

## **Birdsfoot Trefoil Production and Utilization in Indiana**

**ID-139**

**C.L. Rhykerd, B.J. Hankins and K.D. Johnson, Agronomy Department T.T. Bauman and J. L. Williams, Jr., Botany and Plant Pathology Department, Purdue University, Cooperative Extension Service West Lafayette, IN 47907**

Birdsfoot trefoil is the best long-lived legume for growing in a mixture with Kentucky bluegrass as permanent pasture in the northern half of Indiana. It competes remarkably well with bluegrass under proper management.

Of the perennial forage legumes, birdsfoot trefoil is the most tolerant to the broad range of soils found in the northern region and is the only one that will survive in a mixture with Kentucky bluegrass on muck soil. It is also the most tolerant to wet springs, dry hot summers and cold winters.

Trefoil is palatable, nutritious, high in protein and very digestible to cattle, sheep and horses. Even after the plants start going to seed, forage quality and protein content remain high much longer than other pasture species. Also, trefoil is low in the estrogens that cause breeding problems, and apparently does not cause bloat in cattle or sheep.

Despite all of the above advantages, very little birdsfoot trefoil is grown in Indiana, primarily because of the difficulty in establishing and maintaining a good stand. Attempts to grow it in southern Indiana have generally been unsuccessful, the main reason thought to be susceptibility to various crown- and root-rot diseases.

The purpose of this publication is to provide management information for establishing, growing and utilizing birdsfoot trefoil in the northern half of Indiana. Included are discussions on its characteristics and adaptation, keys to successful establishment and suggestions for maintaining productive stands.

### **CHARACTERISTICS OF BIRDSFOOT TREFOIL**

Three species of trefoil are grown in the United States. Birdsfoot (*Lotus corniculatus* L.) is the most common both in the nation and in Indiana. Narrowleaf trefoil (*L. tenuis* Waldst. et Kit.), being more limited in adaptation, is not grown here. Big trefoil (*L. pedunculatus* Cav.), once thought not winterhardy enough for the state, has recently been found adaptable to the fragipan soils of southern Indiana *if* properly managed.

Birdsfoot trefoil (Figure 1) develops a semi-branching root system, which makes the plant less susceptible to heaving than tap-rooted legumes, such as alfalfa and red clover. Its semi-erect to erect stems, which arise from the crown, vary in height from 12-30 inches. A vigorously growing plant may produce up to 200 stems from a single crown. Each leaf consists of five leaflets, with three at the tip and two at the base of each petiole.

Bright yellow flowers start to appear in late May. and flowering continues until early fall. Pods form at the end of the flowering stem at right angles, the shape resembling that of a bird's foot. The seeds vary from light to dark brown and are quite small. In fact, a half million seeds weigh only about one pound.

#### ADAPTATION OF BIRDSFOOT TREFOIL

Birdsfoot trefoil seedlings are slow to establish; therefore, the species is best used for long-term pasture or possibly hay. Many fields have remained productive for more than 10 years. In fact, the first known Indiana seeding, made in 1940 at the Miller-Purdue Agricultural Center at Upland, is still a very good pasture today.

Trefoil's long life is due partly to the fact that few pests are known to attack it. Also, new plants emerge annually from the seeds of older plants that have fallen to the ground or been spread in animal manure.



Figure 1. Birdsfoot trefoil visual characteristics-- each leaf with three leaflets at tip and two at base of petiole, bright yellow flowers, pods at end of flowering stem resembling a bird's foot, and many stems per plant ranging from 1-3 feet long.

Because it is a warm-season legume, birdsfoot trefoil makes an ideal companion species for Kentucky bluegrass in permanent pastures. Bluegrass, a cool-season grass, grows most vigorously in spring and fall, while trefoil grows best in late spring and summer.

This fact must be kept in mind if trefoil is to persist in bluegrass sod. Heavy grazing of the bluegrass is required in early spring in order to prevent the later-emerging trefoil plants from being shaded out. Shading is more damaging to trefoil than to other legumes.

Trefoil is adaptable to a wide range of soils that vary in acidity, fertility and drainage. But it still needs adequate liming and fertilizing for maximum production.

## KEYS TO ESTABLISHING GOOD STANDS

As already mentioned, birdsfoot trefoil is difficult to establish. This is because the seedlings lack vigor and, therefore, do not compete against a companion crop, weeds or grasses as well as other forage legumes. However, good stands can be obtained by using all of the following management "keys":

- \* High-quality seed of a proven variety. \* Adequate lime and fertilizer. \* Proper seedbed preparation. \* Proper inoculation. \* Proper time, method and rate of seeding. \* Effective weed control.

### **Seed Selection**

It is important to select high-quality seed of a proven variety. Several excellent varieties of birdsfoot trefoil have been developed in the semi-erect (decumbent) and erect categories.

If the forage is to be used for permanent pasture, the semi-erect variety *Empire* is the one most commonly recommended in Indiana. However, for the southern portion of the trefoil belt (south of U.S. Hwy. 40), consider a new Missouri-developed variety called *Dawn*, provided seed can be obtained. It is similar to *Empire* but with greater resistance to root rots and to stem and leaf diseases.

If the forage is to be harvested as hay, erect varieties are best. Superior ones include *Viking*, *Mansfield*, *Granger* and *Tana*. As is the case with *Dawn*, seed of the latter three might be hard to get in Indiana at this time.

Birdsfoot trefoil seed may contain 15 percent or more "hard seeds," which do not take up water and are slow to germinate. Therefore, seed companies often mechanically scarify the seed to speed germination. The process must be done carefully, however, because excessive scarification can injure the seed, thus lowering germination and seedling vigor.

