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Seed processing equipment

G. B. Welch

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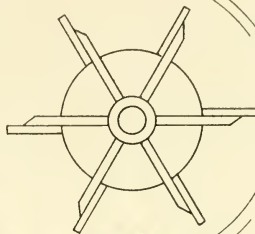
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Seed Processing Equipment



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Seed Processing Equipment

By G. BURNS WELCH¹

New and superior crop varieties make their intended contributions to agriculture only when the seed stocks of such crops reach the farmer varietally pure, in a viable condition, free of noxious weeds, in adequate quantities and at a reasonable price.

Seed producers are dependent on commercial processors for separating, cleaning, grading, delinting, and treating seed they grow. The quality of the final product, regardless of its inherent capacity to produce, is in direct proportion to the processors' ability to remove inert material, weeds and other crop seeds, and to prevent mechanical mixtures of other indistinguishable varieties. The ability of the processor to render these services is affected by the availability of the proper combination of cleaning and separating equipment, the design or arrangement of the processing plant, and the know-how and skill of the operator.

Through the cooperative efforts of the Mississippi Agricultural Experiment Station, the United States Department of Agriculture, and State and Regional Seedsmen Associations, a comprehensive seed research and training program was initiated at Mississippi State College in 1948 and 1950. The resulting facility, known as the Regional Seed Research Laboratory, is the most completely equipped seed processing laboratory in the world.

The information contained in this Handbook for Seed Processors is offered

¹The author acknowledges the assistance of Dr. Louis N. Wise, in charge, Regional Seed Research Laboratory; H. D. Bunch, assistant agronomist; O. W. Easley, Jr., formerly associate agricultural engineer, Mississippi Agricultural Experiment Station; D. S. Doby, acting chairman, State College Research and Educational Committee, Mississippi Seedsmen's Association; and the principal manufacturers of seed processing and handling equipment.

as a guide to the better processing of Southern seeds.

How Are Seed Separated?

Seed of different varieties are separated by taking advantage of one or more of the differences in their physical characteristics. The following methods are now being used in separating seed:

Size: Seed differing in thickness and width are separated with an air and screen machine, width grader, etc.

Length: Seed differing in length are separated with indented disc and cylinder separators.

Weight: Seed differing in weight are separated with a gravity table.

Surface texture: Rough-surfaced seed are separated from smooth surfaced seed with fabric covered rolls, inclined moving belts, etc.

Degree of roundness: Flat seed are separated from round seed with a spiral gravity separator.

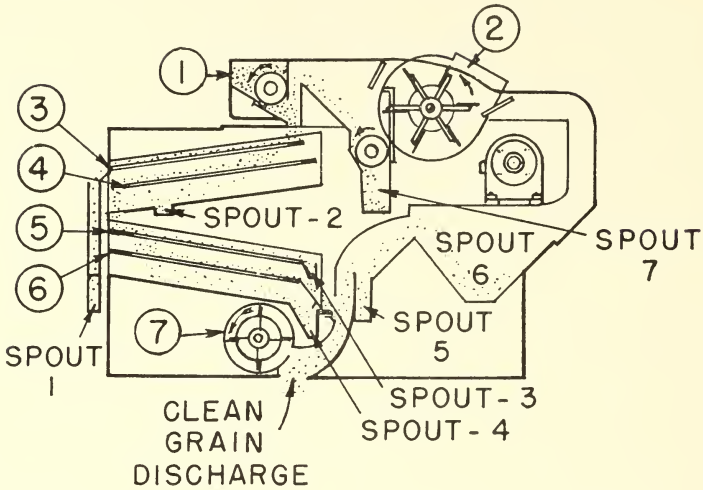
Color: Seed differing in color are separated with the electric eye. (This method is limited to large seed and under special conditions).

In addition to these methods, there is the sawdust method of removing buckhorn, magnetic method of removing dodder, and others.

The machines most commonly used in processing plants are the air and screen machines, indented disc and cylinder length separators, gravity tables, gravity spiral separators, and the roll mills.

