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**Crop Adjustment
Oklahoma's Opportunity
for Soil Improvement**

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—Photograph by Dr. H. J. Harper.
Plowing Under Austrian Winter Peas in April

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CROP ADJUSTMENT—OKLAHOMA'S OPPORTUNITY FOR SOIL IMPROVEMENT

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With the hope of remedying a difficult situation created by accumulation of agricultural surpluses, the Agricultural Adjustment act was passed by Congress to enable the government of the United States to cooperate with farmers in an effort to control production. The farmers of Oklahoma, as well as those in other states, were invited by the government to participate in a program to adjust the production of certain surplus farm commodities to market demands, in order to avoid disastrously low prices caused by burdensome surpluses.

At the present time the government of the United States is attempting to accomplish certain fundamental changes in American agriculture, with the hope of laying a permanent foundation for the future welfare of the American farmer.

An essential feature of these changes is the shifting of a proper proportion of our farm land from the production of crops of which surpluses have accumulated into crops which use land less intensively but which conserve and build up our soil resources. The legumes and certain other crops may be effectively used to rebuild soil fertility. Pastures and meadows use land less intensively.

The opportunity which the crop adjustment programs offer to Oklahoma farmers to work into better balance in the use of their land is one which will be welcomed by those who have realized the need of it.

The need for improving the fertility of Oklahoma soils is extremely urgent at this time. This state is barely emerging from the pioneer phase of its agricultural development, and many new methods of farming are due to be introduced as farmers attempt to solve the various new problems which lie ahead. The pioneer who laid the foundation of the Oklahoma of today made his beginning upon fertile soil. He plowed up the sod of the prairies which was well filled with the roots of vigorous growing native grasses. For some years these virgin soils were exceedingly fertile. The pioneer quickly learned to plant certain well adapted cash crops. It was not long before he found that moisture was the most important limiting factor to get good yields. On the virgin soils he was not concerned with soil fertility.

VIRGIN FERTILITY DISAPPEARING

Gradually as the years passed, the fertility of the virgin Oklahoma soils declined when the humus obtained from decayed roots of prairie grasses began to disappear. Often the methods of farming of the pioneer were wasteful of the virgin fertility which was his heritage. In the small grain growing sections of the state, straw stacks were commonly burned each year in order to get them out of the way.

In cotton and corn growing sections of central and eastern Oklahoma the practice of raking up and burning cotton and corn stalks was begun early and has been continued in some sections to the present time. In some sections continuous row crop farming, either with cotton alone, or by alternating crops of cotton and corn or grain sorghums, became common practice and this has resulted in alarming losses of nitrogen and organic matter in such soils. Instances were rare in which the pioneer followed a system of farming which would build and maintain soil fertility.

In almost all sections of the state the method of cropping that has been followed has had the effect of causing a gradual decline in the productivity of our once fertile virgin soil. Many farmers in their efforts to increase acreage of cash crops have plowed up the native prairie sod on rolling lands having entirely too much slope to be maintained under cultivation unless carefully terraced.

Soil Erosion Losses Alarming

Today the cultivated soils of Oklahoma are washing away at a most alarming rate. A soil erosion survey of the state was made by the Oklahoma Experiment Station in 1928. Out of a total of 15,781,904 acres of cultivated land, 374,091 acres (2.3 percent) were classed as so badly gullied that they cannot be crossed by ordinary farm machinery. Another 5,352,361 acres (34 percent) were classed as slightly gullied, and 7,470,283 acres were found to be subject to losses from sheet erosion. A total of 13,196,735 acres (84 percent) of land in cultivation was estimated to be subject to some form of erosion.

Most alarming of all it was estimated that 1,359,327 acres, or approximately 8 percent, of land which at one time or another had been in cultivation in Oklahoma was actually abandoned due to soil erosion. And all this in a new state where most of the cultivated land has been under the plow for much less than 40 years! Is there not need for real concern as to the future, unless drastic steps are taken at once on individual Oklahoma farms to avoid such extreme losses?

Observations of the rolling red lands of central and western Oklahoma indicate that soil erosion is particularly difficult to control, unless the best methods of control are used. Many fields once under cultivation have been irreparably ruined. The rolling hill lands of eastern Oklahoma, and many once fertile cultivated fields of the mountainous sections have suffered untold damage. On fields subject to soil erosion crop yields have declined and the standards of living of farm people attempting to make a living on such land have been effected.

FIRST JOB—TERRACE!

The government makes an exceptional offer to the Oklahoma farmer who signs the crop adjustment contract to begin terracing on his farm. A field which is being retired from production may be left unplanted whenever the cooperating farmer may find it desirable to terrace the land within a short time. Oftentimes the terracing on a farm is greatly delayed because the fields are planted to crops during periods of the year when the labor facilities of the farm could easily be devoted to that purpose. The crop adjustment contract makes it possible to delay planting until terracing is completed. Farmers should keep in mind that terracing does not build up the fertility of the soil. Terracing makes it possible to retain fertility when soil-improving crops have been grown. After terracing, soil-improving crops should be planted to restore the nitrogen and organic matter which have been lost through soil erosion and continued cropping.

The importance of adopting methods of erosion control as a preliminary step in a soil improvement program is to be stressed. Experience has proved the value of terracing as a means of erosion control. A high percentage of Oklahoma farms will require terracing to some extent even on many fields which appear to have very little slope. Instances are common where farmers have attempted to build up the fertility of soils by the growing of legumes and have made little progress excepting on terraced fields. The



Fig. 1.—The first job is terracing so that fertility restored by soil-improving crops may be saved from washing away. Farm power will do the job.

terracing of cultivated fields makes it possible to maintain in cultivation many of our best Oklahoma soils for an indefinite period without undue soil losses. The fundamental principles of terrace construction must be thoroughly understood to insure success of any terracing which is undertaken on the farm. Poorly constructed terraces frequently prove a menace rather than a help. For best results terraces should be built under the supervision of trained men, cooperating with county agents and agricultural engineers.

Plant Soil-improving and Erosion-preventing Crops

This bulletin includes a discussion of those crops which are usually considered as suitable for soil improvement and erosion prevention, and which may be adapted to certain particular conditions of soil and climate in Oklahoma. A review of the different pasture plants suitable for use in tame permanent pasture is given. Recommendations are included of different pasture mixtures for the different areas of the state. Although tame pastures are considered separately, it is to be kept in mind that pasture and meadow crops are among the most efficient crops for the purpose of soil improvement and erosion prevention. The different crops are considered under the following headings:

- I. Soil-improving and erosion-preventing crops
 - A. The legumes
 - B. The small grains
 - C. The sorghums, sowed or broadcasted, including Sudan grass
- II. Pasture and meadow crops
 - A. Perennial grasses
 - B. Legumes for pastures
 - C. Pasture mixtures

The planting of the contracted or rented acres to soil-improving and

erosion-preventing crops to conform with any one of the crop adjustment contracts should not cause any difficulty. Neither should the sowing of tame pastures cause any confusion. For the most part, the contracted acres should be planted to crops, and often to crop varieties, which are known to be well adapted to local conditions. It is not practicable to make extensive plantings of new crops or new pasture plants with which the grower is not familiar. At the same time there are many farmers who will find it to their advantage to try out certain comparatively new soil improvement crops and new pasture plants in a limited way, especially when there is good reason to believe that such crops may be safely grown.

In Oklahoma there is an outstanding need for increasing the acreage of legume crops for soil improvement. Fortunately, there are many different legumes well adapted to the soils and climate of Oklahoma. Some of these are not commonly grown in the state at the present time, but many preliminary trials indicate that they are deserving of extensive introduction. Certain other legumes are quite restricted in their adaption. In beginning a soil improvement program a careful study should be made of the characteristics of each one of the different legumes, and of its particular requirements.

In western Oklahoma there will be numerous instances in which emphasis should be placed on the planting of erosion-preventing crops. Particularly in this case in sections where dust storms cause considerable damage during spring months. An erosion-preventing crop may be considered as any crop which covers the ground during its growth, and is usually sown broadcast, or solid with a grain drill. Such a crop may be a legume, or one of the small grains, or any kind of sowed sorghum. An erosion-preventing crop is also a soil-improving crop when pastured, or permitted to make growth which is plowed under.

SUMMER ANNUAL LEGUMES

The summer annual legumes include cowpeas, mungbeans, soybeans, Tepary beans, velvet beans, peanuts and most of the lespedezas. These crops are planted in the spring and mature in late summer or fall of the same year. The above mentioned crops vary in their respective adaptations to Oklahoma conditions. Velvet beans are not commonly grown in the eastern counties.

Cowpeas

The cowpea is well adapted to all sections of Oklahoma and does well on practically all types of soil. It is strictly a warm weather crop. It stands drouth fairly well, but the yields of seed and hay are limited under such conditions. A light frost kills the plants in the fall. The cowpea is a particularly good crop to build up poor soils. Most Oklahoma farmers are familiar with the cowpea and its culture. The cowpea should be one of the most popular crops for planting the contracted acres, as its culture is in no way a greater gamble than any other adapted field crop.

Culture. Cowpeas should not be planted before the ground becomes thoroughly warm in May, and plantings may be made as long as moisture conditions are favorable until early July. Cowpeas should be planted on a seed bed carefully prepared by plowing, or disking and harrowing. Seed may be sowed broadcast, or solid with a grain drill, or in wide rows to be cultivated. Under average conditions best results are obtained by planting reasonably early, in wide rows. However, for soil improvement broadcast seeding may often be desirable to avoid the expense of row cultivation.

About 15 or 20 pounds of seed per acre are required to plant in rows three feet wide; if drilled solid four or five pecks per acre is satisfactory; while if sowed broadcast by hand a heavier rate of seeding is usually advisable.

Varieties. A number of cowpea varieties are grown successfully in Oklahoma. The varieties differ in time of maturity, disease resistance, habit of growth, and other characteristics. The most important varieties for seed and forage production are Whippoorwill, New Era, Groit, and Brabham. A brief discussion of cowpea varieties follows:

Whippoorwill. A good general purpose variety for grain and hay production, and commonly grown in Oklahoma. Plants, medium bushy; seeds, buff, marbled with brown.

New Era. A popular general purpose variety, somewhat earlier than Whippoorwill, and has smaller seeds. Plants, medium bushy; seeds, buff, speckled with blue.

Groit. A cross between Whippoorwill and New Era. A productive variety, well adapted to Oklahoma, and should be popular when better known. Plants, medium bushy; matures about the same time as Whippoorwill; seeds, buff, marbled with brown and finely speckled with blue.

