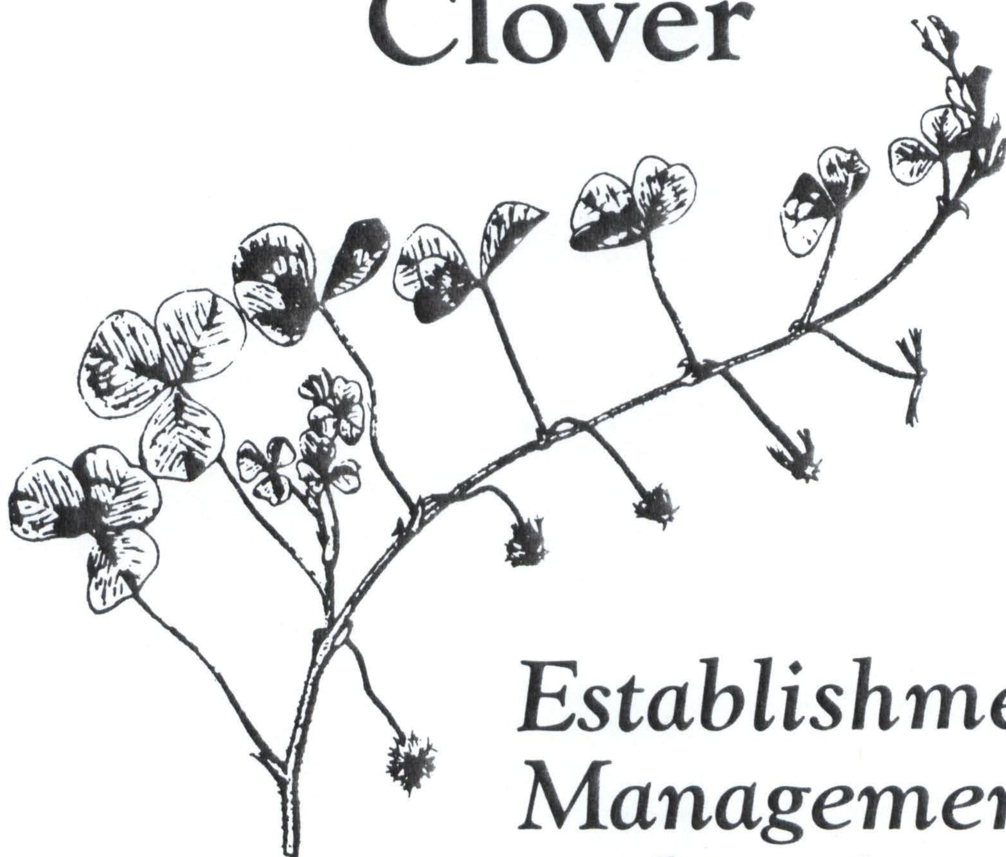
PUBLICATIONS
1988

MP-1640
March 1988

Subterranean Clover



Establishment, Management, and Utilization in Texas

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CHAPTER 9

Managing Subterranean Clover for Persistence

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Subterranean clover is an annual and must come back from seed each fall. Volunteer reseeding is desirable because it eliminates the annual costs of seed, inoculant, and planting. Volunteer stands generally come up earlier and thicker than planted stands which results in earlier forage production. Subclover growth habit and method of seed formation lends itself to good seed production even under grazing which is not the case with most other annual clovers. Successful reseeding of subclover is dependent on numerous factors.

Seed Production

The first step to obtaining a thick volunteer subclover stand in the fall is the production of a good seed crop the previous spring. Subclover is capable of producing seed even when it is grazed very short. However, close grazing does reduce leaf area and general vigor of the plant. More moderate grazing to a 2- to 3-inch height will increase the amount of seed produced. Research in Oregon has shown that seed production is maximized when subclover pastures are grazed until early burr formation (17). Moisture stress during flowering and seed maturation also reduced seed yield, number, and size. Under good management and climatic conditions in Oregon, subclover produces in excess of 500 lbs of seed per acre. Research under Texas conditions indicate seed yields to be in the range of 200 to 400 lbs/A (6).

Summer Pasture Management

The two primary factors affecting the percent clover in a grass mixture is pasture height and available nitrogen (3). Short grazing (2 to 4 inches) and low soil nitrogen favor the clover. However, management of the grass pasture during the summer, when the clover is absent, can also affect subclover reseeding the following fall. Clover forage production averaged 37percent less when 100 lbs nitrogen per acre were applied to Coastal bermudagrass and Pensacola bahiagrass the previous summer (4) (Table 1). The nitrogen fertilizer increased the grass growth and made it more competitive to the subclover seedlings trying to get established in September. Subclover growth, reseeding, and persistence are improved if nitrogen fertilizer is not applied to grass pastures during the summer.