Air and Screen Machines

The air and screen machine is considered the basic equipment in most processing plants. Practically all seed are first processed with this machine. It makes use of three cleaning elements; aspiration, scalping, and grading screens or lower screens. The size of this machine varies from the small two-screen farm model



- ① - ROLL FEED HOPPER
- ② - TOP SUCTION FAN
- ③ - TOP SCREEN TOP SHOE
- ④ - BOTTOM SCREEN TOP SHOE
- ⑤ - TOP SCREEN BOTTOM SHOE
- ⑥ - BOTTOM SCREEN BOTTOM SHOE
- ⑦ - BOTTOM BLAST FAN

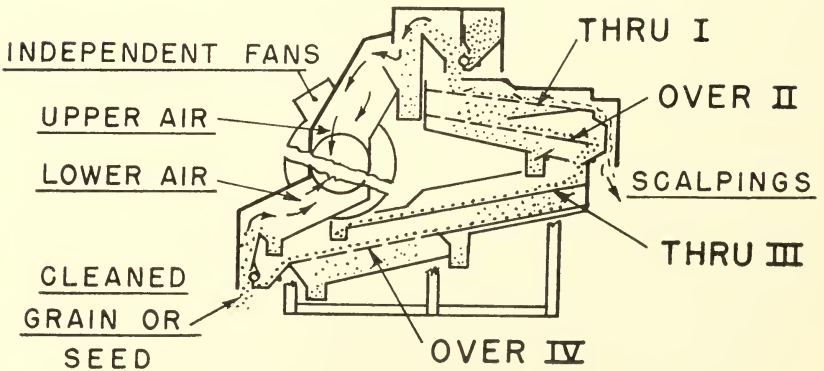


Figure 1. Air and Screen Machine.

with one air blast to the large industrial type machine.

Operation

For this discussion a four-screen machine with the following screen arrangement will be used: first screen scalping, second screen grading, third screen close scalping, and fourth screen fine grading. Some machines are equipped so that other screen arrangements can be made.

The seed to be cleaned are fed from the bottom of the feed hopper by means of a feed roll. As they fall from the feed hopper, they pass through the upper air suction which removes most of the light chaff and dust before they reach the top screen. The upper air suction should be strong enough to pull out a few good seed along with the trash. Its force is usually regulated by an adjustable damper in the air passage.

The top screen is used for rough scalping. The perforations in this screen should be large enough to let the seed being cleaned drop through readily, but small enough to scalp off the large foreign material such as stems, sticks, dirt, and seed larger than the seed being cleaned.

A round-hole screen is usually best for removing long material such as straw, sticks, and stems. However, in some cases such as cleaning ryegrass or fescue that contains cheat or wild onions, a screen with oblong openings would be better.

The seed which pass through the first screen are caught on the second screen. The perforations in this screen are just large enough to allow the small trash, small weeds, and dirt to drop through and be removed from the machine. The good seed ride over the second screen and drop off onto the third screen. For maximum capacity, it is important that the second screen be covered at all times.

The third screen serves as the close scalper. It removes any foreign material or seed larger than the seed being clean

ed but which was small enough to have passed through the first screen.

A large percentage of wild winter peas or vetch can be separated from oats by using $7/64 \times 3/4$ screen in the third position. The oats drop through the oblong openings while most of the peas and vetch are scalped off.

The seed that drop through the third screen go over the fourth screen for the final close grading. The fourth screen has perforations a little larger than the second screen. It removes any seed or other material smaller than the seed being cleaned but which was too large to drop through the second screen. Splits and immature seed are removed by this screen.

As the good seed drop off the fourth screen, they fall through the lower air blast. This air blast blows out the light seed and trash which was not removed by the upper air and screens. For efficient cleaning, the lower air should be strong enough to blow out a few good seed.

Other Adjustments

Adjustable Screen Pitch: The pitch of screens can be adjusted to place the screens in a steep or flat position. Setting a screen steep tends to cause a sharper separation just as though a smaller size screen were used. The scalpers are ordinarily set at a greater degree of pitch to facilitate scalping off the trash which would tend to drop through with the seed or stay on the screen and interfere with the seed dropping through. The bottom screens should be flattened to the point that undesirable seed and small inert material will have ample time to drop through and not be taken along with the good seed.

After a little practice an observant operator can set the correct pitch without difficulty.

