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Annual Lespedezas

**Culture
and
Use**

Farmers' Bulletin No. 2113

UNITED STATES DEPARTMENT OF AGRICULTURE

The annual lespedezas are of major importance in the eastern half of the United States as forage crops for midsummer and early fall grazing, for soil improvement, and for hay and seed. During the period 1951-60, 4.89 million acres were grown annually for hay and seed, but since that time the acreage has declined. There are production problems in establishing lespedeza in winter oats or wheat, particularly when high rates of nitrogen fertilizers are applied to the grain crop. Under these conditions lespedeza plants are weakened and are unable to compete with weeds after the grain crop is harvested.

The use of the more productive, vigorous Korean varieties—Iowa 6, Rowan, Climax, and Summit—results in better establishment and higher yields under these more competitive conditions. In the southern area, Kobe lespedeza continues to be an important variety while Common is grown to a limited extent for pasture.

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Annual Lespedezas

Culture and Use

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There are only two species of annual lespedeza and both are of interest to the American farmer. The species, both of Asiatic origin, are *Lespedeza striata* (striate) and *L. stipulacea* (Korean).

The species are similar but can be readily distinguished. Korean lespedeza is a larger, coarser, and earlier maturing plant than is striate lespedeza and has broader leaflets and larger bracts, or stipules, at the base of the leaves. At maturity the leaves of the Korean turn forward so that the tips of the branches resemble small cones, but the leaves of striate lespedeza do not turn forward. The hairs on the stems of Korean lespedeza point upward; those of striate lespedeza point downward.

Varieties of each species have been developed and are now in commercial production. The principal varieties are as follows:

Striate: Common, Kobe.

Korean: Iowa 6, Rowan, Climax, Summit.

Striate varieties

Common and Kobe lespedezas are well adapted across the Lower South (fig. 1). Striate lespedeza was first reported in Georgia in 1846. Since it came from Japan, it was called Japan clover; later it

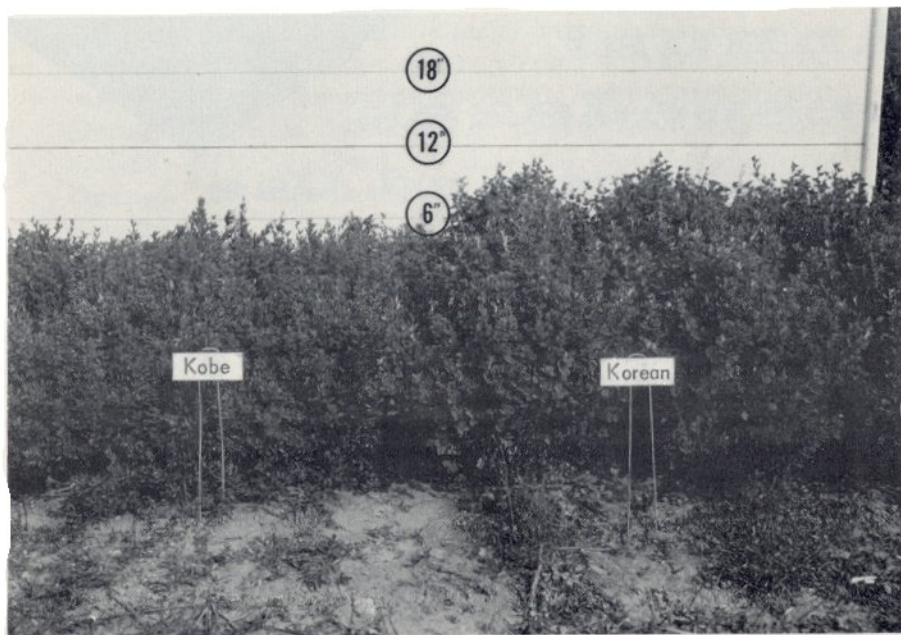
became known as Common lespedeza.

Common lespedeza is a slender plant with small leaflets and purple flowers. It is prostrate in growth except in dense stands. Because of its habit of growth, it is sometimes preferred in permanent pastures in the Deep South. It is smaller growing and generally less productive than Kobe. It is a poor seed producer, and seed stocks are limited.



BN-4668

Figure 1.—Region of the United States to which Common and Kobe lespedezas are well adapted.



BN-4632

Figure 2.—Lespedeza at Beltsville, Md., in late July: Korean, right, shows greater growth than Kobe.

Kobe was introduced from Japan in 1919 by an explorer of the U.S. Department of Agriculture. It is larger and coarser than Common lespedeza.

