (and in Africa) is for human consumption.

Research conducted at Tuskegee Institute in the early 20th century demonstrated that more than 100 indus-

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trial products could be made from the sweetpotato. Few, however, have been commercialized in the U.S. Multinational consortiums (one is Toyota, Cargill, & Dow) are in the planning stages for industrial applications of sweetpotato research—such as production of lactic acid or polylactic acid (PLA)—outside the U.S., near sources of raw materials. Polylactic acid, or PLA, is used for biodegradable plastics.

In the United States, sweetpotato agronomic research is carried on mainly at Mississippi State University and at the Louisiana State University Ag Center. Federally funded organic research is being carried out at North Carolina State University. See **Resources** for links and citations.

What is a sweetpotato?

Sweetpotato (*Ipomoea batatas* L.), a member of the Convolvulaceae family, originated in the Western Hemisphere. Botanically, the underground part is classified as a storage root, rather than a tuber, as is the white ("Irish") potato (*Solanum tuberosum*). The most common type of sweetpotato found in U.S. markets is the "moist-fleshed" type, red-skinned with dark-orange flesh. Dry-fleshed types of *I. batatas* (yellow, ivory, or white flesh) are popular among both Caribbean and Asian shoppers—especially on the U.S. East Coast—and are sometimes sold under the Cuban name of *boniato.* 'Boniato' is also the name of a specific cultivar.

Some consumers call sweetpotatoes "yams." "Yam" (from the Yoruba word *iyama* [to eat]) is a term applied colloquially to the moist, orange-fleshed type of sweetpotato (see links below for a more complete explanation of botanical differences). The true yam (*Dioscorea* spp.)—a tuberous climbing vine not grown commercially on the U.S. mainland—is naturalized in parts of the Upper South (chiefly *D. japonica).* "Yam" is ***not*** a produce industry classification.

See chart **What Is the Difference Between a Sweetpotato and a Yam?** *http://www.ces.ncsu.edu/depts/hort/hil/hil-23-a.html*

Leading U.S. production areas

It is possible to grow some variety of sweetpotato in much of the U.S., but commercial production is confined to just a few states. Sweetpotato production generally requires a minimum frost-free period of 110 to 150 days. 'Georgia Jet' is a 90-day variety that can be grown all the way to the Canadian border.

In recent years, large-scale sweetpotato production has been limited to the Southeast (conventional) and California (mostly organic) in the continental U.S. Since 1989 conventional sweetpotato production in North Carolina has accounted for nearly 40% of U.S. output—followed by Louisiana and Mississippi. The North Florida Cooperative, selling to school lunch programs in Georgia, Alabama, and Mississippi through the Small Farmers Distribution Network, supplies a four-state area with sweetpotatoes grown in Mississippi.(1) California production accounted for about 10,000 of the 92,000 acres harvested in the U.S. in 2003. One grower-shipper, with planted acreage in three southern states, accounts for 3% of the total, in keeping with an accelerating trend toward produce industry consolidation.(2) 'Boniato' is raised in Florida, and "Jersey Group" dry-fleshed varieties are generally favored in the Northeast and Atlantic Seaboard markets. Sweetpotato is also produced in Hawaii (especially 'Satsuma,' a short-day cultivar for the tropics) and the commonwealth of Puerto Rico, as well as the U.S. possessions of Melanesia and Micronesia.

The National Agricultural Statistics Service (NASS) reports commercial sweetpotato acreage in nine states for 2002 and 2003, ranging from about 40,000 acres planted in North Carolina down to 500 acres in Virginia. Louisiana, Mississippi, and California also report significant acreages. New Jersey is the northernmost Atlantic Seaboard state reporting significant commercial production. Varieties such as 'Georgia Jet' can be raised in home gardens in the North. Production figures have varied little from year to year since the 1980s, although the U.S. population has grown by a third. This amounts, statistically, to a decline in U.S. per capita consumption that would have appeared more dramatic except for expanding exports (3) and USDA purchases for donation to domestic food assistance programs.(4) Statistics for organic production are not yet available from NASS.(5)

Canada and the United Kingdom are the main trading partners with the U.S. The North Carolina Sweetpotato Commission considers exports a "small but viable market." China is the largest competitor and also represents a threat to U.S. domestic markets. Cost competitive shipping challenges remain to be resolved. Fuel charges and hurricane damage hurt Georgia shippers in 2004.(3)

Markets

Processing

According to the grocery manager at Ozark Natural Foods (ONF) in Fayetteville, Arkansas, canned organic sweetpotatoes are packed and shipped from Oregon (where manufacturing facilities are more conveniently located than in Southern California). ONF does not stock any organic frozen sweetpotato products at this time. Organic sweetpotato baby food sold through an Internet shopping service (ShopNatural.com) is supplied by the Tucson Natural Foods Warehouse, only a short trucking distance from the organic sweetpotato fields of California.

