Crop Profile for Sweetpotatoes in North Carolina

Prepared: February 1999
Revised: November 1999, June 2005

General Production Information

- North Carolina ranked first nationally in the production of sweetpotatoes in 2003, representing 37.0 percent of U. S. production.
- In 2003, 42,000 acres of sweetpotatoes were harvested in North Carolina.
- In 2003, 5,880,000 cwt. of sweetpotatoes were produced in North Carolina for a value of $85,260,000.
- Approximately 60 to 70 percent of the crop is destined for fresh market and 30 to 40 percent for processing. The best prices are received in June, July, and August, while the lowest prices are received in mid-September through November.

Production Regions

Sweetpotatoes are grown primarily in the coastal plain of eastern North Carolina (Figure 1). However, some are grown for shipping in northeastern North Carolina (near Edenton) and in the Sandhills. Small areas (less than 2 to 3 acres) are grown thoughout the remainder of the state for home use or sale at roadside stands. The top ten sweetpotato-producing counties in North Carolina are Johnston, Nash, Edgecombe, Sampson, Wilson, Columbus, Cumberland, Greene, Wayne, and Wake.

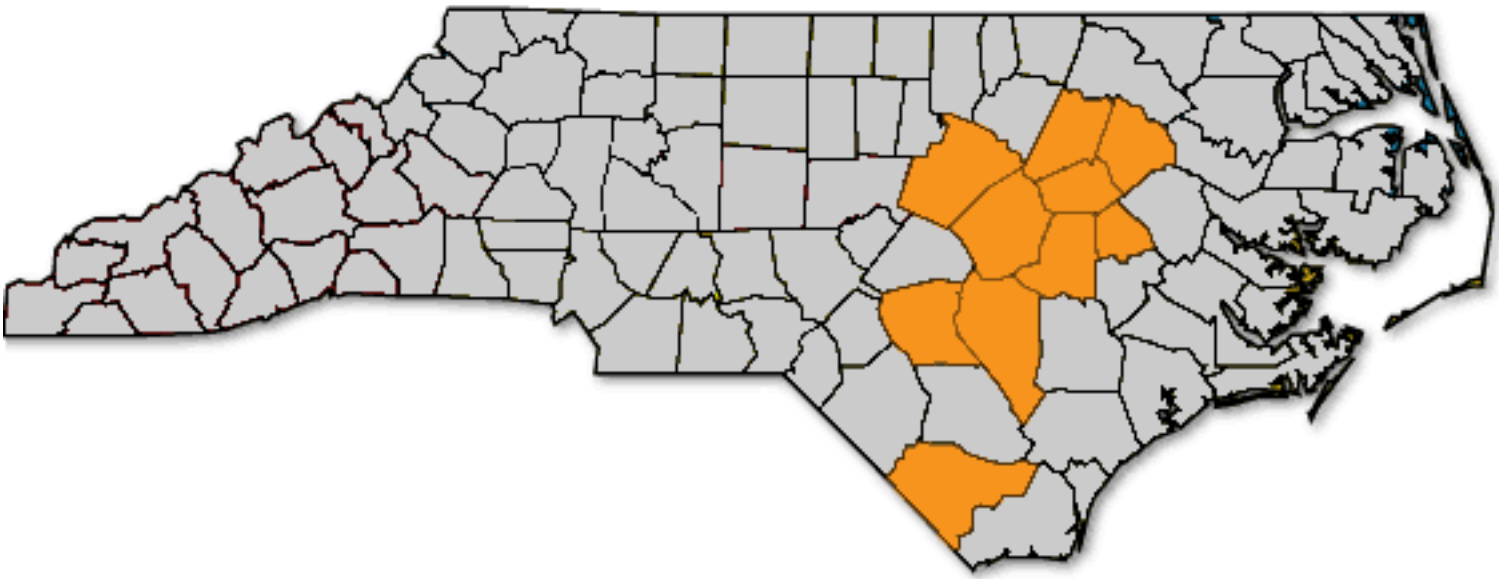

Fig. 1 Primary sweetpotato-producing counties in North Carolina, including Johnston, Nash, Edgecombe, Sampson, Wilson, Columbus, Cumberland, Greene, Wayne, and Wake counties.

