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Michigan State University Extension Service  
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# Growing Birdsfoot Trefoil in Michigan

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Birdsfoot trefoil (*Lotus corniculatus L.*) is the longest-lived forage legume in Michigan and the northern part of the U.S. Stands of imported birdsfoot trefoil (established in 1949 by MSU at East Lansing) and Empire birdsfoot trefoil (established in 1954 in Chippewa County in the Upper Peninsula) are still productive. The stands are long lived because the plants are resistant to root rot disease which kills Ladino clover and red clover and causes them to be biennials. Also, birdsfoot trefoil stands last longer than alfalfa because trefoil produces seed which volunteers and forms new plants in late summer or early spring.

Trefoil was first grown in the U.P. in 1949 on a one-acre demonstration plot in Mackinac County. Today, trefoil is grown throughout the state on an estimated 70,000 acres with over three-fourths of that production location in the U.P.

Birdsfoot trefoil is adapted primarily to the cool moist climate of Michigan's U.P. on clay soils too wet for alfalfa. It is well adapted as a hay, silage, and pasture plant. Since about 1960, it has replaced red clover as the main legume for silage, hay, pasture for dairy and beef cattle in the U.P., primarily because of its longer stand life. The first cutting in the U.P. (or the second cutting after the first is harvested in early June) is frequently harvested for seed as a cash crop.

Trefoil is used mostly for pasture in the lower peninsula, primarily on erosive soils where long stand life is desirable. It makes excellent pasture for cattle or sheep with no reported bloat damage. In trials at Michigan State University at East Lansing, it has produced beef and sheep gains comparable to those from alfalfa.

## PLANT DESCRIPTION

Trefoil is a leafy, fine-stemmed legume which usually grows 20 to 30 inches high depending upon soil characteristics and moisture. Many stems are produced from a single crown. The bright yellow flowers of trefoil are very conspicuous and closely resemble the color of dandelions. The trefoil plant produces three to six seed pod clusters which resemble a bird's foot, hence the common name. The

root system consists of a well-developed taproot with many branch roots. The taproot does not penetrate as deeply as that of alfalfa but the branch roots are much more developed than those of alfalfa. This helps it survive better when frost heaving occurs.

## ADAPTATION

Relative to alfalfa, trefoil performs best on the finer-textured or more poorly drained soils, with a management group number of 0-2.5 and/or a "b" or "c" drainage classification, Table 1. Birdsfoot trefoil is less productive than alfalfa on well drained loams or silt loams (Tables 2 and 3) or on drouthy sandy loams (Table 4). It is *not* adapted to loamy sands or sands. Alfalfa is much better adapted to such drouthy soils.

Trefoil is very productive on fine-textured soils with appreciable clay such as those in soil management groups 0, 1, 1.5, 2.5. If the sandy loams related to soil management group 3 are of drainage class (b) somewhat poorly drained or (c) poorly drained, trefoil is well adapted. It will *not* survive on muck or peat soils.

Trefoil will tolerate acid soils (pH 5.0) which makes it well adapted to many soils in Michigan. Trefoil has been grown successfully in the U.P. on soils of pH 4.8. Although it will perform satisfactorily on acid soils, trefoil responds favorably to liming on acid soils and to phosphorus and potassium fertilizer.

## VARIETIES AND PRODUCTION

Two general types of trefoil — erect or prostrate — are recommended for use in Michigan. A brief description of varieties tested in Michigan is presented in Table 5.

Viking and Maitland are upright types characterized by an erect growth habit, early flowering, and rapid recovery after cutting. The upright type is well adapted to hay and silage production. Leo is less upright than Viking but more erect than Empire.