Kobe is more erect in habit of growth and is more productive for hay and pasture than Common. It is slower in starting growth in the spring than the Korean varieties (fig. 2); however, late summer yields are usually good. Since about 1945, slightly more than 20 percent of the total lespedeza seed harvest has been of the Kobe variety.

Korean varieties

Iowa 6 is an early-maturing variety of Korean lespedeza devel-

oped by the Iowa Agricultural Experiment Station. Because of its earlier maturity, it is well adapted across the upper part of the Korean area (fig. 3) and extends the lespedeza area farther north. Iowa 6 carries some resistance to lespedeza wilt and grows off rapidly in the spring (fig. 4). This variety yields well in the Korean area and appears promising where an early variety is needed to reseed before winter grain is sown.

Rowan, released in 1951, was developed in a cooperative program by the North Carolina Agricultural Experiment Station and the U.S. Department of Agriculture. It is intermediate in maturity between Iowa 6 and Climax. It is moderately resistant to two common

nematode species and to powdery mildew, and has field resistance to tar spot. It is decidedly more productive than other Korean varieties on nematode-infested soils. The difference in growth between Rowan and Kobe at Beltsville, Md., is shown in figure 5.

Climax is a selection from a plant introduction¹ from China. It has been evaluated in a cooperative program conducted by the State agricultural experiment stations of the lespedeza region and the U.S. Department of Agriculture. It carries some resistance to bacterial wilt of lespedeza and has field resistance to tar spot. It matures ear-

lier than Kobe but is about 10 days later than Rowan. The approximate area to which it is adapted is shown in figure 3.

Summit lespedeza was developed by the Arkansas and Missouri Agricultural Experiment Stations in cooperation with the U.S. Department of Agriculture. It is a selection from a Climax \times Harbin cross and was released for the production of foundation seed in 1962. Summit is a high-yielding variety, slightly later in maturity than Korean, and is adapted to the same general area as Rowan except where the root knot nematode is a problem. It is more resistant to bacterial wilt than other varieties and is equal to Climax and Rowan in field resistance to tar spot.

¹P.I. 116138.

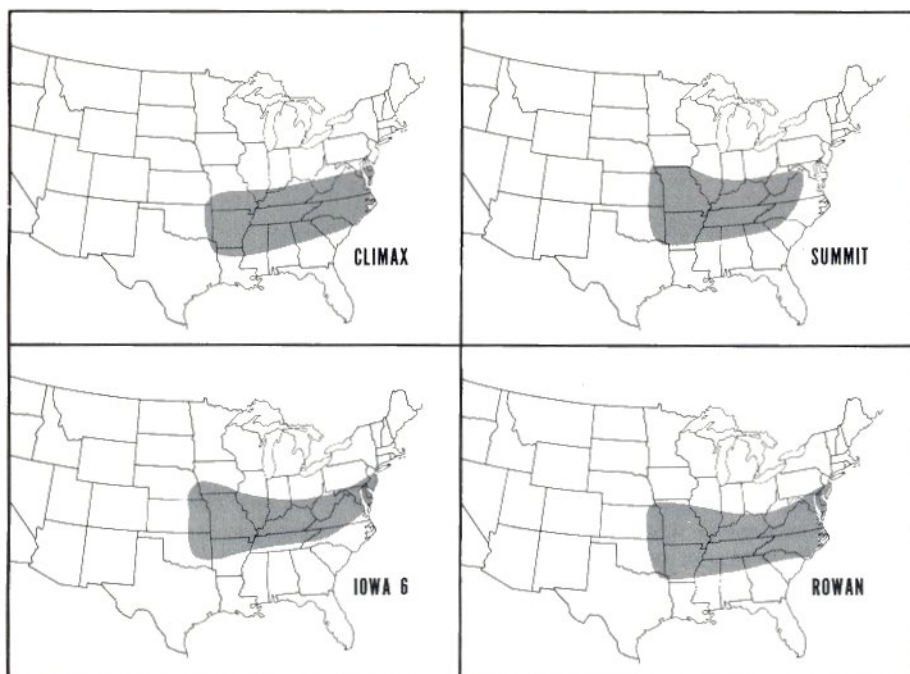
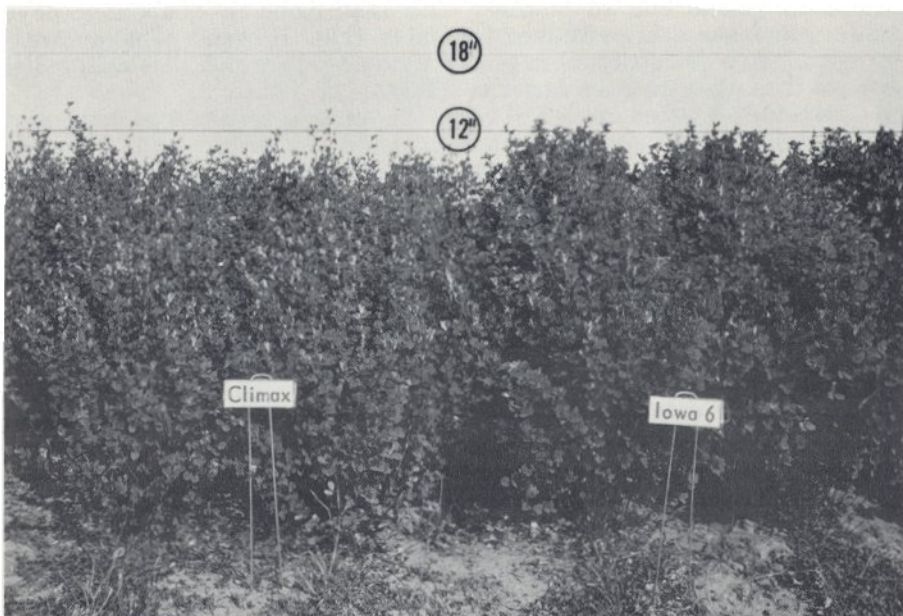