Production Practices

Sweetpotatoes are stored throughout the year. Seed stock is stored in warehouses from harvest in the fall until planting the following spring. Seeds are pre-sprouted in early March. This is the process by which sweetpotato seed stock is conditioned to produce sprouts (transplants) before bedding. Presprouted seeds are placed in soil beds in mid-March to early April. Seedlings are ready for transplanting into fields in early May, and planting is generally completed by late June. Harvest begins in late August and usually ends by late October. Sweetpotatoes are cured and then stored until the roots are sold.

Pre-sprouting results in earlier and greater transplant production. After presprouting, roots are placed in a bed and covered with clear plastic. The plastic is removed when the plants start emerging and can be ready to transplant 4 weeks after bedding if the weather is favorable. Improved planting stock is being produced by carefully selecting superior-yielding, high-quality hills; eliminating disease using meristem tip culture; and 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.

Soil:

Sweetpotatoes grow best in loamy soils. Light, loamy soils usually result n roots with better shapes than those grown in heavy or clay soils. But highest yields are generally produced on well-drained, clay-loam soils. Coarse, deep, sandy soils are generally low in fertility, subject to moisture stress, and require more irrigation and fertilizer to grow a good crop. Soil pH should be 5.8 to 6.2.

Fertilizer:

Fertilizer can be either banded or broadcast. 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).

Planting and spacing:

Planting typically begins in early May, when stock from the greenhouse or outdoor beds is ready. It concludes by the end of June. *Beauregard*, the most popular cultivar, should be planted as closely as possible (8 inches or less) for improved yields and economic gain. *Hernandez* or *Jewel* cultivars (the second and third choices, respectively) work well in 10- to 12-inch in-row spacing.

Curing and storage:

Sweetpotatoes are cured after harvest in order to heal wounds. Recommendations for curing suggest placing sweetpotatoes in rooms that are 80° to 85° F with 90 percent relative humidity and ample ventilation for about 5 days. Rooms with 100 percent relative humidity should be avoided so that the surface of the sweetpotatoes will not be completely wet, resulting in more disease. For long-term storage, temperatures should be maintained at 55° to 60° F with 85 percent relative humidity.

Worker Activities

Sweetpotato field activities typically begin in March in North Carolina. The focus of activity is bedding sweetpotato “seed” for production of sweetpotato slips or transplants. Most growers fumigate their plant beds. The bedding operation involves the following sequence of activities: lay off the bed rows in the field, place sweetpotato seed in bed/row, cover seed roots with soil, cover seed beds with plastic, and punch holes in plastic. A tractor driver is needed for each operation and several workers (about 6 to 7) are needed to provide continuous supplies and assist with various aspects of the bedding operation. After the bedding operations have been completed, maintenance of the beds involves punching more or larger holes in the plastic. Eventually the plastic will be removed as temperatures warm in April and May. The removal of the plastic may involve several workers. As plants begin to reach several inches in height, a tractor driver routinely mows the tops of the tallest plants (grooms) to facilitate more

uniform plant production. Transplants are typically of sufficient size and ready for field planting by mid-May. Some growers mechanically cut their transplants while others hand cut each plant. Maximum plant exposure by the worker occurs during this field operation. A lot of bending and physical exertion occurs during cutting, sorting and the collection of sweetpotato transplants.

Land preparation for planting a sweetpotato crop in a field begins in April and May, and continues into June, depending on the planting conditions in a given season and the quantity of acres a grower intends to plant. After land has been plowed and/or disked, the bedding and fumigation of the soil occurs in one operation. Most growers fumigate with Telone II for nematode control. Just prior to planting, many growers apply insecticide and herbicide while shaping the row. These operations involve a tractor driver to apply the pesticide and perform the tillage operations. Another worker may assist with the mixing of pesticides.

Field planting operations typically begin in mid-May and are mostly complete by early July. Transplant equipment can range from 2-, 4- or 8-row and the number of workers in a given field will depend on the equipment used. Two workers plant one row when working on the transplanter. Other workers support the planting operation by supplying transplants and walking behind the transplanter to plant areas of the row that were missed. Workers are exposed to the plant material and soil during the transplant operation. However, workers riding on the transplant equipment are relatively comfortable during planting but do have to perform repetitive motions during planting.

Pesticides are applied during the production season. The main worker exposed to pesticides is the tractor driver. A post-planting herbicide application that target weeds such as grasses or nutsedge might occur if these weeds become a problem. Application for grass control could be a few to several weeks after planting, while nutsedge pesticide control would occur at least four weeks after planting. It is common that workers may go through a field once during the growing season and hand weed. Worker exposure would be direct contact with the sweetpotato crop. Insect control practices vary dramatically among growers. It is common that three to six foliar applications of insecticide be applied during the sweetpotato production season.