Brabham. A cross between Iron and Whippoorwill. Equal to Iron in resistance to wilt and root knot. Grows quite tall and is medium bushy. Is medium late in maturity. Seeds, buff, marbled with brown, smaller and more angular than Whippoorwill. This is a high yielding forage variety but like Iron sometimes fails to produce much seed.

Iron. Immune to wilt and root knot, and well adapted where these diseases prevail. Good forage producer, but not a heavy yielder of seed. Has rather hard seed, which volunteer readily, buff in color. Plants, tall, medium bushy.

Early Buff. Early in maturity, and usually a heavy seed yielder under Oklahoma conditions but only fair yields of forage are generally produced.

Early Red. A dependable, high yielding variety for both forage and seed production. Seeds, red.

Clay. Clay refers to a commercial group of mostly late maturing varieties, having buff colored seed. Makes large vigorous growth and is especially suited for forage and soil improvement.

Red Ripper. Red Ripper also refers to a commercial group of red seeded sorts, which differ in time of maturity and other characteristics. In certain sections of southwestern Oklahoma Red Ripper is popular because the seed volunteer readily, and fair crops are sometimes obtained without reseeding.

Black. Black includes all black seeded sorts, which are quite common in some sections. Popular to grow in corn fields. Plants, viny; seeds, usually resistant to decay, and volunteer readily.

Blackeye. Blackeye includes many strains, which differ mainly in time of maturity. Seeds white, with a black eye. Usually medium to early in maturity. Good seed yielders, as a rule, and popular for table use.

Crowder. Popular for table use, and commonly used for field planting in some sections. Includes different sorts with buff and mottled seeds, with angular shape.

Inoculation. Inoculation of cowpeas is not usually necessary, since most soils are already inoculated. However, recent observations indicate that nodules on cowpea roots may be scarce, or absent in certain sections of the

state where the crop has not been commonly grown. When any uncertainty exists, inoculation is advisable.

Tepary Bean

The Tepary bean has been grown by the Indians of New Mexico and Arizona for domestic use for many years. It is adapted to an era of low rainfall and dry atmosphere, and has been utilized mostly under semi-arid conditions. It is an annual legume and will compete with the cowpea for hay production, in western counties where adapted. The Panhandle Experiment Station recommends the Tepary bean at the best known crop for legume hay production, on the heavy soil of the Panhandle area. Cultural methods are practically the same as for the cowpea. The crop should be planted in rows for cultivation, during the last half of May, or in June, when moisture conditions are most favorable.

Mungbeans

The adaptation of the mungbean is quite identical with the cowpea, and much that has been said of cowpea culture will apply equally to the mungbean. The mungbean makes a vigorous growth on average soils under quite drouthy conditions. The crop has increased rapidly in popularity in many sections of Oklahoma in recent years. Only two varieties are grown to any extent in this state. These are referred to as the Golden mungbean and the Green mungbean because of the color of seed. As a rule the Golden mungbean is more popular than the Green mungbean. It is medium late in maturity and makes a heavy yield of forage, but usually a light yielder



Fig. 2.—Mungbeans are a summer annual legume which makes fine hay or a rich growth to plow under, adding nitrogen and humus to the soil.

of seed. The Green mungbean is usually a good seed yielder, but is sometimes disappointing in forage yield. Usually, Green mungbean seed sells at a much lower price than the Golden mungbean.

Mungbean seed is quite small when compared with cowpea seed. Five to eight pounds of seed per acre is required when planted in wide rows to be cultivated; and twenty to thirty pounds per acre when sowed with a grain drill.

These varieties of mungbeans make an erect growth which is easily harvested for hay. As a rule the crop is not damaged to any great extent by rabbits.

Soybeans

Soybeans are well adapted to eastern Oklahoma. In central and western Oklahoma the crop has made a good showing under reasonably favorable moisture conditions, and especially when successful inoculation has been obtained. Frequent failures to obtain inoculation under western conditions have proved a handicap. Soybeans make an erect growth and are easily harvested with farm machinery for hay or grain, and the crop is popular on that account in sections where farmers understand growing the crop successfully. As a rule the adapted varieties of soybeans are the best grain yielders of the legumes, and produce an excellent quality of hay. A grain crop may be harvested with a binder or with a combine, and threshed with a small grain thresher when a few adjustments have been made.

Culture. Soybeans are reasonably frost resistant, and withstand a considerable amount of cool weather when planted early. The crop may be planted almost any time after corn is planted until late June, provided moisture conditions are favorable. However, early maturing varieties are not suited for late planting. As a rule the best results are obtained from May plantings. Soybeans are best planted in wide rows, 3 to 3½ feet apart, to be cultivated, in which case 15 to 25 pounds of seed to the acre will be needed. Seed of different varieties vary in size and the rate of planting will depend upon the variety. The rate of planting will be about right if the planter is adjusted so as to drop six or eight seeds per foot in the row. Experienced growers often plant soybeans in close rows with a grain drill to good advantage, and by so doing reduce the cost of cultivation. When this plan is followed, every effort should be made to control weeds during early growth, by harrowing the seed bed ahead of planting, and again harrowing when the soybeans have made several inches of growth.

Utilization. Soybeans are rapidly becoming an important American crop. The acreage has increased rapidly in the central corn belt, and also in the eastern cotton belt. In the important soybean growing centers the grain is milled, and numerous by-products are manufactured from the oil and meal. In recent years soybean grain has begun to find an outlet on the foreign market.

Varieties. Numerous varieties of soybeans are grown in the United States. These varieties vary greatly in their respective adaptation, habit of growth and utilization. Many of these varieties are entirely unsuited to Oklahoma conditions and failure would result from their use. On the other hand, certain varieties not now commonly grown can be planted advantageously under certain conditions. The following varieties deserve mention:

Laredo. One of the most popular varieties among soybean growers in Oklahoma. Plants are slender, erect, and medium late in maturity. Seeds are small in size and black in color. One bushel will plant four to six acres in rows. Tests conducted show the variety to be one of the best for forage production under average Oklahoma conditions.

Chiquita. In recent years Chiquita has increased rapidly in popularity in northeastern Oklahoma. Growth is quite similar to Laredo, but earlier. Seeds are yellow, and medium in size. One bushel of seed will plant three to four acres in rows. Suitable for grain and forage production.

Virginia. The leading variety grown in northeastern Oklahoma, and has given good yields of grain and forage. Medium in maturity. Seeds brown in color, and medium large. One bushel will plant two and one-half to three acres in rows.

Mammoth Yellow, Mammoth Brown, Tarheel Black, and Beloxi. All late maturing varieties, not now grown to any extent in Oklahoma, but having possible adaptation to southeastern area. Plants are quite coarse and make rank growth. Seed is quite abundant as a rule, and may be obtained from southeastern states.

Wilson, Haberlandt, Illini, A. K. and Manchu. These varieties not commonly grown in Oklahoma, but can be introduced for soil improvement purposes on account of usually abundant seed supply. Haberlandt and Wilson are quite similar to Virginia in time of maturity, and may be substituted for that variety. Illini, A. K., and Manchu are medium early in maturity, and can be used for soil improvement if planted reasonably early. All of the above mentioned varieties have yellow seed except Wilson, which is black.

Inoculation. Under Oklahoma conditions soybean seed should always be inoculated before planting, except when planted on fields that have grown the crop regularly and are known to be well inoculated.

The Lespedezas

Common lespedeza or Japan clover is found growing as a volunteer plant in pastures, along roadsides, and in uncultivated fields quite generally in many eastern counties of the state. The growth of common lespedeza has been short, and the yield low except on moist fertile fields in the southeastern corner of the state. Improved varieties of lespedeza, including several annuals, and one perennial, have been introduced into the state in recent years, and a new interest in the crop has become evident.

Numerous demonstrations with the improved varieties have been conducted in central and eastern Oklahoma with most promising results. Present indications are that the new varieties will find a place for hay production on fertile low lying soils well supplied with moisture in eastern Oklahoma, and for pasture under average conditions on practically all soil types throughout the eastern half of the state. The lespedezas do well on comparatively worn-out soils, and on soils too sour to grow the clovers or alfalfa without the use of lime. On soils low in phosphorus, yields may be greatly increased by the use of phosphates.

Varieties. The annual varieties of lespedeza which have been given extensive trials in recent years include, common, Korean, Kobe, and Tennessee No. 76. Korean lespedeza has given excellent results in numerous demonstrations. This variety matures much earlier than the other varieties mentioned, usually along in late August or early September. It makes a rather rapid summer growth, and provides excellent pasture very soon after vigorous growth begins. Kobe and Tennessee No. 76 mature about the same time in late September or early October, Kobe usually being a little earlier. Both make a vigorous growth and good forage yields on fertile soils when moisture is plentiful. Korean lespedeza seems best adapted to the northern half of the state, while Kobe and Tennessee No. 76 are apparently best suited to

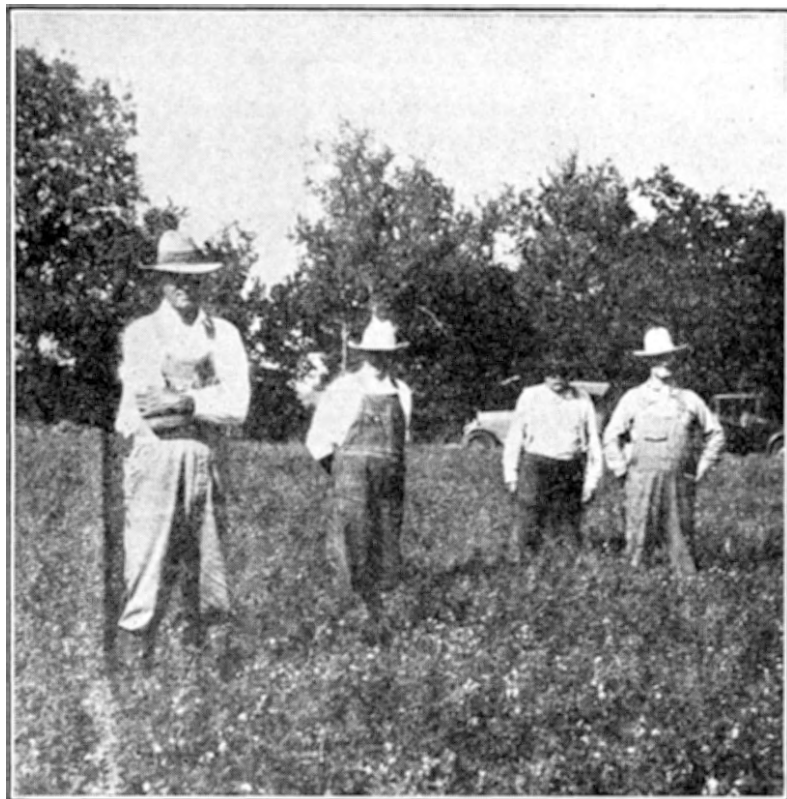


Figure 3.—Korean lespedeza is a promising crop for summer pasture and for soil improvement in central and eastern Oklahoma.

the southern half. It is a good plan to include all three lespedezas in pasture mixtures, and also common lespedeza in southeastern counties.

