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Introductory

SPECIES: Melilotus officinalis

AUTHORSHIP AND CITATION:

ABBREVIATION:
MELOFF

SYNONYMS:
NO-ENTRY

SCS PLANT CODE:
MEOF

COMMON NAMES:
- yellow sweetclover
- sweetclover
- official melilot
- trefle d'odeur jaune (Quebec)

TAXONOMY:
The accepted scientific name for yellow sweetclover is Melilotus officinalis (L.) Lam. Natural hybrids are rare [25,65].

LIFE FORM:
Forb

FEDERAL LEGAL STATUS:
No special status
DISTRIBUTION AND OCCURRENCE

SPECIES: *Melilotus officinalis*

GENERAL DISTRIBUTION:
Yellow sweetclover was introduced to North America from Europe in the 18th century as a forage crop species. It is now pandemic in the United States and nearly so in Canada, occurring more frequently in the southern third [29, 62, 64, 66].

ECOSYSTEMS:
- FRES10 White - red - jack pine
- FRES14 Oak - pine
- FRES15 Oak - hickory
- FRES17 Elm - ash - cottonwood
- FRES18 Maple - beech - birch
- FRES20 Douglas-fir
- FRES21 Ponderosa pine
- FRES26 Lodgepole pine
- FRES28 Western hardwoods
- FRES29 Sagebrush
- FRES34 Chaparral - mountain shrub
- FRES35 Pinyon - juniper
- FRES38 Plains grasslands
- FRES39 Prairie

STATES:
- AL
- AK
- AZ
- AR
- CA
- CO
- CT
- DE
- FL
- GA
- HI
- ID
- IL
- IN
- IA
- KS
- KY
- LA
- ME
- MD
- MA
- MI
- MN
- MS
- MO
- MT
- NE
- NV
- NH
- NJ
- NM
- NY
- NC
- ND
- OH
- OK
- OR
- PA
- RI
- SC
- SD
- TN
- TX
- UT
- VT
- VA
- WA
- WI
- WY
- AB
- MB
- NB
- NF
- NT
- NS
- ON
- PE
- PQ
- SK
- YT

BLM PHYSIOGRAPHIC REGIONS:
1. Northern Pacific Border
2. Cascade Mountains
3. Southern Pacific Border
4. Sierra Mountains
5. Columbia Plateau
6. Upper Basin and Range
7. Lower Basin and Range
8. Northern Rocky Mountains
9. Middle Rocky Mountains
10. Wyoming Basin
11. Southern Rocky Mountains
12. Colorado Plateau
13. Rocky Mountain Piedmont
14. Great Plains
15. Black Hills Uplift
16. Upper Missouri Basin and Broken Lands

KUCHLER PLANT ASSOCIATIONS:
Common in many Kuchler Plant Associations

SAF COVER TYPES :
Common in many SAF Cover Types

SRM (RANGELAND) COVER TYPES :
NO-ENTRY

HABITAT TYPES AND PLANT COMMUNITIES :
Yellow sweetclover is found in a wide variety of habitats. Clary and Medin [11] reported yellow sweetclover as an important forb in riparian zones dominated by Kentucky bluegrass (Poa pratense) and bluebunch wheatgrass (Pseudoroegneria spicata).

Hopkins and others [32] reported that yellow sweetcover is an important understory component of cottonwood (Populus spp.) woodlands. The overstory components are eastern cottonwood (P. deltoides var. deltoides), Rocky Mountain juniper (Juniperus scopulorum), and green ash (Fraxinus pensylvanica).

Girard and others [28] reported yellow sweetclover as a consistent, important understory species in an eastern cottonwood/green ash community type. The other dominant overstory species is Rocky Mountain juniper. Important shrubs are wolfberry and wild rose (Rosa woodsii). Dominant herbs are yellow sweetclover, veiny meadowrue (Thalictrum venulosum), and falsae Solomon's seal (Smilacina stellata), with no important grasses. They also reported a similar community type in the same series: eastern cottonwood/Rocky Mountain juniper plus green ash, with the same important shrubs. The herb layer is dominated by yellow sweetclover, poison ivy (Toxicodendron rydbergii), Canada wildrye (Elymus canadensis), and daisyseed meadowrue (Thalictrum dasycarpum). In addition, they reported a ponderosa pine (Pinus ponderosa)/Rocky Mountain juniper habitat type with the shrub layer dominated by wolfberry and the herb layer dominated by western wheatgrass (Fascopyrum smithii), blue grama (Bouteloua gracilis), and sedge. Yellow sweetclover is consistently present but not a major component of ground cover.

