BULLETIN 537
MAY 1982

Birdsfoot Trefoil in Alabama

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FIRST PRINTING 4M, MAY 1982

Birdsfoot Trefoil in Alabama

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ORIGIN AND DISTRIBUTION

BIRDSFOOT TREFOIL *(Lotus corniculatus)* is a perennial forage legume that originated in the Mediterranean area of Europe *(5)*. It occurred naturally in many pastures but was not cultivated in Europe until after 1900. Since then, it has also been grown in southern Brazil, Chile, Uruguay, Australia, and New Zealand. It is not known when trefoil was introduced to the United States, but during the 1930's and 1940's it became recognized as a valuable legume in New York State. At present, trefoil is mainly grown in the Northeast, Upper Midwest, and Pacific Northwest.

DESCRIPTION AND CHARACTERISTICS

Birdsfoot trefoil is a broad-leaved, tap-rooted, perennial legume which grows to a height of 12 to 30 inches, figure 1. It is finer stemmed and leafier than alfalfa *(Medicago sativa)*. Trefoil leaves differ from alfalfa leaves in that the latter are always in groups of three, but trefoil has an additional two leaves at the base of the leaf branch. Flowers, resembling those of peas, are yellow and may have faint orange or red stripes. The slender brown to purple seed pods are 1 to 1½ inches long and radiate from the stem branch similar to toes on a bird's foot; hence the name of this legume, figure 2. As the seed pods mature and dry they snap open and scatter the seed. Seeds are light to dark brown, oval to spherical in shape, and larger than seed of ladino clover

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(Trifolium repens) but smaller than seed of alfalfa and red clover *(Trifolium pratense)*. Birdsfoot trefoil seed must be inoculated with a special inoculum before planting. Bacteria that inoculate alfalfa, arrowleaf clover, or white clover are not effective on trefoil.

Trefoil has several advantages: (1) tolerant of soil acidity, (2) drought tolerant, (3) not damaged by alfalfa weevil, (4) reseeds well from hard seed, (5) high quality forage, and (6) does not cause bloat in cattle or sheep. Disadvantages are: (1) indeterminate flowering and seed shattering, generally resulting in low seed yields, and (2) susceptibility to crown and root-rotting diseases in the Southern United States. In addition, northern trefoil varieties generally have poor seedling vigor and are slow to establish.

New varieties and experimental lines developed from Mediterranean germplasm at the Alabama Agricultural Experiment Station and other institutions offer promise that trefoil may have a place in the South. This publication summarizes research with birdsfoot trefoil in Alabama.

Research was conducted with the following trefoil varieties and lines:

AT-U—Erect-growing, hay type selected for persistence from Italian and Yugoslavian plant introductions at Auburn University. Not released.

AT-1—Semi-erect type selected at Auburn University from superior plants of the San Gabriel variety brought from Brazil. Not released.

AT-P—Semi-prostrate type with stolons, selected at Auburn University from Italian and Yugoslavian plant introductions. Not released.

Fergus—Naturalized semi-prostrate strain from a 15-year-old Kentucky pasture planted to a mixture of Empire and imported French germplasm.

Dawn—Semi-erect variety selected in Missouri for resistance to root rots and to leaf and stem diseases.

Empire—Prostrate, late-maturing variety selected for persistence in New York State.

Viking—Erect, broad-leaved variety developed in New York State from Danish and New York strains.

San Gabriel—Naturalized erect strain from Rio Grande do Sul in southern Brazil.

Vega II—Erect type selected from San Gabriel trefoil by Northrup King Co. in California.

Carroll—Semi-prostrate, pasture type developed in Iowa.

Georgia-1—Seed increase of erect-type Mediterranean germplasm that had persisted for many years at Griffin, Georgia. Not released.

SEED GERMINATION

Trefoil is normally seeded during autumn in the South when soil temperatures are often high and moisture is limited. In laboratory seed germination

TABLE 1. SEED GERMINATION OF TREFOIL VARIETIES AT TWO TEMPERATURES AFTER 16 DAYS

Variety	Seed germination	
	68°F	86°F
	Pct.	*Pct.*
AT-U	85ab*	81a
AT-1	90a	79a
AT-P	90a	79a
Fergus	92a	73ab
Viking	81ab	63bc
Dawn	79ab	56c
Empire	74b	40d

*Any two means within a column marked with the same letter are not significantly different at 5 percent level of probability.

trials, trefoils of Mediterranean or Brazilian origin (AT-U, AT-1, and AT-P) germinated better at high temperature than trefoils of northern origin (Viking, Dawn, and Empire), table 1. Fergus was intermediate in germination at high temperature.

