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BROMEGRASS PRODUCTION

in Nebraska



CIRCULAR 68

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

W. W. BURR, DIRECTOR—LINCOLN, NEBRASKA

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Bromegrass Production in Nebraska¹

A. L. FROLIK and L. C. NEWELL²

BROMEGRASS (*Bromus inermis*) is a hardy, long-lived, introduced perennial grass which is rapidly increasing in acreage on Nebraska farms. It is also known as smooth brome, awnless brome, Hungarian brome, Russian brome, and Austrian brome.

A native of the old world, from central Europe to China, bromegrass was introduced into the United States about 1884. In 1899, the Nebraska Agricultural Experiment Station reported that "all things considered, it is the most promising cultivated pasture grass for this state that has been tested on the Station farm." Early records of the Station show that considerable seed was distributed to farmers during the period from 1898 to 1902. A few of these early plantings are still in existence.

Bromegrass increased in popularity in Nebraska until about 1910. Very little interest was shown in this crop during the World War and the years following when the use of grain crops was being stressed and grasslands were being plowed. During recent years, interest in bromegrass has again greatly increased, with thousands of acres being seeded in Nebraska during 1939 and 1940.

CHARACTERISTICS OF BROMEGRASS

Bromegrass is a typical sod-forming perennial, spreading aggressively by rootstocks or rhizomes. It may form a dense sod, and, where adapted and properly managed, tends to crowd out most other species of vegetation. Like Kentucky bluegrass, bromegrass is slow in becoming established after planting and often one to two years are required to secure a good sod. After two or three years in solid stands, it is likely to develop a so-called "sodbound" condition. The plants become stunted, yellowish in color, and yields of forage and seed are reduced. This condition is due largely to a lack of available nitrogen. It occurs under favorable as well as unfavorable moisture conditions but its effects are no doubt intensified by prolonged periods of drouth.

Bromegrass plants grow from two to four feet in height and are leafy and rather prolific seed producers. The seeds are borne in open panicles four to six inches in length. The long, flat seeds are awnless or may have a short awn. The seed ripens during the latter part of June or the first part of July under Nebraska conditions. It is chaffy, ordinarily weighing only 12 to 14 pounds per bushel.

Bromegrass starts growth early in the spring and continues growth late into the fall. Ordinarily it becomes more or less dormant during mid-

¹ Cooperative investigations of the Nebraska Agricultural Experiment Station and the Division of Forage Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.

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summer after seed production, but a longer season of growth is obtained with it under Nebraska conditions than with other grasses of similar seasonal growth habits.

ADAPTATION

Climate

Bromegrass is especially well adapted to a dry to semihumid, cool climate. At the same time it does relatively well under moderate conditions of heat during part of the year. It has proved best adapted to those areas in this country in which the native vegetation was the tall or mid-tall grasses. In recent years bromegrass has come into prominence in the central and eastern Corn Belt states and is being used extensively for both pasture and hay. It is ordinarily recognized as one of the best of the introduced grasses for the prairie provinces of Canada south through the eastern parts of the Dakotas, Nebraska, and northern Kansas. It is superior to other introduced grasses under eastern-Nebraska conditions and can be grown over much of the state, but with less success westward.

Soil

The best soils for bromegrass are the deep silt loams, but it also does well on light sandy soils. Since it requires a readily available supply of nitrogen, the soil should be fairly fertile. Bromegrass possesses some degree of tolerance to alkali, but is surpassed by western wheatgrass in this respect. Short periods of flooding are withstood in a satisfactory manner and the grass will emerge through a considerable deposition of silt.

A bromegrass-alfalfa mixture provides excellent pasturage.



TYPES OF BROMEGRASS

Bromegrass exhibits a variety of types of plants varying in leafiness, height, habit of growth, rhizome production, heat and drouth tolerance, disease resistance, and seed-producing qualities. Seed lots obtained from a broad geographic range produce plants with wide differences in these characteristics.

Considerable breeding work is under way at several experiment stations to develop superior, uniform strains or varieties. A few varieties, none of which is recommended for Nebraska conditions, have been released for farm use in certain other states and Canada.

