

**W**hite clover (*Trifolium repens* L.) is the world's most widely grown clover. White clover originated in the Mediterranean region and was subsequently spread throughout Europe by wind, water, birds, and grazing animals. It was cultivated in the Netherlands in the 1600's and introduced into England in the 1700's. Early European colonists who had recognized its value as a pasture plant brought it to America. White clover evolved in areas characterized by fertile soils and good soil moisture. Its evolution and spread was closely associated with the domestication of grazing animals.

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# White Clover

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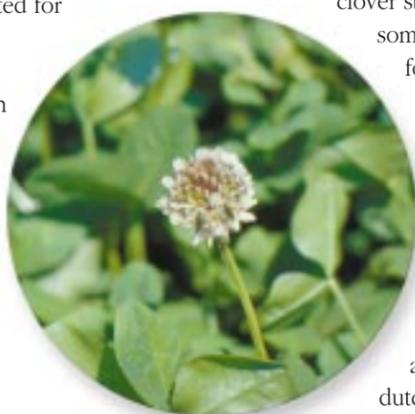


## ADAPTATION AND USE

White clover grows best in humid areas of the temperate zones during cool, moist seasons. Optimum growth and persistence occurs on fertile soils with adequate soil moisture availability and when competition from other plants is minimized by grazing or clipping. It is not tolerant of drought or extremes in soil pH. White clover provides high quality grazing, is an excellent nitrogen-fixing perennial legume, and can play an important role in soil conservation, soil improvement, and crop rotations.

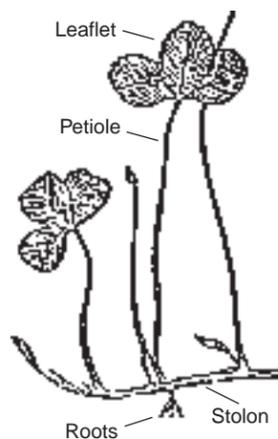
White clover is most often grown in association with cool-season grasses (orchardgrass, Kentucky bluegrass, perennial ryegrass, tall fescue, brome-grass, and to a small extent with perennial warm season grasses. White clover supplies nitrogen and improves the nutritive value of pastures. It is one of the most nutritious and palatable of all legumes. Although white clover is best suited for grazing, it can be used for haylage, hay, soil improvement, and reclaiming disturbed lands. Yields are lower than for red clover or alfalfa when harvested for hay or haylage.

White clover is more widely adapted within the United States than any other clover species. It is a common component in cool season perennial grass pastures, especially east of the Mississippi river and in humid portions of the Pacific Northwest. Though less common in warmer and/or drier areas, it can be grown or found in specific sites across the nation.



## DESCRIPTION

White clover is a low growing short-lived perennial, and in areas where it is well adapted, individual plants will often live for 3 to 5 years. In more stressful environments such as the lower South, it often survives only 1 to 2 years. It is a leafy plant that often grows 8 to 12 inches tall and that spreads by stolons (above-ground runners) and forms shallow roots at nodes (Figure 1). Leaves are non-hairy and usually marked with a white "V". White flowers are clustered into heads. Seeds are extremely small with over 700,000 per pound. Together with surviving plants and natural reseeding, a white clover stand will sometimes persist for many years.



**Figure 1.** White clover spreads by creeping stems (stolons) that root at the nodes.

Three types of white clover, based on plant size, are grown in the USA. Small white clover, generally referred to as "wild white" originated in England. The "intermediate" types are larger than wild white clover. Many unnamed varieties of white clover sold in the USA are intermediate types and are referred to as "common" or "white dutch," white clover. Large leaf white

clover, "ladino", is taller growing and may produce more forage than intermediate types, but does not persist as well in stressful environments or with grass competition. Ladino types are most commonly seeded for pasture in the USA.

## ESTABLISHING THE CROP

Getting a good stand of white clover is a first and critical step to success with this high quality, persistent crop. Since white clover is usually grown with a cool season perennial grass, it is usually either seeded at the same time as the grass or seeded into an existing grass stand. Regardless of when it is seeded, certain principles and practices are important for success. These will be discussed below; however, readers should refer to state and local sources for specific recommendations for their area.

