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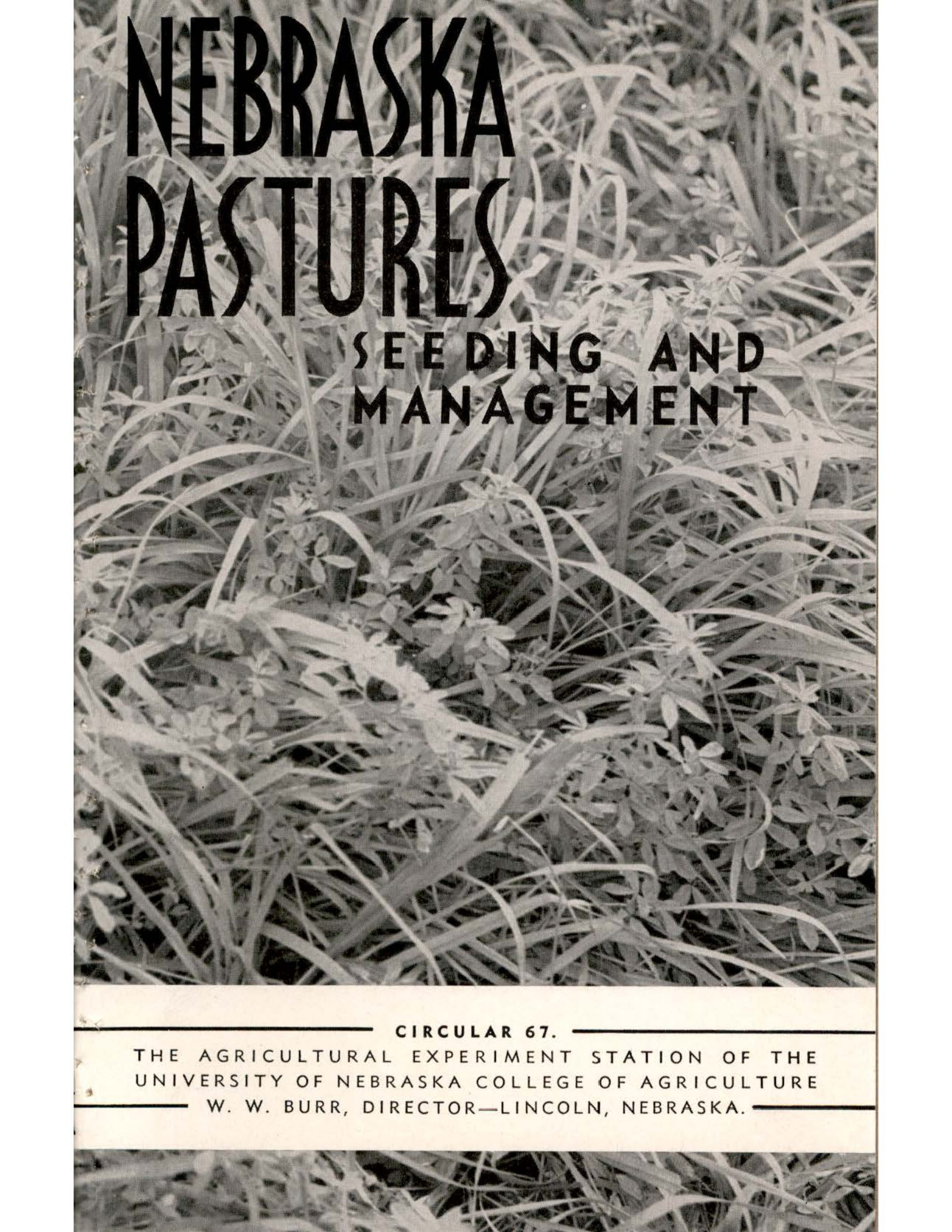


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NEBRASKA PASTURES

SEEDING AND MANAGEMENT

CIRCULAR 67.

THE AGRICULTURAL EXPERIMENT STATION OF THE
UNIVERSITY OF NEBRASKA COLLEGE OF AGRICULTURE

W. W. BURR, DIRECTOR—LINCOLN, NEBRASKA.

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Nebraska Pastures--Seeding and Management

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ALMOST 50 per cent of Nebraska's land is devoted to grass. Grasslands range from small pastures in the eastern part to extensive grazing areas in the sandhills, and comprise approximately 23 million acres. Part of the cultivated land in the state is annually planted to sweet clover, sudan grass, winter wheat, winter rye, and other temporary crops for pasture purposes. It has been carefully estimated that approximately two million acres of land in Nebraska now under cultivation should be returned to grass.

Pastures are an important source of feed in the livestock industry. Approximately 70 per cent of the income from Nebraska farms is from the sale of livestock and livestock products, and for this reason consideration should be given to the maintenance of good pastures. Poor pastures, like other poor crops, are expensive. Good grass cover is also an effective means of conserving the soil resources.

KINDS OF PASTURES

The pastures of Nebraska are of two kinds, permanent and temporary. The permanent pastures may be classified into five major types with respect to the most important grasses: (1) tall grass, (2) mixed grass, (3) sandhill grass, (4) short grass, and (5) introduced grass. The first four types consist of native grasses.

The tall-grass type consists principally of such grasses as big bluestem, little bluestem, Indian grass, switchgrass, sloughgrass, and side-oats grama. It appears chiefly in the eastern one-fourth of the state and in the moist valleys westward. The mixed-grass type is characterized by such species as little bluestem, side-oats grama, western wheatgrass, needlegrass, blue grama, and buffalo grass. This type occurs chiefly in central Nebraska, exclusive of the sandhills. It also occurs to a considerable extent in eastern Nebraska and to a limited extent on lightly grazed pastures in western Nebraska. The short-grass type is dominated by such species as blue grama, buffalo grass, and niggerwool. This type is especially important in western and southwestern Nebraska, and as a result of close grazing has increased materially in central Nebraska. The sandhill-grass type consists of such species as sand reedgrass, sand dropseed, little bluestem (bunchgrass), sandhill bluestem, hairy grama, and lovegrass. The dunes and dry valleys of the sandhills region are covered with this type of vegetation.

Grazing and drouth have materially altered the vegetative cover of native-grass pastures in Nebraska. There has been a decided transition in eastern and central Nebraska from tall grasses to shorter, more grazing-tolerant and more drouth-resistant grasses. For example, in eastern Nebraska side-oats grama and sand dropseed have increased materially and big bluestem and little bluestem have decreased. An even more noticeable change

has occurred in central Nebraska where blue grama and buffalo grass have greatly increased and the taller grasses have decreased.

Introduced-grass pastures are composed of one or more grasses and legumes which were brought into the state. Examples of introduced species are Kentucky bluegrass, redtop, brome grass, white clover, and alfalfa. Pastures containing introduced species occur chiefly in the same areas as the tall-grass pastures and to a limited extent in the remainder of the state. In eastern Nebraska, introduced species have largely replaced native grasses either because the land has been plowed and later restored to pasture by seeding or else because continuous close grazing has severely injured the tall native grasses. As the tall native grasses became weakened by close pasturing, introduced species such as bluegrass and white clover, which are more tolerant of close grazing, gradually replaced the former.