Experimental work at the Station at Lincoln indicates that the present most satisfactory source of seed is from local old fields, or from fields which have been planted with seed from old fields. Seed produced from such fields in Nebraska or northern Kansas is usually well adapted to Nebraska conditions. Locally adapted varieties produced by selection and breeding have not yet been made available commercially.

SEEDING

Time

The most favorable time for seeding varies somewhat with the locality. Ordinarily, late-summer seeding following a small-grain crop gives the best results in the eastern part of the state. Seeding should be done from August 20 to September 15 if moisture conditions are favorable. The practice of late-summer seeding is ordinarily more satisfactory than spring seeding because of freedom from weed competition and the lessened danger from injury by heat and drouth. This practice gives seedlings the advantage of the cool fall and spring seasons in which to become established before a prolonged hot season. Late-summer and fall seedings, however, are often subject to injury from grasshoppers, and if planting is delayed past Sep-

A bromegrass selection nursery at the Agricultural Experiment Station, Lincoln. Spaced plants are grown from single seeds, for selection and breeding of superior varieties.



tember 15 the danger of winterkilling increases materially. As one proceeds westward in the state, seeding following a small-grain crop becomes less practical because the soil is too dry. Under such conditions it may be practical to store up moisture by means of summer fallowing and then seed in August.

An important factor in spring seeding is to get the seed in as early as the ground can be worked in order that seedlings may become established before hot weather begins. Frost injury is relatively infrequent. Even if a legume such as alfalfa is used with brome grass, it is better to plant early and risk frost injury to the legume than to delay and thus increase the risk of injury to the seedlings by hot weather later.

Preparation of Seedbed

A seedbed for brome grass should be moist, finely pulverized, firmly packed, and free of weed seeds.

Spring-seeded brome grass may be sown advantageously on land plowed the previous fall, wherever fall plowing is practical. Otherwise the ground should be plowed as early as possible in the spring. In either case, it should be thoroughly pulverized and packed with such implements as the disk, harrow, and corrugated roller prior to seeding. If planted in late summer following a small-grain crop, the land may be plowed or thoroughly disked immediately after harvest. The use of a subsurface tillage machine offers possibilities for seedbed preparation in which the crop residue is left on the surface for soil and moisture conservation. Following the initial preparation, the ground should be worked as may be necessary to prevent weed growth and to prepare a pulverized, well-packed seedbed. A corrugated roller is an excellent implement to use just before and again after seeding, thereby helping to pack the seedbed.

Depth

The seed of brome grass should ordinarily be covered to a depth of one-half to three-fourths inch. It may be planted slightly deeper if the soil is dry or sandy. However, failure to establish stands in many cases may be due to seeding too deep. For this reason, shallow seeding is considered very important.

Rate

Brome grass in pure stands should ordinarily be seeded at the rate of 15 to 20 pounds per acre. Under most conditions for either pasture or hay, alfalfa should be included in a mixture with brome grass. If the planting is intended primarily for pasture, a good proportion is 15 pounds of brome grass and 3 pounds of alfalfa seed per acre. Brome grass is included in most introduced-grass mixtures recommended for Nebraska conditions, and it should ordinarily constitute at least 50 per cent of the mixture. A common practice is to include 3 or 4 pounds of brome grass seed in a full planting of alfalfa. Such a mixture makes excellent hay for several years and eventually, as the brome grass increases, the field provides excellent pasturage.

