

Specific Certification Standards Micropropagated Virus-indexed Sweetpotato

I. Explanation of General Standards as Applied to Sweetpotato

A. The General Planting stocks (roots, plants & cuttings) Certification Standards as adopted are basic and together with the following specific standards constitute the standards for certification of Virus-indexed Sweetpotato Planting Stocks.

B. Definitions

Field is the seed production area enclosed by natural borders such as ditches, tree lines, buildings, roads, or a minimum of a 5' clean and tilled break.

Mericlone is a plant clonally propagated from a single apical meristem.

Micropropagation is the art and science of plant multiplication *in-vitro*.

Sweetpotato is most commonly micropropagated in tissue culture by aseptic transfer of stem segments containing one to three nodes to sterile medium to produce Nuclear Stock Plants.

Virus-indexed is a Nuclear Stock Plant that has been tested for the presence of Sweet Potato Feathery Mottle Virus and other viruses by grafting to indicator plants. If no virus symptoms develop on the indicator plant, then the Nuclear Stock Plant is considered to be free of designated viruses or virus-indexed. This method does not prove that the plant is virus-free.

Cutting is a stem section 8 -12 in. (20 - 30 cm) long with at least 2 - 3 nodes for transplanting in the greenhouse or field.

C. The General Planting Stock Certification Standards are further defined to apply specifically to Virus-indexed Sweetpotato Planting Stocks. Classes and sources of certified Planting stocks are:

1. Breeder Seed Stock is material entering the Micropropagation and Repository Unit (MPRU) at North Carolina State University (NCSU) obtained by methods acceptable to the North Carolina Crop Improvement Association (NCCIA).
2. Nuclear Stock Plant is a plant derived from Breeder Seed Stock. It is virus-indexed, apparently free of other pests, and evaluated in field test for trueness-to-type. This material is maintained under strict isolation by the MPRU. Nuclear Stock Plants may exist as *in-vitro* tissue culture plantlets, or greenhouse plants in screen cages. NCCIA inspections begin at the MPRU.
3. Nuclear Plant (Mother Plant) is a greenhouse plant, produced by the MPRU from a Nuclear Stock Plant.

4. Elite Plants are greenhouse plants produced by certified nurseries from Nuclear Plants

Elite plants may be used to produce Elite stock in the greenhouse or G1 stock when exposed to field contamination. Elite plants are propagated as follows:

Nuclear Plants are obtained from the MPRU and are isolated in screen cages. Nuclear Plants may be cut repeatedly to produce D1 Daughter Plants and used for only one planting season.

D1 Daughter Plants are produced by cuttings from Nuclear Plants. D1 plants may be cut repeatedly to produce D2 Daughter Plants.

D2 Daughter Plants are produced by cuttings from D1 Daughter Plants. D2 plants may be cut repeatedly to produce D3 Daughter Plants.

D3 Daughter Plants are produced by cuttings from D2 Daughter Plants. ..

5. G1 Seed Roots: G1 plantings are established from Elite and G1 plants. Vine-cuttings may be taken repeatedly from this original G1 planting to establish a second G1 planting. Vine-cuttings may be taken repeatedly from the second G1 planting to establish a third G1 planting. Vine-cuttings may be taken repeatedly

from the third G1 planting to establish a fourth G1 planting. No additional sequential plantings may be established from this fourth G1 planting.

Vines and roots produced during this first year in the field are designated as G1.

6. G2 Seed Roots: G2 plantings are established from G2 plants grown from G1 roots. Vine-cuttings may be taken repeatedly from this original G2 planting to establish a second G2 planting. Vine-cuttings may be taken repeatedly from the second G2 planting to establish a third G2 planting. Vine-cuttings may be taken repeatedly from the third G2 planting to establish a fourth G2 planting. No additional plantings may be established from this fourth G2 planting. Vines and roots produced during this second year of field production are designated as G2.
7. Cutting from an Elite Plant, a G1 plant, or a G2 plant
 - Elite Cuttings are produced from Elite plants grown in a certified greenhouse.
 - G1 Cuttings are vine-cuttings from G1 plants that are established in the field from Elite cuttings which become G1 cuttings once they leave the greenhouse or from other G1 plants. G1 cuttings produce G1 roots.
 - G2 Cuttings are cuttings from sprouts from bedded G1 roots or from vine cuttings from G2 plants. G2 cuttings produce G2 roots.

II. MPRU

- A. All Nuclear plants are to be inspected by NCCIA within 7 days of shipment to nursery greenhouse.
- B. Inspection of MPRU greenhouse and plants will conform to nursery greenhouse standards below.

III. Nursery Greenhouse

A. Production Requirements

1. NCCIA must approve greenhouses before Nuclear plants are released to the nursery *for* production of Elite stock. Nursery must give a copy of the NCCIA greenhouse certificate for the current growing season to the MPRU before plants are released to the nursery. Greenhouse certificates are valid from September 15 through August 15.
2. Isolation
 - a. No sweetpotato field plants are allowed within 250 feet of the perimeter of the greenhouse.
 - b. There should be no plants growing within 10 feet of the greenhouse (grass for stabilization is permitted, but weeds must be controlled).
 - c. Only approved indicator plants are allowed in the greenhouse; no other plants are allowed when sweetpotatoes are in the greenhouse.
3. Growing medium (e.g. soil), containers, etc. used in the greenhouse must be sanitized by a recommended method.
4. Nuclear Plants must be kept isolated from other plants within screen cages to exclude aphids until all daughter cuttings have been completed.
5. Different cultivars must be clearly identified and separated. Original labels from the MPRU must remain with the plant.
6. Doors must be kept locked when attendants are not present.
7. Yellow sticky traps must be used to monitor aphids and other insects with one on each end no farther than 10 feet from the end and 50 feet thereafter.
8. Greenhouses must be clearly marked to warn workers that they must decontaminate before entering, i.e. washing hands and clean clothes.
9. A foot bath must be kept at the entrance for sanitizing shoes.

