

## CRIMSON CLOVER

*Trifolium incarnatum* L.

Plant Symbol = TRIN3

Contributed by: USDA NRCS Corvallis Plant Materials Center, Oregon



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### Alternate Names

*Alternate Common Names:* scarlet clover, Italian clover, German clover, French clover, carnation clover, incarnate clover

*Alternate Scientific Names:* Synonyms for *Trifolium incarnatum* var. *incarnatum* include: *Trifolium incarnatum* L. var. *elatius* Gibelli & Belli, *Trifolium incarnatum* L. var. *sativum* Ducommun, *Trifolium stellatum* L. ssp. *incarnatum* (L.) Gibelli & Belli, and *Trifolium stellatum* L. var. *elatius* Gibelli & Belli.

Synonyms for *Trifolium incarnatum* var. *molinerii* include: *Trifolium incarnatum* ssp. *molinerii* (Balb. ex Hornem.) Syme, *Trifolium molinerii* Balb. ex Hornem., *Trifolium stellatum* subvar. *stramineum* (C. Presl) Gibelli & Belli, and *Trifolium stramineum* C. Presl.

### Uses

*Cover crop:* Crimson clover is commonly used as a winter or summer annual cover crop in rotation with vegetables or field crops (Clark, 2007). It can be used alone or as part of a mixture with other legumes, small grains, and winter annual grasses. Species commonly used in mixes with crimson clover include vetches (*Vicia* spp.), subclover (*Trifolium subterraneum*), red clover (*Trifolium pratense*), black medick (*Medicago lupulina*), oats (*Avena sativa*), cereal rye (*Secale cereale*), and annual ryegrass (*Lolium perenne* ssp. *multiflorum*). It is also used as a winter annual reseeding cover crop between rows in vineyards, berries, and fruit and nut orchards. A case study in West Virginia showed that a corn silage crop was more profitable (10% savings) when preceded by an incorporated crimson clover cover crop than when side-dressed with a solution of urea and ammonium nitrate (UAN) at the standard rate of 120 lb/acre (Wickline and Rayburn, 2008). Given sufficient soil moisture, crimson clover can also be interseeded with corn and cotton or vegetable crops such as cantaloupe right after the last cultivation (Westgate, 1913).

*Green manure:* Crimson clover makes an excellent weed-suppressing green manure crop, adding 70 to 150 lb N/acre as a winter annual if it is allowed to reach the late bloom stage before being killed or turned under (Ball and Lacefield, 2000; Clark, 2007). Mutch and Martin (2010) found that as a summer annual in lower Michigan, crimson clover produced ¾ to 1 ton dry matter and 50 to 60 lb N/acre by late November (as cited in Clark, 2007). At least three weeks should be allowed between green manure crop termination and planting another crop to allow residue to break down and soil microbial communities to stabilize.

*Forage, silage, and hay:* Crimson clover is reportedly “among the most widely planted annual forage legumes in the United States” (Ball and Lacefield, 2000). It has been a popular winter pasture crop in the South since the 1940’s due to its good growth under cool temperatures and its ability to produce a substantial seed crop if livestock are removed six to eight weeks prior to flowering (Hollowell, 1951). Crimson clover also produces high yields of good quality hay when harvested at or before the mid-bloom stage. A good stand can yield 1 to 2½ tons dry matter per acre, while mixtures with winter annual grasses generally yield much higher (Ball and Lacefield, 2000; Hollowell, 1951). When overseeded on warm season grasses, crimson clover provides 60 to 100 pounds or more N per acre to the grass, even if grazed or hayed (Ball and Lacefield, 2000).

*Livestock:* Crimson clover forage is highly nutritious, with over 25% crude protein that can be 80% digestible in

early spring growth, and may contain 12 to 14% crude protein and 60 to 65% digestible nutrients on a dry matter basis even at full bloom (Ball and Lacefield, 2000; Harper, 2004). Although bloat is much less likely in animals grazing crimson clover than white clover or alfalfa, it should generally be used in mixtures with grasses to reduce this risk (Knight, 1985). The barbed hairs on overly-mature crimson clover flower heads can be problematic for horses, but can be avoided by harvesting hay promptly when it begins to bloom.

**Beneficial insect habitat:** The flowers produce abundant nectar and pollen that attract European honey bees, as well as a wide variety of native bees. Honey bees make a light, good quality honey from the nectar. The flowers also harbor minute pirate bug (*Orius tristicolor*), a beneficial insect that feeds on many agricultural pest species, including thrips (UC SAREP, 2012).

**Wildlife:** Crimson clover can be an important component of cool-season forage plots managed for turkeys and white-tailed deer, either alone or in a mixture with small grains such as oats, rye or wheat, and other legumes such as arrowleaf clover (*Trifolium vesiculosum*) and Austrian winter pea (*Pisum sativum*) (Harper, 2004). It can also be planted as reseeding cool-season forage in firebreaks near wildlife plots as part of a mixture with Austrian winter pea and wheat.

