Commercial Growing

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Because there is so much information here, we've broken it up into the following sections to make it easier to read and to print out. When you click on the topic list below they will launch new windows.

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Many varieties of Sweet Potatoes are grown in North Carolina. Although some are grown for special uses only, the majority are the orange-fleshed moist, sweet varieties that are widely accepted in the fresh market and for processing. The variety picture changes rapidly, and new varieties with superior qualities are released almost annually. Each variety has certain advantages and disadvantages.

Because Sweet Potatoes are vegetatively propagated and because uniformity in appearance of roots is essential, it is important to choose a variety that will suit your soil type, market requirements and weather conditions. It is advisable to plant at least two varieties each year because no single variety performs best on all soil types and under all climatic conditions. Below is a comparative table to help you with your choice.

### Sweet Potato Variety Description Table

<table>
<thead>
<tr>
<th>Variety (Origin Date)</th>
<th>Foliage</th>
<th>Skin</th>
<th>Flesh</th>
<th>Yield</th>
<th>Disease &amp; Insect Resistance</th>
<th>Flood Damage</th>
<th>Other Weaknesses</th>
<th>Other Strengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beauregard (LA, 1987)</td>
<td>Green heartshaped leaves, blooms prolific</td>
<td>Rose</td>
<td>Orange</td>
<td>V. good</td>
<td>White grub, soil pox</td>
<td>Resistance, roots may be misshapen</td>
<td>Susceptible to root-knot, nematodes; bacterial soft rot; slow sprouting</td>
<td>Stores well, high % No. 1 roots</td>
</tr>
<tr>
<td>Hernandez (LA, 1992)</td>
<td>Green arrow-shaped leaves, purple stems, faciation</td>
<td>Burnt Orange</td>
<td>Deep Orange</td>
<td>Good</td>
<td>Root-knot, Soil Pox, Fusarium Wilt</td>
<td>Wet soil may result in raised lenticels or black pimples on skin</td>
<td>Late, sporadic sprouting, black flecks on skin. Slow sprouting, poor taste. Susceptible to blister; boron application may be necessary.</td>
<td>Very uniform shape</td>
</tr>
<tr>
<td>Jewel (NC, 1970)</td>
<td>Green stems, bushy</td>
<td>Copper</td>
<td>Deep Orange</td>
<td>V. good</td>
<td>Root-knot, Internal Cork</td>
<td></td>
<td>Mutations, Soil Pox, Cracking with variable soil moisture</td>
<td>Storage life, shapes high % No. 1 roots</td>
</tr>
<tr>
<td>Carolina Ruby (NC 1988)</td>
<td>Green heart shaped leaves with purple veins</td>
<td>Dark Red to Purple Red</td>
<td>Dark Orange</td>
<td>V. good</td>
<td>Fusarium Wilt, moderate soil rot, moderate to flea beetle</td>
<td>Wet soil may result in cracking and blisters on skin</td>
<td>Susceptible to root-knot nematodes, white grub &amp; wireworm</td>
<td>Stores OK Excellent baking quality</td>
</tr>
<tr>
<td>Porto Rico 198 (NC 1966)</td>
<td>Deep Purple Stems and Veins</td>
<td>Rose-pink Orange Mottled</td>
<td>Average</td>
<td>None</td>
<td>Moderate resistance</td>
<td>Susceptible to major diseases/cracking</td>
<td>Baking quality</td>
<td></td>
</tr>
<tr>
<td>Cordner (TX 1983)</td>
<td>Green stems</td>
<td>Copper</td>
<td>Medium Orange</td>
<td>V. good</td>
<td>Root-knot</td>
<td>Susceptible to pox</td>
<td>Earliness, good plant production</td>
<td></td>
</tr>
<tr>
<td>White Delight (GA)</td>
<td>Green heartshaped leaves</td>
<td>Purplish pink</td>
<td>White</td>
<td>V. good</td>
<td>Fusarium wilt</td>
<td>Root-knot</td>
<td>Susceptible</td>
<td>Damp soil can cause high % rot</td>
</tr>
</tbody>
</table>
Section 2: Climate Conditions

Commercial Growing Information
Section 2: Climatic Conditions

Sweet Potatoes can be grown where there is a long frost-free period with warm temperatures in the growing season. Most cultivars require a minimum frost-free period of 100-125 days, with a minimum average daily temperature of 77 degrees. Sweet Potatoes also require almost an inch of water per week uniformly distributed throughout the growing season for highest yields. Conditions 6 to 7 weeks after planting are particularly critical to development or “set” of storage roots. If soil oxygen is low, either because the soil is flooded or because it is so dry a crust has “sealed” the soil, the storage roots do not set well and yields are reduced.

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Section 3: Selecting and Growing Seedstock

Commercial Growing Information

Section 3: Selecting and Growing Seedstock

Link to Certified Sweet Potato Seedgrowers

healthy sweetpotatoes

Improved planting stock is being produced in North Carolina by carefully selecting superior-yielding, high quality hills; eliminating disease using meristem tip culture; reducing mutations and providing better, true-to-type clones by maintaining planting stock in a vegetative state. Approximately 20 to 25 percent of the North Carolina sweetpotato acreage is produced using this improved planting stock. Sweetpotato roots for bedding and plants (slips) for transplanting into the field can be purchased from NC Certified Seed Producers or you can buy plants at a garden center if storing roots and pre-sprouting is not an option for you. Planting sweetpotato root pieces directly in the field, as done with white potato tubers, does not result in sufficiently uniform storage roots. True seed is not a viable option because SweetPotatoes are genetically complex and plants growing from true seed are extremely variable. At all stages there is potential for disease transmission. Good sanitation practices and use of disinfectants will reduce the need for fungicides, but it is difficult to grow SweetPotatoes without any crop protection.

Presprouting Seedstock

In early March, the stored roots are presprouted, a process by which sweetpotato seed stock is conditioned to produce sprouts. Research has shown that pre-sprouted seed will yield 2 to 3 times as many plants and will produce them earlier than seed that has not been pre-sprouted. To pre-sprout, warm the seed roots for 2 to 4 weeks at temperatures from 75-85 degrees, with a relative humidity of 90 percent. Ventilation is necessary during pre-sprouting because roots are taking up oxygen and giving off carbon dioxide. Roots with scurf, black rot or other diseases, obvious off-color flesh or skin mutations should be discarded before bedding. In conventional production, seedstock is treated with fungicides before bedding. Pre-sprout until most of the seed stock has sprouts approximately 1/4 inch long. Sprout development can be delayed if necessary, by lowering the temperature in the pre-sprouting room.

greenhouse plant beds

Once pre-sprouting is finished, the seed roots are bedded to produce sprouts or slips. Several types of beds may be used for growing sprouts - hot beds with or without plastic covers. The most practical type for the majority of North Carolina growers is the field bed covered with clear plastic. Seed stock is usually bedded by the end of March and plants are ready for transplanting into the field by early May in eastern North Carolina. Plastic greenhouses are recommended for early plant production. Plants can be produced in 4 to 5 weeks in greenhouses if artificial heat is provided and pre-sprouted seed stock is used.

Bed Site Selection and Preparation

To avoid any carry over of disease and other root pathogens from a previous crop, select a well-drained, sandy, loamy soil that has not been used to produce SweetPotatoes for at least 3 years. Unshaded field sites that have been out of sweetpotato production for 3 to 4 years are best. Good drainage is necessary to prevent rotting of the bedded roots. Locate the bed where water is available, as it will be necessary to irrigate periodically. However, do not use water sources that are fed by drainage from old sweetpotato fields. Allow 12 square feet for each bushel of seed stock 1 1/8 to 2 inches in diameter. Allow 20 to 30 square feet for seed stock 1 to 2 inches in diameter. Additional space will need to be provided for driveways and alleys between beds.

plant beds

The width of the bed is a matter of individual preference. Narrow beds, 24 inches to 28 inches wide, are popular because they can be prepared (opened) easily and the seed stock can be covered with soil mechanically. Equipment is also available to place the plastic covers over the beds mechanically. Cutting transplants from narrow beds is preferred because workers damage fewer developing plants and mother roots.

Plant bed sites are usually not fumigated. If serious weed and disease problems are anticipated, the site may be treated in the fall when the soil is warm. Do not treat when the soil temperature at the 4-inch depth is less than 55 degrees F.

Each bedded seed root will produce up to 15 plants. Often, as many as 6 sprouts will be growing on each root at one time. To prevent the production of small, weak, spindly plants, give the seed roots sufficient space: at least 1 inch between roots that are less than 2 inches in diameter and just enough space that the roots do not touch for those more than 2 inches in diameter. Be sure that the depth of the soil covering the seed stock is at least 1 inch. Seed stock covered with more than 3 inches of soil may rot as a result of oxygen starvation.

Fertilizing Plant Beds

Proper fertilization will increase the size and vigor of the plants as well as the number of transplants produced. Fertilizer may be applied to the top of the bed, 75 pounds of 8-8-8 fertilizer per 100 square yards of bed space, after the seed roots have been covered with soil. After application, rake the top of the bed lightly, without injuring the roots, to incorporate the fertilizer into the top inch of soil. For those bedding larger quantities of seed stock, it is best to broadcast the fertilizer and mix it into the top 6 inches of soil before making the beds. Use 3,600 pounds of 8-8-8 fertilizer per acre. While this method greatly reduces the labor and time required to apply the fertilizer, the alleys and walkways are also fertilized.
Covering Plant Beds

After bedding and fertilization is completed, cover each bed with 1.5-to 2.0-mil clear plastic film to trap and hold the heat in the bed. Do not attempt to keep the plastic off the soil. Cover the edges of the plastic with soil to keep the wind from blowing it off. Punch a few small holes in the plastic cover (a 1/2 inch diameter hole every 4 inches) for ventilation. These holes allow carbon dioxide to escape and oxygen to enter, minimizing oxygen starvation, carbon dioxide buildup, overheating, and decay. If oxygen is limited or the carbon dioxide cannot escape, the roots will decay. This usually occurs when the soil in the bed is extremely wet. It is undesirable to cover the Sweet Potatoes with soil and wait until after a rain to put on the plastic covers. If the cover is airtight, the soil surface under the plastic may reach 120 degrees on a clear day when the outside air temperature is only 70 degrees. If such conditions persist for an extended period, sprout production may be reduced.

