GRASSES AND LEGUMES

for Forage and Conservation

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GRASSES AND LEGUMES

For Forage and Conservation

Grasses and legumes are grown on large acreages of Ohio farmland. Ohio farmers harvest annually about 1.6 million acres of hay. Alfalfa and alfalfa-grass mixtures are grown on 600 thousand acres, clover-grass mixtures on 940 thousand acres, and other hay crops including soybeans, small grains and sudangrass or sorghum-sudangrass crosses or hybrids occupy small acreages.

Pasture acreage in Ohio totals nearly 5 million acres. Of this total, more than 2½ million acres are permanent bluegrass pastures; 1 million acres are classified as woodland pasture; and 1½ million acres of cropland are used each year exclusively for pasture.

Corn is harvested as silage from 300 thousand acres annually.

Of the more than 2,000 grass and legume species grown in the United States, only a few are of major importance in Ohio. This publication lists the general characteristics and areas of adaptation of grasses and legumes used for forage production and conservation in Ohio; several species of minor importance and non-adapted species are included. Grasses and legumes are listed alphabetically by common names (not in order of importance).

For information regarding recommended varieties of important species see Ohio Cooperative Extension Service Bulletin No. 472, *Ohio Agronomy Guide* for the current year. See your local Cooperative Extension Service office for other forage crop publications.

GRASSES

Bermudagrass

BERMUDAGRASS, *Cynodon dactylon*

Bermudagrass is the most common pasture grass in the Southern States. It has been found growing as a weed in protected vegetable and flower gardens in many sections of Ohio. The Midland variety of bermudagrass is more winter-hardy than other varieties. Under exposed field conditions, Midland bermudagrass usually winter-kills in northern and central Ohio. Midland bermudagrass does not produce viable seed; it is propagated vegetatively by planting runners or crowns. Certified planting stock is available. In southern Ohio, Midland bermudagrass begins spring growth about mid-May and is killed back to the ground by the first frost.

Bluegrass

KENTUCKY BLUEGRASS, *Poa pratensis*

Kentucky bluegrass is the most important permanent pasture grass in Ohio. It is the dominant species in well-managed permanent pastures. Many low producing, so-called "bluegrass pastures" in Ohio actually contain only a small amount of Kentucky bluegrass and a high percentage of weeds.

Bermudagrass

Kentucky bluegrass is a shallow-rooted, sod-forming, cool-season perennial which readily volunteers into pasture and crop fields when conditions are favorable for its growth. Contrary to popular opinion, bluegrass seldom "crowds out" alfalfa; rather, it replaces alfalfa and other legumes or grasses as they die out. Because bluegrass readily volunteers into forage seedings, its inclusion in seeding mixtures is advisable only in special situations. Including 1 to 2 pounds per acre of bluegrass seed in mixtures of tall-growing grasses and legumes may hasten the establishment of a bluegrass sod. In many instances, it is better to seed a mixture of tall-growing grasses and legumes and let the bluegrass volunteer into the stand.

Many low-producing, weedy, permanent pastures can be transformed into vigorous bluegrass pastures by applying recommended amounts of lime and fertilizer to the present sod.

Kentucky Bluegrass

Well-fertilized bluegrass is highly productive during late April, May, and early June when temperatures are cool and soil moisture is adequate. Bluegrass is almost dormant in mid-summer during periods of high temperatures and low soil moisture.

CANADA BLUEGRASS, *Poa compressa*

Canada bluegrass is found in many permanent pastures. It is most prevalent on soils that are too acid, too droughty, or too low in nutrients to support good stands of Kentucky bluegrass. Canada bluegrass is easily distinguished from Kentucky bluegrass by its blue-green foliage and its flattened stems. It is later in maturity and lower in yield than Kentucky bluegrass.

Most Canada bluegrass seed is produced in Canada. It is not recommended for use in Ohio forage seedings.

ROUGHSTALK BLUEGRASS, *Poa trivialis*

Roughstalk bluegrass, sometimes sold as Danish bluegrass, is adapted to much the same conditions as Kentucky bluegrass, but is somewhat more tolerant to shade and wet soil. It is used in pastures in Europe, but its use in the U. S. is largely confined to lawn mixtures. Roughstalk bluegrass is not recommended for use in Ohio forage seedings. It is often included as a shade-tolerant species in seed mixtures for lawns on moist, shady sites.

Bromegrass

SMOOTH BROMEGRASS, *Bromus inermis*

Smooth bromegrass is a high-yielding, tall-growing, sod-forming perennial which is well-adapted for use as silage or hay. It matures somewhat later in the spring than common orchardgrass and makes less summer growth than orchardgrass.

Special care must be taken in seeding bromegrass; covering bromegrass seed too deeply has caused many seeding failures. It can be sown successfully in spring oats or in summer seedings. When winter wheat is planted on or before the fly-safe date, bromegrass may be seeded with the wheat; when wheat planting is delayed, bromegrass may be drilled into the wheat during the following spring. Bromegrass may be seeded with a special seeder or with a standard grain drill by mixing the bromegrass seed with fertilizers or with small grains; shallow seeding is important. It is extremely difficult to obtain a uniform seeding by broadcasting the seed or by seeding it through the grass seed box of the ordinary grain drill.

FIELD BROMEGRASS, *Bromus arvensis*

Field (annual) bromegrass is used in Ohio as a winter cover or green manure crop. It is an annual, with an extensive, fibrous root system. With adequate moisture, field bromegrass seeded during mid-summer makes considerable fall growth. It remains alive over winter and produces seed during June of the following year.