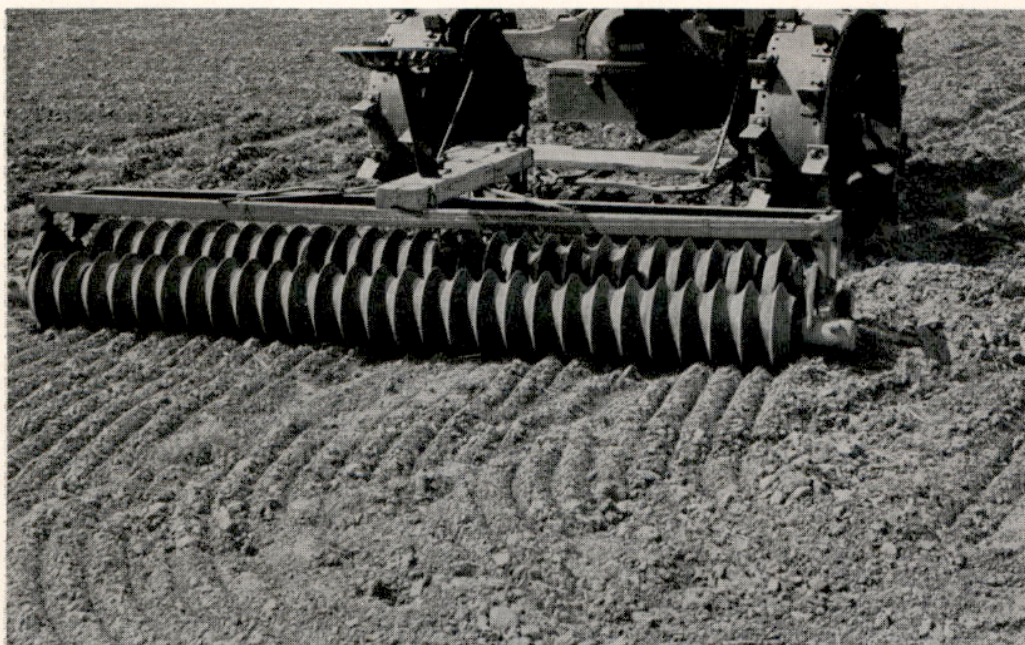
Methods

The light, chaffy character of brome grass seed causes difficulties in planting. This has no doubt been a factor in the slowness with which the grass has met favor and may also have contributed to the difficulty in obtaining stands.

A common method of planting brome grass has been by hand on the surface of a well packed but roughened seedbed. The broad flat seed is easily broadcast if done on a quiet day or on one with a light breeze. With practice, a uniform spread of the seed can be obtained, as it can easily be seen on the soil surface. An endgate seeder may be used for broadcasting the seed. A mixture of a small amount of grain in the hopper as a companion crop facilitates the feeding through of the seed. Broadcasting should be followed by a light harrowing to cover and by packing with a corrugated roller.

Drilling is recommended over broadcasting because a more uniform distribution and depth can be secured. It is necessary to adjust the depth control connections carefully in order to insure a uniform, shallow depth of planting. On most drills the pressure rods, used to connect the pressure arms with the disks, can be lengthened or shortened to vary the depth obtained with a given setting of the depth lever. This makes it possible to obtain shallow depths without affecting the automatic throwout that operates in the drive to the planting mechanism. In some cases it may be necessary to devise other ways to obtain a shallow setting of the disks. Another important advantage that may be gained by using a press drill or drill equipped with press-wheel attachment is the packing of the soil over the seed in the furrows. The press wheels leave the soil well packed

A corrugated roller is of value in preparing a firm, well-packed seedbed.



and yet rough enough to retard water runoff and blowing soil. Another rolling after drilling may not be desirable if it causes the seedbed to be left too smooth.

Most farmers experience considerable difficulty in getting brome grass seed to flow through the ordinary drill. For this purpose, good-quality seed free of stems and leaves is desirable. The seed has a tendency to "bridge over" the holes in the bottom of the drill or across the tops of the grain spouts. This effect may be completely overcome by the use of "processed" seed. (See section on Seed Harvesting and Cleaning.)

Since processed seed may not be available, it is usually necessary for a helper to ride the drill for the purpose of poking the seed through with a lath or other instrument. Only a small amount of seed should be put in the drill box at one time. The "bridging" effect may be prevented in part by the planting of a grain with the brome grass and by the use of an agitator.

Oats or barley may be used to facilitate drilling and to act as a companion crop. The use of a rapidly growing crop is especially desirable on sandy or sloping land or on large fields subject to erosion. The grain should be seeded at a rate that will not offer too serious competition to the brome grass. With fall seeding competition is removed by winterkilling, but the spring grains make sufficient growth to afford considerable protection from blowing soil and water erosion. The companion crop seeded in the spring should not be considered as a crop for grain harvest, two pecks per acre being a maximum rate under the most favorable conditions. Competition under drouthy conditions is most serious. Consequently if a large proportion of grain is necessary to facilitate drilling, its viability should be destroyed in part by heating in a hot oven.

