



## Establishment of Bird's-Foot Trefoil

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Trefoil should be established using "normal" tillage and seeding equipment wherever possible. When such equipment is used, the seed will be placed in a fine firm seedbed and will germinate and grow rapidly. But, the seed must be inoculated; the correct fertilizer must be used; and the competition from weeds and other crops has to be removed. Under such conditions, the trefoil plants will be well branched at the crown by early fall, they will overwinter and produce high yields during the first crop year. There will be no waiting for production.

### SEEDBED PREPARATION

Land, particularly fine textured (heavy) soils that cannot be worked until late in the spring, should be fall plowed, disked or harrowed and left in a rough condition over winter. If the land is rolling or hilly and subject to erosion, 1 to 1½ bushels per acre of oats can be sown in the fall. The oats will control erosion, will die during the winter and the residue will not interfere with cultivation in the spring.

In the spring, the land should be disked shallowly and harrowed to form a firm seedbed. Coarse textured (sandy) soils should be packed before and after planting to ensure a firm seedbed. Fine textured (clay) soils however, should be packed only after seeding.

### INOCULATION

Inoculation consists of coating the trefoil seed with a **proper strain** of bacteria. Once the seed germinates, the bacteria enter the root hairs and form a nodule. The bacteria living inside the nodule take nitrogen from the air and convert it into a form the plant requires.

Without this nitrogen the establishment and subsequent production of trefoil is poor. The seedlings do not develop. The leaves turn a pale yellow color. They cannot compete with broadleaf weeds or the accompanying grasses. Often such trefoil plants do not develop sufficient root and top to successfully overwinter and even if they do, low yields will occur in the succeeding year. One or two years are required before a sufficient population of bacteria develop in the soil to permit nodulation of trefoil that will allow healthy and vigorous growth of the trefoil.

It is **extremely important** to insure that trefoil seed is inoculated with the proper strain of bird's-foot trefoil inoculant prior to seeding. Under conditions where the inoculation "did not take" the trefoil stand can be

inoculated after establishment. This latter procedure must be considered a "rescue" operation only.

Seed may be inoculated by "Home Treatment" using a peat based inoculant, or seed can be purchased that has been "Pre-Inoculated" by the seed firm.

### Home treatment

Peat based inoculant can be purchased for home treatment of seed. The advantage of this method is that the inoculant can be purchased, stored in a refrigerator and the seed inoculated with viable bacteria. The major disadvantage to the use of this method is that bacteria must be fixed to every seed. If the following procedure is followed, good nodulation will result.

1. *Use the proper inoculant* A specific type of bacteria is required for trefoil. Inoculant for alfalfa or peas will not give proper nodulation on trefoil.
2. *Use fresh inoculant* Check the expiration date on each package of inoculant to ensure it is fresh. Once purchased, the inoculant must be stored in a cool place. The bacteria in the inoculant die rapidly at temperatures greater than 27°C (80°F).
3. *Inoculate the seeds just before planting* Do not inoculate large quantities in advance and store it for several days.
4. *Use a sticker* A sticker is recommended to keep the inoculant on the seed and distributed uniformly over the seed surface. Corn or maple syrup or molasses make good stickers. A mixture of one teaspoon of corn syrup or molasses in one cup of lukewarm water will dampen two bushels of seed. Excessive amounts of syrup or molasses will cause the seeds to stick together and flow improperly from the seeder.
5. *Use 2 or 3 times the recommended rate of inoculant* This is to make sure that enough bacteria are on the seed. Mix the inoculant and seed thoroughly so that all seeds are covered evenly with the inoculant.

### Pre-inoculated seed

Trefoil seed may be purchased that has been treated with the correct inoculant by the seed firm. Various patented processes have been developed. The processes vary from where the bacteria is fixed to the seed coat to that where the bacteria are encased with the seed in a pellet.

The major advantage of this pre-inoculated seed is that no time is required by the farmer to treat the seed at home. This saving of time may be important consideration in the spring. As pre-inoculated seed must be inoculated some time before the seed is sold, the viability of the bacteria may be reduced. The reduction in viability will depend upon the temperature at which the seed was stored from the time of inoculation to the time the seed was sold and planted. Generally, the bacteria will remain viable from 3 to 4 months if the seed was stored under cool dry conditions. Pelleted seed appears to have an advantage over other pre-inoculation methods as the bacteria are encased in a pellet and will withstand greater changes in temperature without a reduction in viability of bacteria.

