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PASTURES

for ILLINOIS

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PASTURES FOR ILLINOIS

By R. F. FUELLEMAN, W. L. BURLISON, and W. G. KAMMLADE¹

PASTURE HAS COME TO BE RECOGNIZED as a valuable crop by Illinois farmers. Even during World War II when production of such cultivated crops as corn and soybeans was greatly expanded, almost as much land was maintained in pasture as before the war. Since the war the tendency has been to keep about eight million acres of land in pasture, and to increase the productivity by improving the soil and by good management.



Livestock like these can be produced on good, well-managed pastures.

Pastures are particularly valuable in livestock programs and for erosion control. Profitable production of livestock depends on generous use of pastures. Realizing this, many Illinois farmers are establishing new pastures and improving their old ones so they will furnish a long grazing season with a maximum production of good-quality pasturage.

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Pastures are also effective in controlling soil erosion. At the Dixon Springs Soil Conservation Service Station in southern Illinois, on land having a 9-percent slope every inch of rainfall carried away 1,462 pounds of soil an acre where corn was grown; on adjoining pasture land the soil loss was only 22 pounds an acre. On the corn land nearly one-third inch of topsoil was lost each year. At this rate, in twenty-one years the plow layer will be gone if corn is grown continuously.

ESTABLISHMENT AND CARE

Good Yields Depend on Good Soil Treatment

Much rough, poor land is given over to pasture. This is partly because pasture has seldom been considered a cash crop and partly because many pasture species can survive under rather adverse conditions. Poor land can often be used more economically for pasture than for any other crop.

Many people think that pasture is cheap feed. It is true that a good pasture with a high yield of forage gives cheap feed. But high yields from pastures depend on the fertility of the soil in much the same way that a good crop of soybeans or corn depends on the fertility of the soil. If a good field is pastured constantly, the soil loses nutrients that plants need, especially calcium and



Grass waterways provide pasture and hay, protect the land against soil erosion, and carry away surplus water.

phosphorus. As the fertility goes down, pasture yields go down. Then either the number of livestock on the pasture must be reduced or the pasture acreage expanded.

For highest yields, pasture lands must be fertilized. In tests in western Illinois, yields of forage were increased from about 1,800 pounds an acre to about 4,000 pounds an acre by the use of fertilizers. This increase cost only about one-tenth of a cent per pound of dry matter.

Pasture Crops Vary in Fertility Needs

Species of pasture plants may be adapted to the same climate without having the same soil-fertility requirements. Alfalfa does not do well on poorly drained soils, whereas redtop may produce very well on such areas. Korean lespedeza is much better adapted to soils of low fertility than sweet or red clover or alfalfa. Ladino clover has more tolerance than alfalfa for wet, cool soils because Ladino has a relatively shallow root system. The fact that such plants as lespedeza, timothy, and redtop produce good yields under a wider range of soil conditions than do some of the other Illinois pasture crops does not mean that they will thrive anywhere — they too will not yield well on soils of very low fertility.

It follows that soils low in productivity may need less building up for some pasture crops than for others. Sweet clover, for instance, when inoculated, can gather most of its nutrients except calcium from subsoil sources that are not so readily available to other crops; but not being able to get calcium so readily, it is very sensitive to soil acidity. It will fail entirely on soils only moderately acid even though they are otherwise in a fair state of productivity. Some species like Korean lespedeza, birdsfoot trefoil, alsike clover, and some of the grasses have a greater tolerance than sweet clover for soil acidity.

Many Illinois Soils Need Organic Matter

To grow well pasture plants need nitrogen and moisture, both of which depend to some extent on the organic matter in the soil. Nitrogen can be supplied by organic matter in the form of manure and legume crops plowed down, manure applied as a

top-dressing, or legumes and nonlegumes seeded together. If the soil is well supplied with organic matter, moisture penetrates it more easily and its water-holding capacity is greatly increased.

One way to supply the soil with organic matter and keep the productivity high is to grow legumes in association with grasses. When pastures are made up of either legumes alone or a combination of legumes and grasses, nitrogen and organic matter are not likely to need further attention. If grasses are grown without legumes, either barnyard manures or commercial nitrogen should be applied on the pasture.

Few farmers have used manure regularly as a top-dressing for pastures, preferring to apply it to cultivated crops. Excellent results have been obtained, however, from the consistent use of manures on pasture at Urbana. The use of commercial nitrogen, although more expensive, may often be justified where high-producing dairy cows, beef-breeding cattle, and breeding sheep are pastured. It increases both yield and quality of pasture (Table 1).

Limestone Usually Needed

In Illinois, where a large portion of the pasture land is low in readily available lime because of the losses through leaching and crop removal, application of limestone is, in general, the most important single soil-treatment practice for good pasture production. Many of the pasture crops, especially the legumes, require liberal amounts of calcium, and when grown on soils low in available lime, they are not able to get all the plant-food materials they need. Consequently they grow poorly or not at all, depending upon their tolerance of the acidity and lime deficiency existing at the time.

When calcium deficiencies are corrected by proper amounts of limestone, legume growth is encouraged. This increased growth enables plants to take up mineral elements easily from sources in the soil they were not able to reach before and then to fix atmospheric nitrogen. As a result, more fresh organic matter can be returned to the soil, and fertility levels are gradually raised.

Most grasses, particularly Kentucky bluegrass and brome-grass, receive indirect benefit from limestone. This benefit comes

Table 1.—Yield and Chemical Composition of Bluegrass Hay Under Different Soil Treatments^a

Soil treatment ^b	Hay, pounds per acre	Nitro- gen	Pro- tein	Phos- phorus	Cal- cium	Mag- nesium	Pounds per ton of hay						
Clayton, May 25, 1939													
None.....	790	24.0	150	3.2	6.0	4.4							
Lime.....	840	26.0	162	3.6	6.8	3.4							
L (NH ₄) ₂ SO ₄	1 770	37.8	236	3.4	6.8	4.4							
LsP.....	910	24.2	151	5.4	6.8	4.4							
LsPK (NH ₄) ₂ SO ₄	1 990	32.4	202	5.8	8.0	4.8							
(NH ₄) ₂ SO ₄	1 640	34.0	212	3.2	5.2	4.8							
sP.....	960	25.8	161	5.8	5.2	4.7							
sPK (NH ₄) ₂ SO ₄	1 790	33.6	210	6.2	5.2	4.8							
Elizabethtown, June 2, 1943													
None.....	240	29.2	182	3.6	5.8	3.0							
(NH ₄) ₂ SO ₄	2 100	60.0	375	3.2	2.4	1.0							
Uramon.....	1 790	55.2	345	4.0	4.8	1.2							
Soybean meal.....	1 910	55.6	348	4.0	3.6	.8							
sP (NH ₄) ₂ SO ₄	6 340	60.4	378	6.6	5.0	2.0							
sP Uramon.....	4 740	49.6	310	6.4	8.2	3.8							
sP Soybean meal.....	5 280	50.4	315	6.6	6.4	3.2							

^a Adapted from Illinois Bulletin 518.

^b L = limestone; (NH₄)₂SO₄ = ammonium sulfate or nitrogen fertilizer; sP = superphosphate; K = potassium; Uramon = trade name for urea; **boldface** = treatments containing commercial nitrogen.

from the nitrogen produced by the legumes and from the increased fertility of the soil.

Some Illinois Soils Lack Phosphorus

In some parts of the state the use of phosphorus fertilizers is a basic need for pasture production. Many soils are naturally deficient in phosphorus; crop removals and pasturing have depleted the phosphorus still more. On these soils production both of grasses and legumes is increased very greatly by the addition of phosphorus. At Dixon Springs in southern Illinois pastures treated with limestone and phosphate yielded 3,164 pounds of dry matter an acre while untreated land yielded only 1,069 pounds. The forage produced on phosphorus-deficient soils has not been found, however, to be deficient in nutrients.

Both lime and phosphate help indirectly to control weeds by stimulating the growth of grasses and legumes.

Potash Deficiencies Becoming More Common

Within recent years applications of potash have become more and more necessary for production of legumes and grasses. This condition is a result of heavy crop removals and pasturing. Although pasturing does not remove potash as rapidly as does the growing of cultivated crops, over a long time the constant slow mining of potash reduces pasture productivity.

Soil Tests Will Show Soil Deficiencies

Before deciding what soil treatment a pasture needs, the soil should be thoroughly tested, especially for its need for lime and phosphorus. Tests of thousands of acres of Illinois farm land have shown a wide variation in available phosphorus as well as in acidity. Other tests have likewise shown that legumes have definite phosphorus requirements as well as definite lime requirements, but that the amounts needed vary for different legumes. Since a deficiency of potash frequently limits pasture production, this test should also be made, especially if a deficiency is suspected.

Instructions for making rapid tests for acidity and available phosphorus can be obtained from the University of Illinois College of Agriculture, Urbana, or from the county farm adviser. To test for available potash, however, it is better to send soil samples to the county laboratory, if there is one, or to the Department of Agronomy at the University of Illinois.

These tests will aid in deciding:

1. Whether fertilizer materials should be applied and the quantities needed
2. The field or parts of fields best suited to growing legumes
3. The legume best adapted to that particular soil

How to Apply Fertilizers

Limestone. The requirements of established pasture crops are best met by applying the limestone as a top-dressing and lightly harrowing or disking it in. Where a new pasture seeding is to be established, apply the limestone after plowing. Then

before seeding, disk or harrow the limestone into the surface of the soil.

Phosphorus. Phosphorus deficiencies are corrected by applying rock phosphate, superphosphate, bone phosphate, or mixed fertilizers high in phosphorus. Rock phosphate and superphosphate are ordinarily the most economical forms to use. Rock phosphate is probably best applied during seedbed preparation at rates ranging from 500 to 2,000 pounds an acre, although it may be applied as a top-dressing. Superphosphate, because of its relatively higher availability, can be applied more frequently than rock phosphate and in smaller amounts, ranging from 100 to 300 pounds an acre. Superphosphate also may be applied either during seedbed preparation or as a top-dressing. Some farmers use a small quantity of superphosphate along with the rock phosphate with good results.

Potash. Where potash is needed, it can be applied either as a part of a mixed fertilizer or as muriate of potash at the rate of 100 to 150 pounds an acre or according to needs shown by the soil tests.

Nitrogen. During the war nitrogen in huge quantities was produced for explosives and other materials. This production continued after the war and with the nitrogen available from natural sources may well result in greater use of nitrogen in agriculture, especially for pastures. If commercial carriers of nitrogen are used, spring and fall applications of 100 to 500 pounds an acre may be made. The nitrogen can be purchased in the form of sodium nitrate, ammonium sulfate, ammonium nitrate, urea, or calcium cyanamid.

Nitrogen fertilizers should not be applied when the foliage is wet or they will burn it.

Terraces Helpful on Some Soil Types

On sloping land subject to erosion, properly spaced terraces are helpful in holding the soil while a good sod is being established, and in conserving moisture. On badly eroded and impermeable soils, terraces are effective in disposing of the excess water which will not penetrate into the soil. Terrace outlets must

be well established before the terraces are built, and it will be necessary to watch and maintain both the terraces and their outlet after they are built, just as one would maintain a well-built fence. (Not all sloping land that is in pasture needs to be terraced.)

Contour furrows on relatively steep slopes in permanent pastures help to prevent erosion and to conserve moisture.

Quality of Seed More Important Than Price

For maximum yields only the best seed should be sown. Both grass and legume seeds vary greatly in quality and adaptation, and naturally the better seed commands the higher price.

The germination record should be high, and the seed should be free from weed seeds, especially of noxious weeds. Although state and federal weed and seed laws give a measure of protection against poor seed, it is well to read the label on each bag of seed.