The seedbed should be solid beneath and firm enough on the surface to prevent drilling too deep. With favorable moisture such a seedbed insures an even stand.



The ordinary type of agitator found in drills is not well suited to brome-grass seed. A homemade agitator, built with one-by-one-inch wood the length of the drill and wires of different lengths, has been used successfully. Three long wires projecting from the wood into each of the drill cups provide the necessary agitation to cause the flow of the seed. The outer two wires should be shorter than the center one. This type of agitator is superior to a single nail or wire which tends to produce, rather than remedy, the undesirable "bridging" of the seed. The agitator may be worked rapidly by hand or by power taken from the spokes of the wheel.

In planting a mixture of brome-grass and a legume, the legume may be seeded in the grass-and-legume seeder attachment on the drill, or broadcast ahead of the drilling or the last packing operation. The legume seed should not be mixed with brome-grass seed in the drill box, because of the tendency of the smaller seed to settle and be planted first.

Care After Seeding

Brome-grass seeded alone or in mixtures should be permitted to become well established before it is pastured. The amount of growth should be the criterion in deciding when to turn the stock on the new pasture. The companion crop, if used, may be pastured off judiciously. Cutting the companion crop for hay in June is preferable to cutting it for grain.

For spring seedings without a companion crop, mowing the weeds about the middle of June is ordinarily desirable. Many plantings are killed by delaying the mowing until midsummer. The sudden exposure of the tender seedlings to the heat and drouth may be fatal. Other mowings should be made during the season as needed. The sickle bar should be set to mow relatively high, and the clipping should be done if possible during cool, damp, and cloudy weather. Fall-seeded brome-grass will ordinarily require little mowing the following year to control weeds.

USAGE AND MANAGEMENT

Pasture

Brome-grass, where adapted, is an excellent pasture grass, particularly when seeded in a mixture with a legume such as alfalfa or sweetclover. It resumes growth early in the spring and grows late in the fall with an abundance of feed produced during these periods. It becomes somewhat dormant during the hot, dry summer months.

The pasturage furnished by brome-grass is highly palatable and nutritious. All classes of livestock relish brome-grass. It differs from many grasses in that it remains relatively palatable up to maturity and thus a more uniform grazing is obtained when grown with a legume such as alfalfa. This has two advantages in that: (1) the stand of alfalfa is not reduced by overgrazing to force the livestock to eat the grass, and (2) grazing may be delayed to obtain considerable growth without the pasturage becoming unpalatable. Brome-grass plantings containing a mixture of alfalfa rank high in carrying capacity.

Bromegrass utilized for seed may be cut high with a binder or combine. The remaining stubble with its heavy growth of green basal leaves affords good pasture during July. Fall pasture is also available following this practice.

Hay

Although bromegrass in Nebraska is used primarily as pasture, it also has value as a hay crop. For this purpose it should be cut in the bloom stage. The second growth is commonly used for pasture.

If bromegrass is planted for hay, it should be mixed with alfalfa in approximately equal proportions, unless a pure-grass hay is desired. The mixture will be much more productive than bromegrass alone.

The yield of hay varies from one to four tons per acre. In quality and feeding value, it compares favorably with timothy. Where bromegrass is cut for a seed crop by binding, the resulting "straw" is relished by horses even though cut too late to make a hay of high quality.

Crop Rotation

Bromegrass offers considerable promise as a crop in rotations in eastern Nebraska and on irrigated lands westward in the state. It may be practical in rotations for as short a period as three or four years. Although sometimes slow in becoming established, it is a heavy yielder during the second to fourth year. After this period its productivity usually decreases, even in mixture with a legume, for the latter usually gradually disappears. Accordingly, it may be more profitable to establish a new field of bromegrass than to keep a field which is several years old. The inclusion of a grass in a rotation leaves the soil in a more favorable condition for the reception of water and also makes it less subject to erosion and easier to till.

Sheep grazing on bromegrass-alfalfa pasture.



