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Adjusting Planters and Listers for Sorghums

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IT IS THE PURPOSE of this circular to present data and suggestions that will aid the farmer in attaining greater success in the planting of sorghum. It has been prepared primarily for the machine operator; and, although it is not a complete discussion of planters and listers, it contains highly practical suggestions regarding the adjustment of the corn planter and lister for sorghum seed.

Sorghums are no exception to the familiar fact that rate of seeding has much to do with the quality of the stover and the yield of grain per acre. The question of how much seed to plant is not as easily answered for sorghum as it is for other crops. Stands may be influenced by a number of factors, including size and viability of seed, seedbed conditions, and planter adjustment. Experience has shown that application of certain practices will do much to control these variable factors.

Choosing the Proper Seed Plate

Two methods may be used to obtain the proper seed plate for a given sample of seed. These methods are: (1) Send seed to the nearest implement dealer or branch house for a seed plate test. (2) Drill blank plates to fit the seed.

Usually if a representative quart sample of seed is sent to a dealer he will be able to determine the correct seed plate to use. If the dealer is not equipped to do seed-plate testing he will send the sample, or advise about sending the sample, to the nearest branch house for a test. There generally is no charge or obligation for this service. When seed is supplied for testing it should be accompanied by the following information:

1. Model number of the planter or lister.
2. Width of row.
3. Number of kernels desired per hill, if checked, or spacing if drilled.
4. Sprocket arrangement to be used with the selected plate.

In drilling blank plates it is necessary to consider a number of factors that may affect the seeding rate of a lister or planter. Some of them are: number of holes in the seed plate, size of hole, shape of hole, thickness of the plate, ground travel of the lister per revolution of the plate, size of seed, and condition of the seed box. There are as many combinations of these factors as there are models of listers. Since some of the variations occur in the seed as well as in the seeding mechanism, it is evident that no general solution will fit all cases.

Importance of the Instruction Book

The first step toward the solution of the problem of drilling blank plates is to make a close study of the lister or planter instruction book. In-

formation contained here may help to eliminate a number of the steps that are otherwise necessary. If the instruction book has been lost, a new one can generally be secured from the manufacturer. This book not only contains helpful tables that give the wheel travel per revolution of the seed plate and the drilling distances that can be obtained with various combinations of sprockets and seed plates, but also other information that will aid in securing the most efficient operation of the machine.

Determining Number of Holes

If the instruction book is not available it will be necessary for the operator to determine the number of holes needed in the plate to give the seed spacing desired. It is not practical to give a fixed rule governing the number of holes to drill in a seed plate since the size of the seed plates and ground travel of the lister or planter per revolution of the seed plate vary greatly. Some farmers follow the practice of drilling from two to three times as many holes in their sorghum plates as there are holes in their corn plates. The reason for doing this is based on the spacing of the kernels of corn by the lister or planter. If the kernels of corn were spaced 17 inches apart and twice as many holes are drilled in the sorghum plate it will drop seeds each 8½ inches of ground travel. A popular practice has been to drill a sufficient number of holes in the plate to allow sorghum seeds to drop from adjoining holes each 6 to 8 inches of ground travel. (The term "sorghum seeds" is used because it is good practice to drill the holes large enough to hold two or more seeds.)

There are three ways by which the seeding rate of a lister or planter equipped with a given size of seed cell may be varied, namely:

1. By changing the sprocket or gear ratio between the driving axle and the seed-plate drive gear.
2. By increasing the number of holes in the seed plate.
3. By changing both the sprocket or gear ratio and the number of holes in the seed plate.

If the rate at which the seed plate turns, with reference to the drive wheel, is increased —or in other words if the ground travel of the machine per revolution of the seed plate is less—the number of holes required to give a certain spacing of the seeds will be smaller. Conversely, if the rate of turning of the seed plate is decreased the number of holes required to give a certain spacing of the seeds will be larger. By means of the first and second adjustments, two listers using plates of the same thickness and holes of the same size yet each having a different number of holes, can be adjusted to give the same spacing of the seed and, consequently, the same rate of planting.

It is good practice to select a plate having the proper number of holes to give the desired seed spacing when an intermediate drive sprocket or gear is used. This arrangement permits a change in the seeding rate by increasing or decreasing the ground travel of the planting machine during one revolution of the seed plate.