Seed germination in the laboratory under simulated drought was highest for Fergus and trefoils of Mediterranean or Brazilian origin, table 2. According to these results, varieties such as Fergus should result in better stands than varieties such as Dawn or Empire when soil moisture is not optimum.

TABLE 2. SEED GERMINATION OF TREFOIL VARIETIES AFTER 12 DAYS AS AFFECTED BY SIMULATED DROUGHT USING A POLYETHYLENE GLYCOL SOLUTION AT 68°F

Variety	Seed germination	
	Pure water, 0 bars	Simulated drought, -3 bars
	Pct.	*Pct.*
Fergus	98a*	98a
AT-U	97a	90a
AT-1	94ab	88ab
AT-P	95ab	85ab
Viking	82bc	75bc
Dawn	82bc	70c
Empire	76c	45d

* Any two means within a column marked with the same letter are not significantly different at 5 percent level of probability.

SEEDING RATE

Broadcast seeding of trefoil varieties was made at the Plant Breeding Unit on a well-prepared fine sandy loam seedbed. The first year, AT-P yielded more at 6 pounds than 4 pounds seed per acre while Fergus required 8 pounds per acre for highest yields, table 3. Dawn yielded more at 10 pounds per acre than at 6 pounds. By the second year, seeding rate had no effect on yield of AT-P and only a small effect with Fergus and Dawn. Considering the

TABLE 3. FORAGE YIELD OF TREFOIL VARIETIES AS AFFECTED BY SEEDING RATE AT PLANT BREEDING UNIT, TALLASSEE, OVER TWO YEARS

Variety	Seeding rate/acre	Dry forage yield per acre	
		1980	1981
	Lb.	*Lb.*	*Lb.*
AT-P	10	6,180a*	8,730ab
	8	6,180a	9,340a
	6	6,140a	8,700ab
	4	4,990bc	9,100ab
Fergus	10	5,350b	8,980ab
	8	4,900bcd	8,590ab
	6	4,090e	9,250a
	4	4,170de	8,530b
Dawn	10	5,270b	8,680ab
	8	4,660bcde	8,380bc
	6	4,280cde	8,220bc
	4	4,210de	7,840c

*Any two yield entries within a column marked with the same letter are not significantly different at 5 percent level of probability.

cost of trefoil seed, 4 pounds per acre should be a practical seeding rate when planting on a good seedbed.

VARIETY ADAPTATION

The performance of San Gabriel trefoil was excellent when compared with alfalfa and red clover, at the Sand Mountain Substation over a 4-year period, table 4. Average forage yield for trefoil was similar to that for alfalfa, just under 4 tons per acre. The productive seasons extended from April through July and again during September to mid-October. Red clover yield declined each year of the test as stands thinned. Stands of trefoil were still good after 5 years, figure 3. Natural reseeding of the trefoil into adjacent areas was common.

In the first series of trefoil variety trials, good stands were obtained at each location except at the Sand Mountain Substation where rains delayed planting and many seedlings were lost due to soil heaving. Three-year average forage yields were similar for all varieties except AT-1 and Vega II at

TABLE 4. FORAGE YIELD OF TREFOIL, ALFALFA, AND RED CLOVER OVER 4-YEAR PERIOD AT SAND MOUNTAIN SUBSTATION

Species	Dry forage yield per acre					Legume stand	
	1975	1976	1977	1978	Average	1976	1978
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*	*Pct.*
Gladiator alfalfa	5,600a*	10,410a	8,110a	7,020a	7,780a	92	78
San Gabriel trefoil	6,330a	10,270a	7,450a	5,830b	7,470a	89	71
Kenstar red clover	5,400a	8,960b	4,970b	0c	4,830b	95	0

*Any two yield entries within a column marked with the same letter are not significantly different at 5 percent level of probability.

