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## **I. GOALS**

The three primary goals of the TSA program are:

- < to control and prevent the spread of TSA from the generally infested area in Florida, and
- < to eliminate infestations outside of the generally infested area, and
- < to educate and inform about TSA.

This harmonization plan establishes a framework for education, survey, and management of TSA consistent with the above goals. TSA has caused serious problems in Florida pastures and natural areas. There is potential for the same impact in other southern states.

## **II. GENERAL INFORMATION**

TSA, a perennial broadleaf weed native to South America, spread across Florida and into other southeastern states.

On August 11, 1995, the USDA/APHIS/PPQ listed TSA, *Solanum viarum*, on the Federal Noxious Weed List. The USDA/APHIS/PPQ now has legal authority to deal with some of the problems associated with TSA.

For additional general information on TSA, please refer to Appendix I and Appendix II.

## **III. SURVEY PROCEDURES**

### **A. DETECTION SURVEY**

#### PURPOSE:

To detect TSA infestations outside the generally infested area as soon as possible in order to prevent further spread and reduce control costs.

#### COOPERATORS:

All survey should be a cooperative effort between USDA/APHIS/PPQ and participating stakeholders.

Seek assistance from the Cooperative Extension Service (CES) County Agents for survey as they have proven to be valuable in finding new infestations.

Identify and seek assistance from key individuals in other organizations to assist with survey. Include TSA survey in the Cooperative Agreement for the Cooperative Agricultural Pest Survey Program.

It is essential that good public relations be maintained with cooperators and landowners at all times.

#### MODE OF SPREAD:

Movement of TSA seed is the primary method of spread. This is done by livestock and wildlife eating the fruit and redepositing seed in new areas after passing through the digestive system.

Other new TSA infestations have been discovered as a result of the:

- < fields planted with bahia grass seed that came from infested areas, and/or
- < composted cow manure commercially bagged from infested areas, and/or
- < hay, topsoil, and grass sod movement from infested areas, and/or
- < movement of animal waste (particularly cattle) from wash pits and/or collection/holding tanks by waste haulers.

#### WHEN TO LOOK:

Conduct surveys in southeastern states from May until the first killing frost. Larger plants will be easier to spot from July to frost. Yellow fruit becomes visible in late summer or fall.

Survey can be conducted in tropical areas such as Puerto Rico or southern Florida during any month of the year.

#### AREAS AT RISK:

The southeastern part of the United States where TSA is most likely to act as a herbaceous perennial weed will be considered as a high risk area for establishment. Counties in the southeastern states which have received cattle from infested areas should be considered highest priority. These can be identified from animal health certificates which can be obtained from the State Animal Health Board. These certificates will show the origin of cattle shipped into the state.

Other areas at high risk on the receiving end are:

- < Auction Lots,
- < Cattle Pens,
- < Fairgrounds,
- < Slaughter Houses,
- < Cattle Truck Washing Areas,
- < Trucking Firms,
- < Sod Along Highways, or
- < Loading and Unloading Areas.

It would be helpful to know the status of infestations at sites in infested areas such as the following:

- < Cattle Ranches,
- < Dairy Farms,
- < Livestock Farms,
- < Manure Processors,
- < Hay and Sod Producers/Brokers,
- < Citrus Growers,
- < Vegetable Farms,
- < Highway Right of Ways,
- < State Parks,
- < National Parks,
- < State Forests,
- < National Forests,
- < Wildlife Preserves,
- < Private Nature Preserves,
- < Golf Courses, and
- < Newly Sodded Areas.

#### WHERE TO LOOK:

Infestations are found in areas where cattle, horses, and other livestock are unloaded and initially kept upon arriving at a property. Look for seedlings growing in manure piles since cattle and wildlife eat the fruit and disperse seeds throughout their natural range.

TSA grows best in sunny areas on well drained soil. It does not persist under flooded field conditions. TSA grows taller in the shade. However, TSA seeds could still be viable if a flooded area is drained or disturbed in any manner. Survey should be conducted if this occurs.

Look for TSA in areas where cattle congregate. Cows spend much time under trees in the summer. Check cow paths in wooded areas. They also congregate around large bales of hay, feed, and water troughs.