A perennial species known as *Lespedeza Sericea* is so new in Oklahoma, that only limited information is available concerning its adaptation and value. Many excellent demonstrations were conducted with this lespedeza during 1933 in central and eastern Oklahoma, and the results of the first year's trials promise well for the future.

Culture. In lespedeza growing sections of states east of Oklahoma, lespedeza is commonly sowed on winter small grain during the first of March. After the small grain crop is harvested the lespedeza continues its growth without further attention. This practice has given good results in some instances in eastern Oklahoma on fertile soils. The practice has not yet become common. Under average conditions in central and eastern Oklahoma, it is undoubtedly best to sow lespedeza alone, rather than with a small grain crop, to avoid the risk of losing the stand because of lack of moisture when the grain crop is harvested.

Lespedeza can be seeded advantageously following a cotton or corn crop, particularly for soil improvement. The seed bed should be well prepared by disking or plowing, as may seem best, or in the case of cotton by stirring the soil with a "gee whiz" before or after seeding. A firm seed bed is quite essential.

Seed may be sowed broadcast by hand, or with either a cyclone or a wheel barrow type of seeder, or with a grain drill. If seeded with a small grain nurse crop best results will be obtained by reducing the rate of seeding of the small grain by one-half or more. Another plan worth limited trial would be to sow oats with a grain drill in February, closing each alternate hole of the drill, and sow the lespedeza broadcast in March. This plan has proved quite satisfactory with sweet clover seedings.

Lespedeza is sowed at the rate of 20 to 25 pounds per acre to obtain a good uniform stand for hay production or soil improvement. This rate of seeding is frequently reduced to as low as 15 pounds per acre when seed is expensive.

In tame pastures lespedeza may be seeded during March, either alone, or with other grasses and legumes normally seeded at that time. In pasture mixtures the rate of seeding is usually reduced to five to ten pounds per acre, and the stand in subsequent years increases from the scattered plants. In northern Oklahoma it would be desirable to sow Korean alone, while in central and southern counties it is a good plan to include Kobe and Tennessee No. 76 in the mixture to extend the period of grazing from mid-summer to late fall.

In demonstrations which have been conducted with *Lespedeza Sericea*, the perennial form, the seed has been sown in wide rows to permit weed control by cultivation. The seed has been expensive, and by using great care fairly good stands have been obtained by sowing two pounds of seed per acre in rows three feet wide. Seeding should be shallow. Further experience with this crop is necessary to determine the adaptation and uses of the crop. So far *Lespedeza Sericea* has been planted chiefly for seed production, and the seed crop is harvested quite late in the fall. To what extent this crop will prove practical for planting under ordinary field conditions must be determined when the seed supply becomes more abundant.

Inoculation. *Lespedeza* requires the same bacteria for inoculation as the cowpea and peanut. However, several observations of *lespedeza* roots have indicated a scarcity of nodules where the crop has not been commonly grown. Inoculation of seed before planting is advisable when any uncertainty exists.

In the Cropping System. The *lespedezas* are altogether too new in Oklahoma to determine the extent of their possibilities. Farmers are only beginning to learn of their value. The *lespedezas* deserve extensive trials, particularly in central and eastern Oklahoma, and there is every indication that this crop will find a definite place in Oklahoma agriculture.

WINTER ANNUAL LEGUMES

The winter annual legumes include the vetches, Austrian winter field peas, and bur clover. It is customary to sow the seed of these legumes in the fall in time for the plants to become well established before winter. Experimental tests, and numerous demonstrations indicate that the more winter resistant legumes are adapted to a large part of the state, while others are very limited in their adaptation. The winter legumes provide an excellent opportunity to build up soil fertility during fall, winter, and spring months when adapted varieties are used.

Vetch. Hairy vetch is the most winter hardy of the winter annual legumes. This variety will stand severe winters when planted early under proper conditions. In numerous trials throughout eastern Oklahoma, hairy vetch has shown astonishing results when given proper cultural and fertilizer treatments. Hairy vetch is well adapted to certain soils in central and eastern Oklahoma. It has done well in tests conducted at Granite in southwestern Oklahoma. The crop deserves extensive trial in a cropping system with cotton. There is some danger of hairy vetch becoming a weed pest in wheat growing sections of the state, if allowed to go to seed. The seed, when mature, shatters readily, and makes a volunteer growth. The tangled growth interferes when harvesting with a binder or combine, and the vetch seed are somewhat difficult to separate from wheat kernals. However, hairy vetch deserves a trial under western Oklahoma conditions in sections where wheat is not extensively grown.

Common vetch seed is on the market at a lower price than hairy vetch. Common vetch is not nearly so winter hardy as hairy vetch, but may be substituted in a few southeastern Oklahoma counties when hairy vetch seed is not available.

Austrian Winter Peas. Austrian winter field peas is a new legume in the United States, and has rapidly gained in popularity in a number of cotton belt states since its introduction. Trials made at the Oklahoma Experiment Station at Stillwater indicate that the variety is quite winter hardy under favorable soil conditions. On several occasions the top growth was killed by severe winter freezes, but growth was resumed in the spring from buds well below the surface of the ground. Reports of failure, due to winter killing, have been more numerous than with hairy vetch. In Garfield county, Austrian winter peas have been grown with remarkable success during the past four years, and without appreciable winter killing in most instances. Plantings were increased the past fall in that section. Austrian winter peas work well into a cropping system with wheat, since there is no risk of the crop becoming a pest in wheat fields, and furthermore the seed can be harvested with the same machinery used for small grain when a few adjustments have been made. Present indications are that Austrian winter peas will find a definite place in the agriculture of central and west central Oklahoma, and probably also in eastern sections of the state. The crop can be planted advantageously between cotton rows for soil improvement.

Time of seeding. Vetch and Austrian winter peas should be planted during September or early October so that the young plants will become well established before winter. At Stillwater seedings made during August have been satisfactory in the case of vetch, but the growth of Austrian winter peas sown at that time became too rank through the winter for safety. With both crops seedings may be made through October and even in early November with reasonable safety, but a decreased yield may be expected as the date of seeding is delayed; also, the plant in spring will grow off more slowly, and the time of plowing under for soil improvement will be delayed.

Rate of Seeding. Hairy vetch should be sown at not less than 20 pounds to an acre, and Austrian winter peas at not less than 30 pounds. A heavier rate of seeding is often to be preferred when the seed is cheap and abundant. Under the drier conditions of southwestern Oklahoma it is sometimes the practice to close every other hole of the grain drill in sowing Austrian winter peas, a smaller amount of seed per acre being required when seeding is done in this way. The possibilities of either hairy vetch or Austrian winter peas under western conditions have not been fully determined.

Need of Phosphates. Neither vetch nor Austrian winter peas will succeed to the best advantage on soils low in phosphates. On many soils in central and eastern Oklahoma an application of 200 pounds per acre or more, of a phosphate fertilizer will prove profitable to insure vigorous growth of these legumes.

How to Sow. Seed should be sowed, if possible, with a grain drill, since a more uniform stand can be obtained with a small amount of seed. A one-horse drill may be used advantageously to sow between cotton rows. Many farmers will find that a combination grain and fertilizer drill will prove most convenient in order to sow the seed and distribute phosphates in the same operation. However, seed may be sowed broadcast by hand and covered by a spike tooth harrow, or covered with a "gee whiz," or a sweep between cotton or corn rows. A one-horse three-row combination fertilizer and grain drill is a very satisfactory implement for use in cotton and corn growing sections.

Inoculation. The bacteria which cause the formation of nodules on the roots of vetch and Austrian winter peas are seldom present in Oklahoma soils and inoculation of seed before planting is practically always necessary. Under usual conditions these legumes do not do well unless successful inoculation is obtained.

Place in Cropping System. Hairy vetch and Austrian winter peas will find many uses in Oklahoma. The ordinary cotton field provides an almost perfect seed bed for planting in September or October. The crop may be plowed under in time for planting cotton in early May, or for planting grain sorghum or June corn.

In wheat growing sections the Austrian winter pea affords a good possibility as a crop to replace wheat, and certainly deserves a limited trial for this purpose.

Bur Clover

The bur clovers are apparently best adapted to southeastern Oklahoma, and will sometimes winter kill in that section. Bur clover will do well on nearly all soil types, but prefers moist, well drained soils. There are two kinds commonly grown, spotted or Southern bur clover, and toothed or California bur clover. The spotted bur clover may be readily distinguished by a purple spot in the center of each leaflet.

Bur clover came into prominence in Oklahoma with the finding of an abundant seed supply (mostly toothed bur) growing naturally in the valleys and hills near Bromide on the border of Coal and Johnston counties. Seed from this source has been distributed throughout southeastern Oklahoma. As a rule spotted bur clover appears to be most popular in the southern states, and it is probable that more attention should be given to this clover in Oklahoma. However, there is no evidence available to indicate the superiority either of spotted bur or the toothed bur clover in Oklahoma, and no preference in favor of either kind would be warranted at the present time.

In Oklahoma bur clover is usually sown in pastures. However, the crop fits well into the regular cropping system, and will maintain itself without further seeding if permitted to produce a seed crop every three or four years.

Seeding. Spotted bur clover seed as a rule is obtained in the bur. The Bromide supply of toothed bur clover is usually sold in the burs. However, toothed bur clover seed can be obtained on the market as hulled seed.

In the bur the seed is sowed at the rate of two or more bushels per acre. It is recommended that the burs should be mixed with stable manure, at the rate of one bushel of burs to five bushels of manure. This mixture may be dropped in small handfuls about a yard apart on the field to be planted. Seed may be planted between cotton rows in midsummer or later, and covered with a cultivator. July and early August planting is desirable, so that more of the hard seed will absorb moisture and germinate in the early fall.

Inoculation. As a rule the inoculation for bur clover is carried with the bur, and the manure added at time of planting further stimulates successful inoculation. When hulled seed of toothed bur clover is planted care should be used to inoculate the seed before planting.

Place in Cropping System. Bur clover is a most convenient crop to have on a farm, especially when a seed crop has been produced and plowed under. Afterwards the clover plants come up volunteer during the fall and provide continuous heavy grazing, usually after the middle of February. The growth may be plowed under in time to plant corn or cotton, or occasionally permitted to produce a seed crop and then followed by June corn or a grain sorghum.