Variable Shake of Screens: The vibration of the screens should be adjusted to

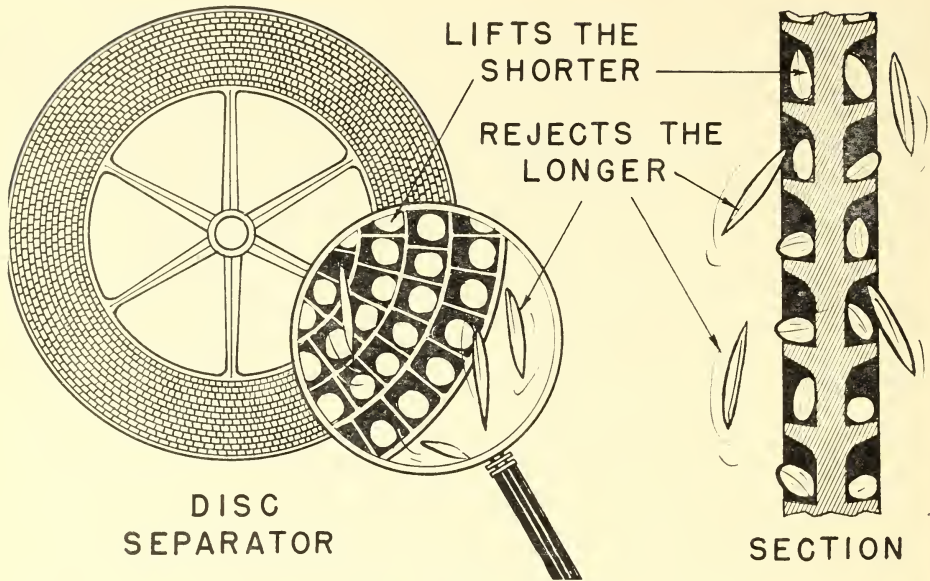


Figure 2. Disc Separator.

whatever speed is best suited for the particular separation. A speed too fast tends to bounce the seed so rapidly that they do not drop through the screen. However, a fast vibration can sometimes be used to make a sharper separation just as though a smaller screen were being used. If the shake is too slow, the seed will tend to lie dead on the screen. This causes the screen to clog up and poor cleaning is obtained.

Length Separators

Some varieties of seed have practically the same width or thickness and would be impossible to separate were it not for their difference in length. By taking advantage of the difference in length, a precise separation can be made with either a disc or cylinder type separator.

Disc Separator: The disc separator consists of a series of disc which revolve together on a horizontal shaft. Each disc contains hundreds of undercut pockets on each side. As the discs revolve the pockets lift out the short seed and reject the longer seed. The long seed are conveyed

by the flights on the disc spokes to the end of the machine and discharged through the tailings gate.

The length of time the seed are exposed to the cleaning action of the discs can be controlled by raising and lowering the tailings gate. Raising the tailings gate tends to keep the seed in the machine longer and gives the disc more time to clean the seed thoroughly.

The disc pockets vary in size from the very small ones for cleaning clover to the larger ones for separating grains such as wheat and oats. The disc separators can be equipped with all disc having the same size indents or a combination of different sizes. In the combination type, the disc are divided into sections. Each section has different size disc. With this arrangement, the material both longer and shorter than the seed being cleaned can be removed.

Cylinder Separator: The cylinder separator consists of a long cylinder with hundreds of semi-spherical indents that line the inside surface of the cylinder.

As the cylinder revolves the short seed are lifted out of the mixture by the indents and dropped into a trough inside the cylinder. The degree of separation is controlled by the position of the separating edge of the trough. If some of the long seed are lifted out by the indents, the trough is set too low. If the trough is set too high, the short seed picked up by the indents will fall back into the mixture and be discharged with the long seed at the end of the cylinder.

Some cylinder separators are equipped with variable speed drives. The desirable speed can be determined by setting the trough level and then adjusting the speed of the cylinder so that the seed picked by the indents will fall into the trough from the top of the cylinder. It is important that the cylinder be run at the correct speed. If the speed is too fast, the indents will pick up some of the longer seed that would normally be re-

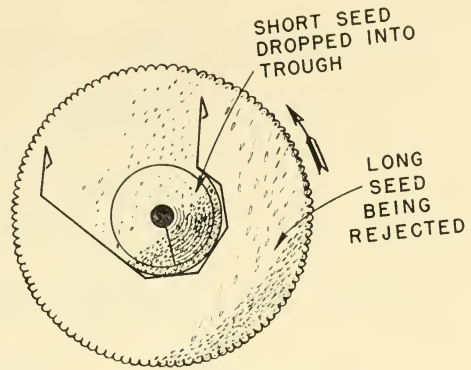


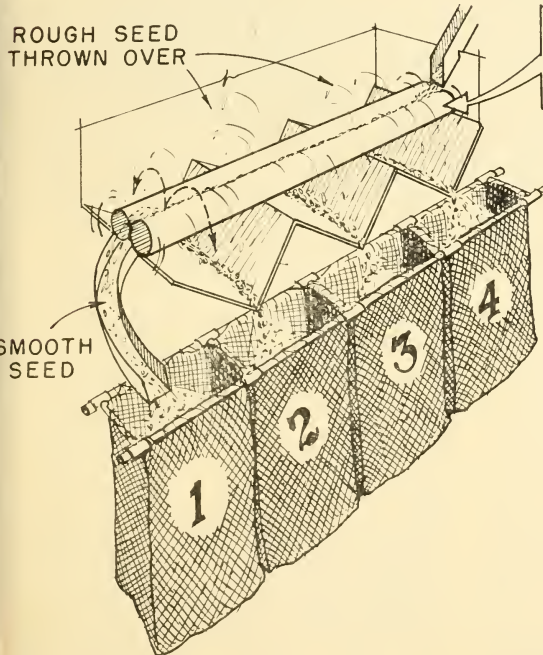
Figure 3. Cylinder Separator.

jected. If the speed is too slow, the indents will reject some of the short seed that should be lifted out.

