



In-Depth Look at the NCPN Crops Continues

In this issue, we examine the rapid growth and challenges of the U.S. sweetpotato industry, and the progress being made by NCPN-Sweetpotatoes in the fight against viruses that threaten this important crop.

NCPN Sweetpotato Hits the Ground Running!

Sweetpotatoes joined the National Clean Plant Network (NCPN) in 2015 and participants have made huge strides in a short amount of time. Much of the progress is attributable to the fact that sweetpotato viruses are extremely common, can be devastating, and there is a huge need for clean plant material. Like other NCPN crops, yield and quality are affected by virus diseases, and the extent to which they are affected depends on cultivar and virus(es). Yield is often reduced 10 to 40%. If a grower plants with clean plants, even if they become infected during the season, which usually happens, the yield is higher than if they had planted with dirty or infected plants. (Clark, et al., 2010)

NCPN-SP was able to hit the ground running by capitalizing on organizational lessons learned from other crop groups in the Network. The Sweetpotato group adapted and modified documents honed by other crops, such as a charter and their priority list. The NCPN-SP then proceeded to quickly develop a list of target viruses, as well as a logo, trifold, factsheet, and website. The Sweetpotato group also pioneered a virtual tour of their Louisiana clean plant center, featured on their website at <http://ucanr.edu/sites/ncpnsweetpotato/>. (continued on page 6)



This is the only sign that might slow down NCPN Sweetpotatoes in their quest to stop the threat of viruses and virus-like diseases in a crop that is enjoying rapid growth within the U.S.



Sweetpotatoes (*Ipomoea batatas*) have recently experienced a resurgence in popularity in the United States. Between 2000 and 2015, sweetpotato consumption in the U. S. almost doubled from 4.2 to 7.5 lbs./person/year. They have been made into new products such as fries, chips, bread, alcoholic and non-alcoholic beverages, dog food, dog treats and livestock feed. They are recognized as being a good source of vitamin A, beta-carotene, dietary fiber and other nutrients. They are also being investigated for use as a natural food dye and even as a food source for long term space travel (Bovell-Benjamin, A. 2007). There are ornamental cultivars that are very popular in planters and hanging baskets for commercial installations and home gardens because of their vigor, hardiness and color.

The total value of the U. S. sweetpotato crop more than doubled in a decade to over \$478 million in 2010 (ERS, 2011). The export market has grown tremendously; it increased 440% between 2002 and 2011. A total of 114,867 tons was exported in 2011 (Offner, J. 2013). In 2012, the dollar value of fresh sweetpotato exports rose 8% to \$79.9 million (Huntrod, 2013).

NCPN Sweetpotato Centers Cover a Lot of Ground!

Q: What do Arkansas, California, Hawaii, Louisiana, Mississippi and North Carolina have in common?

A: They all participate in the NCPN-Sweetpotato!

ARKANSAS: The Sweetpotato Foundation Program at the University of Arkansas at Pine Bluff (UAPB) is developing a clean seed program focusing on serving small, previously underserved communities of growers. Dr. Muthusamy Manoharan manages the program which begins with clean material from LSU. Within 2 years of joining NCPN-SP, the Sweetpotato Foundation Program has produced an impressive 85,000 slips. That is enough material to plant 7 acres of sweetpotatoes. They recently visited the NPCN-SP center in Mississippi to learn their production methods.



CALIFORNIA: Foundation Plant Services (FPS) at the University of California at Davis has a small sweetpotato program that was developed in the 1960s. Involvement in NCPN-SP has led to updates in testing and a dramatic increase in the number of cultivars that are publicly available, including many heirloom cultivars. Sue Sim managed the program from 1994 until recently. Josh Puckett, FPS Production Manager, currently manages the program. Dr. Maher Al Rwahnih, is a subject matter expert in virology to the NCPN-SP Tier 2 committee and is working to update lab testing protocols using HTS.



HAWAII: The University of Hawaii at Manoa is beginning a clean seed program to focus on unique heirloom Polynesian cultivars. Dr. Mike Melzer manages the program, is a NCPN-SP Tier 2 member who is also active in NCPN-Citrus and is working to clean up, test and provide materials to the Pacific Islands.