Carroll, Empire, and Mackinaw are prostrate types characterized by a low or decumbent growth habit. These varieties are best adapted for pasturing since they will tolerate grazing better than the up-

**Table 1. Forage crop recommendations as related to soil management crops.**

Dominant profile texture	Natural drainage class				
	Well drained <i>a</i>	Somewhat poorly drained		Poorly drained	
		Artificial drainage <i>b</i>	Not drained <i>b</i>	Artificial drainage <i>c</i>	Not drained <i>c</i>
O - Over 60% clay	T	T	T	T	T
1 - 40-60% clay	T	T	T	T	T
1.5 - Clay loam & silty clay loam	A, T	A	T	A	T
2.5 - Loam and silt loam	A, T	A	T	A	T
3/2 - Sandy loam over loam	A, T	A	T	A	T
3/5 - Sandy loam over sand	A	A	T	A	T
3 - Sandy loam	A	A	T	A	T
4/1 - Loamy sand over clay	A	A	T	A	T
4/2 - Loamy sand over loam	A	A	T	A	T
4 - Loamy sand	A	A	T	A	T
5/2 - Sand over loam	A	A	T	A	T
5 - Sand	A	A	T	A	T
M - Organic (muck)	—	—	—	*	**

A = alfalfa, T = birdsfoot trefoil

\* On very well drained organic soil, use Canadian smooth bromegrass.

On less well drained organic soil, use late maturing orchardgrass.

\*\* On undrained organic soil, use reed canarygrass.

(Prepared by L.S. Robertson and M. B. Tesar)

**Table 2. Yields of birdsfoot trefoil and alfalfa at the MSU Beef-Forage Experimental Farm, Lake City, Michigan.**

Variety	Yield, tons/acre, 12% moisture, weed free						6-yr. Average	
	1974	1975	1976	1977	1978	1979	Yield	% of Empire
<b>Birdsfoot Trefoil</b>								
Leo	4.3	3.4	1.7	0.8	3.1	2.6	3.4	127
Viking	4.0	3.0	1.7	1.0	3.0	3.1	3.3	122
Carroll	3.8	3.1	1.3	.9	2.7	2.3	3.1	114
Empire	3.2	2.6	1.3	.8	2.3	2.3	2.7	100
<b>Alfalfa</b>								
Iroquois	4.8	6.2	3.7	2.1	3.7	4.9	5.3	197
Vernal	4.8	5.7	3.7	2.1	3.8	5.3	5.3	196

Nestor silt loam, pH 6.9, P130, K391, 0+70+210 annual spring topdressing. Seeded Aug. 7, 1973, three cuts per year in 1974, 75, and 79 (mid-June, mid-Aug., and mid-Oct.), two cuts in 1976, 77, and 78 (mid-June and mid-Aug. to Sept. 15).

right varieties. Viking and Maitland begin flowering about 5 to 7 days before Carroll, Empire, and Mackinaw (Fig. 1).

Hay yields of varieties evaluated in Michigan are presented in Table 6 for the U.P., in Table 2 for Lake City in northern lower Michigan, and Table 3 at East Lansing in south central Michigan. Viking was highest yielding in two of the three tests and similar to Leo in the third test at Lake City. Viking is an excel-

lent variety because of seedling vigor, adequate winterhardiness, high yield for hay or silage, and availability of seed. Empire and other low growing types are more suitable for pasturing because of their prostrate growth habit. The low growing types are more difficult to establish than Viking because of their lower seedling vigor, Table 7. Viking is more difficult to establish than alfalfa. Stands established in summer are satisfactory in Michigan.

**Table 3. Yields of birdsfoot trefoil and alfalfa at the MSU Experimental Farm, East Lansing, Michigan.**

Variety	Yield, tons/acre, 12% moisture, weed free						6-yr. Average	
	1974	1975	1976	1977	1978	1979	Yield	% of Empire
<b>Birdsfoot Trefoil</b>								
Viking	4.6	4.7	4.0	2.9	3.7	2.9	4.0	111
Carroll	4.6	4.4	3.7	2.9	3.3	3.0	3.9	108
Leo	4.6	4.5	3.6	2.7	3.9	3.0	3.9	108
Empire	4.7	4.2	3.0	2.7	3.3	2.7	3.6	100
<b>Alfalfa</b>								
Iroquois	7.6	8.1	8.5	8.3	7.8	6.5	7.8	218
Vernal	7.6	7.5	8.2	7.7	7.0	6.5	7.5	209