Managing Plant Beds

Remove the plastic covers when the plants begin to emerge throughout the bed or until chance of a killing frost has passed. After each cutting or pulling of plants—and after each leaching rain—dress the bed with 1 to 3 pounds of nitrogen per 100 square yards of bed. This amount is enough to keep the plants growing but not enough to make them tender and brittle. The beds should be irrigated as needed to maintain adequate soil moisture for plant growth. Irrigation after each cutting helps rejuvenate the beds and activate applied fertilizers. Disease and weed treatments are usually neither warranted nor practical after plants have emerged.

Producing and Handling Quality Plants

The quality and vigor of plants are best determined by the size of the stems and the number of leaves. The best plants are 8 to 12 inches long and have 8 or more leaves. Plants that have less than 8 leaves and are slender-stemmed and weak do not survive in the field, especially if the soil is dry immediately after transplanting. Plant cuttings longer than 12 inches create a problem if a precision-type transplanter is used, and they will be difficult to cultivate even if they go through the transplanter. Transplant as soon as possible after removal from the bed, supply 1.5 to 2 ounces of water to each plant when planted, and press the transplanting hole closed. Do not dip the plants in water because this will spread the pathogens that cause bacterial soft rot, pox, fusarium root and stem rot, and other diseases.

When transplants are pulled out of the ground, underground portions of the stem, roots formed near the mother root, and some mother root tissue remain attached. To reduce the risk of disease, sprouts are sometimes allowed to grow longer and sprout cuttings, usually called vine cuttings, are made above the soil line. Roots continue to produce sprouts for several weeks, depending on cultivar, root size, and the vigor of the bedded seedstock. An additional 20 pounds of NaNO₃ per 100 square yards is top-dressed after each pulling or cutting.

Plant Bed Destruction

After the plants have been harvested, destroy the bedded seed stock. Even though “mother roots” may look good enough to market, they should not be eaten. This used seed stock has been exposed to materials and conditions that render it unsuitable or even dangerous for human consumption.

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Section 4: Soils and Fertilization

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Section 4: Soils and Fertilization

Sweet Potatoes grow best in loamy soils. The best soil types are well-drained, fine sandy, or clay loams. Light, loamy soils usually result in roots with better shapes than those grown in heavy or clay soils, which results in rough, irregular roots. High (more than two percent) organic soils also reduce production. Coarse, deep, sandy soils are generally low in fertility, subject to moisture stress, and require more irrigation and fertilizer to grow a good crop. Poor aeration caused by poor drainage decreases yields. With severely impeded drainage, insensitive cultivars can cause either souring (tissue breakdown of the storage roots) or water blisters (enlargement of lenticels on the periderm) if the drainage problem is less severe. Sweet Potatoes will grow at a soil pH of 4.5 to 7.5, but 5.8 to 6.2 is optimal. To ensure that the soil is properly limed and fertilized, representative soil samples should be collected from each field. Careful sampling and testing are most important for fields being used for the first time or whenever little is known about recent liming and fertilization practices.

Agricultural lime, if needed and applied several months before planting, can effectively change the soil pH value. Lime can best be mixed by disk ing or chiseling before plowing or bedding. Use dolomitic lime if the soil's magnesium level is low; other calcitic lime may be preferred if it is less expensive. In general, fields that have the proper soil characteristics and have not produced a crop of Sweet Potatoes in the last 2 years are preferred. Avoid fields that have been idle (grassy), seriously eroded, or have very high nematode populations. Fields with a history of pox should be avoided for 5 years. Before planting, determine which herbicide or herbicides (if any) have been used on these fields for the past 2 seasons to be certain that there will be no herbicide carry-over problems.

Fertilizer is applied during 3 cultivations, under the row or banded preplant. Harvesting 1 ton of Sweet Potatoes removes 4 to 5 pounds nitrogen, 1.4 to 3 pounds phosphorus, and 7 to 11 pounds potassium from the soil. Sweet Potatoes only need moderate amounts of nitrogen and phosphorus, but need significant amounts of potassium.

Fertilizer can be either banded or broadcast after transplanting. Application rates should be determined by a soil test. The general recommendation is 40 to 60 pounds of nitrogen per acre about 28 days after planting, 60 pounds per acre of phosphate at or shortly after planting, and 150 to 200 pounds of potash (50 pounds at or near planting and 150 pounds at layby). Beuregard requires even less nitrogen than other varieties. Low potassium reduces yields and increases the number of long, slender, malformed roots. The following table are fertilizer recommendations for the popular variety, Beuregard:

1ST CULTIVATION - (WITHIN 1 WEEK AFTER TRANSPLANTING)
**400 LBS./ACRE 00-15-25

2ND CULTIVATION
** 400 LBS/ACRE 00-00-30
THIS BLEND IS MADE BY USING 1/2 MURIATE OF POTASH & 1/2 GYPSUM (GRANULAR)

3RD CULTIVATION - (28-30 DAYS AFTER TRANSPLANTING)
150-160 LBS/ACRE - 34% NITROGEN
MUST USE AMMONIUM NITRATE (PRILLED)
REGULAR AMMONIUM NITRATE WILL MELT IN JUNE

**MICRO NUTRIENTS ARE NECESSARY FOR PROPER GROWTH BEAUREGARD SWEETPOTATOES

Sweet Potatoes also require more boron than many vegetables. On boron deficient soils, 0.5 pounds B per acre (5 pounds Borax or 2.6 pounds solubor) should be added to prevent a disorder called blister. This disorder is characterized by small, raised bumps on the root surfaces and plant stunting. Except for very susceptible cultivars, blister does not show up until Sweet Potatoes have been stored for several months.
Section 5: Planting

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Section 5: Planting

Field planting typically begins in early May, or when all chance of frost has passed, and concludes by the end of June. Soil temperature in the production field should reach at least 65 degrees at a 4-inch depth for 4 consecutive days before transplanting. If the plants are set out too early, they may be injured by frost. Feeder roots of the transplant will not grow at soil temperatures below 65 degrees, and, if planted too early, vines develop a purple color, vigor will be reduced, root yield is low, and roots are round or chunky rather than oblong.

The production field should be broken up with a moldboard plow and then disked. Silt or clay loams and sandy soils with hardpans are usually formed into wide, 8-to 10-inch high ridges with no turn rows to provide drainage. Rows are usually placed 32 to 42 inches apart with in-row spacings 10 to 12 inches apart for most cultivars. Beauregard, the most popular cultivar, should be planted 8 to 9 inches apart for improved yields and economic gain. Closer spacings delay harvest in most cultivars. A uniform stand of evenly spaced plants is important in producing high yields of No. 1 fresh market grade. Plants on both sides of a missing hill usually produce “jumbos” in the same amount of time that uniformly spaced plants are producing SweetPotatoes of ideal sizes.

The sweetpotato plants (slips) are transplanted into the rows at a depth of 3 inches with no less than 2 plant nodes in the ground and leaving at least 2 leaves or more above the ground. Drag and precision types of transplanters may be used to plant the crop. Precision equipment spaces the plants uniformly but is hard to adjust when planting in soft, dry soil. (Supporting workers on seats mounted on a tool bar independent of the planting mechanism minimizes this problem). Drag equipment can be used in either wet or dry soils but provides little control over spacing of the plants.

If water is provided at transplanting and as necessary for the next 40 days, the plants will probably survive later water stress. Thus, SweetPotatoes are sometimes thought of as a drought-tolerant crop. In reality, however, SweetPotatoes are vulnerable to reductions in yields and root quality if they receive irregular watering, too little or too much water. Uneven water availability will cause growth cracks, and drought may reduce yields. Too much water also injures SweetPotatoes. Storage roots of most cultivars cannot tolerate extended periods of very wet soil due to the lack of oxygen. In saturated soils, lenticels expand becoming more noticeable. These expanded lenticels are sometimes called water blisters. If rainy conditions persist, roots sour and rot. Thus late season rains often reduce yield and quality on poorly drained soils.
Section 6: Cultivation

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Cultivate at least 3 times with a rolling cultivator to apply fertilizer and to control emerged weeds after transplanting. Cultivator gangs are set to throw dirt on the sides of the ridge and leave a 2-inch band across the transplants untouched. To control weeds, herbicide can also be sprayed during cultivation. After sweetpotato vines have grown down the sides of the ridge it is best not to cultivate anymore because the vines suppress weed growth, and yields can decrease when the vine is injured.
Section 7: Harvest

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Section 7: Harvest

Storage roots continue to grow until the leaves are killed by frost. Depending on the cultivar, roots develop to marketable size in 90 to 120 days after transplanting. Time of harvest is often determined by digging up a few representative plants and determining the percentage of roots in the size classes. Normally, harvest begins when most of the roots are in the No. 1 size class, as No. 1 SweetPotatoes command the highest price. When to harvest can best be determined by sampling or digging a couple of rows in each field. When tops of the plants turn black after the first frost, it is imperative to harvest as quickly as possible. However, partial or complete freezing of the foliage is not likely to damage the crop unless the temperature of the soil around the roots falls below 55 degrees for several hours. Roots chilled below 40 degrees overnight may develop internal breakdown in storage or may develop hardcore.

In harvest systems where the vines would tangle in the harvester, vines are cut before harvest. Vine killing in hot, wet weather and/or in poorly drained soils may result in anaerobic conditions and subsequent souring of roots either in the ground or in storage, so roots should not be left in the ground for long periods after the vines are killed. Sweetpotato roots are turned up on top of the ground by a side angle disk plow and partially exposed to aid the workers in picking and sorting.

Sweetpotatoes are very susceptible to damage at harvest; therefore, hand-harvest is preferred over mechanical harvesting. Harvested roots left in the sun at temperatures above 90 degrees sunscald in 30 minutes. Scalded areas turn purplish-brown and are more susceptible to storage rots. In very dry soil, the root periderm, or outer layer of skin, becomes more fragile and easily abraded, or “skinned,” on the hard soil clods during harvest. Sweetpotato roots do not have a thick protective outer layer of cells such as that on white potato tubers. Any abrasion can lead to rots in storage. Skinning injury in dry soil can be avoided either by waiting for rain or by irrigating the field before harvest. Rough handling by workers also tears the delicate skin. Workers should wear gloves and avoid dumping the roots roughly into the container.