**SOIL SELECTION:** White clover grows best in moist, well-drained, fertile soils. Because of its shallow root system, it does not grow well on dry soils. The shallow root system also limits production during hot, dry summer months.

**FERTILITY:** The most important investment in a fertility program is a soil test, which will indicate soil needs with regard to pH, phosphorus, and potassium. White clover yields better and stands last longer when grown on soils with a medium level of phosphorus and potassium. A pH of 6.0 - 6.5 is usually recommended for excellent yields and stand persistence. In some states, minor elements may also be recommended. Refer to state

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### ...ESTABLISHING THE CROP *continued*

recommendations for specific elements and rates.

Fertilization with nitrogen is not recommended when seeding white clover into grass. Nitrogen will stimulate the grass, thus providing more competition for the white clover seedlings during establishment. This becomes even more of a problem when seeding white clover into established grass pastures. Increased grass competition from added nitrogen can result in death of white clover seedlings. In most states, application of nitrogen to established clover/grass mixtures is not recommended if white clover occupies 20% or more of the ground cover.

**VARIETIES:** White clover varieties with higher yield, greater persistence and better pest resistance have been developed and released by private and public plant breeders. Careful selection of the best varieties for a given situation can be one of the most important factors affecting yield, persistence, and potential profit. Several universities conduct variety tests in replicated, unbiased field studies. Research from university variety trials have shown considerable differences among existing varieties. Even though only a limited number of varieties may be marketed in an area, careful consideration of the varieties available can pay big dividends relative to yield and persistence. State variety test reports are the best source of information on performance of varieties. It is important to select high quality seed with a high germination percentage and low amounts of weeds and other foreign materials. If not pre-inoculated, seed should be inoculated before planting with proper strain of bacterium.

**SEEDING RATE:** Seeding rates vary with geographic location, seeding method, and seeding mixture. In general, rates of 1 to 3 pounds per acre are recommended.

**SEEDING DEPTH:** The ideal seeding depth is approximately 1/4-inch, but under favorable weather and soil conditions, seed present on the soil surface may germinate and become established. Good seed-soil contact is important to ensure rapid germination and emergence.

**SEEDING DATE:** In the Southern USA, white clover is seeded in late winter or early spring and in late-summer-autumn. In the Northern USA, most white clover is seeded in late winter-early spring.

**SEEDING METHOD:** White clover can be seeded by many no-till or minimum till techniques and by broadcast-seeding on closely grazed grass pastures. In conventional seedbeds, white clover is almost always seeded with a perennial grass.

**Renovation seedings** – Throughout much of the eastern USA, white clover is mainly seeded into existing pasture (especially tall fescue) and/or hay fields. Research and farmer experience have shown that establishing white clover into a grass-dominant pasture or hay field can increase yields, improve forage quality, lower nitrogen fertilizer costs, and extend the grazing season. Keys to success with renovation seedings are similar to other establishment methods and include fertilizing as needed, suppressing existing vegetation (by grazing, close clipping, and/or use of herbicides), using high quality seed, inoculation of seed, planting at an appropriate time with the correct amount of seed, ensuring good seed-soil contact, and controlling pests.

**PEST CONTROL:** Fields should be monitored for pests (insects, diseases and weeds) during establishment. If problems arise, rapid identification of the problem and implementation of a control strategy is critical. Control



strategies may include cultural practices such as mowing to suppress weeds or use of pesticides to control insects. Whenever pesticides are used, it is important to read and follow all label instructions.

The goal of establishment is to have rapid germination and emergence, quick ground cover for erosion control, and ultimately a dense stand of white clover with the desired amount of grass. High yields and high forage quality will not be achieved if a good stand is not obtained during establishment. The establishment principles mentioned will not guarantee success, but will increase the chances of success.

## MANAGEMENT

Once established, a white clover/grass stand needs to be managed properly in order to obtain high yields, high quality, and adequate stand persistence. Some important considerations are as follows:

**FERTILITY:** Adequate amounts of lime, phosphorus, potash and minor elements are needed to produce high yields of white clover and to maintain desirable stands. Nitrogen is supplied by nitrogen-fixing bacteria in nodules of properly inoculated white clover. Except for seed production and in certain geographic locations, minor elements are usually supplied in adequate quantities by the soil. In general, lime, phosphorus, and potassium are the critical elements for white clover-grass production. White clover requires a higher pH, as well as more phosphorus and potassium than most grasses. Low potassium is a major reason for poor white clover growth. In many areas, about 2 pounds of boron should be applied/acre/year if good seed production is desired. A soil test should be used as a guide in determining the amounts of fertilizer and lime needed.