Getting Started. In planting bur clover for the first time it is not desirable that farmers shall go to the expense of purchasing a large quantity of seed. An economical plan would be to buy enough seed for a small field in order to produce seed for later plantings on the farm. Bur clover produces seed abundantly, which can be gathered by sweeping with brooms when the vines have been raked away.

PERENNIAL AND BIENNIAL LEGUMES

Alfalfa

Alfalfa is one of the most valuable legume forage plants. It is the most important legume grown in Oklahoma and easily exceeds in acreage all other legumes combined. Estimates of the United States Department of Agriculture show that the acreage of alfalfa at the present time is well over 200,000 acres, but during war times reached a total of nearly 350,000 acres. The popularity of alfalfa has been due largely to its value as a cash crop when marketed for hay or for seed, and the commercial production of hay and seed has been developed into an important industry in certain sections of the state. Most of the alfalfa acreage is found in the western half of the state, and the crop is usually limited to the river and creek bottoms in eastern Oklahoma.

Alfalfa is adapted to well drained soils abundantly supplied with lime and phosphorus. The moisture requirements of an alfalfa crop are high, and fields should be located where moisture conditions are most favorable. Alfalfa will not succeed on acid soils, nor on soils low in phosphorus. Experiments conducted by the Oklahoma experiment station show that alfalfa can be grown successfully on many soil types where the crop previously failed by applying lime or phosphorus or both, according to the soil requirements. Tests also show marked increases in yields of hay on soils of north central Oklahoma by means of top dressings of phosphate fertilizers during the spring when growth begins.

Alfalfa cannot be excelled as a feed crop for different kinds of livestock. Under favorable conditions it is one of the most productive hay crops known, averaging four good cuttings of highly nutritious hay in a season, and the life of an alfalfa field extends from a period of 4 to 5 years to over 15 years. No crop is more deserving of a place on the average farm than alfalfa.

There is no reason why alfalfa acreage should not be greatly increased in Oklahoma. This can be done to a good advantage on many Oklahoma farms to provide hay for home use.

Selecting the Field. Carefully look over the farm and select a field where soil and moisture conditions are most likely to be favorable. Have the soil tested when any question arises as to a possible lime or phosphorus deficiency. It is a decided advantage to know the soil requirements for growing alfalfa several months ahead of seeding, so that both lime and phosphates may be applied when needed. An alfalfa field will usually remain in the crop as long as it is productive. For this reason, every possible effort should be made to get the field ready for alfalfa ahead of sowing in order to obtain satisfactory returns.

The Seed Bed. Alfalfa should be sown on a well prepared seed bed, in late summer or early fall, or in the spring. Methods of seed bed preparation will vary greatly in different sections. As a rule early plowing followed by an occasional harrowing or disking is desirable so that the seed bed will be well pulverized on the surface, but firm at time of sowing. The use of a cultipacker is desirable when available. Early to mid-summer plowing is an advantage for fall seeding, and fall or early winter plowing for spring seeding.

Time of Seeding. Late August or early September seeding is considered an advantage whenever moisture conditions are favorable, so that young plants will become well established before winter, and ready to start growth in early spring ahead of weed competition. Usually when the seed bed is prepared early moisture conditions are most likely to be satisfactory for sowing during early September. Sometimes prolonged drouths make fall seeding impossible. Spring seeding of alfalfa is a common practice in many sections, and has the advantage that moisture conditions are usually favorable for obtaining a stand. Usually March or early April are preferred for spring sowing, the earlier seeding being preferred whenever possible. Delayed spring seeding even in early May is sometimes desirable in certain western localities on account of dust storms.

Rate and Methods of Seeding. The rate of seeding will vary to some extent in different alfalfa growing sections, but will average 10 to 15 pounds per acre in central and western Oklahoma, and 15 or more pounds per acre in eastern Oklahoma. Seed should be sown with a drill if available, but may be sown broadcast. With a good drill good stands are often obtained with six to eight pounds to an acre. Broadcast seeding requires more seed.

Inoculation. Inoculation of seed before sowing is always advisable on fields where alfalfa or sweet clover has not previously been grown. However, in river bottom sections alfalfa is usually planted without inoculating the seed. It is probable that the proper bacteria for the inoculation of alfalfa are quite generally distributed in soils in alfalfa growing sections. The cost of inoculating seed is low and as a rule farmers can afford to attend to this important detail in order to obtain best results.

Farm Manure. Farm manure is an excellent fertilizer for alfalfa fields. This is especially true on many upland fields, and often on bottom lands which have been cropped for some time. Farm manure furnishes valuable organic matter and nitrogen, but is low in phosphorus. Farm manure should be applied at the rate of four to six tons to an acre or a higher application may be made if desirable. As a rule it is best to scatter the manure before plowing and plow under. However, good results are obtained when well rotted manure is used as a top dressing.

Sweet Clover

Sweet clover has a wide adaptation to Oklahoma conditions. The common type of sweet clover grown is a deep rooted biennial which stands drouth very well when once established. In recent years the crop has increased rapidly in popularity both as a pasture and as a soil improvement crop. As a rule the acreage is limited to comparatively small fields. The crop has become quite common throughout western Oklahoma, and in certain localities of eastern Oklahoma. Sweet clover does well on soils well supplied with lime and phosphorus. Many Oklahoma soils, particularly in central and eastern counties, are acid, and often are low in phosphorus. Experiments conducted by the Oklahoma experiment station show that sweet clover can be grown successfully on such soils when either lime or phosphates or both are applied.

In western Oklahoma the difficulty of getting good stands to survive the first summer after seeding, has limited extensive seedings of sweet clover. Summer killing of young clover plants due to prolonged hot, dry weather has been frequent. In some sections good stands have been difficult or almost impossible to obtain on upland fields, because of dust storms during spring months. Recent experiences of sweet clover growers indicate that such hazards may be greatly reduced when improved methods of culture are used.

Sweet clover possesses outstanding advantages for soil improvement and erosion prevention. The tap roots of the crop extend deeply into the sub-soil, adding much needed organic matter and nitrogen, and increasing the feeding zone in the soil for the roots of other crops. A good stand of sweet clover will provide more pasture during certain periods of its growth than any other pasture plant grown. Although cut for hay occasionally, the most important use of sweet clover is for pasture and soil improvement.

Method of Seeding. Seeding with a nurse crop, such as a winter grain or spring oats, is a common practice in sections where moisture conditions are normally favorable. This method is commonly used in eastern Oklahoma where spring oats are usually preferred for the purpose. A nurse crop is an advantage since a grain crop is produced during the first year. Also, a nurse crop provides some protection to young clover plants when getting started. Many farmers prefer sowing sweet clover with a nurse crop to avoid losing a crop. However, in dry seasons a nurse crop quite often proves to be a detriment in obtaining a stand of sweet clover, robbing the young plants of moisture, and shading them so that they perish when exposed to the hot sun after the nurse crop is removed. The risks involved are greatly lessened when the small grain nurse crop is sown at about one-half the normal rate of seeding.

In several central Oklahoma counties it is becoming a common practice to sow spring oats as a nurse crop, closing every other hole of the common grain drill, in which case the drill rows of oats are 14 to 16 inches apart, depending upon the width of the furrow openers. The clover is sown broadcast, and as a rule the sweet clover plants make a rapid, vigorous growth between the rows of oats. The oats are sown at the usual time in February, with the drill set at the three-bushel rate. The sweet clover may be sown at the same time, using a grass seeding attachment on the grain drill, or it may be sown later in order to miss the late freezes which often damage a stand.

In drier sections of western Oklahoma sweet clover is usually sown alone, or on a scattered stand of winter grain, usually wheat. Under the drier conditions, the risk of summer killings of sweet clover plants increases greatly when sown with a nurse crop. On the other hand a nurse crop

may prove a protection to young sweet clover plants during the dust storms. Sowing sweet clover alone in sown sorghum stubble land in numerous instances has proved good practice to enable young plants to survive severe dust storms. Sorghum sowed in early fall and not harvested will make a desirable soil protection for sowing sweet clover under the more difficult conditions.

Sweet clover should always be sown on a firm seed bed and lightly covered when possible. Sowing with a grain drill with press wheel attachments is desirable under drier conditions.

Oklahoma farmers who have had difficulty in growing sweet clover would do well to try planting in wide rows to be cultivated. At the Oklahoma Experiment station at Stillwater, sweet clover planted in three-foot rows, to permit cultivation during the first year, has given excellent results. The row plantings stand drouth better, and pass through the summer with improved vigor. Demonstrations conducted in several western counties indicate that the hazards in growing sweet clover may be reduced when the sweet clover is planted in wide rows and cultivated. In several instances excellent stands have been obtained on average upland soils following prolonged summer drouths. The row plantings may be planted with a grain drill by closing intervening holes.

Time of Seeding. Young sweet clover plants are very delicate when coming up, or when only a few inches high. After the young plants have become well rooted they will stand considerable freezing without injury. It is common practice to sow clover in late winter and early spring, and frequently such early seedings are seriously damaged by freezing weather. Many farmers who have attempted to grow sweet clover have become discouraged after losing a good stand because of early freezes. Recent experiments indicate that the seeding of sweet clover often can be delayed to advantage until the danger of severe freezes is past. There is reason to believe that good stands can be obtained with greater safety when sweet clover is sown after the middle of March, or during April or early May. The delayed seedings will escape serious freezes and, also, the disastrous effects of the earlier dust storms in western counties.

Kinds of Seed. In buying sweet clover seed, it is important to understand the difference between the kinds of seed sold on the market. Most commercial seed is carefully cleaned with the hull removed, and is here referred to as "clean seed." Many seedsmen run clean seed through a scarifying machine, and such seed is referred to as "scarified seed." Seed sold in the hull is referred to as "unhulled seed." A discussion of the essential differences between these classes of seed follows:

Clean seed is seed with the hull removed. Such seed is obtained when sweet clover is threshed with a common grain thresher. Often the seed coats of such seed are scratched or scarified to some extent during the threshing operation so that the percentage of hard seed is reduced. Good clean seed is usually sown at the rate of 15 to 20 pounds per acre, although the rate is often reduced to 8 to 10 pounds in dry weather localities. The use of such seed is to be recommended for most conditions.

Scarified seed is hulled or clean seed which has been run through a scarifying machine. In the scarifying operation the seeds are hurled with considerable force against sand paper. This operation reduces greatly the number of hard seeds. Scarified seed absorbs moisture and germinate quickly when planted. Such seed decreases quickly in vitality after the first year. Scarified seed is often preferred for delayed seedings; however, the experiences of many farmers indicate that it is questionable whether scarified seed has any advantage over unscarified seed, even for late planting..