Seedbed Should Be Firm

Many stands of pasture plants are thin or are lost because of poor seedbeds. These plants need a moist, fine, compact, and fertile seedbed. In fact a well-prepared seedbed is probably more essential for them than for any other crop.

Thorough plowing and cultivation, including disking and sometimes rolling, of land that is adequately drained, usually provides a satisfactory seedbed. On steep slopes, plowing and disking should be done on the contour, and any sod draws that have developed should be left undisturbed to form grass waterways.

Time and Methods of Seeding

The best time to seed pastures depends on the crop as well as on seasonal conditions. Early fall seeding is best for grasses, though very early spring seeding is often practiced too. For legumes, early spring seedings are the most common, except that in southern Illinois alfalfa is usually seeded in late summer or early fall. Spring seedings are often endangered by weeds and lack of rainfall; fall seedings are in danger of winterkilling.

Depth of planting must be adjusted to the crop. Grasses and small-seeded legumes should be planted not over $\frac{1}{4}$ inch deep. Larger-seeded legumes can be planted $\frac{1}{2}$ inch deep. All should be covered to the proper depth with fine, moist soil.

Uniform distribution of seed is especially important for mixtures. Any method that will assure this result can be used. Half the seed is sometimes sown in one direction and the other half at right angles to the first. When mechanical seeders are used, the legume seeds must be sown separately because they do not remain uniformly mixed with the lighter grass seeds but gravitate to the bottom of the seeder.

When a pasture mixture is to be seeded with a small-grain nurse crop, the small grain should be seeded first and the mixture afterward to prevent the small seeds from being covered too deeply. Many farmers arrange the grass spouts on their drills so that they extend back of the disks and broadcast the seed on the surface of the ground. Rolling with a corrugated roller before broadcasting and again after seeding usually covers the seed sufficiently and firms the seedbed.

Grazing and Clipping of New Pastures

Small grains used as a nurse crop not only hinder the growth of weeds, but furnish forage soon after seeding. As soon as a nurse crop is large enough for pasturing it should be grazed lightly during dry weather in order to prevent its competing with the delicate pasture seedlings.

New pastures should never be heavily grazed before they are well established, but light grazing of pasture mixtures seeded alone helps to control weeds. When weeds threaten to smother out the pasture mixture, clipping with a mower is usually helpful.

Management of Established Pastures

Unproductive pastures usually result from poor soil conditions, poor management, or both.

Overgrazing is a common fault in pasture management, and is an important cause of poor production. Overgrazing does not give the grass a chance to develop satisfactorily — in fact, under such treatment it does well to survive even when soil and climate



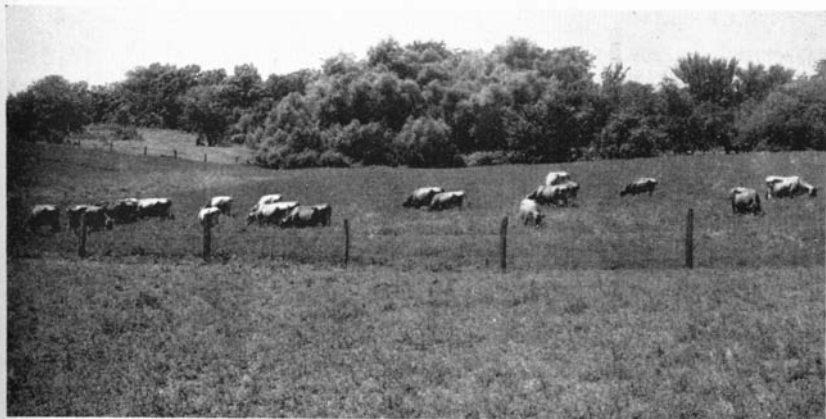
Overgrazing is responsible for more unproductive pastures than any other management practice. An overgrazed pasture cannot carry as many animals through the season as one that is well managed.

are favorable. Animals should not be turned onto the pasture in the spring until the grass has reached a height of 4 to 5 inches.

Alternate grazing gives better quality feed than continuous grazing, better gains are obtained by animals, and legumes remain as a part of the pasture for a longer time. If more than one pasture is available, or if a pasture can be divided conveniently, the animals should be permitted to graze one area down to a height of 3 to 4 inches before being moved to the next. After the first pasture has revived, the animals may then be brought back for further grazing while the second recuperates.

At Urbana, sheep were grazed on brome-grass-alfalfa pasture under heavy and moderate continuous grazing and heavy and moderate alternate grazing. (During the alternate grazing sheep were on pasture during May, July, August, and October.) Averages of six years of trials were:

<i>How grazed</i>	<i>Average seasonal production lb.</i>	<i>Average seasonal gain lb.</i>
Heavy continuous.....	6 448	230.0
Moderate continuous.....	6 763	211.7
Moderate alternate.....	7 976	230.8
Heavy alternate.....	7 122	303.0



Alternate grazing on alfalfa. The cattle have just been moved from the field in the foreground to the recovered pasture on the other side of the fence.

Rolling the pasture in early spring is beneficial if heaving has been severe. **Cultivation** and **reseeding** of old pastures are not recommended unless the soil has been tested and minerals added to correct deficiencies.

Mowing established pastures will prevent weeds from reseeding and thus cause more rapid development of pasture plants.



Farm ponds help solve the water problem on pasture. This pond was made by building an embankment across a gully. It has a 40-acre watershed.

Frequent harrowing will scatter the droppings from the stock and encourage more uniform grazing.

Fall, winter, or early spring applications of barnyard manure will materially increase the carrying capacity of pastures on lands low in fertility.

PASTURE PLANTS ADAPTED TO ILLINOIS

Four kinds of pastures are common in Illinois:

Permanent pastures — which remain year after year on the same land.

Rotation pastures — which are part of a regular crop rotation, as, for example, sweet clover in a corn, oats, sweet clover rotation.

Temporary and supplementary pastures — used to supplement permanent pastures during periods of low production and during the late fall, when the permanent pasture should be given an opportunity to develop a good cover and to replenish the root reserves before growth ceases. A number of different plants can be used for this purpose, including Sudan grass, sweet Sudan grass, soybeans, winter rye, oats, cowpeas, rape, annual lespedeza, foxtail millet, Japanese millet, and buckwheat.



The field on the right is an improved pasture seeded with deep-rooted legumes — alfalfa, sweet clover, and red clover.

Woodland pastures—where the grazing is supplemented largely by brush and shrubs.

Choice of plants depends upon the use for which the pasture is intended, upon adaptation to type of soil, drainage, and prevailing weather, and often upon the likelihood of attack by insect pests and plant diseases. Palatability should also be considered. Some information on palatability is included with the descriptions of the different species of plants given on pages 28 to 61.

For permanent pastures many kinds of grasses and legumes are available, of which the most important for Illinois are listed below. Rotation pastures usually consist of one or more of these.

Grasses

Timothy
Kentucky bluegrass
Canada bluegrass
Redtop
Orchard grass
Ryegrass
Tall oatgrass
Tall fescue
Meadow fescue
Bromegrass
Meadow foxtail
Reed canary grass

Legumes

Alfalfa
Alsike clover
Red clover
Mammoth clover
White clover
Sweet clover
Lespedeza
Birdsfoot trefoil
Ladino clover
Hop clover
Yellow trefoil

Soil, Drainage, and Climate Need To Be Considered

The adaptation of various forage crops to the different soil and climatic conditions in Illinois is given below. Those marked with a star (*) are not discussed in the text because they are of only limited use in Illinois. Grasses are listed first and legumes second.

Drouth resistant

Bromegrass
Tall oatgrass
Switch grass
Big bluestem
Wheat grasses*
Lespedeza
Sweet clover
Alfalfa
Birdsfoot trefoil

Tolerant to shade

Orchard grass
Rough-stalk meadow grass
Wood meadow grass*
Tall fescue
Red fescue*
Chewing's fescue*
White clover
(slight tolerance)

Tolerant to poor soil

Orchard grass
 Canada bluegrass
 Tall oatgrass
 Red fescue*
 Chewing's fescue*
 Redtop
 Tall fescue (Alta
 and Kentucky 31)
 Big bluestem
 Little bluestem
 Switch grass
 Indian grass
 Bentgrass*
 Sheep fescue*
 Lespedeza
 Sweet clover
 Mammoth clover
 Birdsfoot trefoil

} Tolerant if
 soil is sweet

Warm weather required

Sorghums
 Sudan grass
 Bermuda grass*
 Soybeans
 Cowpeas
 Lespedeza
 Hubam sweet clover*
 Kudzu*

Tolerant to sandy soil

Bromegrass
 Italian ryegrass
 Tall oatgrass
 Canada bluegrass
 Meadow foxtail
 Reed canary grass
 Redtop
 Red fescue*
 Sheep fescue*
 Bermuda grass*
 Alfalfa
 Winter vetch
 Cowpeas

} Tolerant if
 soil is wet

Cool weather required

Kentucky bluegrass
 Canada bluegrass
 Timothy
 Bromegrass
 Wheat grasses*
 Field peas
 Winter vetch
 Red clover
 Alsike clover
 Crimson clover
 Hop clover
 Yellow trefoil
 Bur clover*
 Button clover*
 Strawberry clover*
 Field peas*

Rich soil required

Kentucky bluegrass
 Timothy
 Bromegrass
 Perennial ryegrass
 Alfalfa
 Red clover
 Alsike clover
 White clover
 Ladino clover

Tolerant to wet soil

Reed canary grass
 Timothy
 Tall fescue
 Meadow foxtail
 Canada bluegrass
 Rough-stalk meadow
 grass
 Redtop
 Alsike clover
 White clover
 Ladino clover
 Big trefoil*

Mixtures Make Best Permanent Pastures

Permanent pastures are rarely made up of only one kind of plant. Mixtures of different grasses and legumes generally give the best results. Important reasons for using mixtures are:

1. Legumes in the mixture, when properly inoculated, gather nitrogen.
2. Mixtures usually give more complete coverage.
3. Production is more uniform throughout the season.
4. A mixture of grasses and legumes provides a more nearly balanced ration than either alone.
5. Mixtures of grasses and legumes often are more productive than either alone.
6. Mixtures of grasses and legumes lessen the danger of freezing and heaving of legumes.
7. Mixtures of grasses and legumes lessen the danger of bloat.

The rates and dates of seeding of forage crops in pure stands are given in Table 2. Since pure stands are not recommended for permanent pastures, the rates should be reduced in proportion to the number of species used in the mixture. Further adjustment in rates is usually necessary, depending upon soil types, fertility, and the use to which the pasture is to be put. A pasture satisfactory for beef cattle, for example, may not be desirable either for dairy cattle or for hogs.

The choice depends largely upon the adaptability of the various plants to natural conditions. Under the best conditions of soil and climate and freedom from insect pests and disease, many crops can be used for permanent pasture. Under the most adverse conditions — shade, poor drainage, and depleted, acid soil — the choice is much more limited, unless some of the limitations are corrected.

Since the establishment of every pasture is an individual problem, only a few pasture mixtures are suggested here. By consulting the list of adapted plants on page 15, the plant descriptions on pages 28 to 61, and Table 2, mixtures can be compounded for individual conditions.

Wherever a turf is wanted in the shortest time possible without a nurse crop of small grain, ryegrass if adapted may be included in any of the following mixtures.

Table 2. — Seeding Rates and Dates for Forage Crops
When Seeded Alone

(These are only approximations; seedings may be heavier or lighter,
depending on the soil, the purpose, or other variables.)