MANAGEMENT CONSIDERATIONS

SPECIES: Melilotus officinalis

IMPORTANCE TO LIVESTOCK AND WILDLIFE :
Eaten by most herbivores including elk, deer (all species), pronghorn, and domestic livestock, yellow sweetclover is an important range, forage, hay, and pasture species [20, 62, 64, 66]. Yellow sweetclover will comprise up to 35 percent of pronghorn diet [5]. Mule deer diet consists of up to 77 percent yellow sweetclover in summer and early fall [16, 20, 44, 45, 49]. Kufeld [39] and Mackie [44] rated sweetclover as highly valuable for Rocky Mountain elk in summer and fall.

Yellow sweetclover is important to birds as cover and food, and is planted with grass seed to improve sage grouse and prairie chicken.
habitat [2, 36, 48, 58, 61]. It is considered important nesting habitat for dabbling ducks (mallard, gadwall, blue-winged teal) in hayland and seeded fields [12, 41]. Crop adjustment program areas (fields left fallow for wildlife habitat) in North Dakota containing yellow sweetclover as a principal species with wheatgrasses (Agropyron spp.) or brome grasses (Bromus spp.) and alfalfa (Medicago sativa) provide habitat for pheasants, sharp-tailed grouse, greater prairie chickens, American bitterns, marsh hawks (northern harriers), short-eared owls, and many species of passerine birds [19, 36, 67].

A problem with yellow sweetclover as a hay crop is sweetclover bleeding disease. Coumarin, which is present in sweetclover and gives its bitter taste, breaks down to dicoumarol when sweetclover becomes moldy. Dicoumarol is a powerful anticoagulant and causes hemorrhage in cattle (it is not as harmful to sheep or horses), and can result in death. Sweetclover bleeding disease can be avoided by proper curing of sweetclover hay and/or by interspersing the feeding of moldy hay with other materials, as it takes several weeks of feeding moldy hay to cause the disease. Cultivars with reduced coumarin content are available [9, 64]. Bloat can also be caused by yellow sweetclover but occurs less frequently than with alfalfa (Medicago sativa) or clover (Trifolium spp.) [44, 64].

**PALATABILITY:**

Yellow sweetclover has a bitter taste, making it less palatable to cattle than other legumes. It is more palatable in early spring and summer, becoming woody in late summer and fall [62, 64].

Palatability of yellow sweetclover for elk and deer is rated high in spring and summer, and for pronghorn is rated medium in summer [60].

Palatability of yellow sweetclover in several western states has been rated as follows [17]:

<table>
<thead>
<tr>
<th></th>
<th>UT</th>
<th>CO</th>
<th>WY</th>
<th>MT</th>
<th>ND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>fair</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Sheep</td>
<td>fair</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Horses</td>
<td>fair</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
</tbody>
</table>

**NUTRITIONAL VALUE:**

Yellow sweetclover makes palatable and nutritious hay when properly cured. Protein content and digestible protein of yellow sweetclover hay was reported as follows [48]:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>crude protein</td>
<td>15.0 %</td>
</tr>
<tr>
<td>digestible protein-cattle</td>
<td>10.2 %</td>
</tr>
<tr>
<td>goats</td>
<td>10.8 %</td>
</tr>
<tr>
<td>horses</td>
<td>10.5 %</td>
</tr>
<tr>
<td>rabbits</td>
<td>10.4 %</td>
</tr>
<tr>
<td>sheep</td>
<td>10.6 %</td>
</tr>
</tbody>
</table>

**COVER VALUE:**

Yellow sweetclover provides good cover for small mammals and birds [12, 19, 36, 41]. Wildlife cover values for several western states are as follows [17]:

<table>
<thead>
<tr>
<th></th>
<th>UT</th>
<th>CO</th>
<th>WY</th>
<th>MT</th>
<th>ND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elk</td>
<td>----</td>
<td>poor</td>
<td>----</td>
<td>poor</td>
<td>----</td>
</tr>
<tr>
<td>Mule deer</td>
<td>fair</td>
<td>----</td>
<td>poor</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>White-tailed deer</td>
<td>----</td>
<td>----</td>
<td>poor</td>
<td>----</td>
<td>good</td>
</tr>
<tr>
<td>Pronghorn</td>
<td>fair</td>
<td>----</td>
<td>poor</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Upland game birds</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Waterfowl</td>
<td>fair</td>
<td>----</td>
<td>good</td>
<td>----</td>
<td>good</td>
</tr>
<tr>
<td>Small nongame birds</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Small mammals</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
</tbody>
</table>
VALUE FOR REHABILITATION OF DISTURBED SITES:

Yellow sweetclover grows rapidly and is easy to establish, therefore it is widely used in grass and forb seed mixtures for stabilization of disturbed sites such as road cuts, mining disturbances and mine spoils [1, 14, 30, 55] after any type of burn [10, 15, 23, 31, 37], and for rehabilitation of overgrazed rangeland [42, 50, 62].

OTHER USES AND VALUES:

Yellow sweetclover is often planted in grass/forb seed mixtures on range sites, including pinyon (Pinus edulis)-juniper (Juniperus spp.) communities, to improve forage production [13, 35, 58, 62], and for soil improvement, to increase available soil nitrogen and to improve drainage, aerate the soil, and increase water absorption in heavy clay soils [62, 64].

Yellow sweetclover is considered an excellent source of nectar for honey production and also an excellent source of pollen [62].

Yellow sweetclover is used medicinally as a source of an anticoagulant (dicoumarol and derivatives) used to reduce postsurgical blood clots [62].

OTHER MANAGEMENT CONSIDERATIONS:

Use of yellow sweetclover as an agricultural species has declined in part due to its tendency to "volunteer" for years after planting and to its weediness in colonizing disturbed sites. It is considered a noxious weed in some areas; its ability to colonize undisturbed habitat is related to the amount of disturbed area (including roads) adjacent to habitat and the amount of light penetrating to the understory [26]. Additional factors contributing to the decline in its use include: stand establishment problems due to sweetclover weevil (Sitona cylindricollis), bleeding disease, a decrease in rotation systems of cropping, and the availability of inexpensive nitrogen fertilizers [62, 69].

Control: In an effort to restore native prairie, invading yellow sweetclover is controlled with a combination of brush-hogging, herbicides, and prescribed fire [8]. Yellow sweetclover is sensitive to 2,4-D, dicamba, tordon, aflon, nevron, and dalapon. It is more difficult to kill with 2,4-D in the second year [67].

Establishment: To provide habitat for dabbling duck nesting, it is necessary to establish vigorous stands with the tallest, densest cover form possible. This can be achieved through a combination of prescribed fire and planned grazing for native seedings, but mechanical tillage, with reseeding every 2 years, is best to maintain introduced grasses and legumes [19]. Prairie grouse habitat can be developed on cultivated land by planting yellow sweetclover and leaving it undisturbed until stand vigor declines, and then restoring it by tillage and replanting or by prescribed fires [36].

If yellow sweetclover is to be used to convert sage range to grassland, there needs to be a minimum of 11 inches (30 cm) of annual precipitation. It should be seeded in grass mixtures at a rate of 1 to 2 pounds of yellow sweetclover seed per acre (2.2 kg/ha) [35]. Love and Jones [42] recommend a grazing rotation that includes no grazing the first year; light grazing the second; grazing early in the third year then removal of stock; a prescribed fire the fourth year, keeping stock off; then a repeat of the cycle, with the fifth year as the second. Removal of tops during the critical growth period in September reduces root growth and top growth the following year. No grazing or mowing should be done during this time [62, 67]. Nitrogen fertilizers are not needed if sweetclover is inoculated with Rhizobium bacteria at seeding; it does respond to phosphorous, potassium, and sulfur fertilization [64].