Other value-added organic sweetpotato products include flour and pancake mixes from Bruce Foods and sweetpotato chips by Terra. Some East Coast restaurants—especially in New York and Florida—now feature sweetpotato fries, most likely made on-site from boniato or Jersey types. The National Aeronautic and Space Agency (NASA) is researching sweetpotato breakfast cereal.(6)

Many canneries processing conventionally-grown sweetpotato are located in eastern Louisiana. The Mississippi Sweetpotato Growers Association began a relationship in 1995 with Glory Foods of Columbus, Ohio, contracting for 1,000 acres of production to supply Chicago markets. Products included sweetpotato fries. (See *www.milewis.com/sweetpotatofund/history*.) White potato (*Solanum tuberosum*) processers with excess capacity due to a recent downturn in demand are now shifting to sweetpotato products.

In January of 2004, capitalizing on interest in convenience foods, the Mississippi Land, Water, and Timber Board agreed to put up two-fifths of the cost of building a $5 million plant in Vardaman, Mississippi, to produce "fresh-cut" and "frozen-cut" sweetpotato products, contracting with nearby conventional growers. Ninety percent of Mississippi commercial sweetpotato acreage (3,500 acres in 2003) lies within a 30-mile radius of Vardaman. (The grant is contingent upon sweetpotato farmers in two counties raising an additional $3 million.) In April 2004 the Arkansas Rural Enterprise Center announced plans for a sweetpotato processing storage center in the Arkansas Delta counties, where about 1,200 acres of sweetpotato are harvested annually, and unemployment rates are chronically high.

Small quantities of fresh-dug sweetpotato, both conventional and organic, find local buyers throughout the South, especially at farmers' markets. Oklahoma Cooperative Extension recommends Pick-Your-

Own as a marketing strategy. (See *http://osuextra.com/pdfs/F-6022web.pdf*.) An Internet search turned up several hundred vendors selling fresh sweetpotatoes (mostly non-organic) on-line.

Fresh produce

U.S. No. 1s and 2s are the sweetpotato grades intended for fresh produce markets. Jumbos, cuts, cracks, and splits are considered culls. Although root length and diameter may be consistent with U.S. grades 1 or 2, roots are frequently omitted from the premium grades due to damage caused either by soil-dwelling insects feeding on the roots or by rough handling at harvest or during sorting and grading, which results in "skinning." These types of damage affect appearance, and feeding holes and skinning may lead to secondary infections by pathogens in storage. Overfertilization, thin (nonuniform) stands, or failure to harvest at the right time can cause jumbos. Skinning occurs because the outer layer of a sweetpotato is not bound as tightly to the flesh as that of a white potato. Louisiana growers don't seem to have as much of a problem with skinning, perhaps because of their siltier soils.(6).

Unfilled niches

There may be unfilled marketing niches for the dry-fleshed sweetpotato types preferred in Asian cuisines and in gourmet markets as year-around grill food. Sweetpotatoes, high in minerals and vitamin A, can be marketed as a "health food." A baked sweetpotato makes a satisfying entrée for a vegetarian meal. If properly cured and handled, sweetpotatoes have a long shelf life (6 to 9 months) without refrigeration. (Organic handling/curing facilities would need to comply with the National Organic Standard and might need separate handler certification—even on the farm where the crop is produced. Consult your certifier.) Time-consuming and exacting traditional curing procedures to prolong storage life are increasingly being bypassed in favor of "fresh-cut," "frozen-cut," fresh-dug (farmers' markets, Internet), or "You Dig."

Sweetpotato can be used as animal feed—more commonly outside the U.S., although hunters in the Carolinas reportedly buy truckloads of cull or surplus sweetpotato to use as legal "deer bait."