Smooth Bromegrass

Field bromegrass is similar to other annual bromegrasses including the common grass weeds, Cheat or Chess. As with most annual cover or green manure crops, field bromegrass can become a serious weed if seed is permitted to mature and fall to the ground. This problem can be avoided by careful seeding and timely spring plowing.

Fescue

TALL FESCUE, *Festuca elatior* var. *arundinacea*

Alta and Kentucky 31 are nearly identical varieties of tall fescue. Tall fescue is a vigorous-growing, sod-forming perennial which is easily established and grows well on practically all Ohio soils. It is less palatable than other grasses recommended for use in Ohio pastures.

In southern Ohio, tall fescue is useful for early spring, late fall, and winter grazing by beef cattle and sheep.

Tall fescue is a tough, sod-forming grass which can withstand heavy wear. It is the best grass for seedings in areas to receive heavy traffic from livestock or farm machinery. Tall fescue is also useful for erosion control. It is widely used for seeding diversion terraces, waterways, and farm pond dams. The highway department uses tall fescue for seedings along the right-of-way including berms, divider strips, cuts, and fills. Tall fescue is included with bluegrass in seed mixtures for some hard-use recreation areas, such as playgrounds and camping areas where a high level of maintenance is not required.

MEADOW FESCUE, *Festuca elatior*

Tall fescue is a sub-species of meadow fescue. Meadow fescue is a smaller-growing plant than tall fescue; the leaves are somewhat finer and less rough. Meadow fescue is generally inferior to the tall fescues for use in waterways and in areas subjected to heavy trampling or traffic. There is little, if any, place for seedings of meadow fescue in Ohio.

Meadow Fescue

NARROW LEAF FESCUES

- 1) **Sheep fescue**, *Festuca ovina* is a low-growing bunchgrass which forms dense tufts of numerous stiff, rather sharp, bluish-grey leaves. It is not recommended for use in Ohio.

- 2) **Red fescue**, *Festuca rubra*, is similar to sheep fescue. There are two forms: Red fescue, a creeping grass, and chewings fescue, a bunch-grass that does not creep. These fescues are often included in lawn mixtures for shaded areas.

Red Fescue

Johnsongrass

Sorghum halepense

Johnsongrass is an important hay crop in some sections of the South. It is a serious weed on the first bottom and terrace soils along streams in southern and central Ohio. Johnsongrass is a perennial which spreads by seed and by heavy underground stems or rhizomes. It usually winter-kills in northern Ohio and is normally controlled by cultivation and normal crop rotations on the uplands of southern Ohio.

Johnsongrass hay is about equal to other grass hays in feeding value. It can also be utilized as pasture, greenchop, or silage. Under heavy grazing or regular mowing at immature stages of growth, johnsongrass is weakened and yields decline.

Johnsongrass is a noxious weed in Ohio.

Millet

PROSSO MILLET, *Panicum miliaceum*, is grown for grain.

Millets grown for forage include:

FOXTAIL MILLET, *Setaria italica*

PEARLMILLET (CATTAIL), *Pennisetum glaucum*

JAPANESE BARNYARD MILLET, *Echinochloa frumentacea*

None is an important forage crop in Ohio. Foxtail millets are slender stemmed annuals which grow 1

Johnsongrass

to 5 feet in height. They are grown in the northern plains and to some extent in the southwest. Pearl-millet attains heights of 5 to 16 feet, the stems are large and pithy. It is grown in the southern states. Japanese barnyard millet is a thick-stemmed plant that grows 2 to 4 feet tall. It is occasionally grown as an annual forage in the Northeast.

Millets vary greatly in height and leafiness. The larger-growing types have thick pithy stems, and produce rather low-quality forage.

Sudangrass, forage sorghums, and sorghum-sudangrass hybrids are better annual forage species for Ohio than are the millets.

Orchardgrass

Dactylis glomerata

Orchardgrass is a tall-growing, high-yielding, perennial bunchgrass. It makes more summer growth than timothy or brome grass: inclusion of orchardgrass in seeding with ladino clover reduces the hazard of livestock bloat. Orchardgrass is an early-maturing species. It becomes coarse and unpalatable at maturity, thus proper timing of harvest is of great importance in orchardgrass management. Orchardgrass should not be permitted to mature seed. When late-harvested orchardgrass hay is fed to livestock, the manure will contain large quantities of viable orchardgrass seed. Orchardgrass seed in manure can become widely scattered over the farm and cause a serious problem.

Orchardgrass is easily established in spring or summer seedings. Seedings made in the fall at the time of sowing winter grains are seldom successful.

Early maturing varieties and common orchardgrass mature 3 to 4 weeks earlier than timothy. The first harvest from these early strains is best utilized as pasture or silage.

Late maturing varieties bloom 10 days earlier than timothy (at about the same time as smooth brome grass). The late-maturing varieties are excellent companion grasses for seeding with alfalfa for hay, pasture or silage.

Rape

Brassica napus

In Ohio, rape is occasionally used as an emergency annual pasture for sheep or swine. Dwarf essex rape is a biennial which produces a large amount of succulent high protein feed during the first year, but usually does not live over winter. It may be sown at any time between April 1 and June 1. For maximum grazing, rape should be sown during the early spring. The young plants are hardy and not injured by light frost. Early plantings should be ready for grazing by June 1 and will furnish grazing until plants are killed by winter temperatures. Rape should be seeded in a well-prepared seedbed. Seeding is best done with a standard grain drill.