Unhulled seed is obtained when the "beater type" of seed harvester is used. Such seed remains in the hull, and may contain a high percentage of so-called hard seed. Hard seeds are normally good seed with a resistant seed coat which does not absorb moisture readily. Such seed may remain in the soil several days before germinating. When such seed is sown and exposed to weather conditions a certain percentage may be expected to germinate immediately while others will be delayed in getting started. Such seed is preferable for sowing in late winter or early spring. Sow unhulled seed at the rate of 25 to 30 pounds per acre which is usually enough seed for two or three normal stands. Many experienced sweet clover growers prefer unhulled seed for their own use, and practice late winter or early spring seeding.

Inoculation. Sweet clover seed should be inoculated before sowing except on fields where sweet clover or alfalfa has been grown, and which is known to be well inoculated.

Place in Cropping System. Sweet clover can be introduced into most cropping systems by extending the rotation in a single year. How frequent the crop should be grown on a field under usual western Oklahoma conditions to maintain the nitrogen and organic content of the soil has not been established.

Red Clover

Red clover is widely grown as a leguminous forage plant throughout the corn belt states and eastward. It is a popular hay crop in certain sections of northeastern Oklahoma, where it is usually grown in combination with timothy. Red clover is adapted to soils which are well supplied with lime and phosphorus.

Red clover is usually sown in late February or the first half of March on a winter small grain, or with spring oats as a nurse crop. However, the risk of summer killing is less when the clover is sown without a nurse crop. When sown in spring red clover behaves as a biennial, producing a seed crop the second year. Red clover is usually sown at the rate of 8 to 10 pounds of seed per acre, alone; or about 5 pounds of clover, with 5 pounds of timothy, in combination.

Red clover may be sown in September, in which case it behaves as a winter annual, producing a seed crop the following year. This practice has given good results in certain trials in northeastern Oklahoma. Red clover may be sown alone, or in combination with timothy or orchard grass in September, and a hay crop produced early in the following summer.

Inoculation of red clover seed before planting is to be recommended on soils where the crop has not been previously grown.

Alsike Clover

Alsike clover is grown to a very limited extent in Northeastern Oklahoma, and is preferred to red clover under certain conditions. Alsike clover prefers a cool climate, and withstands severe winters better than red clover.

In the south it thrives only where an abundance of moisture enables it to overcome the injurious effects of hot summers. Alsike clover is particularly adapted to low wet lands and thrives best on heavy soils with plenty of moisture. It may be planted in much the same way as red clover, or may be included in pasture combinations. Inoculation is usually advisable. Sow seed at the rate of five pounds per acre alone, or one to three pounds per acre in pasture combinations.

OTHER EROSION-PREVENTING CROPS

The Small Grains

The small grain crops which include wheat, oats, barley, and rye are effective erosion-preventing crops during the time they occupy the land. In western Oklahoma winter wheat cannot be excelled either for economy or efficiency when it comes to providing protection from both water and wind erosion during fall, winter, and spring months. Moderate pasturing, when permitted under the crop adjustment contract, will not cause noticeable damage. On western soils lacking in organic matter the possibility is worth considering to permit wheat which has been sown on contracted acres for pasture to grow until in full head (approximately May 1 to May 10) before being plowed under.

In cotton growing sections of the state due consideration should be given to adapted small grain crop varieties for fall seeding to provide a winter cover and soil improvement crop to be pastured moderately and plowed under in the spring. Ordinarily the supply of seed of the small grains is cheap and abundant, and the cotton farmer in beginning a soil improvement program will run little risk in planting such crops.

The Sorghums

Any sorghum crop when sowed broadcast or in close rows with a grain drill is one of the cheapest and most efficient erosion-preventing crops for eroded land, or for soils so low in organic matter that most legumes will not do well. The seed of almost any kind of grain or forage sorghum, including kafir, milo, hegari, darso, sumac, etc., or of Sudan grass, will be satis-

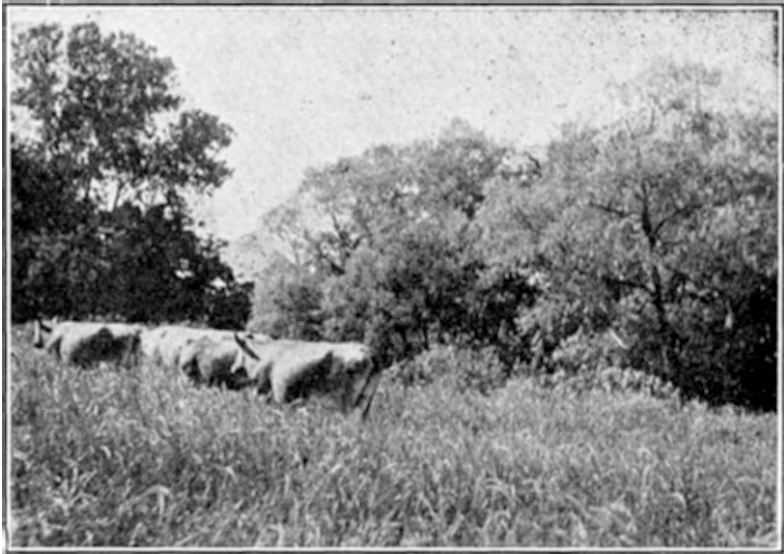


Fig. 4.—Good tame pastures of adapted grass and legume plants improve soil and make milk and meat at lower cost. From this pasture of rye grass, orchard grass, lespedeza, White Dutch, hop and black medic clovers, the cows are going home contented.

factory. As a rule the rate of seeding for such a purpose will vary from 40 to 70 pounds an acre, depending upon the quality and size of seed.

PASTURE AND MEADOW CROPS

The enthusiasm of Oklahoma farmers for the planting of tame permanent pastures has increased rapidly in recent years. Numerous trials have been made, especially in central and eastern Oklahoma, with different pasture plants. Much valuable information concerning the adaptation of different pasture grasses and legumes to the varying conditions of this state has been obtained. However, the tame pasture program in Oklahoma is in its infancy, and final statements regarding adaptation and best methods of pasture management are not possible at this time. In the light of present experience it appears that the range of probable adaptation of certain promising pasture plants will be extended over a larger area than was thought possible in the beginning.

Fortunately for Oklahoma, there are many different pasture plants which can be grown successfully within the borders of the state. The geographical location of Oklahoma is quite peculiar, as related to the probable adaptation of the different pasture plants. In this state there is an overlapping of the grasses commonly grown in the northern corn belt states and of the grasses of the cotton belt. In a restricted area of northeastern Oklahoma certain northern grasses dominate, while in southeastern Oklahoma the southern grasses are decidedly most important. As one proceeds westward in the state the rainfall decreases, and the difficulty of introducing pasture plants adapted to humid sections become evident. Particularly is this true under the drier climatic conditions of western Oklahoma. Although this bulletin will discuss probable adaptation of different pasture plants, it is to be understood that the tests of the experiment stations and the later experience of farmers may materially change present recommendations.

Classification of Pasture Plants. For the purpose of classification the different pasture plants may be divided into two classes: (1) grasses, and (2) legumes. Grasses may be subdivided into annuals and perennials. The perennial grasses are most important as a basis for tame permanent pastures. The perennials may be subdivided into short lived and long lived perennials, depending upon the length of time they persist in pastures. Perennial grasses are conveniently classified as (1) bunch grasses, and (2) sod grasses. In tame pastures it is usually desirable to plant a mixture of both types. The bunch grasses have a bunch habit of growing while the sod grasses propagate readily through the development of rhizomes or underground rootstocks and make an even sod on the ground. The sod grasses are best adapted to pasturing.

For Oklahoma conditions, grasses may well be further divided into two classes: (1) the northern or cool season group which includes the grasses commonly grown in the corn belt and adjacent areas, and (2) the southern or hot season grasses which are common to different sections of the cotton belt. In Oklahoma these two groups meet in a widely overlapping border area, running east and west approximately on line through Muskogee.

The northern or cool season grasses provide pasture during the spring and early summer, and through the fall and early winter months, and to some extent during mild winters. These grasses are more or less dormant during the hot summer, and during the coldest winter weather. The most important grasses of this group in Oklahoma are orchard grass, redbud and Kentucky bluegrass. Others of lesser importance, but which may be used to a limited extent, include brome grass, timothy, meadow fescue, the rye grasses, the wheat grasses and tall oatgrass. Rescue grass is a cool season plant, but appears to be adapted only to the south.

The southern or hot season grasses grow best in late spring, summer, and until frost in the fall. These grasses are considered drouth resistant because they do well during hot weather and on rather dry soil. The most important grasses of this group are Bermuda, Dallis, carpet, and Johnson grass. These grasses show marked differences in adaptation and should be studied separately. Johnson grass is usually considered a weed pest and will not be discussed further.

Legumes for Pasture. There are a number of legumes which can be utilized advantageously for pasture. Some of the most important are annuals which do exceedingly well in grass mixtures and reseed profusely. Certain of the legumes may be seeded alone in temporary pastures, as well as in mixtures, while others are practically always included in mixtures. The most important legumes for pasture purposes are sweet clover, lespedeza, alfalfa, hop clover, and white or Dutch clover, alsike clover, bur clover, and black medic. The adaptation and utilization of these legumes for pasture purposes are discussed separately.

Culture

Preparation of Seed Bed. The task of getting a good pasture established is by no means a simple one. The seeds of pasture grasses are often light and chaffy, and are slow to germinate and begin growth. The young grass seedlings are exceedingly delicate during early growth, and the mortality is usually high. In common practice a very much larger quantity of seed is sown per acre than would be necessary if most of the seeds sown could be depended upon to establish themselves.

The importance of a good seed bed deserves stress. The seeds of pasture grasses and legume plants are too expensive to incur unnecessary risks due to careless methods. The small grass and legume seeds should always be sown on a firm seed bed. Whether a seed bed should be prepared by plowing or disking will depend upon the condition of the field where the pasture is to be established. Cleared woodlands which are relatively free of vegetation provide a good seed bed in many instances without additional preparation. Sowing grass mixtures on abandoned cultivated fields, or in areas where native vegetation flourishes, is sometimes attempted, with reasonable success provided the weeds and vegetative growth are kept under control until the grass seeds become established. Usually such seedings result in near failure, because of neglect in keeping down weed growth. Young pasture plants like plenty of sunlight and moisture, and rank growing vegetation will quickly smother them out.

It is always preferable that a weed free crop should precede the sowing of pasture grasses. In many instances it is desirable to have a well prepared seed bed for establishing a pasture. The land should be plowed several weeks, or even months, ahead of seeding to allow time for the subsoil to become firm. An ideal seed bed will be one with a firm subsoil and a finely pulverized surface. Many of the cotton fields which are being retired from production should provide reasonably desirable conditions for establishing tame pastures, and without much additional preparation. Fields in sorghum or Sudan stubble should be quite satisfactory when attempting to establish a pasture in central or western Oklahoma. The stubble will provide some protection to young plants during dust storms.