Sweetpotato leaves and vines are also edible, available through Asian markets in larger U.S. metropolitan areas. In South and Southeast Asia and in Hawaii, young leaves and shoots of a related species, *Ipomea aquatica* Forsk (also *Ipomoea reptans* Poir), are reportedly the most popular fresh cooking green, sold under the name of *kangkong (water spinach, ong choy,* or *engtsai*); stems are processed into pickles. Although these species can form tubers, they are marketed before the tubers and vines form. NOTE: Kangkong, propagated by seed, MAY NOT BE PLANTED IN FLORIDA WITHOUT A SPECIAL PERMIT. (See *http://edis.ifas.ufl.edu/BODY_MV085*.)

Recently introduced to the nursery trade, ornamental sweetpotato vines—with purple, green, or variegated leaves—have been available in garden centers for the past few years. Shipping any part of the unprocessed sweetpotato across any state line is heavily regulated in the U.S., to prevent spread of diseases and pests.

Like white potatoes, sweetpotato food products may have lost some ground with the public because of a perception that they are a "high-carb" food. Many studies have shown sweetpotatoes to be far richer in vitamins and minerals than white potatoes.(6) USDA is a large buyer for the school lunch and other feeding programs. According to *The Packer*, sales of moist-fleshed types (traditionally known as "yams"), both canned and fresh, go up right before the fall holidays.(5)

Comparison of organic and conventional marketing options	
Conventional	**Organic**
Vertical integration	Rise of alternative marketing methods
Indications of falling domestic demand	Rising demand for organic produce
Emphasis on interstate trade, exports, feeding programs	Compatible element in local food systems
Transport difficulties/rising fuel prices	Local sales
Industrial uses	Organic ethanol (3)
Extensive breeding programs	Specific cultivars for organic production
Movement away from curing for winter storage to processing as a convenience food	Shift of responsibility for medium-to-long-term storage to the retail customer; organic processed versions

At present, USDA regulations prohibit importation of unprocessed, live sweetpotato plant materials. If the situation should change, the significant amount of certified organic farmland in tropical portions of North and South America, and readily available USDA-accredited certification, could lead to serious competition for U.S. organic sweetpotato growers. Processed organic sweetpotato products could conceivably come from China, eventually.

In Iowa, fresh sweetpotatoes are currently being advocated as a "historic food," based on their position in the regional market of the 1930s, '40s, and '50s.(7,8) This and similar attempts to tie products to a state, region, or period have marketing potential, even though the public at the moment clearly prefers highly processed "snack" foods.

Small Grower Exemption

Producers who sell less than $5,000 worth of organic products each year are not required to be certified. However, they must follow all the regulations, and they may not sell their produce for processing into commercial organic food products. *www.ams.usda.gov/nop/*.

A critical question is, of course, what is going to happen to transportation costs in any future "oil crunch"? Availability of other petro-derived products, such as pesticides, would also be in question. And what is the timeline? A forced reliance by a critical mass of consumers, in say, Iowa, on local food systems is one scenario where demand would induce farmers to gear up again (as they did during the Great Depression) for large-scale organic sweetpotato production at the local level.

Sweetpotato Production

Conventional Information

Basic sweetpotato production and handling information is best obtained through state Cooperative Extension offices. Extension leaflets are available on-line or from your county agent.

- North Carolina Sweetpotato Commission
  www.ncsweetpotatoes.com

- University of Georgia Cooperative Extension
  www.ces.uga.edu/pubcd/C677.htm
- Louisiana Sweetpotato Commission
  www.sweetpotato.org
- University of California at Davis
  http://fps.ucdavis.edu/sweetpotato/background.html
- Oklahoma State University Cooperative Extension
  http://osuextra.com/pdfs/F-6022web.pdf
- Oregon State University
  http://oregonstate.edu/Dept/NWREC/swpotato.html
- University of Hawaii Extension
  www.extento.hawaii.edu/kbase/reports/sweetpot_prod.htm

Organic Production

Cultivars/Propagation

Growers should consult state Extension literature for cultivars recommended for a specific region. Only a few varieties show any resistance to pests (none to sweetpotato weevil) or diseases (except where virus-free plants have been tissue-cultured).

Sweetpotato propagation for U.S. farmers is from slips only. A recent Clemson introduction, 'White Regal' sweetpotato, can be stored for several months. This is a dry-fleshed variety with reported high resistance to fusarium wilt and the southern root-knot nematode. It also, reportedly, shows resistance to internal cork virus, sclerotial blight, white grub larvae, wireworms, and cucumber beetles.(9) Production of organic slips should be contracted well in advance of the growing season. In 2003, the first full year after national organic standards were finalized, many certifiers (including at least one state department of agriculture) arranged for sources of plant starts for organic growers. In California, certified disease-free sweetpotato propagation material is distributed by the California Sweetpotato Council (*www.cayam.com*) to its members, many of whom are organic growers.

