EM 8702
January 1998
50¢

SUBTERRANEAN CLOVERS

(Trifolium subterraneum)

R. Sattell, R. Dick, D. Hemphill, and D. McGrath

Subterranean clovers are cool-season annual legumes that grow in circular clumps 6–15 inches tall. Leaves and stems usually are slightly hairy. Their long, slender stems are prostrate and non-rooting, often forming a thick, intertwined mat over the soil surface.

Inconspicuous, self-fertilized, white flowers are located under the leaves. As the seed develops, the flower stem bends to the ground, eventually pushing the seed below the soil surface. Seed size is relatively large for clovers—approximately 70,000 seeds/lb.

These clovers have a taproot and many fibrous branching roots. Generally, the root system of subclovers is larger and contains more nitrogen (N) than other clovers. Approximately 40 percent of the N in a subclover plant is below ground.

Fall and winter growth is slow. Nearly all dry matter production occurs in spring, when subclover grows rapidly. Most varieties mature in May, but maturity dates vary widely. Percentage of hard seed also varies among varieties.

Environmental preferences and limitations

Subterranean clovers do well in Mediterranean climates of cool, wet winters and hot, dry summers. They tolerate temperatures down to approximately 5°F. Although they prefer well-drained soils, many varieties do well on waterlogged soils. 'Karridale' subclover in the mid-Willamette Valley was observed to survive a week of complete flooding.

Subclovers may be grown on loam to clay soils. Tolerance to soil pH varies among varieties, but in general the species is best adapted to moderately acid or neutral soils. Subclovers often respond to liming. Decreased development of N-fixing root nodules has been observed on soils of pH 5.0 or lower, and iron deficiency may be a problem on soils with high pH.

Subterranean clovers have moderate shade tolerance.

Uses

Subclovers are used for forage and hay and have been used successfully in Oregon as fall-planted and relay-interplanted cover crops in annual rotations. They are capable of accumulating substantial amounts of N, a portion of which is available to the following crop. Rapid growth suppresses weeds in spring.

Although subclovers' mat of creeping stems is suitable for erosion control, ground cover usually is not complete before winter rains begin. Growing subclover in mixtures with grasses or cereals that exhibit fast fall growth increases fall N-scavenging and winter soil protection. However, dense stands of grass or cereal compete with subclover for light in spring.

Subclovers' low growth habit, relative shade tolerance, and ability to reseed make them ideal for use as a cover in vineyards and orchards, where they often are planted in mixtures of grasses and/or other legumes. Unlike most other clovers, subclovers can produce seed under close grazing or mowing. Mowing before flowering actually increases seed yield.

Dry matter and N contributions

In a Willamette Valley trial, cover crops were planted in mid-September and sampled in mid-April. 'Karridale' subclover produced 1.1–3.3 tons dry biomass/acre (average 2.4) and 37–159 lb N/acre (average 114) during the 3 years it was grown. 'Mt. Barker' subclover was planted 2 years and yielded 0.6 and 2.8 tons dry biomass/acre, and 35 and 135 lb N/acre. 'Northam' subclover also was planted 2 years and yielded 2.6 and 3.6 tons dry biomass/acre and 114 and 132 lb N/acre.

Management

Best stand establishment is obtained by drilling into or broadcasting over a smooth, firm

Quick facts: Subterranean clovers

Common names	Subclover or subterranean clover
Hardiness zone	7 (see Figure 1)
pH tolerance	5.5–7.5; optimum is 6.5
Best soil type	Wide range
Flood tolerance	Moderate to high
Drought tolerance	High
Shade tolerance	Moderate
Mowing tolerance	High even when mown close to the ground
Dry matter accumulation	2.5 tons/acre
N accumulation	115 lb/acre
N to following crop	Half of accumulated N
Uses	Excellent for perennial systems where close mowing is practiced. Use as relay-interplanted or winter annual cover crop in annual rotations to smother spring weeds, fix N, and improve soil tilth.
Cautions	Can be a serious weed in annual vegetable rotations

OREGON STATE UNIVERSITY EXTENSION SERVICE

seedbed. Drill in narrow rows to a depth of ½ inch. Cover broadcast seed using a harrow or similar implement and roll if soil is dry. Drilling in narrow rows or broadcasting decreases competition between clover seedlings and creates a solid mat of growth more quickly than drilling in wide rows. Alternative seeding methods that can reduce seedbed preparation but require higher seeding rates are: drill into a rough seedbed prepared by disking, or broadcast over a rough or smooth seedbed and then disk lightly to cover the seed. If possible, irrigate dry soils to hasten germination and increase fall growth; otherwise plant before a fall rain.