The last field activity involves harvest, which begins in late August and is completed by early November. Most fields of sweetpotatoes are dug using a disk plow. Hand laborers harvest the roots by placing them in buckets and transporting them to a nearby flat bed truck which holds 20 or 40 bushel bulk bin boxes. Harvest involves the grower and numerous hand labor workers. Workers are in constant contact with the crop. Harvest is an intense physical activity that involves lots of bending and lifting. Gloves are often worn to minimize worker exposure and to minimize damage to the sweetpotatoes.

Worker activity also includes postharvest handling. Workers are potentially exposed to dust (especially at the dump), chlorinated water, Botran, waxes, and Bio-Save. Packingline workers where plastic gloves and dust masks (if working near dump) and often where ear plugs for high noise levels.

Insect Pests

Soil-Borne Insects

Wireworms
There are several species of wireworm (tobacco wireworm, southern potato wireworm, gulf, and corn). Wireworms feed on the roots and are currently controlled with an application of a soil insecticide, such as chlorpyrifos (Lorsban), endosulfan (Thiodan) or carbaryl (Sevin). Bifenthrin (Capture 2F) has had a Section 18 Emergency Exemption for three years and has worked well as a preplant treatment.

White grubs
White grubs are sporadic pests; however, they can cause heavy damage when present in a field. Many species of the pest exist and there are many hosts. White grubs feed on the roots are controlled by pre-plant applications of soil insecticides such as chlorpyrifos (Lorsban), endosulfan (Thiodan) or carbaryl (Sevin).

Sweetpotato flea beetles
Adult flea beetles feed on the surface leaves and the larvae feed on roots. Typical treatment includes a chlorpyrifos (Lorsban) pre-plant application. Imidacloprid (Admire) or thiomethoxam (Platinum) preplant or as a sidedress will give some control of flea beetles, tortoise beetles, thrips, whiteflies and aphids.

Banded cucumber beetles
The banded cucumber beetle lays eggs in the fields and the larvae create small holes in the roots. Typically growers control this pest with a pre-plant application of chlorpyrifos (Lorsban).

White fringed beetles
White fringe beetles have one generation per year and their larvae feed on the roots. They are difficult to control. White fringe beetles occur sporadically in North Carolina.

Foliar Feeding Insects

Under average conditions, insect damage to sweetpotato foliage is not severe enough to justify treatment with insecticides. However, flea beetles, tortoise beetles, leafhoppers, leafminers, corn earworms, hornworms, armyworms, and loopers can significantly damage plant beds and small parts of the field. Growers typically use little insecticide in plant beds or for managing foliar-feeding insects in sweetpotato fields. Endosulfan (Thiodan) and carbaryl (Sevin) are used in sweetpotato beds or fields planted.

Sweetpotato Weevils

The sweetpotato weevil, a serious insect pest, is not yet present in the commercial sweetpotato-production areas of North Carolina. However, it is established in coastal areas near Wilmington, where it can be found on seaside morningglory. The adult weevil can feed on any part of the sweetpotato plant but prefers stored roots. The larvae also feed on roots. To prevent this destructive pest from becoming established in the state, growers are advised to use only certified seeds or plants produced in North Carolina or in non-infested areas. Traps containing sex pheromones are used in plant beds, fields, and storage houses to detect adult male weevils.

Insecticide Use Estimates for Sweetpotatoes

Chlorpyrifos (Lorsban) preplant, bifenthrin (Capture) preplant and phosmet (Imidan) as a foliar spray are commonly used in sweetpotatoes in North Carolina. Imidacloprid (Admire) is used in micropropagated plant production in the greenhouse.

Current Insecticide Recommendations for Sweetpotatoes

Current North Carolina Cooperative Extension Service recommendations for insecticide use on sweetpotatoes (including information on formulations, application rates, and precautions/limitations) are provided in the following table from the *North Carolina Agricultural Chemicals Manual*:

Table 5-10: Insect Control for Commercial Vegetables
(http://ipm.ncsu.edu/agchem/chptr5/510.pdf)

Non-chemical Controls

Insect-monitoring is important for managing both foliar-feeding and root-feeding insects on sweetpotatoes. Crop rotation and using resistant cultivars are effective management practices for root-feeding insects. Crops most often rotated with sweetpotatoes included tobacco, soybeans, corn, cotton, wheat, cucumbers, peanuts, and rye.