Smaller quantities of certified organic starts are available in some localities—particularly in California, where Ecology Action and other organizations offer organic sweetpotato and other vegetable starts. Since the inception of the National Organic Program, propagation material, especially plants, has been in extremely short supply, and a grower without a connection to a university with a micropropagation unit may be out of luck.

As a last resort, some organic growers attempt to propagate their own sweetpotato slips from saved tubers. However, if growers are using slips that have been cut from roots saved over several generations, mutations (common in sweetpotato) begin to accumulate, and root quality declines. This has been demonstrated in research and is one of the driving forces behind development of micropropagation units like the ones at North Carolina State and the University of California. Growers term the mutation accumulation "running out." Expression of the "good" genes is masked by expressions of mutated genes (10), sometimes leading to the knarled, misshapen, skinny offerings in farmers' markets. Detailed information on propagation basics may be found at one of the international Internet sites aimed at large-scale commercial production, such as *www.apcaem.org*.

Note that shipping of sweetpotato propagation materials across state lines is subject to inspection and strict regulation by USDA (see *www.aphis.usda.gov/npb/F&SQS/alsq.pdf*).

Disease control begins with disease-free planting stock. California, the leading organic sweetpotato producer, leads in practical research applications for its growers—for example, the FPMS Sweetpotato Program at UC–Davis. Certified virus-free propagation material was developed through the California Sweetpotato Council (*www.cayam.com*) and since 1995 has been distributed to members by the Foundation Plant Marketing Service of the University of California. For details of the program, see *http://fps.ucdavis.edu/sweetpotato/background.html.*

Recent research by CIP personnel in China has shown that sweetpotato yield can be increased by as much as 30 to 40% without additional fertilizer, pesticide, or genetic improvement. In a five-year project in the provinces of Anhui and Shandong, using a procedure that eliminates viral diseases from planting materials, scientists were able to develop virus-free cuttings that developed into healthy plants. If extended to all of China's sweetpotato growing regions, benefits exceeding $1.5 billion could be realized. This development would considerably reduce the country's reliance on cereal imports for livestock feed. See *www.cgiar.org/research/res_sweetp.html.*

Soil Fertility and Fertilization

Sweetpotatoes do best on light, deep, friable loams (sandy loam) with high fertility. Barnyard manures and composts have a history of use in sweetpotato production. Ware and McCollum (11) note the common practice of applying manure in a furrow under the ridge at rates of 2 to 4 tons per acre, cautioning that applications on already fertile loams can lead to oversized and irregularly shaped roots. In certified organic production there are special, detailed restrictions on the use of uncomposted manure. See the ATTRA publication *Manures for Organic Crop Production*.

Ware and McCollum (11) also advise using legume green manures when growing on sandy soils. The green manure should be disked in or plowed down at least one month before the plants are set out. For more details, see ATTRA's *Overview of Cover Crops and Green Manures*. University of Hawaii Extension recommends that legume green manures not follow sweetpotato in rotation, since sweetpotato inhibits N-bearing node formation. According to University of Hawaii Extension:

> Sweetpotato residues may prevent nodulation in nitrogen fixing crops, which should be taken into account when designing a rotatation schedule. Crops traditionally rotated with sweetpotato in Hawaii include lettuce, spinach, beets, radish, kai choy, sweet corn, cowpea, peanut, bean, sorghum, alfalfa, and pigeon pea. Crops following sweetpotato in a rotation scheme should be carefully selected considering sweetpotato's allelopathic characteristics.
> *www.extento.hawaii.edu/kbase/reports/sweetpot_prod.htm*

Publication of first results from a multi-year study at NCSU by Treadwell and Creamer—comparing organic compost only, an organic hairy vetch and rye cover-crop mix incorporated before planting, and the same cover-crop mix in a reduced-tillage system, compared with a conventional control—is expected sometime in 2005. Research on other aspects of nutrient management is ongoing.(6)

Wireworm density also affects yield. For additional information on soil fertility management in organic systems, see ATTRA's *Sustainable Soil Management, Organic Crops Workbook, Overview of Organic Crop Production, Manures for Organic Crop Production, Drought Resistant Soils* and *Overview of Cover Crops and Green Manures (www.attra.ncat.org).*