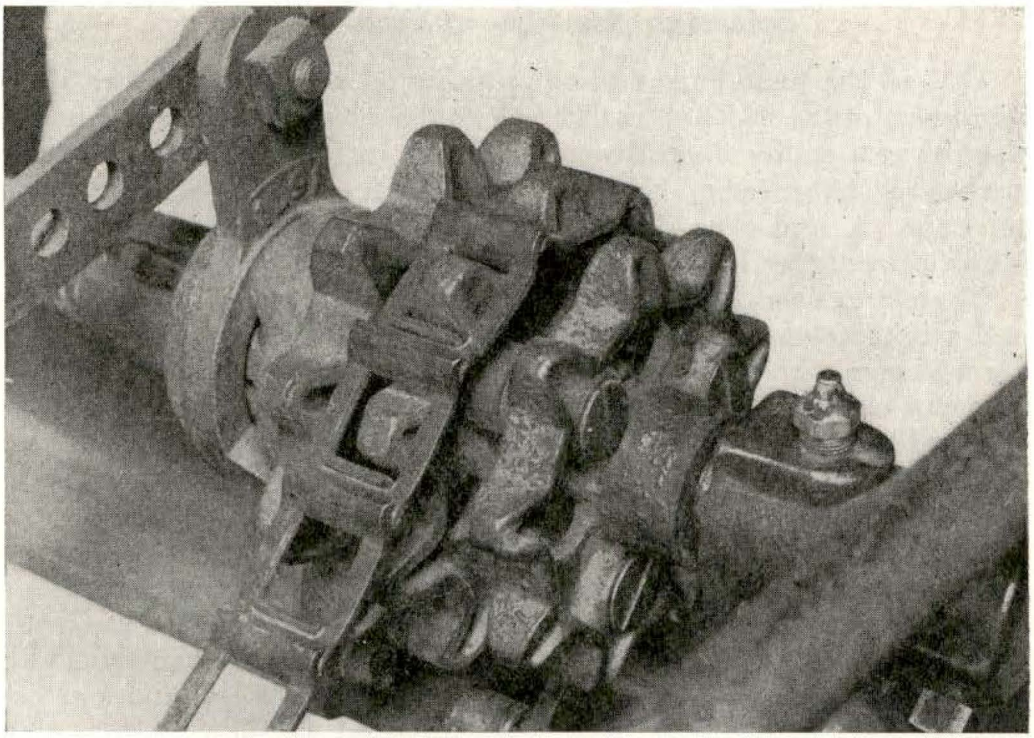

FIG. 1.—The ground travel per revolution of the seed plate can be changed on most listers and planters by changing a sprocket or gear setting in the seed-plate drive. It is good practice to drill a sufficient number of holes in the plate to give the desired seed spacing when the intermediate sprocket or gear is used.

If the relationship between the sprocket and gear setting, number of holes in the seed plate, and seed spacing is not given in the instruction book, it can be determined by the following procedure:

1. Block the drive wheel off the floor.
2. Engage the seed shaft clutch.
3. Place a mark on the seed-plate drive gear and a corresponding reference mark on the seed-box floor plate or on some other stationary part of the lister.
4. Fix a reference point near the rim of the drive wheel and mark the rim of the drive wheel at the reference point.
5. Turn the drive wheel enough to give one revolution of the seed plate; then measure the inches of drive-wheel circumference that passed the reference point while the seed plate was making one revolution.
6. Determine the number of holes needed in the seed plate to give the desired seed spacing as follows: divide the inches of wheel circumference that passed the reference point during one revolution of the seed plate by the distance (inches) desired between the seed dropped from two adjoining holes in the plate. A seed plate 7 inches or more in diameter can accommodate 32 to 36 holes up to 17/64 inch in diameter.

Selecting the Size of Hole to Use

One of the most important adjustments on a lister or planter is the adjustment of the size of seed-plate hole to the seed to be planted. Accurate planting is a matter of mechanical precision; one cannot depend upon a mechanical seed-selecting device to handle all sizes and shapes of seeds without error. A seed plate designed to handle only one seed per hole will handle correctly seeds having only a limited variation in size.

Therefore, since there is generally considerable variation in the size of seed within samples taken from a given variety of sorghum, it is good practice to choose a hole size that is large enough to hold at least two seeds of the milos or feteritas and from two to three seeds of the sorgos or kafirs. The seed holes tend to clog when the average number of seeds per hole is less than two. This tendency is shown clearly in Table I in the first two groups of data taken with Sooner Milo and feterita. Even though this precaution is taken to prevent clogging, it should be emphasized that a grader is an important accessory for a seeding machine using perforated seed plates.

Table I contains a summary of calibration data taken with a lister carefully adjusted to plant sorghum seed and operated under simulated field conditions. The number of holes in the seed plate and the sprocket combination used to drive the plate were arranged to allow seed to drop from adjacent holes each 6 inches of ground travel. Representative samples of certified seed were used in all of the tests. The plates used to obtain the data were 5/32 inch thick.

The data in Table I are presented to show how the seeding rate will vary with the size of the seed hole when other factors are held constant and to offer a basis for choosing the proper size of hole to use when planting a given variety of sorghum. Since there are a number of factors other than hole size that may affect the seeding rate, the data should be considered to be indicative rather than conclusive. Factors other than size of seed hole which may affect the seeding rate are size of seed, plate thickness, sprocket or gear combination used to drive the seed plate, and the condition of the seed box. In general, these data indicate that when sorghum is planted with a plate that is 5/32 inch thick, there is a fairly close relationship between the average number of seeds per hole and the pounds of seed planted per acre. For good plump Sooner Milo seed this relationship is such that the number of pounds planted per acre is approximately equal to the number of seeds dropped per foot. For good sorgo and kafir seed, the pounds of seed planted per acre amount to approximately one-half the number of seeds dropped per foot.

