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# Yellow and Dalmatian Toadflax

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INVASIVE SPECIES
MANAGEMENT
IN SOUTH DAKOTA

# YELLOW and DALMATIAN TOADFLAX

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Mature yellow toadflax

Mature Dalmatian toadflax

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Two species of toadflax are considered invasive in South Dakota. Both are on the state's locally noxious weed list.

Yellow toadflax (*Linaria vulgaris*), commonly known as butter and eggs, and Dalmatian toadflax (*Linaria dalmatica*) are members of the figwort (Scrophulariaceae) family that were introduced to North America as ornamental plants. Yellow toadflax is native to Eurasia and may have been introduced to North America by a Welsh Quaker who immigrated to Delaware and planted it as a garden flower. It was used as a lotion for insect bites or as a fly poison when boiled in milk. The more common use of the plant was as a yellow dye. Yellow toadflax has become naturalized throughout North America and has spread in many areas by seeds, roots, and rhizomes.

Dalmatian toadflax is native to the Mediterranean region. The plant was likely introduced into the western U.S. as an ornamental flower in 1874. The heaviest infestations of escaped Dalmatian toadflax can be found in the mid- to western U.S.

Currently, according to the 2006 South Dakota Weed and Pest Annual Report, there are 29,056 acres of yellow toadflax and 20,772 acres of Dalmatian toadflax in the state. This is up significantly from 5 years ago when 350 acres of yellow toadflax and 12,395 acres of Dalmatian toadflax were reported.

## IDENTIFICATION

**Plant**

Yellow and Dalmatian toadflax are short-lived perennials that reproduce by seed and vegetatively from adventitious buds originating on horizontal roots. Both toadflax species can produce an extensive creeping rhizomatous root system; however, yellow toadflax shoots tend to emerge in dense patches and Dalmatian toadflax shoots may be more scattered.

Mature plants generally grow new shoots from the roots in the spring. First-year Dalmatian toadflax plants can produce shoots in the fall that survive into the spring.

The toadflaxes prefer well-drained, relatively coarse-textured soils that range from coarse gravels to sandy loams, but they also can be found in heavy clay soils. Yellow toadflax grows best in moist, more fertile soils, and Dalmatian toadflax grows well in cool, semi-arid climates where soil pH is neutral to slightly alkaline.

Toadflax seedlings are relatively poor competitors but once established they become very competitive with grasses and other forbs. Dalmatian toadflax may be more aggressive than yellow toadflax, but once established, yellow toadflax often becomes more difficult to control.

**Roots**

Yellow toadflax roots can grow over 3 feet deep and over 10 feet laterally. Root buds can be detected 2 to 3 weeks after germination. Dalmatian toadflax roots can grow 4 to 10 feet deep and over 10 feet laterally. Extensive root systems make toadflax species competitive and difficult to control.

Both species have extensive creeping rhizomatous root systems.

**Stems**

Yellow toadflax stems are smooth, narrow, erect, and often grow 1 to 2.5 feet tall. Relative to yellow toadflax, Dalmatian toadflax stems have a larger diameter and may grow even taller (3 to 4 feet). Dalmatian toadflax may grow more branches near the top of the plant than yellow toadflax.

**Leaves**

Leaf shape is the easiest way to separate the toadflax species. Yellow toadflax has numerous pale green, narrow leaves that are pointed at both ends. Leaves are about 2.5 inches long and grow alternately on the stem but may appear to be opposite.


Yellow toadflax

Yellow toadflax leaves closely resemble those of leafy spurge, but yellow toadflax shoots do not contain a milky sap.


Dalmatian toadflax

Dalmatian toadflax leaves are broad, sometimes egg to heart-shaped, and have a thick, waxy leaf cuticle. The leaves often grow alternately on the stem and the upper leaves often clasp the stem. Leaves are green and have a whitish to blue cast.

**Flowers**

Yellow and Dalmatian toadflax have distinct snapdragon-like flowers that are yellow with bearded orange throats. Yellow toadflax flowers are about one inch long and can vary from yellow to pale cream in color. Dalmatian toadflax flowers are about .75 to 1.5 inches long and tend to be a brighter yellow. Both appear as dense terminal elongated clusters. Dalmatian toadflax blooms in June and on into the fall, while yellow toadflax blooms later in August and September. Droughty conditions may delay yellow toadflax flowering.


Yellow toadflax


Dalmatian toadflax

**Fruits and Seeds**

Both yellow and Dalmatian toadflax form a brown two-celled capsule that contains many seeds.

The seeds of yellow toadflax are very small, rough, round, and flat with a papery notched circular wing that is about 1/2 inch in diameter and dark brown in color. Each yellow toadflax seed capsule will have 10–110 seeds, and each plant may produce about 1,500 to 30,000 seeds. Normally, 80–90% of yellow toadflax seed falls within 18 inches of the parent plant.