Orchardgrass

Bentgrasses

REDTOP, *Agrostis alba*

Redtop is the most important forage species of the bentgrasses. It is a sod-forming perennial, which is easily established in fall seedings and spreads in meadows and pastures by creeping rhizomes. In Ohio, redtop is used primarily as a poor-land hay crop. It is tolerant of a wide range of soil fertility, pH, and moisture conditions. Redtop can withstand considerable drought, and is a good wet-land grass. Under medium to high levels of soil fertility, other grasses are more productive.

Redtop has been successfully established on some strip mine spoil areas in eastern Ohio; and is, at times, included with alsike or ladino white clover for hay and/or pasture seedings on poorly-drained soils.

Redtop

It is easily established in fall seedings; spring seedings are usually successful if made early while soil moisture is adequate.

OTHER BENTGRASSES

CREEPING BENT, *Agrostis palustris*, is widely used as a hay and pasture species in Northern Europe. In the United States, it is used exclusively as a turf grass.

COLONIAL BENT OR RHODE ISLAND BENT, *Agrostis tenuis*, is the most abundant grass species in unimproved pastures of the New England States. It is adapted to close mowing and is sometimes included in seed mixtures for lawns. **Bentgrasses are not recommended for inclusion in general lawn seedling mixtures in Ohio.**

VELVET BENT, *Agrostis canina*, is sometimes used on golf putting greens.

Reed Canarygrass

Phalaris arundinacea

Reed canarygrass is a tall, broad-leaved, somewhat coarse, sod-forming perennial. It spreads by seed and by rhizomes. In volunteer stands, it frequently grows in clumps or patches up to several feet in diameter. Its natural habitat is areas of poor drainage and/or occasional flooding; it is commonly found in roadside ditches throughout Ohio.

Although reed canarygrass is generally found on poorly-drained sites, it is one of the most drought-tolerant of the cool-season grasses. When grown on upland soils, reed canarygrass is less palatable than most other cool-season perennials and, therefore, is not used extensively for pasture or hay production on these sites.

Reed canarygrass is unexcelled in its ability to heal and control gullies. For this purpose, the usual method of establishment is to imbed small pieces of

Reed Canarygrass

sod in the bottom and across the gully. A sod piece containing rhizomes and one or more shoots will quickly establish and spread.

In grass waterways, reed canarygrass should be used only on large, well defined watercourses. It forms a very dense sod which may impede water flow, cause sedimentation, and divert water to other unprotected areas.

Reed canarygrass seedings should be made during the early spring or late summer. Late summer seedings are usually best on poorly-drained sites; a suitable seedbed can often be prepared on such sites during the dry periods of July or early August. On areas which are wet throughout the year, shredded reed canarygrass sod may be spread on the surface and incorporated into the soil by disking or by driving cattle over the newly spread plant material.

Reed canarygrass is generally considered to be of little value as a hay crop. This opinion is based on poor animal acceptance of the coarse, woody, mature hay which is harvested from low-lying wet areas. In these situations, excess soil moisture makes timely, early harvest impossible. Livestock readily eat early-cut reed canarygrass. Plant breeders in several states are trying to produce a more palatable and higher yielding strain of reed canarygrass. If these efforts are successful, reed canarygrass could become an important species in Ohio forage seedings for hay, pasture, and/or silage.

Ryegrass

ANNUAL (ITALIAN) RYEGRASS, *Lolium multiflorum*

This is a bunchgrass which grows 2 to 3 feet tall. The leaves are smooth, dark green, and rolled in the bud. The seed have awns.

In Ohio, annual ryegrass is used as a winter cover crop, and for temporary summer cover and erosion control. Ryegrass has a remarkable ability to establish under dry and otherwise unfavorable conditions such as in standing corn and to make a heavy sod in a short time after seeding. Ryegrass, which goes into the winter with considerable top growth, is frequently killed by leaf diseases during the winter and/or early spring. When included in seeding mixtures with other forage or turf species, ryegrass germinates and establishes quickly, giving rapid cover; however, this ready establishment and rapid growth frequently slows or prevents the establishment of more desirable, permanent species.

Ryegrass will start by seeding during early spring or late summer. Late fall seedings are usually successful, but severe heaving may cause serious stand losses.

PERENNIAL (ENGLISH) RYEGRASS, *Lolium perenne*, is the predominant species in many permanent pastures in the British Isles and parts of Central Europe. In Ohio, it is a short-lived perennial which

is somewhat shorter and more coarse than annual ryegrass. The leaves are short, stiff, smooth, and folded in the bud. The seed are awnless.

There is little, if any place for perennial ryegrass in Ohio agriculture. It is lower yielding and shorter lived than other perennial grass species.

COMMON AND DOMESTIC RYEGRASS are predominantly annual; however, seed labeled as common or domestic ryegrass, may contain limited amounts of perennial ryegrass.

Annual Ryegrass

Sorghum

Sorghum vulgare

It was among the first plants cultivated by man. Believed to have originated in Africa, it was grown in India during prehistoric times and was taken from there to Egypt. The earliest known records of sorghum culture came from Egypt.

There are a number of distinct types of sorghum. These include:

GRAIN SORGHUMS — grown primarily for live-stock feed and human consumption.

SWEET SORGHUMS OR SORGOS — grown for forage and for syrup.

GRASS SORGHUMS — grown for pasture and/or greenchop; sudangrass is the most important of this type.

SORGHUM-SUDANGRASS CROSSES AND HYBRIDS — grown for pasture and/or green chop, and to a lesser extent for silage and hay.

BROOMCORN — grown primarily for the panicle which is used in the manufacture of brooms.