Elliot [22] found that yellow sweetclover does not affect seedling
survival of ponderosa pine and can be used as part of soil stabilization seeding mixtures.

Rietveld [56] noted that the bunchgrasses contain a substance toxic to germination of sweetclover, and that sweetclover roots contain substances allelopathic to crested wheatgrass (Agropyron cristatum), Russian wildrye (Psathyrostachys juncea), intermediate wheatgrass (Thinopyrum intermedium), smooth brome (Bromus inermis), and timothy (Phleum pratense).

Diseases and Pests: Some diseases of yellow sweetclover include root rot (Phytophthora cactorum), brown root rot (Plenodomus meloliti), common leaf spot (Pseudopeziza meliloti), and gray stem canker (Ascocyntha caulicola). The 'Yukon' cultivar is resistant to brown root rot and gray stem canker. Common leaf spot is controlled by cutting before defoliation becomes severe, and gray stem canker can be controlled through crop rotation and cutting fields cleanly [62, 64].

The primary pest of yellow sweetclover is the sweetclover weevil (Sitona cylindricollis). To avoid infestation, new stands should not be planted adjacent to established stands. Cultivars that are more resistant to sweetclover weevil are available [62]. Other serious insect pests include grasshoppers and cutworms, which can be controlled with poisoned baits [69].

**BOTANICAL AND ECOLOGICAL CHARACTERISTICS**

**SPECIES: Melilotus officinalis**

**GENERAL BOTANICAL CHARACTERISTICS:**

Yellow sweetclover is 20 to 60 inches (50-150 cm) tall. It is a biennial legume, with a narrow root crown producing 1 to 10 upright stems; short, erect rhizomes; a deep taproot; and adventitious roots that extend the root diameter to 12 to 16 inches (30-40 cm) [62, 64, 67]. The roots form nodules when infected with Rhizobium bacteria, but no mycorrhizal associates have been reported [67].

Yellow sweetclover will take up molybdenum at a higher rate than grasses, maintaining a low copper to molybdenum ratio when grown on sites with high concentrations of those metals [14].

**RAUNKIAER LIFE FORM:**

Therophyte

Hemicryptophyte

**REGENERATION PROCESSES:**

Yellow sweetclover reproduces by seed. The seeds are "hard" (impervious to water) and require scarification before germinating. Natural scarification occurs through freezing and thawing; passage through animal digestive tract; or by fire. The seeds remain viable for 40 or more years, and can be either wind dispersed, carried by rainwater, or carried by animals [62, 64, 67]. Yellow sweetclover is winter hardy, with contractile roots that pull the crown 2 inches (5 cm) or more below the soil surface in the fall. No vegetative reproduction appears to occur in this species [64, 67].
SITE CHARACTERISTICS:
Yellow sweetclover will grow on a wide variety of soil types and is tolerant of saline and alkaline soils [21,63,69]. It is not tolerant of acidic soils [33,63]. Often found on disturbed sites, yellow sweetclover can occupy a wide variety of sites, including roadsides, railroad beds, sand bars, and prairie dog colonies [46,52]. It is highly drought tolerant; water stress is critical only for a short period during germination [55,69].

Some common associates of sweetclover include white sweetclover (Melilotus alba), quackgrass (Agropyron repens), wild carrot (Daucus carota), black medic (Medicago lupulina), buckhorn plantain (Plantago lanceolata), goldenrod (Solidago spp.), common dandelion (Taraxacum officinale), milkweed (Asclepias syriaca), timothy, red clover (Trifolium pratense), and white clover (T. repens) [66].

Associates of yellow sweetclover in riparian zones dominated by Kentucky bluegrass (Poa pratense) are slender wheatgrass (Elymus trachycaulus ssp. trachycaulus), sedge (Carex spp.), mannagrass (Glyceria spp), Baltic rush (Juncus balticus), field horsetail (Equisetum arvense), common yarrow (Achillea millefolium), Aster spp., clover (Trifolium spp.), and lupine (Lupinus spp.) [11].

