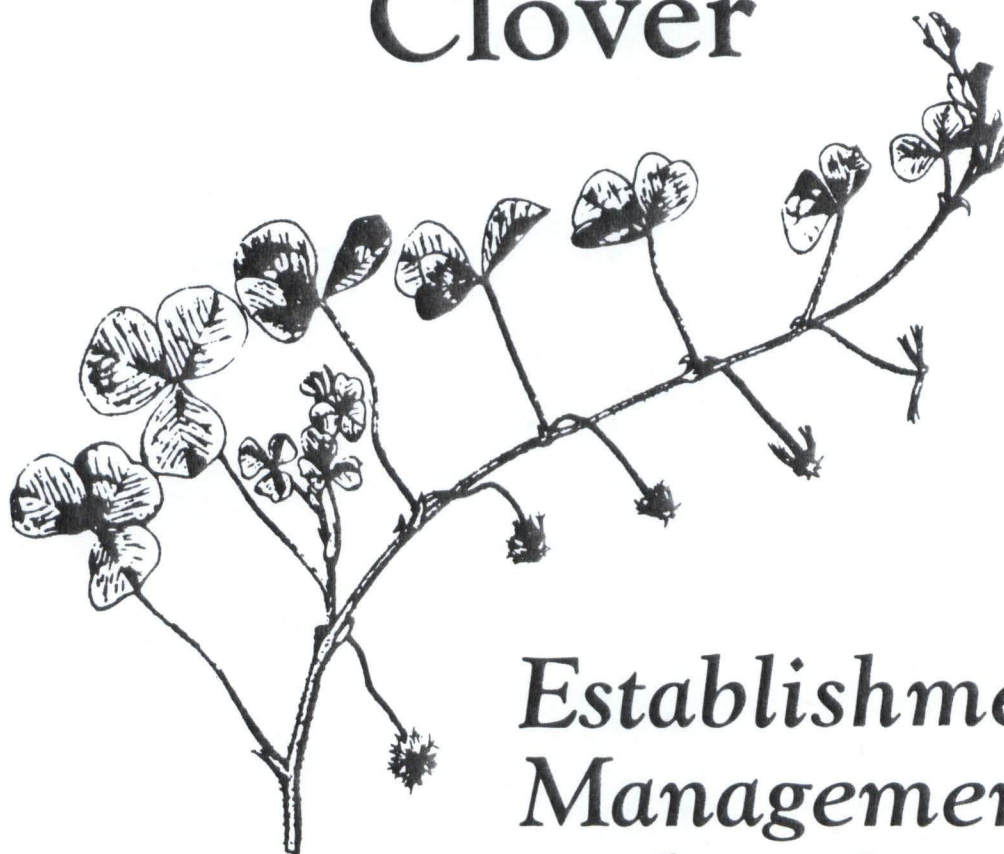


# Subterranean Clover



*Establishment,  
Management,  
and Utilization  
in Texas*

# Subterranean Clover Establishment

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The greatest challenge most forage producers face is obtaining a quick and thick stand of clover. The degree of land preparation can vary from extensive to none. An excellent job of land preparation and seeding is still at the mercy of the weather following planting. The right amount of rain at the proper time can turn a poor job of planting into a success. The weather cannot be controlled, but there are certain management practices that can be used to improve the chances for attaining a good subclover stand.

## Preplanting Activities

Steps for successful establishment begin several months before the desired planting date. Taking a good soil sample is the initial step and serves two purposes. Soil analysis identifies nutrients that are limiting and how much will be required for good plant growth. The second purpose is to determine the soil pH to aid in selecting the best adapted variety. Most subclover varieties do well at a soil pH of 6 to 7. If the pH is around 7.2 or higher, only Koala or Clare should be planted. This topic is discussed in more detail in the chapter on "Adaptation of subterranean clover to calcareous soils." Soils with a pH of 5.5 or lower will require lime.

Purchasing good quality seed insures a high germination percentage and limits the amount of weed seed a seed lot may contain. Texas seed law requires that agricultural seed sold in Texas must have a vendor's statement of analysis tag. This tag contains information on clover variety, where the seed was produced, percent pure seed, name and number of noxious weeds per pound of seed, percent germination and hardseed, and when the seed was tested. The seed law also requires that seed be tested within 9 months of being sold. The percent hard seed is very important since it will not germinate at planting but at some later date. Most of the subclover seed is produced in Australia. There is a small amount of seed production of Mt. Barker in Oregon. It is best to order seed at least one month before the desired planting date.