### **Lime and Fertilizer Application**

Although birdsfoot trefoil will grow on rather acid, low-fertility soil, lime and fertilizer are generally needed to establish and maintain productive stands. Thus, at the outset at least, a soil test is strongly suggested.

The soil should be limed to a pH of at least 6.2. If the soil is found to be of low fertility, especially if low in phosphorous, band seeding is recommended. Phosphorous fertilizer should be banded about 1 1/2 -2 inches directly below the trefoil seed. This placement results in rapid and efficient utilization of phosphorous by the roots.

Once seedlings are established, annual broadcast applications of phosphorous and potash should be made. Suggested rates are 50- 100 pounds of P<sub>2</sub>O<sub>5</sub> and 100-200 pounds of K<sub>2</sub>O per acre, unless soil tests show otherwise. Grazing animals will not greatly reduce fertilizer requirements, since the animal excreta covers only a small portion of the pasture.

### **Seedbed Preparation**

Birdsfoot trefoil seedlings made in grass sod without seed bed preparation usually fail. Shallow plowing or thorough discing is needed to create a fine, firm seed bed. The plowing should be done several weeks ahead of planting so the seed bed has a chance to settle.

The amount of tillage required depends on: (1) type of soil (sands require less tillage than clays), (2) moisture content (cultipacking is more critical when soils are dry), and (3) time of year that seedlings are made (more weeds and lush grass are present as the spring season progresses).

### **Seed Inoculation**

An inoculum must be applied to birdsfoot trefoil seed before planting. If trefoil has not been grown previously in a given field, an inoculum is the only source of bacteria for the legume to fix its own nitrogen.

To inoculate the seed yourself, follow instructions on the container. However, some seed companies add inoculum to legume seeds prior to bagging. If there is any concern as to its effectiveness, you might re-inoculate prior to seeding.

When trefoil seedlings are 3-4 inches tall. check the roots of some plants for proper nodulation. Effective nitrogen-fixing nodules have a pink interior, whereas the presence of pale yellowish-green leaves is evidence of poor nodulation. Trefoil seedlings which fail to nodulate may be saved by mixing inoculum with sand, and broadcasting this mixture on the soil surface immediately before a rain.

### **Seeding Time, Method and Rate**

Generally, the best time to seed birdsfoot trefoil is early spring. although late summer seedings may be successful if moisture conditions are favorable. The advantage of late summer is reduced weed problems, but the trade-off is a higher risk of insufficient rainfall for germination.

A band seeder or cultipacker-type seeder is most reliable for seeding birdsfoot trefoil. Normally, plant at about a 1/4-inch depth; however, in the case of sandy soils or if seeding in late summer, increase planting depth to 1/2 - 3/4 inch.

A seeding rate of 5 pounds per acre should be adequate, if good quality seed and proper seeding techniques are used.

If trefoil is seeded to a field previously in Kentucky bluegrass, the bluegrass will slowly come back on its own without having to be reseeded. If a spring-seeded trefoil field contained no bluegrass, overseed it in the early fall with 2 pounds per acre of bluegrass. This permits the trefoil to get established before the bluegrass becomes competitive.

Most other cool-season grasses grow more vigorously than bluegrass, thus making trefoil stands harder to maintain. If other grasses are used, here are their recommended per-acre seeding rates: 5 pounds bromegrass, 3 pounds orchardgrass, 7 pounds tall fescue or 2 pounds timothy.

Oats is not a good companion crop, since it also shades trefoil seedlings and competes for moisture and nutrients. Nevertheless, if used, seed oats at a rate of no more than 1 1/2 bushels per acre, and then either graze or cut for silage or hay when in the boot to milk stage. Don't graze when the soils are wet.

### **Controlling Weed Competition**

Birdsfoot trefoil seedlings grow quite slowly and, thus, are not very competitive with rapidly-growing weeds. The weeds will shade trefoil and stunt its growth.

Several herbicides, such as 2,4-DB, Balan and Eptam, may be used when seeding trefoil. These materials, if properly applied, can greatly improve the chances of the legume getting established.

Many broadleaved weeds like pig-weed and ragweed can be partially controlled by mowing just above the trefoil seedlings when the weeds are 10 - 15 inches tall. Earlier mowing is not very effective, and later mowing results in excessive weed competition.

Grassy weeds, usually more injurious to new trefoil seedlings than broad leaved weeds, are not effectively controlled by mowing. Rather, a pre-plant application of Balan or Eptam incorporated into the soil, is recommended.

### **MANAGEMENT OF ESTABLISHED STANDS**

Proper grazing management is required to maintain a highly productive trefoil-bluegrass pasture. Bluegrass grows rapidly in early spring, while trefoil starts some time later. Therefore, be sure to graze heavily early in the season to allow the trefoil to survive.

Trefoil is most productive in late spring and summer, with the bluegrass picking up again as cooler temperatures return In the fall. Thus, the mixture tends to even out pasture production over a long period of time.

Rotational grazing is the best way to manage trefoil-bluegrass pastures. It is important to rotate the pastures often during the spring (every 3-4 weeks if production permits), so that the bluegrass does not shade excessively the young trefoil plants. However, do not graze closer than 4 inches to prevent damage to the trefoil crowns and also to insure that there will be sufficient axillary buds for regrowth.

Trefoil can be grazed often. One way of reseeding and spreading trefoil is to graze mature seed pods, allowing passage of the seeds through the animals.

Birdsfoot trefoil is seldom used for hay. But if so, it should be cut when in early bloom. Plants bloom throughout the summer, so protein content and forage quality do not drop with maturity as rapidly as they do in other legumes.