*Tile drained Capac loam, pH 6.8, P53, K129, 0+100+300 annual spring topdressing. Seeded Aug. 8, 1973, four cuts per year (late May-early June, early July, Aug. 10-25, and Oct. 15-30).*

**Table 4. Yield and % legumes seeded with brome grass in 1953 on a renovated bluegrass pasture, Traverse City, Michigan.**

Species with brome grass	1954	1955	1956	1957	1958	1959	6-yr. Average
Ranger alfalfa	4.1	4.3	3.8	4.6	3.1	3.3	3.8
Empire birdsfoot trefoil	3.0	2.6	2.6	2.9	1.4	2.1	2.5
Pilgrim ladino clover	3.1	2.7	2.9	3.1	1.6	2.3	2.6
<b>% legumes in hay</b>							
Ranger alfalfa	85	84	54	38	43	54	
Empire birdsfoot trefoil	70	57	32	16	10	11	
Pilgrim ladino clover	70	35	9	9	9	8	

*Emmet sandy loam, pH 6.1-7.4, two hay cuttings/year (mid June and mid-to late Aug.), 0+80+40 fertilizer at seeding and annual topdressing with 0+80+80 starting in spring of 1955.*



**Figure 1. Birdsfoot trefoil stands in the second cutting on July 6, 1976, at East Lansing one year after seeding. Viking flowers about one week earlier than Empire and Carroll; Leo is intermediate.**

## CULTURE AND MANAGEMENT

Birdsfoot trefoil has lower seedling vigor than alfalfa and clovers, and does not compete as well with either a companion crop or weeds in the seeding year, Table 7. For successful establishment, follow these practices:

### Land Preparation

Fall plow fine-textured soils with poor drainage. If soils are likely to erode, sow one bushel of oats in the fall to prevent erosion. Work the land shallowly, keep it free of clods, and cultipack in the spring to help insure a firm seedbed. If the soil is heavily infested with quackgrass (*Agropyron repens* L.), control by tillage as indicated below.

## Fertilization

Soil test to determine the proper rate of fertilizer and lime. In general, it is not necessary to increase pH above 5.8. A pH of 5.5 is satisfactory but add lime if the pH is below 5.0. When needed, it is preferable to apply lime 6 months or more in advance of planting. Based on soil test results, apply fertilizer at rates up to 100 pounds of phosphate

(P<sub>2</sub>O<sub>5</sub>) plus 100 pounds of potash (K<sub>2</sub>O) per acre through the grain drill, preferably in a band under the seed. If more potassium fertilizer is needed, broadcast before or after seeding. Control quackgrass before seeding as indicated under seeding methods below.

**Table 5. Characteristics of birdsfoot trefoil varieties evaluated in Michigan.**

Variety	Origin	Plant Type	Winterhardiness	Performance	Remarks
Viking	Cornell University, public variety	Erect, hay type, earliest maturity	Moderate, generally adequate for Mich. but greater hardiness is desirable	Excellent seedling vigor, good yield performance, good regrowth	Less winter hardy than Empire but adequate for Michigan; good seed production in Michigan
Maitland	University of Guelph, Canada	Erect, hay type	Moderate, similar to Viking	Similar to Viking, yields slightly less than Viking	Adapted to same conditions as Viking
Norcen	North Central states, public variety, released in 1981	Intermediate, semi-upright, matures later than Viking, earlier than Empire	Moderate to high	Limited information to date in Mich; looks promising	More winterhardy than Viking in Minnesota trials; high yielding; excellent seed producer
Leo	Macdonald College, Canada, public variety	Intermediate, semi-upright, matures slightly earlier than Empire	Moderate to high	Very good seedling vigor, yields are as good as Viking	Poor seed producer; seed very difficult to obtain
Carroll	Iowa State University, proprietary variety	Similar to Empire but more upright, matures earlier than Empire	High	Excellent seedling vigor, yields are as good as or better than Empire	Adapted to same soil conditions as Empire; seed difficult to obtain
Empire	Cornell University, public variety	Low growing, fine-stemmed, late maturity	High	Good tolerance to grazing, adapted to wetter soils than Viking	Harder to establish than Viking
Mackinaw	Soil Conservation Service, USDA, public variety	Low growing, fine-stemmed, late maturity	High	Slightly better seedling vigor than, Empire, yield similar to Empire	Adapted to same soil conditions as Empire

