Index of Species Information

**SPECIES:** Melilotus alba

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**Introductory**

**SPECIES:** Melilotus alba

**AUTHORSHIP AND CITATION:**

**ABBREVIATION:**
MELALB

**SYNONYMS:**
NO-ENTRY

**SCS PLANT CODE:**
MEAL2

**COMMON NAMES:**
- white sweetclover
- sweetclover
- white melilot

**TAXONOMY:**
The scientific name of white sweetclover is variously reported as:

- Melilotus alba Ders. [32]
- Melilotus alba Medicus [11,38]
- Melilotus alba Medikus [1]
- Melilotus albus Ders. ex Lam. [39]

Without regard to authority, Melilotus alba is the most commonly used binomial.
European and Asian material exhibits much variation and may be divided into several subspecies. Plants in North America, however, probably descended from relatively few introductions and exhibit much less variation. There are no recognized subspecies or varieties in North America.

**LIFE FORM:**

Forb

**FEDERAL LEGAL STATUS:**

No special status

**OTHER STATUS:**

NO-ENTRY

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**DISTRIBUTION AND OCCURRENCE**

**SPECIES:** Melilotus alba

**GENERAL DISTRIBUTION:**

White sweetclover is native to Europe and western Asia. It was probably introduced into North America by early settlers and was first recorded in the United States in 1739 [32]. Its widespread use as bee pasture, in agriculture, and for soil stabilization hastened its spread across North America. Today it is found in Alaska, Hawaii, every Canadian province and territory, and in all of the contiguous United States [34].

**ECOSYSTEMS:**

FRES10  White - red - jack pine
FRES11  Spruce - fir
FRES15  Oak - hickory
FRES17  Elm - ash - cottonwood
FRES20  Douglas-fir
FRES21  Ponderosa pine
FRES23  Fir - spruce
FRES26  Lodgepole pine
FRES28  Western hardwoods
FRES29  Sagebrush
FRES34  Chaparral - mountain shrub
FRES35  Pinyon - juniper
FRES38  Plains grasslands
FRES39  Prairie
FRES41  Wet grasslands

**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  WV  WI  WY
AB  BC  MB  NF  NT  NS  ON  PE  PQ  SK
YT  MEXICO
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:
NO-ENTRY

MANAGEMENT CONSIDERATIONS

SPECIES: Melilotus alba

IMPORTANCE TO LIVESTOCK AND WILDLIFE:
White sweetclover is eaten by all classes of livestock. It is grown for hay, used as pasture, and is seeded with other legumes to improve western rangelands [27,31]. The hay is palatable and nutritious but must be thoroughly cured. Partially cured hay can produce a hemorrhagic syndrome when ingested by cattle. The toxic substance, dicoumarol, which occurs only in moldy hay, results from the conversion of nontoxic coumarin by fungi in moist plants [3]. Sheep and horses are less susceptible than cattle to the disease. Bloat can occur in livestock pastured on white sweetclover, but it occurs less frequently than animals pastured on alfalfa (Medicago sativa) or true clovers (Trifolium spp.) [31].

Big game animals, including elk, pronghorn, bighorn sheep, mule deer,
and white-tailed deer consume this plant when it is available [5,10,12,34]. The seeds are eaten by numerous species of birds and small mammals, and are especially common in the diets of quail and partridge [10,12]. Muskrats feed on the roots when other preferred foods are scarce. Rabbits eat the leaves and stems [10].

**PALATABILITY** :
White sweetclover palatability to livestock and big game animals is moderately high to high during spring and early summer [4,5,6,45,19,29]. As plants mature, however, they become less palatable because they become woody and the amount of "bitter tasting" coumarin increases [35]. When in bloom in the summer, wildlife and livestock "relish" the flowers [13].

Palatability of white sweetclover in several western states is rated as follows [4,6,29]:

<table>
<thead>
<tr>
<th></th>
<th>CO</th>
<th>KS</th>
<th>MT</th>
<th>ND</th>
<th>UT</th>
<th>WY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>fair</td>
<td>good</td>
</tr>
<tr>
<td>Sheep</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>fair</td>
<td>good</td>
</tr>
<tr>
<td>Horses</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>fair</td>
<td>good</td>
</tr>
<tr>
<td>Pronghorn</td>
<td>----</td>
<td>----</td>
<td>fair</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Elk</td>
<td>----</td>
<td>----</td>
<td>good</td>
<td>----</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Mule deer</td>
<td>----</td>
<td>----</td>
<td>fair-good</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>White-tailed deer</td>
<td>----</td>
<td>----</td>
<td>fair-good</td>
<td>good</td>
<td>----</td>
<td>good</td>
</tr>
<tr>
<td>Small mammals</td>
<td>----</td>
<td>----</td>
<td>fair</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Small nongame birds</td>
<td>----</td>
<td>----</td>
<td>fair</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Upland game birds</td>
<td>----</td>
<td>----</td>
<td>fair</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Waterfowl</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
</tbody>
</table>