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To harvest, the field rows are usually plowed with a modified disk or moldboard plow with a spiral attachment. Roots are then hand harvested and graded in the field. Sweetpotatoes can also be dug by a chain digger or a riding harvester that conveys the roots to a sorting crew using a harvest aide. Potato harvesters are sometimes used to harvest sweetpotatoes but damage is usually unacceptably high.

After harvest, the sweetpotatoes are transferred to 20-, 40-, or 60-bushel bulk containers and are either packed and shipped immediately or put into a controlled environment storage facility for curing.

Close Window
Section 8: Curing and Storage

A small portion (15 to 20%) of the marketable roots are washed, graded, and packed within a few days of harvest and immediately shipped to the buyers. Such roots are referred to as "green" and are usually not as sweet as cured sweetpotatoes. Most roots are cured immediately after harvest to improve flavor and storage life. Curing heals cuts and reduces decay and shrinkage in storage because it allows the periderm to thicken and to reform. Curing also converts some starches to sugars, enhancing flavor.

Curing should be started within 1 to 2 hours of harvest and continued for 4 to 7 days at 80 to 85 degrees and 90 to 95% relative humidity with ample ventilation for about 5 days. Rooms with 100% relative humidity should be avoided so that the surface of the sweetpotatoes will not be completely wet, resulting in more disease. Earlier in the season, when the soil and air temperatures are higher, the roots will cure in a shorter time than later in the season when the roots start out cooler. Sweetpotatoes are normally stored in bulk containers that hold from 20 to 60 bushels.

Storage temperatures are very important. Long-term storage areas should be maintained at 55 to 60 degrees with 85% relative humidity and with sufficient venting to produce a total volume change of air at least once a day. Above 60 degrees, internal breakdown, shrinking, and sprouting can occur. Temperatures below 55 degrees may cause hardcore, a disorder where a whitish, hard area appears in the cooked sweetpotato. Properly cured and stored sweetpotatoes can be held up to 12 months with little reduction in quality. Shrinkage occurs at 1 to 2% per month if cured, 2 to 5% if uncured. In some cultivars, pithiness also increases with length of storage.
Section 9: Marketing

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For many growers, the most serious challenge is marketing their crop successfully. Successful marketing requires that farmers deliver high quality SweetPotatoes to the locations at the times and in the forms that buyers want them. For an individual operator, important factors that influence price and marketing options include:

- Local and national supply levels.
- The costs of growing the product and transporting it to major consuming areas as compared with those same costs for growers in competing areas.
- The volume of product available from a specific geographic area.
- When the crop is harvested.
- The length of time over which buyers can obtain SweetPotatoes from an area.
- The quality of the crop, as determined by production, harvesting, and postharvest handling practices.
- The reputation of the grower. An inexperienced grower who provides SweetPotatoes of variable quality over short time periods will find limited marketing opportunities.

Growers must often deal with the complexities of selling beyond the local market. To do so successfully requires specialized knowledge about buyer desires, transportation arrangements, and regional consumption patterns where the SweetPotatoes will eventually be sold. Medium- to large-volume producers often find it to their advantage to employ a sales agent whose sole responsibility is to locate and contact possible buyers and to arrange for transportation. The sales agent works exclusively for the farmer-shipper and negotiates with the buyer over the time and place of delivery, the quantity to be sold, and the price on behalf of the grower.

Another option for the grower is to hire a sweetpotato broker, who acts as a go-between. In other words, the broker negotiates the specific details of a sale contract between a seller and buyer. Brokers will work for a seller or buyer (depending on who is paying the brokerage fee) and usually do not take possession of, or even handle, the SweetPotatoes.

For smaller-volume producers, marketing options can include direct sales to consumers, selling to local grocery stores, or selling to local shipper-packers. In several areas of the state, growers have organized marketing cooperatives that permit them to market their product jointly. Because of the increased volume, they are able to hire a sales agent to handle the marketing process.

Following this link will give you a list of Packer/Shipper/Brokers in North Carolina.

It is estimated that over 70% of all the SweetPotatoes grown commercially in North Carolina are sold directly to chain stores, terminal market facilities, or foodservice providers. The remaining 30% are sold to processors for canning, flaking, chipping, frying, freezing, or baby food.

It is advised that before you plant SweetPotatoes that a marketing plan be developed and confirmed.

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Section 10: Integrated Pest Management

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Section 10: Integrated Pest Management

It is useful to select cultivars that have resistances to the more common insects and diseases and employ crop rotation. Planting sweetpotatoes in the same field once every 3 years helps to reduce pests and diseases. Crops most often rotated with sweetpotatoes include tobacco, soybeans, corn, cotton, wheat, cucumbers, peanuts, and rye. Insect monitoring is important for managing both foliar-feeding and root-feeding insects. Routine field scouting either by the grower, a family member, or a professional scout and the use of light traps and seed baits in the soil will identify which pests are present and what course of action is necessary. Should chemical insect control be warranted, the grower should follow all applicable directions, restrictions, and precautions of the EPA registered label.

In addition to adhering to the steps outlined above, it is beneficial to record every pest problem observed and diagnosed in each field or storage lot and keep those records available for future reference. Assistance in diagnosing pest problems is available from county agricultural extension agents. These agents are often able to identify the cause of problems quickly. In addition, many crop consultants and private laboratories can help with these and related services.

Insect Pests

**Lepidoptera larvae**, (a) SweetPotato hornworm, *Agrius cingulatus* (Fab.); (b) corn earworm, *Heliothis zea* (Boddie); (c) Southern armyworm, *Spodoptera eridania* (Cramer); (d) yellowstriped armyworm, *Spodoptera ornithogalli* (Guenee); and (not illustrated) fall armyworm, *Spodoptera frugiperda* (Smith) and soybean looper, *Pseudoplusia includens* (Walker), feed on foliage leaving small to large, irregular holes. In plant beds and newly set fields damage may be serious. After harvest, larvae may continue feeding on SweetPotatoes left in the field and in storage.

Management: Apply insecticide to plant beds. Cuttings should be free of insects before planting. Remove harvested SweetPotatoes from the field immediately.

**Twospotted Spider Mite**, *Tetranychus urticae* Koch. Immature mites and adults feed on underside of leaves and may cause stippling on leaves which appear yellowish, bronzed or burned. Mites favor hot, dry conditions, and often migrate from adjacent vegetation. Management: Minimize application of approved insecticides. Chemical control is usually not necessary.

**Tortoise Beetle adults and larvae** that feed on SweetPotato foliage include: (a) mottled tortoise beetle, *Deloyola guttata* (Olivier); (b) striped tortoise beetle, *Agrioconata bivittata* (Say); and (not shown) argus tortoise beetle, *Chelymorpha cassidea* (Fab.); black-legged tortoise beetle, *Jonthonata nigripes* (Oliver); and golden tortoise beetle, *Metriona bicolor* (Fab.). Leaves of infested plants are riddled with large round holes. Generally damage by tortoise beetles only threatens seedlings or newly set plants. Management: Isolate plant beds and control morning glory. Apply approved insecticides to young plants if needed. Control beetles on plants around plant beds and fields.
Sweet Potato Weevil, *Cylas formicarius elegantulus* (Summers) is the most serious, worldwide pest. Its northern distribution is on the Outer Banks near Wilmington, NC where it feeds on seaside morning glory. Adults (a) and larvae (b) feed on foliage but prefer stems and roots. Infested Sweet Potatoes are riddled with small holes and galleries especially in the stem end. They turn bitter and are unfit for consumption by either humans or livestock. Management: Use only seed and plant stocks produced in approved weevil-free areas. All purchased stocks, including out-of-state, must be certified. Use pheromone traps in plant beds, storage houses, and in fields to detect Sweet Potato weevil. Some varietal tolerance exists. Chemical control is difficult at best.

Sweet Potato Flea Beetle, *Chaetocnema confinis* Crotch. Adult beetles spend the winter in debris, along fencerows, and at the edges of wooded areas. In the spring, eggs are laid in the soil near host plants. There are several generations per year. Adults feed on foliage leaving channels on the upper leaf surfaces. Larvae feed on roots etching shallow, winding, sunken trails on the surface, which enlarge, darken and split. Management: Control weeds along field margins and plow under crop debris. Use resistant or tolerant varieties. In fields with a history of infestation use a pre-plant soil insecticide.

Whitefringed Beetle, *Graphognathus* spp. Larvae feed on roots causing damage similar to that of wireworms and white grubs. Only flightless, female adults occur and feed at the base of plants leaving scars on the stem. They are most active in July and August and produce eggs without mating. Management: Avoid infested fields and rotate crops. Limited control may be achieved with resistant varieties and use of soil insecticides.

Wireworms. (a,c,g) Tobacco wireworm, *Conoderus vespertinus* (Fab.); (b,f) southern potato wireworm, *Conoderus falli* Lane and (d,e,h) corn wireworm, *Melanotus communis* (Gyllenhal) leave small, irregular, shallow or deep holes in the surface of Sweet Potato roots. Larvae are identified by differences in the last abdominal segment. Wireworm adults (click beetles) lay their eggs in grassy, undisturbed soil. Wireworms may be detected prior to planting using corn, wheat, or oatmeal bait stations. Management: Avoid land previously not in row crops, in sod, or fallow. If necessary, broadcast and incorporate a pre-plant insecticide or use a granular material at root swell.

Diabrotica and Systena spp. (not illustrated). Cucumber beetles and flea beetles may damage Sweet Potatoes. Adults produce irregular holes in foliage and larvae eat small holes through the periderm and form irregular cavities under the skin. Management: Treatment for wireworms may provide some control. Foliar sprays control adult beetles.