Sorghum is a coarse, annual grass. The stems are solid and grow in height from 2 to 15 feet. Leaves are alternate; a single leaf originates at each node. The length of the internode determines the height of the plant. Varieties with the same maturity but different heights have the same number of nodes and leaves. There is a lateral bud at each node: in some varieties the lateral buds at the lowermost nodes develop into tillers.

Sorghums are noted for their drought tolerance. The leaves have a waxy surface and roll inward during periods of moisture stress. Sorghums which have almost stopped growing during periods of drought will resume near normal growth rates when moisture again becomes available. This is in contrast to corn which never fully recovers growth rates when stunted by lack of moisture during its period of vegetative growth.

Tall Oatgrass

Arrhenatherum elatius

It is a long-lived perennial bunchgrass which grows to heights of 4 to 6 feet. Like oats, it produces seed in an open panicle; the seed are smaller and more chaffy than oats. Tall oatgrass matures early in the spring — at about the same time as orchardgrass. It is less drought and heat tolerant than orchardgrass, and is usually lower in yield.

Timothy

Phleum pratense

Timothy is a bunchgrass which differs from most other forage grasses in that one of the lower internodes (just below the soil surface) remains short and enlarges in diameter to form the haplocorm (corm), sometimes erroneously called the bulb. Individual timothy plants are biennial; however, stands of timothy are maintained perennially by vegetative reproduction from corms. Timothy has a relatively shallow root system and is best adapted to cool, moist climates. In Ohio, timothy makes little summer growth after the first cutting.

Timothy is easily established by seeding with fall-sown small grains. Satisfactory stands are less certain from spring seedings — thus heavier seeding rates are recommended. Timothy may be summer seeded.

Because it is easy to establish in winter grains, timothy is seeded for hay and pasture in Ohio on more acres than any other grass species.

Tall Oatgrass

Wheatgrasses

There are about 150 species of the genus, *Agropyron*. About 30 of these species are found in North America. The most important are:

CRESTED WHEATGRASS, *Agropyron cristatum* is a perennial bunchgrass introduced from Russia by the USDA in 1898. It is adapted to the cool, dry areas of the Northern Great Plains, the prairies of

Timothy

Canada, and the high elevations of the Rocky Mountain States.

Crested wheatgrass is one of the most valuable forage grasses available to farmers and ranchers in the Northern Great Plains. It has drought resistance, extreme winter hardiness, and withstands moderate to close grazing. Because of the availability of seed and ease of establishing stands, crested wheatgrass is of great value in the replanting of abandoned and/or burned-over range lands. It makes maximum growth during the early spring when temperatures are cool and soil moisture is adequate.

Although crested wheatgrass will grow in Ohio, it is less productive and less palatable than other more commonly used perennial grass species.

INTERMEDIATE WHEATGRASS, *Agropyron intermedium*

It is a perennial sod-forming grass fairly recently introduced from Russia. It is adapted to the general wheatgrass region, the Northern and Central Great Plains and the Pacific Northwest.

QUACKGRASS, *Agropyron repens*

It is known to most Ohio farmers as a serious weed. It is a sod-forming grass that spreads by seed and by rhizomes. Young, vigorous-growing quackgrass is moderately palatable and can be utilized as pasture or hay.

Quackgrass

OTHER WHEATGRASSES of importance under rangeland conditions are:

Western wheatgrass, *Agropyron smithii*

Slender wheatgrass, *Agropyron pauciflorum*

Tall wheatgrass, *Agropyron elongatum*

Wild Rye

The wild rye grasses are adapted to the same general area as the wheatgrasses. Wild ryes are sometimes confused with the ryegrasses which are unrelated (*Lolium* species, page 9). Wild rye differs from wheatgrass in having two spikelets at each rachis node. Important species are:

CANADA WILD RYE, *Elymus canadensis*

A short-lived perennial bunchgrass adapted over a wide range of soil types. It is a cool-season grass, with fair palatability; it is widely distributed throughout the range lands of the Northern Great Plains.

RUSSIAN WILD RYE, *Elymus junceus*

A perennial bunchgrass adapted to the drier sites in the Northern Great Plains and the Pacific Northwest.

Wild rye grasses will grow in Ohio, but are inferior to the commonly grown perennial grasses in yield, persistence, and palatability.

Canada Wild Rye

LEGUMES

Alfalfa

Medicago sativa

Has the highest yield potential and the highest feeding value of all the perennial forages grown in Ohio. It is unexcelled in drought tolerance. For best production, alfalfa requires excellent surface drainage, good internal soil drainage, and a soil reaction of pH 6.5 or higher. Stands are quickly destroyed by improper cutting or grazing.

Alfalfa rhizobia fixes large quantities of atmospheric nitrogen, thus increasing the nitrogen level of soils and raising the protein content of grasses grown with it. Alfalfa is a heavy user of soil minerals, including phosphorus, potassium, and calcium. High levels of soil fertility are necessary for maximum yields.

Shading by companion grain crops or weeds greatly retards the seedling growth of alfalfa. Red clover is less severely damaged by moderate shading; thus, alfalfa is not as readily established in wheat as is red clover. Stands of alfalfa from seedlings in oats or seedings without companion grain crops are frequently better than those from seedlings made in wheat. Alfalfa is well-adapted to summer seeding.

There is no good substitute for alfalfa in the forage crop program on most Ohio farms. Control of insects infesting alfalfa, especially the alfalfa weevil and potato leafhopper, is a nuisance, but in most situations insect control is less costly than the production of alternate crops. The cost of producing forage for livestock from alternate crops is usually greater than the cost of controlling alfalfa insects.