**NUTRITIONAL VALUE** :
White sweetclover has a well-balanced complement of nutrients during early growth stages, and when cut and cured properly, makes a nutritious and palatable hay. On a dry matter basis, white sweetclover hay resembles alfalfa hay in metabolizable energy and most digestible nutrients, but is slightly higher in digestible crude protein [31]. Crude protein content of hay often exceeds 15 percent on a dry matter basis [22]. Protein content and digestible protein of dry white sweetclover aerial parts were reported as follows by the National Academy of Sciences [22]:

<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 for cattle</td>
<td>9.9 %</td>
</tr>
<tr>
<td>digestible protein for goats</td>
<td>10.6 %</td>
</tr>
<tr>
<td>digestible protein for horses</td>
<td>10.3 %</td>
</tr>
<tr>
<td>digestible protein for rabbits</td>
<td>10.3 %</td>
</tr>
<tr>
<td>digestible protein for sheep</td>
<td>10.8 %</td>
</tr>
</tbody>
</table>

**COVER VALUE** :
White sweetclover provides good cover for small mammals, waterfowl, quail, and ring-necked pheasant [10,14,23,34].

Wildlife cover values for several western states are as follows [6]:

<table>
<thead>
<tr>
<th></th>
<th>MT</th>
<th>ND</th>
<th>UT</th>
<th>WY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pronghorn</td>
<td>----</td>
<td>good</td>
<td>fair</td>
<td>poor</td>
</tr>
<tr>
<td>Elk</td>
<td>----</td>
<td>----</td>
<td>poor</td>
<td>poor</td>
</tr>
<tr>
<td>Mule deer</td>
<td>----</td>
<td>good</td>
<td>fair</td>
<td>poor</td>
</tr>
<tr>
<td>White-tailed deer</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>poor</td>
</tr>
<tr>
<td>Small mammals</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>Small nongame birds</td>
<td>good</td>
<td>good</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>
</tr>
<tr>
<td>Waterfowl</td>
<td>----</td>
<td>good</td>
<td>fair</td>
<td>good</td>
</tr>
</tbody>
</table>
VALUE FOR REHABILITATION OF DISTURBED SITES:
Seeded white sweetclover generally makes rapid growth, quickly providing vegetative cover on disturbed areas. Its chief rehabilitation use is for erosion control and revegetation of mined lands [14,37]. It grows well on calcareous and alkaline mine spoils but is not recommended for use on acidic spoils [14,30]. It is especially important as a preparatory crop on mined lands because it incorporates large amounts of nitrogen and organic matter into the soil, which is made available to succeeding plants [31,33]. Scarified seed is generally sown in the fall in southern latitudes and in the early spring in northern latitudes. White sweetclover planting information has been reported in detail [4,37,40].

OTHER USES AND VALUES:
White sweetclover makes valuable bee pasture and has long been recognized as one of the most important of all plants for honey production [31,37].

Besides its use for hay or pasture, white sweetclover is also used in agriculture as a soil improvement crop. Because of its symbiotic relationship with Rhizobium bacteria, pure stands may add up to 70 pounds of nitrogen per acre (78 kg/ha) to the soil [16].

OTHER MANAGEMENT CONSIDERATIONS:
Control: First-year white sweetclover plants have a "special growth period" at the end of summer, when rapid root growth and food storage take place [21]. This begins about September 1 in the Midwest. Plants mowed just prior to the start of this special growth period experience high rates of winter mortality. In Ohio, winter kill resulting from top-growth removal at different times of the year was as follows [31]:

<table>
<thead>
<tr>
<th>Mortality</th>
<th>Cutting Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>75% winter kill</td>
<td>Sept 9 (beginning of root growth period)</td>
</tr>
<tr>
<td>53% winter kill</td>
<td>Sept 26 (middle of root growth period)</td>
</tr>
<tr>
<td>12% winter kill</td>
<td>Nov 3 (end of root growth period)</td>
</tr>
<tr>
<td>5% winter kill</td>
<td>plants not cut</td>
</tr>
</tbody>
</table>

Additionally, clipped plants that survived the winter showed poor vigor the following spring, and many died during the summer of their second year.

White sweetclover is easily killed with phenoxy herbicides such as 2,4-D or dicamba, but soil-stored seed is unaffected [31].

Grazing: For best use of pasture, first year plants can be lightly grazed in the spring when 10 to 12 inches (25-30 cm) high, but should not be grazed heavily until after late September. Pastures dominated by second year plants should be grazed in the spring and maintained at a height of about 12 inches (30 cm), which prevents plants from becoming woody and unpalatable [4,13].