White grubs (a) cause large, shallow, irregular damage on the surface of Sweet Potatoes. Species in North Carolina include (b,e) Japanese beetle, *Popillia japonica* Newman; (c,f) spring rose beetle, *Strigoderma arboricola* Fab.; and (d) green June beetle, *Cotinis nitida* (L.). Adults lay eggs in
grassy areas. Management: See wireworms.

**Nematode** problems may be caused by the southern root-knot nematode, *Meloidogyne incognita*; the northern root-knot nematode, *Meloidogyne arenaria*; the reniform nematode, *Rotylenchus reniformis*; and others. Symptoms include plant stunting, yellowing, leaf fall, reduced yields, and roots with cracks and black, partially decayed surfaces. Symptoms are much worse under drought conditions. Management: Assay fields for nematodes in the fall. Avoid problem fields. Treat infested soils in the row with a nematicide prior to or during planting. Use resistant cultivars.

**Fruit Fly**, *Drosophila* spp. Fruit flies may be a nuisance in storage houses when SweetPotatoes decay due to other causes such as souring, chilling, and Rhizopus soft rot. Fruit flies feed on decaying vegetables. Maggots may be seen in decaying roots. Fruit flies may become established in cull piles and spread to the storage house. They do not cause rots. Management: Harvest, cure and store only sound SweetPotatoes. Dispose of culls, inspect the storage house and use traps. If necessary spray with an appropriate insecticide.

The following Insect Management Program for SweetPotatoes was developed by Dr. Kenneth Sorensen, Entomologist, NC State University and Bill Jester, Area Specialized Agent Commercial Vegetables and Fruit, NC Cooperative Extension Service:

**Total SweetPotato Insect Management Scheme**

Develop field histories based on soil baiting (February) and previous experience. Avoid fields with white fringed beetle.

- Use Admire in plant beds.
- Use Lorsban preplant. Use Temik or fumigate with Telone.
- Scout fields biweekly after transplanting.
- Apply Admire as a soil drench 30-45 days after transplanting.
- Increase monitoring in early June. Eg: light traps, sweep nets.
- Begin foliar insecticide sprays using suggested action thresholds.
- Continue sprays every 7 to 14 days until September.

**Suggested Action Threshold**

- **White Fringed Beetle** - soil baits - any beetles, do not plant
- **Grubs** - 3 beetles in white water pails or 5 beetles in Japanese beetle traps
- **Wireworm** - larvae in corn baits, 5 beetles in yellow sticky traps or black light trap.
- **SweetPotato Flea Beetle** - 5 beetles in yellow sticky traps or net sweeps, 5% damage early
- **Cucumber Beetles** - 10 beetles in traps, 10% damage

**Foliar Insecticides**

- Marlate
- Sevin
- Thiodan - Phaser
- Imidan
- Penncap M
Spintor
Confirm
BT

**Suggested Insecticide Program**
- Lorsban Preplant
- Temik or Fumigants
- Admire in Plant Bed
- Admire Drench 30 to 45 Days After Planting
- Foliar Sprays Every 7 to 14 Days

Close Window
Section 11: Weeds

The major weeds found in North Carolina Sweet Potato plant beds and fields are annual grasses, pigweeds, common cocklebur, common lambsquarters, common ragweed, Pennsylvania smartweed, and nutsedge. Weeds are slightly more common in Sweet Potato plant beds than in fields. Weeds in plant beds can reduce plant numbers and weight. In fields, severe weeds can reduce yields by 100 percent, as well as diminish Sweet Potato root quality and interfere with harvest. Sweet Potato producers have only two options for controlling weeds in plant beds: hand weeding and herbicides. Annual grasses are easily controlled in plant beds with the use of herbicides, but broadleaf weeds are difficult to control. In fields, growers have four options for tackling weeds: pre-plant tillage, herbicides, cultivation, and hand weeding.

For each field you should know the weed problems expected, the soil type, the time of planting, and the cultural practices you plan to use before selecting herbicides. Applying chemicals at the wrong time or at a rate that is excessive for the soil type can cause injury. In soils low in organic matter (less than 2%) use the lowest rates suggested on the herbicide labels. To help minimize the effects of adverse weather and the potential for injury, use herbicide rates that are appropriate for the soil type in the field.

Plant Beds Pre-emergence control:

Napropamide (Devrinol 50DF @1-2 lb active ingredient per acre) is labeled for preemergence control of annual grasses and small-seeded broadleaf weeds such as common purslane and pigweed.

Clomazone (Command 4EC @ 0.75-1 lb active ingredient/acre) is labeled for preemergence control of annual grasses and small-seeded broadleaf weeds such as velvetleaf, common ragweed, common lambsquarters, and prickly sida. It does not control pigweed.

Plant Beds Post-emergence control:

Fluazifop (Fusilade DX 2EC @0.1-0.25 lb active ingredient/acre) is labeled for postemergence control of annual and perennial grasses. It does not control broadleaf weeds or sedges.

Sethoxydim (Poast 1.53 EC @0.2-0.3 lb active ingredient/acre) is labeled for postemergence control of annual and perennial grasses. It does not control broadleaf weeds or sedges.

Fields Pre-plant Control:

Fields are prepared for Sweet Potato planting approximately 2 weeks before planting, and weeds often emerge between field preparation and planting. Thus, growers in North Carolina rework their fields just before transplanting to control weeds.

Glyphosate (Roundup 4L @0.75-1 lb active ingredient/acre) is labeled as a preplant application in Sweet Potato fields for the control of emerged weeds. It is used on approximately 1 to 2 percent of the acreage.

Fields Pre-emergence control:

Clomazone (Command 4EC @ 0.75-1 lb active ingredient/acre) is labeled for preemergence control of annual grasses and small-seeded broadleaf weeds such as velvetleaf, common ragweed, common lambsquarters, and prickly sida. It does not control pigweed.

EPTC (Eptam 7E @ 1.75-3.5 lb. active ingredient/acre) is labeled for preemergence control of yellow and purple nutsedge and is more than 85 percent effective. It is used primarily for control of these weeds since no herbicide labeled for SweetPotatoes, except EPTC, will control nutsedge. EPTC must be preplant-incorporated. It is sometimes applied with clomazone.

Napropamide (Devrinol 50DF @1-2 lb. active ingredient/acre) is labeled for preemergence control of annual grasses and small-seeded broadleaf weeds such as common purslane and pigweed. Napropamide is sometimes mixed with clomazone for improved pigweed control because the action is better than with clomazone alone.

Fields Post-emergence Weed Control:

Fluazifop (Fusilade DX 2EC@ 0.1-2.5 lb active ingredient/acre) is labeled for control of broadleaf weeds or sedges.

Sethoxydim (Poast 1.53 EC @ 0.2-0.3 lb active ingredient/acre) is labeled for postemergence control of annual and perennial grasses. It does not control broadleaf weeds or sedges.
Section 12: Diseases & Physiological Disorders

Commercial Growing Information
Section 12: Diseases & Physiological Disorders

Most of the important SweetPotato diseases attack the roots. Fungal leaf spots are common but seldom justify control measures. In North Carolina, the economically important diseases are viruses, nematodes, Fusarium root and stem rot, Fusarium surface rot, soil rot, Rhizopus soft rot, root know, scurf, and southern blight. Disease-control measures are carried out in the field, the plant bed (where transplant production occurs), and the packinghouse.

Feathery mottle and cork are caused by the feathery mottle virus and most SweetPotato cultivars are infected. Leaves show light green patterns along veins and circular spots surrounded with a purplish ring (a) Roots may have radial and longitudinal surface cracks (b) and may develop internal corking (c) The virus is transmitted by aphids (insert) and planting stock. Management: Use tolerant cultivar, virus-free transplants, and isolate planting.

Black rot is caused by the seed-borne fungus Ceratocystis fimbriata. Symptoms include large circular, brownish to black, firm, dry rots on SweetPotatoes. In plant beds symptoms include plant stunting, wilting, yellowing, leaf drop, and plant death. Rots may continue developing in storage. Infected roots have a bitter taste. Management: See scurf.

Ring rot is caused by the common, soil-borne fungus Pythium spp., which also parasitizes many other plants. Infected roots have sunken, chocolate colored lesions that tend to extend laterally and often form a ring around the SweetPotato. The soft rot extends into the interior as illustrated. Losses generally occur late in the season during cool, rainy periods. Symptoms may be confused with Rhizopus and bacterial soft rots and souring. Ring rot usually does not spread in storage. Management: Harvest prior to cool, wet periods.

Circular spot is caused by the soil-borne pathogen Sclerotium rolfsii, which also causes stem rots on many plant species. Lesions are circular with sharply defined margins, saucer-like in cross section, and yellowish-brown to brown. Lesions become dark and leathery as they dry and may be removed intact. The underlying tissue has a bitter taste. The disease does not develop in storage. Management: Avoid fields with history of southern blight.

Pox (Streptomyces root rot) is caused by Streptomyces ipomoea, a soil-borne bacterium that only parasitizes SweetPotatoes. It may persist in soil for many years in the absence of SweetPotato. Pox spots are circular, V-shaped in cross section, and composed of dark brown to black, corky tissue. Affected roots may be cracked, distorted and resemble dumbbells. Feeder roots, especially tips, are rotted. Plant growth and yields are severely reduced. Management: Use a five year rotation; select resistant varieties; avoid light, sandy soils with high pH; inject chloropicrin in the row prior to planting; and keep soil moist.

Souring (Flooding Damage). SweetPotatoes are alive and constantly exchange oxygen and carbon dioxide. In waterlogged fields or airtight curing and storage facilities this cannot occur and roots die because ethyl alcohol accumulates in the root. Decay organisms rapidly invade affected roots. Initially, affected roots appear normal; internally the surface is dull, somewhat darkened, latex does not flow, and alcohol can be
Smelled. Souring may occur more frequently in well-drained, drought-prone fields than in fields that remain moist because these roots may have high gas exchange needs. Management: Select well-drained, non-drought-prone fields and provide irrigation when necessary. Ventilate storage and curing facilities with 2 to 4 air exchanges per day and double these rates for curing.