10. NCCIA may conduct additional inspections if problems are encountered.
11. Aphids, whiteflies or other insects with sucking mouth parts must be controlled.
12. Cutting tools must be decontaminated frequently and between groups of plants.
13. Screens must be of such mesh to prevent entry of aphids and placed over all openings (vents, fans, windows, etc.).
14. Double doors or a single door with air screens are required for entry into greenhouse.
15. NCDA must be notified when plants are received so that weevil traps can be installed

B. Inspections

1. Nursery Responsibility
 - a. Nursery will regularly inspect plants. All plants that are symptomatic of disease or etc. are removed and destroyed. The nursery will keep a log book recording cultivar and number of destroyed plants and make it available to NCCIA inspectors.
 - b. Nursery will inspect in and around the greenhouse perimeters to ensure isolation and weed standards are being met.
2. NCCIA Responsibility
 - a. NCCIA inspector approves greenhouses for production of Elite sweetpotato stocks for the current growing season prior to receipt of nuclear plants.
 - b. Elite Plants are inspected two months after receipt of nuclear stock plants and once a month afterwards. If a greenhouse fails an inspection it has one week to correct the problem; at that time it will be re-inspected. Plants symptomatic of disease are to be removed and destroyed. If a greenhouse fails two consecutive inspections, plants from that greenhouse cannot be certified.
3. General Requirements:
 - a. Unit of certification shall be the entire greenhouse.
 - b. Plant increase standards are described in Section I, C, 4.
4. Specific Greenhouse Plant Requirements, maximum % of factor

Factor	Nuclear Plants	Elite Plants
Bacterial Stem Rot	0	0
Black Rot	0	0
Scurf	0	0
Sweet Potato Feathery Mottle Virus or other viruses ^{††}	0	0
Fusarium Wilt	0	0
Sweetpotato Weevil	0	0
Exotic or hazardous pests/pathogens	0	0
Cultivar Mixture	0	0

^{††} Based on visual assessment of symptomatic plants

IV. Field

A. Production Requirements

1. The field can only have sweetpotato plants that are to be certified.
2. Sweetpotato roots are not eligible for certification if produced on land which:
 - a. Has produced sweetpotatoes in the last 3 years.

- b. Has received manure or sweetpotato residue in the last 3 years.
- c. Is subject to drainage from fields in which sweetpotatoes have been grown in the last 3 years (i.e. 4-year rotation).
- 3. Fields for production of certified sweetpotato seed roots should be 750 feet from other sweetpotato plants not in the certification program.
- 4. Different generations and cultivars (varieties) of plants must be clearly identified and separated by a minimum of 5' clean and tilled break.

B. Inspections

- 1. The certified seed grower inspects fields regularly and informs NCCIA if problems are found.
- 2. At least one inspection by NCCIA inspector is made around two weeks prior to harvest. The certified seed grower may rogue symptomatic plants.

C. Specific Field Plant Requirements

- 1. Unit of certification for production is a field.
- 2. Vine inspection standard

Factor[†]	G1 Plants	G2 Plants
Bacterial Stem Rot	None	None
Sweet Potato Feathery Mottle Virus and other viruses ^{††}	< 25%	< 25%
Fusarium Wilt	None	None
Sweetpotato Weevil	None	None
Exotic/Hazardous Pests/Pathogens ^{†††}	None	None
Cultivar Mixture	0.03%	0.05%

[†] If other severe factors are observed at time of inspection, rejection of all or a portion of a field may occur

^{††} Based on visual assessment of symptomatic plants

^{†††} If sampled roots report presence of guava root-knot nematode (*Meloidogyne enterolobii*) then the entire field will not be eligible for certification

V. Seed Roots Storage Standards

- A. One storage inspection is made by NCCIA after January 1.
- B. Sweetpotato Seed Roots certified by NCCIA must be separated in storage houses from other sweetpotatoes and properly identified and must not be exposed to dust from grading and packing area.

C. Specific Seed Roots Standards

Factor	G1 Seed Roots	G2 Seed Roots
Surface & Soft Rots	5%	5%
Bacterial Root Rot	None	None
Black Rot	None	None
Scurf	None	None
Streptomyces Soil Rot (Pox)	None	None
Root-knot Nematode*	5%	5%
Russet Crack	None	None
Internal Cork	None	None
Sweetpotato Weevil	None	None
Wireworm	5%	5%
Exotic or Hazardous Pests	None	None
Cultivar Mixture	0.03%	0.05%

*There is a zero tolerance for samples reporting guava root-knot nematode (*Meloidogyne enterolobii*)

- D. An official certificate or tag will accompany each sale of certified Sweetpotato Cuttings and Seed Roots.
- E. A complete record of certified Sweetpotato Cuttings and Seed Roots sales will be maintained and made available to NCCIA. The record will include (a) class, (b) kind and cultivar, (c) clone number, (d) date of shipment, and (e) number of plants or bushels shipped.
- F. Seed roots must pass the greenhouse, field, and seed root storage standards to be eligible for Certification.

VI. General Inspection Standards for Plants and Seed Roots

A. Plants

1. Apparently free of diseases, insects, and other pests.
2. True-to-cultivar characteristics.
3. Good color, fresh, firm.
4. Satisfactory size for commercial planting (cuttings approximately 8 – 12 inches long).
5. Cuttings should be loosely packed and shipped in an upright position in boxes.
6. Cuttings must not be shipped with non-program plants.

B. Size of Seed Roots should meet expectations of the purchaser.