Insects and Disease: The sweetclover weevil is the most damaging insect affecting white sweetclover. In Montana, severe infestations have resulted in complete failure of new seedlings [29]. Second-year plants are susceptible to root rot [4].
BOTANICAL AND ECOLOGICAL CHARACTERISTICS

SPECIES: Melilotus alba

GENERAL BOTANICAL CHARACTERISTICS:
Annual forms of white sweetclover exist, but the plant is primarily biennial. First-year plants are comprised entirely of vegetative growth (usually a single stem) and overwinter as buds on the caudex. Second-year plants have a strongly developed taproot which may exceed 50 inches (120 cm) in depth, and 1 to 10 upright or ascending flowering stems from 3 to 8.5 feet in height [31,33]. The inflorescence is a raceme with 40 to 80 white flowers. The fruit is a one-seeded pod.

RAUNKIETER LIFE FORM:
Hemicryptophyte (biennial form)
Therophyte (annual form)

REGENERATION PROCESSES:
White sweetclover is a good seed producer. Seed production estimates of 14,000 to 350,000 seeds per plant have been reported. Large plants growing in the open in Ontario produced between 200,000 and 350,000 seeds each. The fruits are shed in the fall, and are dispersed by gravity, strong winds, and water. The seeds float, and thus rain wash and stream flow may be an important means of dispersal [34]. A large percentage of the seeds have a hard seed coat and can remain viable in the soil for more than 20 years [31]. Natural scarification occurs through fluctuating freezing and thawing temperatures or by heat from a fire [15]. New seedlings are found almost any month during the growing season, but only spring-emerged seedlings survive the winter [17,34].

Vegetative reproduction: Vegetative reproduction does not occur naturally. If second-year plants are cut, new growth must come from buds on the stems rather than the caudex [31].

SITE CHARACTERISTICS:
White sweetclover is shade intolerant and grows in a wide variety of open habitats but is most common along roads and railways, and in prairies, arid rangelands, fields, and waste places [16,34]. Its associates are too numerous to list, but it often grows with yellow sweetclover (Melilotus officinalis) in the West [1]. It is not tolerant of continuous flooding but occasionally grows on open, gravelly riverbanks that experience brief spring flooding. White sweetclover grows on a wide range of soil types and textures from clay to dune sand and river gravels [34]. It is most commonly found on calcareous soils. It grows poorly on acid soils [31,34]. It requires sufficient moisture for establishment but is thereafter very drought tolerant [34].

SUCCESSIONAL STATUS:
Obligate Initial Community Species

White sweetclover is an early colonizer of disturbed sites. It is common on strip-mined lands in the central and eastern United States [9,16]. Turkington [34] reported that it may be eliminated from an area within 2 years if the ground surface is covered by perennial species because seedlings cannot survive in a perennial sward. Other researchers have detailed its persistence in many native and established tallgrass prairies; however, its abundance in these communities was probably due to periodic disturbance (fire) [15,18]. It was found in oldfields in Ohio but disappeared from sites when tree cover became
SEASONAL DEVELOPMENT:

First-year plants: Nearly all energy in the early part of the growing season is put into top-growth. In late summer, however, the tops grow very little, while the roots grow dramatically. This is the "critical growth period" when plants allocate most energy to root growth. Root weight of first-year plants grown near Ames, Iowa, was as follows [21]:

<table>
<thead>
<tr>
<th>Date</th>
<th>Root Weight (grams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 4</td>
<td>24.5</td>
</tr>
<tr>
<td>July 3</td>
<td>118</td>
</tr>
<tr>
<td>August 4</td>
<td>430</td>
</tr>
<tr>
<td>September 3</td>
<td>448</td>
</tr>
<tr>
<td>October 3</td>
<td>1609</td>
</tr>
<tr>
<td>November 6</td>
<td>2388</td>
</tr>
</tbody>
</table>

Second-year flowering shoots become noticeable as root crown buds about the time rapid root growth begins. First-year shoots are killed by freezing temperatures in the fall or winter.

Second-year plants: In the spring of the second year, several shoots arise from the root crown and elongate rapidly. By midsummer, each shoot bears many flowers, and flowering may continue until early fall. Flowering for several locations has been reported as follows [6,41].

<table>
<thead>
<tr>
<th>Location</th>
<th>Flowering time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado</td>
<td>June through September</td>
</tr>
<tr>
<td>Montana</td>
<td>July through August</td>
</tr>
<tr>
<td>North Dakota</td>
<td>June through September</td>
</tr>
<tr>
<td>Utah</td>
<td>May through July</td>
</tr>
<tr>
<td>Wyoming</td>
<td>June through September</td>
</tr>
<tr>
<td>New England</td>
<td>June 9 to September 25</td>
</tr>
</tbody>
</table>

Blooming usually occurs earlier during hot, dry years [40].