**Table 6. Yields of birdsfoot trefoil at the MSU Experimental Farm, U.P., Chatham.**

Variety	Yield, tons/acre, 12% moisture, weed free					5-yr. Average		
	1972	1973	1974	1976	1977	Yield	% of Empire	Seedling <sup>(1)</sup> vigor
Viking	3.8	4.1	2.8	2.3	4.6	3.5	113	1.7
Maitland	4.0	4.0	2.7	2.2	4.3	3.5	111	1.9
Empire	3.9	3.7	2.1	1.4	4.6	3.1	100	3.0
Leo	3.4	3.9	2.3	1.5	4.2	3.1	99	1.5

<sup>(1)</sup> Seedling vigor rating: 1 = High 3 = Low

Trenary loam, two cuts yearly, except only one cut in 1974 and 1976, dry in July and August. Seeded July 1971.

## Seeding Date

Early spring seeding will normally give best results. April and early May are best for southern lower Michigan. Late April and May are optimum times for seeding in northern lower Michigan and the U.P. Seeding early allows the plants to take advantage of spring rains and become well established before winter. Summer seedings have also been successful with seeding dates of early- to mid-July for northern Michigan and the U.P., or late July to early August for southern Michigan, Table 7. Later seedings in September will generally fail. Plant the slower-establishing "Empire" types about two weeks earlier in summer than the more rapid-establishing "Viking" types.

## Seeding Rates and Mixtures

If pure stands of trefoil are desired, use 5-6 pounds of certified or high quality seed. For a trefoil-grass mixture, use 5-6 pounds of trefoil seed with 2 pounds of timothy or orchardgrass, or 4 pounds of bromegrass. Bromegrass and orchardgrass can be mixed with the fertilizer. Timothy can be mixed with the trefoil seed.

In the U.P., trefoil can be seeded satisfactorily on wet clay soils in the spring with oats or barley as a companion crop in a mixture with red clover. The red clover becomes established more quickly than trefoil. In the year after seeding, about 80% of the stand is red clover and 20% is trefoil. In the second year, the ratio is about 50-50. In the third year, about 90% is trefoil and 10% is red clover. In later years, the stand is almost entirely trefoil.

## Inoculation

It is absolutely essential to inoculate birdsfoot trefoil just before seeding with a rhizobia inoculant specific for trefoil. Alfalfa or clover inoculant will *not* work on trefoil. Trefoil will not add nitrogen to the soil if not inoculated since the rhizobia bacteria are not in the soil.

Inoculate the seed just prior to planting by mixing the seed with a slurry of water and the peat-based inoculant used double strength. Directions and expiration date of the live rhizobia bacteria are on every package of inoculant.

## Band Seeding is preferred

Band seeding (Fig. 2) with a starter fertilizer is the preferred method. A grain drill equipped with

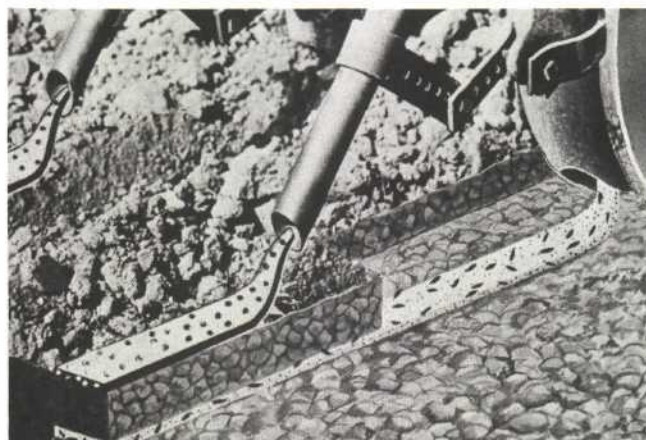


Figure 2. The best method for establishing trefoil is to band seed  $\frac{1}{4}$  to  $\frac{1}{2}$  inch deep over a band of fertilizer containing phosphorus placed 1 to  $1\frac{1}{2}$  inches deep.