With reference to Table I, it can be noted that the number of seeds per pound in the variety samples used varied from 12,600 for Sooner Milo to 33,400 for Early Sumac. There may be also considerable variation in seed size within a given variety. For example, samples of Early Kalo varied from 23,000 to 33,000 seeds per pound. It is therefore quite evident that the size of seed is an important factor to consider when the seeding

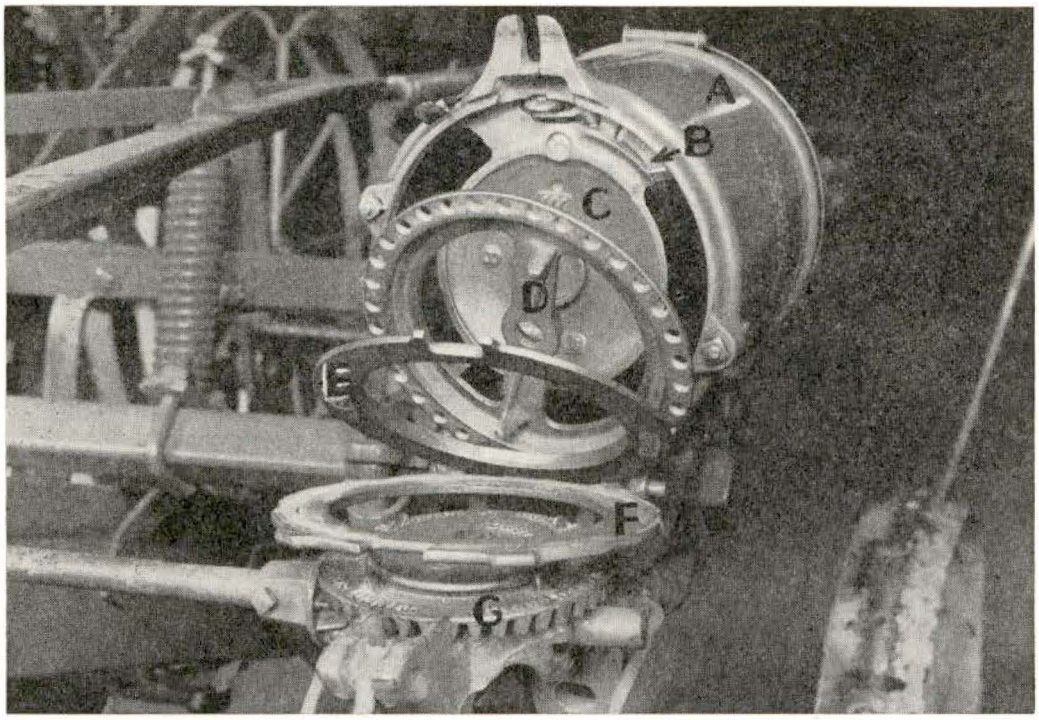

FIG. 2.—The seeding mechanism of a lister is made up of several important parts. Some of the parts are: *A*—sheet metal hopper; *B*—cut-off; *C*—cone; *D*—seed plate; *E*—false or filler plate; *F*—box bottom; *G*—seed-plate drive gear.