TABLE 5. FORAGE YIELD OF TREFOIL VARIETIES AT FOUR ALABAMA LOCATIONS

Variety	Dry forage yield per acre				
	Tennessee Valley Sub. 1978-80	Sand Mountain Sub. 1977-78	Upper Coastal Plain Sub. 1978-80	Black Belt Sub. 1978-79	Average all locations
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
AT-P ...	6,130a*	3,860a	5,090a	5,000a	5,020
AT-U ...	5,870a	--	4,870a	4,220ab	--
Fergus ..	5,670ab	3,550a	5,080a	4,430ab	4,680
AT-1	5,550b	--	4,650ab	3,360c	--
Vega II .	5,490b	--	4,230b	3,630bc	--
Dawn ...	5,860a	2,780b	4,560ab	4,160b	4,340
Viking ..	6,050a	2,520b	4,500ab	2,610d	3,920
Carroll ..	--	2,660b	--	--	--
Empire .	--	1,120c	--	--	--

*Any two yield entries within a column marked with the same letter are not significantly different at 5 percent level of probability.

the Tennessee Valley Substation, table 5. At the Sand Mountain Substation, the advantage of excellent seedling vigor in AT-P and Fergus resulted in less loss of plants by soil heaving in winter so yields were higher than for northern types. Yields were generally similar for most trefoils over a 3-year period at the Upper Coastal Plain Substation. At the Black Belt Substation, however, AT-P, Fergus, and AT-U were more productive than AT-1 and Viking. When yields at all locations were averaged, AT-P and Fergus were most productive.

In the second series of trefoil variety trials, forage yields of about 2 to over 4 tons per acre annually were obtained over 2 years at five locations, table 6. Good stands were obtained at all locations. At the Tennessee Valley and Piedmont substations, forage yields were similar for all trefoil entries. At the Plant Breeding Unit, Georgia-1, AT-P, and AT-U outyielded Fergus and Dawn. AT-P was the highest yielding and Dawn the lowest yielding variety

TABLE 6. FORAGE YIELD OF TREFOIL VARIETIES AT FIVE ALABAMA LOCATIONS, 2-YEAR AVERAGE, 1980-81

Variety	Dry forage yield per acre					
	Tennessee Valley Sub.	Piedmont Sub.	Plant Breeding Unit	Prattville Exp. Field	Gulf Coast Sub.	Average all locations
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Georgia-1 ..	--	--	7,350a	--	8,820a	--
AT-P	5,410a*	4,100a	7,240a	7,020a	6,620b	6,080
Fergus	5,360a	4,070a	5,610b	5,930b	6,580b	5,510
AT-U	5,570a	4,190a	7,040a	6,550b	3,950d	5,460
Vega II	4,650a	3,870a	6,580ab	6,150b	4,440d	5,140
AT-1	4,770a	4,360a	6,620ab	6,370b	3,520d	5,130
Dawn	5,020a	3,650a	5,750b	5,670c	5,170c	5,050

*Any two yield entries within a column marked with the same letter are not significantly different at 5 percent level of probability.

FIG. 1 (top left). Birdsfoot trefoil is a leafy legume with bright yellow flowers that bloom over much of late spring and summer in Alabama. FIG. 2 (top right). Birdsfoot trefoil gets its name from the five or six seed pods attached to the end of a flower stem, which give the appearance of a bird's foot. FIG. 3 (bottom left). Excellent stand of trefoil (left) is contrasted with poor survival of red clover (right) after 5 years at the Sand Mountain Substation (photo made June 21, 1979). FIG. 4 (bottom right). Seedling vigor of some trefoil varieties such as Fergus (left, labeled Kentucky) is much better than most northern varieties, such as Dawn (right).

at Prattville. Surprisingly, the highest trefoil yield in the State was made at the Gulf Coast Substation. First-year production of all entries at this location was good, but by the second year only Georgia-1, AT-P, and Fergus had good stands. Poor persistence was a serious problem with the other entries. Other observations indicate that trefoil varieties currently available are not adapted and will not persist in central or southern Alabama.

Seedling vigor is important in trefoil establishment. Weed competition can be severe and seedlings of northern trefoil varieties grow much slower

FIG. 5 (top left). Growth habits of trefoil varieties differ greatly, ranging from the more erect, experimental Georgia-1 (left) to the prostrate Fergus (right). The photograph was made March 31, 1980, at the Gulf Coast Substation. FIG. 6 (top right). Trefoil grows well in association with orchardgrass. The photograph was made April 21, 1981, at the Tennessee Valley Substation. FIG. 7 (bottom left). To maintain a stand of trefoil and replace plants lost from diseases, it is essential to allow the plants to make seed for natural reseeding. Small seedlings are shown in an older stand of trefoil. FIG. 8 (bottom right). Beef steers have made excellent gains on tall fescue-trefoil pasture at the Tennessee Valley Substation (photo made July 1, 1981).

than those of Mediterranean or Brazilian origin, figure 4. Often, northern trefoil varieties, such as Dawn or Empire, fail to become established in Alabama because they are poor competitors.