Seed Production

Many farmers have realized more profit from seed harvested off their brome grass fields during the past few years than from any other similar acreage on their farms. Like alfalfa, brome grass will often produce a good seed crop even when weather is so adverse that other crops yield little. High seed yields occur in years with favorable moisture supply during May and early June. Yields commonly range from 200 to 500 pounds per acre. The legal weight per bushel is 14 pounds.

Soil Conservation

Brome grass is an excellent plant for retarding water runoff and soil erosion. In this respect it may be used under a wide variety of conditions. The vegetative cover is especially valuable in reducing water and soil losses. Grazing, especially on rolling land, should be managed so that a vegetative cover is present at all times.

It also withstands considerable silting, which makes it especially valuable for erosion control. The heavy mass of roots makes it suitable for use on steep slopes, in field draws which are subject to gullying, for "buffer" strips in strip cropping, for small sod dams and drainage outlets, and on terraces.

Management

It is well to have a definite plan of use for brome grass fields on the farm. For example, if brome grass is to be included in rotation with other crops, a small acreage should be established each year that weather conditions permit. In its early years a field may be used for seed or for hay, with only light pasturing of the later growth. Greater utilization for pasture may be considered after stands are well established.

In pasturing brome grass, greater returns in forage production can be obtained if the grass is not pastured too closely. The amount of growth

Brome grass is ideal for vegetating drainage channels.



should determine when to graze. If it is given a few weeks for growth in the spring before pasturing begins, opportunity is afforded for better root growth and maintenance of stands. Likewise, some growth should be left at the end of the grazing season. Bromegrass fields should not be pastured when too wet nor during the hot, dry midsummer period.

This grass fits well into systems of rotation grazing. It may be used for spring and fall grazing in conjunction with native-grass pastures or with temporary summer pasture crops such as Sudan or sweetclover. Because of its palatability at several stages of growth, it can be used for reserve or for supplemental pasture. These practices are ideal in maintaining perennial grass stands and in insuring a supply of reserve feed.

One of the chief difficulties with bromegrass fields is that they may become "sodbound," a condition that is especially likely to appear in pure stands. Certain practices may be followed to avoid or at least greatly reduce the effects of this condition. Any treatment which stimulates the production of available nitrogen is helpful.

Fertility in the soil will delay the appearance of the sodbound condition. The inclusion of a legume such as alfalfa or sweetclover in a planting with bromegrass is an especially good method of delaying the appearance of this condition. If the legume can be so managed as to persist for a considerable period of time, its effect is the more lasting.

In old bromegrass fields the following practices are recommended to overcome the sodbound condition. The sod may be severely torn up with a plow, disk, or subsurface tillage machine; this practice results in nitrogen becoming more rapidly available for a period of time. Seeding a legume into the disturbed sod offers possibilities during favorable years. The application of barnyard manure is an effective and economical method. The use of commercial nitrogenous fertilizers offers possibilities under favorable moisture conditions, especially if the crop is grown for seed production.

SEED HARVESTING AND CLEANING

A high degree of purity and good quality are essential for the ready sale of bromegrass seed. Within the limits imposed by season, these may be secured by careful attention to the purity and adaptation of the seed planted, and to details of harvesting, cleaning, and storage. If weed seeds such as those of downy bromegrass or hairy chess are planted with the bromegrass or are blown in from adjacent areas, a careful roguing of these plants may be necessary before their seeds ripen. The ingenuity of the farmer is challenged in adapting his own machinery to the job of harvesting and cleaning. Both threshing from bundles and combining in the field are to be considered.

Binding and Threshing

Bromegrass may be cut for seed with a grain binder after most of the seed has passed the soft dough stage. If the binding is delayed until the seed is entirely ripe, considerable shattering of the best seed may result.

The stems and leaves retain their green color and moisture during the ripening of the seed. Consequently, the bundles should be made small. The trip spring should be adjusted to compress the stems sufficiently to allow for shrinkage of the bundle while drying. Shocks likewise should be small for best curing. The presence of large succulent weeds in the bundles may cause loss by molding. Large areas of weeds, sometimes found in new stands, should be avoided; other scattered weeds should be rogued.