Alfalfa is a highly variable plant; varieties differ widely in yield potential, winter hardiness, disease and insect resistance, earliness, and rate of recovery after harvest. In the selection of the alfalfa variety to sow on a given field, consideration should be given to the intended use of the forage and the expected life of the stand. See the current issue of the *Ohio Agronomy Guide* for a listing of the characteristics of alfalfa varieties commonly sold in Ohio.

Alfalfa yields have been reported of 10 tons per acre in Ohio. Many producers have pushed the yields to the 6- to 8-ton level. Profitable alfalfa production can be obtained under Ohio conditions.

Alfalfa

Black Medic

Medicago lupulina

This is an annual or sometimes biennial which resembles the hop clovers (page 15). It has bright yellow flowers; the stems are rather small and leafy and lie close to the ground unless growing in thick stands or with tall-growing species. Black medic is found in many pastures throughout Ohio, and is a fairly common weed in home lawns. The feeding value of black medic is similar to that of other pasture legumes. Yields are low. Although it is a welcome addition to the vegetation of many permanent pastures, black medic is not sufficiently productive to warrant its inclusion in pasture seedings.

Birdsfoot Trefoil

Lotus corniculatus

This is a deep-rooted perennial legume which produces well in long lay stands in Northern Ohio. Birdsfoot trefoil stands are generally short lived in Southern Ohio, and yields are relatively lower. Crown and root diseases are more severe in southern than in northern Ohio. These diseases are a major factor in stand losses. Loss of stands in southern Ohio can be partially overcome by permitting birdsfoot trefoil to mature and reseed itself once each year.

Although birdsfoot is primarily a pasture legume, hay yields from birdsfoot trefoil have exceeded those of alfalfa on some northeastern Ohio soils not well adapted to alfalfa. Birdsfoot trefoil is adapted to a wide range of soil conditions. Once established, birdsfoot trefoil will grow on soils too wet for best growth of alfalfa; it is much less susceptible to winter heaving than are alfalfa or sweetclover. Although birdsfoot trefoil will grow at pH levels too low to support satisfactory stands of alfalfa, it makes best growth at a soil reaction of pH 6.5 to 7.0.

With proper harvest schedules, a favorable soil pH, and adequate fertility, birdsfoot trefoil stands should survive almost indefinitely. The legume lacks seedling vigor and should be seeded only on fields to remain in sod for several years.

Birdsfoot trefoil should not be seeded with alfalfa or clovers; these legumes start quickly and crowd out the slower growing birdsfoot seedlings. Unusual care in inoculation is essential in establishing birdsfoot trefoil.

Birdsfoot trefoil should be seeded during the early spring with spring oats or without a companion grain crop. Summer seedings which go into the winter with limited growth, frequently do not survive the first winter.

Birdsfoot trefoil is sometimes regarded as a "poor-land" legume; it will grow on poorly drained soils, it will tolerate soil pH levels too low for satisfactory stands and growth of alfalfa and sweetclover, and it will survive under conditions of relatively low fertility. However, birdsfoot trefoil grows best on soils with pH values of 6.5 to 7.0, and medium to high levels phosphorus and potassium. Many disappointments with the performance of birdsfoot trefoil have resulted from failure to maintain the pH and fertility of the soil within the range necessary for maximum productivity.

Low-growing types. Empire birdsfoot trefoil is the only variety of the low-growing type of which seed is currently available. Fields of Empire birdsfoot have been grazed for 20 or more years with no decrease in the birdsfoot stand. Birdsfoot trefoil can, however, be killed by continuous close grazing with sheep and probably with cattle. Low-growing types withstand close grazing better than the upright types. Both types produce more total forage under rotational than under continuous grazing.

Birdsfoot Trefoil

Upright types. Several varieties of upright-growing birdsfoot trefoil are available. These have more seedling vigor than the low-growing types but make much less seedling growth than legumes such as alfalfa, red, or ladino white clover. The upright types recover more quickly after grazing or clipping than the low-growing types. Upright types of birdsfoot trefoil should be used where an occasional harvest may be removed as hay or silage.

For long-lived stands and highest yields, birdsfoot trefoil requires the same fall management as alfalfa. During the period from mid-September until growth is stopped by freezing temperatures, there is a build-up of food reserves in the root system of the plant. Harvesting by clipping or grazing during this period will prevent the build-up of plant food reserves and will weaken the plant. Many losses of birdsfoot trefoil stands can be attributed to improper fall harvest schedules.

Clovers

ALSIKE CLOVER, *Trifolium hybridum*, is a perennial but is usually treated agriculturally as a biennial. It grows well on heavy, poorly-drained soils and will even withstand flooding for considerable periods of time. Alsike will grow on soils with pH levels too low to support satisfactory growth of red clover, but produces better when soil pH levels are 6.0 or higher. It is extremely sensitive to heat and drought.

The growth habit differs from red clover in that the flowers are not borne at the end of the stems, but on flower-bearing branches which arise at each leaf axil. Thus the youngest flowers are near the top of the plant with older blossoms farther down the stem. Alsike usually produces only one hay cutting each year. Harvesting at full bloom is usually recommended although that stage is difficult to determine because of the continuous blooming pattern. In Ohio, alsike clover is almost never grown in pure stands. In mixtures, the harvest should be timed to

Alsike Clover

make maximum feed from the total mixture. This usually means a late May or early June harvest.

Because of its natural adaptation to wet soils, alsike is a valuable plant to include in mixtures for hay or pasture on fields having "seep" or wet spots which have not been drained. It is also a useful species for bottomland fields where alfalfa and/or red clover cannot be successfully grown.