Introduced-grass pastures suffered severe deterioration as a result of the drouth beginning in 1934. The effect on these pastures was much more pronounced than on the native-grass pastures. Notable exceptions to the behavior of the introduced grasses were brome grass and crested wheat-grass, which survived the drouth years relatively well.

Temporary pastures consist of annual and biennial crops, including chiefly winter rye, winter wheat, sudan grass, and sweet clover. Spring small grains and rape are also used to some extent. Except for the strictly range areas, temporary pastures are used throughout the state.

PLANNING A PASTURE PROGRAM

Three factors should be considered in planning a pasture program: (1) to provide as long a grazing season as possible, (2) to furnish seasonally uniform, palatable, nutritious pasturage, and (3) to adjust the number of livestock to prevent overgrazing of the permanent pasture.

Pasturage may be provided with temporary pasture or permanent pasture, or with a combination of the two. Continuous pasturage throughout the grazing season can be supplied with a combination of winter rye or winter wheat, second-year sweet clover, and sudan grass. However, using only temporary pastures is not as practical as using permanent pastures alone or temporary pastures in combination with permanent pastures. The necessity and hazard of annual planting, together with the extra labor and expense involved in the handling of temporary pastures, makes their use somewhat less desirable. Certain temporary pasture crops may also cause unfavorable effects such as: tainting of milk as a result of grazing rye, bloating of stock from grazing sweet clover, and hydrocyanic acid poisoning as a result of pasturing sudan grass. Temporary pastures, however, offer an economical method of providing feed where ample permanent pasture is not available. During dry years and during the time that permanent pastures are being established, temporary pastures provide excellent supplemental feed. Their use is necessary during periods when permanent pastures are in a low state of productivity.

In eastern Nebraska continuous pasturage can be provided throughout a long season by having an introduced-grass pasture and a native-grass

pasture. The former, consisting of such species as brome grass and alfalfa, furnishes an abundance of feed throughout the spring, early summer, and fall months; the latter, consisting of such grasses as big bluestem, switch-grass, and side-oats grama either alone or in combination, furnishes feed during the summer months. This combination of pastures is not recommended on the uplands of central and western Nebraska because of the limited adaptation of introduced species in those areas.

ESTABLISHING PERMANENT PASTURES

Seeding of permanent pastures is most practical in eastern Nebraska and under irrigated and subirrigated conditions in the central and western portions of the state. The chances of getting a pasture established are greatest in the extreme eastern part of the state and become progressively less westward. However, with the introduction of harvesting and planting of native-grass seed, adapted species are becoming available for all parts of the state.

Time of Year to Seed

There are two distinct types of grasses with respect to season of growth, that is, cool-season grasses and warm-season grasses. Cool-season grasses are those that start growth early in the spring, make their principal growth during the cool months, tend to remain dormant during the summer, and then resume growth in the late summer and fall. Nearly all of the adapted introduced species and a few native grasses such as western wheatgrass belong to this group. Warm-season grasses resume growth late in the spring, produce most of their forage during the summer, and become dormant as cool weather approaches. In contrast with those of the first group, warm-season grasses show little green color from the time of the first killing frost in the fall until the latter part of the following spring. Most of the native grasses belong to this latter group. The optimum time of seeding varies markedly for the two groups of grasses.

There are three general periods of the year when seeding may be considered: (1) late summer, after the danger of extremely hot and dry weather is past, (2) early in the spring, before weeds, particularly annuals,

Cattle grazing on brome grass-alfalfa pasture during the fall months.



start growth and while the weather is still relatively cool, and (3) mid-spring or during the month of May after one or more crops of weeds have been killed by cultivation. Late-summer and early-spring plantings are recommended for the cool-season grasses and mid-spring planting is suggested primarily for the warm-season grasses.

Late-summer seeding.—The chances of securing stands of cool-season grasses such as brome grass are greater with late-summer seeding than with spring seeding.

It is important that late summer seeding be done as soon as moisture conditions are favorable and the danger of extreme summer heat is past. This is usually sometime after the middle of August. Planting should not be delayed too late, as the grasses and legumes may winterkill if they are not well established before very cold weather sets in. Seeding later than September 15 is considered hazardous in southeastern Nebraska, and the corresponding date is progressively earlier north and west.

Late-summer seedings are commonly made on ground from which a small-grain crop has been harvested earlier. Under average conditions, planting following small grain works satisfactorily in eastern Nebraska. However, during dry years and westward in the state, it is better to summer fallow in order to store ample soil moisture prior to seeding. Often the value of this stored soil moisture in getting stands is greater than that of the small-grain crop which otherwise would be secured.

The chief advantages of late-summer seeding over early-spring are: (1) less competition from weeds, (2) better establishment of plants by the time that heat and drouth become serious during the following summer, and (3) no loss of a crop as the pasture can usually be grazed during the year following seeding. The chief disadvantages are: (1) danger of winterkilling, especially if the seeding is not done sufficiently early, (2) greater possibility of grasshopper injury in the fall than in the spring of the year, and (3) insufficient moisture to establish a good seedbed for late-summer seeding during some years.

Early spring planting.—More plantings in Nebraska are made early in the spring than at any other time of the year. Such plantings should be made as early in the season as the ground can be worked. This is important in order to give the young plants a chance to become well established before the advent of summer heat and drouth. The more growth the plants have made when this period occurs, the greater are their chances of surviving. The cool-season grasses are of northern origin and hence are favored by relatively low temperatures. If planted early, these grasses are better able to compete with annual weeds which grow better when the weather becomes warm.

Planting very early in the spring may result in frost injury to the seedlings. Such damage, however, is infrequent. Of the recommended species, alfalfa is the most susceptible to cold injury. However, it is better to plant the pasture mixture containing alfalfa early and risk the hazard of frost injury than to delay planting and thereby increase the possibility of losing the stands later as a result of hot, dry weather.

The advantages of spring as compared to late-summer planting are: (1) there is usually enough moisture in the soil to assure emergence and (2) grasshoppers are usually not a factor. The chief disadvantages are as follows: (1) Stands may be lost during the hot, dry weather of mid-summer. (2) The competition from weeds is much greater than with late-summer seeding. (3) Since new plantings ordinarily furnish little pasturage during the first year, one crop is usually lost when seeding is done in the spring.

Mid-spring planting.—The most favorable time to plant warm-season grasses such as big bluestem, blue grama, and side-oats grama, is during the latter part of April or the first half of May. Germination of the warm-season grass seed occurs only when the soil is fairly warm. Because of this temperature relationship, seeding should be delayed until late in April or early in May so that the ground can be worked one or more times prior to planting in order to control weeds. Delayed spring planting is not recommended for the cool-season grasses.

Recommended time for sodding buffalo grass.—Buffalo grass sod pieces may be planted from the first of May to the middle of August. The optimum time, however, is during May or early June. This time represents the early period of seasonal growth of buffalo grass. Less time will be required in getting complete ground coverage when planting is done at this time than at any other time of the year. Weed control is usually necessary during the period of establishment, and less labor will be required because of the shorter period of establishment.