Table 7. Effect of summer seeding date on birdsfoot trefoil yields in the following year.

Method of seeding	July 27	Aug. 13	Aug. 27	Sept. 11
<b>Viking Birdsfoot Trefoil</b>				
Alone	2.16	3.62	1.69	.31
Oats	.65	1.16	.82	.52
Oats removed Oct. 3	.46	1.95	.92	.63
Average	1.10	2.23	1.15	.48
<b>Empire Birdsfoot Trefoil</b>				
Alone	1.32	3.38	.70	.25
Oats	.49	.67	.52	.79
Oats removed Oct. 3	.43	1.42	.70	.64
Average	.74	1.49	.64	.56

Two experiments started in 1960 and 1961 and harvested in 1961 and 1962; 2-yr. avg., Conover loam soil. East Lansing, Michigan.

press wheels or followed by a cultipacker will insure good soil-seed contact (Fig. 3). Band the seed on top of the soil above the fertilizer band and cover  $\frac{1}{4}$  to  $\frac{1}{2}$  inch deep with press wheels or cultipacker.

A Brillion cultipacker seeder (Fig. 4) also works well for seeding trefoil because it insures shallow seed placement. It has separate seed boxes for the trefoil and grasses but requires separate fertilizer application prior to seeding. For more information on seeding methods refer to Extension Bulletin E-1017, "Good Stands for Top Alfalfa Production" (free) and Extension Bulletin E-961, "Clear Seedings of Alfalfa" (free).

Seedings can be made satisfactorily in spring or summer if quackgrass has been adequately controlled and seeding suggestions above are followed. Specific recommendations:

## SPRING SEEDING

Seed in early spring — April or early May in southern Michigan and May in northern lower Michigan and the U.P. — to get the benefit of cool, moist weather before weeds start.

1. Thoroughly field cultivate or plow old pastures in July of the previous year and till soil through October to kill quackgrass and bluegrass (*Poa pratensis* L.) (June-grass). Trefoil will not tolerate grass competition during establishment. On clean land, plowing in the spring followed by disking and harrowing is adequate. As grass-killing herbicides become registered for use, they will provide excellent quackgrass control without tillage, Fig. 5, and are particularly valuable on hilly land and erosive soil.

2. Two alternative seeding methods are available:

**Method 1.** Clear seed alone, without a companion crop, using a pre-plant and/or a post-emergence herbicide to control broadleaved weeds and annual grasses.

**How to make a clear seeding.** Control annual broadleaved and grassy weeds with one of two pre-plant herbicides: (1) EPTC (Eptam) 3 pounds active ingredient (a.i.) per acre is first choice because it controls the broadest range of broadleaved annual weeds and annual grassy weeds; or (2) benefin (Bal-an),  $1\frac{1}{8}$  pounds a.i. per acre. Spray both on the soil and incorporate into the soil immediately after application.

One pound of 2,4-DB (a.i.) can be used post emergence when trefoil has one or two leaves with 5 leaflets each (about 1 to 2 inches tall). This is usually 4 to 6 weeks after seeding. The 2,4-DB can be used alone or after pre-plant herbicides if a broadleaf weed problem develops. 2,4-DB will control broad-

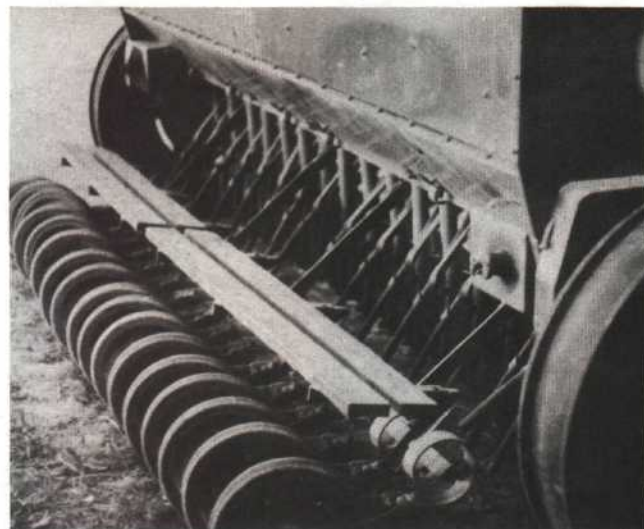


Figure 3. Firming the soil over and above seed helps insure good stands. A band seeder fertilizer grain drill with press wheels (upper photo) or a cultipacker following the drill effect shallow seeding and firming of the soil over the seed.