BERSEEM (EGYPTIAN) CLOVER, *Trifolium alexandrinum*, is a tall-growing winter annual which is grown extensively as a forage crop in parts of Asia and Africa. Small acreages have been grown in southern California and Arizona. Berseem does not survive Ohio winters.

CRIMSON CLOVER, *Trifolium incarnatum*, is a soft pubescent annual. It is widely grown as a winter annual throughout southern United States. In the southern fourth of Ohio, crimson clover usually survives the winter; elsewhere in the state, it winter kills.

Under favorable moisture conditions crimson clover seedlings make rapid growth. This growth may continue throughout the winter, the amount of growth depends on the temperature. Seedlings grow at lower temperatures than do most other legumes. Flower stems develop during the spring; the florets are bright crimson in color. After seed has matured, the plant dies. The seed shatters readily.

Crimson clover is the most important winter annual legume for the South. It produces large amounts of forage for winter and spring grazing. When reseeding varieties are permitted to seed naturally, a new stand develops in the field each fall.

In Ohio, even where crimson clover survives the winter, it makes only limited winter growth. It is not recommended for use in the state.

HOP CLOVER, *Trifolium agrarium*, is an annual or biennial with showy yellow blossoms. It volunteers into pastures and waste areas throughout Ohio; it commonly attains a height of 4 to 8 inches. The feeding value of hop clover is not greatly different from that of other legumes. Although it may make a contribution to the yield of some pastures, hop clover does not produce enough forage to warrant its inclusion in pasture seedings in Ohio.

RED CLOVER, *Trifolium pratense*: **Medium red clover** is the most widely grown of the true clovers. In Ohio, the acreage of red clover-grass mixtures exceeds the acreage of alfalfa-grass mixtures. Medium red clover is a perennial which acts as a biennial under usual farm conditions. The clover root borer and crown and root rots kill many plants after the second cutting of the first hay year. If red clover is left over the second winter, winter injury, combined with diseases and the clover root borer, further deplete the stand.

Red clover normally produces two cuttings during the hay year. The first cutting should be taken at the proper time for harvesting the companion grass. First-cutting yields are usually equal to first cutting

Red Clover

yields of alfalfa. The second cutting can be utilized as forage or permitted to mature seed. With unusually favorable growing conditions, a third harvest is possible.

Farmers often are uncertain about the potential seed yield of red clover. Seed yields of 2 to 3 bushels per acre may be expected from good stands if random seed counts range from 40 to 60 seed per head. The seed harvest should be made when the heads have turned brown and the stems are yellow-brown in color.

Red clover grows on soils with pH values below those necessary for satisfactory production of alfalfa and sweetclover. It is easier to establish in wheat or other winter grains than is alfalfa. Red clover may be seeded in oats. It is not as well adapted to summer seeding as is alfalfa; however, summer seedings frequently are successful.

It is often noted that when red clover blooms during the fall of the seeding year, many plants die

during the winter. Blooming causes a physiological change in the red clover plant which makes it less winter hardy. In addition, excess summer and fall growth which is not removed from the field, will lodge and create conditions favorable for the development of crown and root rots. These diseases can damage new seedings. The general rule-of-thumb is that new seedings of red clover which have reached a height of 8 to 10 inches by mid-August should be harvested not later than September 1, regardless of the presence or absence of bloom.

Mammoth red clover is a variety of red clover. It differs from medium red in that it is later maturing, recovers slowly after cutting and makes only one good hay cutting a year. Mammoth yields more at the first cutting than medium red because it grows two to three weeks longer, but its total yield for the season is usually less than medium red. Contrary to popular opinion, mammoth does not have a larger root system than medium red. There is little, if any, place for mammoth red clover in forage seedings in Ohio.

SUBTERRANEAN CLOVER, *Trifolium subterraneum*, is a pubescent annual which somewhat resembles a large white clover. It is adapted to regions with little or no frost. The name, subterranean clover, comes from its peculiar growth habit: the plant burys its seed heads in the soil as they mature and seed pods develop mostly underground.

WHITE CLOVER, *Trifolium repens*, is a native of Europe; it was probably brought to North America by early white settlers. Its spread across the United States was phenomenal. Christopher Gist reported that white clover was common in Ohio in 1750-51. Among the factors which probably contributed to its spread are: small seed, hard seed coat which permits seed to remain viable in the soil for long periods of time, the long period of flowering, and high palatability. Good stands of white clover appear without seeding in almost any field in Ohio when conditions favorable to its growth prevail. Such conditions include soil pH of 5.5 or higher, moderate levels of phosphorus and potassium, adequate moisture, and close grazing or frequent clipping.

White clover is a perennial with a prostrate habit of growth. The stems root at the nodes and thin stands quickly thicken under favorable conditions. White clover is shallow rooted and makes little growth during dry weather.

Common white clover is the most prevalent legume in Ohio permanent pastures. Because it volunteers so readily into pasture areas, common white clover is not included in recommended pasture seeding mixtures.

Ladino is a large type of white clover. Ladino white clover is frequently included in pasture seeding mixtures. It is shallow-rooted and makes most growth during periods of high rainfall or on poorly drained soils. Ladino stems lie on the surface of the soil; under favorable conditions, roots may form at

each node. A ladino stem may grow 2 to 4 feet in length during a single season. Thus, ladino has the ability to spread rapidly, and, under favorable conditions, stands thicken quickly.

Ladino white clover is most useful as a pasture legume. It is difficult to cure as hay. There is a serious hazard of livestock bloat when ruminants graze ladino clover. Because of its low yield during mid-summer and the bloat hazard from grazing the lush spring growth, ladino has lost favor with many farmers. Growing ladino with a vigorous grass greatly reduces the bloat hazard. Ladino-orchardgrass and ladino-tall fescue pastures rate high with some livestock producers.