Legumes are added to pasture systems to utilize nitrogen gas from the atmosphere instead of nitrogen fertilizer. However, it is not the legume plant which can remove nitrogen from the atmosphere but *Rhizobium* bacteria. These bacteria enter the legume roots and live in nodules where they transform atmospheric nitrogen into forms that the plant can utilize. This nitrogen fixation process is maximized when each clover species is infected by a specific *Rhizobium* strain. To ensure that the maximum amount of nitrogen is fixed, the proper *Rhizobium* bacteria is applied to the clover seed before planting (inoculation process). Poor nodulation, or ability to fix nitrogen from the air, reduces clover growth and the clover's ability to compete with grasses and weeds. Subclover seedlings should have 3 to 8 nodules when they reach the three-leaf stage.

It is recommended that the correct inoculant (*Rhizobium* bacteria) be ordered at least 2 weeks before estimated planting date since local seed and feed stores may not keep it in stock. Be sure to check that the expiration date on the inoculant package has not expired and that subclover is listed on the package. Bacteria in the inoculant package are sensitive to sunlight and drying and therefore should be kept in a cool place such as an air-conditioned room until used. Inoculants which also include a special sticker such as Pelinoc-Pelgel by Nitragin Company are best because they hold the inoculant on the seed and extend the life span of the bacteria in dry soil.

## Prepared Seedbed

**Planting date.** Good germination of subclover does not occur until the daily low temperature reaches the mid-60's (1, 6). For the upper and middle Texas Gulf Coast, this generally occurs from mid-September to mid-October. An early planting date maximizes fall forage production before winter but also increases the risk of losing the clover stand to fall drought. Delaying the planting date for cooler temperatures increases the amount of time for germination and seedling establishment (7) and reduces the amount of fall forage production. However, there is less risk of drought. Subclover should not be planted later than early November.

**Seeding rates.** Subclover has an establishment advantage over the other clover species because of its large seed size. Subclover seedlings are more vigorous and have more leaves and nodules than crimson and arrowleaf clovers at 3 and 7 weeks after planting (3). This allows subclover to be a little more competitive with grasses and easier to establish than some of the smaller seeded clovers.

The general seeding rate recommendation for subclover is 10 to 16 lbs/A with a range of 4 to 20 lbs/A. This wide range in proposed seeding rates is due to the numerous factors affecting establishment, the amount of risk a producer is willing to take, and the distribution and amount of forage production desired. The influence of planting method and seeding rate on establishing subclover on a prepared seedbed is demonstrated in Table 1 (4). Increasing the seeding rate increases the amount of early forage production and a solid cover of subclover is formed sooner. Seeding rate effects on total forage production are not as dramatic. Broadcasting the seed resulted in the highest yields followed by narrow rows and then wide rows. Broadcasting the seed delayed competition between clover seedlings for light and moisture and produced a solid canopy of subclover quicker. Drilling the seed in rows resulted in early competition between clover seedlings within the row and delayed forming a solid canopy until the plants were big enough to cover the area between rows.



**Table 1. Influence of Planting Method and Seeding Rate on the First Harvest and Total Forage Production of Subclover on Prepared Seedbed (3-year average)**

Seeding rate	First harvest	Total yield	Planting method	First harvest	Total yield
	Pounds/Acre			Pounds/Acre	
4	437 e <sup>1</sup>	4,720 d	broadcast	1,122 a	5,843 a
8	688 d	5,222 c		5-in. rows	999 b
12	907 c	5,509 b			
16	1,085 b	5,891 a			
24	1,331 a	6,062 a	10-in. rows	782 c	5,282 c
32	1,354 a	6,068 a			

<sup>1</sup>Yields followed by the same letter within a column are not significantly different at the .05 level, Duncan's Multiple Range Test.

Excellent stands and production were obtained at the low seeding rate of 4 lbs/A because each year a good firm seedbed was prepared, the area was rolled after planting to insure good seed to soil contact and weeds were controlled with herbicides. The seeding rate needed for a satisfactory subclover stand increases as the seedbed become rougher and/or the weed and grass competition becomes more severe.

**Planting.** Subclover can be established most successfully on a prepared seedbed which is smooth, firm, and free of clods. A good seedbed also results in more control over planting depth. Best stands occur when seed are placed in the top one-half inch of soil. Covering the seed with soil also protects the inoculant on the seed which promotes nodulation and nitrogen fixation. Rolling, especially on loam and clay soils, insures good seed to soil contact which improves movement of moisture from soil to seed. Packing effect of the roller also reduces moisture loss from the soil surface. If planting on a well-drained sandy soil, drilling the seed in narrow rows about 3/4-inch deep may be more desirable. Moisture loss from the soil surface is rapid on sandy soils.