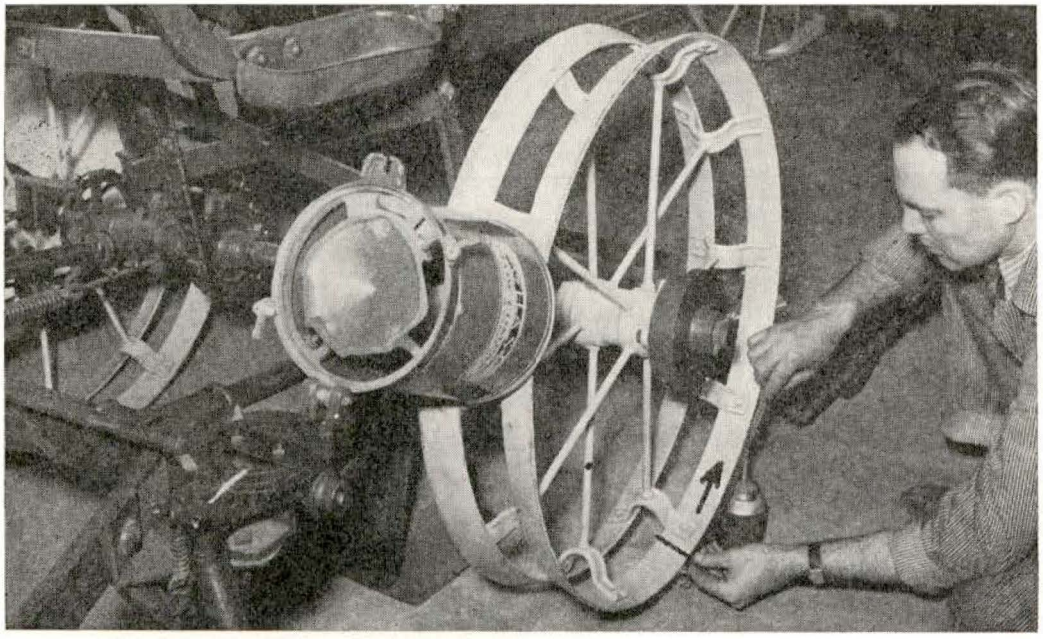

FIG. 3.—The seed-plate drive gear has made one complete revolution, while the drive wheel lacked 9 inches of making two revolutions. Since the drive wheel is 92 inches in circumference, the inches of wheel circumference that passed the tip of the oil can spout was 2 x 92–9 or 175 inches. In other words, this lister must travel forward 175 inches to produce one revoultion of the seed plate. If seed is to be dropped each 6 inches of ground travel there will need to be 175 ÷ 6 or 29 holes in the plate.

TABLE 1.—*Effect of seed-hole diameter on the seeding rate of a lister carefully adjusted to plant sorghum seed—adjusted to drop seed each six inches of ground travel. With this spacing twice the average number of seeds per hole will give the number of seeds dropped per foot.*

Diam. of hole	Sooner Milo 12,600 seeds per lb.		Feterita 15,900 seeds per lb.		Early Kalo 23,200 seeds per lb.	
	Seed per acre	Seeds per hole	Seed per acre	Seeds per hole	Seed per acre	Seeds per hole
In.	*Lb.*	*Av. No.*	*Lb.*	*Av. No.*	*Lb.*	*Av. No.*
10/64	0.55 [1]	0.3	1.63 [3]	1.0	2.26	2.1
11/64	2.04 [2]	1.0	2.20 [4]	1.4	2.64	2.5
12/64	2.69	1.4	2.32	1.5	2.93	2.7
13/64	3.29	1.7	3.04	1.9	4.15	3.9
14/64	3.77	1.9	4.04	2.6	5.25	4.9
15/64	4.12	2.1	4.48	2.9	5.76	5.4
16/64	4.72	2.4	5.54	3.5	6.59	6.1
17/64	6.00	3.0	6.43	4.1	7.16	6.7

Diam. of hole	Atlas Sorgo 20,900 seeds per lb.		Pink Kafir 22,400 seeds per lb.		Early Sumac 33,400 seeds per lb.	
	Seed per acre	Seeds per hole	Seed per acre	Seeds per hole	Seed per acre	Seeds per hole
In.	*Lb.*	*Av. No.*	*Lb.*	*Av. No.*	*Lb.*	*Av. No.*
10/64	2.13	1.8	2.37	2.1	2.73	3.7
11/64	2.62	2.2	2.55	2.3	3.05	4.1
12/64	2.94	2.5	3.06	2.8	3.55	4.8
13/64	4.06	3.4	3.94	3.6	4.64	6.2
14/64	4.58	3.8	4.85	4.4	5.12	6.9
15/64	5.42	4.6	5.32	4.8	5.14	6.9
16/64	6.15	5.2	6.30	5.7	6.68	9.0
17/64	7.00	5.9	6.99	6.3	7.55	10.1

[1] Thirty holes clogged—1 seed per hole.
[2] Ten holes clogged—1 seed per hole.
[3] Eight holes clogged—1 seed per hole.
[4] Two holes clogged—1 seed per hole.

mechanism is being adjusted to the prevailing planting conditions. It is one of the most important reasons why the planter or lister should be calibrated each year before the start of the planting season. A method that may be used for calibrating a lister or planter will be discussed later.

Corn Plates vs. Sorghum Plates

Owing to the fact that a number of farmers have been using corn plates for planting sorghums with varied success and others have expressed general interest in trying to use corn plates, a test was made to determine the seeding rate of a standard 16-cell edge-drop extra-small corn plate (cell dimensions 1/2″ x 5/32″ x 5/16″). The sprocket combination used with this plate allowed seed to drop each 12 inches of ground travel. The resulting seeding rate was as follows: Atlas Sorgo 14.6 pounds per acre, Sooner Milo 12.7 pounds per acre, Club Kafir 9.3 pounds per acre, and Leoti Red 10.3 pounds per acre. In some cases this was two or three times the recommended amounts. If a corn plate is used, the large number

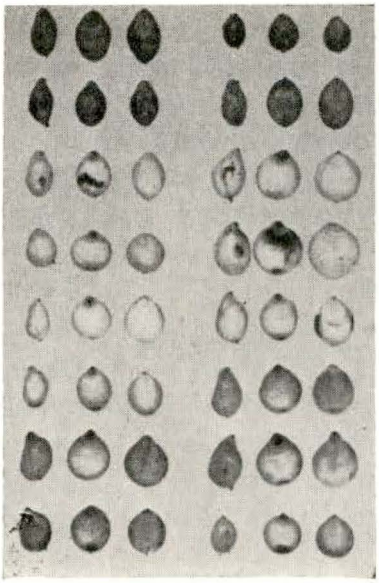

FIG. 4.—Varieties of sorghum seed showing differences in size and shape. Variation may also occur within samples of the same variety. Such variations show clearly the importance of using plates with seed holes suited to the different varieties.