Tillage and Weed Management

Sweetpotato is usually planted on preformed ridges, maintained at the proper height and shape by early-season cultivation. One or two cultivations as plants are becoming established helps them get ahead of the weeds and shade them out—the first cultivation by a week to 10 days after transplanting. Sweetpotato plants soon form feeder roots very near the surface; vines must have ample room to run, precluding late cultivation. According to the California Sweetpotato Council, hand weeding is customary for weed control in organic sweetpotato fields (*http://fps.ucdavis.edu/sweetpotato/background.html).* Keep fields and borders clear of weeds to prevent seed contamination. Flaming may be an option for organic production. See the ATTRA publications *Sustainable Weed Management* and *Flame Weeding for Vegetable Crops (www.attra.ncat.org).* For additional information on reduced tillage options, see ATTRA's *Pursuing Conservation Tillage.*

According to Danielle Treadwell, a graduate research assistant in the Department of Horticultural Science at North Carolina State University (NCSU), preliminary results of a three-year NCSU study on management strategies for organic sweetpotato show promise for reduced tillage as a strategy for increasing the percentage of marketable No. 1s. Results are consistent with a parallel study at Auburn.(6) Treadwell writes:

> Some advisors favor laying the slip on its side so that four to six nodes are underground, in order to maximize production.

> In the first year, we observed a significant increase in the No. 1s that were not damaged by soil dwelling larvae of the beetle wireworm (Coleoptera, Elateridae) in the reduced tillage treatment, compared to conventional and other organic treatments, but in the second year, damage severity ratings were similar to conventional. The results from the third year will be forthcoming. This supports my optimism for reduced-tillage root crops, and reduced-tillage vegetable crops in general, but we still have a lot of research to go before we can recommend this practice to growers. Adoption of a reduced tillage system would require additional field activities in the fall, plus additional equipment such as a reduced tillage vegetable transplanter (6).

Plastic mulch may be an option for organic sweetpotato production in some climates. According to sources at Oregon State University, use of plastic mulch and trickle irrigation has been shown to be very effective. Early and total yields are increased and more than compensate for the increased cost. For black plastic mulch to properly increase soil temperature, it is imperative that the soil surface be smooth and that the plastic adhere to it. This can only be accomplished with a plastic-laying machine designed and properly adjusted for this purpose. Clear plastic mulch is very effective for increasing soil temperature but does not control weeds. A new generation of plastic mulch films allowing for good weed control and soil warming is intermediate between black plastic and clear film. These films are called IRT (infrared-transmitting) or wavelength-selective films. They are more expensive than black or clear films, but appear to be cost effective where soil warming is important. Remember that all plastics must be taken up and disposed of in an environmentally sound manner at the end of the season. See *http://oregonstate.edu/Dept/NWREC/swpotato.html.*

> **§205.206(c)(6) of the National Organic Rule** approves use of plastic or other synthetic mulches: "Provided, That, they are removed from the field at the end of the growing or harvest season."

Non-woven or spunbonded polyester and polypropylene, and perforated polyethylene field covers, may be used immediately after transplanting. Row covers increase heat accumulation by two to three degress over the ambient temperature. Two to four degrees of frost protection may also be obtained at night. Soil temperatures and root growth also increase under row covers, as do early yields and, in some cases, total yields. See *http://oregonstate.edu/Dept/NWREC/swpotato.html.*

Insect Pest and Disease Management

Soils must also be disease-free. A three- or four-year rotation is recommended to help control soil-borne diseases. Except for stem rot, the most common diseases in parts of the country that depend on rainfall rather than irrigation—scurf (*Streptomyces ipomoeae*), soil rot/pox (*Streptomyces* spp.; *Rhizopus* spp.), stem rot (*Fusarium* spp.), internal cork (necrotic lesions formed in defense against microorganisms), root rot (*Ceratocystis fimbriata*), and soft rot (*Rhizopus* spp.)— are most likely to manifest in long-term storage. This is why selling fresh-dug, uncured sweetpotatoes through farmers' markets, PYO, and the Internet is so popular. During the growing season, light, frequent waterings or drip irrigation (as opposed to heavy, infrequent waterings) help control rots. Good soil drainage and lack of soil compaction are also useful in controlling rots.

Too-recent applications of manure have been implicated in the development of scurf. See *www.extento.hawaii.edu/kbase/reports/sweetpot_prod.htm.* Organic production rules on application of fresh manure are very stringent.