Time of Sowing. The best time of seeding will depend to a great extent on the kind of grasses and legumes included in the pasture mixture. Ordinarily when moisture conditions are favorable the northern or cool season grasses may be sown in early fall to best advantage, although spring sowing is practicable when provision is made to control weeds. In areas of limited rainfall, early fall seeding (late August and early September) of the cool season grasses would seem always preferable, to enable the young plants

to become well rooted before hot summer weather. Usually the southern or hot season grasses are sown in the spring, usually late March or April being considered best.

Method of Seeding. Pasture grass mixtures are always sown broadcast. The cyclone and wheelbarrow types of seeders are efficient for getting the job done. Or the grass seed may be sown by hand. In either case it is better to sow only half the seed the first time the field is gone over, and then sow the other half crosswise to the direction in which the first half was sown, as to cover any skips. Whenever possible, a roller, preferably of the cultipacker type, or a plank drag, should be used for covering the seeds. The covering should always be very shallow, and consequently the use of a roller is a great advantage, as it packs and firms the soil without covering the seeds too deeply. A light smoothing harrow with teeth slanting backward, or a homeade drag made of brush, may be used to advantage. Under drier western conditions it may be desirable to make seedings with a grain drill equipped with press wheel attachments.

Some difficulty has been encountered in sowing pasture grass mixtures on prepared cultivated land during spring months in central Oklahoma, due to the damage to young grass plants from the cutting effects of sand during the occurrence or normal spring winds. This damage may be lessened by sowing with a more rapidly growing protective crop, as spring oats, which however, should later be clipped and not permitted to make mature growth.

Rate of Seeding. When pasture grasses are sown in mixtures the rate of seeding of each kind is much lower than when sown alone. Ordinarily the seeds of many pasture grasses and legumes are quite expensive and it is often more practicable to sow minimum rates, and to figure on the stand increasing in succeeding years. Suggested rates of seeding are given later in a discussion of pasture mixtures.

Pasture Management. When tame pastures are seeded, it is highly important that weeds and other tall growing vegetation should be kept under control during the first year, so that young pasture plants will not be smothered out. Usually it will be necessary to clip weeds with a mowing machine at different times during the first season. In some instances weed growth may be controlled by judicious pasturing.

The important objective during the first year is to obtain as good a stand of the different pasture plants as possible. Do not over-graze and abuse the pasture. Let the young plants have a chance to get started.

PERENNIAL GRASSES

Bermuda Grass (*Cynodon dactylon*). Bermuda grass is a sod grass, spreading by runners or by rootstocks, or both, and is the most common and most valuable pasture plant for all conditions in the south. It endures severe drouth and also overflow, and makes excellent grazing from late spring until frost. On fertile soils with abundant moisture it grows large enough to be cut for hay, quality of which is excellent.

Bermuda grass has a wide adaptation to Oklahoma, and does well on low moist soils of the river and creek bottoms, and is the most dependable grass on dry uplands. It is the only tame pasture grass that can be safely recommended for general use throughout much of western Oklahoma. In recent years Bermuda grass culture has extended into the northernmost counties, chiefly for use in lawns. Instances of winter killing have become less common, as the plant has apparently adapted itself to Oklahoma conditions. On account of its ability to grow on any type of soil, and its creeping character, Bermuda grass is one of the most dependable plants for erosion prevention on steeper slopes and in gullies.

Bermuda grass may be propagated from root-cuttings or from the seed. The present Oklahoma strains of Bermuda grass are unquestionably more

hardy and dependable than strains from southern sources. Commercial Bermuda grass seed is produced in southern latitudes, and is of questionable value under most conditions in the state owing to lack of winter hardiness, but probably can be used in the southeastern area.

Use of Roots. The use of roots is the surest and most common method of getting a stand. For quickest and best results prepare a good seed bed by plowing and harrowing. Lay off furrows four feet wide, using a single stock, or two shovels properly spaced on a two-horse cultivator. Drop pieces of sod two or three feet apart in the row, as you would plant potatoes. Step on each sod when planted, and cover with any suitable implement. Bermuda roots may be planted any time from March until June, preferably when moisture conditions are most favorable. During the first year the weeds should be kept down, preferably by giving two or three cultivations, in which case the Bermuda will make rapid growth and cover the ground quickly.

Obtaining Roots. To obtain roots for planting, an old Bermuda sod should be plowed shallow and cut into small pieces (approximately three inches by three inches) by hand with hoe and spade, or by using a disk harrow heavily weighted, and set to cut effectively. The small pieces of sod may be broadcast over the plowed land and disked in. Or, if the land is being plowed, they may be dropped in every third of fourth furrow. Or, the roots can be loaded into a wagon. Drive the wagon across the freshly prepared field in which planting is to be done, and drop the small sods about two or three feet apart in the wheel tracks. Sometimes this is done through a stovepipe fastened ahead of the rear wheel. A quicker stand will be obtained by driving over the ground twice, and lapping the spaces between the wheel tracks. Follow with a smoothing harrow to level the ground, and to complete covering the roots.

Use of Seed. Bermuda grass seed should be sown on a firm, well prepared seed bed, preferably in April or early May. The seeds are exceedingly slow to germinate and to get started. Sow at the rate of five to six pounds per acre.

Eradication. Many Oklahoma farmers hesitate to plant Bermuda grass for fear that it cannot be killed out when the land is wanted for other purposes. This is especially true of many cotton farmers who are equipped to grow only row crops, as Bermuda grass is difficult to kill in a row crop system of farming. It is quite difficult to kill Bermuda by ordinary methods of cultivation. It may be eradicated without great difficulty when advantage is taken of certain of its peculiarities.

Keep this in mind—Bermuda grass will not thrive when shaded. When it is desirable to destroy a field of Bermuda, it should be well plowed at the best time from July to September, and sown to wheat, rye or winter barley, or some other vigorous growing winter crop. If the plowing is done in July or August, disk frequently to prevent any growth before sowing the winter crop in September or October. When the crop is harvested, the ground should be disked and plowed at once, and then planted with a rank growing smother crop such as sowed sorghum, or cowpeas. When the smother crop is removed, there will be little, if any, Bermuda left.

In the northern part of the state, Bermuda grass may be greatly weakened or killed by shallow plowing in the fall, leaving the furrows on edge as much as possible, so that the roots will be frozen during the winter. Follow with spring seeded oats, and a smother crop in summer, if necessary to complete the kill.

Dallis Grass (*Paspalum dilatatum*). Dallis grass has a tendency to grow in bunches, but if grazed closely it will spread out and form a smooth sod. It came originally from Argentina and has become thoroughly es-

tablished throughout a large part of the cotton belt. It is particularly adapted to the heavier moist soils. In the spring it furnishes good grazing several weeks ahead of Bermuda grass, and in the fall it remains green longer. It never becomes a weed. Since its introduction into Oklahoma, Dallis grass has increased rapidly in popularity, especially in the southeastern area. Any statements concerning the northern or western limits of this grass would be premature at this time. At Stillwater it has winter killed on several occasions on exposed upland locations, but seems to survive in the low protected areas. However, unless Dallis grass gradually adapts itself through acclimatization to northern counties, as appears to have been done by Bermuda grass, it is probable that its use will be confined to the southern two-thirds of Oklahoma, and limited to subirrigated and low lying moist soils in the western part of the area.

When Dallis grass is not grazed too closely it will usually produce a large seed crop. A large part of the seed often fail to mature in good condition. It seems to be quite common for a fungous disease to attack the seeds. This fungous disease (*Claviceps paspali*) is closely related to ergot of rye. In cases where it is abundant and cattle consume enough of the seed it results in an injury semillar to ergotism. Cattle have been known to die where they were being pastured on Dallis grass that had been headed out rather uniformly. No trouble should be experienced from this source when the pasture is grazed quite closely, and no one should be deterred from giving this excellent grass a trial on this account. When seed heads are allowed to form abundantly, they should be clipped with a mower before pasturing.

In sowing Dallis grass seed it is well to be informed concerning the germination and quality of any seed to be planted. Both domestic (American grown) seed, and imported seed are on the market. The imported seed is usually of much better quality and germination, and it is to be preferred although higher in price. The best grade is imported from Australia.

Dallis grass is somewhat difficult to get started, and often only a scattering stand is obtained the first year. Fortunately, the grass is very hardy, and when a few plants have become established in a field it will spread slowly over the field. It is best to sow Dallis grass in a mixture with other pasture plants which will occupy the land until the Dallis grass spreads out.

The seed should be sown on a clean firm seed bed, in early spring, preferably in March or April when moisture conditions are most favorable. Sow at the rate of seven to ten pounds per acre alone, or from three to five pounds per acre in mixtures. Under humid conditions, the seed do not need covering, but under drier conditions a shallow covering would seem desirable.

Attention is called to the furrow method of seeding which is recommended by the extension service of North Carolina. Shallow furrows, four to eight feet apart, are laid off across the field with a small narrow shovel plow, and the seed is scattered lightly down these furrows. A long funnel-like pipe will greatly aid the placing of seed in the furrows on windy days. This method of seeding is less expensive, and under adapted conditions the Dallis grass will spread over the field.

Carpet Grass (*Axonopus compressus*). Carpet grass is a sod forming grass spreading by creeping stems which root at each joint, and bears close grazing without injury. It is especially adapted to sandy or sandy loam soils, particularly where moisture is near the surface most of the year, and is quite common throughout the southern cotton belt. The area of adaptation extends into southern Arkansas, northeastern Texas, and probably into the lower southeastern corner of Oklahoma. A few trials of carpet grass in Mc-

Curtain and Pushmataha counties indicate that it may possess some value in that section. Observations of this grass in Oklahoma are too limited to warrant definite recommendations. It is never a pest, and one plowing will kill it. When seeded alone eight to ten pounds per acre is recommended. The same cultural attention in seeding should be given as with Dallis grass. The grass may be propagated by scattering sod, as with Bermuda grass.

Orchard Grass (*Dactylis glomerata*). Orchard grass is a bunch grass, and should be included in mixtures with sod grasses for pasture. It is grown extensively in a wide area from Missouri to Virginia and northward. It succeeds well in shady places. Orchard grass is popular for pasture in the Ozarks and nearby sections in northeastern Oklahoma. This grass deserves trial in higher elevations of mountainous districts of southeastern Oklahoma. Preliminary trials in the north central area indicate that seedings should be restricted to the more fertile soils and where moisture conditions are more favorable. It may be sown in the fall or early spring.

