



Red Clover

Red clover (*Trifolium pratense* L.) is grown throughout the northeastern United States for forage and is used in rotations for soil improvement. It is adapted to areas with moderate summer temperatures and adequate moisture throughout the growing season. Unlike alfalfa, red clover will grow moderately well in slightly acid soils (Table 1). However, maximum yields are obtained when soil pH is 6.0 or higher.

Red clover, a short-lived perennial, usually produces two or three hay crops per year. It is characterized by rapid spring growth and low winterhardiness, which contributes to its short-lived nature.

Growth habit varies from erect to prostrate. Numerous stems with large trifoliate leaves arise from the crown region each year. Red clover has a thick tap root that grows to a length of 24-36 inches. Lateral roots arising from the tap root are concentrated mainly in the upper 5 inches of the soil. Small ovoid, pinkish, nitrogen-fixing nodules can be found on the lateral roots if the plant is actively incorporating atmospheric nitrogen into protein nitrogen.

ADAPTED VARIETIES

Look for good disease resistance and persistence in a red clover variety. Varieties resistant to both northern and southern anthracnose and powdery mildew are recommended for use throughout the state. Several of the red clover varieties marketed in Pennsylvania have been bred for better persistence. With proper management, you can expect these varieties to persist for two to three years after the establishment year. Refer to the current Penn State Forage Trial Report for red clover variety performance and resistance information.

ESTABLISHMENT

Red clover can be established as a pure stand, with or without a companion crop, seeded with forage grass, or sod-seeded into a grass sod to improve the existing stand. Each situation has special requirements that should be considered.

Seeding red clover in the spring (April to early May), alone or with a spring oat companion crop in a conventionally prepared seedbed, is common. Best clover stands result if oats are seeded at about 1.5 to 2 bushels per acre. Harvesting the oats early for silage is recommended because this will greatly reduce competition with the red clover. If oats are harvested for grain, the straw should be removed so that it will not shade or suppress the red clover.

Red clover direct seeded in the spring without a companion crop will yield less total forage than when seeded with a companion crop to be harvested as a forage. However, a larger portion of the forage will be red clover when seeded without the companion crop. Use of herbicides may be necessary when direct seeding red clover without a companion crop. Direct seedings of red clover can be made by broadcasting, band seeding, or fluid seeding. Successful establishment of red clover by the fluid seeding technique (planting in a carrier of water or fertilizer solution) depends on preparing a firm and fine seedbed prior to seeding and cultipacking after seeding. Fluid seeding requires special equipment; therefore, a custom applicator is recommended.

Red clover can be no-till seeded and is the easiest legume to establish using this method. Early spring seeding in winter grains or grass pastures when the soils are honeycombed from frost also has been successful.

Red clover should be seeded at a rate of 10 to 12 lb per acre in a pure stand and 6 to 8 lb per acre when seeded with

Table 1. Characteristics of perennial forage legumes in Pennsylvania.

Legume	Seedling vigor	Tolerance to soil limitations			Heaving potential	Persistence	Tolerance to frequent:		Relative maturity ^b
		Drought	Wet	Low pH ^a			Grazing	Harvest	
Alfalfa	M ^c	H	L	L	H	H	L	M	Early
Birdsfoot trefoil	L	M	H	H	L	M	H	H	Late
Red clover	H	L	M	M	M	L	M	M	Medium-late
White clover	M	L	H	M	L	H	H	H	Early-medium

^a pH below 6.0.

^b Maturity characteristic refers to relative time of flower appearance in the spring. This will depend not only on species but also on variety.

^c L = low, M = moderate, H = high



a forage grass (Table 2). Best establishment occurs when red clover is not planted deeper than 1/4 inch.

Table 2. Seeding rates for red clover and a single grass in mixture.