**Roadside erosion control and beautification:** In the southeastern United States, crimson clover is planted along highways or roadsides to provide quick cover for erosion control, stabilization, and beautification.

**Seed crop:** Crimson clover is a major seed crop in the Willamette Valley of western Oregon, accounting for 95% of the total US seed production and totaling \$2.5 million in sales in 2010 (Oregon State University, 2011).

### Status

Please consult the PLANTS Web site and your State Department of Natural Resources for this plant's current status (e.g., threatened or endangered species, state noxious status, and wetland indicator values).

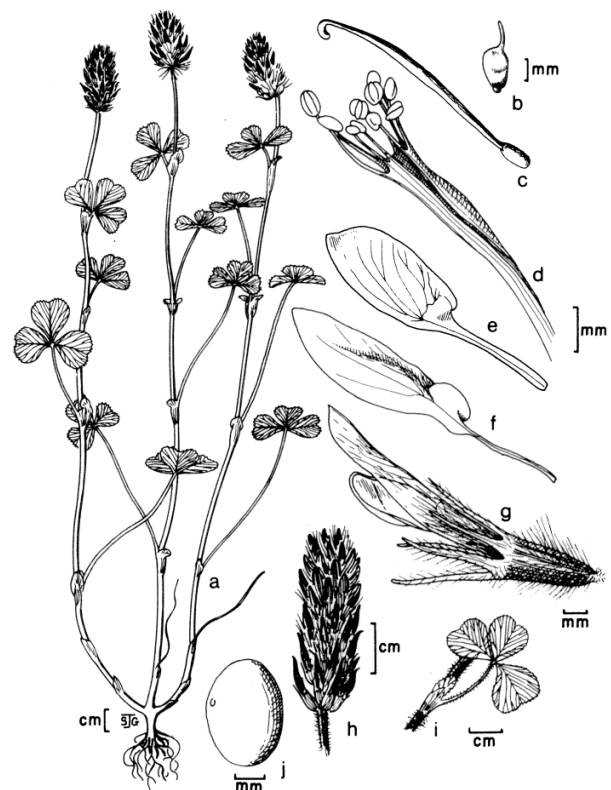
### Weediness

This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed. Please consult with your local NRCS Field Office, Cooperative Extension Service office, state natural resource, or state agriculture department regarding its status and use. Weed information is also available from the PLANTS Web site at <http://plants.usda.gov/>. Please consult the Related Web Sites on the Plant Profile for this species for further information.

### Description

**General:** Crimson clover is an annual in the legume family (Fabaceae). Plants are generally densely hairy with a rosette of upright, usually unbranched stems

reaching 1 to 3 feet tall supported by a central taproot and many fibrous roots. The trifoliate leaves growing along the stems have egg- to heart-shaped leaflets that are nearly ½ to 1 inch long and are distinguished from the leaves of red clover (*T. pratense*) by their rounded tips and absence of V-shaped leaf marks (Burke Museum of Natural History and Culture, 2012; Knight, 1985; Vincent and Isely, 2012). The cylindrical or conic flower heads at the ends of the stems are about 1 to 2½ inches long and contain many small (about ½ inch long) bright scarlet (or occasionally white) florets that open in succession from the bottom to the top of the flower head. Flowering is induced by day lengths over 12 hours, and plants bloom between April and August, depending on the climate and region (UC SAREP, 2012). Flowers are generally self-fertile but not self-pollinating (about 68 to 75% out-crossing), relying instead on bees that visit the flowers for nectar and pollen (Hollowell, 1951; Knight, 1985). The yellow seeds borne singly in small pods are larger and more rounded than red clover seeds. Crimson clover has approximately 120,000 to 150,000 seeds per pound (Hollowell, 1951; Whyte et al., 1953).



*Trifolium incarnatum* L. a) habit, b) pod, c) pistil, d) staminal column and free stamen, e) keel, f) wing, g) flower, h) inflorescence, i) leaf, j) seed. Reprinted with permission of ASA-CSSA-SSSA Publishers, p. 59.

**Distribution:** Crimson clover is native to southeastern Europe and southwestern Asia Minor, and was introduced to the United States as a cultivated crop in the 1800's (Hollowell, 1951). It is now grown widely as a winter annual in the Southeast from Kentucky southward and from eastern Texas to the Atlantic Coast (USDA Hardiness Zones 6–9) (Ball and Lacefield, 2000; Clark,

2007). It is also grown as a winter annual in the Pacific Northwest and California, and as a summer annual in the extreme northern US and parts of Canada (Hardiness Zones 3–4). There are naturalized populations of crimson clover in the southeastern and temperate western United States (Vincent and Isely, 2012). For current distribution, please consult the Plant Profile page for this species on the PLANTS Web site.