Planting clovers with a drill or sod seeder generally requires a small seed or clover seed box. The small grain seed box on a regular grain drill will work for subclover if high seeding rates (about 15 lbs/A or higher) are used. Lower rates can be put out if mixed with ryegrass. A general recommendation is to plant ryegrass at 10 lbs/A and mix in the desired amount of subclover seed.

There has always been a question concerning the benefit of adding nitrogen fertilizer to clover at planting. Some suggest a small amount of nitrogen will stimulate clover seedling growth while others believe a well-nodulated clover seedling will not respond to nitrogen. The controversy may be due to different responses by different clovers.

The response of subclover to nitrogen fertilizer applied at planting is reported in Table 2 (2). Nodules per seedling decreased as nitrogen rate increased in a pure subclover stand. The clover seedlings utilized the nitrogen fertilizer instead of taking their nitrogen from the air through the *Rhizobium* bacteria in the nodules. There was no change in leaves per seedling and only a slight increase in seedling weight. When nitrogen fertilizer was applied to a subclover-ryegrass mixture, there was no de-

**Table 2. The Effect of Nitrogen Fertilizer at Planting on Nodulation, Leaf Number, and Weight of Subclover Seedlings in a Pure Stand and Ryegrass Mixture Five Weeks After Emergence**

	Pounds of nitrogen/acre at planting			
	0	25	50	100
	<u>subclover alone</u>			
nodule number	16.1	13.4	11.5	8.6
leaf number	5.4	5.0	5.4	5.2
weight (mg)	73	77	81	80
	<u>subclover-ryegrass mixture</u>			
nodule number	14.9	14.8	15.0	11.7
leaf number	4.5	4.5	4.9	4.9
weight (mg)	57	61	64	65

crease in nodulation until the 100 lbs/A rate. It appears that the ryegrass was taking up most of the available nitrogen which prevented a decrease in nodulation up to the 50-lb rate. Grass and weeds can also retard subclover stands if high rates of nitrogen fertilizer are applied.

### Sod Seeding

Benefits of using any clover are maximized when it is grown with a warm season perennial grass such as bermudagrass, bahiagrass, or dallisgrass. Planting clovers in an established grass sod is less expensive than on a prepared seedbed. However, it is more difficult to obtain a good clover stand because of the grass competition. In October, when the clover should be seeded, the grass sod is still growing. The grass sod has a strong advantage over the emerging clover seedling for light, moisture, and nutrients. This grass competition must be reduced by grazing, disking, or mowing. Avoiding the use of nitrogen fertilizer in late summer and in the fall while subclover is becoming established has also improved the stand and quantity of subclover (5). This topic is discussed in more detail in the chapter on subclover reseeding.

Subclover drilled into a bermudagrass sod at Overton produced 49 percent more forage than when the seed was broadcast (8). Placing the seed in the soil surface has several advantages. There is good seed to soil contact which improves germination. Seed in the soil develop a better root system quicker than seed germinating on the

soil surface. Survival of the *Rhizobia* bacteria on seed in the soil is better because it is shaded from the sun. Success with broadcast seed on a grass sod is improved if planting is delayed until November when temperatures are cooler. However, early and total subclover forage production is reduced.

### Literature Cited

1. Evers, G. W. 1980a. Germination of cool season annual clovers. *Agron. J.* 72:537-540.
2. Evers, G. W. 1980b. Effect on nitrogen on subclover nodulation and seedling growth. *In Forage Research in Texas*, p. 81-82. Texas Agric. Exp. Stn. Departmental Technical Report No. 80-6.
3. Evers, G. W. 1982. Seedling growth and nodulation of arrowleaf, crimson and subterranean clovers. *Agron. J.* 74:629-632.
4. Evers, G. W. 1984a. Subterranean clover establishment. Texas Agric. Exp. Stn. MP-1565.
5. Evers, G. W. 1984b. Effect of nitrogen fertilizer, clovers and weed control on Coastal bermudagrass and Pensacola bahiagrass in Southeast Texas. Texas Agric. Exp. Stn. MP-1546.
6. Jones, M. B., P. W. Lawler, and A. H. Murphy. 1971. Establishment of subclover in relation to nodulation, time of seeding, and climatic variations. *J. of Range Management* 24:147-150.
7. Raquese, C. A., F. K. Fianu, and J. W. Menke. 1970. Development of subterranean clover (*Trifolium subterraneum* L.) at very early stages. *Crop Sci.* 10:723-724.
8. Rouquette, F. M. and M. J. Florence. 1982. Establishment of subterranean clover and annual ryegrass in a Tifton 44 bermudagrass sod. *In Forage Research in Texas*, p. 120-123. Texas Agric. Exp. Stn.