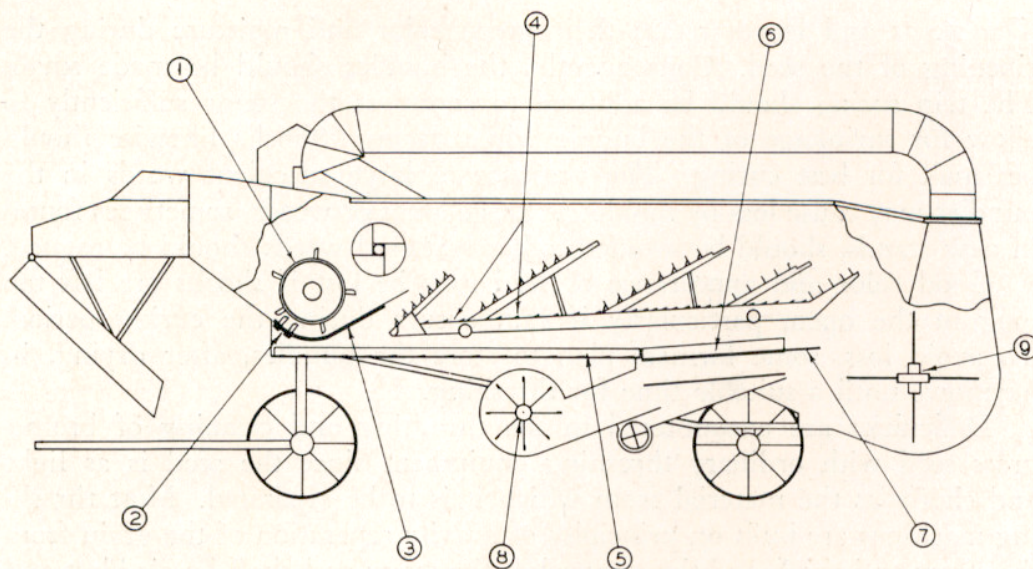
Good color and appearance of seed may be lost if shocks are left too long in the open, particularly if rain occurs during the curing period. To avoid loss, some farmers plan to store the bundles, after drying, in haymows until a suitable time for threshing.

Difficulties are encountered in the threshing and cleaning of brome-grass seed with ordinary threshing equipment since the seed is as light and chaffy as the material from which it is to be separated. Most threshing machines are built on principles of gravity separation of the grain from the straw and chaff, and the removal of the straw and chaff by air blast and suction into the blower. The stems and leaves of brome-grass when dry break easily in the threshing process, thus making the cleaning more difficult. The lightness of the seed requires that little if any air should be used from the grain fan. If the air blast cannot be decreased by the ordinary adjustments, it may be necessary to remove the fan set-screws to allow the fan to idle. In this case the shaft should be kept well oiled.

The actual threshing of the seed should be accomplished with a minimum number of rows of concave teeth. The clearance between the concaves and cylinder should be adjusted to cause as little breakage of the brome-grass as possible, since the finer the material coming through the cylinder, the more it will accumulate on the grain pan and sieves. Here a piling up of the seed along with broken leaves and stems may result in loss over the tailpiece of the upper sieve into the blower. The remedy is to accomplish as much gravity separation from the straw racks as possible. Sheet metal bolted over the grates back of the cylinder may be used to lift all of the threshed material onto the straw racks. It may be necessary to reduce the size of the openings in the straw racks to retain the stems. The seed will then be filtered through the straw racks and have opportunity for separation without accumulating in large piles of trashy material.

Brome-grass harvested for seed with a binder.





Relation of the parts of a grain threshing machine with reference to its adaptation for threshing light grass seed: (1) cylinder, (2) concave set to reduce breakage of leaves and stems, (3) metal covered grates, (4) straw racks stripped with metal to decrease the size of the openings, (5) grain pan, (6) upper sieve or chaffer, (7) tail piece on upper sieve or chaffer extension, (8) cleaning fan idling or with air blast reduced, (9) blower fan.