**Habitat:** Naturalized populations of crimson clover can be found in moist to dry sites along roadsides, and in fields, pastures, and disturbed areas from lowlands to montane zones (Douglas et al., 1999).

### **Adaptation**

Crimson clover grows best on well-drained, fertile, loamy soils, and is adapted to sandy to clayey soils of moderate acidity (pH 5.5 to 7.0); it does not grow well on poorly-drained or highly alkaline soils (Clark, 2007; Knight, 1985). This species tolerates more acidity than white and red clover (Whyte, 1953). Once established, it produces more biomass at lower temperatures than most other clover species (Hollowell, 1951).

### **Establishment**

If sowing in a location where crimson clover has not been grown in the last three years, seed should be inoculated (use inoculant type “R”, *Rhizobium leguminosarum* biovar *trifolii*) immediately before sowing for best stand establishment and root nodulation (Harper, 2004). Soil testing prior to sowing is important, particularly for phosphorus and potassium levels, which may limit N fixation and stand productivity if they are too low. Boron may also be limiting if reseeding is desired, especially on sandy soils, and lime is often needed to adjust the soil pH (Ball and Lacefield, 2000). Nitrogen fertilizer is generally not needed as these legumes are able to obtain sufficient N from symbiotic N fixation, and excess N levels may actually inhibit nodule formation (Gardner et al., 1983). Consult your local extension service for recommended fertilizer types and rates.

As a winter annual, crimson clover is seeded from summer to late fall depending on region and intended use. It is generally recommended to plant six to eight weeks before the average first frost date (Clark, 2007), although research at Mississippi State University showed highest yields for crimson clover planted August 15 (Knight, 1985). For summer annual plantings in northern regions, sow in late May or early June as soon as all danger of frost has passed for a fall hay harvest, rotation with fall vegetables, or overseeding of corn (Clark, 2007; Westgate, 1913).

Seed should be planted at a depth of no more than ¼ inch in clay soils and ½ to ¾ inch in sandy soils (Hollowell, 1951). In a well-prepared seedbed, drill at a single species rate of 15 to 18 pounds pure live seed (PLS) per acre, or broadcast at 22 to 30 lb PLS/acre (Clark, 2007). For mixtures, sow crimson clover at about two-thirds the normal rate and companion crops at one-third to one-half

their single species rate, or no more than 90 lb/acre for small grains and 15 to 20 lb/acre annual ryegrass (Ball and Lacefield, 2000; Clark, 2007). Seedlings generally emerge within 7 days given proper soil moisture and optimum germination temperature of 70°F (Johnson et al., 2007).

Crimson clover can also be seeded into existing pastures or hayfields of warm season perennial grasses such as bermudagrass (*Cynodon dactylon*), dallisgrass (*Paspalum dilatatum*), Johnsongrass (*Sorghum halepense*), and broad-leafed bahiagrass (*Paspalum notatum*) if the grasses are burned, grazed, or mowed short just prior to sowing (Hollowell, 1951). The clover should be seeded into summer sod around the time of the first killing frost (Ball and Lacefield, 2000). Seed can be broadcast or drilled to a shallow depth; if broadcast, a light disking or heavy stocking with livestock after seeding may improve seed-to-soil contact and establishment.

### **Management**

**Livestock/Grazing:** If seeded with winter annual grasses, initial growth should be monitored closely and grazed appropriately to keep the grasses from shading out the clover. In general, crimson clover should not be grazed until the plants are 4 to 6 inches tall, and grazing should leave at least 3 inches of stubble (Ball and Lacefield, 2000). However, leaving too much foliage may increase the occurrence of crown rot, so mowing or grazing prior to the coolest, wettest months is often necessary. Careful monitoring and grazing management is needed to prevent overgrazing crimson clover pasture, both alone and in mixtures. Crimson clover is generally a low-bloat forage, but should be fed with a mixture of grasses to minimize the risk of bloat. Other methods to avoid problems with bloat include providing dry hay to animals during periods of lush growth, avoiding turning hungry animals into a lush pasture, and providing anti-bloat materials (Ball and Lacefield, 2000).

**Reseeding:** While some varieties of crimson clover have been selected for hard seed, seed does not persist long in the soil, so stands should still be allowed to make seed every year if reseeding is desired (Ball and Lacefield, 2000). As soon as bloom begins, livestock should be removed or stocking rates should be significantly reduced for at least a month to allow seed set. Plants can then be grazed again or cut for hay. Clover head weevils can severely limit reseeding potential some years if not controlled with an insecticide, but care should be taken to avoid harming bees if any sprays are used (Ball and Lacefield, 2000; Hancock, 2009).