Pasture Mixtures

Most permanent pasture seedings consist of a mixture of two or more species. The reasons commonly given for planting mixtures rather than individual species are as follows: (1) In addition to the long-lived perennials which are slow in starting, annuals or short-lived perennials in the mixture provide earlier pasturage. (2) Adding legumes to the mixture increases the nutritive value of the pasture. (3) Because of varying soil conditions, including different species gives maximum production under all conditions since some do better under certain conditions than others. (4) Including species of differing seasons of growth provides a longer season of grazing than there would be with one species.

Under Nebraska conditions, the use of mixtures is less important than under some other conditions. Because of limited rainfall, it is more difficult to get the long-lived perennials established when annuals and short-lived perennials are included in the planting. The rapid-growing annuals and short-lived perennials use soil moisture which may be needed for the establishment of the long-lived perennials. For this reason it may be better to omit the former from a pasture mixture.

The following mixtures are recommended for general use in eastern Nebraska:

Mixture 1¹

	Amount per acre (lbs.)
Bromegrass	15
Alfalfa	3
	—
Total per acre.....	18

Mixture 2¹

Bromegrass	10
Timothy	4
Alfalfa	2
Sweet clover	2
	—
Total per acre.....	18

Mixture 3¹

Kentucky bluegrass	10
Timothy	5
White clover	2
	—
Total per acre.....	17

Any of these mixtures planted at the recommended rate makes a full seeding. Red clover may be substituted for a part of the other legumes, especially in the counties along the Missouri river. Kentucky bluegrass and white (Dutch) clover usually come in naturally where adapted. If the land is wet or acid, redtop or reed canary grass and alsike clover may replace a part or all of the other grasses and legumes. Orchard grass may be used to replace some of the bromegrass for shaded areas, especially in southeastern Nebraska.

Mixtures recommended for eastern Nebraska are satisfactory under irrigated and subirrigated conditions westward in the state. In the sandhill area increased yields on the subirrigated lowlands may be secured by seeding in alsike clover, red clover, timothy, redtop, and reed canary grass.

Where plantings are attempted on uplands in the western part of the state, the following mixture is suggested:

	Amount per acre (lbs.)
Western wheatgrass	5
Crested wheatgrass	4
Bromegrass	3
	—
Total per acre.....	12

Mixtures of native grasses, except for western wheatgrass, are not included because seed is not generally available in commercial quantities. As improved methods of harvesting, cleaning, and planting the seed are developed, native grasses will be more generally planted. The following species, because of their seed and forage producing qualities, merit special

¹ Three different mixtures are suggested to meet various needs. Mixture 1 is highly recommended under average conditions. Mixture 2 is less expensive and will provide quicker pasturage in favorable seasons. The use of Mixture 3 is restricted to the most favorable growing conditions.

consideration: big bluestem, switchgrass, side-oats grama, blue grama, western wheatgrass, and buffalo grass.

Use of a Companion Crop

The use of a companion (nurse) crop is particularly adapted to conditions in the northeastern part of the state, in the Missouri river counties south of the Platte river, and farther west under irrigation. In addition, companion crops are often used with plantings on sandy soils throughout the state. Spring-grain crops, when planted in the fall, can be used to advantage in all parts of the state to reduce the danger of winter blowing.

Reasons commonly given for the use of companion crops are the following: (1) They afford shade and hence protection for the young seedlings. (2) They provide cover in a relatively short time and thus reduce the danger of erosion. (3) They utilize the moisture that would otherwise be taken by weeds, making it possible to realize some income from the companion crop.

The difficulty commonly encountered with the use of companion crops is that instead of being protective, they are competitive. The companion crop, usually small grain, is either planted at such a heavy rate or else tillers so profusely that there is a normal stand instead of a modified one. Leaving the crop for grain results in too much shading of the seedlings and utilization of too much of the soil moisture. The result is that except in unusually favorable seasons, the seedlings perish during the hot, dry weather following harvest of the small grain.

The manner in which the companion crop is handled is more important than whether or not the companion crop is used. It is important that the proper kind of crop and variety be selected. The variety should be one which matures early and which does not shade the ground too heavily. For example, Spartan barley is a good companion crop because it ripens early, is fairly lodge resistant, and has a tendency to shed its leaves as it reaches maturity. In contrast, winter grains are ordinarily undesirable companion crops. They make such a vigorous growth during the spring following planting that they provide too much competition for the seedlings. If planted in the spring, winter grains grow more or less prostrate over the surface of the ground, forming a matted growth which hinders the grass.

The companion crop should be planted at a much reduced rate and should be removed before maturity. This can be done either by grazing or cutting for hay. If care is used not to pasture the fields when wet, grazing the companion crop is preferable to cutting for hay. In removing the companion crop by grazing, as much stock as possible should be turned on at one time. This practice tends to prevent grazing of portions of the field too closely and others not closely enough. After the major portion of the companion crop has been grazed, the stock should be removed until the planting becomes well established.

Seedbed Preparation

Loose, poorly prepared seedbeds are a cause of more failures than any other one factor except unfavorable weather. A good seedbed is one which



A corrugated roller is very useful in preparing a well-packed seedbed.

is moist, free of weeds, well pulverized, and firmly packed. To obtain such a seedbed it is well to plow as far in advance of seeding as possible. If the land is fairly free of weeds and trash, thorough disking may be preferable to plowing because there is less danger of having the ground insufficiently packed. One of the best ways to get a firm seedbed is to pack with a corrugated roller. If a corrugated roller is not available, a satisfactory seedbed can be prepared by disking, with the disk set fairly straight, and ample harrowing.

Methods and Depth of Seeding

Drilling is preferable to broadcasting if the seed will feed through a drill. Seed can be distributed and covered more uniformly with drilling than with broadcasting. Seed of some of the native grasses such as big bluestem, side-oats grama, and blue grama, as it comes from a combine or threshing machine, is so light and chaffy that it cannot be planted with any types of drills or other mechanical seeders now available. Special cleaning of the seed will, however, remove this difficulty.

Since brome grass seed is light, some difficulty is encountered in drilling it. Drills equipped with agitators handle the seed relatively well. One of the ways to keep the seed from "bridging over" the holes in a drill box is to put only a small quantity of seed in the box at one time. If necessary, brome grass seed can be forced through a drill by agitating it with a stick or by mixing in a small quantity of oats. If the oats are not desired in the planting, they may be exposed to high temperature for a short time in the oven of an ordinary stove.

An endgate seeder can be used for planting brome grass if the seed is agitated with a stick. Another way to get the seed through the seeder readily is to keep only a small amount in the hopper. This can be done by holding a scoop shovel over the edge of the hopper and gradually shaking the seed into it as planting is in progress.

Broadcasting by hand works satisfactorily and it often provides the best method of planting small acreages. In order to obtain a uniform distribution of seed, it is well to plant half of the seed by crossing the field in one direction and the second half at right angles to the first.

Grasses and legumes should not be planted too deep, as the small seeds cannot emerge through as thick a covering of soil like seeds of most other farm crops. Under average soil conditions, seeds of legumes and all but a few grasses should be planted approximately one-half inch deep. In sandy soils, planting should be done somewhat deeper. Very small seeds such as side-oats grama, blue grama, and sand dropseed should not be covered over one-fourth inch deep.

