

# Birdsfoot Trefoil For Pasture

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Forty years ago, birdsfoot trefoil was unknown in Iowa. Today it is grown on over one-half million acres of Iowa pasture. It has become a favorite legume in permanent pastures because of its longevity, ability to withstand close grazing, high nutritive value, and non-bloating characteristics.

## Adaptation

Trefoil tolerates a wide range of soil conditions including variation in soil acidity, fertility, and moisture. This legume has earned a special reputation for sustained productivity and performance on less fertile soils. However, it yields more on productive soils and responds well to fertilization.

Trefoil has produced well throughout the state except in the deep loess soil area of western Iowa. It is less dependable in the area north of I-80 and west of Highway 71, and in the area south of I-80 and west of Highway 59. In this part of western Iowa, trefoil yields are low and stands are usually short lived. The reasons appear to be lower rainfall and more frequent drought periods as compared to other parts of the state.

## What Does it Look Like?

Trefoil is a leafy, fine-stemmed legume usually growing to a height of 20 inches or more. It has a low crown with numerous stems that tend to lodge when allowed to grow tall. When grazed closely, many stems spread out close to the ground and escape grazing. This is an aid to its persistence.

Flowers are bright orange-yellow to lemon-yellow and are attractive to honey bees. Trefoil is largely cross pollinated and, for seed production, cross pollination must be done by bees and other insects. Honey bees often are supplied to seed fields and excellent quality honey can be obtained.

Trefoil is a good seed producer. However, seed is difficult to harvest because of lodging and seed shattering. Hand harvested seed yields have been as high as 500 pounds per acre but seed producers usually consider 50 to 100 pounds per acre a good yield. The difficulty of harvest and low yields are primary reasons for high trefoil seed prices.

Trefoil has a strong, branched non-spreading root system. Root rot problems occur with trefoil and limit plant life. However, when stands are once established, new plants come each year from natural reseeding.

## Where to Use

Birdsfoot trefoil is an excellent choice for fertilized pasture left down for a long period of time (10 years or more), as well as for pastures that are difficult to plow or cultivate. Trefoil fits where soils are too acid and poorly drained for alfalfa.

The bloat-free nature of trefoil plus its ability to survive under continuous grazing are attractive attributes to many producers. Also, producers like trefoil because it can be stockpiled for deferred grazing and it can be managed to provide mid-summer grazing.

Trefoil is an excellent legume for improvement of established bluegrass sods by interseeding or frost seeding.

## Performance

The first-known seedings of trefoil in Iowa were made in 1938, one near Atlantic and the other near Centerville. Observations during the first 13 years showed excellent performance.

In 1941 and 1942, seedings were made on the Pasture Improvement Farm at Albia. The success of this study conducted over many years triggered seedings in much of southern Iowa.

A grazing study with yearling steers at the Shelby-Grundy Research Center near Beaconsfield compared trefoil-bluegrass with fertilized and unfertilized grass. The results are shown in table 1. Averaged over a 6-year period, an extra 0.31 pound daily gain and 240 pounds live weight gain per acre were obtained from trefoil-bluegrass compared to unimproved bluegrass. In the same study, fertilized bluegrass (60 pounds N and 20 pounds P<sub>2</sub>O<sub>5</sub> per acre) was associated with lowest daily gain and intermediate live weight gain values.

A more recent grazing study with yearling steers was conducted at the Lancaster (Wisconsin) Experimental Farm. Soil and other conditions there are similar to northeast Iowa. Results obtained in 1967 and 1968 are shown in table 2. In this study, steers on trefoil-grass gained 1.39 pounds per day with a total gain per acre of 355 pounds. The trefoil-grass production was slightly higher than straight grass (bluegrass, redtop, and timothy) with 120 pounds of N applied per acre.

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**Table 1. Yearling Steer Performance. Shelby-Grundy Research Center, Beaconsfield, Iowa.**

Pasture Treatment	Daily gain, lbs.	Live-weight gain, lbs. per acre
Unimproved	1.36	141
Fertilized grass <sup>1</sup>	1.21	225
Trefoil-grass <sup>2</sup>	1.67	381

<sup>1</sup>60 lbs/acre N annual and 20 lbs/acre P<sub>2</sub>O<sub>5</sub> biennially.

<sup>2</sup>20 lbs/acre P<sub>2</sub>O<sub>5</sub> biennially.

**Table 2. Yearling Steer Performance. Lancaster, Wisconsin Experimental Farm.**

Pasture Treatment	Daily gain, lbs.	Liveweight gain, lbs. per acre
Grass <sup>1</sup> (0 lbs N)	1.49	219
Grass (120 lbs N)	1.32	349
Grass <sup>1</sup> + Trefoil	1.39	355

<sup>1</sup>Mixture of bluegrass, redtop, and timothy

### Establishment on Prepared Seedbeds

Birdsfoot trefoil has lower seedling vigor than alfalfa and clovers. It does not compete as well with either a companion crop or weed growth in the seeding year. Successful establishment can be expected when the following production practices are followed:

#### Fertilize

Apply needed lime and fertilizer according to soil test. Apply at seeding time by broadcasting and working into the soil.