Cylinders with various size indents are available for making different separations.

Roll Mill (Dodder Mill)

The roll mill separates seed by their difference in seed coat texture, that is



ROLLS COVERED WITH
FLANNEL OR VELET LIKE
MATERIAL

GRADES

- 1- ALL SMOOTH SEED
- 2- SMOOTH, SMALL
PERCENT ROUGH
- 3- ROUGH, SMALL
PERCENT SMOOTH
- 4- ROUGH

Figure 4. Roll Mill (Dodder Mill).

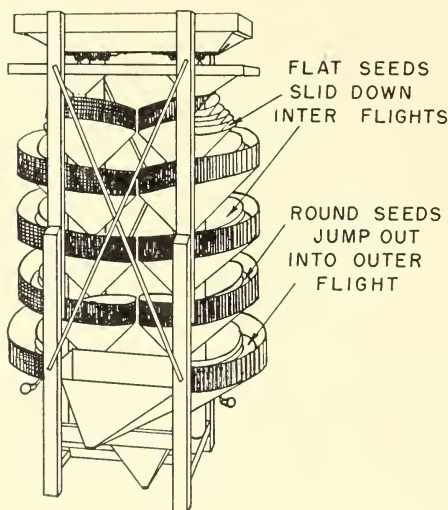


Figure 5. Spiral Separator.

the rough seed from smooth seed. A pair of rolls covered with a flannel like material are placed side by side close enough to touch lightly. The rolls are mounted in an incline position and turn in opposite directions, outwardly when viewed from the top.

The seed mixture is fed onto the rolls at the high end of the mill. As the seed travel downhill between the revolving rolls, the rough seed are caught by the flannel like rolls and thrown over the sides. The smooth seed continue bouncing downhill between the rolls and discharge off the end.

The seed thrown over the sides are caught in graduated grade hoppers underneath the mill. The grades of seed from these hoppers vary from a high percentage of rough seed from the one nearest the feed end of the mill to a very low percentage of rough seed from the one nearest the discharge end. The intermediate grade can be re-run to recover the smooth seed that were thrown out with the rough seed.

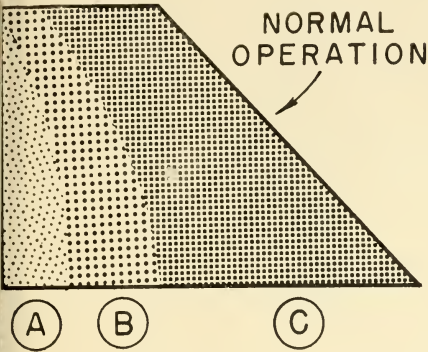
The dodder mill has two main adjustments—rate of feed and the speed of the

rolls. If some of the rough seed are being discharged at the lower end with the smooth seed, the feed is too fast or the rolls are running too slowly. If too many of the smooth seed are being thrown over the sides, the rolls are running too fast. A good practice is to make one adjustment at a time. Let the machine run two or three minutes and observe the effect of the adjustment on the separation. After experimenting with the adjustment, the operator should have no trouble in making the proper settings.

Spiral Separators

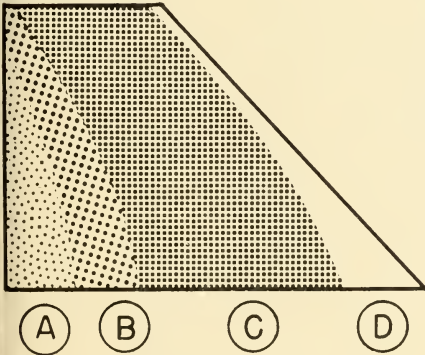
Some seed such as wild winter peas and wheat differ so little in thickness and length that they cannot be separated satisfactorily with a screen machine or length grader. However, since the round peas roll more readily than the wheat, a separation can be made with a spiral separator.