NCPN Sweetpotato Centers, continued

There are seven centers or programs in the Sweetpotato Network. NCPN has funded physical improvements such as greenhouse and lab upgrades, including lights, benches, stereomicroscopes, PCR supplies and personnel. As valuable as the physical upgrades are, the collaboration and cooperation between centers has been a huge advantage of the NCPN-SP to the centers and programs. Below are a few highlights of each center or program.

LOUISIANA: The Sweet Potato Research Station (SPRS) LSU AgCenter in Chase, LA is a 308-acre facility with a primary aim to produce clean sweet potato plants and provide research, breeding and other support to the sweetpotato industry. Louisiana has a state certification program for certified sweetpotato seed. NCPN-SP funding has allowed it to make needed upgrades and hopefully expand its reach within Louisiana and to other states. Dr. Tara Smith, a member of NCPN-SP Tier 2, manages the Chase Station. In the Plant Pathology and Crop Physiology Department in Baton Rouge, LA, Dr. Chris Clark also serves as NCPN-SP Chair.



MISSISSIPPI: Mississippi has the second highest sweetpotato acreage in the US. The Mississippi Agricultural and Forestry Experiment Station (MAFES), a branch of Mississippi State University, provides certified seed to growers in Mississippi. Located in Pontotoc MS, the Foundation Sweetpotato Program is managed by Dr. Mark Shankle and Dr. Steve Meyers, along with Jeff Main and Callie Morris. This team has greatly updated and enhanced physical facilities, maintained tissue cultures and distributed over 1 million cuttings/roots in 2017. They collaborate closely with LSU for testing. Shankle, Meyers, and Main also serve on the NCPN-SP Tier 2 leadership group.



NORTH CAROLINA: North Carolina has more acreage in sweetpotatoes than any other state. The Micropropagation and Repository Unit (MPRU) at North Carolina State University has extensive experience in operating a clean plant program and is directly tied to one of the two major U.S. sweetpotato breeding programs. North Carolina has a state certification program for certified sweetpotato seed. The MPRU was started in the 1990s by Dr. Zvezdana Pesic-vanEsbroeck, who directed it until her recent retirement. Dr. Christie Almeyda is the current manager and works closely with Dr. Bill Foote of the North Carolina Crop Improvement Association. Dr. Foote also serves as the NCPN-SP vice-chair. The NCPN-SP coordinator, Dianne Coats, is also located at NC State.



Sweetpotato Viruses are Extremely Common and Can Be Devastating

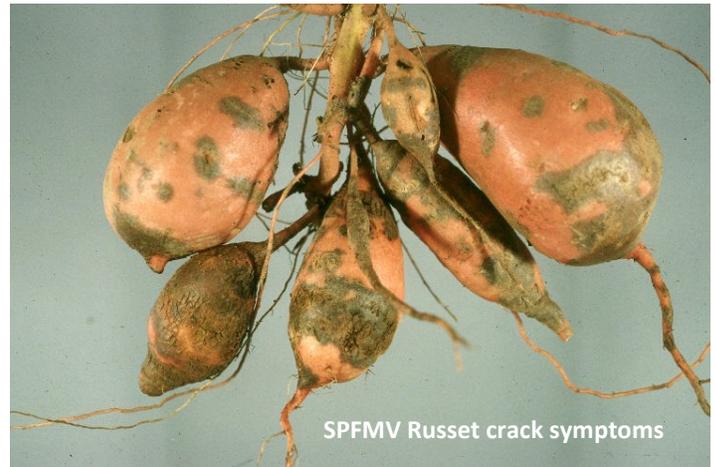
The potyvirus, *Sweetpotato feathery mottle virus* (SPFMV), is, by far, the most common sweetpotato virus. It is found worldwide wherever sweetpotatoes are grown. In the 1990s, the Russet--Crack strain of SPFMV (SPFMV-RC) reduced yield up to 50% in affected fields in North Carolina. In response, the Micropropagation and Repository Unit (MPRU) in North Carolina was begun with the mission to clean up and distribute clean propagation material or 'seed'. LSU, which had already been producing true to type seed, added virus testing and elimination to its mission. Two other strains that are recognized are Ordinary (O) and East African (EA).

Other potyviruses found in the U.S. include *Sweet potato virus C* (SPVC), *Sweet potato virus G* (SPVG) and *Sweetpotato virus 2* (SPV2). Those, along with SPFMV, form a complex of four potyviruses that the NCPN-SP centers target for testing. By definition, potyviruses are aphid-transmitted. Even in relatively isolated fields, potyvirus reinfection occurs rapidly, often within one growing season.