#### Seedbed Preparation

A well worked, firm seedbed is required for trefoil establishment. Best seedbeds and stands usually result after plowing. Fall plowing is preferred to spring plowing. The settling and mellowing of the soil over winter makes it much easier to develop a fine, firm seedbed.

The seedbed also can be prepared by tilling with a disk, spring-tooth harrow, or field cultivator. Several operations may be required to kill existing vegetation and reach the desired seedbed conditions. This kind of primary tillage will provide more protection from erosion than plowing and is important on rolling land.

Preparing the seedbed with a disk, springtooth, or field cultivator usually presents a greater weed problem than plowing. This is especially noticeable when reseeding land previously in pasture. Plowing will bury much of the weed seed whereas surface tillage makes conditions favorable for their germination.

### Seeding

Early-spring seedings are usually most successful. In years of favorable rainfall, late summer seedings (August 15 to September 10) have been successful.

Trefoil is seldom grown in pure stands. Yields are better and weed problems less when trefoil is grown with a perennial grass. Trefoil seems to be most compatible with Kentucky bluegrass, orchardgrass, or timothy. These three grasses are considered best for establishing a new seeding of trefoil-grass. Timothy tends to be short-lived and when seeded with trefoil it eventually is replaced by volunteer bluegrass.

Successful stands of trefoil have been established and maintained with bromegrass, tall fescue, and reed canarygrass. However, establishment may be slow, and close grazing is necessary to maintain the stand in these vigorous, sod-forming grasses. Iowa tests indicate that tall fescue is most competitive.

**Rate** For a trefoil-bluegrass pasture, sow 6 pounds per acre of birdsfoot trefoil on sites previously in bluegrass. Although volunteer bluegrass will fill in the stand in time, it may be desirable to include 2 to 3 pounds of bluegrass seed.

For other sites, sow 6 pounds of trefoil plus 3 pounds of orchardgrass or 2 pounds of timothy per acre.

**Variety**—Use Empire, Dawn, Carroll, or Leo. Carroll and Leo are more recently developed varieties that show some advantage in seedling vigor and yield, see tables 3 and 4. However, seed is in scarce supply.

**Inoculation**—Trefoil seed must be inoculated with the proper strain of bacteria. The bacteria do not occur naturally unless trefoil was grown previously. Use plenty of inoculant with milk or a commercial sticking agent to help hold inoculant on each seed.

**Seeding method**—Seeding with a grain drill or roller-packer-seeder is preferred. When using a broadcast seeder, roll with a corrugated roller both before and after seeding. An ideal condition is to have the seed firmly covered at a depth of 1/2 inch.

**Oat companion crop**—Oats seeded at 1 1/2 bushels per acre can be used as a companion crop to provide quick cover for erosion and weed control.

Graze when oats reach 6 to 8 inches in height. Graze off quickly and remove all animals until growth again reaches 6 to 8 inches. To prevent injury from trampling, avoid grazing when the soil is too wet. If the crop cannot be grazed, clip as often as needed to reduce competition for the trefoil. Do not graze or mow between September 10 and frost so food reserves can build up in the plant roots.

**Seeding with herbicides**—Seedings can be made by using herbicides instead of an oat companion crop. If

trefoil is seeded alone, apply 2 quarts Eptam (EPTC) 7E or 4 quarts Balan (Benefin) 1.5E per acre.

These herbicides must be incorporated by disking at least 4 inches deep. Eptam must be incorporated immediately after applying and Balan within 8 hours after application.

Annual grasses and some broadleaf weeds will be controlled by Eptam or Balan. As a result, the stand of trefoil is usually markedly improved. A disadvantage of using herbicides is that oats or perennial grasses cannot be seeded also. Also, any bluegrass seed present in the soil that germinates soon after herbicide application will be killed. Since a trefoil-grass combination is best for pasture, the use of preplant herbicides should be limited to conditions where a severe weed problem is expected or when trefoil alone is desired such as for seed production.

If a grass is seeded with trefoil and a severe broadleaf problem develops 2,4-DB can be applied. It will control many broadleaf weeds but not grass weeds. Application must be made when weeds are about 2 inches in height. Either the amine or ester form can be used at rates indicated on the label. Do not graze for 60 days after treatment.

### Management After Establishment

Stands as low as two plants per square foot may be considered satisfactory in the spring following seeding. Hard seeds in trefoil (25 to 30 percent) will usually add additional plants during the seeding year. Also, trefoil will produce seed even under close grazing that will improve and maintain stands over time.