Figure 3.—Approximate areas of adaptation of Korean varieties of lespedeza.



BN-4631

Figure 4.—Lespedeza at Beltsville, Md., in late July: Iowa 6, right, shows greater growth than Climax.

Soil and fertilizer requirements

Lespedeza will grow on almost any type of soil. It does well on the sandy loam soils of the Coastal Plain, the clay soils of the Piedmont, and the limestone soils of Virginia, Tennessee, and Kentucky. It will grow on soils too acid to grow clover. It does better on good land and makes its best growth on fertile, bottom land, where yields of 2 to 3 tons of hay per acre are not uncommon.

On very acid soil lime has proved very beneficial to lespedeza. The Korean lespedezas are more responsive to lime than the Common variety of striate lespedeza. Where soils are poor, lespedeza will respond to both lime and fertilizers.

Phosphate in particular has caused increased yields and should be used generally on all the poorer soil. In the Coastal Plain, both phosphate and potash are generally needed, and 200 to 400 pounds per acre of an 0-14-14 fertilizer is recommended.

The amount of fertilizer that should be used depends to some extent on the amount of fertilizer that was applied to the crop preceding the lespedeza in the rotation and on the management of the lespedeza in the rotation. Where lespedeza is grown each year with winter grains and harvested for hay, the available supply of phosphate and potash may be exhausted unless particular attention is paid to the fertility requirements of the crop.

Although lespedezas are fairly drought resistant, good yields depend on an adequate moisture supply.

Inoculation

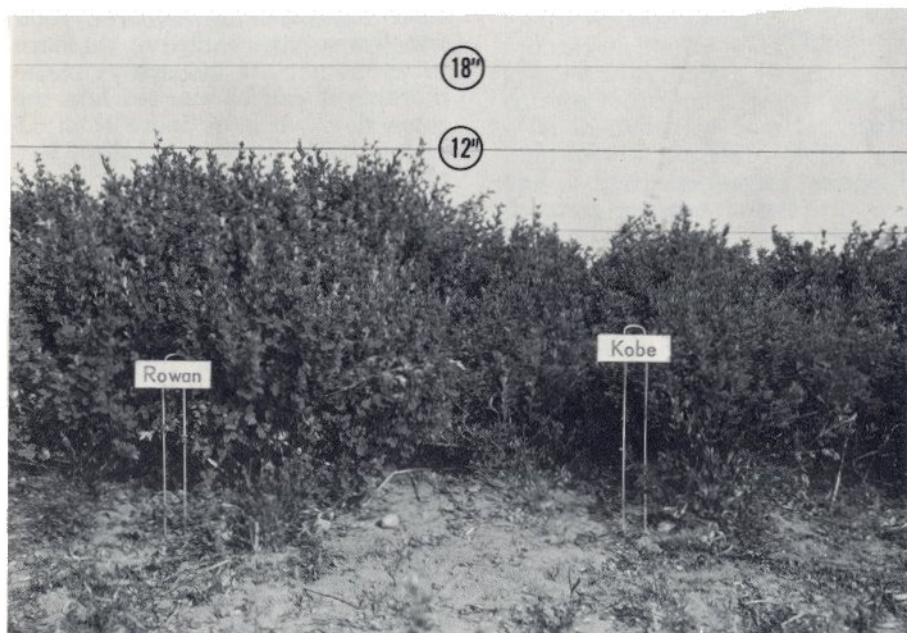
In the region where lespedeza is commonly grown, inoculation is generally not needed. On badly eroded soils it may be beneficial or necessary. On land that has not previously grown lespedeza, inoculation is necessary the first year. Inoculation with commercial cultures is more helpful in plantings north of the Ohio River than farther south. This is particularly true of Korean lespedeza.