It should be noted that if any type of pre-inoculated seed is "carried-over" from one season to another, the seed must be re-inoculated using the home treatment method.

### Rescue inoculation

Following the sowing of trefoil and emergence of the seedlings, it may become obvious that the trefoil is not nodulated. The first sign of lack of nodulation is the appearance of small plants (2 to 2½ inches tall) with yellow leaves. Lack of nodulation can be checked by



**Figure 1.** Unnodulated trefoil seedlings are pale yellow in color, small and weak (left). Usually they do not develop sufficiently during the seeding year to overwinter.

carefully digging a few plants, removing the soil and examining the roots for nodules. If trefoil plants are not nodulated, the following procedure can be used.

1. Thoroughly mix one bushel package of peat inoculant with sufficient fine sand to insure an even distribution for each acre.
2. Broadcast mixture over the surface of the soil when the soil is damp and in the evening, or on a cloudy day. Avoid broadcasting the mixture on a hot dry day.

### TIME OF SEEDING

Seedings made in April or early May have been the most successful. Dormant seedings (broadcasting seed on the surface of frozen soil during the late winter months) have been successful in some areas. Seed sown at these times takes advantage of spring moisture to germinate and develop prior to periods of summer drought. Early seeding is particularly important on coarse textured (light) and droughty soils. Late summer (July, August) seedings are not recommended. The seed may germinate but the seedlings do not have time to develop sufficiently to overwinter.

### SEEDING EQUIPMENT

Seed drills, packer seeders or broadcaster seeders can be used to sow trefoil. The main objective is to place the seed about ¼-inch below the surface of the soil. Packing after seeding covers the seeds and firms the seed bed.

Band seeding, a method where the seed is placed directly over a band of phosphorus fertilizer, has the following advantages: (1) the seedlings emerge rapidly and the plants are better able to resist the dry soil conditions of midsummer, and (2) under low soil fertility conditions, fertilizer is available for germination and seedling growth. Many of the new drills are equipped with band seeding attachments. Hoses are connected to each outlet of the forage seed box of the drill. The ends are fastened about 6 inches behind each disk and extend to 6 inches above the soil surface.

### DIRECT SEEDING OR COMPANION CROP

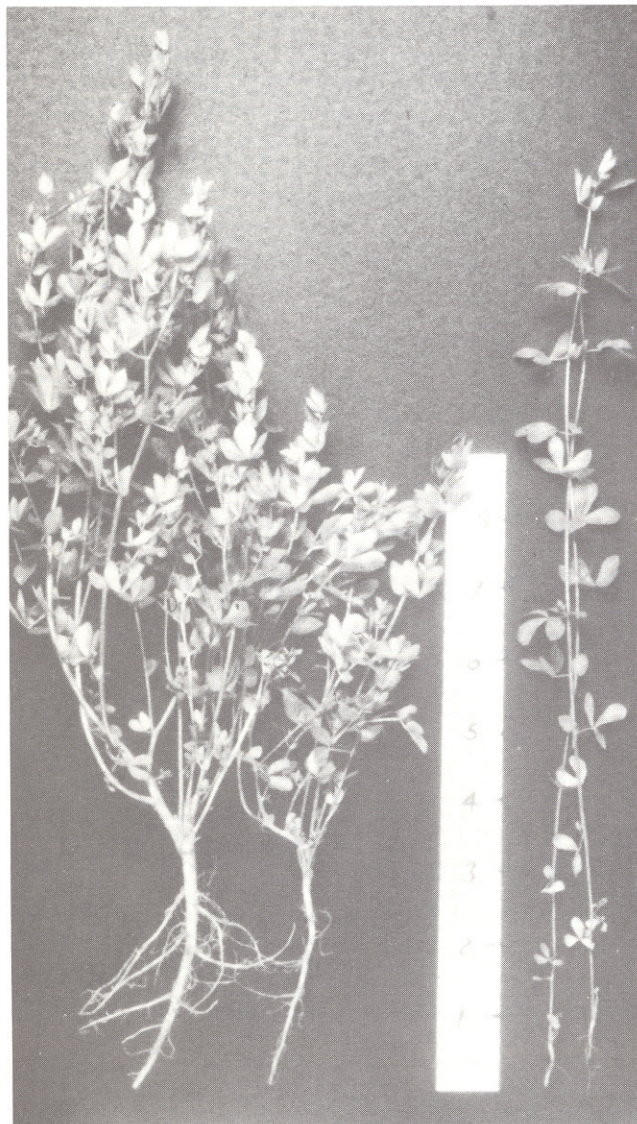
**Direct Seeding** Best results are obtained if trefoil is seeded without a companion crop. The companion crop competes with trefoil for light and moisture and reduces seedling growth and nodulation. These small plants usually winterkill. Where no companion crop is used, reasonably high yields can be expected the year after seeding. Little production should be expected from trefoil in the seeding year, using either seeding method.