**Cover crop termination:** Crimson clover is easily killed mechanically by mowing or by spraying with herbicide after early bud stage, but N gains are maximized by waiting until late bloom or early seed set (Clark, 2007). If spraying as part of a conservation tillage system, a systemic herbicide will produce a more complete kill than a contact herbicide (Owsley, 2012). Clover can also be killed by a roller-crimper or rolling stalk chopper ahead of

a no-till transplanter if it is in full bloom. In northern regions (Hardiness Zone 5 and colder), crimson clover is used to provide a winterkilled mulch that can then be disked or directly planted into in the spring.

### Pests and Potential Problems

The two most widespread, serious diseases of crimson clover are crown and stem rot (caused by *Sclerotinia trifoliorum*) and sooty blotch (caused by *Cymadothea trifolii*) (Hollowell, 1951). Crown and stem rot is worst in the cool wet weather of fall, winter, and spring, and may completely destroy a stand. Stands that are overly thick or rank throughout the winter months may create conditions that promote this rot, but fall and winter grazing that removes excess foliage can reduce the spread of the disease. Sooty blotch is a leafspot disease evident during bloom. Both diseases can be substantially reduced by rotating crimson clover to another location for a few years. In general, crimson clover is more resistant to diseases and some nematodes than other species of clover (Clark, 2007). Clover head weevil (*Hypera meles*), an introduced pest from Europe, can sometimes severely limit seed yields, but some newer cultivars have been bred to be insect resistant (Knight, 1985).

### Environmental Concerns

Crimson clover is a secondary host plant to pests such as corn earworm and cotton bollworm in the genus *Heliothus*, and has been removed from roadsides in Mississippi due to concerns over increased populations of those pests (Clark, 2007).

### Control

Please contact your local agricultural extension specialist or county weed specialist to learn what works best in your area and how to use it safely. Always read label and safety instructions for each control method.

### Seeds and Plant Production

In the Willamette Valley of Oregon, where much of the US crimson clover seed is produced, fields are planted in late September with the fall rains, flower in mid-May, and are harvested in late June to early July when about three-fourths of the pods have turned golden brown (Aldrich-Markham, 2012). Plants are swathed at night, when they are damp with dew, to reduce losses of the easily shattered seed. Seed is allowed to dry in the swath for about a week, and then harvested with a combine using a belt pick-up header. Honeybee colonies placed in or near blooming fields will generally increase seed set and harvestable yields. Seed set may range from 1,000 to 1,200 lb/acre, but harvested yields are generally around 750 lb/acre due to shatter before and during harvest (Chastain, 2012; Hollowell, 1951). In Georgia, yields of improved cultivars such as 'AU Sunrise' and 'AU Sunup' harvested by direct combine are typically between 100 and 200 pounds of clean seed per acre.



Seed increase field of crimson clover at the USDA-NRCS Jimmy Carter Plant Materials Center, Americus, GA.

### Cultivars, Improved, and Selected Materials (and area of origin)

Crimson clover seed is widely available from commercial sources in both common type and improved cultivars. Cultivars should be chosen based on variety trial data from your local university. Early-maturing cultivars are best for over-seeding on summer grass sod to avoid competition, and also for green manure crops to allow early spring termination (Ball and Lacefield, 2000). Late cultivars may have higher yields if early termination and competition are not an issue, and can be grazed longer in the spring.

'Dixie' is the oldest cultivar, and along with 'Auburn,' 'Autauga,' 'Chief,' and 'Talladega' was once among the most widely used reseeding cultivars selected and/or bred for hardseededness (Knight, 1985). Dixie, Auburn, and Autauga are early cultivars whose seed matures about a week earlier than that of Chief, Talladega, or common types. Chief is the most winter-hardy cultivar. Another reseeding cultivar, 'Tibbee' (released in 1970), along with a soft-seeded cultivar, 'Frontier' (1962), were bred for improved seedling vigor, greater fall and winter growth, and early maturity (Knight, 1985), but have been largely replaced by more modern cultivars. 'Flame' (Florida, 1989) and 'AU Robin' (Alabama, 1992) are cultivars that were selected for early maturity from stands of Dixie.

'AU Sunrise' (1997) and 'AU Sunup' (2009) are reseeding cultivars jointly released by the USDA-NRCS Jimmy Carter Plant Materials Center in Americus, GA, and Auburn University (Owsley, 2007, 2009, 2012). AU Sunrise was selected for vigor, growth, disease resistance, and especially early bloom date. It blooms 5 to 18 days earlier than AU Robin (previously the earliest blooming crimson clover line on the market) and 12 to 28 days earlier than Tibbee. AU Sunup was selected from the same line as AU Sunrise after another cycle of selections, and can flower 5 to 21 days earlier than AU Robin, and 7 to 30 days earlier than Tibbee, depending on the year and location. Both cultivars are well-adapted to Alabama and Georgia, and can also grow in Florida and Mississippi.

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