Diseases

Most of the important sweetpotato diseases attack the roots. Fungal leaf spots are common (e.g., white rust, chlorotic leaf distortion), but are not known to adversely affect yields. In North Carolina, the economically important diseases are viruses, Fusarium root and stem rot, Fusarium surface rot, soil rot

(pox), Rhizopus soft rot, root knot, scurf, and southern blight. Disease-control measures are carried out in the field, the plant bed (where transplant production occurs), and the packinghouse.

Plant Beds

Seed roots in plant beds are treated with dicloran (Botran) to prevent Rhizopus soft rot. Chlorine and thiabendazole (Mertect) are also used as broad-spectrum fungicides. Many growers use Botran and Mertect in the plant bed to control Rhizopus soft rot and scurf. These products can be applied as roots dips or sprays but for convenience are typically applied as sprays. Many growers do not use any fungicides in their plant beds. Scurf is mainly controlled through the use of disease-free planting material and proper transplant-cutting practices that avoid contact with the soil by cut plant surfaces. It is important to note that plant bed acreage is a tiny fraction of the total acreage. Therefore, products used in the plant bed do not apply to the total acreage. Moreover, the land used for plant beds is distinct from land used to grow the crop.

Fields

Viruses are controlled primarily through the use of disease-free (micropropagated) planting material and by physically separating sweetpotato fields from susceptible weed hosts. Growers use nematicides in plant beds and fields. Those used in fields are dichloropropene (Telone II), aldicarb (Temik), ethoprop (Mocap), Telone C-17, chlorpyrifos (Lorsban), chloropicrin and oxamyl (Vydate). Telone C-17 is used where pox problem areas exist. Temik use has declined drastically and now is used only when sweetpotatoes are saved for seed.

Storage

The important sweetpotato storage rots in North Carolina are Rhizopus soft rot, Fusarium surface rot, Fusarium root rot, bacterial soft rot, and scurf. Of these diseases, only Rhizopus is controlled using fungicide. The remaining diseases result from poor growing/harvest conditions, wounding during handling, improper storage conditions, or poor sanitation. Sweetpotatoes are treated with dicloran (Botran) before shipment to control Rhizopus soft rot. Chlorine is also used to sanitize roots. Due to decreased acceptance of dicloran residues in exported product (e.g., European markets) alternative disease control products have been pursued. In 2005, Bio-Save 11LP (a biological control product containing the bacterium *Pseudomonas syringae*) was registered for use on sweetpotatoes. A few packinglines are currently using Bio-Save 11LP for the export market.

Packinghouse

Chloropicrin and methyl bromide are used to fumigate packinghouses once per year. Chlorinated water

is used to sanitize packinghouse surfaces. Sulfur candles and other common disinfectants (creosol, quaternary ammonia, and formaldehyde) are used occasionally.

Fungicide Use Estimates for Sweetpotatoes

The two most commonly used fungicides are dicloran (Botran) and chlorine. Both are used on the majority of packinglines as a postharvest sanitizer (chlorine) and for decay control (Botran). No fungicides are used in the field with the exception of chloropicrin, which can be found in certain Telone products (e.g., Telone C-17, Telone C-35) or in methyl bromide (rarely used), all used for soil fumigation. Occasionally, Botran and/or thiabendazole (Mertect) are used in the plant bed.

Current Fungicide and Nematicide Recommendations for Sweetpotatoes

Current North Carolina Cooperative Extension Service recommendations for fungicide and nematicide use on sweetpotatoes (including information on formulations, application rates, and precautions/ limitations) are provided in the following tables from the *North Carolina Agricultural Chemicals Manual*:

Table 6-17: Vegetable Crop Disease Control Schedule
(http://ipm.ncsu.edu/agchem/chptr6/612.pdf)

Table 6-24: Nematode Control in Vegetable Crops
(http://ipm.ncsu.edu/agchem/chptr6/617.pdf)

Recommendations and efficacy ratings for fungicide and nematicide use on sweetpotatoes are provided in the following tables in the Vegetable Crop Guidelines for Southeastern United States:

Tables 3-51, 3-52, and 3-53 (pages 185-186): Disease Control for Sweetpotato, Relative Importance of Alternative Management Practices for Disease of Sweetpotato, and Relative Importance of Chemicals for Sweetpotato Disease Control
(http://ipm.ncsu.edu/vegetables/CommercialVegetables/SECommercialVegGuide.pdf)