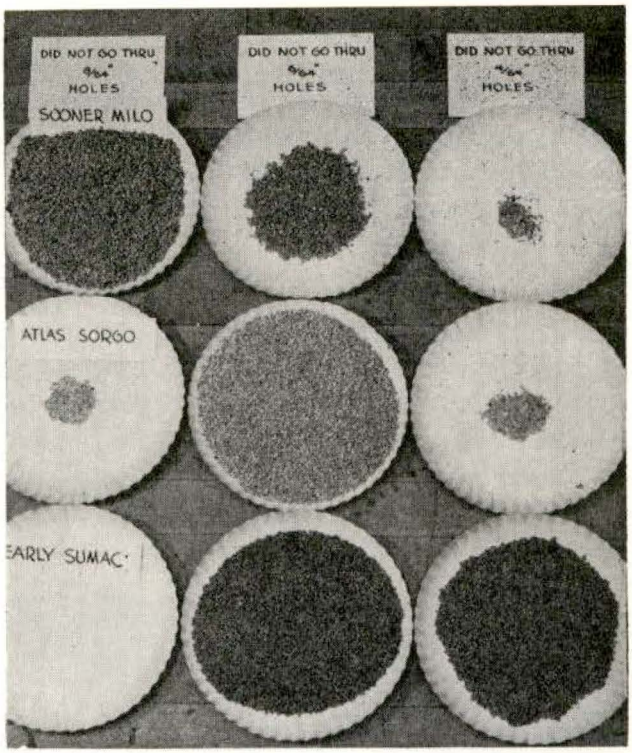

FIG. 5.—Three samples of good plump certified seed that have been sieved to show variation within a given sample. Most samples vary more than these. It is the large seeds, as shown in the sample of Atlas, that cause most of the seed-hole clogging.

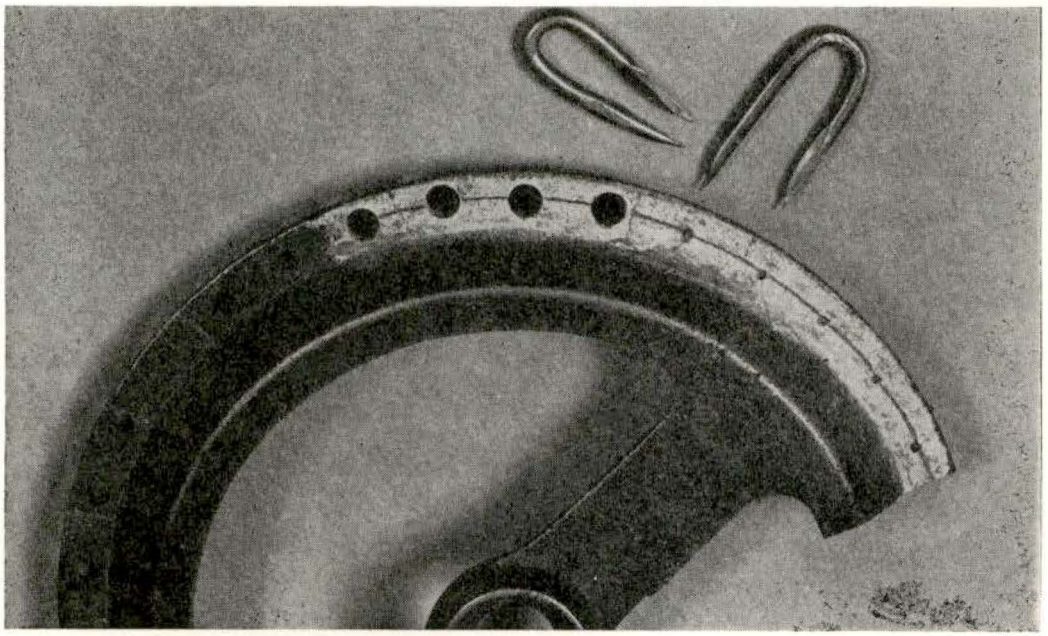

FIG. 6.—The points of a fence staple can be respaced to locate the holes a given distance from the edge of the plate and to space the holes the proper distance apart. The proper distance between holes can be determined by the "cut and try" method.

of seeds dropped from each cell makes it quite desirable to add some device to the seeding mechanism that will spread the seed along in the row. The successful use of a revamped corn plate for planting sorghums will depend to a considerable extent upon the operator's ability to adjust the seeding mechanism and devise a method of distributing the seed in the row. In general, it seems to be most satisfactory to use plates made especially for sorghum.