Seeding

Time and Rate

In North Carolina, Tennessee, and farther south, annual lespedezas should be seeded in late February or the first half of March. Farther north, seeding should be delayed until late March or early April.

The Korean varieties and Common lespedeza should be seeded at the rate of 25 to 30 pounds of seed per acre and Kobe at the rate of 30 to 40 pounds. Fifteen pounds of the Korean varieties and of Common and 15 to 20 pounds of



BN-4633

Figure 5.—Lespedeza at Beltsville, Md., in late July: Rowan, left, shows greater growth than Kobe.

Kobe per acre are sown when lespedeza is included in a pasture mixture.

Method

The seed of the annual lespedezas should be sown broadcast or drilled alone or on winter grain. If broadcast seeding is done too late or if the ground is too hard for freezing and thawing to work the seed under the surface, the field should be lightly harrowed after seeding. Freshly prepared land or loose seedbeds should be rolled or otherwise firmed. A firm seedbed is essential in obtaining a good stand.

When annual lespedezas are seeded on meadows or pastures, a spring-tooth harrow or disk should be used to loosen the surface soil before the seed is sown. This will do much to insure a stand.

Hay

Annual lespedezas yield an average of 1 ton of hay per acre. On good soils 2 to 3 tons may be expected.

Many farmers have establishment problems when seeding lespedeza in small grain. Stands are lost or surviving plants are too weak to compete with weeds when high nitrogen rates are used on the grain crop. The use of the more vigorous, improved varieties of lespedeza and adequate but not excessive amounts of nitrogen will result in better stands and hay yields.

Weeds are a serious problem on small grain-lespedeza rotations where soil fertility is improved by application of a complete fertilizer. Under these conditions it appears desirable to shift from lespedeza to other legumes or grasses that are

capable of greater production on the more fertile soils.

Cutting

The best hay is made by cutting the annual lespedezas in first bloom or just before first bloom. In the latitude of North Carolina this will usually be the first half of August for the Korean varieties and about 2 weeks later for the striate varieties. When lespedeza is left until a considerable part of the seed is ripe, the hay is of poorer grade.

Lespedeza contains less moisture than alfalfa or red clover and is consequently more quickly cured. The field-cured hay contains somewhat more dry matter than field-cured alfalfa or clover hay. Annual lespedeza that is cut when no more than 10 inches high should be windrowed soon after cutting and in good weather may be hauled to the barn in 24 hours. If cut early in the morning it can be stacked late the same day. If it is more than 15 inches high when cut, the hay should lie in the swath longer. In the southern part of the lespedeza region, a seed crop of the annual lespedezas may be produced after harvesting a very early hay crop.

If a volunteer stand of annual lespedeza is desired the following year, the hay must be cut early (about first bloom) and high enough for the second growth to have time to produce seed; or the cutting must be delayed until part of the seed has matured sufficiently to shatter while the hay is being cut. The latter practice, however, will result in poor hay.

Feeding value

Each year between 1943 and 1952, American farmers produced over 6 million tons of lespedeza hay.

Feeding trials indicate that annual lespedeza hay is nearly equal in quality to alfalfa hay. Chemical analyses show that the protein and mineral content of lespedeza hay varies with the stage of maturity at which it is cut and with the fertility or composition of the soil on which it is grown. The maturity of annual lespedeza hay markedly affects its nutritive value.

In tests at the Tennessee Agricultural Experiment Station, hay cut when in bloom was more palatable and resulted in greater milk production than late-cut hay. It was also found that large quantities of foreign material, such as straw and weeds, reduces the nutritive value of lespedeza hay. Tests with milk cows showed that 4 tons of U.S. No. 3 lespedeza hay containing 18.3 percent of foreign material is equal to 5-tons of lespedeza hay of which one-third is foreign material.

Pasture

The annual lespedezas are primarily pasture plants that afford good grazing in both temporary and permanent pastures. They make their best growth in the summer and provide excellent grazing during this period. This is often the time that ladino and other white clover pastures are low in production and forage is needed.