Crop	Weight per bushel	Rate of seeding per acre	Time of seeding		Depth
			Fall	Spring	
	<i>lb.</i>	<i>lb.</i>			<i>in.</i>
Alfalfa.....	60	12-15	Aug. 1-15	Apr.-May	1/2-1
Bentgrass.....	14	15	.....	.....	1/2-1
Bermuda grass.....	20-40	5	Aug. 1-15	Late spring	1/2-1
Birdsfoot trefoil.....	60	4-6	Aug. 15-Sept. 1	Apr.-May	1/4-1/2
Bluegrass					
Canada.....	14	15	Aug. 15-Sept. 20	Mar.-May	1/2-1
Kentucky.....	14	15	Aug. 15-Sept. 20	Mar.-May	1/2-1
Rough-stalk meadow	14	20-25	Aug. 15-Sept. 20	Mar.-May	1/2-1
Bromegrass.....	14	7-10	Aug. 15-Sept. 1	Mar. 24-Apr. 15	1/2-1
Clover					
Alsike.....	60	7-8	.....	Feb. 20-Apr. 10	1/2-1
Crimson.....	60	15	July-Sept.	.....	1/2
Hop.....	60	2-4	Aug. 15-Sept. 15	.....	1/2
Ladino.....	60	2-3	Aug. 15-Sept. 1	Apr.-May	1/4-1/2
Mammoth.....	60	8-10	Aug. 15-Sept. 1	Feb. 15-Mar. 15	1/4-3/4
Red.....	60	8-10	August	Feb.-Apr.	1/2-1
White.....	60	2-4	August	Apr.-June	1/2-1
Crested wheat grass... 20-24	12-20	12-20	August	Mar. 15-Apr. 15	1/2-1
Fescue					
Chewing's.....	24	15	August	Mar.-May	1/2-3/4
Tall or Meadow.....	24	8-10	August	Apr.-May	1/2-3/4
Red.....	24	15	August	Mar.-May	1/2-3/4
Sheep.....	10-15	15	August	Mar.-May	1/2-3/4
Lespedeza					
Common.....	25	10-20	.....	Mar.-Apr.	1/2
Kobe.....	25	10-20	.....	Mar.-Apr.	1/2
Korean.....	25	10-20	.....	Mar.-Apr.	1/2
Sericea.....	60	10-15	.....	Feb.-Apr.	1/2
Meadow foxtail.....	14	12-15	Aug. 20-Sept. 10	Feb.-Apr.	1/2
Millet					
Foxtail.....	50	20-30	.....	May 20-July 1	1
Japanese.....	50	20-30	.....	May 20-July 1	1
Oats.....	32	64 (2 bu.)	.....	Mar. 15-Apr. 15	1
Orchard grass.....	14	15	August	Mar.-May	1/2
Rape.....	50	2-5	.....	Apr. 1-Aug. 15	1/2-1
Redtop.....	14	8-10	July 15-Sept. 10	Mar.-May	1/2
Reed canary grass..... 44-48	6-8	August	Mar. 1-Apr. 15	Mar. 1-Apr. 15	1/2-1
Ryegrass.....	24	12-15	Aug. 15-Sept. 1	Apr.-May	1/2-3/4
Rye					
Spring.....	56	75-90	.....	Mar. 1-Apr. 15	1/2-2
Winter.....	56	70-112	Sept.-Nov.	.....	1/2-2
Sorghum, sweet.....	50	60-80	.....	May 1-June 10	1/2-1
Soybeans.....	60	90-130	.....	May 10-June 10	1 1/2-2

Table 2.—Continued

Crop	Weight per bushel	Rate of seeding per acre	Time of seeding		Depth
			Fall	Spring	
	<i>lb.</i>	<i>lb.</i>			<i>in.</i>
Sudan grass (also sweet Sudan).....	36-40	20	.....	May 10-June 15	½-1
Sweet clover					
Biennial white hulled	60	12-15	Aug. 1-15	April	½-1½
Biennial yellow hulled	60	12-15	Aug. 1-15	April	½-1½
Unhulled.....	60	15-18	.....	March 1-15	½-1½
Hubam annual.....	60	12-15	.....	April	½-1½
Tall oatgrass.....	10-16	15	August 15	Mar.-Apr.	½-1½
Timothy.....	45	6-10	Aug. 15-Oct. 1	Mar.-Apr.	½-1
Wheat					
Spring.....	60	120 (2 bu.)	.....	Feb. 25-Apr. 10	1-3
Winter.....	60	90 (1½ bu.)	Sept. 20-Oct. 10	.....	1-3
Winter vetch.....	60	30	Sept. 10-Oct. 10	Mar. 20-Apr. 10	1½-2
Yellow trefoil.....	60	12	Aug. 15-Sept. 15	.....	½

Mixtures for rich, well-drained soils. For rich, well-drained cornbelt soils there is a wide choice of crops. A simple mixture for such soils may include both a large and a small legume and a large and a small grass, such as the following:

	<i>Pounds per acre</i>
Alfalfa.....	10 or 11
Ladino clover.....	1
Bromegrass.....	5
Redtop.....	3

Properly managed, this mixture should furnish many seasons of good grazing.

Other mixtures that may be used on rich, well-drained soils are:

	<i>Pounds per acre</i>		<i>Pounds per acre</i>
Bromegrass.....	4	Bromegrass.....	5
Kentucky bluegrass.....	4	Timothy.....	4
Timothy.....	3	Red clover.....	2
Redtop.....	3	Alsike clover.....	2
Red clover.....	2	White clover.....	1
Alfalfa.....	2	Ladino clover.....	1
White clover.....	2		
Alsike clover.....	2		

	<i>Pounds per acre</i>		<i>Pounds per acre</i>
Timothy.....	4	Orchard grass.....	5
Kentucky bluegrass.....	4	Kentucky bluegrass.....	4
Redtop.....	4	Redtop.....	3
Alfalfa.....	2	Red clover.....	3
Red clover.....	2	White clover.....	1
White clover.....	1	Ladino clover.....	1
Ladino clover.....	1		

Mixtures for fertile but poorly drained soils. A wide variety of forage plants may be included in the mixtures for fertile, poorly drained soils:

	<i>Pounds per acre</i>		<i>Pounds per acre</i>
Tall fescue.....	5	Tall fescue.....	5
Timothy.....	4	Timothy.....	4
Redtop.....	4	Canada bluegrass.....	4
Alsike clover.....	2	Redtop.....	3
Ladino clover.....	2	Alsike clover.....	2
		White clover.....	2

If the soil is extremely wet, reed canary grass should be used alone. On moderately wet soils or bottomland, alsike clover, redtop, and Ladino clover are used to hasten establishment.

Mixtures for poor but well-drained soils. The plants in the following mixtures are well adapted to soils of this type:

	<i>Pounds per acre</i>		<i>Pounds per acre</i>
Orchard grass.....	5	Tall fescue.....	5
Canada bluegrass.....	5	Orchard grass.....	4
Redtop.....	4	Timothy.....	3
Lespedeza.....	5	Redtop.....	3
Birdsfoot trefoil.....	2	Lespedeza.....	4
		Alsike clover.....	2
		White clover.....	2

Mixtures for poor, wet soils. Not so many kinds of plants are adapted to these soils, but the plants that are adapted include both grasses and legumes.

	<i>Pounds per acre</i>		<i>Pounds per acre</i>
Timothy.....	7	Canada bluegrass.....	6
Redtop.....	7	Timothy.....	5
Alsike clover.....	3	Redtop.....	5
		Alsike clover.....	3

Reed canary grass is not used here because it requires fertile soil.

Mixtures for sandy soil. Unusual soils demand special consideration. On a sandy soil, for example, the following mixtures may be used:

	<i>Pounds per acre</i>		<i>Pounds per acre</i>
Bromegrass.....	5	Bromegrass.....	5
Tall fescue.....	4	Italian ryegrass.....	3
Italian ryegrass.....	4	Canada bluegrass.....	3
Canada bluegrass.....	4	Sweet clover or alfalfa.....	4
Redtop.....	3	Birdsfoot trefoil.....	4
Alsike clover.....	2		

Meadow foxtail is tolerant to sandy soils only when they are wet. Alfalfa or sweet clover is not tolerant to wet or acid soils.

Mixtures for varying soils. Where soils of a field vary in type, fertility, and drainage, as they often do, plants which have a wide range of adaptation or widely different requirements should be included:

	<i>Pounds per acre</i>		<i>Pounds per acre</i>
Orchard grass.....	4	Bromegrass.....	5
Timothy.....	3	Tall fescue.....	5
Redtop.....	3	Orchard grass.....	3
Kentucky bluegrass.....	3	Birdsfoot trefoil.....	4
Canada bluegrass.....	3	Alsike clover.....	2
Lespedeza.....	4		
White clover.....	2		

Lespedeza is not so well adapted to the northern part of the state as alfalfa and red clover.

Mixtures for shaded areas. For shaded areas plants tolerant to shade would be chosen from the list on page 15. For example—

	<i>Pounds per acre</i>
Orchard grass.....	10
Rough-stalk meadow grass.....	6
White clover.....	2

This mixture would not be chosen for a more favorable environment; but only a few crops are tolerant to shade, and no legumes will stand dense shade.

Rotation Pastures Are Usually Legumes

Legumes alone, legumes and grasses, and grain, grown as part of regular crop rotations, furnish an important source of livestock forage. Exactly how much pasture land in Illinois is now included

in regular rotations is not known, but the information available indicates that more than 25 million acres of plowable land were in pasture in 1946, of which a fairly large portion was probably in more or less regular rotations.

Rotation pastures usually consist of legumes — sweet clover, red clover, alfalfa, and lespedeza — for one of the principal reasons for including pasture in rotations is to enrich the soil through the addition of organic matter and nitrogen.

Sweet clover was grown on about 900,000 acres of Illinois land in 1946. Although in the livestock section of Illinois sweet clover has been used extensively for pasture, it is usually grown in this state primarily for soil enrichment and only secondarily for pasture.

Red clover still remains an all-round legume for soil enrichment, for pasture, and for hay. In regular rotations it serves well for pasture. During recent years the acreage has increased, partially to offset sweet-clover losses from weevils.

Alfalfa acreage in Illinois has expanded to about 650,000 acres in recent years. Although much of the crop is used for hay, the trend has been to include more alfalfa in pasture mixtures.

Lespedeza has found a place in the rotation on many farms where small grain is grown extensively. After grain harvest, when permanent pastures are in a period of low production, this plant furnishes an abundance of pasture, especially in the southern half of Illinois.

Grazing of *small grain* in the regular rotation is increasing in southern Illinois owing largely to the introduction of winter barley, Balbo rye, and winter oats. Legumes such as red clover, sweet clover, and lespedeza, grown with a grain crop make a productive combination for rotation pastures.

Small Grains Make Good Temporary Pastures

All the small grains — oats, rye, wheat, and barley — produce good pasture and are often used for emergency or temporary pastures. Various combinations of small grains with legumes are also used for emergency pastures (Table 3).