Drilling the Holes

After the number and size of holes have been determined, the next step is to drill the holes. *As a practical suggestion it is well to use a blank plate to check the box for leaks, as explained further on, before the holes are drilled.* They should be accurately located by the use of dividers (a fence staple, with the points respaced, can be used) and carefully spotted with a center punch. It is important to have them accurately spaced and located on a line drawn at a given distance from the edge of

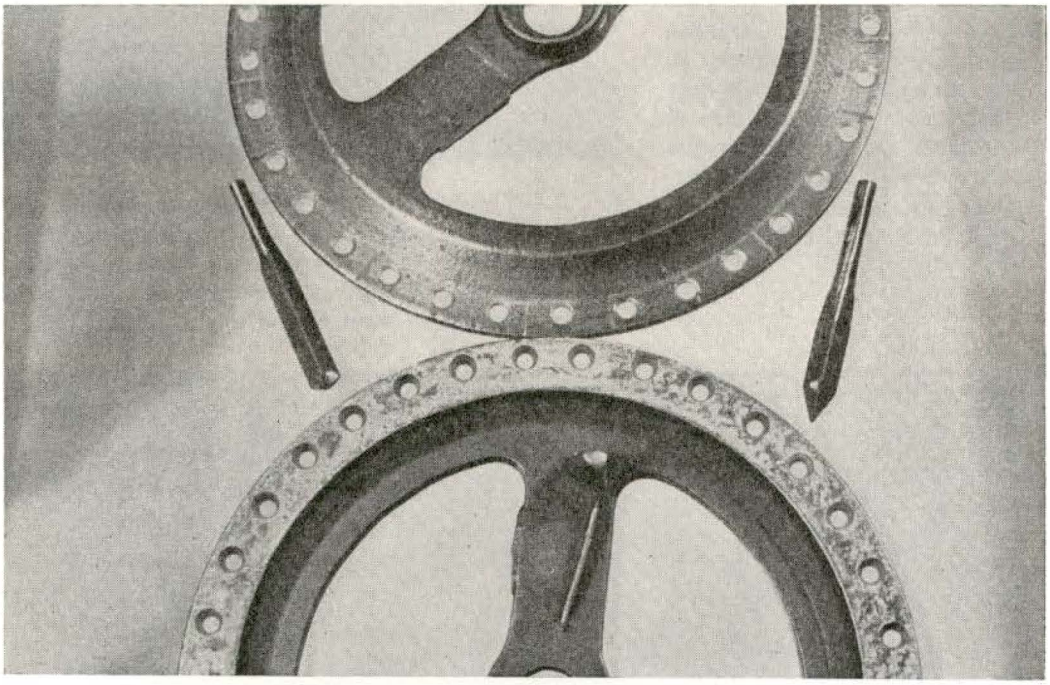

FIG. 7.—Short sections of a three-cornered file can be made into taper reamers. The reamer with the blunt point is used to take the sharp corner off the upper part of the hole. The reamer on the right is used to ream the lower part of the hole.

the plate. A stationary drill is best suited for the drilling operations. Seed plates are made of cast iron and must be handled very carefully to prevent breakage. The portion of the seed plate that is being marked with a punch or drilled should rest on a flat, solid surface.

Reaming the Holes

It is a time-honored rule to taper-ream the lower part of the seed hole so that once a seed enters, it is sure to pass on through without binding. In order to determine the importance of such tapering a test was made

in which a sample of Atlas Sorgo was planted through reamed and unreamed holes. Data taken with an unreamed 32-hole plate showed that seeds clogged twenty-seven 7/32-inch holes, fourteen 15/64-inch holes, and two 1/4-inch holes. The number of seeds clogged into a hole ranged from two to five. Plates with 9/64-inch holes tapered to within 1/16 inch of the upper surface of the plate were used without consistent clogging.

A very satisfactory taper reamer can be made from a 4-inch section of a three-cornered file. One end of the file can be ground so that the three sides come to a point; the other end can be ground to form a round shank so that it will fit into a drill chuck. The reamer point should give the sides of the holes approximately a 30-degree slope.

It is also well to give the seed hole about a 15-degree bevel from the upper surface of the plate. Its purpose, as shown in Figure 8, is to help prevent seeds from becoming wedged between the sharp edge of the hole and the cutoff. If a seed is far enough into the hole so that it cannot be pushed out, the cut-off will slide over the seed and cause the snapping noise often heard coming from the seed box when sorghums are planted. The snapping noise can be further reduced by using a rat-tail file to make a small notch in the cut-off. The notch should be directly over the seed cells and should be small enough to prevent seed from getting by without first going into the seed holes.