The Geminivirus, Sweetpotato leaf curl virus (SPLCV), poses a potential threat to production. It is fairly common in ornamental sweetpotatoes, but, for reasons unknown, it has not been a problem in commercial production fields (Clark and Hoy, 2006). SPLCV is transmitted by whiteflies.

Sweet potato chlorotic stunt virus (SPCSV), a Crinivirus in the family Closteroviridae, poses a severe threat to production. When it coinfects with SPFMV it causes a devastating disease called Sweetpotato Virus Disease (SPVD). SPVD can reduce yield 90% (Clark et al, 2012). SPCSV primarily occurs in Africa and South America but it has been identified in the U. S. twice. The first time was in an accession at the USDA Plant Genetic Resources Conservation Unit in 1996 (Pio-Ribeiro et al, 1996). More disturbing, it was reported again in 2007 in two field sites in North Carolina. (Abad, 2007, Valverde, 2007). SPCSV is also transmitted by whiteflies.

Over 30 other viruses have been identified in sweetpotatoes. High-throughput sequencing (HTS), a new tool recently used on sweetpotatoes, may discover more. Biological effects of many of these and newly discovered viruses remain unknown.



SPFMV Russet crack symptoms



SPFMV feathery mottle symptoms



Large, green healthy *I. setosa* leaf is being held below a whole *I. setosa* plant that is virus-infected and showing severe stunting, leaf chlorosis and distortion.

There is a huge opportunity to greatly improve the state of the sweetpotato industry in the US

The solution to the problems caused by sweetpotato viruses is to ensure that growers plant virus – tested clean propagation material or ‘seed’. To accomplish this, growers need to be convinced that clean seed is valuable and demand it, and clean seed must be produced in high quantity to meet that demand. **This presents a two-fold challenge.** The number of growers that use clean seed varies greatly from state to state. It’s estimated that 80% of growers in California and Louisiana use clean seed; in other states, no clean seed is planted. Nationwide, if only half of all acreage was planted with clean seed, we would need over 1 billion plants. It is estimated that approximately 577 million clean plants are produced, which represents a shortfall of 433 million plants needed to plant just half of all the acreage in the U.S.

In terms of **increasing demand**, a regional approach makes the most sense beginning in states where the use of clean planting stock is lower. Outreach efforts have gotten a good start but there is lot of ground to cover! (pun intended) A fact sheet, [The Benefits of Using Virus Tested Planting Stock](#), was produced and distributed at the National Sweetpotato Convention held in Wilmington, NC in January, 2018. This type of information is shared at grower meetings and field days held every year in California, Louisiana, Mississippi and North Carolina, with as many as 60 growers attending in each state. At a grower meeting in Hawaii on Sep 26, 2017, results of field trials in Hawaii and an overview of the Louisiana clean plant program were presented. The most recent meeting was held in Mississippi on February 23, 2018 and featured speakers from the Micropropagation and Repository Unit (MPRU) and Foundation Plant Services (FPS) by video link; members from Louisiana, Mississippi and Arkansas participated in person. The topic for all was how their respective clean plant program worked and the role of NCPN-SP. Representatives from NCPN-SP are eager to collaborate with growers in other states who are interested in clean plant programs.

As for **increasing supply**, opportunities to improve production systems are being identified. Unlike other NCPN crops, there are

State	Acres Planted	# Plants required if 50% acreage was planted with clean plants	# Estimated clean plants produced	Percent clean plants produced/ demand if 50% acreage used clean plants	Percent clean plants produced/ demand if 100% acreage used clean plants
North Carolina	87,000	565,500,000	339,300,000	60%	30%
Mississippi	27,000	175,500,000	31,200,000	18%	9%
California	18,500	120,250,000	192,400,000	160%	80%
Louisiana	10,000	65,000,000	13,866,667	21%	11%
Alabama, Arkansas, Florida, Hawaii, New Jersey, Texas	15,500	100,750,000	0	0%	0%
Total	157,600	1,027,000,000	576,766,667	56%	28%

Based on this estimate, there is a 72% shortfall of clean plant units needed to cover all sweetpotato acreage. NCPN-SP is tackling both of these issues simultaneously.

few established private nurseries in the sweetpotato industry. There are approximately 20 private and public producers of clean sweetpotato plants in the U.S.