Weeds

The major weeds found in North Carolina sweetpotato plant beds and fields are annual grasses, pigweeds, common cocklebur, common lambsquarters, common ragweed, Pennsylvania smartweed, and yellow and purple nutsedge. Weeds are slightly more common in sweetpotato plant beds than in fields. Weeds in plant beds can reduce plant numbers and weight. In fields, severe weeds can reduce yield by 100 percent, as well as diminish sweetpotato root quality and interfere with harvest. Sweetpotato

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: preplant tillage, herbicides, cultivation, and hand weeding. Information on the critical timing of controlling weeds can be found in following reference: Seem, J.E., N.G. Creamer and D.W. Monks. 2003. Critical weed-free period for 'Beauregard' sweetpotato (*Ipomoea batatas*). Weed Tech. 17:686-695.

Plant beds

Weed control in beds has become an important issue in sweetpotato production. Florida pusley and yellow and purple nutsedge are the most troublesome weeds in plant beds however many other grass and broadleaf weeds are also troublesome.

Preemergence control:

Napropamide (Devrinol) is registered for preemergence control of annual grasses and small-seeded broadleaf weeds such as common purslane. It gives only poor to fair control of pigweed.

Postemergence control:

Fluazifop (Fusilade), Sethoxydim (Poast) and clethodim (Select) are registered for postemergence control of annual and perennial grasses. They do not control broadleaf weeds or sedges. These herbicides give effective control of most emerged grasses.

Fields

Preplant control:

Fields are prepared for sweetpotato planting approximately 2 weeks before planting, and weeds often emerge between field preparation and planting. Thus, approximately 50 percent of growers in North Carolina rework their fields just before transplanting to control weeds.

Glyphosate (Roundup) is labeled as a preplant application in sweetpotato fields for the control of emerged weeds.

Preemergence control:

Clomazone (Command) is registered 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. This herbicide is extensively used in sweetpotato fields in North Carolina.

Dimethenamid (Outlook) is registered for preemergence use in sweetpotato to control annual grasses and certain small seeded broadleaf weeds including pigweed. It is a recent registration and has great potential for use as it controls pigweed. It will likely be used with other herbicides.

EPTC (Eptam) is registered 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 making it difficult sometimes for growers to apply it properly and difficult for growers to achieve effective weed control especially in the row where the tranplanter travels. Care must be taken to prevent transplant operation from moving herbicide from the center of crop row resulting in poor weed control. It is used extensively in fields having a history of nutsedge problems.

Flumioxazin (Valor) is registered to apply preplant in sweetpotatoes (Beauregard only) after fields are bedded but prior to transplanting. It is very effective on many broadleaf weeds including pigweed. Care must be taken to prevent transplant operation from moving herbicide from the center of crop row resulting in poor weed control. Growers will sometimes apply another herbicide after transplanting to reduce risk of escapes in the middle of the row where the transplanter travels. The registration of this product came since last season however wide spread use occurred this season.

Napropamide (Devrinol) is registered 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 mixture sometimes gives better control than with clomazone alone. This product has been used on a limited basis in North Carolina.

Postemergence weed control:

Fluazifop (Fusilade), Sethoxydim (Poast) and clethodim (Select) are registered for postemergence control of annual and perennial grasses. They do not control broadleaf weeds or sedges. Timing can be an issue in their application such that if growers delay application due to the environment (rainy weather) then yields are sometimes reduced. Sethoxydim is applied to approximately 18 percent of the acreage.

Cultivation:

Cultivation is also used for controlling emerged weeds after transplanting. Virtually all sweetpotatoes are cultivated an average of three times per growing season.

Hand weeding:

Hand weeding is another way to control weeds after sweetpotato transplanting. Most of the fields are hand weeded at least once.

Mowing:

Many of our fields are mowed above the sweetpotato canopy to suppress tall growing weeds late in the growing season. An option to mowing sometimes is growers using crews to cut these weeds at the soil surface for control. A high percentage of the acreage in North Carolina experience these methods of weed control.