The lespedezas start growth slowly in the spring and are of little value for early grazing. Iowa 6 is ready to graze a week ahead of Rowan, Summit, and Korean. Climax, Kobe, and Common provide progressively later initial grazing. Grazing begins in June or July, depending on the location, and may continue until frost.

Maximum production from lespe-

deza is obtained if it is seeded in late winter or early spring in winter oats, winter wheat, rye, or barley. Winter grain may be grazed off completely, or the grazing animals may be removed in February or March in order to produce a grain crop. Lespedeza seeded in the grain crop is ready for grazing shortly after the grain is combined. The pastures can be renewed by disking the land in the fall after the lespedeza seed has matured, again drilling in the small grain, and allowing the lespedeza to volunteer. High rates of nitrogen fertilization of the small grain, however, may crowd out the lespedeza.

In the region to which lespedeza is adapted, annual lespedeza may be included in any grass-legume mixture for permanent pasture. In areas where orchardgrass and Korean lespedeza are adapted, the seeded mixtures will give good, season-long grazing with limited fertilizer applications. Annual lespedezas are often included in rotation pasture mixtures containing orchardgrass and ladino clover to balance the mixture, and they may help to reduce bloat hazards.

The annual lespedezas can be maintained well with grasses that do not form a dense sod. Grasses that make a heavy, matted growth, such as carpetgrass and bermudagrass, crowd out the lespedeza almost completely in the second season. (Bermudagrass offers less competition than carpetgrass.) Such pastures usually must be plowed or otherwise renovated every third year if lespedeza is to be maintained. The use of phosphate with a lespedeza-grass mixture helps maintain the stand of lespedeza. In a perennial grass pasture, close grazing in spring is advised to assist the young lespedeza plants to become well established.

When annual lespedeza is seeded with a grain crop and the grain is harvested for seed, the lespedeza, which grows rapidly after the grain harvest, can be used as summer pasture to supplement the regular pasture during the summer period of short growth. In this way overgrazing of permanent pastures can be avoided.

Since the seed and leaves of Korean lespedeza remain on the plant well into the winter, this variety provides late grazing. Livestock readily eat the dried leaves and seed.

Harvesting for seed

Lespedeza is harvested for seed throughout the region in which it is grown. Depending on latitude, Common, Kobe, and Climax mature from October to November; and Iowa 6, Rowan, Summit, and Korean from September to October.

The seed of all varieties shatter. Seed of the striate varieties, Common and Kobe, shatter more readily than Korean. Maximum yields of any of the varieties can be obtained only by harvesting the seed very soon after maturity. Studies have shown that 50 percent of the seed may be lost from shattering if harvesting is delayed 2 or 3 weeks after the plants are ripe.

The seed is ordinarily harvested with a combine, with most of the acreage being combined direct. As soon as most of the seed is mature, the lespedeza may be mowed and windrowed while still tough with dew. After curing in the windrow, it can be threshed from the combine with pickup attachments.

If harvested too early, much of the seed will be immature. Early harvested seed may contain green leaves, stems, and other trash that

is high in moisture content. Such seed should be cleaned immediately or spread out to dry. When a killing frost occurs before the crop has ripened sufficiently, the seed should be harvested as soon as possible to avoid excessive shattering.

Seed yields of the striate varieties are usually 100 to 250 pounds per acre. The Korean varieties average around 300 pounds per acre. Seed yields of over 1,000 pounds per acre have been reported for Korean, and approximately 70 percent of the total lespedeza seed crop harvested is from Korean varieties.

The seed from the combine must be recleaned to take out the seeds of such weeds as ragweed, povertyweed, and dodder. Dodder seed is about the same size as that of lespedeza, with the exception of Kobe, which is larger. Unbroken pods of dodder are easily cleaned out in other trash. In threshed samples, many pods of dodder are broken, and the screens must be carefully adjusted to remove all or nearly all of the dodder. It is often extremely difficult to remove enough of the dodder to bring the seed up to State certification standards.

Soil improvement and erosion control

Because lespedeza grows in thick stands, it affords an excellent cover throughout the growing season for the prevention of erosion. Lespedeza grown alone or with a grain crop protects the soil from eroding rains from summer to early fall.

It increases soil fertility by adding nitrogen and organic matter. Its use for this purpose is strongly recommended. If it is allowed to remain on the land without being cut, maximum benefit to soil fertility is obtained, but even when the

crop is harvested for hay or seed or is used as pasturage, it increases yields.