SUCCESSIONAL STATUS:
Obligate Initial Community species

Yellow sweetclover is not tolerant of shade. In a study of secondary succession in New Jersey, it was found only on newly abandoned fields (2 years) and not on older sites [4,67]. In a study of succession, Eichhorn [21] found it in various cover percentages (not steadily increasing or decreasing) up to 18 years following a wildfire in Montana. Rietveld [56] found yellow sweetclover as an invader species in a ponderosa pine/bunchgrass community, able to colonize disturbed areas. If the ground surface is covered by perennial species, yellow sweetclover tends to be eliminated, although it will persist on sites that have periodic disturbances [30,67]

Roberts [57], in a seed bank study of secondary succession, found sweetclover seeds only on early seral sites.

SEASONAL DEVELOPMENT:
Germination of yellow sweetclover can occur at any time of year, with the largest flush of new seedlings in March and April. The first year of growth involves a primary, branched stem and a primary root, sometimes branched. Yellow sweetclover only rarely flowers the first year. The first year is characterized by rapid top growth through late summer, then a critical growth phase that occurs in mid-September, in which carbohydrates and nitrogen are transferred to the roots. During this phase and into winter dormancy the crown buds become enlarged and conspicuous. First year shoots die back with freezing temperatures [67].

The second year of growth begins in early spring with rapid growth from the crown buds or rhizomes, using the previous fall-accumulated reserves, which are not replenished. Flowering begins in May and June, continuing through frost, with seed set in June and July [62,67].

FIRE ECOLOGY
**SPECIES: Melilotus officinalis**

**FIRE ECOLOGY OR ADAPTATIONS:**
Fire scarifies the seed coat of yellow sweetclover, increasing germination. Yellow sweetclover will colonize areas disturbed by fire [30, 62].

**POSTFIRE REGENERATION STRATEGY:**
- Caudex, growing points in soil
- Ground residual colonizer (on-site, initial community)
- Secondary colonizer - off-site seed

**FIRE EFFECTS**

**SPECIES: Melilotus officinalis**

**IMMEDIATE FIRE EFFECT ON PLANT:**
Fire can damage tissues of yellow sweetclover, particularly the crown buds of second-year plants. If these are killed by an early spring fire, the plant cannot produce any new stems. Fire can kill or injure stems at the base [30].

**DISCUSSION AND QUALIFICATION OF FIRE EFFECT:**
NO-ENTRY

**PLANT RESPONSE TO FIRE:**
Fire kill of the crown buds of second year effectively kills the plant. Death or injury to branched stems at the base will severely retard new growth; once the crown buds have expanded, new growth occur from the tip of branches and from buds in branch axils. No additional top growth will occur after stems have been severed or killed below the axil of the lowest lateral branch. An early May fire appears to result in a decrease in second-year plants and an increase in first-year plants. A July fire appears to decrease both first and second year plants, and a fall burn results in increased winter mortality if it occurs at or before the critical growth period [30].

**DISCUSSION AND QUALIFICATION OF PLANT RESPONSE:**
The Research Project Summary Vegetation response to restoration treatments in ponderosa pine-Douglas-fir forests of western Montana provides information on prescribed fire and postfire response of plant community species including yellow sweetclover.

**FIRE MANAGEMENT CONSIDERATIONS:**
Burning aids establishment of yellow sweetclover on grassland, probably because it aids germination of seeds through scarification and by creating openings in which sweetclover can establish. If the management goal is to establish yellow sweetclover, then an early spring fire would be recommended [30].
If the management goal is to suppress yellow sweetclover, there are three strategies that may achieve that objective. The first strategy is an annual early May fire once the second-year shoots are visible. The second strategy involves burning every second year in July before the second-year plants have ripened seed. The third strategy is to burn annually near the beginning of the critical growth period. Whether the presence of the sweetclover is more damaging than the fire regime to the management objectives is a question that should be considered. A rotational scheme of this type of management is recommended: divide the area into plots that undergo different treatments and alter treatments over time [30,33].

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SPECIES: Melilotus officinalis

REFERENCES:


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