ZIGZAG CLOVER, *Trifolium medium*, is a perennial with creeping rootstalks. It is a native of Europe and is reported to be prevalent in many parts of Russia. Zigzag clover has been included in small observational plantings at several locations in the United States. The plant produces very little seed and is generally propagated vegetatively. A planting at the Ohio Agricultural Research and Development Center, Wooster, has spread slowly, but has not appeared promising as a forage legume.

Crotalaria

There are numerous species of crotalaria. Those of most importance in the United States are:

- Crotalaria striata*, striped crotalaria
- Crotalaria spectabilis*, showy crotalaria
- Crotalaria intermedia*, slenderleaf crotalaria
- Crotalaria lanceolata*, lance-leaf crotalaria

All crotalaria are warm-climate plants, early-maturing strains can be grown throughout the cot-

ton belt, later-maturing strains are adapted only to the extreme southern states. They are used as summer annual, green manure, or cover crops. Showy crotalaria contains an alkaloid which is poisonous to livestock. Other species have some value as forages.

Crotalaria will grow in Ohio; however, for satisfactory growth, planting should be delayed until soils are warm. Crotalaria is not recommended for use in Ohio because it is inferior to other legumes for cover and green manure.

Crownvetch

Coronilla varia

This is a deep-rooted perennial legume. It is winter hardy, drought tolerant, and will persist under light shade. The stems of crownvetch are coarse, semi-erect, and attain lengths of 3 to 5 feet at maturity. The showy blossoms vary in color from whitish-pink to light purple with various shades of pink. Crownvetch blooms from mid-June to August.

Crownvetch spreads by seed and by heavy rhizomes. With favorable growing conditions and proper management, crownvetch plantings thicken with time and eventually almost completely eliminate other herbaceous species. Crownvetch should be seeded during early spring. A special inoculant is required.

Crownvetch is a native of Europe. It has, however, been known in the United States for many years. The old literature states that crownvetch is not palatable to livestock: it certainly is not as palatable as are many common legumes such as alfalfa, birdsfoot trefoil, and the clovers; however, recent observations in Ohio and elsewhere are that

livestock eat crownvetch readily and thrive on it. The most extensive use of crownvetch in the United States has been for cover and erosion control along Pennsylvania highway rights-of-way. It is particularly valuable on cuts and fills which receive little or no mowing. On many such sites, pure stands of crownvetch have developed with excellent ground cover. On the better sites which receive some traffic and are mowed regularly, other species predominate and crownvetch is of only minor importance or disappears completely.

The most extensive plantings of crownvetch in Ohio are on high lime strip mine spoils in Eastern Ohio. These plantings have developed excellent cover and appear to have potential for forage production. Some strip mine plantings have been grazed, and excellent beef cattle gains are reported. These plantings have not been closely grazed, and thus do not furnish information regarding the persistence of crownvetch under moderately intensive grazing or cutting management. At the O.A.R.D.C., Wooster, crownvetch plots have maintained good stands when cut for hay two times each year.

Preliminary observations from pasture plots at the Eastern and Southern Branches, O.A.R.D.C., indicate that crownvetch stands are maintained when grazed 2 or possibly 3 times each year. Yields have been 50 to 60 per cent of alfalfa.

Kudzu

Pueraria thunbergiana

It is a perennial vine with long runners or stems. These stems become woody when not killed by frost. Well-established plants may produce runners of 30 to 50 feet in length. These stems root at nodes when

in contact with moist soil, thus establishing new plants from which runners spread the following year.

Kudzu is adapted to the southern half of the United States. In the northern states it usually winterkills. In southern Ohio, well established kudzu plants usually survive the winter; new growth begins during late spring and continues until frost. The stems and leaves are killed by frost and only well-established crowns survive the winter.

In the South, kudzu is a valuable plant for soil cover and erosion control. In Ohio, under the best growing conditions and on protected sites, kudzu provides soil cover for only 3 or 4 months during the summer months. It is not recommended for use in Ohio.

Lespedeza

ANNUAL

- 1) **Common lespedeza**, *Lespedeza striata*
- 2) **Korean lespedeza**, *Lespedeza stipulacea*

Common lespedeza can be distinguished from Korean by differences in leaflets, stipules, and seed. The leaves of common are more narrow and slender. The large, broad, stipules of Korean are much more prominent than the smaller stipules of common. Common lespedeza sets seed at leaf axils along the stem; the seed of Korean is borne in clusters at the tips of branches.

These shallow-rooted annuals are used to a limited extent for pasture in southern Ohio. In the states south of Ohio, annual lespedezas are more productive and are used extensively for hay, pasture and cover crops. In Ohio, annual lespedezas germinate during March, and are large enough to provide some grazing by late June or early July.

Korean Lespedeza

Inoculated Korean lespedeza may be sown during March, south of U. S. Highway 50, on pastures in which there is considerable bare ground. It will exist on very poor soils but requires lime and phosphate to make any appreciable yield. After lime and phosphate have been applied, other legumes are more profitable. Once bluegrass occupies the area, lespedeza cannot be established in it. Although considerable pasture can be obtained from lespedeza seeded on pastures where bare ground is exposed, it is not recommended for use in general pasture seedings in Ohio.