When a full growth of lespedeza is worked into the soil it greatly increases the yield of the following crop and influences the yield of succeeding crops for several years.

Loss from erosion and decline in productivity of soils is greater in the southeastern part of the United States than elsewhere. Here the lespedezas are especially useful. The annual lespedezas grow slowly in the spring, but during the summer they cover and protect the soil, and the stubble and debris help to prevent erosion during the winter. However, a winter-growing crop, which prevents loss of plant food by leaching, should follow the lespedeza.

For soil improvement and erosion control, lespedeza may be fitted into the farm program in various ways. In areas where acreages of cash crops such as cotton and wheat are being reduced, annual lespedezas can be maintained at little cost. Seeding annual lespedeza on small-grain strips that alternate with corn or cotton will prevent excessive soil wash. The small grain protects the soil during the winter, the lespedeza during the summer. The strips should be moved every 2 or 3 years.

Rolling fields may be kept in annual lespedeza for several years and the lespedeza used for hay, grazing, or seed. A winter-growing grass should be seeded in mixture with the lespedeza, or a winter grain seeded following the lespedeza crop. This will insure against leaching and prevent erosion when the crop is cut or very closely grazed.

Continuous cropping to lespedeza reduces phosphorus in the soil, and the addition of phosphorus as a

Value for Wildlife

The seed of lespedeza furnishes an abundance of feed for birds, and the annual species are grazed by deer and other wild animals. As a honey plant, annual lespedeza has little value.

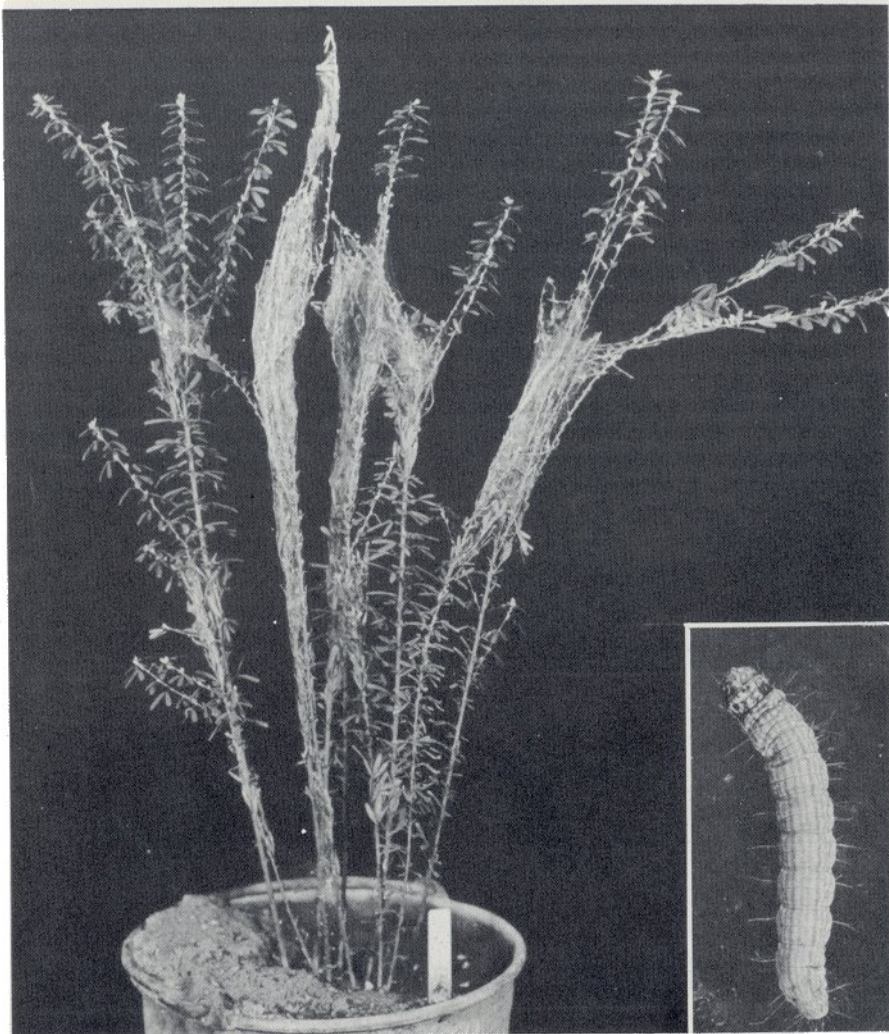
Leaflet 373, *Lespedeza for Quail and Good Land Use*, may be obtained from the U.S. Department of Agriculture, Washington, D.C. 20250.

fertilizer is necessary to insure good yields. After 2 or 3 years the lespedeza field will have a higher productivity and may then be used for cultivated crops. Under a cover of lespedeza little soil loss will occur.