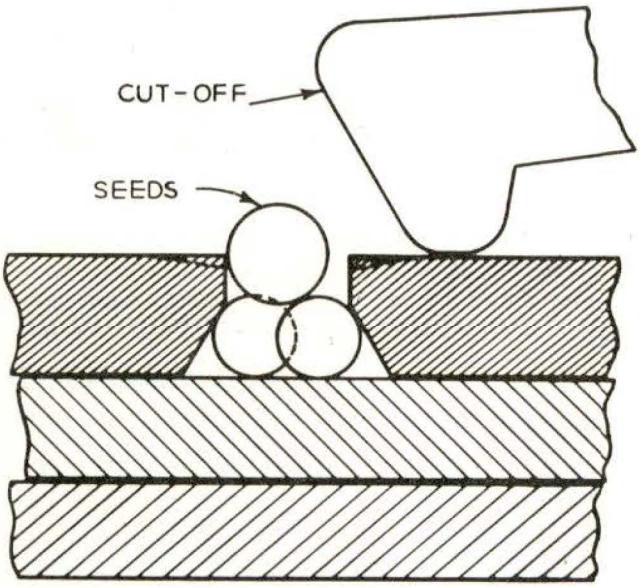

FIG. 8.—If the cut-off strikes a seed that is only partly in the seed hole it must push the seed out or pass over the top of the seed. If the cut-off bounces over a seed it will produce a snapping noise when it drops back. This can be reduced by beveling the upper edges of the seed hole.

Check the Seed Boxes for Leaks

An important step in the adjustment of the seed box is to check the false plate or box bottom for wear and inspect the box to find if there are any openings that will allow the seed to escape around the sides of the plate, between the cut-off and the plate, or by the corner formed by the seed plate, the cut-off, and the seed cone. Tests revealed several new seed boxes that leaked from 1½ to 3 pounds of sorghum seed per acre. The excessive clearance through which the seed leaked was quite easily reduced by brazing. A check for leaks can be made best by removing the sheet-metal portion of the hopper and pouring a small stream of seed directly

on a blank seed plate as it is turned in the base of the seed box; at the same time inspect the seeding device for leaks. If seed leaks by the cut-off it will be carried under the cut-off cover and around the edge of the seed-box cone. Seed that leaks by the edge of the seed plate will drop on the ground. Seed-box leakage should not be entirely unexpected at the present time, for the seeding devices commonly found on listers and planters were designed to handle relatively large corn kernels.

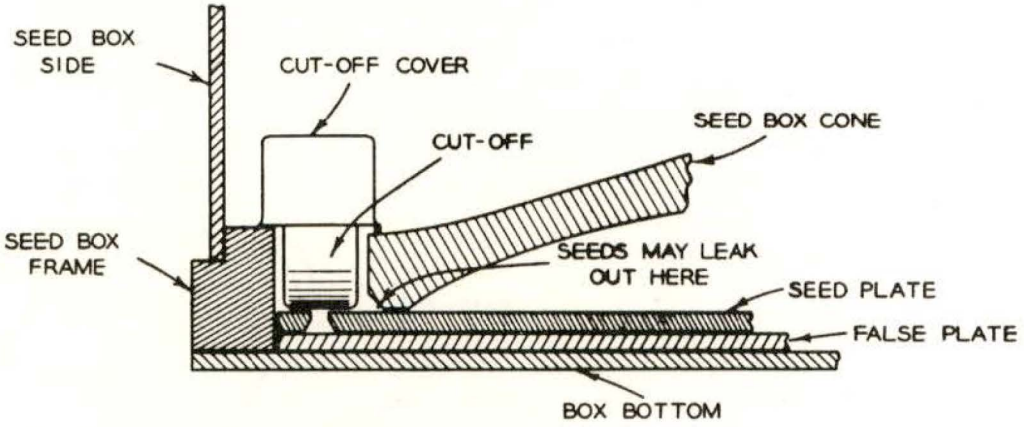

FIG. 9.—Some seed boxes may need to be remodeled or repaired to prevent the small sorghum seed from leaking out. Even new boxes may leak sorghum seed. The diagram shows a place where a leak may occur unnoticed and cause the seeding rate to vary in proportion to the amount of seed escaping.

Some Causes of Cracking

Irregularities in the seed plate, false plate, or box bottom may cause cracking of the seed. During one of the tests an imperfect new false plate was found to be cracking as much as 34 per cent of the seed dropped. In general, it was found that well-adjusted boxes cracked less than one per cent of the seed. The imperfect false plate had 30-thousandths variation in thickness, whereas the other plates giving good performance had less than 17-thousandths variation in thickness. It is rather difficult to detect this small variation without very close observations and measurements. A similar trouble could be caused by a worn false plate or a worn box bottom when there is no false plate used between the seed plate and the box bottom.