Redtop, or Herds Grass (*Agrostis alba*). A sod grass with short rootstocks, and well suited for pasturage. Redtop probably has a wider adaptation to climatic and soil conditions than any other cultivated grass. It thrives best on moist or wet soils, either of loam or clay loam texture, but does well on moist soils if moisture is abundant. Although preferring a wet soil, redtop will stand considerable drouth and is often grown on poor uplands. Redtop is especially well adapted as a pasture and meadow grass to northeastern Oklahoma, where it is one of the most aggressive and vigorous growing grasses. It stands frost well, and often provides some winter grazing. Redtop is often sown with lespedeza for hay and pasture on low lying soils in cotton growing sections of eastern Oklahoma. The seed is small and usually cheap, and can well be included in pasture mixtures.

Kentucky Bluegrass (*Poa pratensis*). Kentucky bluegrass is a sod grass spreading by abundant short rootstocks, and has attained the widest popularity as a pasture grass in northern states. It is resistant to cold, never freezing out during most severe weather, and is adapted to a temperate climate having a relatively high humidity. The northern limit of cotton culture is nearly the same as the southern limit of bluegrass adaptation. Bluegrass prefers the well drained loam and clay loam soils which are rich in humus. In Oklahoma it makes its best growth during the fall and spring and usually remains green through the winter, but suffers severely during long continued hot weather of summer. It is adapted chiefly to northeastern Oklahoma.

Meadow Fescue (*Festuca elatior*). Meadow fescue, commonly called English bluegrass, produces a fairly good sod and withstands pasturing very well. It is grown chiefly in the region north of the cotton belt and has attained a wide popularity in eastern Kansas, where seed has been grown extensively for the domestic and export market. It is best adapted to fertile and moist soils, rather than poor uplands, and does fairly well in the shade. Meadow fescue is used mostly in mixtures, and is valuable for supplying pasturage while slower growing species are being established. It has a limited adaptation in northeastern Oklahoma, and provides grazing during cooler seasons. When grown alone it is seeded at the rate of 15 pounds per acre.

Tall Oatgrass (*Arrhenatherum elatius*). Tall oatgrass is a tall growing bunch grass which does well in pasture combinations. It is adapted to about the same climate conditions as orchard grass, but seems especially suited to light sandy and gravel land. It is considered quite drouth resistant. It is not an important grass in this country, and has never been sown extensively in this state. It has a poor seed habit as the seed shatter before be-

coming fully mature, and are usually of low vitality. The seed is difficult to harvest and is usually expensive. It can be used in mixtures in north-eastern Oklahoma.

Perennial or English Rye Grass (*Lolium perenne*). A short-lived rapid growing grass, commonly acting as a winter annual in Oklahoma, and well adapted for use in pasture mixtures. Its greatest value seems to be that of providing early grazing, and at the same time keeping down weeds while other slower growing grasses are becoming established. It is adapted to moist regions with mild winter climate, and thrives best on moist fertile soils. When seeded in early fall it makes its maximum growth the following season. The germination of seed is usually good and the seedlings are vigorous in getting started.

Italian Rye Grass (*Lolium multiflorum*). Italian rye grass is quite similar to perennial rye grass in its growth characteristics and requirements, and is usually treated as a winter annual. As a rule the price of seed will determine its use as compared with perennial rye grass. It is especially suited for fall seeding to provide winter and spring grazing, either alone, or in a combination with a winter legume such as hairy vetch. The seed is easily harvested and home needs can be produced on the farm. When grown alone it is sown at the rate of 35 to 40 pounds per acre.

Bromegrass (*Bromus inermis*). A long-lived sod grass spreading by underground roots, forming a dense sod after two or three years and ideally suited for pasture. It is one of the first tame grasses to begin growth in the spring, and will endure rather dry conditions during the summer. It is adapted to regions of rather low rainfall and moderate summer temperatures, and is adversely affected by hot summer temperatures. It is one of the most drouth resistant of the tame grasses when grown under adapted conditions. Trials in Oklahoma have been very limited. It is deserving of limited trials in the north central area on the more fertile low lying soils. Bromegrass is usually seeded at the rate of 18 pounds per acre alone, or four to eight pounds in mixtures.

Rescue Grass (*Bromus unioloides*). Rescue grass is to be found growing naturally along roadsides, and waste areas in certain sections of south central Oklahoma. Usually it provides much pasturage during late winter and spring months, and disappears on the approach of hot weather. It thrives best on fertile soils, and makes little growth on poor upland. It is considered the best adapted to a humid climate with mild winters. It begins growth in fall and matures in early summer. It should be sown in early fall to provide early pasture. It deserves further trials to determine its value. When a local seed supply is available it may well be included in mixtures with more permanent grasses.

Timothy (*Phleum pratense*). Timothy is the most important grass in the northern United States. It is a bunch grass, and is sown in mixtures with sod grasses for pasture. Its primary use is for hay, and it is planted mainly with red clover for this purpose. Its southern limit is approximately the northern limit of cotton culture. Timothy is grown extensively in certain sections of northeastern Oklahoma. It is best adapted to fertile moist soils and does not stand drouth well. Timothy is a good seed yielder. The seed is usually of good quality, low in price, and usually produces good stands easily. It is sometimes used in permanent grass mixtures to occupy the land while growing grasses are getting started.

Crested Wheat Grass (*Agropyron cristatum*). Crested wheat grass was introduced from the cold plains of Russia and Siberia. It is long-lived perennial bunch grass, and is closely related to slender wheat grass and western wheat grass which are common wild grasses in the northwestern plains. Western wheat grass may be found growing native in western Oklahoma. Crested wheat grass begins growth very early in the spring, and

continues late in fall. It tends to remain dormant during the extreme heat and drouth. The grass is worthy of limited trials for demonstration purposes, particularly in northwestern and Panhandle areas of the state. It is probable that crested wheat grass will find difficulty in withstanding the hot summers of western Oklahoma, but may do well in the higher altitudes.

LEGUMES FOR PASTURES

Sweet Clover. Sweet clover (previously discussed) has already proved its adaptation to soils of Oklahoma which are supplied with lime and available phosphorus. It may be sown alone to provide supplemental grazing, in addition to a tame permanent pasture. Or, it may be included in pasture mixtures, in which case it will be grazed closely, and doubtless will have difficulty in reseeding. Under such conditions it will require occasional re-seeding to maintain the stand.

Lespedeza. The improved lespedezas (previously discussed) deserve a very important place in tame pasture mixtures throughout central and eastern Oklahoma, and are deserving of limited trials on better soil types in western counties.

Hop Clover. Hop or low clover is a true clover belonging to the same genus (*Trifolium*) as red clover, Alsike, and white clover. It is to be found growing naturally throughout a wide area of the cotton belt, and to a limited extent has spread northward out of the cotton region. It is quite common in several eastern Oklahoma counties. Two kinds of hop clover are to be found growing: namely, the large hop clover (*Trifolium procumbens*) and small hop clover (*Trifolium dubium*), the latter predominating as a rule. The two are quite similar in growth, but the small hop clover is a smaller, more slender plant, with smaller heads. Recently an attempt has been made by a Tennessee experiment station to place the seed of large hop clover on the market. Hop clover is a winter annual, beginning its growth usually from October to December, and producing an abundance of good grazing during the spring months. It matures seed in early June and may be depended upon to reseed itself when once introduced. The seeds are small in size and quite expensive. However, only one or two pounds per acre are necessary to get a good start. Best results are obtained by fall seeding. Hop clover makes a matted root growth close to the surface which is ordinarily well inoculated. It is well adapted to eastern Oklahoma, and deserves extensive trial throughout the central area. It is used almost altogether in pasture mixtures.

White Clover. White clover is also known as Dutch clover. It is a long-lived but shallow rooted perennial legume, which spreads from stems which creep on the surface and root abundantly. It does well on moist soils, and is to be found growing in humid sections of the north and south. It will grow on any kind of soil, provided moisture is abundant but thrives best in good loamy soils rich in humus, and well drained. It is usually sown in mixtures with other grasses. It has given a good account of itself in pasture mixtures in northeastern Oklahoma but for some reason does not seem to have given as good results generally as would be expected.

Alsike Clover. Alsike clover (previously discussed) is grown quite extensively in pasture mixtures, especially on wet land. It is worthy of extensive trial for this purpose.

Red Clover. Red clover (previously discussed) is grown quite extensively in northeastern Oklahoma, mostly as a hay crop. It is sometimes included in pasture mixtures in that section, and provides good grazing during the time it occupies the land, but will not reseed abundantly.

Alfalfa. Alfalfa (previously discussed) is grown extensively in the state

and is sometimes pastured with livestock, especially in western counties. There is some danger from bloat, and precautions to avoid such trouble should be taken. Heavy grazing is detrimental to the stand.

Black Medic. Sometimes called yellow trefoil, closely related to alfalfa, and widely adapted from Ontario to the Gulf of Mexico. It is a winter annual which has proved valuable in pastures under adapted conditions. It is used almost altogether in pasture mixtures, and is recommended for limestone soils in several southern states. It requires the same inoculation as alfalfa and sweet clover, and appears to have similar soil requirements. It is deserving of further trials, particularly on soils fairly well supplied with lime and available phosphorus.

Black medic is to be found growing along roadsides and in lawns and pastures to a limited extent in central and western Oklahoma. It makes a viney, creeping growth and under pasture conditions produces seed close to the ground.

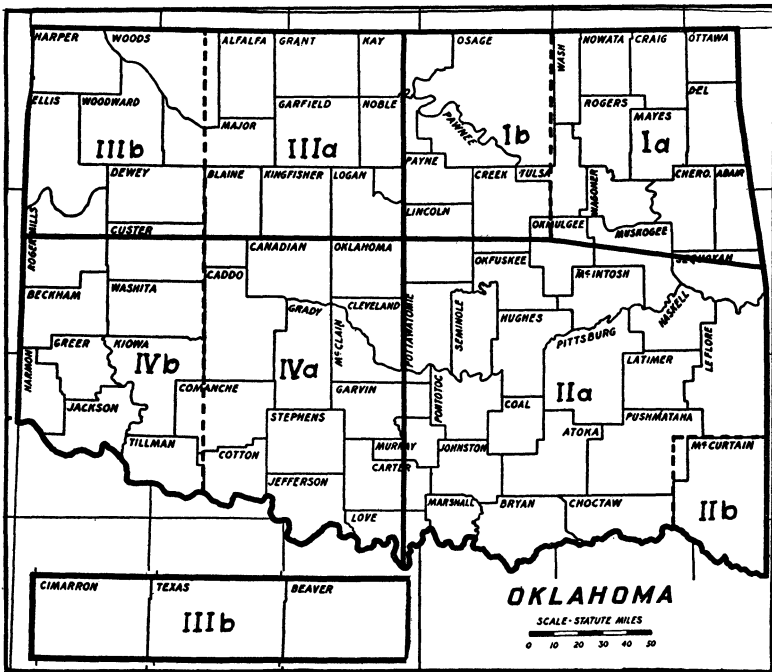


Fig. 5—Showing the division of the state into areas, to indicate the probable adaptation of different pasture plants. See text following for mixtures recommended for trial.