#### Grain Companion Crops Reduce Yield of Trefoil

Establishment	First Crop Year lb/ac DM
No oats	7800
Oats (1½ bu/ac)	6900

**Companion Crop** In order to have a harvestable crop during the seeding year, some farmers wish to seed with a

companion crop. Oats, seeded at 1½ bushels per acre, is the best grain crop to use with trefoil. Barley or mixed grains are more competitive to trefoil than oats. If the companion crop is to be removed as grain, it is advisable to sow the oats in 14-inch drills (plug every other run of the drill adjust the feed mechanism to read 3 bushels per acre). These wide drill spacings permit trefoil to develop rapidly. If you plan to pasture the companion crop or cut it for green feed or silage, the oats can be sown in 7-inch drills at 1½ bushels per acre. Pasturing when the oats are 10 to 12 inches tall, or cutting for silage at the medium dough stage, removes the competing oat crop at the early dough stage and will allow time for the trefoil seedlings to develop into sturdy plants before winter.



**Figure 2.** Direct seeding (no companion crop) results in vigorous, well established trefoil plants by the fall of the seeding year (left). If a companion crop is desired, sow oats in 14-inch drills.

## WEED CONTROL

Annual broadleaf and grass weeds grow rapidly during trefoil establishment and compete with trefoil seedlings

for light, water and plant nutrients. These weeds should be controlled by herbicides and/or clipping.

2,4-DB and Eptam are available for use in trefoil establishment. Each of these herbicides however, have different effects upon the grass, legume and companion crops. Care should be used in selecting the correct herbicide to best suit the situation.

2,4-DB can be used on pure trefoil and on trefoil-grass mixtures sown with or without a companion crop. This herbicide will not affect grasses or the companion crop and will control most annual broadleaf weeds. 2,4-DB should be applied postemergence at 16 ounces per acre (active) when trefoil has three true leaves. Trefoil growth may be suppressed for a period of 2 to 3 weeks. Where adequate moisture is available, the trefoil will recover. Injury to trefoil may be severe and plants may be killed if the chemical is applied during dry, hot conditions.

Eptam, preplant incorporated, should be used only when **pure** sowings of trefoil are to be seeded **without** a companion crop. The grass as well as the companion crop will be killed. Stands of quackgrass will not be controlled by Eptam. This herbicide will control many of the broadleaf weeds but ragweed, pigweed and mustard may escape. Eptam must be applied to a dry soil at the rate of 3 pounds per acre and immediately incorporated with a disk.

Clipping broadleaf weeds when they begin to shade the trefoil removes some of the competition. Set the height of the mower to clip most of the weeds and remove only the top of the trefoil growth. Clip as often as necessary throughout the seeding year to control weed competition.

## FERTILIZER

The rate and kind of fertilizer should be based upon a soil test. The following general recommendations should be used only when a soil test is not available.

### General Fertilizer Recommendations for Trefoil Establishment

Time of Application	Sandy or Loamy Soils	Clay Soils
At planting	6-24-24 250 lb/ac	8-32-16 250 lb/ac
Fall topdressing	0-10-30 400 lb/ac	0-20-20 200 lb/ac

Two applications of fertilizer in the seeding year, one at planting and one in late August, helps trefoil establishment and production. A starter fertilizer, containing phosphorus, potassium and up to 20 pounds per acre of nitrogen, speeds up establishment. Phosphorus is the major fertilizer element required during the establishment year. It promotes rapid root and shoot development.

The August topdressing, containing phosphorus and potassium helps the plants to overwinter and provides nutrients for production during the first year. In August only phosphorus and potassium should be used. Do not apply nitrogen. It is recommended that the correct ratio and amount of fertilizer based on soil tests be applied in mid to late August each year.