Sweetpotato production systems (and the final product, whether it is a storage root or a green plant) vary greatly from state to state. The Sweet Potato Research Station (SPRS) in Louisiana produces clean storage roots (sweetpotatoes) that are then increased on farm by the production or tablestock grower. The MPRU produces green, rooted cuttings that are increased on certified seed farms. Foundation Plant Services (FPS) in California also produces green, rooted cuttings that are increased at a seed farm or on farm by a tablestock grower. SPRS has identified points in the production where supply could easily be increased using aeroponics. Their experience and methods are transferable to the newer centers and programs. In common, is the fact that most tablestock growers increase the planting stock for another year on their own farm.

The existence of certification programs is also state-specific. In Louisiana, North Carolina and Mississippi there are laws governing what is required for certified seed. There is no state certification system for California, but the program at FPS is well known; and clean planting stock from that center is widely distributed.

NCPN Sweetpotato Hits the Ground Running!

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Impressive progress has also been made on the standardization and optimization of diagnostics – always a critical issue for NCPN participants. Two meetings have been held to focus on diagnostics. The first meeting was September 2015 in Beltsville, MD at the APHIS Quarantine station; a second meeting was held in Baton Rouge, LA on March 19-20, 2018.

The rapid successes over the last three years would not have been possible without a dedicated, focused group of people working in concert. Many of the people involved have been working together in the National Sweetpotato Collaborators Group. This group began in 1938 and has had annual meetings since then. The Collaborators Group has fostered a spirit of cooperation among research and extension personnel from different states. They received a multi-state and multidisciplinary grant from USDA Specialty Crop Research Initiative for research and extension aimed at efforts to improve production efficiency, quality and food safety awareness for sweetpotato producers. Now, NCPN has enabled the sweetpotato industry to apply the same spirit of collaboration towards another aspect of sweetpotato production – the production and availability of clean, virus-tested planting material.

The NCPN-SP has made a lot of progress in three short years and, although there is much work to be done, the future looks bright.



What is the difference between a sweetpotato and a yam?

Sweetpotatoes (*Ipomoea batatas*) are a dicot and member of the Convolvulaceae or morning glory family and originated in the Americas. They can be white, orange or purple flesh. Grocery stores use the term yam for some varieties of sweetpotatoes, usually the moist, orange ones. The USDA requires labels with the term *yam* to also have the term *sweetpotato* on the label.

True yams (*Dioscorea* spp.) are a monocot, a member of the Dioscoreaceae family and originated in Africa and Asia. True yams have rough skin and usually white, pink or purple flesh. Each yam is usually about 5 to 10 lbs, but they are known to grow up to 55 lbs or more! True yams are generally imported into the US from the Caribbean.

NCPN-SP Tier 2

Chris Clark (Chair), LSU Ag Center
Bill Foote (Vice Chair), NCSU
Matt Garber, Industry, Louisiana
Jim Jones, Industry, North Carolina
Sue Leggett, Industry, North Carolina
Dave Souza, Industry, California
Ann Gallagher, Regulatory, N.Carolina
Richard Miller, Regulatory, Louisiana
Sean Runyon, Regulatory, California
Christie Almeyda, University, NCSU
Stephen Meyers, University, MSState
Sathish Ponniah, University, UAPB
Scott Stoddard, University, UCANR
Dianne Coats, Coordinator

A Look Ahead: *What's Happening in the Network*

- **May 23-24, 2018** NCPN-Berries Tier 2 Meeting, Fayetteville, AR
- **June 5-6, 2018** NCPN-Citrus Tier 2 Meeting, Dallas, TX
- **June 25-27, 2018** APS Pacific Division Joint Meeting, Portland OR
- **June 12-13, 2018** Education & Outreach, plus Coordinators Meeting, Portland OR
- **June 26-27, 2018** [NCPN-Roses Annual Meeting](#), Arcadia, CA
- **June 26, 2018** NCPN Governing Body Meeting, Corvallis, OR
- **June 27-29, 2018** WERA-20 Meeting, Corvallis, OR
- **July 23, 2018** NCPN-Hop Tier 2 Meeting, Prosser, WA
- **July 29-Aug 3, 2018** [International Congress of Plant Pathology](#), Boston, MA

National Clean Plant Network

USDA-APHIS-Plant Protection
and Quarantine
Science and Technology
4700 River Road, Unit 152, Room 5C-0341
Riverdale, MD 20737

nationalcleanplantnetwork.org