When seed of grasses and legumes is broadcast, it can be covered by means of a harrow with the teeth nearly flat, and the ground can be packed with a corrugated roller.

Care after Seeding

Many pastures are ruined by too severe grazing during the first one or two years after planting. On the other hand judicious grazing may be helpful in removing the growth of a companion crop or of rapidly growing pasture crop such as sweet clover. After the small grain in spring seedings is grazed off during May or early June, the stock should be removed and kept off until late in the summer. This will permit a better establishment of the grasses and legumes.

Plantings should be clipped as necessary during the first year, even though a companion crop is used. With most grasses the clipping should be done at least three or four inches above the ground. With short grasses such as blue grama and buffalo grass, clipping may be done approximately two inches above the ground. The mower sickle can be raised by equipping the bar with shoes or a special wheel attachment. The first clipping should be made early, ordinarily during the latter part of May. In this way the weed growth or companion crop is removed before it utilizes too much soil moisture and the seedlings are hardened off for the approaching hot and dry weather. It is a mistake to leave a weed growth or a companion crop undisturbed until July or August and then mow closely. Plantings left undisturbed until this late produce plants which are tall, spindly, and lacking in resistance to heat and drouth because of the shaded protection. The sudden exposure may result in a total loss of the plants.

With native grass, clipping may need to be continued for two or three years after planting, because native grasses are slow in becoming established.

Under unfavorable growing conditions most grasses become established slowly. Oftentimes fields are plowed before ample time has been allowed to determine whether or not a stand has been obtained. Native grasses in

particular are slow in starting and becoming established. The stand of grass may appear to be poor during the entire first season. During the second year the stand, although improved, may still be unsatisfactory and weedy. In fact it may not be until the third or fourth year that the grass is well established and weeds are under control.

The amount that a pasture is grazed during the first year should be determined partially by the species included in the mixture. Mixtures containing rapidly starting species such as timothy and sweet clover can be grazed more heavily during the first year than those which contain only species becoming slowly established.



A practical method of transplanting buffalo grass sod. The wheels pack the sod pieces into the soil.

Sodding Buffalo Grass

Buffalo grass has some characteristics which merit special consideration. The seed is difficult to harvest and therefore virtually prohibitive in price for large-scale plantings. However, the plants spread rapidly by means of stolons (creeping stems). One plant will spread over an area of two feet or more in diameter within one favorable season. Therefore, planting sod pieces affords a practical method of establishment.

The sod should be moved when the soil is reasonably moist. If moved when excessively dry, soil will tend to crumble away and leave the roots exposed. Satisfactory plantings can be made with dry sod but greater care in handling must be exercised than if the soil is moist.

Sod should be secured from a good thick stand of relatively pure buffalo grass. For large scale operations, the sod can best be cut with a sod cutter. A

satisfactory cutter can be built by bolting a sharpened U-shaped flat steel blade onto a walking plow or some other suitable frame. The blade should cut a strip about 12 inches wide. The cutter may be equipped with one or two rolling coulters to cut the 12-inch strip into two or three narrower strips.

Ordinarily not all of the sod should be removed from a field of buffalo grass. Where the 12-inch cutter is used, for example, alternate strips of sod approximately 12 inches in width may be left undisturbed. The remaining grass will soon spread over the denuded furrows. If it is desired to have the ground level, the furrows may be filled with dirt, or the strips left in the field can in turn be removed after the grass has spread over the furrows. On rolling land, sod should be removed only on the contour.

The strips of sod can be cut crosswise with a sharp spade into convenient pieces for moving. Before planting, the sod should be further cut into cubes about 2 to 4 inches on a side. The sod pieces can be set into the ground by hand but such a procedure is tedious and expensive. Planting can be done by dropping the sod pieces on freshly tilled land and pressing them into the soil (level with the surface) with a heavily weighted packer. Obviously care must be taken to keep the sod right side up.

Planting may be done from a specially equipped wagon or truck, by fastening sheet-iron chutes to the vehicle with one end dragging on the ground. The chutes form an incline down which the sod pieces slide to the ground. With a truck the chutes may be set to drop the sod pieces just in front of the rear wheels, which help to press them into the ground. A manure spreader may also be used in planting sod pieces. The reel can be removed and platforms fastened to the sides of the rear end. One man can be stationed on each platform to slide the sod pieces down the chutes. The driver can operate the apron-moving lever to keep a supply of sod constantly available for unloading.

The best time of the year to sod buffalo grass is during May or the early part of June. However, planting may be done at any time that sod can be moved. The advantage during May or June is that less time will be required in getting complete coverage and accordingly less weed control will be necessary. A good seedbed can be obtained by plowing early in the spring. Weeds should be controlled by tillage as necessary prior to planting. The ground should be in good tilth.

In eastern Nebraska sod pieces planted two to three feet apart will ordinarily result in complete coverage of the ground in one season. The spread is relatively slower westward in the state. In western Nebraska, the average spread is only about a foot per year. The exact spacing of sod pieces should be determined by the location within the state, by the amount of time and money available, and by the length of time within which complete coverage is desired.

Care following planting consists principally of weed control. If weeds have been properly controlled prior to planting, little subsequent attention may be necessary. But if a heavy weed growth comes in while the grass is spreading, weeds will have to be controlled in order to give the grass a

chance to cover the ground. This can be done most effectively by timely mowing.

Regrassing Abandoned Land

Land abandoned from cultivation is ordinarily so unproductive that the operator may not feel justified in expending money to plant it. Ultimately, such land will return to native grass naturally. When land is to be taken out of cultivation, it should either be left with a growth of stubble or planted to a cover crop such as rye seeded at a thin rate to reduce the danger of erosion. The rapidity with which the land returns to grass depends somewhat upon the length of time that the land was under cultivation and accordingly the extent to which roots and other underground parts were destroyed during the period of cultivation.

Research work has been done in western Nebraska to determine how rapidly cultivated land returns to grass. These studies show that, following abandonment, land is usually covered with weeds for three or four years. Western wheatgrass begins to appear about the fourth year and during the next year or two there is a marked increase in the amount of this grass. Other grasses begin to come in during the fifth and sixth years. About this time the land begins to provide considerable feed. By the tenth year a fairly good grass cover is established. The vegetation on such land after ten years is not the same as on virgin prairie, but it is reasonably productive. This illustration is merely an example of what occurred in one county. The kind of plants and rate of regrassing will vary with different locations and conditions. Artificial reseeding would hasten the process of establishing a grass cover.

MANAGEMENT OF PERMANENT PASTURES

Proper management of permanent pastures following establishment is extremely important. Certain practices must be followed if highly productive pastures are to be maintained.

An overgrazed pasture which has little grass, and is weedy and gullied.



Grazing

The objective in the management of pastures should be to secure the greatest possible returns from livestock grazing on them without decreasing the productivity of the forage plants. To accomplish this necessitates the use of such grazing methods as will permit the forage plants to make enough top growth to maintain their vigor. A critical period in the life of a perennial pasture plant is in the spring of the year when new growth is taking place. During this time the plant depletes rapidly the stored food reserves in the underground parts. If the plant is permitted to make sufficient top growth, food will again be stored in the roots. Therefore livestock should not be turned into permanent pasture in the spring until most species have made a growth of four or five inches.