The growth habits of trefoil varieties differ greatly, figure 5. The most prostrate types, such as Fergus, are likely to persist better than erect types under grazing. It is also likely that yield trials under clipping do not properly assess the worth of prostrate trefoil types which have more leaf tissue near the ground than the erect types.

PESTS

Crown and root rots are important diseases of trefoil, often resulting in serious stand losses. These problems are much more severe in central and southern Alabama than in the northern part of the State.

Nematodes are a major problem in trefoil persistence on sandy soils of central and southern Alabama. In a 3-year field trial in central Alabama, trefoil stands and forage yields were good the first year but declined drastically the second year on untreated soil, table 7. Trefoil on soil previously treated with methyl bromide maintained fair stands and a low level of forage production during the second and third years. Parasitic nematode numbers were higher on red clover than on alfalfa or trefoil, table 8. Rootknot was the major nematode species on trefoil.

TABLE 7. FORAGE YIELD OF TREFOIL, RED CLOVER, AND ALFALFA AS AFFECTED BY NEMATODE CONTROL, PLANT BREEDING UNIT, OVER 3 YEARS

Legume	Dry forage yield per acre					
	1978		1979		1980	
	Treated soil	Untreated soil	Treated soil	Untreated soil	Treated soil	Untreated soil
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Gladiator alfalfa	14,790a*	12,380b	9,470a	7,960a	6,040a	2,410b
Redland red clover	9,690c	8,190cd	4,680b	460c	0c	0c
AT-1 trefoil	7,550cde	6,390e	3,120b	500c	3,090b	0c

*Any two yield entries for a particular year marked with the same letter are not significantly different at 5 percent level of probability.

TABLE 8. PARASITIC NEMATODE POPULATIONS IN SOIL AND ROOTS OF ALFALFA, RED CLOVER, AND TREFOIL AS AFFECTED BY NEMATODE CONTROL

Legume	Nematodes per 50 cc soil and roots			
	1978		1979	
	Treated soil	Untreated soil	Treated soil	Untreated soil
	No.	*No.*	*No.*	*No.*
Gladiator alfalfa	0	28	18	37
Redland red clover	34	86	86	103
AT-1 trefoil	0	49	13	46

TREFOIL-GRASS MIXTURES

Trefoil grows well in association with a cool season perennial grass. In a trial planted in September 1976 at the Sand Mountain Substation, autumn drought caused late establishment of trefoil seedlings, resulting in severe stand loss due to soil heaving during winter. With natural reseeding, however, trefoil stands increased each year over the 3-year period so that by the third year the grass-trefoil yield equalled that of grass-red clover, table 9.

TABLE 9. FORAGE YIELD OF TREFOIL AND RED CLOVER IN MIXTURES WITH KENTUCKY 31 TALL FESCUE AND BOONE ORCHARDGRASS AT SAND MOUNTAIN SUBSTATION

Grass-legume	Dry forage per acre			
	1977	1978	1979	Average
	Lb.	*Lb.*	*Lb.*	*Lb.*
Ky. 31 tall fescue—none (120 lb. N/acre)	8,200a*	5,600ab	7,980a	7,260a
Ky. 31 tall fescue—Redland red clover	8,344a	5,660ab	4,230b	6,080b
Ky. 31 tall fescue—AT-1 trefoil	5,860b	4,690bc	5,020b	5,190b
Boone orchardgrass—None (120 lb. N/acre) ...	6,840b	5,550ab	5,250b	5,880b
Boone orchardgrass—Redland red clover	7,940a	6,300a	4,050b	6,100b
Boone orchardgrass—AT-1 trefoil	4,430c	5,200b	5,460b	5,030b

*Any two yield entries within a column marked with the same letter are not significantly different at 5 percent level of probability.