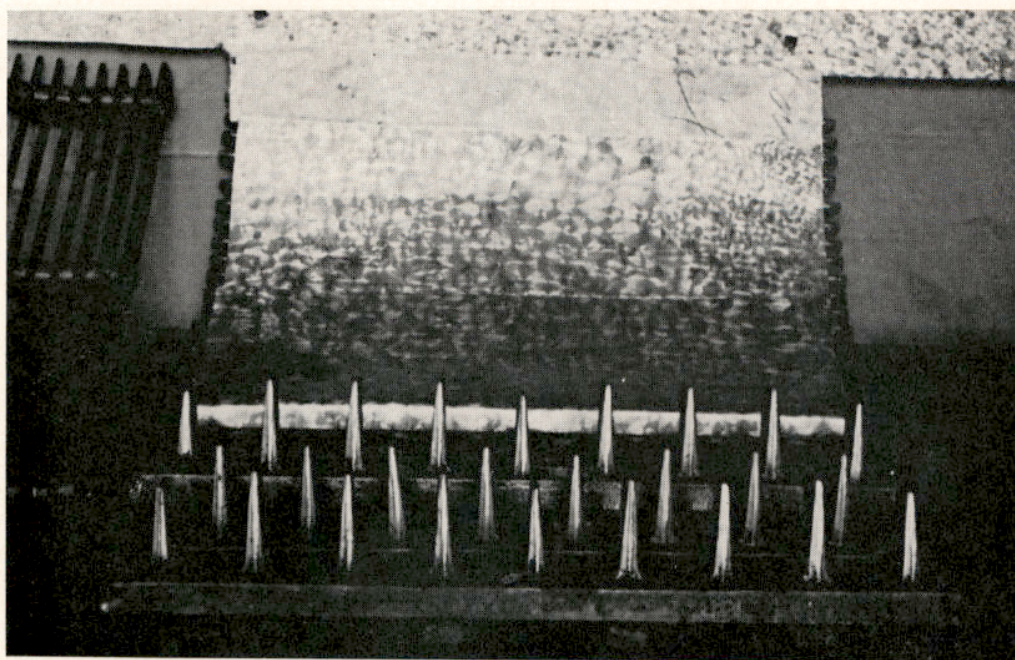
The use of counter drafts produced by opening the rear doors may assist in keeping the seed from being drawn over the upper sieve into the blower. The feeding of the machine should be slow and even, and the machine should be run at a moderate speed.

Combining

Bromegrass seed should be combined only when the seed is fully ripe. Ripening of the seed progresses from the top of the panicle downward. The seed may be considered ripe for combining when the lower branches of the panicles have lost their green color.

The combine may be run over the field at a height which will take the ripened heads and exclude the green leaves and stems of the bromegrass and the seed of short weeds below. Patches of large weeds should be avoided.

The same principles are involved in the operation of the combine as in the operation of the grain thresher. Slow feeding of the machine should be accomplished by pulling it at a slow to moderate speed and by taking a swath of suitable width. Overthreshing may result in too finely cut material for a good separation. Maximum separation should be obtained by gravity through the straw racks. If the openings in the racks are too large, some means of reducing their size should be undertaken such as stripping with sheet metal. The air blast should be cut down to a mini-



The method of covering the grates back of the concaves in order that the threshed material may be raised onto the straw racks. The strips of metal are bolted onto the front edge of each grate and extend over the edge of the next grate section.