Fall-sown pastures. Rye sown in the fall is an excellent winter and early spring pasture. Under favorable conditions

Table 3.—Crops and Crop Mixtures for Emergency Pastures

Crop or mixture	Rate of seeding per acre	Date of seeding	Time from sowing until ready to pasture	Approximate grazing period	Precaution
Oats alone	2-3 bu.	March or early Apr.	4-5 wk.	4-6 wk.	Seed early as possible
Oats	2 bu. }	March or early Apr.	6-7 wk.	4-6 wk.	Canada peas not advised in southern Illinois
Canada peas	60-90 lb. }				
Oats	2 bu. }	March or early Apr.	6-7 wk.	4-6 wk.	Rape not desirable for dairy cattle
Rape	3-4 lb. }				
Oats	1-1½ bu. }	March or early Apr.	8-10 wk.	Rest of summer	Seed early on sweet soil
Sweet clover	10 lb. }				
Oats	2 bu. }	April	6-8 wk.	Rest of summer	Lespedeza will reseed where adapted
Lespedeza	10 lb. }				
Cowpeas	2 bu.	May-June	6-7 wk.	4-6 wk.	For southern Illinois
Sudan	20 lb.	May 15-20	6-8 wk.	4-6 wk.	Use only guaranteed pure Sudan
Sweet Sudan	20 lb.	May 15-20	6-8 wk.	4-7 wk.	
Soybeans	1½ bu. }	After corn planting	8-10 wk.	4-6 wk.	Use only guaranteed pure Sudan
Sudan	10-15 lb. }				
Soybeans	1½ bu. }	After corn planting	8-10 wk.	4-6 wk.	Not safe after frost
Sorghum (sweet)	20 lb. }				
General mixtures					
(1)					
Oats	2 bu. }	March or April	6-8 wk.	Rest of summer	Do not seed on sour soil
Sweet clover	2 lb. }				
Red clover	2 lb. }				
Alsike	2 lb. }				
Timothy	2 lb. }				
Rape	2 lb. }				
(2)					
Oats	1 bu. }	March or April	8-10 wk.	Rest of season	Do not seed on sour soil
Alfalfa	4 lb. }				
Sweet clover	4 lb. }				
Red clover and (or) alsike	4 lb. }				
Timothy	4 lb. }				
Corn	2-3 bu.					May to July	4-6 wk.	Rest of season	Best adapted as a soiling crop
German or foxtail millet	20 lb.	Up to June 20	3-4 wk.	6-7 wk.	

winter wheat also affords winter and early spring pasture, although considerable care must be exercised not to overpasture it and thus prevent it from returning an average crop of grain. Wheat that is to be pastured should be seeded on the most fertile soil available, for otherwise the yield is likely to be somewhat reduced. Where chinch bugs are present, pasturing wheat increases the insect hazard, especially on soils of medium to low fertility and when moisture is not plentiful during early spring.

In the southern part of Illinois *winter barley* for pasture is attracting attention. Considerable interest has also been manifested in *winter oats* during recent years. This crop, however, is not likely to live through the winter in Illinois, except in the extreme southern part of the state.

Where adapted, however, winter oats make a desirable pasture crop. They are not subject to infestation by Hessian fly as are winter wheat and winter barley, so they can safely be seeded early enough to provide a good yield of forage.

Spring-seeded pastures. Among the spring-seeded pastures, *oats* give the greatest pasturage in the shortest time and at the least cost. Seeded early they give satisfactory pasturage in four to six weeks. When pastured lightly they may still produce a hay or grain crop in June or July.

Unfortunately oats do not provide prolonged pasturage, and consequently some system of pasture rotation should be provided. The field should be so divided, where practicable, that the stock can be confined to one portion until another section is ready for grazing, and in the second section a crop that will provide additional forage should be planted with the oats. A good mixture for the second section is 2 bushels of oats and 1½ bushels (90 pounds) of Canada field peas an acre, a combination that makes highly satisfactory pasturage on medium-fertile soils provided stock are not put on it for at least seven weeks after it is seeded. The oats and peas should be sown early at oat-seeding time. Canada field peas are primarily adapted to cool weather and to soils of medium fertility. They are of doubtful value on the light gray soils of southern Illinois.

Another commonly used mixture, which has proved highly satisfactory, especially for hogs and sheep, for the second plot

of an oats pasture is *2 bushels of oats and 3 pounds of rape an acre*. Oats and rape can be seeded as early in the spring as the land can be cultivated and they are ready for pasturing practically as early as the plot seeded to oats alone. Where milk cows are to be pastured, rape is not desirable in the mixture, as the milk may be off-flavor.

Another mixture that may be used for the second pasture is *2 bushels of oats and 8 pounds of sweet clover an acre*. This mixture is worthless on sour soils, and it must have at least eight weeks before stock are started on it. On medium-acid soils that have been limed recently, and where sweet clover has not been grown, one or more clovers should be added to make the mixture a little more certain. A good mixture under such conditions is *2 bushels of oats an acre and 2 pounds each of red clover, sweet clover, alsike, timothy, and rape*. (Omit rape where dairy cows are to be pastured.) On soils in a relatively low state of fertility and inclined to be acid, the sweet clover should be left out and alsike clover correspondingly increased. This mixture is not adapted to the light gray soils of southern Illinois. At Urbana this mixture, known as Haas mixture, has produced as much as 416 pounds of beef an acre.

On soils of medium to low fertility *Sudan grass* or *sweet Sudan* seeded 20 pounds to the acre at corn-planting time will



Sudan grass is a well-liked annual emergency pasture and hay crop.

usually carry more stock than any other pasture that can be seeded for emergency purposes. Here again an oat pasture to carry the stock until the Sudan grass is well started is helpful. After the oat section has been pastured off, a second seeding of Sudan can be made, in this portion of the field, as late as August 5 in central Illinois and still develop into good pasture for late summer and early fall if there is enough moisture to start the crop. Sudan can be pastured safely until frost, but should be abandoned after a killing frost because of the danger of forage poisoning.

Sudan grass or sweet Sudan also serves well in a mixture with *soybeans* seeded as soon as the soil warms up. This mixture is ready for use in midsummer, when permanent pastures are usually short and additional pasturage is badly needed. Soybeans seeded with Sudan grass may reduce the hazard of chinch bugs injuring the Sudan grass. A mixture of Sudan and soybeans makes better pasture than soybeans alone. Millet is sometimes used, but experience thus far has shown it to be much less desirable than Sudan, even in a mixture with soybeans.

Woodland Pastures Generally Unproductive

Research at various state experiment stations shows that woodlands in northern areas are best used for timber production. Both timber and pasture cannot be economically produced on the same land.

Woodlands are undesirable for pasturing because, under average grazing conditions, they produce only a limited supply of forage and because they are likely to contain plants poisonous to stock. Grass growing in shade yields only about one-third as much (dry-weight basis) per unit of area as grass grown in open sunlight, and the nutritive value also is less, for such grasses contain a smaller amount both of sugar and of starch. Furthermore the grazing of some woodlands destroys more timber than the forage is worth. Timber can be produced successfully only on land that is not grazed.

Where only enough trees are maintained to give shade for the pasturing animals, forage plants tolerant to shade should be selected for seeding. These are orchard grass, tall fescue, rough-stalk meadow grass, and white clover.



Although it will grow on a wide range of soils, timothy is best suited to clay loams and silt loams. It is one of the most palatable forage grasses and should be a part of most pasture mixtures.

PASTURE GRASSES

Timothy Adapted to Wide Range of Soils

Timothy is the most important hay grass in the United States, and wherever adapted it usually is an ingredient of pasture mixtures. It is a perennial that frequently reaches a height of 30 inches or more. It propagates by seed and by new branches growing from buds in the axils of the leaves.

Adaptation. Timothy is better adapted to a cool, humid climate, than to a hot, dry climate. Although it grows on a wide range of soils, it is best suited to clay loams and silt loams. It is grown throughout Illinois.

Culture. Timothy may be seeded with small grain or alone, either in the spring or in the fall. Probably 60 percent of the crop is seeded in the fall with small grains, the rate of seeding being about 6 to 10 pounds of timothy an acre.

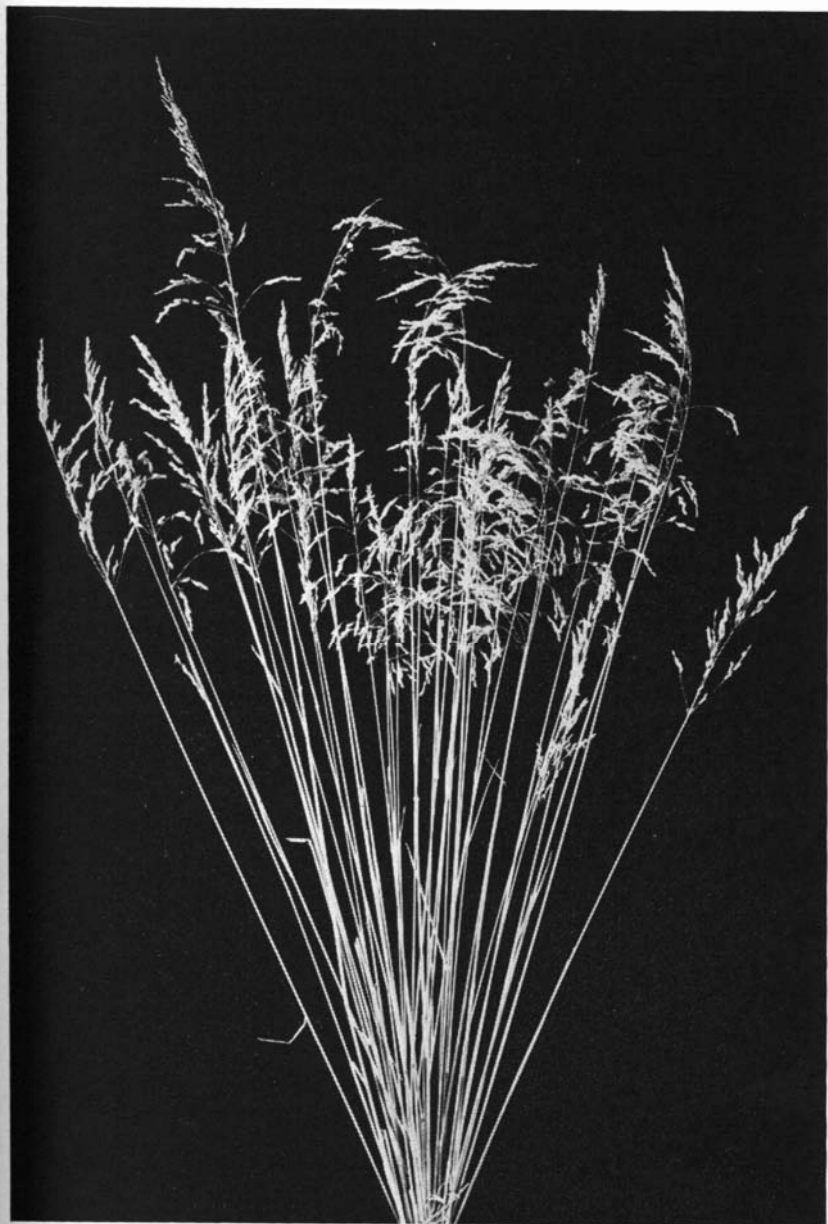
Uses. Timothy is one of the most palatable of pasture grasses; all classes of grazing animals relish it. It should be included in most pasture mixtures for use on land of average to high fertility. Under normal conditions it increases the early carrying capacity of the pastures. Seeded with bluegrass or with bluegrass and legumes, timothy usually furnishes grazing for a full season before the bluegrass has developed enough to carry its share of the grazing.

When seeded in mixtures with bluegrass and bromegrass, where these are well adapted, timothy is gradually crowded out. When used in pure stands, it does not furnish as much grazing as bluegrass or bromegrass, and weeds are usually more troublesome than in good stands of bluegrass. Another disadvantage of timothy is that it starts rather late in the spring.

During recent years several new strains of timothy have been produced. One of these, Marietta, is an early strain especially adapted to southern areas. A second strain, Lorraine, is later than ordinary timothy and is adapted to northern areas. Both strains were selected and increased at the Ohio Station.