The seed are fed onto the spirals from a hopper at the top. Going down the inclined flights, the round seed travel at a much faster speed. The momentum of the round seed increases until they go so fast that they run over the edge of



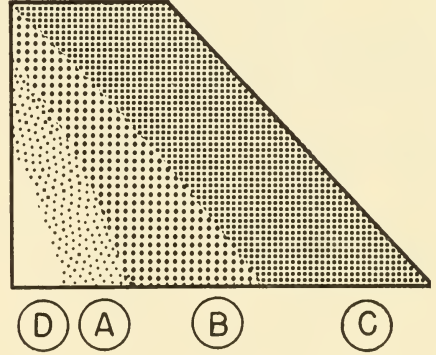
LEGEND

- A - LIGHT (WASTE)
- B - MIXED (SEED & WASTE)
- C - HEAVY (GOOD SEED)
- D - BARE



TO CORRECT

- DECREASE AIR
- OR INCREASE SPEED
- OR LOWER RIGHT END
- OR LOWER BACK SIDE



TO CORRECT

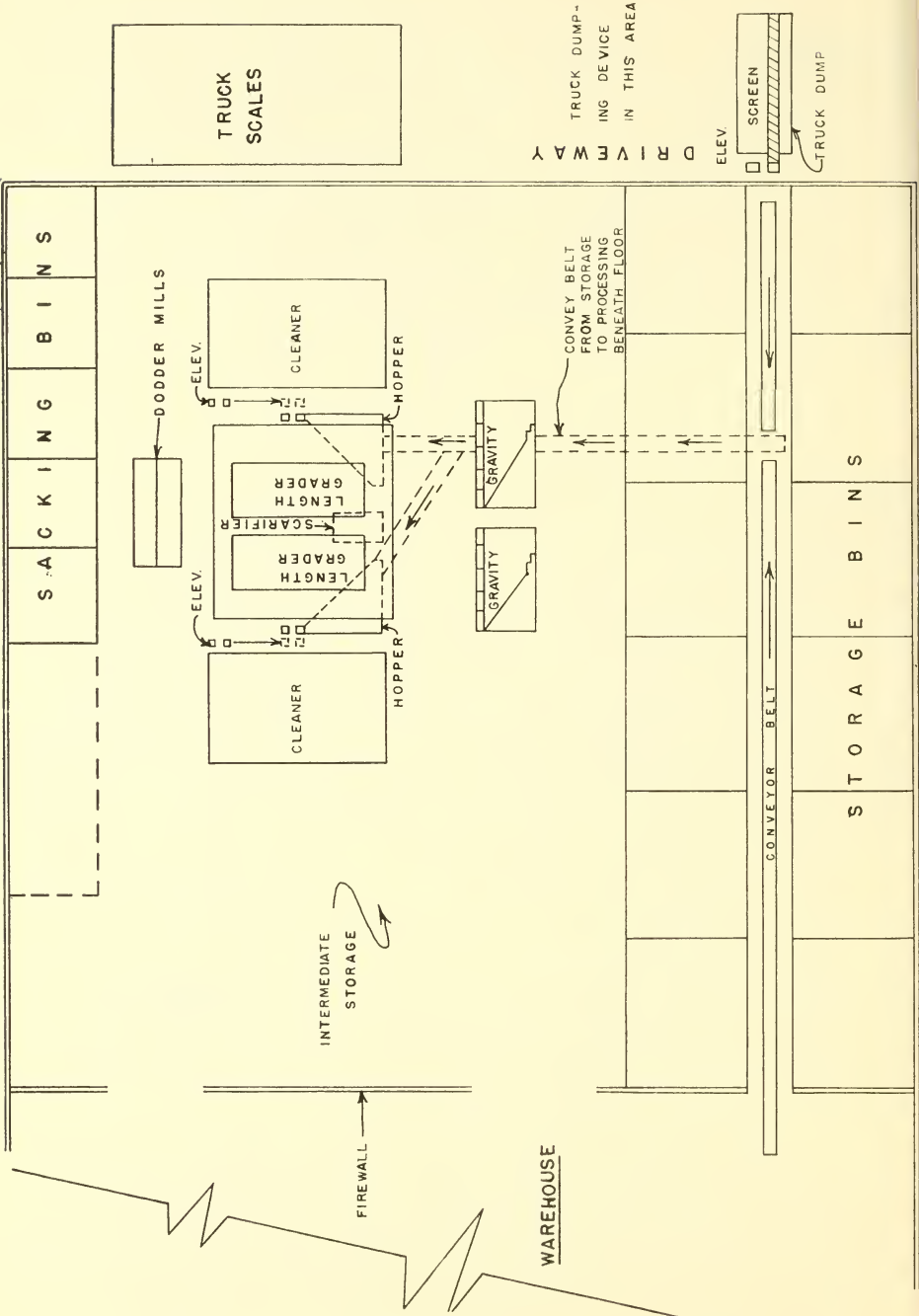
- INCREASE AIR
- OR DECREASE SPEED
- OR RAISE ^{Right} LEFT END
- OR RAISE BACK SIDE

Figure 6. Specific Gravity Table.

the inner flights, drop into the outer flight and discharge through a spout under the machine. The other seed continue sliding down the inner flights to the bottom and discharge through another spout.

