

## Treatment Methods

All herbicides should be applied in accordance with specific label instructions, which include personal protective equipment and storage requirements.

**Foliar Treatments** - Foliar applications should be made with a low pressure (20-50 psi) backpack sprayer at rates of one gallon or less per minute. All foliar treatments should be made after full leaf expansion in the spring and before fall colors are visible. Allow herbicide treatments to dry for at least three hours at an air temperature above 60°F to ensure adequate absorption and translocation. In areas that receive significant public use, it may be necessary to close off the treatment area until the herbicide has completely dried.

Use a nonionic surfactant with all herbicide solutions, unless otherwise specified by the manufacturer's label. Surfactants increase the effectiveness of the herbicide by 1) reducing surface tension and ensuring complete foliar coverage, and 2) increasing the rate of absorption through the leaf cuticle.

Apply herbicide with a backpack or similar hand-operated pump sprayer equipped with a flat spray tip or adjustable cone nozzle. Apply herbicide to the leaves and stems of target plants using a consistent back and forth motion. Herbicide should thoroughly cover foliage, but not to the point of run-off. All recommended herbicides require complete foliar coverage to be effective. Applications made while walking backward will reduce the risk of the herbicide wicking onto the applicator's clothing.

**Cut Surface Treatments** - Cut surface treatments include hack and squirt, frill, and cut stump methods. The main advantages to these methods are: 1) they are very economical, 2) there is minimal probability of non-target damage, 3) minimal application time, and 4) they can be used in the winter as long as the ground is not frozen. Backpack sprayers or spray bottles are very effective for all of these methods.

**Hack and Squirt Method:** Using an axe or similar cutting tool, make uniformly spaced cuts around the base of the stem. The cuts should angle downward, be less than 2.5 cm (1 in) apart, and extend into the sapwood. Apply herbicide to each cut to the point of over flow.

## Yellow and White Sweet Clover

*Melilotus officinalis and Melilotus alba*

### Description -

- Primarily a biennial, first year's growth is vegetative. Second year plants have a taproot that may exceed 50 inches and 1-10 upright or ascending flowering stems from 3-5 feet in height.
- Fruit a small one to two-seeded pod. Pea-like flowers, either yellow or white.
- Both species flower in June and July, yellow usually a few weeks earlier than white.
- Leaves are alternate and divided into three serrated leaflets; the middle leaflet is on a distinct stalk.

**Distribution** - Its use in agriculture and for soil stabilization has helped it to spread across N. America. It is now found in every state.

**Threat** - Invades grasslands and out competes native plants for space and resources. A plant can produce 14,000 to 350,000 seeds. Seeds may remain viable in the soil for more than 20 years. Infested areas managed with prescribed fire can actually enhance germination rates and seedling establishment.

**Control** - For small infestations, hand-pulling of first year stems in late summer/early fall may be effective. Mowing in late spring/early summer may reduce but not prevent seed set, as flowering shoots can resprout. Burning two years in a row can reduce plants. Burn early the first year (before green-up, usually in early to mid-April) to stimulate germination. If plants are found that summer, burn the next year in early to mid May. If burning is conducted before buds develop, plants will resprout. Heavily infested areas may need this burning sequence repeated for a few years to effectively impact uneven-aged patches. Foliar application of 2,4-D on young seedlings has been effective.

**Similar Plants** - Seedlings closely resemble those of alfalfa (*Medicago sativa*), but note the clover's absence of hairs on the underside of leaves and the bitter taste. Sweet clover is most easily identified when in flower.

**Origin** - Europe and Western Asia. Introduced as a forage crop and for nitrogen fixing to rebuild depleted soils.

Information and resources provided by TN & SE Exotic Pest Plant Councils (tneppc.org and se-eppc.org), Plant Conservation Alliance-Alien Plant Working Group, The Nature Conservancy, and the USDA.

## Musk Thistle

(Nodding Thistle)

*Carduus nutans*

### Description -

- Mature plants range from 1½ to 6 feet tall with multi-branched spiny stems.
- Spiny leaves are dark green, coarsely lobed with a smooth waxy surface and a light colored spine at the tip
- Large, showy pink-purple disk-shaped flower heads contain hundreds of tiny individual flowers which emerge in May to August and occur at the tips of stems. The flower heads will droop on a 90-degree angle from the stem when mature.
- Each plant can produce thousands of straw-colored seeds with plume-like hairs.
- Usually a biennial, a seedling emerges in mid- to late July and develops into a rosette the first year and begins to bolt in mid-March the following year.

**Distribution** - Found throughout the continental U.S. except for Maine, Vermont, and Florida.

**Threat** - Invades native grasslands and pastures. Can out compete natives as grazing animals will not eat it. Plants can produce thousands of seeds and may colonize open soil areas that result from prescribed burning.

**Control** - Hand-pulling or cutting of small populations can be done after the stems have bolted but should be done before seed production. Flowers and seed heads should be bagged and taken to landfill to minimize seed dispersal. Foliar spraying of glyphosate or triclopyr applied during rosette stage prior to flowering is also effective.

**Similar Plants** - Resembles other thistle species, but nodding head is unmistakable.

**Origin** - Introduced from Europe and Asia.

Information and resources provided by TN & SE Exotic Pest Plant Councils (tneppc.org and se-eppc.org), Plant Conservation Alliance-Alien Plant Working Group, The Nature Conservancy, and the USDA

## Musk Thistle



## Yellow and White Sweet Clover



## Treatment Methods

(continued)

**Frill Method:** Using an axe or similar cutting tool, make continuous cuts around the base of the stem. The cuts should angle downward, be less than 2.5 cm (1 in) apart, and extend into the sapwood. Apply the recommended herbicide to the entire cut area to the point of over flow.

**Cut Stump Method:** Horizontally cut stems at or near ground level; all cuts should be level, smooth, and free of debris. Immediately apply the herbicide to the outer 20% (cambial area) of the stump; delayed treatment may reduce the effectiveness of treatment.

**Basal Bark Treatments** - Basal bark treatments are effective for controlling woody vines, shrubs, and trees. Treatments can be made any time of year, including the winter months, except when snow or water prevent spraying the basal parts of the stem. Proper plant identification is crucial during the dormant season due to the absence of foliage.

Apply herbicide with a backpack sprayer using low pressure (20-40 psi) with a straight stream or flat fan tip. To control vegetation with a basal stem diameter of less than 7.6 cm (3.0 in) apply specified herbicide-oil mixture on one side of the basal stem to a height of 15.25 cm (6 in) from the base. Apply herbicide to the point of run-off; within an hour mixture should almost encircle the stem. For stems greater than 7.6 cm (3.0 in) basal diameter or with thick bark, treat both sides of the stem to a basal height of 30.5 cm (12 in) to 61 cm (24 in).

**Mowing and Cutting Treatments** - This method is appropriate for small initial populations or environmentally sensitive areas where herbicides cannot be used. Stems should be cut at least once per growing season as close to ground level as possible. Repeated mowing or cutting may be required for control.

**Hand Pulling Treatments** - Plants should be pulled as soon as they are large enough to grasp but before they produce seeds. Seedlings are best pulled after a rain when the soil is loose. The entire root must be removed since broken fragments may resprout. If plants have seed capsules present, they should be bagged and disposed of to prevent seed dispersal. Care should be taken to minimize soil disturbance.