TABLE 10. FORAGE YIELD OF TREFOIL AND CLOVER IN MIXTURES WITH KENTUCKY 31 AND TRIUMPH TALL FESCUE AT SAND MOUNTAIN SUBSTATION, 2-YEAR AVERAGE

Grass-legume	Dry forage yield per acre
	Lb.
Ky. 31 tall fescue—none (150 lb. N/acre)	8,260ab*
Ky. 31 tall fescue—Redland red clover	8,950a
Ky. 31 tall fescue—Regal ladino clover	7,360bc
Ky. 31 tall fescue—Fergus trefoil	6,640c
Triumph tall fescue—none (150 lb. N/acre)	8,170ab
Triumph tall fescue—Redland red clover	8,000ab
Triumph tall fescue—Regal ladino clover	6,690c
Triumph tall fescue—Fergus trefoil	6,540c

*Any two yield entries within a column marked with the same letter are not significantly different at 5 percent level of probability.

Trefoil with tall fescue *(Festuca arundinacea)* did not produce as much dry forage as tall fescue that received 120 pounds of N per acre. However, trefoil with orchardgrass *(Dactylis glomerata)* yielded nearly as much as orchardgrass with nitrogen fertilizer. Since orchardgrass is less competitive than tall fescue, it is an ideal companion grass with trefoil, figure 6.

In another 2-year trial at the Sand Mountain Substation, trefoil with Kentucky 31 or Triumph tall fescue yielded about the same as ladino clover but less than red clover or tall fescue with 150 pounds of N per acre, table 10. Had this experiment been continued another year, red clover stand and production probably would have declined while trefoil would have remained productive.

Sod-seeding Fergus trefoil in tall fescue using Paraquat™[1] as a growth suppressant was successful *(1)*. By the third year, trefoil stands and productivity were superior to both red clover and ladino clover.

[1]Paraquat is a product of Chevron Chemical Co.

MANAGEMENT FOR PRODUCTION AND PERSISTENCE

Reseeding is important for persistence of trefoil in pastures. In areas where the perennial nature of trefoil is shortened by diseases, natural reseeding is essential for maintaining stands and productivity *(7)*. This is demonstrated by a 3-year experiment at the Sand Mountain Substation, table 11. Clipping frequently to simulate grazing sharply reduced trefoil stands and production by the third year as compared to clipping frequently but allowing seed production each year. New seedlings arise from natural reseeding from existing trefoil plants, figure 7.

Rotational grazing with cattle or sheep resulted in better persistence and higher animal productivity than under continuous grazing in Ohio research *(8, 9)*. This was due to the unfavorable effect of continuous grazing on maintenance of carbohydrate root reserves, which are normally low for trefoil during the growing season *(6)*. Vigorous trefoil stands can best be maintained by long intervals between harvests, cutting at a high stubble height, and leaving some leaf tissue on plants. Thus, prostrate trefoil types, such as Fergus, can be grazed more frequently and will maintain productivity much better than erect-growing types since many leaves remain on the plants. Practical grazing management of trefoil should allow considerable leaf tissue to assure vigorous regrowth throughout the season. Management becomes even more critical under high temperature conditions in Alabama because carbohydrate root reserves are lower under warm than cool temperatures *(4)*.

TABLE 11. TOTAL FORAGE YIELD AND BOTANICAL COMPOSITION OF AT-1 TREFOIL WITH TALL FESCUE AND ORCHARDGRASS AS AFFECTED BY MANAGEMENT, SAND MOUNTAIN SUBSTATION OVER 3-YEAR PERIOD

Cutting treatment[1]	Dry forage yield per acre			Average trefoil content of forage		
	1978-79	1979-80	1980-81	1978-79	1979-80	1980-81
	Lb.	*Lb.*	*Lb.*	*Pct.*	*Pct.*	*Pct.*
Trefoil alone						
Hay-reseeding	7,850bc*	3,480a	3,550bc	100	100	100
Pasture-reseeding	7,710bc	2,470bc	4,790a	100	100	100
Pasture-no reseeding	6,760cd	2,680bc	3,010bc	100	100	100
Trefoil-Ky. 31 fescue						
Hay-reseeding	8,500ab	3,100ab	3,480bc	25	17	28
Pasture-reseeding	9,270a	2,490bc	3,980ab	34	24	28
Pasture-no reseeding	9,060a	2,160c	2,210d	33	17	2
Trefoil-Boone orchardgrass						
Hay-reseeding	7,280cd	3,630a	3,560bc	70	31	30
Pasture-reseeding	7,130cd	2,780bc	3,960ab	72	38	33
Pasture-no reseeding	6,160d	2,710bc	2,550d	54	22	21

*Any two yield entries within a column marked with the same letter are not significantly different at 5 percent level of probability.