Cultural pest controls recommended for sweetpotato production include planting in fields that have been kept free of weeds and grasses, especially bindweed and morning glory, for the preceding two years. Many of the foliage-feeding insects harbored year to year on plants surrounding fields lay eggs that hatch into larvae that damage the underground portion of the sweetpotato.

Since sweetpotato shares some foliage pests with corn and soybeans, some sources recommend that sweetpotato fields be kept as far away as possible from these crops. However, other experts disagree on the necessity for this. A three- (or more) year rotation schedule should be followed for sweetpotato for control of insect pests, as well as diseases. Some recommend planting only in fields that have been kept clear of weeds and grasses for the preceding two years. After harvest, clean up fields as soon as possible. Composting or incorporating all plant residues into the soil is recommended. Discing the roots in is an adequate sanitation measure. Gleaners can help harvest roots left in the ground to prevent them from serving as hosts for pests and diseases.(13)

State/Regional Considerations

The sweetpotato weevil is the most vexing insect pest. Quarantine of infested soils is the strategy of choice, enforced by state authorities in parts of the South. Other pests include aphid, fall armyworm, flea beetle, wireworms, southern corn rootworm, and rootknot nematodes. Wireworm density affects yield. Certain cultivars resist flea beetle and wireworms, as well as some nematodes. Wireworms and nematodes are sometimes a problem west of the Rockies, but cause only minor damage. (See *http://fps.ucdavis.edu/sweetpotato/background.html.)* This favors southern California producers, the chief source for organic sweetpotatoes in winter vegetable markets nationwide.(14)

North Carolina

The biggest insect problem is the soil-dwelling larvae of several species of wireworm, otherwise known as the click beetle in its adult form. Sweetpotatoes harvested earlier in the year seem to have less damage than those harvested later. Early planting (before the normal May 15 to June 15 dates) is not always possible, due to rain and cool temperatures in the early spring. In a bad year, growers may have to leave 30% or more of their roots in the field due to wireworm damage.(13) The NCSU sweetpotato breeding program is currently conducting research to develop a new cultivar with a shorter time to maturity.

Wireworm and consequent feeding activity in sweetpotatoes increase following grass crops like sorghum, pasture, or ryegrass. NC Extension recommends NOT using a cover crop at all prior to sweetpotato. See *http://ipm.ncsu.edu/safety/notes/pfacts.htm*.

Louisiana

The sweetpotato weevil (*Cylas formicarius elegantulus*) is a primary pest and can severely limit yields and increase production costs. The range of alternate plant hosts and the environmental range of the sweetpotato weevil are being investigated to determine patterns of seasonal survival and reproduction in Louisiana. See *www.lsu.edu/entomology/review/ipm.htm.*

Georgia

Sweetpotato weevil is a serious pest in Georgia. The Georgia Department of Agriculture prohibits the production of sweetpotatoes in quarantined areas. If you are unsure about weevils in your area, contact your county Extension agent or the State Department of Agriculture. See *www.ces.uga.edu/pubcd/C677.htm*.

Alabama

Sweetpotato weevil is a serious pest in Alabama. The Alabama Department of Agriculture requires certification of sweetpotato seed stock and plants and also enforces a sweetpotato weevil quarantine. Each shipment of sweetpotatoes entering Alabama must be accompanied by a certificate of quarantine compliance. For more information, see *www.aphis.usda.gov/npb/F&SQS/alsq.pdf*.

Arkansas

At the Matthews Sweetpotato Farm on Crowley's Ridge in eastern Arkansas, wireworm and sweetpotato weevil are the main pests. Organic production, mainly in Northwest Arkansas, occurs on a small scale for local markets.

Curing and Handling

Proper curing requires drying the freshly dug roots on the ground for two to three hours, then placing them in a warm room (perhaps one constructed especially for the purpose). Sweetpotatoes require curing right after harvest at 85°F (with relative humidity of 90 to 95%) from 5 to 14 days, to promote wound healing—then storage between 60°F and 55°F. This is easily accomplished in Southern California, but proper curing during harvest can be a problem in the Midwest, Upper South, and Southeast. In case of frost, cut the vines from the roots immediately, to prevent decay spreading from vines to roots, and dig as soon as possible. In large-scale production, vines are mowed before digging begins. Low soil temperatures quickly lessen keeping ability. Do not allow roots drying on the ground to be frosted.(15) Detailed information on basic storage and handling may be found at *http://oregonstate/Dept/NWREC/swpotato.html.*