Scurf is caused by Monilochaetes infuscans. Dark brown to black blotches with diffuse borders develop on the surface of the SweetPotato in the field. The stem end of SweetPotatoes is more frequently affected because scurf usually develops from infected plants. Spots may coalesce and spread to cover the entire surface. Management: Avoid infected seed roots. Cut transplants above the soil line. Rotate with other crops in a 2 to 3 year rotation. Treat seed roots with a fungicide.

Foot rot, caused by the fungus Plenodomus destruens, may occur in plant beds, fields, or in storage. Lower leaves yellow, and plants gradually wilt and die with brown, necrotic lesions at or below the soil line. The disease may also extend into the root causing a dark brown, dry firm decay at the stem end of storage roots. In storage, the decay continues, but generally does not destroy the entire root. Management: See scurf.

Chilling. SweetPotatoes exposed to temperatures below 55 degrees may appear normal, but internally, the flesh may be spongy with dark vascular elements and latex does not flow. When chilled SweetPotatoes are cooked, the central area of the root may be hard. The effects of chilling injury are cumulative with intermittent exposure to low temperatures. Management: Keep storage temperatures above 55 degrees. In late fall, remove roots immediately after digging.

Dry rot, caused by the fungus Diaporthe phaseolorum, is primarily a storage rot. Occasionally it is found in plant beds and fields. The firm, dry rot generally progresses from one end and causes the SweetPotato to shrink or wrinkle. Affected tissue is light to dark brown externally and dark brown to black internally. Affected roots become mummified. Sprouts from infected seed roots may develop a reddish-brown to black decay at the base. Management: See scurf.

Fusarium surface rot, caused by Fusarium oxysporum, develops in the field and in storage. Lesions are circular, light to dark brown, firm, dry, and superficial. This rot is common and occurs primarily where there has been mechanical injury. Management: Minimize harvest and handling injuries, harvest when soil is dry, treat and cure immediately.

Fusarium root and stem rot, caused by the fungus Fusarium solani, is a common field and storage rot. The rot extends deep into the SweetPotato and is firm and dark tan in color. Internally, elliptical cavities form in which a white mold develops. The soil-borne disease may be spread by infected transplants. The base of mature stems may become swollen and distorted. Management: See scurf and fusarium surface rot.
Rhizopus soft rot, caused by the common bread mold fungus *Rhizopus nigricans*, is a field and common post-harvest problem. Infection usually occurs before and during harvest through injuries on the surface of the SweetPotato. Infected tissue rapidly becomes soft, stringy, and watery with a pleasant fermentation odor. In a few days, "whiskers" consisting of fungal strands and spores appear. Fruit flies are attracted to the rotting roots. Management: See fusarium surface rot.

Bacterial soft rot is caused by the "seed"-borne bacterium *Erwinia chrysanthemi*. The rot is largely internal, very wet, and mushy. Black streaks may appear in otherwise normal stem and root tissue. Diseased roots are seen at harvest, during curing, and in storage. Infected seed roots and transplants may be symptomless. After hot weather begins, random plants in the field may become yellowish, especially on the lower foliage, and the base of stems may have a black, shiny rot, which is the "black leg" stage. Management: Practice good sanitation in the seed program. Thoroughly clean and wash packing and grading equipment and rinse with water with at least 50 ppm chlorine. Water used for washing SweetPotatoes should contain at least 300 to 500 ppm chlorine.

Fusarium wilt (not illustrated) is caused by the wide-spread, soil-and plant-borne fungus, *Fusarium oxysporum* *batatas*. The disease is frequently observed when susceptible cultivars are grown. Vines are stunted, older leaves yellow, and plants wilt and die. The base of vines may turn brown to purple and pith may decay. Vascular elements in stems and roots turn brown. Storage roots may appear normal but vascular tissue may be discolored. If these roots are used for plant production, wilt will occur in the field. Management: Use resistant cultivars, rotate crops, select seed roots from wilt-free fields, and use cut transplants.

Growth cracks are caused by uneven growing conditions, usually uneven watering, and are sometimes associated with secondary disease problems. Cracks are most common on large roots and on nematode-infested roots. Certain viruses also increase cracking.

Mutations. SweetPotatoes have an unusually high rate of mutation. Multicolored roots, called chimeras, have areas of differently colored skin or flesh.
Sweet Potatoes are tropical vegetables and thrive in the long, hot summers of the South, but they can be grown wherever they will have 150 frost-free days to develop. Once planted, sweet potatoes will produce their nutritious, flavorful roots with little care.

1. Select a Sweet Potato Variety

There are two types of Sweet Potatoes: dry-fleshed and moist-fleshed. Popular moist-fleshed varieties include Beauregard, Hernandez, Jewel, Carolina Ruby, Cordner, Porto Rico 198, and White Delight. There are currently no dry-fleshed varieties for which seed roots and plants are available in North Carolina. For a more complete comparison of Sweet Potato varieties, click here for the Sweet Potato Variety Description Table.

2. Start Your Sprouts

Start your sprouts a month before warm weather takes hold, when night temperatures get no colder than 60 degrees.

A) Suspend a Sweet Potato on toothpicks in a container and cover half of the Sweet Potato with water. This will produce several sprouts. Larger quantities can be grown by placing several Sweet Potatoes on a bed of sand and covering them with a 2-inch layer of moist sandy soil.

B) If starting your own sprouts isn’t feasible, buy them at a garden center or from NC Certified Seed Growers.

In about a month, the sprouts will grow 8-10 inches, which is the optimum length for transplanting to the garden, and will bear several leaves. Remove the sprouts for planting by giving them a twist or cutting them off with a knife.

3. Transplant Your Sprouts

With sprouts in hand, you’re now ready to plant. Sweet Potatoes do best in well-drained, sandy, loamy soil. Light, loamy soils usually result in roots with better shapes than those grown in heavy or clay soils.

A) Prepare the soil by tilling well and applying an 8-8-8 fertilizer at the rate of 2 pounds per 25 feet of row. Push the softened, fertilized soil into a foot-wide, flat-topped ridge row that is 8 inches high.

B) Plant sprouts 9 to 10 inches apart in the center of the ridge row and at a depth of 3 inches with at least 2 plant nodes underground and 2 or more leaves above ground. Immediately after transplanting, water well.

Fertilizing: Roots will begin to form in 30 to 45 days and need nitrogen, phosphorus, and potash for optimum growth. Thirty days after transplanting, sidetreat, place fertilizer 2-3 inches to the side of the plant, with an 8-8-8 fertilizer at the rate of 2 pounds per 25 feet of row.

Insect Control: Root-feeding insects can be controlled with one application of Diazanon 14G when the roots begin to form (30 to 45 days after transplanting) at the rate of 1/2 pound over 1000 sq. ft. of foliage or 2 oz. per 25 foot of row. Be sure to follow all label directions, restrictions, and precautions. Thereafter, use a foliar spray of Sevin or Malathion at the rate of 2 tablespoons per gallon of water every 7 to 14 days as necessary.

Weed Control: A bit of weeding, done carefully so as not to injure the shallow roots, is usually all that is needed. Uncontrolled weeds can decrease Sweet Potato yields as much as 100%.

4. Harvest Your Sweet Potatoes

Harvesting of Sweet Potato roots is usually done between 90-120 days after transplanting or as soon as possible after a frost has blackened the tops of the plants.

A) Check roots for maturity. A mature Sweet Potato will have 4 to 5 roots of varying sizes, but the majority should have a 1 3/4 inch diameter and be 3-9 inches in length. You can check for maturity by gently lifting the Sweet Potatoes out of the ground with a shovel making sure they do not become detached from the vine. If not mature, lower back down and cover with soil.

B) Dig Sweet Potatoes carefully because their skin is thin and they will bruise easily. It is best to wear gloves when handling them. Do not leave the roots exposed to direct sunlight with temperatures above 90 degrees for more than 30 minutes because they will sunscald and be more susceptible to storage rots.

C) Once the Sweet Potato roots have been removed from the garden, spread them out to dry for several hours away from direct sunlight. Once dry, put them in newspaper-lined boxes and leave them in a dry, ventilated area for 2 weeks for curing. Once cured, store in a cool, dry place (50-55 degrees) until you’re ready to cook them.

Sweet Potatoes can be stored for up to 10 months with little reduction in quality.

Close Window
INTRODUCTION

Sweetpotato (Ipomoea batatas), a member of the morning glory family, originated in South Mexico and Central America and is now the seventh most important food crop, world-wide. Sweetpotato, along with taro, was a major staple of the early Hawaiians. Commercial cultivation in the islands began in 1849. In 1919, sweetpotato was considered tenth in value among agricultural crops in Hawai‘i when grown as an emergency crop during the war years. By 1948, the farm-gate value for sweetpotato was $100,000. The sweetpotato is grown for its enlarged roots which can be boiled, baked, fried, or processed into chips. The stems and tips may be boiled or fried for use in soups and salads. Both roots and foliage can be grown as feed. The 1991 farm-gate value for sweetpotato in Hawai‘i was about $600,000. It is presently planted and harvested year-round throughout the state, with production acreage primarily in Moloka‘i. Sweetpotato has a wide adaptability to Hawai‘i's environments and has a high content of vitamins, beta carotene, and ascorbic acid. The young leaves, common in some oriental and Filipino dishes, have a 25 to 33 percent protein content on a dry weight basis.

CLIMATE

Short days promote fleshy root development and flowering, while long days promote top growth. The optimum soil temperature range for fleshy root development is 70 to 80°F (21 to 28°C). Optimum growing temperatures for top growth are >77°F (>25°C). Sweetpotato can be grown at altitudes of up to 2000 feet. It is considered to be drought tolerant. However, the plants are the most sensitive to deficits in irrigation during the first 40 days after planting. Sweetpotato yields in sandy loam soils with 25 percent moisture content will generally be similar or greater than yields in soils with 40, 60, and 80 percent moisture contents. Most cultivars are susceptible to waterlogging and to water tables <1.5 feet (<0.5 m). The sweetpotato tolerates a rainfall range of 20 to 50 inches (500 to 1300 mm) per growth cycle with optimum levels at 35 to 50 inches (900 to 1300 mm).