Figure 4. A Brillion cultipacker seeder places the seed shallowly and is an excellent seeding method, particularly in soils where phosphorus levels are high.

leaved weeds only. If perennial grasses such as bromegrass (*Bromus inermis* L.), orchardgrass (*Dactylis glomerata* L.) or timothy (*Phleum pratense* L.) are seeded with the trefoil, 2,4-DB is the only herbicide which can be used.



Figure 5. A grass killing herbicide (left) or tillage to control quackgrass is necessary for good trefoil stands.



Figure 6. Seedings of birdsfoot trefoil in oats (left) on a fine textured soil in Chippewa County in the U.P. are very successful. Trefoil on the right was seeded the previous year in oats.

**Method 2.** Seeding with oats is much less reliable than clear seeding alone with a herbicide. Seed with 1 bushel of early-maturing oats removed (1) for pasture when 8 to 10 inches tall and regrazed again; or (2) for silage. Do not leave the oats for grain since excessive competition will generally result in seeding failures.

Seeding with oats is not likely to be successful on drouthy sandy loams but has been a very good method of establishing trefoil on wet clay soils in the U.P. (Fig. 6). Seeding with oats has resulted in many failures in lower Michigan, probably because of drouthier soils and excessive competition from the oats, Table 7. In lower Michigan, seedings with Eptam or Balan preplant or 2,4-DB post emergence are much more reliable and preferred seeding methods than seeding with oats.

When trefoil is seeded with oats or barley, seed the oats at no more than one bushel per acre using an early maturing stiff-strawed variety. Control

broadleaved weeds with (1) MCPA at  $\frac{3}{8}$  pound per acre a.i. when oats are 6 to 8 inches high (some injury can result from the use of MCPA); or (2) 1 pound of disoneb per acre a.i. to control broadleaved weeds when the companion crop is 2 to 6 inches tall and weeds are small. Disoneb can injure the crop, especially if sprayed during cloudy weather.

## SUMMER SEEDING

1. *Kill existing sod.* Graze old grass pastures or fields in May. Plow, disk, or field cultivate in late May or early June, then till the field every 10 days until late July. If broadleaved perennials (such as Canada thistle) are present, spray with 1 pound 2,4D ester a.i. 10 days prior to tillage. Sods which are heavily infested with quackgrass can be controlled by this system. Sods with bluegrass, orchardgrass, bromegrass or other grasses with not require as much tillage.

2. Band seed or seed as above in spring seeding with 5 to 6 pounds inoculated seed per acre. Fertilize as described under fertilization.

3. Seed grass as described in seeding rates and mixtures above.

4. Seed in late July or early August, *no later* than August 10 in southern Michigan or mid July in northern lower Michigan or the U.P.

5. Normally, fall frosts will kill annual weeds in summer seedings. Downy brome and common chickweed can be controlled by an early November application of Kerb 50-W at one pound a.i. per acre.

## SOD SEEDING

Seeding of trefoil in herbicide-treated sod without plowing (Fig. 7) is another method of establishing trefoil and improving yield and protein content of grass pastures. Sod seeding is not recommended unless the soil is too steep for safe tillage or is likely to erode excessively. Pastures which are primarily Kentucky bluegrass, timothy, bromegrass, or orchardgrass are the best sites for sod seeding because these species can be suppressed adequately by paraquat herbicide. Do not sod seed on sods predominately quackgrass, since it will compete too vigorously with trefoil.