Current Herbicide Recommendations for Sweetpotatoes

Current North Carolina Cooperative Extension Service recommendations for herbicide use on sweetpotatoes (including information on formulations, application rates, and precautions/limitations) are provided in the following table from the *North Carolina Agricultural Chemicals Manual*:

Table 8-15: Chemical Weed Control in Vegetable Crops
(http://ipm.ncsu.edu/agchem/chptr8/817.pdf)

Contacts

Jonathan R. Schultheis
Extension Specialist
Department of Horticultural Science
North Carolina State University
Campus Box 7609
Raleigh, NC 27695-7609
Telephone: (919) 515-1225
E-mail: jonathan_schultheis@ncsu.edu

Kenneth A. Sorensen
Extension Specialist
Department of Entomology
North Carolina State University
Campus Box 7626
Raleigh, NC 27695-7626
Telephone: (919) 515-1662
E-mail: kenneth_sorensen@ncsu.edu

David W. Monks
Extension Specialist (Weed Management)
Department of Horticultural Science

North Carolina State University
Campus Box 7609
Raleigh, NC 27695-7609
Telephone: (919) 515-5370
E-mail: david_monks@ncsu.edu

Gerald J. Holmes
Extension Specialist
Department of Plant Pathology
North Carolina State University
Campus Box 7616
Raleigh, NC 27695-7616
Telephone: (919) 515-9779
E-mail: gerald_holmes@ncsu.edu

Allan C. Thornton
Extension Associate
Department of Horticultural Science
Sampson County Extension Center
369 Rowan Road
Clinton, NC 28328
Telephone: (910) 592-7161
E-mail: allan_thornton@ncsu.edu

References

1. Curtis Consulting, Inc. 2003. Strategic Plan for Pest Management Research and Education in Southern Sweetpotato Production Systems: Summary of Workshops held October 2001 and January, February and August 2002. Department of Horticultural Science, North Carolina State University. 25 pp.
2. Monks, D. W., J. R. Schultheis, and R.J. Mills. 1996. Effects of weeds and herbicides on sweetpotato transplant production using polyethylene bed covers. *Weed Tech.* 10:273-277.
3. Seem, J.E., N.G. Creamer and D.W. Monks. 2003. Critical weed-free period for 'Beauregard' sweetpotato (*Ipomoea batatas*). Weed Tech. 17:686-695.
4. Sherrell, E. M. (ed.). 2004. North Carolina Agricultural Statistics 2004. Publication No. 204. North Carolina Department of Agriculture & Consumer Services, Raleigh.
5. Sorensen, Kenneth A. and Gerald Holmes. 2003. Diagnosing Insects and Disease Poster, North Carolina Cooperative Extension Service. Poster Display.
6. Sorensen, Kenneth A. 2004. Insect Guide to Sweetpotato Insect Identification. Department of Entomology. North Carolina State University.
7. Sorensen, Kenneth A. 2004. Insect Guide to Sweetpotato Soil Insect Identification. Department

of Entomology. North Carolina State University.
8. Wilson, L. G. and C. W. Averre. 1989. *Growing and marketing quality sweetpotatoes*. North Carolina Cooperative Extension Service. AG-09.

On-Line Resources

Pest Management Strategic Plan for Sweetpotatoes in Alabama, Louisiana, Mississippi and North Carolina
(http://www.ipmcenters.org/pmsp/pdf/sesweetpotato.pdf)

Commercial Vegetables Recommendations for the Southeastern U. S.
(http://ipm.ncsu.edu/vegetables/CommercialVegetables/SECommercialVegGuide.pdf)

Sustainable Practices for Vegetable Production in the South
(http://www.cals.ncsu.edu/sustainable/peet/)

North Carolina Pest News
(http://ipm.ncsu.edu/current_ipm/pest_news.html)

Insects and Related Pests of Vegetables
(http://ipm.ncsu.edu/AG295/html/index.htm)

Insect Pests of Vegetables
(http://ipm.ncsu.edu/vegetables/pests_vegetables.html)

Insect Notes – Vegetables
(http://www.ces.ncsu.edu/depts/ent/notes/Vegetables/vegetable_contents.html)

Plant Disease Information – Vegetables
(http://www.ces.ncsu.edu/depts/pp/notes/Vegetable/vegetable_contents.html)

Knowing and Managing Sweetpotato Insects and Diseases
(http://ipm.ncsu.edu/vegetables/pamphlets/sweetpotato/sweetpotato.html)

Sweet Potatoes, Horticultural Commodity of North Carolina
(http://www.agr.state.nc.us/markets/commodit/horticul/sweetpot/)

Prepared by:

Jonathan R. Schultheis, Kenneth A. Sorensen, David W. Monks, Gerald J. Holmes, Allan C. Thornton, and Stephen J. Toth, Jr. (ed.)

The image of sweetpotatoes is provided by Gerald J. Holmes, Department of Plant Pathology, North Carolina State University.