Kentucky Bluegrass Does Best on Sweet Soil

So named because it was first grown extensively in Kentucky, this plant is the most widely grown pasture grass in America. In some sections it is called June grass. Propagation is by seeds and



Kentucky bluegrass is an excellent grass for pasture and also valuable for use in soil conservation.

short rootstocks. Growth starts early in the spring, and flowering also is early. After the production of seed the plant goes into a semidormant stage but develops a vigorous fall growth if moisture is abundant. Development of sod from a seeding of Kentucky bluegrass is slow, usually requiring two years, but on good soil and with good management this grass forms when mature a very dense sod which withstands trampling. On good soil it often reaches a height of 20 to 30 inches.

Three other species of bluegrass are very similar to Kentucky bluegrass, and are sometimes confused with it. Canada bluegrass is more resistant to drouth than is Kentucky bluegrass. The other two species are tolerant to shade. The most popular of them is known as rough-stalk meadow grass and is often sold under the Latin name of *Poa trivialis*. The other is known as wood meadow grass.

Adaptation. So far as climate is concerned, Kentucky bluegrass is adapted to practically the entire state of Illinois. It thrives best on fertile sweet soils supplied with an abundance of moisture. It is not easily killed by severe winter temperatures. On the other hand, because the plant is more shallow-rooted than orchard grass or bromegrass, it is more susceptible than those grasses to drouth and hot weather. These reduce yields materially or, if severe, kill the plant. Also, it will not survive on poor soils. On limestone soils such as those around Lexington, Kentucky, it has an excellent record.



These sheep are getting good grazing from a permanent pasture of Kentucky bluegrass.

Culture. The seeds of Kentucky bluegrass are small and often germinate poorly. Consequently the seedbed should be prepared especially well, so that it is very firm underneath. The seed should be merely covered. Ordinarily the rate of seeding is about 15 pounds to the acre.

Throughout most of the corn belt, Kentucky bluegrass has for many years been considered the standard of excellence in pasture grasses. Although not as rank a grower as some other grasses, it produces under favorable conditions an amazing amount of grazing. On rich brown silt loam soil it has carried an average of a cow and calf an acre for approximately 170 days.

Cattle, horses, and sheep like Kentucky bluegrass, and it is often used as the only feed for colts, idle work horses, and all classes of cattle and sheep during the pasture season. When the weather is not too hot and flies are not bad, most mature horses, cattle, and sheep will fatten on bluegrass pasture.

The chief disadvantage of bluegrass pasture on the better Illinois soils is the semidormant period in midsummer, a period that may extend over several weeks if the weather is hot and dry.

Canada Bluegrass Will Grow on Poor Soils

Canada bluegrass, found growing first in America near Quebec, is so similar to Kentucky bluegrass that most farmers fail to distinguish between them. Its place in pasture programs in Illinois seems to be on poorer soils where Kentucky bluegrass will not thrive.

Canada bluegrass, a perennial with underground creeping rootstalks, matures later than Kentucky bluegrass. It forms a dense sod. The stems are flattened and on rich land reach a height of about 2 feet. The leaves are few, bluish green, and wiry.

Adaptation. Canada bluegrass can stand unfavorable weather and soil better than Kentucky bluegrass. It is therefore frequently recommended for pasture mixtures.

Culture. The culture of Canada bluegrass is similar to that of Kentucky bluegrass. It often comes in spontaneously, but when seeded the rate of seeding is about 15 pounds an acre.

Uses. Canada bluegrass is primarily a pasture grass and very little is grown for hay. Like Kentucky bluegrass, it withstands considerable trampling, although overgrazing may kill it. It is far more prevalent in

Illinois pastures, especially on the poorer soils, than is generally realized. It has not been seeded extensively in Illinois, and its presence in established pastures of an area is a good indication that it is adapted to the soil and climate of that particular region. On the poorer soils it has an important place, but on the better soils it will not produce as good grazing as Kentucky bluegrass.

Redtop Is Adapted to Entire State

Redtop is the second most important permanent pasture grass in America. A perennial of the bentgrass group, it propagates by seeds and shallow creeping rootstalks generally 2 to 6 inches long. It matures later than Kentucky bluegrass, and about the same time as timothy; but it forms a turf more rapidly than most perennial pasture grasses. If grown isolated, a single plant makes a turf 1 to 3 feet in diameter and grows 12 to 30 inches high.

Adaptation. Redtop is adapted to the entire state of Illinois. No other grass will grow under so wide a range of soil and climatic conditions. It is at least equal to timothy in resistance to cold and to intensive summer heat.

Although redtop thrives best on moist soils, it is highly resistant to drouth. It is most commonly seeded on poorly drained soils of low fertility, where it grows fairly well.

Culture. Redtop thrives best on a well-prepared, compact seedbed, for the seeds are small and the plants are delicate when young. To obtain a stand, 8 to 10 pounds of seed an acre—usually about 10 pounds—are ordinarily required. Time of seeding varies somewhat with the cropping system, though fall is the usual time. In preparing the seedbed following a crop of oats or soybeans, a thorough disking will take the place of plowing. Spring seeding on winter wheat is not uncommon.

Uses. Redtop is grown chiefly for pasture, although it is used to some extent for hay and seed, and rather extensively as a turf grass. A fair estimate of the amount of Illinois pasture that is predominantly redtop is about 325,000 acres for the 32 counties in the redtop district of southern Illinois, and 5,000 acres for the rest of the state.

It is customary to figure that 3 acres of redtop pasture will maintain one animal unit (mature cow or horse) through an average pasture season of 180 days. An acre of redtop used exclusively for pasture would thus supply about 60 pasture days. Most redtop fields



Redtop is a perennial fast-growing turf grass.



This field of redtop has been harvested for seed.

that are harvested for hay or seed are pastured lightly for about 15 days in the spring and about 75 days in the fall after the crop is harvested. About 30 pasture days an acre may consequently be figured as supplied by harvested areas.

Although redtop has many excellent qualities it is not considered as palatable, except in some stages of growth, as brome grass, timothy, Kentucky bluegrass, or orchard grass. However, it fits well into mixtures with these grasses and is usually a part of most pasture mixtures. The seed is very small and the suggested rates of seeding generally provide a wide margin of safety.

Brome grass an Excellent Pasture Grass¹

Formerly grown extensively in the West and Northwest, brome grass has been widely accepted in the central states, including most of Illinois. It is a long-lived, perennial, sod-forming grass, growing to a height of 3 feet or more on good soils. The roots are creeping and fibrous, and often extend to a depth of 5 feet or more.

Brome grass is also called smooth brome grass, awnless brome, and Hungarian, Austrian, and Russian brome. These names serve also to distinguish it from closely related species, such as

¹ See also Illinois Bulletin 496, "Brome grass and Brome grass Mixtures."



Brome grass is a high-producing palatable forage. It can be used for both pasture and hay.

cheat, downy brome, and soft chess, all of which are more or less common weeds in Illinois.

Adaptation. Bromegrass is very resistant to drouth and cold. In mixtures with timothy, red clover, Ladino clover, and some other species it tends to be too competitive, particularly on fertile soils.

Culture. Bromegrass is seeded in the late summer or early spring. It should be seeded in a well-prepared seedbed with a legume, preferably alfalfa, or with a mixture of legumes. Pure seedings are not recommended because the crop is a heavy nitrogen feeder and yields well only on the most fertile soils unless other sources of nitrogen are available.

The seedbed should be thoroughly prepared by plowing, harrowing, and rolling. Since the seed is large and light in weight, it will not pass through the ordinary drill or endgate seeder without some carrier. Oats are generally used with spring seedings and the drill set to allow the proper amount of seed to flow through the opening. For fall seedings, fertilizers such as superphosphate can be mixed with the seed.

The rate of seeding will vary with the mixture and the soil fertility, but will range from 5 to 10 pounds an acre.

Strains of bromegrass seed. A number of strains of bromegrass are available at present. They are divided, according to their adapta-



These high-quality cattle were produced on this bromegrass mixture.

tion, into northern and southern strains. Southern strains include Fischer, Lincoln, Elsberry, and Kansas and Illinois strains. These strains mature earlier, are more aggressive, and yield somewhat better than the northern strains, strains apparently originating in Canada and the northern states (Table 4).

Table 4.— Yields of Bromegrass Strains, Urbana and Brownstown, 1945-1947
(Pounds per acre)

Strain	Yield of dry matter		
	At Urbana (High fertility)	At Browns- town (Low fertility)	Average
Southern			
Elsberry.....	7 986	4 604	6 295
Kansas.....	6 989	4 648	5 818
Lincoln.....	7 293	4 385	5 839
University.....	6 654	4 251	5 453
Fischer.....	6 412	4 516	5 464
Northern			
Northern.....	5 496	3 286	4 391
Canadian Parkland.....	5 303	.....	.....

Uses. Although bromegrass is primarily a pasture grass, it is also used for hay. It yields well, as indicated by average annual yields of almost 7,000 pounds of dry matter an acre over a period of six years at Urbana (Table 5).

Much experience with bromegrass in pasture mixtures at the Illinois Station indicates that it is the most drouth-resistant grass grown in Illinois. It is apparently very palatable for cattle, and yearlings

Table 5.— Yields of Dry Matter From Pasture Grasses, Urbana

Number of years in test	Crop	Average yield in pounds per acre
6	Bromegrass.....	6 840
4	Reed canary grass.....	5 464
3	Kentucky bluegrass.....	4 932
8	Orchard grass.....	4 455
2	Timothy.....	3 085

make excellent gains when pastured on it. It becomes sodbound after a few years, and may require disking and the addition of manure and other fertilizer. It has persisted for fifteen years in one of the cattle pastures at the University with only an occasional application of well-rotted manure.

One advantage of bromegrass for Illinois pastures is that even though it sends up seed stalks and matures seed, the leaves stay green all summer, unless the plants are diseased, and furnish good grazing all through the pasture season.

Orchard Grass Withstands Shade

Although sometimes winterkilled in the northern part of the state, orchard grass is adapted to all of Illinois. The plant is a long-lived perennial known in England as cocksfoot or rough cocksfoot. It is a typical bunch grass, often attaining a height of 30 to 40 inches, and forming a dense tuft which may become a foot in diameter, although it has no stolons and does not form a complete turf. Two to three years are required for orchard grass to become fully developed and produce seed.

Adaptation. Orchard grass stands more heat than timothy, but does not, as a rule, stand severe winter cold. Although it is rather susceptible to cold in the spring, it starts growth very early. It is more resistant to drouth than timothy, yet it thrives on wet soils. An outstanding characteristic is its ability to withstand shade. Although generally adapted to most soils it will not grow well on either sandy or muck soils.

Culture. Orchard grass is seeded in the fall or in early spring, and can be started successfully with a grain crop such as oats or wheat. The rate of seeding is about 15 pounds an acre when seeded alone. Because of its bunchy nature, orchard grass should be grown in mixtures unless intended for seed.

Uses. Orchard grass is a satisfactory pasture grass in mixtures and does well for hay. Because of its deep-growing and rather numerous roots, it has promising possibilities as a crop for controlling soil erosion.

Although orchard grass is one of the well-known grasses in the humid portion of the United States, it has never been extensively grown in Illinois, probably because timothy has been the popular hay grass and Kentucky bluegrass and redbud have satisfactorily met Illinois conditions.



Orchard grass is a perennial bunch grass. It is particularly valuable in shaded areas.

Experience with orchard-grass pasture at the University of Illinois experimental fields at Urbana indicates that it should be given more consideration in Illinois. At Urbana, it has yielded about as well as Kentucky bluegrass and occasionally even better, although its pasture season was not so long. Also, on soils less fertile than that of the University experimental pastures, orchard grass often produces more pasturage than bluegrass. It does not, however, seem so palatable to livestock as Kentucky bluegrass or timothy, particularly when it is well along toward maturity. During the early stages of growth it is well eaten by stock, and for that reason it should be kept in the vegetative stage by close grazing.