Calibrating the Seeding Mechanism

From the results presented in this circular, it is quite evident that the seeding rate of listers and planters cannot be predicted very accurately. The variable factors encountered justify a careful calibration test each season. The seeding mechanism cannot be checked in an efficient manner while it is doing the seeding job. If the planter fails, the mistakes cannot be observed until after the crop comes up, and then it is too late, in some instances, for an effective remedy. The following procedure is suggested for a shop calibration test:

1. Block the drive wheel of the lister or planter off the floor.

2. Measure the circumference of the drive wheel and record this in feet.
3. Place seed in the box, engage the seed-shaft clutch, and turn the drive wheel several times after the seed begins to come through.
4. Place a pan under the seed tube. Make 10 revolutions of the drive wheel, catching the seed in the pan.
5. Count the seeds in the pan. Divide the number of seeds by 10 times the circumference of the drive wheel (in feet). The result will be the approximate number of seeds that would be planted per linear foot.

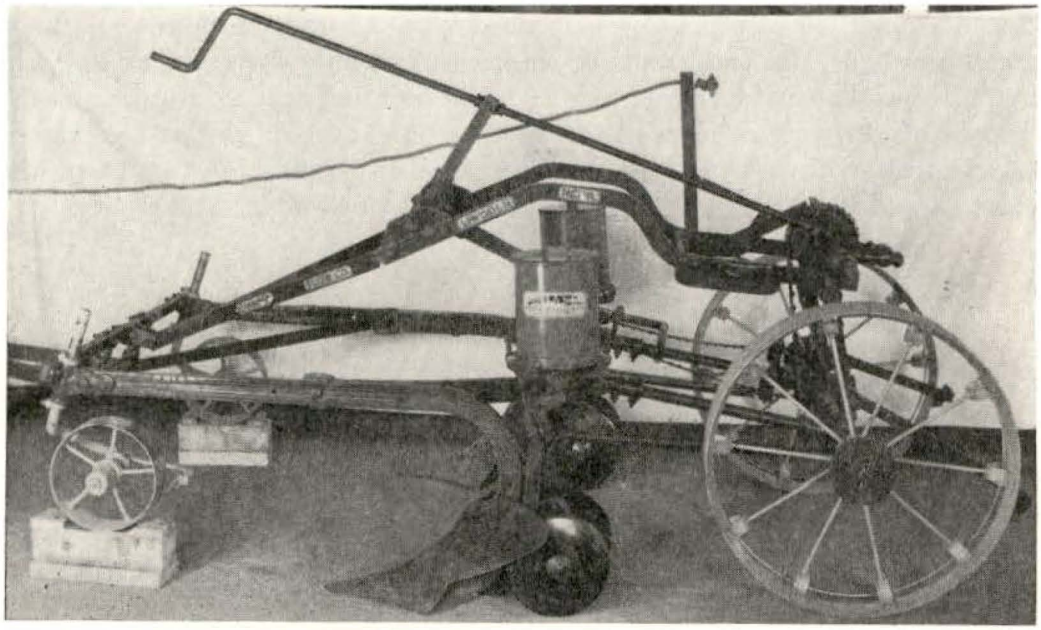

FIG. 10.—A lister blocked up to simulate its working position in the field. The "set" of the bottoms can be adjusted evenly and quickly. The subsoiler can be lowered the proper amount after the bottoms have been adjusted.

Adjusting the Furrow Opening Equipment

Experiments indicate that a good seedbed is of primary importance to sorghum-seed germination and early growth of the young plant. The best seedbed for sorghums is one that will provide warm, mellow, moist soil free of weeds in which the seeds will germinate quickly and uniformly. This information is of particular importance because the main difference in the construction of the planter and lister is based upon the plan of seedbed preparation. Several methods which require the use of either the planter or lister or both machines may be used in getting a satisfactory seedbed. The method employed in its preparation will depend principally upon (1) the available equipment, (2) cost of operation, (3) type of soil, and (4) climatic conditions.

With any method of planting care should be taken to use the furrow-opening equipment in a manner that will reduce the dangers arising from washing. This, of course, is of particular importance when the lister

method of planting is being used. There is also some advantage in making furrows having wide bottoms with the center of the furrow bottom slightly higher than the edges, and gentle slopes to the furrow sides. A furrow of this shape reduces the tendency of water to flow over the seeds or plants; also, it aids in keeping the soil washed from the furrow bank from covering the seeds or plants. Using the planter or lister on the contour will reduce the washing hazard.

Because the lister combines the duties of the plow and the planter, the quality of its work is even more important than in the case of the plow, as it is usually the only equipment used to prepare the soil for planting. To do a good job of preparing a seedbed with a lister, the bottom must be of proper shape, the share must be sharp and properly shaped after sharpening, the moldboard surface must be well polished for scouring, and the bottom properly set in its working position in the field. When the bottom is equipped with a new share and set in this position, the point of the share should be about ⅛ inch lower than the wings of the share.

[10M]