Subclover roots need to be colonized by an *appropriate* strain of rhizobia bacteria to be able to convert atmospheric nitrogen into plant-available forms. Inoculating seed with the proper rhizobia bacteria ensures that the bacteria are present when the seed germinates. Use fresh inoculant, protect it from heat and light, and apply to seeds just before planting according to the manufacturer's directions. Cover broadcast seed with soil to protect inoculant from sunlight.

You may not need to inoculate if the appropriate rhizobia bacteria already are present in the soil. To find out, plant a section of the field with raw (non-inoculated) seed and watch for differences in growth.

In western Oregon, subclover generally is allowed to grow until at least mid-April because nearly all dry matter and N accumulation occur in spring with the onset of warm weather. Incorporate subclover residues with a disk approximately 3 weeks before planting the summer crop to allow time for decomposition.

When relay-interplanting, broadcast seed into a standing vegetable crop before the final cultivation. Increase irrigation frequency to keep the soil surface moist until the subclover is established (about 2 weeks).

Relay interplanting subclovers into sweet corn has produced mixed results in the Willamette Valley. Intense shade, seedling water stress, and heavy harvest residue often result in very thin stands. Varieties differ in their ability to withstand these adverse conditions. In a Willamette Valley trial, 'Karridale' subclover produced 1½ tons dry matter/acre and 80 lb N/acre (in above-ground plant material) when allowed to grow until May 1.

Mixtures of subclovers sometimes are planted when a self-seeding cover is desired so that the most adapted varieties will reseed. If you want subclover to reseed, remove vegetation in fall by close mowing or intensive grazing to make space for new plants.

Subclover can be killed with an appropriate herbicide. Consult your county agent of the OSU Extension Service for herbicide recommendations. Follow all label restrictions.

The subclover varieties used in Oregon do not have high estrogen levels, so they do not reduce lambing percentages when used for sheep pasturage. Neither will subclovers cause bloat.

Figure 1.—Oregon plant hardiness zone map. Subterranean clovers normally will survive in ***Zone 7*** *or any warmer zone. (Extracted from the USDA's national plant hardiness zone map, based on average annual minimum temperature in °F.) Zone 4 = -30 to -20; Zone 5 = -20 to -10 Zone 6 = -10 to 0; Zone 7 = 0 to 10 Zone 8 = 10 to 20; Zone 9 = 20 to 30*

Pest interactions

Subclovers can suppress weeds to some extent with their thick cover if a closed canopy is maintained. Close mowing or intensive grazing gives an advantage to the subclover. Subclovers themselves can become weeds in annual crop rotations.

Subclovers are subject to damage by root rot of the fungi *Pythium*, *Fusarium*, and *Rhizoctonia;* and to the viral diseases clover stunt, bean yellow mosaic, and red leaf. They also are susceptible to the fungus *Kabatiella caulivora*, which causes "clover scorch." Their low, dense growth is ideal for slugs.

Varieties/cultivars

'Karridale' subclover tolerates wet conditions and is resistant to all of the root rot fungi and viral diseases described above. It has outperformed 'Mt. Barker' in western Oregon.

For more information

World Wide Web

Orchard floor management information—http://www.orst.edu/dept/hort/weeds/floormgt.htm

OSU Extension Service publications—eesc.orst.edu

The University of California, Davis cover crop information—http://www.sarep.ucdavis.edu/sarep/ccrop/

Oregon Cover Crop Handbook

This publication also is part of *Using Cover Crops in Oregon*, EM 8704, which contains an overview of cover crop usage and descriptions of 13 individual cover crops. To order copies of EM 8704, send your request and $5.50 per copy to:

Publication Orders
Extension & Station Communications
Oregon State University
422 Kerr Administration
Corvallis, OR 97331-2119
Fax: 541-737-0817

Robert Sattell, faculty research assistant in crop and soil science; Richard Dick, professor of soil science; Delbert Hemphill, professor of agriculture; and Dan McGrath, Extension agent, Willamette Valley; Oregon State University.

Funding for this project was provided by the Oregon Department of Agriculture.

This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties. Oregon State University Extension Service offers educational programs, activities, and materials—*without regard to race, color, religion, sex, sexual orientation, national origin, age, marital status, disability, and disabled veteran or Vietnam-era veteran status*—as required by Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and Section 504 of the Rehabilitation Act of 1973. Oregon State University Extension Service is an Equal Opportunity Employer.