**PEST CONTROL:** Pests including diseases, insects and weeds can reduce yield and quality, weaken stands, and kill plants. Various strategies can be used to combat the different types of pests.

**Diseases** – PREVENTION is the first line of defense. Selecting varieties with disease resistance is the best disease control strategy. Timely harvest also will reduce most foliar diseases.

**Insects** – Many insects can feed on white clover reducing yield and quality, weakening stands, and killing plants. Although many different insects may occasionally attack white clover, it is unusual for producers to have to spray an insecticide. If insect problems occur, early identification of the insect will permit cultural/chemical controls to be used on a timely basis.

**Weeds** – The best weed control is provided by a vigorous white clover-grass stand. If necessary, white clover-grass stands can be mowed to remove grass leaves and seedheads and to suppress broad-leaf weeds and woody vegetation.

## HARVESTING

White clover tolerates grazing very well; however, close continuous grazing can weaken a stand. By subdividing pastures into three or more paddocks, rotational grazing can be used to increase stand life and improve forage utilization. In periods of excess production, some paddocks can be left ungrazed and cut for hay. Short rest periods of two to three weeks allow the clover to renew its vigor. Rotational grazing also makes it easier to mow for weed control or to spread manure piles.

White clover is a short-lived perennial, and thus some effort is required to maintain it in pastures. Ladino does not reseed as well as common or white dutch types of white clover. Therefore, it will be necessary to sow some seed of ladino clover periodically to maintain adequate stands, particularly in more stressful environments where it survives only 1 or 2 years.

**PASTURE QUALITY:** White clover is high in nutritive value partly because only leaves and flowers are grazed. White clover is higher in crude protein than birdsfoot trefoil, alfalfa, or red clover. It is also quite palatable and highly digestible.

In a ten-year Virginia study with orchardgrass and tall fescue, ladino clover or grass mixtures which received no nitrogen fertilizer were compared with grass fertilized with 200 pounds of nitrogen per acre per year. Steers grazing the grass-ladino clover mixtures gained about 17% more than steers grazing the nitrogen-fertilized grasses alone. The grass-clover mixtures were also more palatable than the grasses fertilized with nitrogen.



## ANIMAL DISORDERS

Animal disorders can occur even on highly managed-high quality pasture such as white clover/grass. The most common disorder associated with white clover pastures is bloat.

Bloat describes a digestive disorder of ruminants characterized by over-distension of the rumen with gas. It is a serious, practical, livestock problem resulting in significant economic losses each year. Even greater economic loss results from limited use of high-quality legumes such as ladino clover in pastures because of the fear of bloat.

Cattle may bloat on white clover pastures under certain conditions. This problem can be minimized by proper management. Bloat is more likely to be a problem when:

1. Clovers make up 50% or more of the pasture forage
2. Cattle are first placed on clover pastures when they are very hungry
3. The pasture is lush and lots of forage is available
4. The forage is wet from dew or rain

Special precautions should be taken during these times.

Although it may be impossible to prevent all bloat, some precautions can greatly reduce the incidence of this problem on white clover pastures:

- 1) grow grass with white clover
- 2) never turn hungry animals into a lush white clover stand
- 3) cull chronic bloaters
- 4) put animals on white clover only when plants are free of surface moisture (dew or rain)
- 5) if risk of bloat is high, feed bloat preventing compounds and provide dry hay

A combination of the above management practices can reduce or eliminate the incidence of bloat.

## SUMMARY

White clover is the most widely grown clover in the world. It is an excellent pasture legume and is usually grown in association with cool season grasses. White clover grows best in humid areas of the temperate zones during cool, moist seasons. It provides high quality grazing, is an excellent nitrogen-fixing perennial legume, and can play an important role in soil conservation, soil improvement, and crop rotations.