[1]No nitrogen fertilizer applied.

FORAGE QUALITY AND ANIMAL PERFORMANCE

Crude protein and dry matter digestibility of trefoil is at least equal to that of alfalfa. In a Minnesota study *(3)*, substitution of birdsfoot trefoil for alfalfa-grass as one-third of total seasonal pasture resulted in 22 to 24 percent increases in lamb average daily gains (ADG) over a 3-year period. In a 2-year grazing study at the Sand Mountain Substation in northern Alabama, ADG of beef steers on Fergus trefoil-tall fescue pasture was equal to that on ladino clover even though stands of trefoil were thin and average legume composition of the pasture was only 13 percent as compared to 24 percent for ladino clover *(2)*.

At the Tennessee Valley Substation in northern Alabama, the experimental AT-P trefoil was planted in mixtures with two tall fescue varieties and orchardgrass in 2.5-acre paddocks with three replications. Beef steers were grazed during two seasons on the trefoil-grass and tall fescue-nitrogen pastures. Drought seriously reduced production during both years. Stocking rate and gain per acre were highest on the tall fescue-nitrogen pastures, but ADG was much higher on the trefoil grass pastures, table 12. Tall fescue-nitrogen furnished twice the normal ADG, probably a result of the low level of *Acremonium coenophialum*, a fungus that has been associated with poor animal gains on tall fescue. Even so, the trefoil sharply increased ADG to levels well above those normally obtained on small grain pasture. Natural reseeding of trefoil occurred during the 2 years. Steers on trefoil-grass pastures were in excellent condition, figure 8. The outstanding ADG of steers on trefoil suggests that, with this legume, good gains can be maintained on stocker steers in the summer after small grain-ryegrass pastures are mature.

TABLE 12. PERFORMANCE OF BEEF STEERS ON AT-P TREFOIL-GRASS PASTURES AT TENNESSEE VALLEY SUBSTATION, 2-YEAR AVERAGE, 1980-81

Pasture species[1]	Stocking rate, steers/acre	Gain per acre	Average daily gain of steers
	No.	*Lb.*	*Lb.*
Hallmark orchardgrass + trefoil	1.32	357	2.94
Triumph tall fescue + trefoil	1.44	375	2.50
Ky. 31 tall fescue + trefoil	1.35	336	2.36
Ky. 31 tall fescue + 200 lb. N/acre	2.00	425	2.14

[1]Planted September 1979; no nitrogen fertilizer applied to trefoil pastures.

SEED PRODUCTION

Seed yields of trefoil are much lower than other legumes, due primarily to the tendency of pods to dehisce as they mature, scattering seed on the

ground. Seed harvesting is further complicated by the fact that mature and green pods occur throughout the seed production period since plants flower over a long period. Considerable experience is required to determine when to harvest the seed crop. Trefoil seed production is not recommended for farmers in Alabama.

SUMMARY

Birdsfoot trefoil is a productive perennial forage legume with several desirable qualities: (1) tolerant of soil acidity, (2) drought tolerant, (3) resistant to alfalfa weevil, (4) reseeds well from hard seed, (5) non-bloating, and (6) furnishes excellent animal performance. Undesirable qualities are: (1) low seed yields because of shattering, (2) susceptibility to crown and root rot diseases, and (3) poor seedling vigor of northern varieties.

Dry forage yields of trefoil have averaged from 4,000 to over 8,000 pounds per acre. Once established, most varieties have yielded well for several years in northern Alabama. The productive season in northern Alabama extends from April through July and during September to mid-October.

Trefoil shows promise only for northern Alabama. Root rots and nematodes reduce stand persistence in central and southern Alabama.

Poor seedling vigor and slow establishment are serious problems with northern varieties of trefoil, making them poor competitors with weeds and associated grasses. Trefoil varieties of Mediterranean origin germinate better at high temperature, have much better seedling vigor, and provide more rapid establishment than northern varieties.

Prostrate types of trefoil are better suited to grazing than erect-growing types since some leaf tissue must be kept on plants to maintain productivity and stands.

At this time, Fergus is the only commercially available trefoil variety with good seedling vigor, prostrate growth habit, and disease tolerance that appears to be adapted to northern Alabama.