**Table 3. Growth-Habit and Seeding Vigor of Birdsfoot Trefoil Varieties.**

Variety	Growth-habit rating <sup>1</sup>	Seedling-vigor rating <sup>2</sup>	Yield of dry matter (T/A) at first cutting in establishment year <sup>3</sup>
Carroll	3.2	1.6	1.12
Leo	2.8	2.2	1.07
Dawn	5.0	4.1	0.84
Empire	5.0	4.2	0.80

<sup>1</sup> Rated 1 most upright to 5 most prostrate.

<sup>2</sup> Rated 1 most to 5 least amount of growth average of two tests.

<sup>3</sup> Average of three tests

**Table 4. Forage Yield of Birdsfoot Trefoil Varieties.**

Variety	Average annual yield of dry matter in tons per acre		
	Beaconsfield <sup>2</sup>		
	Ames <sup>1</sup>	Hay mgt.	Pasture mg.
Carroll	3.20	3.07	2.54
Leo	3.20		
Dawn	2.98	3.07	2.71
Empire	2.82	2.73	2.48

<sup>1</sup> Average over 6 test-years including seeding year yield in each of the two tests.

<sup>2</sup> Average over 4 years, 2 or 3 cuttings per year under hay management, and 3 to 5 cuttings per year under pasture management.

Birdsfoot trefoil dies back to ground level each winter. Spring growth depends upon carbohydrates stored in roots the previous fall. After spring growth is under way, the remaining seasonal growth depends primarily upon photosynthesis. For photosynthesis to be adequate and yields satisfactory, a sufficient quantity of viable, healthy leaves must be maintained. Studies at Iowa State University have shown that maintaining at least 3 inches of stem growth throughout the growing season will provide the necessary leaf area. If a 3-inch height is maintained, satisfactory yields can be expected, root and crown diseases will be minimized, and some seed will be produced each year to help maintain the stand.

The following management practices are suggested for maintaining a long-lived, vigorous trefoil stand:

1. Do not graze closer than 3 to 4 inches so that there will be enough stems and leaves left for photosynthesis.
2. Topdress regularly with phosphorus and potassium fertilizer in amounts indicated by soil test. The normal annual rate is about 30 pounds per acre each of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O.
3. Clip as often as needed to control weeds.
4. Trefoil starts spring growth later than grass. Grazing the grass early, then removing the animals until trefoil is well-started, will help maintain vigorous trefoil stands.
5. Remove grazing animals by September 10, allow 5 to 6 weeks regrowth, then graze. This will allow carbohydrate storage for winter survival and spring growth.

### Interseeding and Frost Seeding

Birdsfoot trefoil can be established in existing grass sods by interseeding or frost seeding. The success of these two techniques has been well demonstrated in Iowa State University research studies and field demonstrations. (See table 5.)

Interseeding requires a special drill that opens grass sods and allows shallow seed placement and coverage. With frost seeding, the seed is broadcast on the soil surface in late February or March when the ground is still frozen. Freezing and thawing, plus early spring rains, provide the only seed coverage.

**Table 5. Interseeding Birdsfoot Trefoil in Kentucky Bluegrass. Shelby-Grundy Research Center, Beaconsfield, Iowa.**

Data obtained year after seeding	Unimproved Pasture	Improved Pasture
Plants per sq. ft. <sup>1</sup>	2.4	16
Yield, tons per acre <sup>2</sup>		
Trefoil only	2.3	2.3
Trefoil + grass	3.2	3.5

<sup>1</sup> Seeded May 3, 1972. Counts made June 6, 1973.

<sup>2</sup> Yields for 1973.

Following are major considerations associated with success with both interseeding and frost seeding:

1. Spray for weeds with 2,4-D before seeding. Once trefoil is established, weeds can only be controlled by clipping. Best weed control will be obtained by spraying during the year before seeding. Spray in May or early June and again in the fall if needed.

2. Apply lime and fertilizer as indicated by soil test. For lime, topdress one-half the amount required to reach a pH of 6.5. Don't neglect phosphorus and potassium as they are critical for trefoil establishment.

3. Trefoil can be interseeded alone at 4 pounds per acre. In a mixture, use 3 pounds of trefoil and 3 pounds of red clover per acre. Increase the rates for frost seeding, trefoil alone 6 to 8 pounds per acre or in a mixture, trefoil 4 to 6 pounds and red clover 4 to 5 pounds per acre.

4. Trefoil alone or trefoil and red clover can be spring-seeded. For late summer interseeding, trefoil alone is best because red clover may not survive the winter. Frost seeding should only be done in late winter or early spring, preferably late February or March.


5. When interseeding into vigorous grass stands, paraquat can be applied at seeding time to depress grass growth. For frost seeding, graze the grass closely the fall before seeding.

6. During the year of establishment use light, periodic grazing. The grass should be grazed down but avoid close grazing of the legumes. Some mowing may be necessary to control grassy weeds.

For more information on interseeding and frost seeding see ISU Extension Service publications, Pm-688, *Interseeding Pastures*, and Pm-856, *Improving Pasture by Frost Seeding*.

File: Agronomy 2

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