Introduced grasses can usually be grazed three or four weeks earlier in the spring than most native grasses. The time when livestock can be turned on pasture, however, varies with seasonal conditions and with different parts of the state.

Precaution should be taken throughout the grazing season to avoid overgrazing. It may be necessary to provide temporary pasture or supplemental feeds to help maintain the livestock during the hot summer months.

Overgrazing may be taking place without being evident in the earlier stages. In overgrazed pastures the root systems of plants become reduced in extent with the result that the pastures gradually become less productive. With very little top growth present, much of the precipitation runs off of rolling land whereas otherwise it would be held where it falls. Ultimately

What heavy grazing may do to good grass cover: (left) native-grass meadow; (right) overgrazed native-grass pasture.





Grass will cover pasture gullies which are protected by fencing.

the pasture plants may become so weakened that weeds begin to come in. Occurrence of extremely hot and dry weather may result in the total loss of such a pasture, whereas pasture plants in a healthy condition with some top growth for protection might survive.

There is a second advantage to be gained from not stocking pastures too heavily. If less stock is put in, the grazing season can be lengthened. For

Kochia (fireweed) may afford some pasturage.



example, a pasture stocked to capacity may provide no pasturage after the first of October, whereas the same pasture used less intensively might be grazed until the first of December.

Rotational grazing—that is, dividing a large pasture into two or three smaller units and then grazing these periodically in succession—helps to keep pastures in a productive condition. It has been shown experimentally that a given area of pasture land will usually produce less forage if the entire area is grazed continuously than if the same area is divided into two or three smaller units and these are grazed alternately. It is not advisable, however, to go to too much expense to divide pastures that are established, especially when it is also necessary to provide water in each division. The increased pasturage obtained may not compensate for the additional expense and time involved.

Mowing of Weeds

Weeds do not ordinarily offer a serious problem in pastures which are properly grazed. Grass in a thriving condition grows vigorously and covers the ground so completely that weeds cannot become well established. A pasture may become very weedy as a result of overgrazing or repeatedly grazing too early in the spring. Effective weed control methods vary with growth habits of different weeds. A characteristic such as the length of life of a weed influences materially the type of control practices which are most effective.

Annual and biennial weeds.—Annual weeds such as maretail, hemp, annual ragweed, and snow-on-the-mountain, and biennial weeds such as gumweed, bull thistle, and burdock can be controlled most easily by keeping them from seeding. Mowing at the proper time provides an effective means of preventing weeds from producing seed. Mowing is most effective at the time that the plants are beginning to blossom. In fact, mowing once at this time is usually sufficient to prevent seed production for that year. A common farm practice, however, is to delay mowing until August and September, and by this time most weeds have produced seed. Therefore little other than improving the immediate appearance of a pasture is ac-

Mowing to control maretail, a common annual, on native-grass pasture.





Ironweed, a persistent perennial in eastern Nebraska pastures.



Blue vervain can be controlled by mowing at the proper time.

completed. Neither is it advisable to mow too early, for the plants will then give rise to new stems. Thus seed production will be delayed but not prevented.

Perennial weeds.—Mowing at the proper time offers the most economical method of eradicating perennial weeds such as ironweed, blue vervain, and buckbrush. These weeds utilize reserve food stored in underground parts to start growth in the spring. The plants continue to utilize this reserve until sufficient top growth has been made to manufacture food to supply the growing needs of the plant. Following this, the reserve food supply in the underground parts is gradually restored.

Mowing is most effective if done when the food reserves are the lowest. The exact time of year when this condition prevails varies with species, seasonal conditions, and location within the state. In general, food reserves are lowest sometime during the period from the middle of May to the early part of July; hence mowing during this period is most effective. It is usually necessary to mow perennial weeds for two successive years or more in order to eradicate them.

There are a few common perennial weeds which because of special growth habits cannot be controlled by mowing. These include low-growing species such as prickly pear (cactus) and field bindweed, and those with the rosette habit of growth like the pasture thistle. With such weeds only specialized control measures are effective. Prickly pear can be eradicated by grubbing the individual plants about four inches below the surface of the ground. The plants should then be hauled off the field because they may again take root and resume growth under favorable moisture conditions. The only practical methods of eradicating field bindweed are by applying sodium chlorate or by clean-cultivating the land for at least two years. The pasture thistle can be controlled by either repeated grubbing of individual plants or by applying sodium chlorate.

Burning

Burning of pastures is a harmful practice under most conditions. Any possible advantages of burning are usually more than offset by the disadvantages. Under certain, rather uncommon, conditions burning may be justified.

Early spring burning exposes the soil and hence permits it to warm up more rapidly than it otherwise would. The rapid warming of the soil results in early spring growth. However, the burned areas lose moisture rapidly through runoff and evaporation because of a lack of cover. As the season advances, moisture becomes a serious limiting factor. Grasses in unburned areas start growing later but they produce more forage as the summer advances. Also, burning may result in injury to the plants. The total yield of forage for the season is usually considerably less on burned than on unburned pastures. This is particularly true during drouthy years.



Burning of pastures is injurious under most conditions in Nebraska.

Native-grass pastures, with a heavy growth of old vegetation, may be benefited by burning in the early spring in order to obtain more uniform grazing during the following season. If this dead grass is allowed to remain, it may result in undergrazing in some parts of the pasture and overgrazing in other parts. The burning of introduced-grass pastures is rarely beneficial. Because of its relatively high palatability, old growth of introduced grasses is not an important factor in uniformity of grazing.

Burning is sometimes done to destroy a heavy growth of weeds and weed seeds in badly deteriorated pastures. Late-spring burning (May) of native-grass pastures tends to accomplish the same results in eradicating perennial weeds as mowing at that time would, but it is less desirable because of injury to the forage plants. Also, pastures or parts of pastures containing a

heavy growth of annual weeds such as downy brome grass and little wild barley may be advantageously burned as the weeds mature and before they drop their seed.

Fertilizing

Soil fertility has become a limiting factor in the productivity of some pastures in eastern Nebraska. This is not generally true in the central and western parts except on limited areas of irrigated and subirrigated land. Even in eastern Nebraska, fertility may not be a limiting factor in drouth years but the lack of it becomes apparent in years of greater rainfall. The deficiency if present is usually limited to available nitrogen. The so-called "sod-bound" condition commonly found in older bluegrass and brome grass pastures is associated with a lack of available nitrogen. Nitrates can be applied most economically in the form of manure. Well-rotted manure is preferable because the nutrients become available more readily and there is less danger of introducing weed seeds. It can best be applied to pastures as a light top dressing during the winter or early spring months.

During extremely dry years, no fertilization should be practiced. Moisture becomes the limiting factor and the stimulation caused by added fertility may result in "burning" of the grasses. The addition of fertility elements other than nitrogen has not resulted in apparent beneficial effects on permanent pastures.

Pasture Furrows

The value of pasture furrows has not been fully determined experimentally. At best these structures offer only a secondary method of pasture improvement or maintenance. Their chief function—to retain water on

Pasture furrows made on the contour.



rolling pasture land—can most advantageously be accomplished by keeping ample vegetative cover on the land through practicing proper grazing. However, on rolling hard-land pastures which have been closely grazed, pasture furrows catch and hold much water which would otherwise be lost through runoff. Ultimately this additional stored moisture results in a heavier growth of grass within and adjacent to the furrows.