Specific Gravity Separator
(Gravity Table)

The seed to be separated are caused to flow across an inclined reciprocating deck. The deck is mounted on incline toggles which impart two motions to it; (1) an



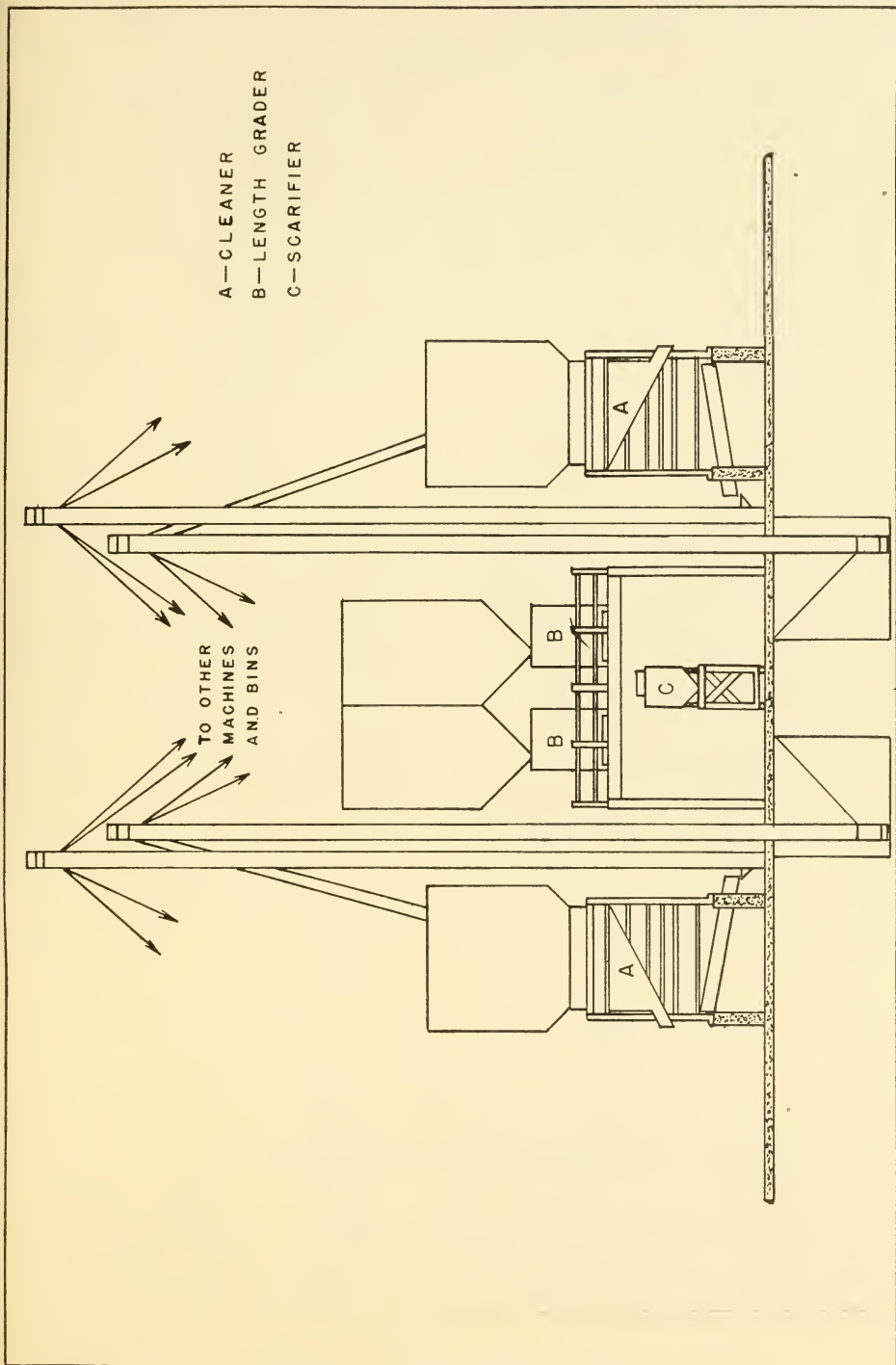


Figure 8. Elevation view of machinery in floor plan on opposite page.