TSA may first appear on ditch banks, around molasses and mineral feeders in cow pens, hay storage areas, and hammocks.

Seek as much information as possible from landowners, livestock haulers, etc., on additional movement of hay, manure, cattle, and equipment from infested areas, and follow up on leads.

Also, check spots where trailers are cleaned and where manure is spread from a dairy farm or slaughter house.

WHAT TO LOOK FOR:

General description of TSA (see Appendix I and II):

- < Mature plants are usually three to six feet tall,
- < the entire plant has thorn-like yellowish prickles up to 3/4 inches long, but the prickles are concentrated on petioles and leave blades,
- < the leaves are alternate, hairy, lobed, and six to eight inches long by three to six inches wide,
- < the flowers are in clusters on stems hidden by leaves, white with yellow or cream-colored stamens, and five recurved petals with tiny prickles on the surface,
- < immature fruits are pale green with dark veins similar to a tiny striped watermelon,
- < mature fruit are dull yellow, leathery-skinned, and two to three centimeters in diameter (up to 1.5 inches).

TSA is most likely to be confused with horsenettle, (*Solanum carolinense*). The table in Appendix I will help differentiate TSA from horsenettle.

HOW TO LOOK:

Contact the landowner and explain what you are doing and get permission to survey the property. Give him/her an information sheet (Appendix I or II). If he/she has received cattle from an infested area, explain that you would like to look at the area where the cattle were unloaded and initially held. This would probably be a small pasture or temporary holding area for the cattle to become adjusted.

Survey is usually conducted on foot, depending on the area being surveyed. Large pastures may be surveyed by vehicle if accessible and with landowner's approval.

If you are surveying early in the season, you will be looking for small plants which may be difficult to find and survey will be more tedious and time consuming. It is better to check known infested sites at this time.

Encourage the land owner to report infestation he/she may find at a later date. Leave a business card with telephone number. Try to get leads from him/her on other landowners who may have received from the infested area.

Place TSA posters (Appendix III) at areas where cattlemen congregate such as stockyards, feed stores, county agent offices, and rodeo arenas.

Mail out letters with information sheets to cattlemen, veterinarians, etc., encouraging them to report TSA infestations to you.

#### B. DELIMITING SURVEY

Delimiting survey is conducted to determine the limits of an infestation. This requires extensive survey surrounding all new finds. A determination must be made on how far surrounding the point of introduction TSA could have been spread. This area must be thoroughly surveyed. It could be that the find is not the point of introduction and therefore you need to know how it got there and from what point it was spread.

At a minimum, check adjacent fields operated by the farmer plus neighboring fields, forest, and other areas.

Also, check manure disposal areas and trailer cleaning areas which may be at a remote location from the farm where the find was made.

#### C. APPRAISAL SURVEY

Sites where TSA has been treated with herbicide will need to be checked periodically to see if plants have been missed or additional plants have grown from seed or come back from the roots.

A minimum of three years of negative survey will be required before eradication can be declared.

#### D. EQUIPMENT NEEDS

Following is a list of equipment which would be helpful when conducting survey:

- < Binoculars,
- < Boots,
- < Camera and Film,
- < Gloves,
- < Grass Whip,
- < Global Positioning System (GPS) Instrument,
- < Insect Repellent,
- < Knife,
- < Maps,
- < Newspaper and Plant Press,

- < Pamphlets About TSA,
- < Paper Bags,
- < Paper Towels,
- < Pencil and Pen,
- < PPQ Form-391,
- < Plastic Bags,
- < Shears or Scissors,
- < Shovel,
- < Snake Leggings,
- < Trowel, and
- < Ziplock® Baggies

#### E. REPORTING

Complete a TSA survey form for each survey site (see Appendix IV). Use GPS to get an exact location. Give the mileage by odometer reading from the nearest intersection.

Use a camera with color print or slide film or camcorder for documentation.

Report all new TSA infestations in a timely manner to the SPHD, state department of agriculture, or other individuals as appropriate. Data will be entered into the National Agricultural Pest Information System. The enclosed TSA Survey Form (Appendix IV) is for this purpose.

#### F. SUBMITTING SUSPECT SAMPLES

Assign a reference number on the form to associate the specimen with the collection site.