Thin, Unproductive Permanent Pastures

One of the most feasible ways of improving thin, unproductive pastures is by removing part or all of the stock for one or more seasons. Many farmers have restored their pastures to a high state of productivity through this practice. Native-grass pastures respond particularly well to this treatment.

Pasture improvement through reduced grazing is especially valuable in central and western Nebraska where seeding is not as practical as it is farther east. In these drier areas of the state one is seldom justified in plowing a pasture because it has become unproductive. Such a pasture should be rested until a good grass cover is restored.

In eastern Nebraska, very thin pastures may warrant reseeding. But even in this area a good grass cover can be restored on thin pastures by taking the stock off entirely and following a judicious mowing program to control weeds.

Advisability of Plowing before Reseeding

Weeds commonly afford a serious problem in attempts to get stands on thin pastures through reseeding. As far as possible, weeds should be eradicated before reseeding is attempted.

In eastern Nebraska, weeds can best be controlled on land where tillage is practical by plowing and planting the land to annual crops for a period of two or more years. During the period of cropping, most of the weed

This weedy drouth-injured pasture will be cropped for two years before reseeding.



roots and seeds can be destroyed. Pastures can be established more easily on such relatively weed-free land.

Reseeding without Plowing

If a pasture is relatively weed-free, successful reseeding may be done without previous plowing. The ground should be thoroughly disked before planting. This method has the advantage of saving most of the remaining grass cover, for perennial grasses withstand one to several diskings without much injury.

On many rolling pastures disking is preferable to plowing in a reseeding program because of the erosion hazard.

In some instances no tillage is possible because of rough topography, rocky projections, deep gullies, or the presence of trees or stumps. This type of grazing land offers a most difficult problem, since the preparation of a seedbed is impossible. Any reseeding attempted must be done by hand and there is little opportunity for covering the seed. Under such conditions seeding on snow in the late winter may offer the only method of planting. The chances of getting a stand under such conditions are not good. Therefore one should probably use an inexpensive mixture. Such a mixture might well include a liberal amount of sweet clover which has the added advantage of becoming established rather easily.

Sudan grass affords excellent supplemental pasture during the summer months.



TEMPORARY PASTURES

There are a number of temporary pasture crops adapted to Nebraska conditions. Among these, winter rye, sweet clover, and sudan grass are especially important. All three crops are highly productive and all play an important role in getting continuous pasturage throughout the growing season.

Rye.—Among the most important of the temporary pasture crops is winter rye. Planted late in the summer, it commonly provides a limited amount of grazing during the fall of that season, and it is usually very productive during the early months of the following year. Under average conditions rye in southeastern Nebraska can be pastured from April 10 to the latter part of May. The corresponding grazing dates are somewhat later northward and westward in the state. The time when grazing can be started varies materially from year to year. Few other crops can withstand as much grazing as rye and still produce a crop of grain.

Rye is valuable in a pasture program because it provides pasturage early in the season before native-grass pasture can or should be grazed. Furthermore, rye in the early stages of growth is high in protein. The fact that milk may be tainted should be recognized. Much can be done to reduce this effect by removing the animals from the rye pasture several hours prior to milking.

Second-year sweet clover.—Where adapted, sweet clover in the second year of growth is valuable in a temporary pasture rotation. Its grazing season extends from the latter part of April until late in July or possibly the first of August. The carrying capacity is high during May and tapers off gradually during June and July.

In choosing between the common white biennial and the common yellow biennial types of sweet clover, certain differences should be recognized. The white type grows taller and coarser and ordinarily blossoms about two weeks later than the yellow type. The former produces more feed over a longer season than the latter.

The pasturing of sweet clover involves some danger of bloat. This danger is somewhat greater on second-year than on first-year sweet clover. The risk can be reduced by following proper grazing management practices. Methods are discussed in connection with the description of alfalfa (page 31). An additional precaution is the planting of winter rye in first-year sweet clover in the fall of the year. A stand of rye not only reduces the danger of bloat the following year but also provides earlier pasturage.

First-year sweet clover.—First-year sweet clover provides pasturage during the late summer and early fall months. A combination of sweet clover and a small grain furnishes earlier pasture than sweet clover alone. However, in tests conducted at the Nebraska Experiment Station during 1932 and 1933, the total amount of pasturage for the season was not increased by the addition of a small-grain crop.

Under favorable moisture conditions, sweet clover is commonly planted with a small-grain crop which is utilized for grain purposes. The sweet

clover may then be used for pasture in the late summer and early fall months after the small grain has been harvested.

Sudan grass.—Sudan grass is a warm-weather crop and hence it is ordinarily not planted until the latter part of May or early June. It makes a rapid growth following planting and provides much pasturage during July, August, and to a lesser extent during September. It is susceptible to chinch-bug injury.

Hydrocyanic or prussic acid poisoning sometimes occurs in certain classes of livestock as a result of grazing sudan grass. The crop appears to be more dangerous from this standpoint when the growth is stunted by drouth or frost. After the growth has dried for several weeks either as hay or following a killing frost, the danger of hydrocyanic acid poisoning is very much reduced. Although relatively little is known about the entire problem, the following suggestions are offered in connection with attempting to reduce danger of hydrocyanic acid poisoning: (1) use pure sudan grass seed; (2) delay pasturing until the crop has reached a height of one foot or more; (3) give the stock hay or grain before they are turned on sudan grass; (4) keep the stock on sudan grass continuously after grazing has been started; (5) divide the sudan grass field into two pastures and graze these alternately; (6) exercise caution in pasturing sudan grass that has been stunted by drouth or frost; and (7) inject intravenously a 30 per cent solution of sodium thiosulphate in water as soon as the effect of toxicity is noted. If possible, it is advisable to have a veterinarian apply the treatment.

Other temporary pasture crops.—Several other temporary pasture crops may be used. Included among these are rape, winter wheat, winter barley, and spring small grains.

Rape is adapted to a cool, moist climate. Its use in Nebraska is restricted largely to the northeastern part where it is commonly planted with spring small grains. It is especially popular as a hog pasture although it is also grazed readily by cattle and sheep.

Winter wheat may be used to replace winter rye. It is similar in quality and has an advantage over rye in that it is less likely to impart an objectionable flavor to milk. Much of the winter wheat planted for grain is also grazed during the late fall and early spring months. If the crop is to be used for grain, it should not be grazed too heavily, not grazed when the ground is wet, and the stock should be removed as soon as the young shoots begin to emerge above the surface of the ground.

Winter barley provides considerable pasturage in the fall of the year, but it commonly winterkills in this state. Spring small grains produce considerably less pasturage than winter rye or winter wheat.

Rotation.—The rotation outlined in Table 1 provides continuous pasturage over a long season in eastern Nebraska. Few farmers follow such a complete plan of temporary pastures. Where part of the pasturage is provided with permanent pastures, some of the temporary pasture crops may be omitted. This is a problem which must be solved for each farm, in-

dividually. In those parts of the state where it is not desirable to plant sweet clover, a combination of rye and sudan provides considerable feed.