CULTIVARS

Two types of sweetpotato are grown in Hawai‘i. The dry-fleshed with white to pale yellow or purple skin type is locally referred to as "sweetpotato." The second type, locally referred to as "yam," has moist, orange flesh and is used for baking. Hawai‘i's population prefers the drier and firmer varieties of sweetpotato. Sweetpotato is, in fact, one word and should not be confused with the Irish or Peruvian potato (Solanum tuberosum), nor with the true "yam" (Dioscorea sp.). Dozens of clones are native to Hawai‘i. Improved selections of many of these clones are still grown commercially or in home gardens throughout the state. Cultivar selection should be based on market demand, yields, and resistance to pests and diseases. Sweetpotato cultivars grown commercially on Kaua‘i include lines 'UH 78-12' and 'UH 71-7'. Current cultivars recommended for local commercial production include:
Moist (baking) types:
1. 'Hoolehua Gold' - Reddish skin with orange flesh.
2. 'Kona B' - High-yielding cultivar. Light red to orangish skin with light orange flesh (Figure 1).
3. 'Iliua' - Orange flesh.

Figure 1. 'Kona B' is a moist-type, high-yielding sweetpotato. Proper root size and uniformity is required to meet Hawai‘i grading standards for sweetpotato.

Dry (boiling, frying) types:
1. 'Waimanalo Red' - Early-maturing, high-yielding variety. Red skin with white flesh. This cultivar was introduced from Okinawa (Figure 2).
2. 'Hoolehua Red' - Red skin with white flesh.
3. 'Rapoza' - Whitish skin with purple flesh.
4. 'Onokeo' - Purple skin, white flesh, excellent quality.

Figure 2. 'Waimanalo Red' is a dry-type sweetpotato preferred in Hawai‘i for boiling and frying. 'Waimanalo Red' is early maturing and high yielding.

Semi-dry type:
1. '71-5' - Light red skin with yellow-orange flesh.

Cultivars from the continental U.S. Standard commercial cultivars developed in the continental U.S. (moist type with orange flesh) perform well when grown in Hawai‘i but take too long to mature (about 7 months) compared to local cultivars (about 5 months). Until recently, 'Jewel', developed by the North Carolina Experiment Station in 1970, was the standard cultivar representing 75 to 85 percent of sweetpotato production in the continental U.S., especially in areas with sandy loams. 'Jewel' is resistant to root knot nematodes and fusarium wilt. It tolerates sweetpotato fleabeetles and internal cork. The Louisiana Experiment Station introduced 'Beauregard' in 1988. It is rapidly overtaking 'Jewel' in several production areas as the industry standard. 'Beauregard' is high yielding and matures a month earlier than 'Jewel' but is not nematode resistant and does not store as well as 'Jewel'. 'Satsuma' is a popular Asian variety in demand by Asian and Polynesian consumers in the continental U.S.

Sources of materials for local cultivars: Local growers; College of Tropical Agriculture and Human Resources, University of Hawai‘i at Manoa; County Extension Agents.

FERTILIZER RECOMMENDATIONS

Soil Type
Preferred soils are sandy loams that are leveled or slightly sloped, moderately fertile, and well drained. Poorly drained, heavy soils with clay result in irregularly sized and shaped fleshy roots. Soils high in organic matter may result in rough, cracked, jumbo-sized roots. Avoid soils contaminated with diseases, nematodes, or sweetpotato weevils. Three-year rotations are recommended to reduce damage from scurf and fusarium wilt. Optimum soil pH range is 5.5 to 6.8. Sweetpotatoes are sensitive to alkaline and saline soils. Cultivar selection varies depending on soil type where the crop will be grown.

Nutrient Uptake
Sweetpotato plants yielding 15,000 to 20,000 lbs/A accumulate an estimated 50 to 80 lbs nitrogen (N), 20 to 30 lbs phosphorus (P), 80 to 100 lbs potassium (K), 4 lbs magnesium (Mg), 5 lbs calcium (Ca), and 0.8 lb iron (Fe) on foliage and roots. Sweetpotato has a high requirement for potassium. Potassium uptake is dependent on the soil availability of magnesium.

Fertilizer Rates and Placement
Fertilizer applications should be made to complement the nutrient content already available in the soil. To
assess the soil fertility status for sweetpotato production, conduct soil tests prior to planting. Soil samples should be taken and appropriate fertilizers added as recommended by University of Hawai‘i soil scientists for that particular soil type. Applications which are made above levels required by plants may result in excessive foliage growth at the expense of root growth, nutrient leaching into aquifers, and in undesirable accumulation of salts in the soil root zone. Sweetpotato is a crop that requires nitrogen, phosphorus, and adequate potassium for optimum root growth. High nitrogen levels will cause excessive vine growth at the expense of root yields and may result in root cracking. Avoid planting on recently manured soils because it renders the tubers to become more susceptible to scurf infection. Estimated fertilizer recommendations for sweetpotato are 50 to 100 lbs/A nitrogen; 100 to 600 lbs/A of phosphorus (P2O5); and 100 to 150 lbs/A of potassium (K2O). The following fertilizer applications are recommended for Hawai‘i based on soil test results:

1. Soil pH is below 5.0 and/or soil calcium content is below 1000 lbs/A: Four to eight weeks before planting, apply 2000 lbs/A of agricultural lime on soils with adequate moisture. Incorporate to a depth of 6 inches with a disk or rototiller.
2. Moderate phosphorus and potassium soil levels: 650 lbs/A of 10-10-10 plus 130 lbs/A of 0-0-61 (murate of potash) fertilizer. Half is applied at planting and half is sidedressed 5 weeks later before rehilling.
3. Low phosphorus level soil (Consult with your local county agent to determine the phosphorus fixing rates typical in your area The higher the soil phosphorus fixing rate, the higher the phosphorus fertilizer requirement): 1000 lbs/A of 0-47-0 pre-plant broadcasted in 12-inch bands in the plant rows and incorporated into the soil at a depth of 8 to 12 inches.
4. Sweetpotato has relatively low demand for nitrogen (40 to 50 lbs/A). Nitrogen applications of 100 lbs/A or more may be required in locations where soil nitrogen levels are low and high yields are expected.

Nutrient Tissue Analysis
Periodic nutrient analysis of foliage tissue provides an estimate of a crop's nutritional status and serves as a record of crop performance. The tissue analysis should be calibrated with soil fertility levels, according to soil samples taken before planting. For tissue analysis, collect a recently matured and healthy whole leaf. A representative tissue sample from a field will consist of 25 to 100 collected leaves free from insect or disease attack. Critical tissue nutrient levels have not been clearly established for sweetpotato. Nitrogen tissue contents up to 1.62 percent will increase the root to top growth ratio. Adequate soluble nutrient levels from sap analysis of sweetpotato petioles are 3500 ppm NO3; 2000 ppm PO4; and 5 percent K. Recommended optimum ranges from sweetpotato leaves and petioles are shown in Table 1.

CULTURE AND MANAGEMENT PRACTICES

Soil Preparation
To improve drainage, cuttings should be planted on 8- to 14-inch ridges. Ridge height will depend on soil texture. The soil should be turned 2 to 3 months prior to planting. Early plowing helps rot debris and reduces soil diseases and nematodes.

Table 1. Recommended tissue nutrient ranges for sweetpotato.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Range</th>
<th>Deficiency Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>3.2-4.2%</td>
<td>1.5-2.5%</td>
</tr>
<tr>
<td>P</td>
<td>0.2-0.6%</td>
<td>0.12%</td>
</tr>
<tr>
<td>K</td>
<td>2.9-4.3%</td>
<td>0.75%</td>
</tr>
<tr>
<td>Ca</td>
<td>0.75-0.95%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Mg</td>
<td>0.40-0.80%</td>
<td>0.16%</td>
</tr>
<tr>
<td>S</td>
<td>0.22-0.30%</td>
<td>0.08%</td>
</tr>
<tr>
<td>Fe</td>
<td>100-250 ppm</td>
<td>30 ppm</td>
</tr>
</tbody>
</table>
Mn  40-100 ppm  2 ppm

*Planting Distance*
Plant 4 feet between rows and 10 to 12 inches between plants in the row.

*Planting Material*
Vine terminal cuttings or sprouts from tubers are used for sweetpotato propagation in Hawai‘i. A spacing of 10 by 48 inches requires 13,068 cuttings per acre while a spacing of 12 by 48 inches requires 10,890 cuttings per acre. Cuttings should be about 12 inches long with about 8 nodes per foot (Figure 3). Roots develop from the buried nodes. Inspect all cuttings carefully. Discard those contaminated with insects, nematodes, or diseases.

*Planting Method*
Place cuttings of up to 2 days old in the open furrows by hand, and then cover with the use of a single disk behind a tractor. To improve uniformity of harvested roots, place cuttings horizontally if the crop will be irrigated. In rainfed or limited irrigated conditions, lay the cutting at a 45 degree angle. The angled planting results in larger roots close to the soil surface because the soil area is more likely to be moist. Bury cuttings at least 4 nodes deep.

Figure 3. In Hawai‘i, most sweetpotatoes are grown from 12-inch cuttings taken from the previous planting. Take cuttings only from fields which are free of insects and diseases.

*Time of Planting*
The best planting period in Hawai‘i is March to May. Lowest yields occur when sweetpotato is planted from October to December. This is attributed to the shorter days and to the higher rainfall during that time of the year (Figure 4).

Figure 4. Mean yield of sweetpotato as affected by planting date in Poamoho (1953).

*Hilling*
Sweetpotatoes are hilled with a disk-hiller about 5 weeks after planting. A second fertilizer application is conducted just prior to hilling in fields which receive split fertilizer treatments. The hilling procedure consists of pulling soil from both sides and increasing ridge height and width by 1 to 3 inches. Hilling aids in weed control, root enlargement, and in reduced damage caused by the sweetpotato weevil.

*Vine Turning*
The main purpose of vine turning is to prevent roots from developing in the nodes of the expanding vines which come in contact with the soil. Small, irregular roots may develop if nodes from vines come in contact with the soil surface, draining carbohydrates from the normal roots destined for market. Two to three vine turnings may be necessary several days after irrigation when vine growth is vigorous, especially on moist, fertile soils.