Collect botanical voucher specimens of TSA suspects for confirmation by a state or PPQ botanist or a preservation in university herbaria. Wear heavy gloves and use shears.

Do not pull fruit off stems since it will probably break and seeds will be left on the stem or may be spread. Cut off a few of the immature and ripe fruit and secure these either in paper bags or hold temporarily in plastic bags containing paper towels. Do not walk on mature fruit since these have a sticky substance which may adhere to shoes or boots.

Collect a flowering branch, a fruiting branch, or both with attached flower and fruit whenever possible. Include a leafy branch. If flowers or fruits are unavailable, plan to return at a later time to collect them for documentation.

Lay out several thicknesses of newspaper, place a specimen between two sheets of newspaper. Place this on top of other papers, add several more thicknesses of paper, then additional specimens as above until all are in place. Add more newspaper thicknesses.

Place a heavy object on top to flatten the specimens. Lay a piece of cardboard over the top and slide one under the bottom of the stack, tie tightly with string or twine, and mail in a large envelope or box.

Place some of the fruit in an envelope or metal tube and then place in a box with sufficient padding to ensure they arrive whole.

#### **IV. REGULATIONS**

USDA/APHIS/PPQ will not take regulatory action unless directed to do so by the SPHD. PPQ may recommend that containment strategies be followed to prevent the spread of TSA.

The movement of TSA plants, or plant parts capable of reproduction, is prohibited in some states by state laws. The Federal Noxious Weed Act of 1974 provides authority for control/eradication, and the regulation of interstate movement of federal noxious weeds.

The movement of TSA plants, or plant parts, and other regulated articles (hay, manure, seed, turfgrass, and cattle) from infested areas is prohibited by state law or regulations. Following is a list of Southern Plant Board states and commonwealths:

- < Alabama,
- < Florida - Florida Law (Florida Administrative Code 5B-57.007),
- < Georgia,
- < Mississippi,
- < North Carolina,
- < Puerto Rico,
- < South Carolina (SC) - SC Noxious Weed Act (Code Section 46-23-10, SC 1962 Code, Section 3-449, and SC 1976 Code Section 46-9-40), and
- < Tennessee.

#### **V. PREVENTION STRATEGIES**

Current control techniques (CCTs) should be used to prevent the spread of TSA. The following CCTs are recommended:

- < Avoid the movement of cattle from contaminated pastures to pastures free of TSA. If this does occur, be prepared to implement a spot treatment program to remove any TSA plants before fruiting;
- < confine cattle that have grazed in pastures infested with TSA in a TSA free holding area or pasture for six days before moving;
- < when purchasing cattle from a ranch that is infested with TSA, confine the animals in a TSA free holding area for six days prior to shipment. This will allow time for ingested TSA seeds to pass through the digestive tract; and
- < purchase hay, sod, grass seed, and planting material that are free of TSA. Areas to which these items have been moved should be monitored.

States should certify the following as TSA-free before shipping from the infested area:

- < Cattle From Ranches or Dairies;
- < Manure Processing Companies; and
- < Hay, Sod, Soil, and Seed Production Sites

Sterilize manure at the processing company with heat (i.e., composting, you need at least 110<sup>B</sup>F for six weeks), steam, or fumigant prior to shipment.

Ensure that processing will devitalize potential TSA seeds in eviscerated stomach and intestines from slaughter houses.

## **VI. CONTROL STRATEGIES**

### **A. CULTURAL CONTROL**

Pastures with dense stands of TSA and/or environmentally sensitive areas where it is not practical to apply herbicides should be mowed. Mow plants to a three-inch stubble height as soon as possible to stop them from producing fruit and seed. Repeat mowing when plants reach the flowering stage (50 to 60) days after first mowing. Fifty to 60 days after the second mowing, when plant regrowth is at the first flower stage, spray with an approved herbicide.

In dairy situations, plants may have to be dug. All plants with fruit collected should be incinerated, buried, or treated by other means to kill the seed or render the seed non-viable.

### **B. CHEMICAL CONTROL**

On pastures and non-crop land TSA can be controlled with existing labeled pasture, hayfield, or non-crop land herbicides as follows:

- < Remedy®,
- < Velpar®,
- < Banvel®, or
- < Grazon P+D®.