Orchard grass is sometimes criticized for extreme bunching. In experimental pastures at Urbana, however, judicious grazing has helped very considerably to minimize bunching. Late fall clipping improves markedly the appearance of orchard-grass pastures.

Ryegrass Needs a Mild Climate

Two important species of ryegrass are grown in the United States — perennial, or English, and Italian. Both are short-lived perennials that grow to a height of about 3 feet and form a turf more quickly than any other grass commonly grown in Illinois. Trials of many kinds of ryegrass at the Illinois Station indicate that the Italian variety yields best.

Adaptation. Ryegrass thrives best on dark rich soils in regions having mild climate. It is not recommended for sandy soils, nor for sections where the winter climate is severe. As far south as central Illinois it is usually winterkilled, and consequently it disappears from mixtures in a relatively short time. Also, it does not withstand hot, dry weather.

In southern Illinois ryegrass matures in June. After the seed stems are formed, it apparently becomes unpalatable, for sheep and cattle do not seem to relish it at that time.

Culture. Ryegrass may be seeded in the fall or in the spring, but in Illinois early spring seeding is recommended because of the danger of fall plantings winterkilling. The rate of seeding is 12 to 15 pounds an acre when seeded alone.

Uses. In Illinois ryegrass is generally used for temporary pastures, but it can be cut for hay. Because of its rapid growth it produces an

early hay crop and some grazing for the rest of the year. Its use for pasture might well be extended in Illinois.

Ryegrass is very attractive for lawns, and where the winters are not too severe it serves very well in such capacity. Its leaves are a bright and glossy green, and it starts growth very early in the spring.



Italian ryegrass

Perennial ryegrass

Ryegrass is a fast-growing grass valuable for pasture and turf mixtures.

Tall Oatgrass Does Well in Mixtures

Tall oatgrass has been a minor grass in America. It is a deep-rooted, long-lived perennial, growing to a height of about 5 feet. In the southern states it remains green the entire year, and for that reason is known as evergreen grass.

Adaptation. Tall oatgrass grows under about the same conditions of moisture and temperature as orchard grass, except that it is not adapted to shade. It is one of the most drouth-resistant of the grasses, being excelled in that respect only by bromegrass and the wheat grasses. While it thrives best on land rich in lime, it has a reputation of doing well also on sandy or gravelly soils. It has been reported to make fair yields on poor soils, but it responds well to good treatment. Wet, poorly drained soils are detrimental.

Culture. In northern Illinois it is probably best to seed tall oatgrass in the spring. In the southern part of the state, late summer seedings have been successful. A good seedbed must be prepared. The rate of seeding is about 15 pounds of seed an acre. The depth of seeding should be 1 to 1½ inches. Because of the difficulty of seeding, tall oatgrass seed is broadcast; following this it



Tall oatgrass is a perennial bunch-type grass, useful in southern Illinois.

should be rolled with a corrugated roller. In a mixture with alfalfa 10 pounds of good seed will usually produce a good stand.

Uses. Tall oatgrass has been considered as less palatable than bromegrass or Kentucky bluegrass. However, in palatability tests at Urbana with sheep, tall oatgrass ranked high. At the Dixon Springs Station, where several acres of tall oatgrass are used for pasture, it has been eaten readily by cattle. It does well in mixtures with alfalfa, clover, and birdsfoot trefoil. It makes an early and rapid growth in the spring, competing successfully with some of the early weeds.

Difficulties in harvesting seed and shattering have been chiefly responsible for the limited use of tall oatgrass. A new nonshattering strain recently developed by the U. S. Department of Agriculture is expected to do much to increase the use of tall oatgrass in Illinois.

Tall Meadow Fescues Grow Rapidly

Tall meadow fescue is a perennial grass becoming more important in Illinois for pasture and for soil conservation. It differs from Chewing's and red fescue in that the leaves are larger, being similar to those of bromegrass. It tillers rather freely, and although it does not have rootstocks, it does not grow bunchy but forms a rather loose turf.

Alta meadow fescue and Kentucky 31 meadow fescue are two selections of tall meadow fescue characterized by rapid growth, leafiness, and spread. Also they are better adapted in southern Illinois than ordinary meadow fescue. Other characteristics are similar to those of meadow fescue.

Adaptation. All the meadow fescues grow rapidly and make good cover on a wide range of soil, varying from tight claypans to sandy loams. They are also adapted to a wide range of climatic conditions. Once established they are resistant to cold, heat, and drouth. Insects and diseases do not seem to affect the meadow fescues.

Culture. They can be seeded early in spring or early in the fall on a good, well-firmed seedbed. Eight to 10 pounds of good seed mixed with some legumes will usually make a good stand. The seed is relatively large and can be seeded with a drill or broadcast. Mixtures with alfalfa, red clover, or Ladino clover make good long-season pastures.

Uses. Alta and Kentucky 31 fescue seem to be especially valuable on soils that will not produce a good crop of bromegrass or timothy.



Tall fescue—a high-yielding, fast-growing perennial grass for pasture and hay.

They yield well for hay; however, the forage is not as palatable as that of either bromegrass or timothy. In pastures the leaves are coarse but livestock eat them readily.

At Dixon Springs beef cattle gained more than 200 pounds an acre in 57 days from a mixture of Alta fescue, Ladino clover, red clover, and timothy.

Native Prairie Grasses Useful in Soil Conservation

Native grasses were the original grasses of our prairies. The common native grasses that were here when this country was first settled were big bluestem, little bluestem, switch grass, and Indian grass. They had a great influence in the development of our good, deep prairie soils.

Adaptation. They are adapted to the whole state. Although they will grow on nearly all our soils, Indian grass and big bluestem are best adapted to clay soils, switch grass to sandy soils, and little bluestem does well on eroded uplands.

Culture. The principal drawback to these grasses is that they are slow in becoming established. They need careful control of weeds during the seeding year, and controlled grazing thereafter. A practical way to get them established is to prepare the seedbed and seed it to spring oats in September at the rate of 2 to 4 pecks an acre; the oats act as a mulch after the first frost, and as seedling protection. In late winter the native grass seed can be broadcast on the surface, on top of the mulch, at the rate of 20 pounds an acre. Lespedeza can be broadcast on the same land a year later.

Uses. Once established, the native grasses are very productive, yielding 2 to 4 tons of forage an acre. Because they make 60 percent of their growth in the hot summer months when many of the cultivated grasses are dormant, they are valuable as summer pastures. Lespedeza can be maintained in these grasses by careful grazing management, or by clipping in early June and again in August if the field is to be harvested for hay. Native-grass pastures can best be maintained in a state of good productivity by pasturing during the summer months and then keeping the livestock off during the rest of the season.

Native grasses make hay of good quality. They can also be satisfactorily used for silage.



Big bluestem is one of the most valuable native grasses.

Meadow Foxtail a Good Wet-Land Grass

Grown for many years in eastern United States and Canada, meadow foxtail is a long-lived perennial producing loose tufts, with many lower leaves, and resembling timothy to some extent. The stems frequently grow to a height of 2 feet or more. Growth begins very early in the spring, and the plant matures earlier than most grasses and recovers rapidly after cutting.

Adaptation. Meadow foxtail is one of the wet-land pasture crops. It is fairly resistant to cold and is adapted to moist, cool regions. It is not particularly exacting as to soil, though it responds to rich soils well supplied with moisture.

Culture. Since the seeds of this plant are short, fine, soft, and somewhat fluffy, it is very difficult to get an even stand. A first-class seedbed is essential. Meadow foxtail is seldom sown alone, but usually with a nurse crop of small grain and at the rate of 12 to 15 pounds an acre.

Uses. Meadow foxtail is used in permanent pasture mixtures on wet land where early growth is desired. It is relished by livestock. When grown experimentally at the Dixon Springs Station in southern Illinois, cattle ate it in preference to redtop and bluegrass.

Reed Canary Probably Best Wet-Land Grass

Reed canary grass is a long-lived, rather coarse perennial with leafy stems growing in Illinois to a height of 5 feet or more. It spreads by rootstocks and forms a dense sod heavy enough to support the weight of cattle on low, marshy land. Like brome-grass, the leaves stay green all through the grazing season even though the plant matures seed.

Adaptation. Reed canary grass does best in moist, cool climates, and is not easily winterkilled. It seems to be especially well suited to swampy, fertile soils, and has been known to grow in standing water. Although it is probably the best wet-land grass under cultivation, it also shows remarkable drouth resistance. Yields at Urbana have averaged as high as 5 tons of air-dry hay an acre a year.

Culture. A good seedbed is desirable for this grass, although sometimes the seed is sown on slashed timber land, burned-over land, or partly cultivated fields simply by broadcasting. Planting may be either in the spring or in the fall, but in Illinois spring seeding is likely to



Reed canary grass—an outstanding forage grass for wet, fertile soils. It forms a dense sod heavy enough to support the weight of cattle, even on low marshy land. The leaves stay green throughout the grazing season.

prove more satisfactory because of better moisture conditions. Usually the grass is seeded alone at a rate of 6 to 8 pounds an acre. The seed is planted with a grain drill or is broadcast. Since it germinates slowly, the seed should be covered well.

Uses. Primarily a pasture grass, reed canary produces large quantities of forage through a long growing season. It is rated very high as a pasture and hay plant in the Northwest, especially on muck or peat soils, where it is said to be palatable and to have a very high carrying capacity. Washington State Experiment Station reports 343 cow-days an acre for continuously grazed reed canary grass. At Urbana it was less palatable than orchard grass, bromegrass, timothy, or Kentucky bluegrass. At the Dixon Springs Station a field of reed canary, timothy, alsike, and strawberry clover provided excellent winter pasture during the winter of 1946-47. The Wisconsin Station reports that silage made from reed canary grass was 60 percent as valuable as corn silage when fed to dairy cattle.

LEGUMES FOR PASTURE

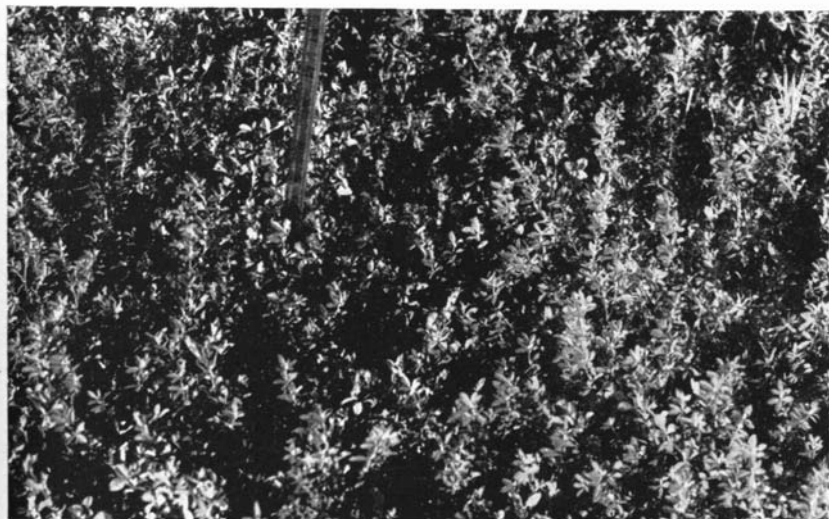
Good permanent pastures usually contain legumes, because legumes not only make the grasses more nutritious through their ability to take nitrogen from the air, but also are generally higher in nitrogen (protein) and calcium than the grasses. Since most legumes are usually more palatable than grasses they are sought out by livestock. This fact makes it difficult to maintain legumes in permanent pastures without frequent reseeding.