There are many types of seeding equipment available for sod seeding. A regular fertilizer-grain-legume drill can be adapted for the purpose. For additional information on sod seeding of trefoil, refer to Extension Bulletin E-956, "Sod Seeding Birdsfoot Trefoil and Alfalfa" (free).





Figure 7. Sod seeding birdsfoot trefoil in Dickinson County in the U.P.

## HARVEST AND STAND MAINTENANCE

The following practices will help you maintain good stands of trefoil:

1. Graze no closer than 3 inches to maintain good stands.

2. Graze grass early in trefoil-grass stands, then remove animals until trefoil blossoms for better quality forage and more persistent stands of trefoil.

3. Cut trefoil for hay when it begins to flower. You can normally take 3 cuttings in southern Michigan (Tables 2 and 3) and 2 cuttings in northern Michigan (Table 6).

4. Topdress annually with fertilizer for increased yields and stand persistence. One ton of trefoil hay will remove 10 pounds of phosphate and 30 to 40 pounds of potash per acre. Trefoil fertility trials conducted on a poorly drained clay loam (Table 8), in the U.P. suggest a yield response up to 25 pounds per acre from applied nitrogen. The soil tested 23 pounds P per acre and 480 pounds K per acre. At these test levels the fertilizer requirement was 50 pounds P<sub>2</sub>O<sub>5</sub> and no K<sub>2</sub>O per acre. Maximum yields were obtained with a fertilization rate of 75 pounds of P<sub>2</sub>O<sub>5</sub> and 50 pounds K<sub>2</sub>O per acre. Topdressing

Table 8. Effect of N, P and K upon yield of Viking birdsfoot trefoil on a poorly drained clay loam\* in the U.P.

Annual treatment, N+P <sub>2</sub> O <sub>5</sub> +K <sub>2</sub> O lbs/acre	Yield tons/acre 12% moisture		
	1978	1979	2-yr average
0+0+0	1.03	2.75	1.89
25+75+0	2.24	4.06	3.15
50+75+0	1.88	3.91	2.89
0+37+0	1.54	3.04	2.29
0+75+0	1.62	2.72	2.17
0+150+0	1.98	3.12	2.55
0+225+0	2.27	2.99	2.63
0+75+50	2.06	3.64	2.85
0+75+100	2.25	2.75	2.50
0+75+200	1.68	3.09	2.38

\* Soil test - 23 lb P, 480 lb K per acre.



Figure 8. Kerb herbicide applied November 1-20 at 1½ lb. active ingredient per acre removes quackgrass effectively from a Viking trefoil stand invaded by quackgrass at Lake City in northern Michigan.

with additional potash on fine-textured soils testing high in potassium is advisable.

5. If annual broadleaved weeds become a problem, clip or graze as low as possible for effective control or use 2,4-DB at 1 pound per acre a.i. applied in early spring.

6. Control quackgrass before planting trefoil or it will compete severely with, and generally kill, trefoil seedlings. If quackgrass starts to dominate trefoil stands as the stand gets older, spray with Kerb 50-W at 1½ pounds per acre a.i. applied in late fall (Nov. 1-20) when soil temperature falls below 60°F, (Fig. 8). For more information on weed control, refer to Extension Bulletin E-434, "Weed Control Guide for Field Crops" (Price 40¢).

## PESTS

### Insects

Although insects have not been a problem in trefoil forage production, a few insects cause losses. The meadow spittlebug (*Philaenus spumarius* L.), feeds by sucking sap from the plant, resulting in stunted plants and aborted flower buds. The potato leafhopper, (*Empoasca fabae*), causes a yellowing or reddening of leaves and stunting of plants. Forage yield and quality may be reduced when heavy infestations of the potato leafhopper occur. Another sucking insect, the alfalfa plant bug, (*Adelphocoris lineoletus*), destroys stem terminals and flowers, reducing seed production of trefoil when the crop is harvested for seed. In general, spraying of trefoil grown for forage is not economical.

### Diseases

Crown and root rots are the most important diseases of trefoil, but these diseases are more likely to be problems in southern states. They are seldom a problem in Michigan. Many fields of trefoil in Michigan have been in production for over 15 years with no apparent disease problems.