PERENNIAL

1) **Sericea lespedeza**, *Lespedeza cuneata*, is the most important perennial lespedeza. It is a deep-rooted, drought-tolerant, hardy legume. In Ohio, it has been used to a very limited extent as a soil-building legume on strip mine spoil banks and as a food plant for wildlife. The top growth of sericea is killed back to the ground in winter, and new growth comes each spring from the crown. It is a woody plant of little value as hay or pasture.

Sericea lespedeza seed normally has a high percentage of hard seeds. Germination of unscarified seed seldom exceeds 25 per cent. It can be spring or summer seeded. Winter or spring seedings make only limited growth during the seeding year. When sericea lespedeza is cut for weed control or to provide surface mulch, the mower should be set high. Regrowth comes from the uncut stubble and not from the crown. Continuous close grazing or frequent mowing will weaken the plants and may result in serious winterkilling.

2) **Bicolor lespedeza**, *Lespedeza bicolor*, is a shrubby perennial used in wildlife border plantings.

Sweetclover

YELLOW SWEETCLOVER, *Melilotus officinalis*, and **WHITE SWEETCLOVER**, *Melilotus alba*, are the important strains of sweetclover. Only biennial yellow sweetclover is important in the United States. Both annual and biennial white sweetclover are grown, the biennial is the more important type.

Sweetclover is usually seeded during the early spring months; seedlings are made into winter grains or at the time of seeding spring-sown small grains. The seeding-year growth of biennial sweetclover consists of a single stem with numerous branches. Biennial sweetclover does not bloom during the seeding year. During late summer and fall of the seeding year, several buds develop on the crown. These buds are usually just at or slightly below the soil surface. Crown buds make rapid growth during the spring of the second year: the plants bloom, set seed, and die.

Annual sweetclover blooms and sets seed during late summer of the seeding year.

Sweetclovers are most useful as green manure crops seeded in small grains. Although satisfactory stands and considerable top growth may be obtained

from seedlings in corn, such seedlings make little root growth and frequently heave during winter. Sweetclover seeded in corn fixes only small quantities of nitrogen.

During the fall months, the roots of biennial sweetclover become fleshy as food reserves produced by the top are stored in the root. Much of the plant food utilized in making second year growth is stored in the roots of the plant during the first year. This concentration of plant foods makes biennial sweetclovers especially valuable for green manure.

Although the annual sweetclovers usually produce more top growth during the seeding year, they make less root growth and are generally inferior to biennial sweetclover for green manure. Annual sweetclover can be fall or winter plowed with little hazard of volunteer spring growth, provided plowing is done before seed shatters. Crown buds of biennial sweetclover are not killed by fall or winter plowing. These buds frequently produce volunteer growth unless plowing is delayed until spring growth

Sweetclover

has started. After spring growth has commenced, biennial sweetclover is rather easily killed by plowing.

In general, the adaptations and uses of biennial white and biennial yellow sweetclover are the same. The commercial yellow is earlier-maturing than the standard white. Yellow sweetclover always puts a higher proportion of the total first year's growth into the roots than does white. Yellow sweetclover has much greater ability to establish itself in dry seasons and dry seedbeds than white sweetclover.

Sweetclover leaves contain a high content of coumarin which gives the forage its characteristic odor and taste. Livestock generally take some time to get accustomed to the taste. When sweetclover hay or silage heats and/or molds due to improper curing or storage, a toxic substance dicoumarol, is formed. Dicoumarol reduces the clotting power of the blood and animals eating spoiled sweetclover hay or silage may bleed to death from slight wounds or internal hemorrhages.

Sweetclovers are extremely sensitive to soil reaction; for satisfactory growth, the pH of the surface soil must be 6.5 or higher. With a suitable soil pH, sweetclovers will stand drought about as well as alfalfa and shade nearly as well as red clover. They will make satisfactory summer growth on wet soils but are likely to heave during winter.

Sweetclover may be broadcast or drilled in small grains during the early spring. The seeding should not be clipped following grain harvest, as this results in a great reduction in the value of the crop as a green manure.

Vetch

There are about 150 species of vetch throughout the world. Several are native to the United States; however, only four species are of any importance in the U. S. and all of these are of European origin. They are:

- Hairy vetch**, *Vicia villosa*,
- Common vetch**, *Vicia sativa*,
- Purple vetch**, *Vicia atropurpurea*,
- Hungarian vetch**, *Vicia pannonica*

Hairy vetch is the only species which will regularly survive Ohio winters. Common vetch frequently winterkills when temperatures approach 10°F.; purple vetch may be injured by temperatures of about 20°F.; Hungarian vetch is somewhat more hardy than Common, but is not used to any extent in Ohio. Hungarian vetch has some tolerance to wet soils.

Hairy vetch is a winter annual which is used primarily as a green manure crop. It should be seeded during the summer or fall months; late June or early July are the preferred months. It is sometimes sown in standing corn. Hairy vetch makes some growth during the late summer and fall, lives through the winter, and makes a vigorous spring growth. It should not be plowed under before mid-

Hairy Vetch

May; it fixes little nitrogen unless permitted to make considerable spring growth.

The second-year growth of hairy vetch can be utilized as livestock feed. It is palatable as pasture, or can be harvested as hay or silage. Yields are much lower than those of other common forage legumes. In the states south of Ohio, common or purple vetch is sometimes drilled with oats as an annual forage crop.

Hairy vetch should never be permitted to mature seed. The plant has a high percentage of hard seeds which will volunteer for many years. Volunteer vetch in wheat is serious both because it makes combining difficult and because it is difficult to separate the vetch from the wheat.

Stands of vetch frequently are badly damaged or completely killed over the winter by diseases. Vetch is not recommended for routine cover crop seedings in Ohio.