Dalmatian toadflax seeds are more irregular in shape, thin-edged, angular, and somewhat flattened. They are slightly winged and tannish-gray in color and 1/24 to 1 1/16 inch wide. Each seed capsule contains 100–250 seeds, and a single plant with 10 to 15 stems can produce over 500,000 seeds.

Seeds of both toadflax species can remain viable in the soil for over 10 years. Wind is the primary means of seed dispersal of both toadflax species.

## ENVIRONMENTAL and ECONOMIC IMPACTS

Yellow and Dalmatian toadflax are commonly found along highway and railroad rights-of-way and in waste areas, overgrazed or distressed pastures or rangeland, and in some cases cropland. Yellow toadflax is mainly found in eastern South Dakota but patches can be found statewide. Dalmatian toadflax is found in western South Dakota in open timber stands and meadows.


Yellow toadflax

Toadflax species can displace existing native plant communities and increase


Yellow toadflax


Yellow toadflax shoots do not contain a milky sap.

the chances of soil erosion, surface run-off, and sediment yield. Grass productivity can be reduced significantly in areas infested by yellow or Dalmatian toadflax.

Both toadflaxes are considered to be unpalatable to wildlife and cattle; however, deer and cattle are known to casually browse the flowering shoots. The plants are mildly poisonous to cattle and some species of wildlife because they contain glucosides and alkaloids. Goats and sheep can graze toadflax species with no apparent problems.

Yellow toadflax is becoming a problem lawn weed in cities and towns across the state.

## CONTROL

Prevention is the best way to keep yellow and Dalmatian toadflax from invading a site. Yellow toadflax patches can be difficult to manage, partly because plants may be in vegetative, flowering, and seed stages at the same time, depending on environmental conditions, primarily moisture.

Using an integrated approach to manage the toadflax species will increase the chance of successfully controlling these invasive weeds.

### Cultural

Maintaining the health and productivity of the plants you want in your pastures can increase their ability to compete with toadflax species. Avoid overgrazing; this creates a disturbed situation, especially during periods of drought, that allows toadflax to become competitive and invasive.

Goats and sheep will graze toadflax; this depletes root carbohydrate reserves. When moving livestock from a toadflax infested pasture to an uninfested pasture, hold the animals in a confined area to allow viable seed to pass through their digestive tracts.

Also avoid purchasing hay that may be infested with toadflax seed. Clean machinery and recreational equipment when leaving toadflax infested areas, so you don't transport seed with mud and dirt.

Grubbing or hand pulling can be effective in controlling small patches. It may take 5 to 6 years to deplete plant food reserves, however, especially if you don't get all the lateral roots.

Burning does not effectively suppress the toadflax species. Instead, burning tends to increase their competitiveness by removing desirable vegetation and stimulating toadflax shoot growth.

Burning could be an effective set-up for a herbicide application as long as the plants are not allowed to produce seed. Scorching toadflax flowers with propane burners can prevent seed production, but this is labor intensive.

### Mechanical

Mowing or clipping is not recommended for control as seedling plants can still emerge. Several clippings during each growing season over several years would be required to reduce root carbohydrate levels. Continued mowing would also weaken surrounding desirable plants.

Intensive cultivation can suppress toadflax populations. This requires at least 2 years of cultivation with eight to 10 cultivations the first year and four to five cultivations the second year. Re-seeding with competitive vegetation following cultivation may help suppress new toadflax growth.

### Bio-Control

Several bio-agents have been released for toadflax control; they are more effective in controlling Dalmatian toadflax than yellow toadflax. A stem-mining weevil, *Mecinus jahthinus*, has successfully controlled Dalmatian toadflax populations. This insect has not been effective for yellow toadflax control due in part to differences in shoot morphology between the toadflax species.

### Chemical

Some herbicide options are available. Yellow toadflax is more difficult to control and the waxy leaf surface of the Dalmatian toadflax can affect herbicide uptake. Refer to the SDSU Extension Weed Control Series FS525N for current herbicide recommendations and rates.

Herbicide treatments should be made when the plants have their lowest root carbohydrate reserves. This is a different time for each toadflax species. Dalmatian toadflax root reserves are lowest in the spring just prior to flowering. Yellow toadflax will have its lowest root reserves in late summer when it begins flowering. Therefore, herbicides should be applied to Dalmatian toadflax in the spring and to yellow toadflax in the late summer or fall.

## WHAT CAN YOU DO?

Prevention is the best way to avoid toadflax infestations.

- Learn to identify yellow and Dalmatian toadflax.
- Control new, small infestations before they are able to spread

If you discover plants that you think might be yellow or Dalmatian toadflax, report the location to:

South Dakota Department of Agriculture
Plant Protection Program
(605) 773-3796 or 1-800-228-5254
or
your local county weed and pest board
or
your local county Extension office

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