Hydrogen peroxide has been proposed as a postharvest treatment, as well as Effective Microorganisms (EM) and other biological controls, but has not been implemented in commercial production.(16)

The National Organic Rule §205.100–205.201 regulates organic processing and handling facilities, procedures, and recordkeeping, including on-farm operations such as curing. See *www.ams.usda.gov/NOP* for the USDA regulations. For a discussion of some implications for organic handling/curing of storage crops such as sweetpotato, see ATTRA's *Organic Crops Workbook,* at *www.attra.ncat.org*. The final say on any specific practice or material resides with your USDA-accredited certifier.

Difficulties with long-term storage mean that organic growers in most parts of the U.S. use direct marketing methods and sell uncured sweetpotatoes to the retail consumer as soon as possible after harvest.

Related ATTRA Publications

- *Farm-scale Composting Resource List*
- *Sources of Organic Fertilizers & Amendments*
- *Foliar Fertilization*
- *Principles of Sustainable Weed Management for Croplands*
- *Flame Weeding for Vegetable Crops*
- *NCAT's Organic Crops Workbook*
- *Organic Greenhouse Vegetable Production* (for slips)
- *Direct Marketing*
- *Farmers' Markets*
- *Pursuing Conservation Tillage Systems for Organic Crop Production*

References

1) Staff. 2004. Common Ground [SoSARE]. And sometimes the answer is "No." Autumn. p. 6.

2) Koger, Chris. 2004. Storms stall part of holiday's bounty. The Packer. October 25. p. A2.
The grower-shipper mentioned is the Wayne E. Bailey Shipping Co., Chadbourn, NC, with a total of 2,800 acres of sweetpotato.

3) Offner, Jim. 2004. U.S. sweetpotatoes challenge China in exports. The Packer. October 18. p. A28, A32.

4) Staff. 2004. USDA plans to purchase sweet spuds by millions. The Packer. October 18. p. A14.
To shore up domestic prices, USDA purchased 20.1 million pounds of sweetpotato in fiscal 2002, 1.6 million pounds in 2003, and 6.3 million pounds in 2004; and has just announced plans to purchase 20 million pounds in fiscal 2005 (4 million fresh, 16 million canned) for domestic food assistance programs—including school breakfast and lunch programs—and distributions to Native Americans, the elderly, and emergency food assistance programs.

5) Staff. 2004. The Packer Yearbook. Vance Publishing Corp., Lenexa, KS. p. 653.

6) Treadwell, Danielle. 2004. Personal communication. November 7.

7) Pirog, Rich. 2004. News Release: New Leopold Center Report Explores Iowa's Geography of Taste. Leopold Center, Ames, IA. October 13. 2 p.

8) Pirog, Rich. 2004. A Geography of Taste: Iowa's Potential for Developing Place-based and Traditional Foods. Leopold Center, Ames, IA.
www.leopold.iastate.edu/pubs/staff/taste/taste.htm

9) Staff. 2001. Disease-resistant "White Regal" sweetpotato is a keeper. HortIDEAS December. p. 139.

10) Ware, George W., and J.P. McCollum. 1980. Producing Vegetable Crops. Third Edition. The Interstate Printers and Publishers, Danville, IL. p. 456–457, 461.

11) Treadwell, Danielle D. 2004. Personal communication. October 27.
*See **Organic Research** below.*

12) Staff. 2004. The Packer. October 11. p. A-4.
***Note:** In California a statewide ban on handweeding in agricultural fields has just gone into effect, "unless there is no readily available or reasonable alternative." Santa Cruz-based California Certified Organic Farmers (CCOF) is working to clarify the status of organic crops (such as sweetpotato), since some botanical pesticides are used in organic production.*

13) Treadwell, Danielle D. 2004. Personal communication. October 24.

14) Rod Hildebrandt. 2004. Personal communication. October 24.
According to Hildebrandt, longtime organic produce buyer, Melissa's/World Variety Produce, Los Angeles, CA, is currently the sole U.S. supplier of organic sweetpotato to natural food stores – apart from local sources.

15) Vandemark, J.S. 1995. Vegetable Gardening in the Midwest. University of Illinois, Urbana-Champaign, Cooperative Extension. p. 118–119.

16) Diver, Steve. 2004. Personal communication to ATTRA Horticulture Team, based on May 2004 IOIA Training. May 12.