Discing a subclover pasture in August helps move the seed from the soil surface into the soil and reduces competition from other plants. This allows for better seed to soil contact and a better established seedling to tolerate poor fall moisture conditions. This practice fits into a management system where subclover is grown with ryegrass and/or small grains for temporary winter pasture on prepared seedbed. Discing is required for the replanting of the ryegrass and/or small grain.

Reducing Fall Grass Competition

The greatest deterrent to an emerging subclover seedling is the competition for light and moisture from a well established warm season perennial grass. The more the grass is suppressed, by whatever means, the better the chances for good clover establishment (9). There are various methods for retarding grass growth.

Grazing. Grazing is the most desirable method of grass suppression in terms of economics, efficiency, and clover

Table 1. Response of Subclover to Nitrogen Fertilizer Applied the Previous Summer

	Coastal bermudagrass		Pensacola bahiagrass		
	1979	1980	1979	1980	Avg.
	Pounds/Acre				
Mt. Barker sub.	4,520	2,250	3,840	2,390	3,250
Mr. Barker sub. +100 lbs N/A	3,420	180	3,370	1,180	2,040

stands. There are no additional costs involved. Most calves have been sold by September which allows the pasture to be grazed short (1 to 2 inches) without any weight loss to dry cows. Stocking rates in excess of two cows per acre may be required to keep pastures grazed short. Producers are advised not to put more than 50 to 70 percent of their pastures in clovers in order to be able to stock their clover pastures properly in the fall for good reseeding.

Table 2 shows the effect of terminating grazing at different times in the fall and mowing on percent and yield of volunteer subclover. Other components of the January 29 harvest were ryegrass, weeds, and dead dallisgrass and common bermudagrass. There was a general increase in percent and yield of clover as the grazing season was extended to October 3. Although subclover began to volunteer in late August, there was less damage to the clover stand from the grazing cattle than from the competiting grass if the cattle were removed. Clover percent and yield were higher at the second harvest on April 2 because the mature grass and weeds were removed at the earlier harvest. The best clover performance occurred when the cattle were allowed to graze until October 3. Volunteer clover pastures could probably be grazed until November 1 or later. The key is to continue grazing until cool temperatures limit grass growth but are still mild enough for clover growth.

Mowing or hay crop. Removing the grass cover by mowing or as a hay crop is an alternative if cattle are not available. An early October hay cutting did help clover performance when grazing was terminated in August or September (Table 2). The benefit from mowing will depend on the amount of competition from the grass and weeds in the pasture. There are several limitations to this practice. Some subclover seedlings which may emerge in late August and September will be lost because of the grass cover which will result in a later and thinner clover stand. There is also added labor and equipment expense. A shredder will not cut as low as a disc mower or grazing livestock. A timely hay cutting may not be possible because of weather or availability of custom hay balers.

Herbicides. Another method to reduce grass competition is the use of herbicides as desiccants. The objective is not to kill the grass but only the top growth similar to the first frost in the fall. Gramoxone, Roundup, and Dalapon are approved for sod seeding. They are discussed in more detail in Chapter 10.

Table 2. Effect of Grazing Termination Date and Mowing on Sub-Clover Percent and Yield in a Volunteer Clover-Ryegrass Mixture on a Dallisgrass-Common Bermudagrass Sod

	Grazing Terminated					
	20 August		9 September		3 October	
Date mowed	%	lbs/A	%	lbs/A	%	lbs/A
			29 January			
Control	3	86	20	338	30	903
6 Oct.	15	223	28	306		
3 Nov.	13	100	24	110	22	150
4 Dec.	13	15	16	28	28	36
			2 April			
Control	8	187	28	714	50	1,508
6 Oct.	40	1,130	35	1,157		
3 Nov.	40	1,059	50	791	58	1,370
4 Dec.	43	1,167	48	1,303	58	1,442

There is a research effort at the Yoakum (8) and Angleton (5) stations to identify herbicides which act as grass desiccants, but are not toxic to clover seedlings which may be present. This would permit the use of these chemicals on pastures where the clover has already emerged. The ideal chemical for sod seeding would be one that desiccates quickly, is effective for 2 to 3 months, is not toxic to cool season forages being seeded, and allows good recovery of the warm season perennial grass in the spring.

Limitations of the three approved herbicides can be seen in Table 3 when used on dallisgrass. Paraquat provides quick desiccation and good grass recovery but does not hold dallisgrass long enough for sod seeded crops to get established. Glyphosate has good desiccation but poor dallisgrass recovery. Dalapon has slow but good dessication, but also reduces the dallisgrass stand. Fusilade and Poast do not harm clover and may have some potential as sod desiccants on dallisgrass.

Coastal bermudgrass is more tolerant of these post-emergence grass herbicides than dallisgrass (4). Poast, Selectone and Verdict demonstrated the best combination of bermudagrass desiccation and spring recovery.