*Mulches*
The use of black plastic mulches in combination with drip irrigation increases both earliness and total marketable yields compared to bare-ground plants. Efficiency of water and fertilizer use may also be improved with the use of plastic mulches for sweetpotato production.

*Irrigation*
Sweetpotato yields in Hawai‘i can be increased by 30 percent with timely irrigation. Generally, sweetpotato requires less water than most other vegetables. Irrigate moderately to improve stand establishment soon after planting. Maintain a constant water supply especially during the tuber formation stage at 7 to 9 weeks after planting. Irrigation is recommended when 40 to 50 percent of the field-capacity moisture has been depleted. Stop irrigation about a month before harvest.
Rotations
Sweetpotato should be raised in the same field only once every 3 or 4 years to reduce the incidence of insect and disease outbreaks. Sweetpotato residues may prevent nodulation in nitrogen fixing crops, which should be taken into account when designing a rotation schedule. Crops traditionally rotated with sweetpotato in Hawai'i 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.

PESTS
Integrated Pest Management (IPM) consists of timely pesticide applications after all other economically viable alternative pest controls have been exhausted. Pest control techniques are recommended if lack of control results in monetary losses. Control practices are not recommended when the control activity would cost more than no control actions at all. The IPM strategy is based on (1) pest identification, (2) understanding of pest life cycles, (3) periodic pest scouting, and (4) development of a pest control strategy based on a systems approach which includes timely cultural, biological, and chemical controls.

To scout for sweetpotato pests, walk through the field at least on a weekly basis. Look for pests in the vines or for symptoms of poor plant growth. On a periodic basis, dig up roots and inspect them for signs of pest attack. Learn to identify the major pests of sweetpotato and to recognize the damage they cause to the plant.

Insects
Foliage and sap feeders attack sweetpotato but seldom reduce yields. These include: aphids, the sweetpotato whitefly, grasshoppers, red spider mites, and the sweetpotato leaf beetle. Insect pests which most often reduce marketable sweetpotato yields in Hawai'i include: the sweetpotato weevil, the gulf wireworm, the sweetpotato flea beetle, and the sweetpotato vineborer. Nematodes may also be a serious pest in non-resistant or non-tolerant cultivars. Emphasis of the IPM program is prophylactic to prevent pest attacks before they appear. Once a pest has been detected, losses are often inevitable.

Sweetpotato Weevil
The sweetpotato weevil, Cylas formicarius Elegantus, is the major insect pest of sweetpotato both in Hawai'i and around the world. The West Indian sweet potato weevil, Euscepes postfasciatus (Fairmaire) is a destructive pest also found in Hawai'i . The adult Cyclas beetle is about 1/2 inch long and resembles a large ant with a slender snout. The head and wing covers are blue-black and the middle body section and legs are light orange.

The adults may feed on foliage and roots. However most damage is caused by the larvae feeding on the fleshy roots. Hundreds of larvae may feed on one fleshy root under high pest pressure. Affected roots are unmarketable because of the feeding damage, presence of larvae, and the bitter flavor that develops on the roots in response to beetle feeding. Yield losses from weevil attack on sweetpotato are normally from 15 to 30 percent, but may be as high as 60 to 97 percent if pest populations go unchecked. Above-ground feeding by both larvae and adults does not normally have significant effect on marketable yields.

To control the weevil, rotate or fallow production fields, disc old sweetpotato fields to eliminate reservoir weevil populations in remaining plants, eliminate volunteer sweetpotato plants including weeds of the morning glory family, plant away from weevil-infested fields, hill the plants, and conduct timely insecticide applications. It is important to start with clean, uninfested cuttings, clean fields, and to spray the base of the vines on infested fields every 3 to 4 weeks.

A commercial pheromone is available which attracts the adult males. This pheromone may be useful in a weevil control program for early detection of field infestations. In addition, the pheromone may be useful for mating disruption, as part of the overall weevil control program (Figure 5).

Fungi and parasitic nematodes have been identified which kill the sweetpotato weevil. However, further research is required to introduce these biological controls into commercially viable weevil control programs. In addition, selection of cultivars tolerant or resistant to the weevil is an important short- and long-term objective for control of the sweetpotato weevil. Thus far, resistance has not been detected in areas such as Hawai'i which experience extremely high weevil population pressures.
**Gulf Wireworms**

*Conoderes amplicollis* (Gyllenhal) is a yellow worm about 1 inch long which feeds on the fleshy sweetpotato roots. The larvae of the gulf wireworm makes small, irregular, ragged holes in the skin and burrows less than 1/4 inch into the fleshy roots. The feeding makes the roots unmarketable and allows the entry and spread of disease microorganisms. Feeding damage is normally greater under dry conditions. Wireworms may remain in the field for several years since the larvae may take over a year to mature into an adult beetle. Wireworms are controlled with timely insecticide applications.

![Figure 5. Pheromone traps detect movement of sweetpotato weevil males into the field and may be helpful in control of this weevil through mating-disruption techniques.](image)

**Sweetpotato Fleabeetle**

*Chaetocnema confinis* Crotch or fleabeetles are 1/16-inch-long, black beetles which jump when disturbed. Fleabeetle larvae feed on the roots leaving shallow tunnels below the periderm. The small tunnels enlarge as the roots grow and root cracks develop. The fleabeetles appear to move frequently from one feeding area to another. Volunteer weeds in the field margins may accentuate fleabeetle infestations in sweetpotato.

**Sweetpotato Vine or Stem Borer**

The vine borer, *Omphisa anastomasalis* (Guenee), is the second most important insect pest in sweetpotato, after the sweetpotato weevil. The larvae of vine borers feed inside the vines and crowns. Most yield losses in sweetpotato due to the vine borer are caused by damage to the vines and to the crown. Damage to the vines reduces movement of water, nutrients, and photosynthates up and down the vascular system. Heavy feeding results in reduced root growth of up to 50 percent. The adult moths, which are most active at night, are white with a characteristic brownish yellow pattern in the wings. Eggs are laid singly below or above the leaf. Larvae begin to bore down the vines as soon as they hatch. The larval stages normally last 30 to 35 days. The larvae usually pupate in the vine for a period of about 2 weeks. Insecticide sprays are ineffective because the borers are found inside the stems. Possible controls for the vine borer in sweetpotato include hilling (already practiced by farmers in Hawai‘i), removal of alternate weedy Ipomoea hosts, planting tolerant cultivars, and timely insecticide applications to reduce elimination of natural enemy populations. Known parasitoids of the vine borer in Hawai‘i include *Chelonus blackburni* Cameron, *Enytus chilonis* Cushman, and *Pristomerus hawaiensis* Perkins.

**Nematodes**

Nematodes are tiny microscopic worms which live on plant roots and in the soil. Resistance to rootknot (Meloidogyne spp.) and, to a lesser extent, reniform (Rotylenchulus reniformis) nematodes has been developed in sweetpotato cultivars grown in the continental U.S. Susceptible cultivars infested with nematodes wilt or appear stunted. Infested fleshy roots crack and show growth deformities. Roots of root-knot nematode infested plants also develop galls. Nematode susceptible cultivars should be grown in nematode-free soils. Rotate nematode infested soils with non-hosts such as sweet corn and other grasses. Soils may be tested for nematodes at the University of Hawai‘i Diagnostic Center Laboratory. Nematicides should be applied if sensitive cultivars will be grown. Plow the field 2 to 3 months before planting to allow existing plant debris to rot prior to nematicide fumigant applications. To improve efficiency of nematicide application, read the label directions carefully and calibrate the applicator. In nematode prone areas, the use of resistant cultivars is one of the several management techniques used for nematode control in addition to rotation and fumigation.

**Diseases**

Diseases normally do not lower sweetpotato yields in Hawai‘i because most plantings are started with disease-free tip cuttings. Leaf scab is a problem in some areas. To prevent the spread of diseases, handle the roots carefully during harvest to reduce bruising and maintain a clean sanitation program in the field, nursery bed, machine shop, and in the packing house. Other cultural practices such as proper rotations, field selection, spacings, fertilizer applications, and irrigation help to reduce disease infestation and spread.
in the field. In the continental U.S., commercial cultivars have been developed with resistance to Fusarium wilt and internal cork. Stem rot, black rot, soft rot, soil pox, scurf, and surface rot are all fungi that attack sweetpotato. Black rot, soft rot, and surface rot also attack fleshy roots during storage or during transit to their market destination.

**Anthracnose**

Anthracnose, caused by the fungus *Elsinoe batatas*, became a serious problem on sweetpotato plantings in Kaua'i in the late 1970s. Symptoms of the fungus are prominent on the younger parts of the vine as distorted leaves and petioles with rusty brown lesions. The vines take on a stunted and "scabby" appearance. Production is affected if the fungus infects the crop during the growing stage. Recommended controls include: (1) crop rotation (the fungus can survive in the refuse plant material after harvest), (2) the use of clean planting material (clean slips can be produced from roots treated with a 10 to 20 percent chlorox solution for 20 minutes), and (3) the use of resistant or tolerant cultivars (the 'Waimanalo' cultivar appears to be tolerant to this disease).

**Bacterial Stem and Root Rot**

*Erwinia chrysanthemi* Burkholder, McFadden, and Dimock may appear in vines and roots in the field, in nursery bed roots, and during storage. Foliage symptoms include black, necrotic, water-soaked lesions. Eventually one or two branches of the plant will collapse resulting in wilting of terminal leaves. Lesions in the root develop more commonly in storage, with a characteristic black margin surrounding the lesions. The cultivar 'Beauregard' is very susceptible to root rot. This fungus penetrates sweetpotato principally through wounds created by handling or insect feeding. Controls include minimizing wounding of the roots, selection of propagating material from disease-free fields, and the use of cultivars with tolerance to the disease.