Alfalfa a Highly Desirable Pasture

Alfalfa is a deep feeder, for the roots are long, extending frequently 12 to 15 feet in rich, well-drained soil. The plants start growth early in the spring and in Illinois reach a height of 2 to 3 feet when soil and growing conditions are favorable. Ordinarily alfalfa lives from three to ten years, depending on the prevalence of diseases and the extent of winterkilling.¹

Adaptation. Alfalfa requires a fertile, sweet, well-drained soil. It does best on high-grade corn soil, although timber soils properly treated with lime and phosphates have produced satisfactory yields. As a rule, northern-grown domestic strains of alfalfa are resistant to

¹ See also Illinois Circular 560, "How to Get Good Yields of Alfalfa."



A fine stand of alfalfa in central Illinois.

drouth, heat, and cold. Winterkilling is likely to be serious, however, in wilt-infected fields, because the plants in such fields are weakened by disease. Cutting late in the fall may result in cold injury and a poor stand the following season.

Culture. Alfalfa requires a fine, firm, moist seedbed for best results. It may be seeded early in the spring either with a nurse crop or alone on fields relatively free from weeds. A nurse crop when used should be seeded at about half the usual rate. Soil that is somewhat foul with weeds should be fallowed until about the middle of May (or for a shorter period if moisture is scarce) and then the alfalfa should be sown alone while there is still sufficient moisture to germinate the seed. Alfalfa may be seeded alone in late summer also, about eight weeks before killing frost. The rate of seeding is 12 to 15 pounds an acre. The seed may be broadcast and rolled or harrowed lightly, or drilled with a fine seed drill.

Uses. In the corn belt alfalfa has been grown primarily as a hay crop, but it is an excellent pasture crop. In pure stands alfalfa is especially good for hog pasture; and both in mixtures and in pure stands it provides excellent pasture for cattle and sheep.

Because alfalfa is severely damaged by trampling when the ground is wet, the spring crop is often harvested for hay and pasturing is confined to the summer months when the fields are firmer. This is good practice, not only because it provides both hay and pasture from the

same land the same season, but also because it provides succulent pasture during the period of limited forage. Grass pastures are at their best usually during the spring and early summer, and are then relatively more palatable than alfalfa; but when the bluegrass pastures approach the midsummer dormant stage and are not so palatable, the alfalfa is ready for grazing. Grazing may continue until killing frosts; but fall growth should not be pastured too closely, for close cropping increases the hazard of winterkilling.

Danger of bloat has deterred many stockmen from pasturing cattle and sheep on alfalfa. At the University farm, however, both sheep and cattle have been pastured on pure stands of alfalfa for several years without abnormal losses. Certain practices believed to be helpful in preventing bloat were, however, carefully followed. The animals were always given a good fill of bluegrass before they were turned on alfalfa, and after once started on alfalfa they were not taken off until the end of the season. Water and salt were always conveniently placed and plentiful, and small amounts of dry roughage were available.

A mixture of alfalfa and bromegrass or timothy or orchard grass makes excellent pasture. Including grasses with alfalfa in a mixture decreases the danger of bloat.

A number of adapted varieties of alfalfa are on the market. Where alfalfa wilt is prevalent, resistant varieties such as Ranger and Buffalo should be used.

Alsike for Pasture Usually Grown in Mixtures

Alsike clover, sometimes known as Swedish clover or hybrid clover, is a shallow-rooted, rather leafy perennial, living from three to five years. The stems are weak and the plants lodge badly. The plant is not so hairy as red clover and for that reason is sometimes more desirable as forage. It grows longer and blooms a little later than red clover. Yields are about the same in the two varieties.

Adaptation. Alsike clover has a wider climatic adaptation than red clover, but not so wide as sweet clover. It resists cold better than red clover, but does not resist drouth so well. It will grow fairly well on moderately acid, poorly drained soils.

Culture. Seedbed preparation and time of seeding are about the same as for red clover. When seeded alone, the rate of seeding is about 8 pounds an acre.

Uses. Primarily a pasture crop, alsike clover may also be used successfully for hay. It owes its popularity as a pasture legume to the fact that it grows on a wider range of soil types and persists longer in pasture mixtures than do other legumes commonly cultivated in Illinois. It is especially good in lowland pastures or pastures with poor drainage. When used for pasture it should be grown in mixtures, for when grown alone it tends to blister tender, white-skinned animals. Since alsike is usually pastured in mixtures, less complaint is made of bloating on it than on clovers more commonly pastured in pure stands.

A mixture of alsike clover, redtop, and timothy is favored for lowland meadows and pastures.

Medium Red Clover Excellent for Forage

Red clover is a leading forage, sometimes said to be the most important of all leguminous forage crops. Until alfalfa became recognized as a legume of major importance in the corn belt, red clover was the standard legume and its presence considered a sign of good farming.

Red clover is treated as a biennial, though plants frequently appear to be short-lived perennials. The roots are the deep-branching type.



A mixture of red and sweet clovers provides an abundance of forage and fits well into rotations.

Adaptation. Because its roots go rather deep, red clover that is well established withstands drouth. A rich, sweet, well-drained soil is essential. It is useless to try to grow red clover on sour soils. It makes a good rotation pasture.

Culture. Red clover is usually seeded in the spring fairly early, with oats or barley or on winter grain, at the rate of 8 to 10 pounds of seed an acre. In mixtures, smaller amounts are used. It is occasionally seeded in late July or August without a nurse crop.

Uses. Though considered primarily of value as hay, red clover is a very prominent crop for pasture and for soil-ing. As pasture it appears to be more palatable than alfalfa, although in pure stands it does not have as high a carrying capacity. The plants are relatively short-lived and do not stand heavy grazing well, but for temporary pastures or pastures in short rotations red clover has a very definite place. It is highly esteemed by some cattle and hog feeders who summer-feed on grass. For pasturing cattle and sheep it is best seeded in mixtures, for like alfalfa it tends to cause bloat. A good practice where red clover is used for pasture is to keep dry hay or straw available.



Red clover is widely used in the corn belt for hay, pasture, and soil improvement.

Mammoth Clover Has Same Uses as Red

Mammoth clover, a subspecies of red clover, looks much like red clover except that it is coarser and usually taller. It blooms about two weeks later than red clover, and for that reason does well in mixtures with timothy. Mammoth clover is a short-lived perennial.

Adaptation. Soil and climatic requirements of mammoth are about the same as of red clover, although mammoth is somewhat more acid-tolerant and is preferred for medium-poor soils.

Culture. The culture of mammoth clover is similar to that of red clover.

Uses. When sweet clover fails or becomes unsatisfactory as a soil-improvement crop because of disease or insects, both mammoth and medium red clover are frequently substituted. Although mammoth clover serves the same uses as red clover, it has not been grown as extensively. It is deserving of greater use, particularly as a soil-improvement crop.

Ladino a Fine Pasture Clover

Ladino clover is a giant-type perennial white clover, similar to white clover except that it is larger, more vigorous, and more productive. It is long-lived under favorable conditions. It does winterkill occasionally, and a severe drouth also injures the stand. When properly managed under grazing conditions, it will set a large amount of seed and maintain itself in the pasture for many years.



Ladino clover — a perennial clover valuable because it is a highly palatable and nutritious pasture plant.

Adaptation. Ladino clover will grow wherever white clover is adapted. For best results the soil should be well supplied with lime and fertilizers.

Culture. Because the small seeds of Ladino clover require shallow planting, a firm, fine seedbed is essential. When seeded in mixtures with other grasses and legumes, 1 or 2 pounds of Ladino seed, properly handled, will make a good stand. If seeded alone for seed production, 3 pounds an acre is enough.



A mixture at Dixon Springs of Ladino clover and brome grass—a useful high-producing combination.

Uses. Ladino is primarily a pasture legume; however, close and continuous grazing will decrease production and weaken the plant. Because of its heavy, dense, tangled, and succulent growth, it is difficult to cure for hay and also difficult to cut with a mowing machine.

Grazing a stand of Ladino for two to three weeks and resting it for a similar period, alternately, will be beneficial. It recovers rapidly after grazing when moisture is adequate. It may cause bloat in livestock, and where it is growing in pure stands the same precautions should be observed as with pure stands of alfalfa and red clover.

Ladino clover is highly nutritious, as shown by Table 6. The high

protein content maintained through the grazing season is characteristic of this legume. The phosphorus is not particularly high, but the calcium-magnesium percentages are characteristically high and are another reason for the nutritive value of Ladino.

Table 6. — Protein and Mineral Content of Ladino Clover
(Dixon Springs and Urbana, 1947)

Location	Date sampled	Protein	Phosphorus	Calcium	Magnesium
		<i>perct.</i>	<i>perct.</i>	<i>perct.</i>	<i>perct.</i>
Dixon Springs	May 28	24.12	.35	1.75	.50
	June 30	24.75	.36	1.54	.51
	Aug. 24	24.00	.21	1.40	.52
	Nov. 7	22.50	.25	1.28	.42
Urbana south farm	June 3	23.75	.47	1.76	.55
	June 10	21.75	.34	1.40	.46
	June 20	21.38	.37	1.50	.50
	June 26	23.50	.40	1.25	.45
	July 9	22.12	.40	1.53	.44
	July 21	19.75	.37	1.45	.46
	Sept. 17	21.25	.30	1.85	.44

Ladino is very palatable to all classes of livestock and is probably unsurpassed as pasture for young livestock. Over a period of years at Urbana and at Dixon Springs, it has yielded 5,000 to 7,000 pounds of dry matter an acre a year. At Urbana lambs gained 440 pounds an acre. At Dixon Springs on a mixture of Ladino clover and brome grass, sheep gained 408 pounds an acre, as an average for 1946 and 1947.

White Dutch Clover Is Widely Adapted

White clover, sometimes known as Dutch clover, is a short-lived perennial widely distributed over the United States. The roots do not go deep into the soil as do those of red clover and alfalfa. Its solid stems creep along the soil surface and take root, and consequently it is not easily injured by clipping. Stems and leaves are smooth, as a rule, and the leaves are similar to those of red clover but they are smaller.

Adaptation. White clover is winter-hardy. It appears to be adapted to more soils than red clover, though it responds to good soil treatment. Unlike alsike, it requires a well-drained soil. It needs, however, an abundant moisture supply.

Culture. White clover is successfully seeded in spring with small grains at the rate of 2 to 4 pounds an acre. In mixtures, smaller quantities are used, depending on the mixture.

Uses. White clover is a valuable addition to any pasture mixture. When once established, it sets an abundance of seed, and although it disappears from the pasture during periods of drouth, as soon as moisture and other conditions become favorable it usually reappears to add to the production of feed and to furnish nitrogen for more abundant growth of bluegrass. It seems to be especially valuable in pastures that are closely grazed but not overgrazed. In such pastures it helps to protect the soil from the direct rays of the sun in midsummer and thus influences soil temperature and possibly the growth of grasses.

Probably because sheep have a tendency to graze some spots very close, white clover appears more abundant where sheep are grazed than where other classes of farm animals are pastured.

White clover is often used also in lawn mixtures.

Sweet Clover a Heavy Producer of Forage

Sweet clover is similar to and closely related to alfalfa as well as to the other clovers. In its early stages it is difficult to distinguish from alfalfa. Most sweet clovers have a bitter taste and have, when bruised, a characteristic pleasant odor caused by a substance known as cumarin.