FIRE ECOLOGY

SPECIES: Melilotus alba

FIRE ECOLOGY OR ADAPTATIONS:

White sweetclover seeds have hard, impermeable seed coats, and may remain dormant in soil seed banks for years. The heat from a fire breaks the seed coat, allowing the seed to germinate. Where soil-stored seed is present, burning is stimulatory, resulting in abundant seed germination and seedling establishment [15,18,23].

Second-year plants present as buds on the caudex may survive dormant-season burns, as they are located about 2 inches (5 cm) below the ground surface [34]. On the Curtis Prairie in Wisconsin, second-year white sweetclover was abundant in the spring following dormant season fall burns [18]. Actively growing second-year plants,
however, are easily killed by fire.

**POSTFIRE REGENERATION STRATEGY:**

Caudex, growing points in soil
Ground residual colonizer (on-site, initial community)

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**FIRE EFFECTS**

**SPECIES: Melilotus alba**

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**IMMEDIATE FIRE EFFECT ON PLANT**:

Once the crown buds of second-year plants have expanded, growth originates from branch tips or branch axils. Thus once shoot growth has begun, fire kills second-year plants simply by removing or scorching the growing points, or on large individuals by charring the stem base [15,18]. Numerous studies have shown that spring or summer burning in prairies and old fields effectively kills most second-year plants.

**DISCUSSION AND QUALIFICATION OF FIRE EFFECT**:

Burning of a remnant tallgrass prairie in Minnesota on May 1, when second-year white sweetclover plants were 2 to 6 inches (5-15 cm) tall, resulted in the virtual elimination of second-year plants from the site. July burning on another portion of the same prairie similarly resulted in killing all first- and second-year plants. Although some large second-year plants were not completely consumed by fire, none sprouted by early September [15].

In the summer following early or mid-May burning on the Curtis Prairie in Wisconsin, frequency of second-year plants ranged from 5 to 26 percent on burned plots and 93 to 100 percent on unburned plots [18].

In grass-dominated old fields in eastern North Dakota, late June burning "completely eradicated" second-year white sweetclover [23].

**PLANT RESPONSE TO FIRE**:

Numerous studies have documented that fire stimulates germination of white sweetclover seed [9,15,18,23,25,28]. Seedling establishment generally occurs as follows after burning at different times of the year:

- **Spring burning** - rapid seed germination and abundant seedling establishment occur shortly after burning. Additional seeds germinate in the summer of the first postburn growing season, but few late-germinating seedlings survive the winter.

- **Summer burning** - poor to fair seed germination can occur after summer burning, but few of these late-germinating seedlings survive the winter. Additional seeds germinate in postfire year 2.

- **Fall burning** - abundant germination occurs in the spring following fall burning.
Following spring burning of grasslands, frequency and cover of first-year white sweetclover is much higher on burned than unburned areas during the first postfire growing season. During postfire year 2, first-year plants are rare, while second-year plants are abundant. White sweetclover frequency declines after postfire year 3.

DISCUSSION AND QUALIFICATION OF PLANT RESPONSE:
NO-ENTRY

FIRE MANAGEMENT CONSIDERATIONS:
White sweetclover thrives under a management program of periodic spring burning on a 2-year or longer cycle, which has been a common practice in many managed grasslands. Under this regime, soil-stored white sweetclover seed is scarified, resulting in abundant seedling establishment. The plants then overwinter, produce abundant seed in their second year, and replenish the soil seed bank. Because of these life history attributes, the use of fire to suppress white sweetclover is possible, but several successive annual or biennial burns are probably required to exhaust the seed supply. Dormant-season burns, whether early spring or late fall, are not recommended because they do not kill overwintering second-year plants.

Heitlinger [15] recommended the following strategies to suppress white sweetclover and reduce seed supplies in tallgrass prairie: (1) burn annually about early May (for Minnesota) when second-year shoots are clearly visible, (2) burn every second year in early July before seed of second-year plants ripens, or (3) burn annually in early September near the beginning of the critical growth period [see Management Considerations and Seasonal Development for more information on the critical growth period].

In Wisconsin, a combination of an April burn followed the next year by a May burn was more successful in reducing white sweetclover than other burning combinations. Heavily infested paririe stands where this burning combination was conducted twice, separated by 2 years without burning, became almost completely free of white sweet clover [18].

REFERENCES

SPECIES: Melilotus alba

REFERENCES:


18. Kline, Virginia M. 1986. Response of sweet clover (Melilotus alba Desr.) and associated prairie vegetation to seven experimental burning and
mowing treatments. In: Clambey, Gary K.; Pemble, Richard H., eds. The prairie: past, present and future: Proceedings, 9th North American prairie conference; 1984 July 29 - August 1; Moorhead, MN. Fargo, ND: Tri-College University Center for Environmental Studies: 149-152. [3560]


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