Funded projects

Evaluation of Cover Crops and Conservation Tillage for Conventional and Organic Sweetpotato Production in North Carolina. 2000. USDA Southern Region SARE Graduate Student Award. Danielle Treadwell and Nancy Creamer.

Mueller, Paul, Nancy Creamer, Mike Linker, Frank Louws, Mary Barbercheck, Cavell Brownie, Michael Wagger, Michele Marra, Shujin Hu, Charles Raczkowski, and Joan Ristaino. The Center for Environmental Farming Systems, North Carolina State University.
*This project is the second three-year grant for the major farming systems experiment at CEFS. Initiated in 1998, the farming systems project encompasses 200 acres and compares five diverse systems: a BMP[Basic Management Program] short-rotation cash-grain system, an organic production system, an integrated crop/animal system with a 15-year rotation, a forestry/woodlot system, and a successional ecosystem. The experiment is slated to continue in perpetuity. A wide range of parameters is being measured. These include above-ground biomass of cover and cash crops, nutrient/energy flows, decomposition, soil quality indices (physical, chemical, biological), soil microbiology, microarthropods, entomapthogens, insects, weeds, disease, crop yield and quality, and economics (viability on/off farm impact). The organic production systems research includes sweetpotato – see Treadwell and Creamer, above. See **Publications**.*

A multi-departmental (led by the Department of Agronomy), multinational (led by the World Laboratory, Ukrainian Branch) project is "investigating Ukrainian isolates of *Bacillus*

thuringiensis to discover Cry proteins (from Bt *cry* genes) that exhibit toxicity to insect pests, including the… sweetpotato weevil…. Microbial insecticides also are being screened for activity against soil insect pests in sweetpotatoes."
www.cgiar.org

Recent research by International Potato Center (CIP) personnel in China has shown that sweetpotato yield can be increased by as much as 30 to 40% without additional fertilizer, pesticides, or genetic improvement. In a five-year project in the provinces of Anhui and Shandong, using a procedure that eliminates viral diseases from planting materials, scientists were able to develop virus-free cuttings that developed into healthy plants. If extended to all of China's sweetpotato growing regions, benefits exceeding $1.5 billion could be realized. This development would considerably reduce the country's reliance on cereal imports for livestock feed.
www.cgiar.org

Research being funded by Cargill Dow LLC et al. was described in testimony on March 29, 2001, before the United States Senate Committee on Agriculture, Nutrition and Forestry by Dr. Patrick R. Gruber, Vice President and Chief Technology Officer of Cargill Dow LLC, as follows:
Toyota recently announced that they are entering the "sweetpotato processing business" in Indonesia with the intent of producing lactic acid and later on PLA [polylactic acid, used for biodegradable plastics]. They have in their view a biorefinery based on sweetpotatoes. I'm told that they chose sweetpotatoes and location based on carbon fixation yield and efficiency.
The document is no longer available on-line.

Publications

General

A list of research papers on sweetpotato as a food resource, at:
http://food.oregonstate.edu/ref/plant/sweet_r.html

Collins, Wanda W. 1993. Root vegetables: New uses for old crops. p. 533–537. *In:* Jules Janick and James E. Simon (ed.). New Crops: Exploration, Research, and Commercialization. John Wiley and Sons, Inc., New York, NY.

Organic research

Collins, Wanda W. et al. 1994. Organic nitrogen sources for sweetpotatoes: Production potential and economic feasibility. SARE/ACE Annual Reports (Project Report LS92-45). p. 45–46.

Creamer, N.G., and K.R. Baldwin. 2000. An evaluation of summer cover crops for use in vegetable production systems in North Carolina. HortScience, Vol. 35, No. 4. p. 600–603.

Seem, Jessica. 2002. Critical Weed-Free Period for 'Beauregard' Sweetpotato (*Ipomoea batatas*) and Weed Seedbank Changes in Response to Transitioning from Conventional to Organic Farming Systems. MS Thesis. North Carolina State University, Greensboro, NC.

Seem, J., N.G. Creamer, and D.W. Monks. 2003. Critical weed-free period for 'Beauregard' sweetpotato (*Ipomea batatas*). Weed Technology. Vol. 17. p. 686–695.

Treadwell, D.D. 2001. Evaluation of Cover Crops and Conservation Tillage for Organic Sweetpotato Production in North Carolina. 16th Annual Southeastern Fruit and Vegetable Expo. December 12. Greensboro, NC.

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