Adaptation. Climatically, sweet clover is the most widely adapted of all cultivated legumes. Although its growth is improved by good drainage, it will grow successfully on soil that is too poorly drained for satisfactory growth of alfalfa or red clover. The lime requirement, however, is especially high, and sweet clover seldom grows satisfactorily on sour soils in Illinois. Failures have been known to occur also because of deficiency in phosphorus.¹

In recent years the sweet-clover weevil has caused serious damage to both new seedings and old stands of sweet clover. Because of the devastation to pure stands, sweet clover should be seeded in mixtures with red clover, alfalfa, and alsike clover for hay and pasture.

Culture. The general culture of sweet clover is similar to that of red clover, except that the rate of seeding is higher, ranging from 12 to 15 pounds an acre for hulled, scarified seed. Unhulled seed planted 15 to 18 pounds to the acre gives good results when seeded early.

¹ See also Illinois Circular 559, "Sweet Clover for Illinois."

Uses. Sweet clover is an excellent green-manure crop. Where the soil is sweet, relatively fertile, and well drained, there are few if any pasture plants that yield a higher tonnage of dry matter. From sweet-clover pastures on such soils some amazing records of carrying capacity have been reported. On the other hand, sweet clover is apt to be very disappointing where soil conditions are not favorable, especially where there is not an abundance of available calcium. But for a combination pasture and green-manuring crop on Illinois soils where lime is not deficient, a better crop than sweet clover has not been found.



Sweet clover — high yielding, and one of the best combination pasture and green-manure crops for Illinois.

In corn-belt rotations, sweet clover is usually seeded in oats or wheat. When seeded in this manner, it may usually be pastured lightly from about the middle of August until frost. At the University farms at Urbana fall growth of sweet clover in oats stubble has given from 42 to 68 days of pasturage for a cow or a cow and a calf an acre. The average for seven trials was $54\frac{1}{2}$ days.

When seeded without a nurse crop the first-year growth of sweet clover may be pastured under favorable conditions as early as the middle of June. The first-year growth should not, however, be pastured heavily if intended for pasture the following year, for heavy grazing

the first season usually results in severe winter damage and always results in lower yields. The second-year growth starts early and may usually be pastured in central Illinois by the first of May. At Urbana the second-year growth has given an average of approximately 110 days of pasturage for a cow or a cow and a calf an acre.

Sweet clover is not very palatable to animals unaccustomed to it, but most farm animals soon acquire a taste for it and do fairly well on it. It will not produce as large gains on beef cattle as will some other pastures. Little trouble is experienced with bloat on sweet clover; in this respect it is one of the safest legumes.

Sweet clover may profitably be included in most mixtures for both temporary and permanent pastures, for it adds materially to carrying capacity. It should not, however, be permitted to overgrow the other seedlings to such an extent as to threaten to smother them out. If light grazing does not keep it down, it should be clipped high enough to avoid injuring the other seedlings.

Birdsfoot Trefoil a Legume for Permanent Pastures

Birdsfoot trefoil is a perennial legume with a deep-growing, branching taproot. The plant looks like alfalfa except that the flowers are bright yellow and look like sweet pea flowers. The stems are usually fine and weak, inclined to lodge, and grow to a height of about 30 inches. Birdsfoot trefoil should not be confused with yellow trefoil. These two plants are not related.

Adaptation. Although birdsfoot trefoil will grow on land that is too poor for alfalfa, it will do much better on land that is properly limed and fertilized. It has been found growing wild as far north as New York, and as far south as Alabama. It is adapted to the whole state of Illinois.

Culture. Time of seeding, depth of seeding, and preparation of the seedbed are the same as for alfalfa. The seed needs to be inoculated with a special culture differing from that required by the other common legumes. One drawback of birdsfoot trefoil is that it is very slow in becoming established and it does not seem to take heavy shading as a seedling. Accordingly, it is desirable to pasture the nurse crop. The rate of seeding alone is 4 to 6 pounds an acre.

Uses. Because of the perennial nature of birdsfoot trefoil under grazing, this plant will undoubtedly find extensive use as a permanent pasture crop in Illinois as soon as enough seed is available.

This plant is palatable and nutritious, and reaches its maximum production in two or three years. Once established, the stand remains productive for many years. The oldest seeding of birds-foot trefoil in Illinois, located on the University south farm at Urbana, is now (1949) about 19 years old. A seeding made in the spring of 1942 at Pontiac on a badly washed Clarence silt loam is now better than it has ever been, even though it has been grazed very heavily. The yields of dry matter on this plot in 1946 averaged 4,583 pounds. Similar yields have been obtained at the Dixon Springs Station in southern Illinois.



Birdsfoot trefoil is a promising perennial pasture legume for Illinois.

Lespedezas Are Important Pasture Legumes in Illinois

Some lespedezas are annual legumes and others are perennial. The annual species are small-branched plants which may reach a height of 30 inches, but more frequently they grow only about 5 to 15 inches high. The leaves are small and numerous, and the stems small and slender. Blooming occurs from midsummer to early fall.

The perennial lespedeza grows much taller than the annual species, reaching usually a height of about 30 inches, and the stems are larger and more woody. Cream or purple flowers appear in late summer or early fall.

Adaptation. Lespedezas rank with alfalfa and sweet clover as among the most drouth-resistant legumes grown in Illinois. But although they survive severe drouth, their growth is diminished very considerably by deficient moisture. All lespedezas are hot-weather

plants and make a very slow early growth. They are adapted to soils too poor and too acid for red clover, but they respond remarkably to soil treatment and do best on well-drained soils.

Lespedeza, of one variety or another, can be grown in every part of Illinois. Early strains of Korean are best suited to northern Illinois. Standard Korean may be used throughout the state except in the extreme northern part. Late strains such as Kobe lespedeza are adapted to southern Illinois.



Korean lespedeza at Dixon Springs. Lespedeza is an excellent high-producing annual legume for central and southern Illinois.

Sericea lespedeza, a perennial species, is adapted to central and southern Illinois. It is difficult to establish, but after a stand is obtained, it thrives and makes a rank, woody growth. It has proved more valuable in Illinois as a refuge for wildlife than as pasture or hay for animals.

Culture. The culture of lespedeza is similar to that of other small-seeded legumes. It is important that the variety best suited for the conditions at hand be chosen.¹ Particular attention should be paid to the source of seed because of the prevalence of noxious weed seeds like dodder, and to age of seed because lespedeza loses its viability rapidly.

¹ See Illinois Circular 561, "Lespedeza: Its Place in Illinois Agriculture."

No special seedbed preparation is necessary where lespedeza is seeded on either winter or spring grain. But when seeded alone or in mixtures it requires a good seedbed. Difficulty is sometimes experienced in seeding lespedeza because of the light fluffy hull, which prevents it from feeding through the seeder uniformly. Endgate and hand-horn seeders, however, have been used successfully.

On winter grain lespedeza should be sown early in the spring, about the time for seeding red clover. On spring grain, or when seeded alone or in forage mixtures, it should be sown about the time spring grain is normally seeded. The rate of seeding varies from 5 pounds an acre in mixtures and in small grain where only a volunteer seeding is desired for the following year, to 10 to 25 pounds an acre where seeded alone.

Lepedeza fields should be clipped in order to control weeds, but should be cut high enough to avoid injuring the lespedeza plants.

Uses. Common lespedeza, or Japan clover, has been a valuable pasture plant in southern Illinois for many years. Its spread was mostly by natural means, and few extensive seedings of lespedeza were made in this state until Korean was introduced.

In pure stands, Korean is usually not ready for grazing in central Illinois until after July 1. Korean is extensively used as summer and fall pasture in southern Illinois. Ease of establishment and heat and drouth resistance make it particularly valuable to supplement or replace unproductive grass pastures during the hottest part of the summer. It is palatable and nutritious.

In ten years of use in pastures of southern Illinois, Korean lespedeza has proved to be most dependable. Although it may not yield as high as alfalfa or red clover, it is practically equal in nutritive value and can be used to advantage on soil that will not support alfalfa or red clover. It is good to use as fall and winter pasture for beef cattle.

A PASTURE CALENDAR FOR NORTHERN ILLINOIS

The calendar given below shows when grazing can be started on different kinds of pasture and how long it can be continued. The calendar can also be used as a guide for fitting other combinations of pasture into a pasture program.

Carrying capacity of these pastures depends upon management, climatic conditions, soil fertility, and type of livestock. Good management of Ladino clover, for example, includes alternate grazing so as to permit rest periods for part of the field. Good management also means that grass and legume combinations should be pastured rather closely during the early part of the season to keep them succulent and to keep the grasses from giving too much competition to the legumes.

GRAZING PERIODS FOR DIFFERENT KINDS OF PASTURE

(Beginning and ending dates will vary with location in the area, whether near the northern boundary of the state or near the southern limit of the area, represented by a line drawn across the state through Mattoon and Jacksonville.)

Crop	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Notes	
Winter rye.....	—————								—————	Seeded in August	
Winter wheat.....		—————								Observe fly-free date	
Oats.....		—————									
Alfalfa.....			—————					—————		In second year	
Alfalfa-bromegrass.....		—————								Begin in second year	
Timothy-red clover....			—————				—————			Second year	
Bluegrass mixture.....		—————						—————			
Tall-fescue mixture....		—————					—————				
Ladino clover.....			—————	—————		—————	—————			Use two fields	
Sweet clover.....			—————							First year	
Sweet clover.....			—————							Second year	
Sweet Sudan grass.....				—————							

A PASTURE CALENDAR FOR SOUTHERN ILLINOIS

The following calendar for southern Illinois, like the one on page 62, shows when grazing can be started on different kinds of pasture and how long it can be continued. The calendar does not include all possible mixtures and seeding combinations, being intended only as a guide. The carrying capacity of any of these pastures will depend on management, climatic conditions, soil fertility, and type of livestock.

GRAZING PERIODS FOR DIFFERENT KINDS OF PASTURE

Crop	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Notes
Winter rye		—————							—————		Balbo rye seeded in August
Winter wheat		—————									Grain crop harvested
Alfalfa-bromegrass			—————	—————	—————	—————	—————		—————		For fertile, well-drained land
Ladino and tall fescue		—————	—————	—————	—————	—————	—————	—————	—————		Fescue alone useful for winter pasture
Ladino clover			—————		—————		—————		—————		Alternate two fields
Grass mixture and lespedeza		—————	—————	—————	—————	—————	—————	—————	—————		Redtop-timothy mixture
Orchard grass, red clover, Ladino clover			—————	—————	—————	—————	—————	—————	—————		Orchard grass is early pasture
Lespedeza alone					—————	—————	—————	—————	—————		Seeded without nurse crop
Legume mixture and timothy			—————	—————	—————	—————	—————		—————		Alfalfa, sweet clover, Ladino, and lespedeza
Sweet clover, first year						—————					To be pastured lightly
Sweet clover, second year			—————	—————	—————	—————					Keep well grazed
Alfalfa, Ladino, timothy, bluegrass, redbtop			—————	—————	—————	—————	—————	—————	—————		
Sweet Sudan grass					—————	—————	—————				

(over)

(Southern Illinois calendar, continued)

Balbo rye is suggested for pasture because it is leafy and well adapted in Illinois. Annual Korean lespedeza is one of the most useful pasture legumes in southern Illinois; it makes a good pasture for all types of livestock and does well on soils of low fertility. On the more fertile soils, however, Ladino clover is becoming one of the more popular legumes. It is a perennial, is high in feeding value, and does well on soils having poor underdrainage. Because alfalfa requires well-drained soils, Ladino is replacing it extensively in pasture mixtures.

Tall fescue (Alta and Kentucky 31 strains) is a long-season pasture grass that stays green during the winter months. It is useful for pasture and soil conservation, but livestock do not like it as well as bromegrass and timothy. Sweet Sudan grass is a good emergency pasture and hay, and many farmers are using it as a regular part of their forage-production program.