Trefoil grows well in association with orchardgrass or tall fescue if the grasses are planted in 12- to 14-inch rows.

Natural reseeding is important for persistence of trefoil in pastures. Grazing should be light enough to permit some seed production each year.

Steer gains on trefoil have been high in Alabama, averaging over 2.5 pounds per day for the grazing season.

Seed production of trefoil should not be attempted in Alabama since yields will be low because of shattering.

Trefoil is a promising legume for northern Alabama. Some suggestions are offered for growing trefoil on a limited basis:

(1) Soil test to be sure fertilizer and lime needs are met.

(2) Plant 4 to 5 pounds per acre of inoculated Fergus trefoil seed in September on a well-prepared seedbed with a cultipacker-seeder. Plant orchardgrass or tall fescue in 12- to 14-inch rows.

(3) Do not graze until trefoil is 6 inches tall. Graze lightly the first year to permit some seed production.

(4) In succeeding years, do not overgraze. Allow some seed production each year.

ACKNOWLEDGMENT

Technical assistance for these studies was supplied by M.W. Alison, Jr., D.H. Sides, C.F. Weaver, and Judy B. Hill.

Assistance of the following substation and experiment field personnel who cared for field plots and grazing experiments is gratefully acknowledged: W.B. Webster and V.H. Calvert II, Tennessee Valley Substation; J.T. Eason and M.E. Ruf, Sand Mountain Substation; R.A. Moore, Jr., Upper Coastal Plain Substation; W.A. Griffey and H.E. Burgess, Piedmont Substation; L.L. Walker and H.C. Hoyle, Plant Breeding Unit; F.T. Glaze, Prattville Experiment Field; L.A. Smith and H.W. Grimes, Jr., Black Belt Substation; and E.L. Carden and F.B. Selman, Gulf Coast Substation.

LITERATURE CITED

(1) HOVELAND, C.S., M.W. ALISON, JR., R.F. MCCORMICK, JR., W.B. WEBSTER, V.H. CALVERT II, J.T. EASON, M.E. RUF, W.A. GRIFFEY, H.E. BURGESS, L.A. SMITH, AND H.W. GRIMES, JR. 1981. Seeding Legumes in Tall Fescue Sod. Ala. Agr. Exp. Sta. Bull. 531.

(2) _____, R.R. HARRIS, E.E. THOMAS, E.M. CLARK, J.A. MCGUIRE, J.T. EASON, AND M.E. RUF. 1981. Tall Fescue with Ladino Clover or Birdsfoot Trefoil as Pasture for Steers in Northern Alabama. Ala. Agr. Exp. Sta. Bull. 530.

(3) MARTEN, G.C. AND R.M. JORDAN. 1979. Substitution Value of Birdsfoot Trefoil for Alfalfa-grass in Pasture Systems. Agron. J. 71:55-59.

(4) NELSON, C.J. AND DALE SMITH. 1969. Growth of Birdsfoot Trefoil and Alfalfa. IV. Carbohydrate Reserve Levels and Growth Analysis Under Two Temperature Regimes. Crop Sci. 9:589-591.

(5) SEANEY, R.R. 1973. Birdsfoot Trefoil. pp. 177-188. *In* M.E. Heath, D.S. Metcalfe, and R.F. Barnes (ed.), Forages, the Science of Grassland Agriculture (3rd ed.). Iowa State Univ. Press, Ames, Iowa.

(6) SMITH, DALE. 1962. Carbohydrate Root Reserves in Alfalfa, Red Clover, and Birdsfoot Trefoil Under Several Management Schedules. Crop Sci. 2:75-78.

(7) TAYLOR, T.H., W.C. TEMPLETON, JR., AND J.W. WYLER. 1973. Management Effects on Persistence and Productivity of Birdsfoot Trefoil (*Lotus corniculatus* L.). Agron. J. 65:646-648.

(8) VAN KEUREN, R.W. AND R.R. DAVIS. 1968. Persistence of Birdsfoot Trefoil (*Lotus corniculatus* L.) as Influenced by Plant Growth Habit and Grazing Management. Agron. J. 60:92-95.

(9) _____, R.R. DAVIS, D.S. BELL, AND E.W. KLOSTERMAN. 1969. Effect of Grazing Management on the Animal Production from Birdsfoot Trefoil Pastures. Agron. J. 61:422-425.