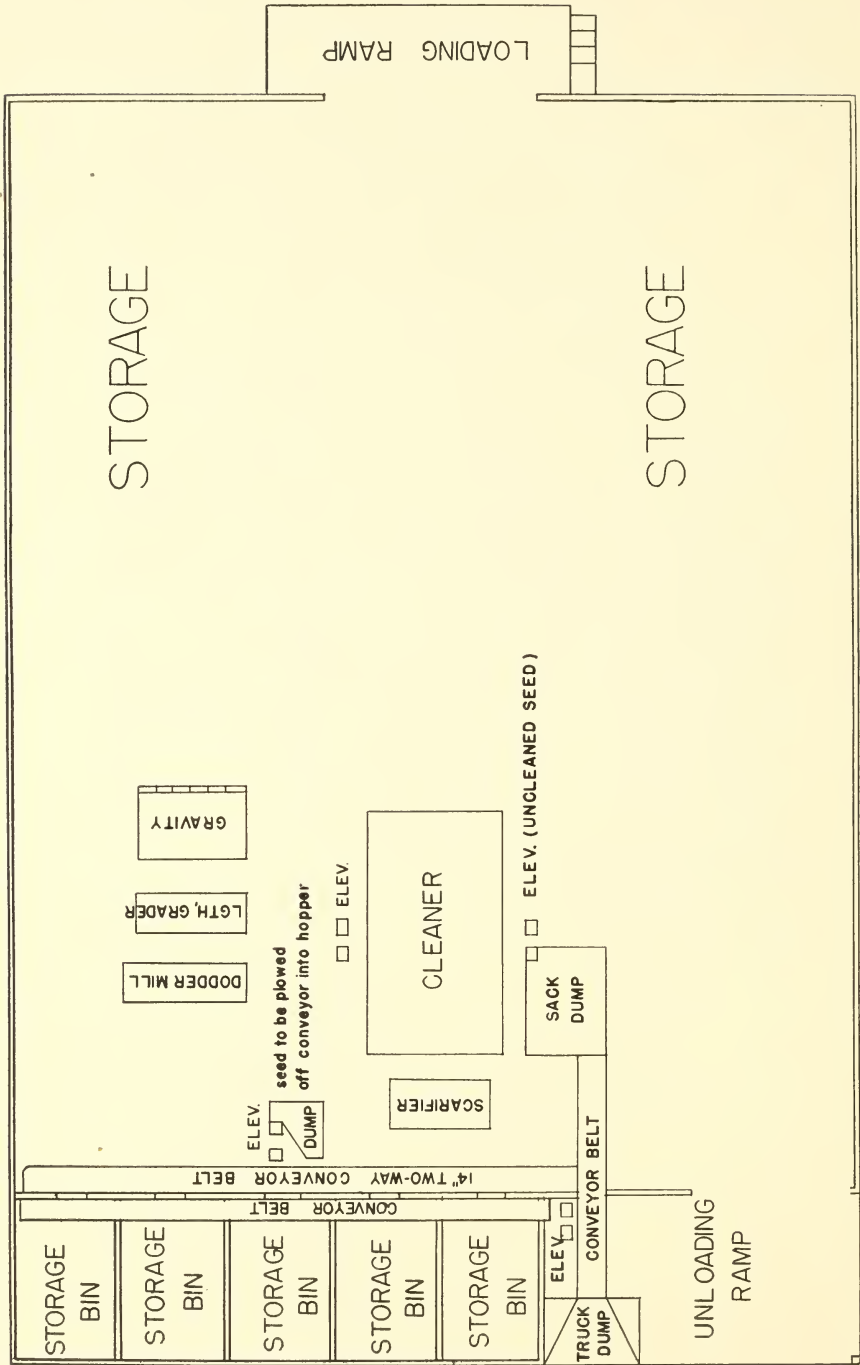


Figure 9. Floor Plan.