TAME PASTURE MIXTURES

I. Northeastern Oklahoma Area (Fig. 5, Page 33)

1. For fertile well drained soils.

Orchard grass	4 to 6 lbs.
Kentucky bluegrass	4 to 6 lbs.
Timothy	4 to 6 lbs.
Lespedeza	4 to 6 lbs.

Alsike clover	1 to 2 lbs.
White Dutch clover	1 to 2 lbs.
Hop clover	1 to 2 lbs.

Other pasture plants which may be included when desirable are as follows: Dallis grass, 1 to 2 lbs.; meadow fescue, 2 to 3 lbs.; either of the rye grasses, 2 to 3 lbs.; on non-acid soils, sweet clover or black medic, or both, 2 to 3 lbs. Use Korean lespedeza in northern part of the area, and two-thirds Korean and one-third Kobe in the southern.

2. For ordinary upland soils.

Orchard grass	4 to 6 lbs.
Redtop	4 to 5 lbs.
Timothy	4 to 6 lbs.
Lespedeza	6 to 8 lbs.
Hop clover	1 to 2 lbs.

For other pasture plants which may be included, see the discussion given above. Also, a similar use of the improved lespedeza is recommended.

3. For poor uplands.

Orchard grass	4 to 6 lbs.
Redtop	4 to 5 lbs.
Timothy	2 to 4 lbs.
Lespedeza	8 to 10 lbs.
Hop clover	1 to 2 lbs.

Tall oat grass, 4 to 6 lbs., may be included.

4. For poorly drained wet soils.

Redtop	6 to 8 lbs.
Timothy	4 to 6 lbs.
Alsike clover	2 to 4 lbs.
Hop clover	1 to 2 lbs.

In all the above mixtures, timothy may be included or omitted as desired. Usually the seed is cheap and of good quality. Timothy should improve the stand during the first year. All of the above grasses and most of the legumes may be planted either in the fall or in the spring. However, the lespedezas are sown in the spring and hop clover in the fall for best results. Early fall seeding is to be greatly preferred in getting the above pasture mixtures started, especially in the western part of the northeastern area (Ib), so as to reduce the risk of summer killing of young plants before they become rooted.

Bermuda grass is well adapted to the entire area, and usually will prove to be the best foundation for a permanent pasture in the southern half of the area. Pastures which include Bermuda are discussed later, along with other combinations given for the southeastern Oklahoma area (II).

II. Southeastern Oklahoma Area

1. For ordinary and good uplands, and bottoms.

Bermuda grass, sod (roots) preferred.	
Dallis grass	4 to 6 lbs.
Lespedeza	5 to 10 lbs.
Hop clover	1 to 2 lbs.

In southeastern Oklahoma, Bermuda grass seed may be used, 3 to 5 lbs., when the seeding is done on a well prepared seed bed. However, Bermuda roots are most dependable. For best results the Bermuda grass roots should be set out the first year in rows and cultivated to control weeds. Sow the hop clover in the fall, and the Dallis grass and lespedeza seed in the spring. The period of grazing of lespedeza will be extended from mid-summer to late fall by sowing a mixture of one-third each of Korean, Kobe and Tennessee No. 76. Common lespedeza may be included in the southern half of the area.

Other pasture plants which may be included are as follows: Bur clover may be planted in the fall of the second year, using the manure and seed mixture plan; on non-acid soils sweet clover or black medic, or both, may be sown, 2 to 3 lbs., and white Dutch and alsike clover are worthy of trial on low moist soils.

2. For good uplands and bottoms.

Dallis grass	5 to 7 lbs.
Lespedeza	5 to 10 lbs.
Hop clover	1 to 2 lbs.

Redtop, 2 to 3 lbs. per acre, can well be included in the eastern part of the area, but should be limited to trials in the west of the area. The redtop and hop clover may be sown in the fall, and the Dallis grass and lespedeza in the spring, or the redtop may be sown in the spring with the others, and the hop clover the following fall. Bur clover may be planted in the fall. On non-acid soils sweet clover or black medic, or both, may

be sown either in the fall or spring. The plan suggested above of mixing the improved lespedezas can well be followed.

3. For poor uplands, and drier soils.

Bermuda grass, using sod (roots).

Lespedeza ----- 5 to 10 lbs.

Hop clover ----- 1 to 2 lbs.

Dallis grass may be included, 2 to 3 lbs.; also, bur clover, using the manure and seed mixture plan; also, on non-acid soils, sweet clover, 2 to 3 lbs.

4. For moist sandy soils in McCurtain county area (IIB).

Carpet grass ----- 5 to 10 lbs.

Lespedeza ----- 8 to 10 lbs.

Hop clover ----- 1 to 2 lbs.

Common lespedeza may be used alone, or still better, a combination of the improved lespedezas along with common may be used.

5. For good lands and bottoms in the McCurtain county area (IIB).

Dallis grass ----- 5 to 7 lbs.

Carpet grass ----- 5 to 7 lbs.

Lespedeza ----- 5 to 10 lbs.

Hop clover ----- 1 to 2 lbs.

Only limited trials with carpet grass have been made in Oklahoma and this grass has yet to prove itself. Carpet grass is worthy of trial in demonstrations on moist sandy soils throughout the entire southeastern area, and particularly in McCurtain county and adjoining area.

III and IV. Western Oklahoma Areas

The possibility of extensive introduction of any of the tame pasture plants, now known, into western Oklahoma does not appear to be especially bright. Certainly no new pasture plants have been introduced as yet which are likely to supersede in an important way the original native grasses of the western prairies.

One should not underestimate the value of the native grasses. The native grasses, including the bluestems, grammas (mesquite), buffalo, and others of lesser importance, provided sustenance for enormous herds of buffalo in earlier Oklahoma history. Later, the same grasses were called upon to support large herds of cattle on the ranges. It was during this period that the native grasses were greatly abused and often weakened in vigor because of overgrazing. Since that time overgrazing has been commonly practiced in most of the native pastures on farms of this state. Consequently, a demand has arisen that new grasses be introduced to replace them.

The importance of the native grasses in western Oklahoma would indicate the great wisdom of adopting improved methods of range and pasture management as a means of conserving them, and renewing their vigor. This may be accomplished by the simple expedient of resting the native grasses and later following a definite plan of pasture rotation in which the native flora are given the opportunity to come back and reseed.

On many farms the native pastures have been plowed up, or almost completely destroyed by overgrazing. An urgent demand has arisen for permanent tame pasture plants to replace them. It is with this in mind that the following discussion is presented.

The climate of western Oklahoma makes the growing of many of the tame pasture plants uncertain and often impossible excepting under favored conditions on subirrigated lands and protected low lands. In the western area the normal annual rainfall decreases from approximately 30 inches in the east, to less than 20 inches in the western Panhandle. Frequent winds prevail during much of the year, and high winds during spring months. High temperatures occur during extended periods in the summer months. Consequently the conditions in the western areas are made difficult by an unfavorable combination of high summer temperatures accompanied by frequent strong winds, which together are responsible for a particularly high moisture requirement throughout the area. This, in addition to the low

and uncertain rainfall, makes the culture of many common pasture plants of the humid areas difficult or impossible.

In the western areas, sweet clover has the widest adaptation of any pasture plant known at the present time, with the possible exception of Sudan grass. Its culture (previously discussed) deserves to be extended in every possible way. Sweet clover deserves to be included as an important part of any pasture mixtures which are attempted.

Also in the western areas, excepting the Panhandle, Bermuda grass has a wide adaptation, and can be used extensively as the foundation of tame permanent pastures. Bermuda grass can be recommended for nearly all conditions in the eastern half of the area (IIIa and IVa.). A few good Bermuda pastures are to be found scattered throughout several southwestern counties (IVb), indicating that it provides a safe basis on the better soil types of that area.

Dallis grass deserves extensive trials in pasture mixtures throughout the southwestern area (IV). It has a reasonably good chance to survive on the better soil types, especially on subirrigated and low moist soils. Doubtless it will have little difficulty to stand the hot summers, if only it can survive the winters. It would be well to include Dallis grass in combination with Bermuda grass to insure best results.

Bromegrass is quite drouth resistant and deserves limited trial in mixtures on better soil types in the north central area (IIIa). Redtop and orchard grass, both excellent grasses in closely adjoining sections deserve a fair trial, especially on low lying moist soils. Any possible use of these grasses depends upon their ability to stand the summer.

The wheat grasses, including western wheat, slender wheat, and crested wheat grasses, deserve limited trials throughout the western area (IIIb and IVb). Western wheat grass is already growing as a native grass in certain localities. The western grasses are drouth resistant, and their use will depend upon their ability to stand the long continued high temperatures of the summer season.

IIIa and b. Northwestern Oklahoma Area

1. For good uplands and bottoms.

Bermuda grass, using sod (roots) only.

Sweet clover ----- 4 to 6 lbs.

Set out the Bermuda roots in the spring and sow the sweet clover in early September or the following spring. For trial include bromegrass, 2 to 4 lbs.; Dallis grass, 2 to 3 lbs.; Korean lespedeza, 2 to 4 lbs.; and black medic, 2 to 3 lbs.

2. For trial on good uplands and bottoms in IIIa.

Bromegrass ----- 4 to 6 lbs.

Orchard grass ----- 4 to 6 lbs.

Redtop ----- 4 to 5 lbs.

Sweet clover ----- 2 to 4 lbs.

Korean lespedeza ----- 2 to 4 lbs.

Under drier conditions, the first four grasses may be sown in the fall using a grain drill with press wheel attachment. Sow the Korean in the spring. Either of the rye grasses may be included for trial, 2 to 4 lbs.

IVa and b. Southwestern Oklahoma Area

1. For average uplands, good uplands, and bottoms.

Bermuda grass, using sod (roots) only.

Sweet clover ----- 4 to 6 lbs.

Set out the Bermuda roots in the spring, and sow the sweet clover in early September, or the following spring. For trial include lespedeza, 2 to 4 lbs.; black medic, 2 to 3 lbs.; Dallis grass, 2 to 3 lbs.; and redtop, 2 to 3 lbs. on low moist soils. Rescue grass deserves a trial in the mixture in localities where this grass is to be found growing naturally.

2. For the eastern part of the southwestern area (IVa).

The same pasture mixtures recommended for the southeastern area (II) often may be used to advantage, especially emphasizing the improved lespedezas in the mixture.