Species	lb/A
Red clover	6-8
	with any one of these grasses
Orchardgrass	4-6
Perennial ryegrass	4-8
Reed canarygrass	6-8
Smooth brome	6-8
Tall fescue	8-10
Timothy	4-6

To ensure adequate nodulation, red clover seed should be inoculated with *Rhizobium trifolii* bacteria and a sticking agent just before seeding. Preinoculated seed should be kept in a cool, dark place to optimize survival of nitrogen-fixing bacteria. For additional information about nitrogen-fixing bacteria or the inoculation process, see Agronomy Facts 11: *Inoculation of Forage and Grain Legumes*.

HARVEST MANAGEMENT

Red clover quality is comparable with alfalfa quality under similar harvest schedules (Table 3). However, intake by the consuming animal is generally greater for alfalfa than red clover. Red clover quality does not decline as rapidly with maturity as does alfalfa quality. This means a longer period over which high-quality forage can be harvested.

Table 3. Yield and quality of alfalfa and red clover under a two- and three-harvest schedule.

Species	No. of cuts	Yield	CP	DDM
		T/A	%	
Red clover	2	4.37	14.6	68.3
	3	3.36	21.3	73.3
Alfalfa	2	4.15	15.6	63.4
	3	4.34	20.7	65.2

CP = crude protein, DDM = digestible dry matter
Source: Smith, *Agronomy Journal* 57:463-465.

Spring-seeded red clover can be harvested three times during the seeding year if growing conditions are favorable. This more aggressive harvest management in the seeding year than has traditionally been implemented provides greater forage and nutrient yields and has not negatively affected yield in the year after establishment. In addition, the third harvest during early September will help maintain better stands the following harvest season. Initial harvest 60-70 days after seeding and subsequent harvest on a 30-35 day interval will generally allow for three harvests during the seeding year.

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Established red clover stands should be harvested at prebloom or early bloom. This harvest timing is a compromise between red clover yield and quality. Traditionally, three annual harvests are made in most of Pennsylvania. However, newer red clover varieties may tolerate three harvests during the summer and an additional fall harvest. The fall harvest should be made only if adequate herbage is present to offset the cost of harvesting. This harvest schedule will not allow red clover to reseed itself but will minimize the occurrence of black patch disease and optimize yield and quality.

Red clover silage, if properly harvested and stored, provides a high-quality forage. However, red clover is more difficult to cure for hay than other legumes. Establishing with a forage grass will decrease red clover's curing time. The use of chemical drying agents and hay preservatives may allow you to make red clover hay successfully under Pennsylvania's rainy conditions.

FERTILITY

Soil tests are required for proper determination of soil nutrient availability. In soils with a pH below 6.0, adding lime is essential to make the soil less acidic and to improve red clover's nitrogen-fixing activity. Nutrients should be added to the soil on the basis of a soil test. Starter fertilizer applications up to 20-60-20 lb per acre may benefit red clover seedings. Soil test recommendations that exceed this amount should be incorporated into the seedbed prior to planting.

Nitrogen (N) is essential for amino acid and protein production. Atmospheric N is captured (fixed) and converted into plant N by well-nodulated plants. On acid soils with pH less than 5.5, nodulation and N fixation are suppressed and fertilizer N should be supplied for vigorous growth. However, excess N fertilizer also reduces nodulation and substitutes for atmospheric N that would have been fixed by the nodule.

Red clover should be top dressed annually with fertilizer (using soil testing as a guide for determining fertilizer requirements) as long as the plant numbers are sufficient for economic production. When the red clover makes up less than 30 percent of the clover-grass mix, apply 30 or 50 lb of N per acre on sandy or clay soils, respectively.

SUMMARY

Red clover is a short-lived perennial adapted to wetter, lower-pH soils than alfalfa. It is a vigorous establisher and good yielder in the establishment year. It is very well suited for use as the forage legume in short rotations with corn. Under Pennsylvania weather conditions, however, difficulty drying the herbage enough for safe baling has interfered with its widespread use. Growing red clover for silage production circumvents that problem.