The best time to apply herbicides is when TSA plants are eight inches to one foot in size and prior to fruiting.

On crop land such as watermelons, soybeans, cotton, etc., consult the PPQ Methods Development Center, the local CES, university weed scientist, or industry representatives for recommendations.

**REMEMBER: The herbicide label is the law and should be STRICTLY followed.**

### VII. COOPERATION AND COORDINATION

The general public should be made aware of the economic and environmental damage being caused by TSA and the potential threat of spread. Ranchers and farmers need to be encouraged to purchase TSA-free commodities, report new infestations, and develop site specific recommendations for eliminating confirmed infestations.

Following is a list from which it would be beneficial to obtain cooperation:

- < Managers of Retail and Wholesale Outlets That Sell Composted Manure and Bahia Grass from Florida.
- < CES
  - County Agents,
  - Four-H Clubs, and
  - County Home Economics Leaders.
- < Education Institutions
  - High Schools,
  - Vocational Agriculture Teachers,
  - Colleges and Universities,
  - Botanists,
  - Extension Weed Specialists,
  - Weed Scientists,
  - Forage Specialists, and
  - Livestock Specialists.
- < State Departments of Agriculture

Nursery Inspectors.

- < State Wildlife and Heritage Trust Departments  
Wildlife/Conservation Officers,  
Wildlife Education Specialists, and  
Natural Heritage Botanists and Ecologists.
- < State Park Departments  
Park Superintendents, and  
State Parks Naturalists.
- < State Forest Services  
District Rangers, and  
District Biologists.
- < Department of Defense  
Natural Resource Managers at Federal Installations.
- < United States Forest Service  
Regional Specialists (Agronomists, Botanists, etc.), and  
National Forest Managers,
- < National Parks Service  
Regional Biologists, and  
Park Superintendents.
- < Private Conservation Groups
- < Private Veterinarians

#### **VIII. EDUCATION AND PUBLIC AWARENESS**

There are many posters and publications available for distribution for educational purposes. [Contact the SPHD in your state or the Florida Department of Agriculture and Consumer Services, Division of Plant Industry, care of the Technical Assistance Section, Post Office Box 147100 (1911 Southwest 34th Street) Gainesville, Florida 32614-7100.]

Public awareness can be achieved through presentations, letters, interviews, and general contacts with the following:

- < Legislators, House, and Senate Agriculture Committees,
- < High School, College, and University Biology Classes,

- < Weed Science Courses at Universities,
- < Weed Science/Plant Science Societies,
- < Agriculture Producer Groups/Associations,
- < Garden Clubs,
- < Scientific Societies,
- < Television Interviews,
- < Radio Interviews,
- < Newspaper Interviews, and
- < Boy/Girl Scouts of America.

## **IX. SAFETY**

Some hazards to avoid during TSA survey are:

- < Allergic reactions - wash hands after handling roots or other plant parts. Do not place hands near eyes. Some people may be allergic to TSA leaves or pollen. Do not keep TSA in vehicle or office.
- < Bulls and Cows - use binoculars for survey and/or get assistance.
- < Debris - watch out for boards, cord, wire, etc., particularly when hand spraying.
- < Fences - beware of electrical charge, close gates.
- < Mosquitoes and Ticks - use insect repellent when at risk.
- < Prickles - wear heavy gloves and protective clothing to avoid getting punctured. Even handling the stems of seedlings may cause itching or punctures.
- < Property Owners - obtain permission before entering a property.
- < Snakes - wear snake leggings when needed.
- < Vehicles - pull onto shoulders and use flashers to avoid collisions.

## **APPENDICES**

- I - TROPICAL SODA APPLE (*Solanum viarum* Dunal) IN THE UNITED STATES by Charles T. Bryson, John D. Byrd Jr., and Randy G. Westbrooks, 1995.
- II - Tropical Soda Apple, *Solanum viarum* Dunal: The Plant from Hell

(SOLANACEAE) by Nancy C. Coile, 1993.

III - NOXIOUS WEED ALERT Poster.

IV - Tropical Soda Apple Survey.

V - Tropical Soda Apple Task Force Membership List.