Update on Tropical Soda Apple

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Introduction

Tropical soda apple (*Solanum viarum*) is a perennial, broadleaf weed that has become a serious problem in perennial grass pastures of Florida. Since its first observed occurrence in 1987, in south Florida, tropical soda apple has spread to Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Puerto Rico. This alarming rate of spread is attributed to fruit consumption by cattle and wildlife, with seed disseminated via feces.

The Problem(s)

The invasion of tropical soda apple has had many effects. It has resulted in lower stocking rates, due to displacement of forage species and the unpalatable leaves of the tropical soda apple, and increased management costs. As of 1995, tropical soda apple has been shown to be a host to three viruses that cause disease in pepper, tomato, and tobacco. This weed also supports the Colorado potato beetle, tobacco hornworm and budworm, tomato pinworm, green peach aphid, and sweetpotato whitefly (McGovern et. al, 1994). Hence, the potential exits for this plant to serve as a reservoir for viruses and other pests of economically important crops. Efforts to find a biocontrol agent have begun, but at present, a biocontrol agent specific to tropical soda apple has not been identified.

Biology

The invasive nature of tropical soda apple in Florida can be explained by the biology and growth habits of this weed. A mature tropical soda apple is from 1 to 2 m tall, with rapid increase in plant height occurring from 60 to 80 days after emergence. Flower production occurs throughout the year; in south Florida, though, it is concentrated from September to May. Greenhouse plants have been shown to flower 75 to 83 days after planting (DAP), with fruit present at 108 DAP (Mullahey et. al, 1996). White flowers are borne in clusters below the leaf and result in green berries, with white mottling, that turn yellow at maturity. Each berry may contain 190 to 386 red-brown seeds that are 2.2 to 2.8 mm in diameter (Nee, 1991).

Seed. Seed germination depends on temperature, pH, and age of the seed. Akanda et. al (1995) found that tropical soda apple germinated over a temperature range of 10 to 35°C, and the highest germination of seed occurred at a pH of 8 (71%), with an increase from 30 to 71%, between pH 4 and pH 8. In addition, Vincente (1972) found that five-month-old seed have the highest germination rate (93%) and germination rate gradually declines to 25 months, when no germination occurs.

Roots. Regeneration of a plant from the roots, provides another means of survival and infestation. Evidence exists that tropical soda apple can store high concentrations of carbohydrates in its roots and stem bases. However, utilization of these carbohydrate reserves for regeneration depends on the root segment size. Root segments 1 cm in diameter and 15 cm in length have higher regenerative capacity than 7.5-cm length root segments, at planting depths of 0, 5, and 10 cm (Mullahey and Cornell, 1994).

Seed Survival in Cattle

Cattle producers have observed tropical soda apple seedlings germinating from dung piles, indicating that the seed can survive passage through the digestive tract of cattle and wildlife. This has

implications for the transport of cattle, from pasture to pasture and state to state. Brown et. al (1996) found that tropical soda apple seed could remain in the gastrointestinal tract for at least 18 days, and possibly longer. However, the seed became non-viable after approximately 6 days in the tract. This suggests that before shipping cattle from a tropical soda apple infested area, cattle should be held in an area that is free of this plant for at least 1 week.

Environmental Limitations

Recent research indicates that neither temperatures nor photoperiods are likely to limit the spread of tropical soda apple in the southern and southeastern United States. Patterson (1996) deduced that tropical soda apple could achieve 50% or more of its maximum growth rate during 9 months of the year in south Florida, during 7 months of the year in Alabama, Mississippi, Louisiana, and Texas, and during 5 to 6 months of the year at sites in Georgia, South Carolina, North Carolina, Virginia, Tennessee, Kentucky, Arkansas, and Oklahoma.

State and Federal Regulations

Tropical soda apple was first brought to the attention of the Florida Department of Agriculture and Consumer Services through Division of Plant Industry, in April of 1993. It was recognized that the primary means of tropical soda apple spread appeared to be via livestock movement and sod and hay distributed from infested sites. In an effort to address this issue, the Florida Department of Agriculture and Consumer Services included this weed on the noxious plant list within Rule 5B-57 (effective February 1994) and the noxious weed seed list within Rule 5E-5 (effective August 1994). With the amendment of these two rules, it became unlawful to move tropical soda apple plants or plant parts, including seed, capable of propagation within the state of Florida. This weed was also added to the federal noxious weed list on August 1995, making it illegal to move any plant part across state boundaries (Gaskalla, 1996).

Control

Broadcast application. The herbicide currently recommended for the control of tropical soda apple is triclopyr (Remedy). Apply by broadcasting 1 quart of Remedy per acre, in 40 gallons of water, with a 0.5% (by volume) non-ionic surfactant. The entire plant should be sprayed for effective control. Repeated application with herbicide will be likely before spot treatment (spraying only isolated weeds) can begin (Mullahey and Colvin, 1996).

Spot application. Spot treating the remaining plants, assuming a successful broadcast treatment occurred, may reduce costs by the use of less chemical. Weedone CB, 2.8% Roundup solution, and a 1% Remedy solution are effective herbicides in this situation. Avoid "drenching" the plants; runoff may damage the pasture forage. Also, spot treatments may be ideal for hammock situations where large equipment cannot venture (Mullahey and Colvin, 1996).

Mowing. Recent research indicates that mowing (to 5.0 inches) may provide some control of tropical soda apple. Mowing monthly, spring through late fall, may provide 70 to 90% control. Mowing bimonthly may provide 55 to 88% control, and mowing every three months may provide 30 to 50% control (Sturgis and Colvin, 1996). However, this is not currently recommended as a "best management practice" and needs further research.

Mowing and Herbicide. The combination of mowing and herbicide application has shown excellent control. Mislevy et. al (1996) recommends mowing tropical soda apple plants to a 3.0-inch stubble, allowing 50 to 60 days for plant regrowth, and following with a herbicide application (Remedy). Mowing weakens the plant, and regrowth insures there will be foliar tissue to uptake the plant will have produced berries. Therefore, herbicide application must be made on a timely basis.

This recommendation is not considered a "best management practice," but the information does warrant further research.

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