Germination Inhibition Mechanisms

The continued existance of any annual plant species is dependant on seed survival. Mature seed must be capable of enduring adverse climatic conditions and germinate when the environment is favorable for plant growth and reproduction. Two germination inhibition mechanisms influence seed survival of subclover.

Hard seed. The production of hard or impermeable seed by subclover reduces summer germination when stands would be lost due to low soil moisture and high temperatures (14, 15). Hard seed enhance the long-term stand persistence by building a seed reserve in the soil for regeneration following stand failures or crop rotations (7).

Both plant genotype and environment affect the level of hard seed production in subclover (1, 13). However, recent studies indicate that environmental effects may be more important than previously recognized (16). The rate of hard seed breakdown is also dependent on

Table 3. Herbicide Evaluated as Sod Desiccants on Dallisgrass

Herbicide	Rate (A.I.) lbs/A	Application before seeding	Desiccation rating[1]	Ryegrass stand %	Dallisgrass recovery[2]
Control	—	—	0	6	5.00
Paraquat	0.5	1 day	4.0	10	4.75
Glyphosate	0.5	1 wk	5.0	100	0.75
Dalapon	3.75	3 wk	1.75	100	1.00
Fusilade	.06+CO[3]	3 wk	2.0	14	3.75
Fusilade	.12+CO	3 wk	4.5	72	1.00
Fusilade	.25+CO	3 wk	5.0	100	0.25
Poast	.12+CO	1 wk	1.0	11	4.50
Poast	.25+CO	1 wk	2.25	18	3.25
Dowco 453	.06+CO	3 wk	5.0	100	1.00
Dowco 453	.12+CO	3 wk	5.0	100	0
CGA-82725	.12+CO	3 wk	2.75	14	3.25
CGA-82725	.25+CO	3 wk	2.75	22	2.00
L.S.D. .05			0.6	9	1.00

[1]0 = no desiccation, 5 = 100% desiccation.
[2]Recovery ration 0 = no dallisgrass, 1 = 20%, 2 = 40%, 3 = 60%, 4 = 80%, 5 = 100% recovery.
[3]Crop oil at 1 qt/A.

both plant genotype and environment (16, 18). Extremes of soil moisture availability during subclover seed maturation can adversly affect hard seed production and rate of softening. At one of five California sites, the hard seed level of Mt. Barker subclover declined slowly with 38 percent hard seed recorded in October (19). The remaining four sites were low in soil moisture during seed maturation and the hard seed level dropped rapidly until all seed were permeable in October. In Mediterranean climate regions (wet mild winters—dry hot summers) low soil moisture after flowering limits subclover hard seed development (13). Both a long seed development period and a high degree of drying after maturity are required for optimum development of high quality hard seed in subclover (1).

Thirty-three subclover lines, including 14 registered cultivars, were evaluated for reseeding at Angleton and Overton, Texas over a 2½-year period (6). Summer and fall germination in the first reseeding year depleted 70 to 99 percent of the seed crop from the subclover cultivars evaluated. Mt. Barker and Woogenellup germinated over 96 percent of their seed crop in this first summer and fall period. Results from this study indicates that one adverse fall season with several stand failures would eliminate most subclover cultivars from the pasture system. The cultivars Meteora and Esperance were marginally better than other cultivars in second year reseeding at Angleton and Overton, respectively. Several breeding lines with better apparent reseeding were also identified.

Mt. Barker, Mississippi ecotype, and several experimental subclover lines were evaluated for hard seed production and rate of softening over three seed production years at Overton (G. R. Smith, unpublished). In 1984 and 1985, most lines produced 60 percent or more hard seed. In 1986, possibly due to high soil moisture during seed maturation, many lines exhibited a sharp drop in initial hard seed level. Rate of hard seed breakdown was influenced by production year and plant genotype. Seed production environment set the upper limit for hard seed level, but plant genotype determined rate of hard seed softening. Subclover breeding lines with more persistent hard seed than Mt. Barker were identified.

Seed dormancy. Seed or embryo dormancy in subclover may be defined as a delay of fully imbibed and viable seed to germinate (10). Seed dormancy in a conservation mechanism that prevents summer germination of soft subclover seed (12). Generally, seed dormancy is expressed at high temperatures (77°F) and can be broken by reduced temperatures (59°F), dependant on seed production environment and cultivar effects (10). The importance of seed dormancy as a seed conservation and reseeding mechanism is unknown for Texas environments.

Burr Burial

Burr burial is important in production of high quality subclover seed with a maximum degree of hardness and in seedling survival. Buried burrs produce larger seed and seedlings have an improved chance of survial from seed germinated below the soil surface (2). Buried seed are protected from some insects and from grazing animals. Subclover cultivars vary in their burr burial ability with Mt. Barker and Woogenellup rating low compared to Geraldton and Nungarin. Soil texture and compaction also affect the expression of this trait.

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