TABLE 1.—*Complete temporary pasture rotation for eastern Nebraska.*

Year in rotation	Fields			
	1	2	3	4
1st year	Rye ¹	Sudan grass ²	Oats and 1st-year sweet clover ³	2nd-year sweet clover, rye in fall
2nd year	Sudan grass	Oats and 1st-year sweet clover	2nd-year sweet clover, rye in fall	Rye
3rd year	Oats and 1st-year sweet clover	2nd-year sweet clover, rye in fall	Rye	Sudan grass
4th year	2nd-year sweet clover, rye in fall	Rye	Sudan grass	Oats and 1st-year sweet clover

¹ The rye may be harvested for grain. If the rye is closely grazed and plowed about June 1 and soil moisture is favorable, the ground may be planted to a sorghum crop. This crop may be used for fodder or silage.

² During dry years sudan grass should be planted on ground where no crop has been grown during the spring. During favorable years, it may be planted about June 1 on ground which has been in rye. Only three fields are then necessary to provide a complete temporary pasture rotation.

³ If not needed for pasture, the oats may be harvested for grain.

DESCRIPTION OF COMMON PASTURE GRASSES AND LEGUMES

Introduced Grasses

Bromegrass is the best introduced grass for permanent pastures. It is used as a basic grass in most recommended mixtures. It is a long-lived perennial, sod-forming, highly cold and drouth resistant, and very palatable. It is relatively slow in getting started, but once established it is persistent. Bromegrass is one of the first grasses to start growth in the spring and it grows late in the fall. Its growth lapses somewhat during the hot, dry summer months, but to a lesser extent than that of other introduced grasses. It commonly becomes sodbound a few years after planting but measures can be taken to avoid this. It is widely adapted in the state.

Orchard grass is a perennial with a bunchgrass type of growth. It is somewhat easier to start than bromegrass, but it is less palatable. Although it withstands high temperatures well, orchard grass is susceptible to winter-killing during the first year. Since it is a bunchgrass, it should be planted only in mixtures containing at least one sod-forming grass. Orchard grass is highly shade tolerant, and can be used advantageously in open wooded areas. Even here its use is recommended only for the southeastern part of the state.

Kentucky bluegrass is sod-forming, very palatable, nutritious, aggressive, and persistent, but rather low in yield. It makes its maximum growth early in the spring and late in the fall and is the most common introduced grass in Nebraska, chiefly because it came into pastures naturally and because it withstands rather close grazing. It invades native hay meadows to some extent. It is found generally in the eastern one-fourth of the state and to a limited extent under favorable conditions in the remainder of Nebraska. Not being well adapted to extremely dry weather, much of the bluegrass cover was destroyed during the severe drouth beginning in 1934.



Introduced grasses: (left to right) bromegrass, orchard grass, Kentucky bluegrass, meadow fescue, timothy, redtop, perennial ryegrass, reed canary grass, crested wheatgrass.

Meadow fescue produces a fairly good sod even though it has no rootstocks. It does best on rich, moist soils and it is not well adapted to poor upland soils. It is not tolerant of drouthy conditions. Meadow fescue becomes established rapidly after seeding but it does not persist for many years. It starts growth early in the spring and grows fairly well in shade. Planted in mixtures, it furnishes early feed while the slower-growing species are becoming established.

Timothy is grown chiefly for hay but is used also for pasture purposes. It is a bunchgrass and is usually short-lived under Nebraska conditions. It is adapted to a cool, moist climate. Timothy does well on heavy soils and is not adapted to poor, upland soils. It is not resistant to close grazing and trampling. Under favorable conditions, it produces high yields of palatable and nutritious forage. In pasture mixtures, timothy has the following advantages: low-priced seed, rapid emergence after planting, and forage production soon after planting.

Redtop is a sod-forming grass that thrives on moist to wet soils and grows on land which is flooded during the spring months. It also withstands considerable dry weather and is adapted to a wide range of soil conditions. Redtop is somewhat less palatable than most other grasses, particularly when utilized for hay. It is not very tolerant of shade. Redtop is valuable in pasture mixtures on low wet lands and also in areas subject to periodic flooding. It is commonly used with alsike clover for this purpose.

Ryegrasses are of two kinds: the perennial (English) and the annual (Italian). Both are short-lived, rapid-growing bunchgrasses. Commercial seed frequently consists of a mixture of the two species. They thrive on rich, moist soils and do not withstand hot, dry weather. Establishment is rapid. The ryegrasses are very palatable and produce considerable forage for one or two years after planting. They are not generally recommended in Nebraska, although they may be used to some extent as quick-starting grasses in mixtures in favored areas.

Reed canary grass is a long-lived, sod-forming perennial, native but so uncommon in the state that seed collection from these native stands is not practical. It thrives on wet, fertile soils, especially under cool conditions. Like redtop, it is adapted to lands flooded during the early spring months. Reed canary grass produces high yields of palatable and nutritious forage on wet soils, and produces heavy seed which is easily planted. Seed yields, however, are low because of susceptibility to shattering.

Crested wheatgrass is a perennial bunchgrass. It is palatable, nutritious, and reasonably productive where adapted. It is drouth and cold resistant but fails to remain productive during periods of excessively high temperatures. Crested wheatgrass is being used extensively in Canada and in the Northern Great Plains region. It is being grown with some degree of success in western Nebraska. In the eastern part of the state, however, it is exceeded in yield by brome grass.

Native Grasses

Big bluestem, an erect perennial three to six feet in height, grows best on moist well-drained soils. It was one of the dominant species of the native vegetation in eastern Nebraska and in the moist and subirrigated valleys of central and western Nebraska. It still persists under these conditions in the native-grass meadows and in judiciously grazed pastures. It cannot withstand close and continuous grazing. Its value both for pasture and hay where adapted is well recognized. Big bluestem propagates by

short rhizomes and seed. Seed can be harvested successfully but is chaffy and difficult to plant unless properly processed.

Switchgrass is a sod-forming perennial growing to a height of two to five feet. It seldom occurs in pure stands, being found chiefly in scattered stands among other species. Like big bluestem it grows most commonly under moist conditions. However, it also appears occasionally on the uplands of central and western Nebraska. Switchgrass seeds abundantly. The plump, heavy seed is easily harvested and planted. Switchgrass offers promise as a grass to be planted for permanent pastures in eastern Nebraska. Where adapted it produces a heavy growth of highly palatable forage. As it reaches maturity, however, switchgrass loses its palatability and feeding qualities more rapidly than does big bluestem.



Native grasses: (left to right) big bluestem, switchgrass, side-oats grama, blue grama, western wheatgrass, sand dropseed.

Side-oats grama, although producing short rhizomes, does not develop a sod. It occurs either in small, open tufts scattered among other native grasses or in nearly pure stands. It grows one to three feet in height. The characteristic spikes hang downward from the culm. Side-oats grama is intermediate in its adaptation to dry areas. It grows throughout the state, in eastern Nebraska mostly on the uplands and in central and western Nebraska on the uplands and more abundantly in valleys. Side-oats grama is usually one of the first grasses evident in the restoration of drouth-damaged, native-grass meadows and pastures. It is not dependable

in seed production but seed can be harvested successfully. The forage is desirable. Side-oats grama is recommended for central Nebraska and on the uplands of eastern Nebraska.