**Black Rot**

Symptoms caused by the fungus *Ceratocystis fimbriata* (previously known as *Endoconidiophora fimbriata*) include leaf yellowing of young plants, underground sections of the stem show black areas, and circular, depressed, grayish blue lesions develop on the fleshy roots. Affected vines are stunted and the slightly shrunkken, circular, black spot lesions in the root develop a bitter taste. Above- and below-ground lesions are localized and do not spread to the entire plant. Fungal spores reproduce rapidly and are easily spread by mites or the sweetpotato weevil during storage or transit to market. This results in severe postharvest losses. Black rot can penetrate the plant through wounds or injury caused by insects, nematodes, rodents, or farming equipment. This fungus persists in the soil for 1 to 2 years in affected roots left over after harvest or in the spore form. Recommended controls include the use of disease-free propagating material, fungicide treatment of seed roots, 3- or 4-year rotations, adequate curing of roots, and sanitation of any equipment or tools that may come in contact with the roots.

**Internal Cork Virus**

Internal cork is caused by the sweetpotato feathery mottle virus. Cross-sections of affected roots show dark brown, "cork-like" areas in the flesh. The virus also causes root necrosis. Infected roots usually appear normal on the outside. Foliage symptoms may range from reddish purple spots to mild mottling and vein banding. Varieties vary in their response to internal cork virus. Sweetpotato cultivars developed in the continental U.S. have shown high tolerance to internal cork. To control, use cuttings from disease-free fields.

**Scab**

Characteristic symptoms caused by *Elsinoe batatas* are small, scabby areas and small, oval lesions, especially along the midrib and veins of leaves. The lesions eventually become corky resulting in shrinkage and leaf deformation. On the petioles, the damage spots may be a little larger and more sunken than on the leaves. The scab spots on both leaves and petioles may join together to a size of an inch or more. Yield losses from leaf scab can reach up to 60 percent. The tubers are not infected by this fungus. Scab can be spread by splashing rain and by utilizing infected cuttings for planting. Controls include disking the crop soon after harvest, 1-year rotations, planting of disease-free cuttings, and avoiding overhead irrigation in
fields affected by leaf scab.

**Soft Rot**
The fungus Rhizopus nigricans (R. stolonifera), commonly called bread mold, is an important postharvest disease of sweetpotato. Affected roots develop a gray, fuzzy mold, turn soft, and later turn dry and hard. The fungus enters the roots through wounds. Recommended preventative measures include careful postharvest handling of the roots to prevent wounds, curing to heal any wounds, and disinfection of the packing shed and equipment. Spores are carried by wind and insects, especially flies. No cultivar resistant to soft rot has been identified.

**Stem Rot or Fusarium Wilt**
This fungus, Fusarium oxysporum Schlecht. f. sp. batatas (Wollenw) Syd. & Hans., can be a serious pest in sweetpotato. Varieties resistant to stem rot exist. Fields are commonly infected through contaminated cuttings. Once in the field, the fungus penetrates healthy plants through open wounds. Yield losses may be up to 50 percent, and are more likely under warm weather and in dry soils. Plants normally die within a few days after visible symptoms appear in the plant. The vascular tissues of affected plants turn dark brown or black, especially close to the soil level. Leaves of susceptible plants may also turn yellow or brown. Resistant or tolerant cultivars grown in the continental U.S. include 'Jewel', 'Redgold', 'Nemagold', and 'Centennial'. In addition to resistance, other controls include crop rotation to lower soil disease pressure, selection of seed roots from disease-free fields, and fungicide treatments.

**Scurf**
Symptoms caused by the asexual fungus Monilochaetes infuscans include black blotches on stem tissue near the soil level and on the surface of fleshy roots. Infection also causes shrinkage during storage which results in unmarketable roots. Affected roots are conspicuous as they are cleaned for market. Infections in the field proceed faster in poorly drained soils. Animal manure applications and soils high in organic matter may increase the incidence of scurf. Recommended controls include root seed treatment before planting, treatment of the basal portion of the stem near the soil level, use of clean seed roots and cuttings, and a 3 to 4 year rotation.

**Soil Rot**
Symptoms on fleshy roots caused by the prokaryotic microorganism (not a fungus) Streptomyces ipomoea include malformed roots, surface pits and scabby cavities, as well as black spots on the crevices. The lesions are normally smaller than an inch in size. Affected plants appear stunted and may die before the end of the growing season. Controls include the use of resistant cultivars, sulfur applications to lower soil pH to 5.2, and soil fumigation. This organism persists by feeding on organic matter residue in the soil and does not require sweetpotato residues to survive. Rotations with other crops may reduce crop losses from soil rot in sweetpotato. Because dry soil conditions favor disease growth, even watering throughout the growing season is recommended.

**Weeds**
Proper cultivation, field selection, rotations, and timely applications can reduce the volume of herbicides applied for weed control in sweetpotato fields. Weeds may be controlled by the "flush" control technique. After the field is prepared for planting, including preplant fertilization, sprinkle irrigate the field to promote germination of weed seeds near the soil surface. The field is then treated with a preplant contact herbicide to kill the initial "flush" of growth. This may be repeated a second time. The sweetpotatoes may then be planted after either 15 or 30 days, depending on the number of "flush-growths" which were promoted to kill the germinating weed population. Fields should be kept weed-free during the first 4 to 8 weeks of growth, after which the vines will completely cover the field. Weeds are also kept in check with the cultivation performed by disk hillers during the hilling operation. Herbicides may damage sweetpotatoes if applied incorrectly.

Some sweetpotato cultivars have been identified which show allelopathy toward plants of other species grown in proximity. For example, sweetpotato has been shown to reduce the growth of the yellow
Sweetpotatoes are harvested as soon as the roots reach marketable size, which is 4 to 6 months after planting under Hawaii conditions. Unmarketable "jumbos" may develop if plants are left in the field longer than desirable. Sweetpotato weevil outbreaks may also increase crop losses if plants are left in the field beyond its normal harvest time. A rotary or flail-type mower is used to mow the vines at the base. Vines are then either removed or rolled into adjacent rows before harvesting. The roots are spaded out by hand or plowed out with a middlebuster (double moldboard plow) or with a modified potato harvester (Figure 6). Roots fall to the ground at the end of the digger, where they are selected, placed in crates, and transported to the packing shed. In the packing shed, roots are washed. Oversized ones or those damaged by weevils, nematodes, diseases, or machinery are culled. Fleshy root damage should be minimized when harvesting in dry soils. If the harvest operation is conducted in wet soil, allow roots to dry naturally in a shaded area until the soil dries. Then remove the soil by gently rubbing with the hands.

Figure 6. Modified tractor-pulled potato harvesters can be used for harvesting sweetpotato. The fields are first mowed and foliage removed before digging sweetpotato with this type of equipment.

Production Yields
Average yields in Hawaii are about 12,000 lbs/A. This is below the average yields of over 20,000 lbs/A which are obtained in commercial operations on Moloka'i. Good yields range from 30 to 35,000 lbs/A. Yields will vary depending on growing season with higher yields obtained when planted between March and May and with lower yields when planted in the fall. Adequate yields are obtained when planting from February to July (Figure 4). Fertilizer applications should be modified depending on the expected yields for each planting season. Good yields in the continental U.S. are about 17,500 lbs/A with plant populations of 12,400/A.

Curing, Holding, and Storage
No "in-house" curing is practiced in Hawaii. Roots are shipped soon after harvest. Curing treatments in production areas where this is practiced include storage at 85°F and 90 to 98 relative humidity (RH) for 4 to 7 days with ventilation, and then stored at 60°F with ventilation. Chilling damage occurs below 55°F. Curing results in the formation of a cork-like layer beneath the skin or in fleshy areas which have been bruised. Benefits of curing include increased sugar content and flavor, suberization of periderm tissue to protect the roots against bruises and disease attack, and improvement of shelf-life by reducing respiration and water loss. Roots lose about 3 to 6 percent of their weight during the curing process. Cured sweetpotato can be stored for 4 to 7 months. Roots are stored at 55 to 60°F and 85 to 90 RH. Sweetpotato roots will not store well if: (1) wet soil conditions are prevalent just prior to harvest, (2) the roots are chilled below 50°F for a period of over 5 days after harvest, or (3) the roots are not properly cured prior to storage.

Packing
Sweetpotatoes are packed in 50 lb crates or 40 lb cartons. Weight loss during transit and marketing is minimized if roots are held in perforated film bags (32 quarter-inch holes in a 3 to 5 lb polyethylene bag).

Grades
U.S. grading standards include:
1. U.S. No. 1 Extra: length - no less than 3 inches and no more than 9 inches; width - no less than 1.75 inches and no more than 3.5 inches; weight - 18 oz per root.
2. U.S. No. 1: length - no less than 3 inches and no greater than 3.5 inches and weight of 20 oz per root.
4. Culls.
Consult the Hawai'i Department of Agriculture -
Marketing and Consumer Services Division for an update on current local grading marketing standards for
sweetpotatoes: Hawai'i Fancy (Grade AA), Hawai'i No.1 (Grade A), and Hawai'i No. 2 (Grade B).

Market Information
Sweetpotato is planted and harvested weekly in Hawai'i. About 1.3 million pounds of sweetpotato are
grown annually, and local demand for sweetpotato has been steady over the past decade. About 40 percent
of the sweetpotato consumed in Hawai'i is imported from the continental U.S. (Figure 7). Before planting
sweetpotato, prospective growers need to target a market, understand monthly market trends, and identify
specific buyers. Production costs for sweetpotatoes in 1990 ranged from $0.35 to 0.45 per pound. Prices
normally dip from August to March. Returns from late spring to fall when yields are the highest are
therefore the most positive (Figure 8). Nationally, harvest volumes are greatest from September to
January, and lowest in June and July. North Carolina, Louisiana, and California are the largest sweetpotato
producing states in the U.S. Per capitaconsumption of sweetpotatoes in the U.S. is about 4.5 lbs annually,
but consumption may be higher with some ethnic groups in Hawai'i. The potential exists for developing
processed products for export to the continental U.S. or Japan, where sweetpotato is increasingly being
recognized as a healthy substitute for high-fat or high-calorie desserts or fast food snacks. Presently, fresh
roots cannot be exported to the continental U.S. primarily because there is a quarantine on the sweetpotato
weevil and on wireworms. Sweetpotato shoots are normally marketed in low volumes in community
farmers' markets or in the Honolulu Chinatown produce market.

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