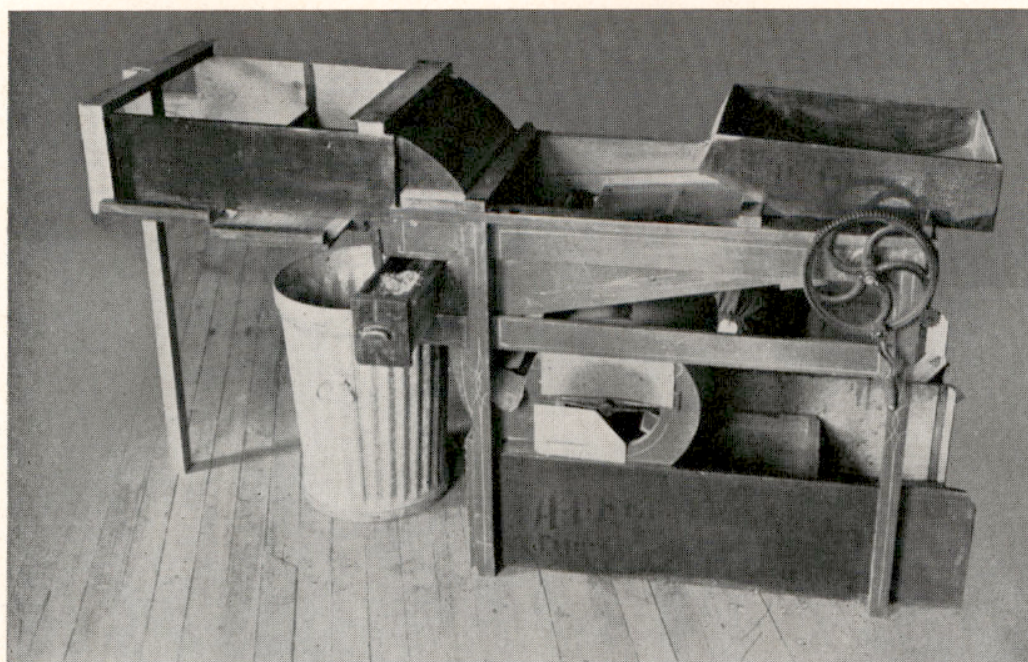
num to save all of the best seed. The instruction books issued by machine companies should be carefully studied for special adjustments.

The newer types of combines with rubber-faced cylinder bar and concaves work well in the threshing of brome grass seed. The use of a combine with a vertical sickle attachment for threshing bundles out of the shock provides another method of harvest.

The small amounts of stems and leaves harvested in combining make the cleaning easier than with ordinary bundle threshing. The seed is more mature and may be of better quality. If any of the seed contains too high a moisture content due to unevenness of ripening or the inclusion of succulent weed material, it should be spread in shallow layers in the bin, with frequent turning until thoroughly dry. Barn floors and rooms in old buildings are frequently used for such drying and storage. A wooden floor is preferred to concrete because it promotes better drying. Seed which is allowed to heat will be of low viability.

Recleaning and Processing

Brome grass seed as it comes from the combine or thresher frequently is of low purity because of large amounts of broken stems and leaves. In this condition it commands a low price. A common practice is for the farmer to sell his seed to the seedsman on the basis of pounds of recleaned seed. Other farmers prefer to retail their own seed. In this case, some recleaning on the farm is desirable. A small fanning mill which can be



A type of fanning mill adapted to clean brome grass seed. Stems and leaves are removed by the sieve. The heaviest seeds fall through the air blast and are collected at the bottom of the machine; the lighter seeds are blown over and are separated into additional grades.

purchased at a reasonable cost should prove to be a good investment. Such a machine may be adapted for removing the foreign material and separating the seed into several grades. The heavier seed may be sold at the higher prices for drilling, whereas the lighter, chaffier seed may be used for broadcast plantings along margins of fields and in thickening up stands.

A method of processing² has been devised to remove the awns and appendages of certain light, chaffy seeds so that they may be drilled. This is accomplished by the rubbing action of the seeds over one another as they are run through the hammermill type of feed grinder. In using this machine, it is very important to operate it at slow speeds from 300 to 1,000 rpm., depending on the diameter of the cylinder and the type of seed to be cleaned. The size and adjustment of the screen through which the seeds pass should be such as to crack as few as possible. With brome grass seed this process markedly increases the test weight of the seed and greatly increases the ease with which it may be drilled.

Farmers as well as seed dealers who offer brome grass seed for sale within the state should inform themselves on the Nebraska Seed Law. Seed must be properly labeled in order to comply with the law. This is a protection both to the seller and the buyer. For interstate shipments of seed the Federal Seed Act applies. Information relative to seed laws may be obtained from the State Seed Analyst, Capitol Building, Lincoln.

² This method of processing light, chaffy seeds was developed by the Nursery Section, Soil Conservation Service, U. S. Department of Agriculture.