The annual lespedezas fit well into 1-year grain-lespedeza rotations. After the lespedeza has been grazed or cut for seed, the field should be well disked and sown to winter grain with a drill. The lespedeza will volunteer from year to year and check erosion. Iowa 6 and Rowan are best adapted to this rotation. If desired, the rotation may be extended 2 or 3 or more years.

If spring oats are alternated with lespedeza, the later-maturing varieties of annual lespedezas may be used. Late in winter the old lespedezas debris should be disked and an early variety of oats drilled in.

When cultivated crops must be raised, they should be grown in rotation with erosion-resisting crops.



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Figure 6.—Lespedeza webworm and its webs on a lespedeza plant.

The annual lespedezas are well suited for this purpose. For example, corn can be followed by oats with lespedeza in the oats. In the fall the lespedeza should be disked and the land sown to wheat. The lespedeza is then allowed to volunteer the next season.

Where crimson clover does well as a winter crop, it may be drilled in the disked lespedeza and the winter growth turned under in the spring for corn. Where crimson clover is not successful, hairy or woollypod vetch or Austrian Winter or Romack peas may be used.

Other rotations with corn or cotton may be arranged, because an annual lespedeza fits in more readily than any other legume.

For soil improvement and erosion control over a period of years, the annual lespedezas are less desirable than the perennial lespedeza, sericea. However, if the annual lespedezas are used for this purpose, a winter annual grass such as Italian ryegrass or rescuegrass fits in well with them. These grasses grow in winter and protect the soil. In the spring they give way to annual lespedezas and some of them will produce seed for a volunteer crop the following winter. This makes an excellent grazing and soil-protecting combination.

Small gullies can be healed and further erosion checked by seeding annual lespedeza. Roadbanks and shoulders can be covered and held by lespedeza which not only offers a good appearance but prevents washing. Grass in combination with the lespedeza can often be used to advantage.

When a summer crop is needed for the addition of organic matter and for soil improvement in orchards, the annual lespedezas can often be used for this purpose.

Insect pests ²

Grasshoppers frequently feed on the leaves and stems of lespedeza plants. In the Southeastern States the American grasshopper (*Schistocerca americana*) is usually the most injurious species.

In some years the armyworm (*Pseudaletia unipuncta*) and the fall armyworm (*Laphygma frugiperda*) cause serious and widespread damage to lespedeza. These worms prefer to feed on grasses, both wild and cultivated, but during outbreaks they will eat many other crops. The nearly full-grown caterpillars have enormous appetites and can strip the plants within a short time.

In the Southern States the three-cornered alfalfa hopper (*Spissistilus festinus*) at times damages lespedeza severely. Both adults and nymphs weaken the plants by sucking the juices. They also girdle the stems with feeding punctures, which later form hard galls, and the injured plants are retarded in growth and break off. Cut badly infested hay as early as practicable.

The lespedeza webworm (*Tetralopha scortealis*) defoliates the plants and reduces seed production. It appears from Maryland to Florida, and in some seasons outbreaks of the web-forming caterpillars (fig. 6) have caused much concern. The leaf tier (*Archips obsoletana*) also infests lespedeza. The larvae produce a webbing effect similar to that of the lespedeza webworm.

In the Southeastern States, white-fringed beetles (*Graphognathus* spp.) sometimes feed on lespedeza. Japanese beetles (*Popillia japonica*) may partially defoliate plantings in Maryland and Virginia.

Some of these pests can be controlled with insecticides. For the latest information on insecticides that are approved for use on lespedeza, contact your county agricultural agent, your state agricultural experiment station, or the U.S. Department of Agriculture, Washington, D.C., 20250.

² Contributed by the Entomology Research Division.

Weeds

Dodder has been a troublesome weed in lespedeza. If the crop of lespedeza is used for pasturage or hay, the presence of dodder is not serious. In a seed crop, dodder not only reduces yields but also makes the seed unmarketable or salable only at a reduced price. Dodder can be eradicated from a field by burning it, spraying it, or cutting and removing it. Fields that are pastured heavily or are cut for hay have relatively little dodder.

Other weeds in lespedeza are objectionable because they reduce the quality of hay and pasturage, and it is often difficult to separate weed seed from the lespedeza seed. Many weeds are eliminated by planting lespedeza after a clean-cultivated crop or by seeding lespedeza with small grain.