Blue grama is a short-growing grass, the flowering stalks attaining a height ranging from 6 to 20 inches. It develops an open sod and produces characteristic heads with all spikelets borne along one side of the central stem. It is easily confused with hairy grama. Blue grama is confined largely to dry soils, being unable to compete with taller-growing grasses on moist soils. It is a common and valuable grass throughout central and western Ne-



Buffalo grass: female plant (left), male plant (right) with stolon producing new plants.

braska, is highly tolerant of close grazing, and produces forage of excellent quality. The growth cures well on the ground, providing palatable, nutritious fall and winter feed. Blue grama is an erratic and low seed producer. It commonly produces two crops of heads annually, one during July and another during August and September. The seed is most easily harvested by stripping. Blue grama is highly recommended where seeding is attempted in central and western Nebraska.

Buffalo grass is a low-growing, sod-forming perennial producing creeping stems which grow vigorously. In contrast with other common grasses where the male and female reproductive organs are borne on the same plant and in fact in the same flower, buffalo grass usually produces male

flowers and female flowers on separate plants. The male flowers are borne on flowering stalks and the female flowers are located on very short stems, embedded among the numerous leaves. Buffalo grass, being unable to compete with tall grasses on moist soils, is confined largely to the dry soils of the state. It is an important grass in central and western Nebraska. It does not do well on sandy soils and accordingly appears sparingly in the sandhills. It withstands close grazing and pairs well with blue grama; together these species dominate the native short-grass pastures of the state. Buffalo grass produces forage of excellent quality and the growth cures well on the ground, providing palatable, nutritious fall and winter pasturage. It is a meager seed producer and the seed is difficult to harvest because it is borne close to the ground. Buffalo grass can, however, be readily propagated by sodding. It is highly recommended for pasture lands of central and western Nebraska.

Western wheatgrass is a persistent perennial, producing vigorous, creeping rootstocks, and spreads rapidly after becoming established. It is highly resistant to drouth and cold, and is one of the most tolerant of the native grasses to alkali. Western wheatgrass occurs throughout the state but it is particularly abundant in western Nebraska. It is an erratic seed producer but the seed can be harvested easily and economically. The forage is nutritious but somewhat unpalatable. The seeding of western wheatgrass for pasture purposes is recommended for central and western Nebraska.

Sand dropseed is a bunch-forming grass, even though it has short rhizomes, and grows to a height of one to three feet. The stems are normally erect but become somewhat prostrate under grazing. The matured flowering panicle is usually open, but it is frequently partially enclosed by the uppermost leaf sheath, an uncommon characteristic among most other grasses. Sand dropseed occurs on the drier soils of the state and is one of the most important species in the sandhills. Like side-oats grama, it is one of the first to appear in the restoration of drouth-injured native pastures. The forage is of fairly good quality. It is a prolific seed producer and the seed is easily harvested, but artificial seedings for the most part have not been successful. It reseeds readily under natural conditions.

Alfalfa provides excellent pasture for hogs.



Legumes

Alfalfa is a desirable legume for pasture purposes. It can be used advantageously in mixtures and it is sometimes grazed in pure stands. Because of its high nutritive qualities and heavy carrying capacity it is particularly valuable as a pasture crop. The chief difficulty encountered in grazing alfalfa is the danger of bloat. This danger is largely removed when alfalfa is grown in mixtures with grasses. Pure stands may be utilized for grazing horses and hogs, and the danger of bloat with sheep and cattle can be reduced by following proper management practices. Precautions are as follows: feed hay or grain to the animals prior to turning them on alfalfa pasture; give animals access to grass pasture or dry roughage while they are grazing alfalfa; and make salt and water conveniently available. The first cutting should ordinarily be used for hay and grazing started thereafter.

Alfalfa suffers severe damage from too close grazing or excessive trampling when the ground is wet. Accordingly, judicious grazing and other careful management practices are essential.

Sweet clover grown in Nebraska consists largely of the white biennial and the yellow biennial types. There are several varieties of each, but as yet recognized sweet clover varieties are not generally handled by the Nebraska seed trade. The annual types, both white and yellow, are not popular among Nebraska farmers. A large acreage of sweet clover is devoted annually to pasture, but most of this is used in temporary pasture. The use of sweet clover in this capacity is discussed in the section, "Temporary Pastures."

Alfalfa seedings with a little brome grass provide excellent hay meadows and after a few years can be used for pasture.



Sweet clover has been used rather commonly in permanent pasture mixtures, but it is being replaced to some extent by alfalfa. It provides abundant feed for two years, but usually disappears at the end of this time. Under average conditions the amount of seed used in a pasture mixture should not exceed two or three pounds per acre. A heavier rate results in too much competition for the grasses during the first year or two.

White (Dutch) clover is a low-growing perennial with stems which creep along the surface of the ground, take root, and produce new plants. Like Kentucky bluegrass, it spreads naturally over the eastern part of Nebraska during the years when moisture conditions are favorable. Prior to the drouth beginning in 1934, these two species constituted much of the pasture in this part of the state. However, white clover is not drouth-resistant and hence much of it disappeared during the extreme drouth years. It withstands close grazing, is not shade tolerant, and provides good spring and fall pasture. During the hot, dry summer months it is more or less dormant. It is low yielding in comparison with alfalfa and sweet clover. White clover pasture causes slobbers in horses.

Alsike clover is a perennial legume living about two to four years under Nebraska conditions. It is rather shallow-rooted and the plants lodge considerably. Because it is best adapted to a cool, moist climate, it is of limited value in the state. Growth is fairly good on somewhat acid and poorly drained soils, conditions under which most other legumes will not thrive. It is recommended in pasture mixtures for low, wet lands subject to flooding and pairs well with redtop under these conditions.

Red clover is a biennial, best adapted to humid conditions. Accordingly its use in Nebraska is restricted to the extreme eastern part of the state and to the irrigated and subirrigated lands of the remainder. It makes excellent pasture, especially for young stock. It may, however, cause bloat. Red clover may be used to the extent of three to five pounds of seed per acre in pasture mixtures.

Lespedeza is of two kinds: the annual and the perennial types. Perennial lespedeza, commonly sold under the name of "sericea," is not recommended under Nebraska conditions, because it produces rather stemmy forage, is unpalatable to livestock, and is subject to winterkilling. There are a number of varieties of the annual lespedeza of which Korean is the most common.

Korean lespedeza is a low-growing, much branched annual with fine stems. It resembles alfalfa in general appearance, but it seldom grows over a foot high. It is a low yielder under Nebraska conditions, although the forage is of excellent quality. It is better adapted to acid soils than other legumes. Being an annual, it must produce seed nearly every year in order to maintain itself in a permanent pasture. Under Nebraska conditions it is not dependable in this respect. Where alfalfa, sweet clover, or red clover can be grown, they should be used in preference to lespedeza. There are acid soils in southeastern Nebraska where these common legumes do not thrive and where lespedeza may be used to advantage.