Broadleaved weeds are frequently a problem in stands of lespedeza. Spraying with 2,4-D when the lespedeza is approximately 4 inches tall has given good control. One-half to 1 pound per acre of the amine forms of 2,4-D or $\frac{1}{4}$ to $\frac{1}{2}$ pound per acre of the ester forms has been satisfactory.

Diseases³

Bacterial wilt

The bacterial wilt disease is generally distributed wherever lespedeza is grown. It has been studied most extensively in Missouri, where reductions of 30 to 50 percent in forage yield have been recorded.

Bacterial wilt occurs principally

³ Prepared by K. W. Kreitlow, research pathologist, Crops Research Division.

in strains of annual lespedeza. The causal bacteria are carried in or on the seeds. They can also persist from one season to the next in diseased stems and leaves. The bacteria are disseminated by wind and rain and possibly by grazing and mowing. They gain entrance to plants through wounds in the stems and leaves.

Early infection occurs as dark, water-soaked spots on the leaves. The infected leaves soon become grayish brown, dry, and curled. The bacteria then spread to the water-conducting tissues, which they fill, and the plants wilt and die. Sometimes only individual stems are affected and killed. Since the bacteria are seed borne, only disease-free seed should be planted. Some strains are more tolerant to the disease than others; however, only Summit lespedeza is resistant to bacterial wilt. It should be used in areas where this disease is serious.

Powdery mildew

This disease is caused by a fungus, and it occurs wherever lespedeza is grown. It usually develops late in the season, but it may cause some premature defoliation.

The mildew fungus overwinters on old leaves and stems. Spores are blown to new leaves, where they start infection. When abundant infection occurs, the leaves turn whitish. If the infection is light, diseased leaves develop whitish patches on the upper surface; they look as if they had been dusted with lime or flour.

The disease can be controlled by planting Rowan, which has some resistance.

Tar spot

This disease, caused by a fungus that is known to occur on many of the native perennial species, occurs on annual lespedezas.

Tar spot has become increasingly prevalent on Korean lespedeza. Disease outbreaks cause severe loss of leaves and reduced seed yields.

Spots on leaves are black and may be slightly raised. They are generally 1 mm. or more in diameter. Some of the spots are round; others are somewhat elongated. When several spots occur on a leaf, the leaf usually turns yellow and drops off.

Lespedeza varieties differ in susceptibility to the disease. Climax, Rowan, and Summit varieties possess some resistance. Striate lespedeza is highly resistant. Crop rotation is a helpful control measure.

Root knot

Nematodes that cause root knot occur on many crops throughout the southeastern United States. Infection is usually more abundant in sandy soils.

The nematodes are most active and cause the greatest damage during warm weather. They produce galls, or swellings, on roots of affected plants. Many diseased plants die during periods of drought—the root systems cannot function properly. Surviving plants are severely stunted and yellowed.

Damage from two widespread forms of root knot in the South can be reduced by planting the variety

Rowan. In addition, rotation with nonsusceptible crops aids in keeping root knot under control.

Southern blight

The fungus that causes southern blight is prevalent and destructive throughout the southern lespedeza range. The disease usually occurs in isolated patches and is most active in June, July, and August, when the soil is warm. The thread-like strands of the fungus can spread and attack plants when the soil is dry.

Seedlings are sometimes attacked and killed. At other times, the infection does not become evident until the plants are older or are undergoing stress such as that resulting from drought.

Usually the roots and the lower part of the stem are decayed, and the fungus frequently forms small, white to orange or brown round sclerotia on the lesions.

No varieties are resistant. Rotation and good seedbed preparation help to control the disease.

Miscellaneous root rots

Occasionally areas will be found in a field in which wilting, dying, or dead plants appear. Several different kinds of fungi can be isolated from the roots of the diseased plants. Very little is known concerning the causal agents responsible for the miscellaneous root rots, and no resistant varieties are known.

Precautions

Pesticides are poisonous to man and animals. Handle them with care. Follow all directions and heed all precautions on container labels.

Keep pesticides in closed, well-labeled containers in a dry place where they will not contaminate food or feed and where children and pets cannot reach them.

In handling any pesticide avoid repeated or prolonged contact with

the skin, and avoid prolonged inhalation of dusts and mists. Wash hands and face before eating or smoking.

To protect water resources, fish, and wildlife, be careful not to contaminate streams, lakes, or ponds with pesticides. Do not clean spraying equipment or dump excess spray material near such water. Avoid contaminating pasture grass, forage crops, or feed by drift of sprays or dusts.