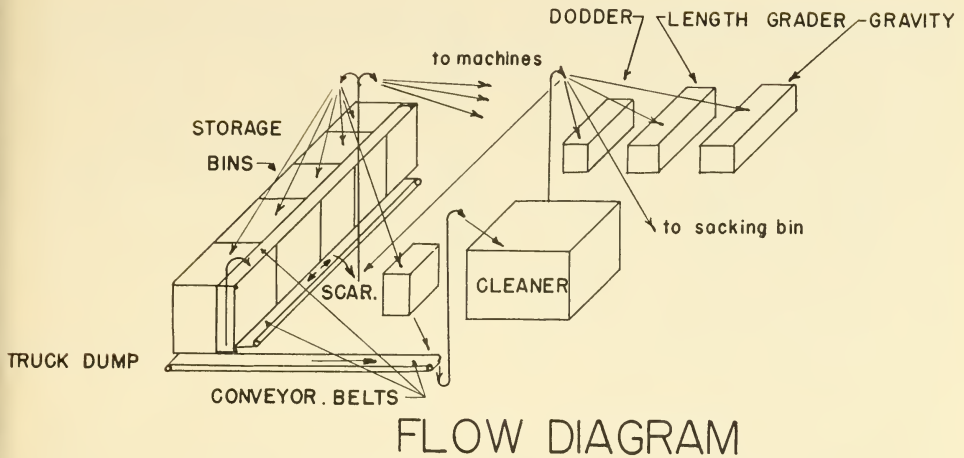


Figure 10. Flow diagram for floor plan in figure 9.

up and down motion, and (2) a backward and forward motion. The deck is covered with an open mesh material through which air is blown. The air is used to float the layer of seed in such a manner that it becomes stratified, the light seed rising up to the top, and the heavier seed settling to the bottom. The up and down motion of the deck pitches the seed up so that stratification is more quickly effected. The backward and forward motion causes the heavier seed to travel uphill because these seed are in contact with the deck surface. If excessive air is used, the seed will not be in good contact with the deck and will not travel uphill.

Types of Decks

Most seed separations are made on either a cloth or a wire deck. The cloth deck is used for the smaller seed such as alfalfa, clover, lespedeza, etc. Seed such as wheat, beans, corn, peas, etc. are separated on a wire deck. It takes more air to float these seed.

There are other types of decks for special separations.

Adjustments

The gravity separators are provided with five main adjustments:

1. **Amount of Air:** The amount of air is controlled by the adjustable gate on the suction side of the fan. Since the air governs the stratification enough must be used to cause the seed to become fluid or floating. Only the minimum amount of air necessary to float the seed should be used. Too much will cause the seed to travel toward the low side of the deck. Insufficient air will cause the lighter seed to travel toward the high side of the deck along with the good seed. At no time should any portion of the deck be bare as this would result in an uneven distribution of air through the deck.

2. **Longitudinal Inclination of Deck:** To make a separation on a gravity table, the seed must be made to travel uphill. The heavier seed, which have settled to the surface of the deck, are carried to the high end of the deck by the backward and forward motion. The lighter seed and trash which are floating on top of the seed layer will float downhill to the low side of the deck. The deck should

have considerable inclination for most separations. Decks with riffles should have less slope than plain decks. However, the slope should never be increased to the point that material will begin leaving the back rail.

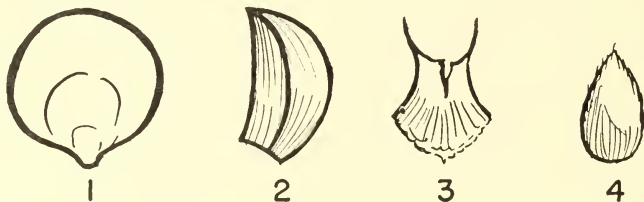
3. **Lateral Inclination of Deck:** The lateral inclination (side slope) should be such that a uniform layer of seed is discharged all along the front edge of the deck. Decreasing the side slope causes more material to flow toward the high end of the deck. Increasing the side

slope causes more material to flow to the low end. Blank decks are generally operated with less side slope than riffled decks.

4. **Rate of Feed:** The rate of feed is regulated by adjusting the feed hopper on the separator. It is important that the separator be fed to its capacity. The separator will operate more satisfactorily when fed to its capacity than when fed slowly. The rate of feed should be uniform at all times.

SUGGESTED PROCESSING PROCEDURE FOR SOME OF THE MAJOR CROPS

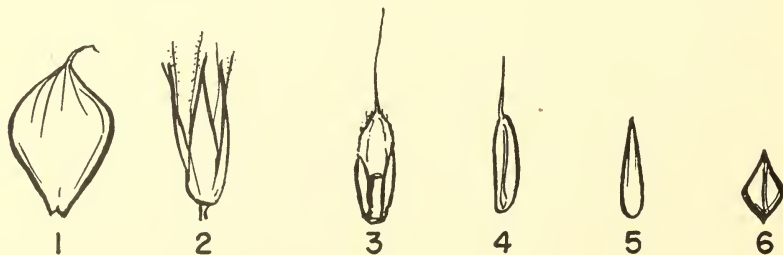
SORGHUM and Weeds Commonly Found



(1) Sorghum, (2) morning glory, (3) prickly sida, (4) Johnson grass.

Machines for processing: Air and screen machine—Johnson grass and prickly sida will drop through lower screens. Morning glory can be removed by using a 10 round or 11 triangle in the bottom position.

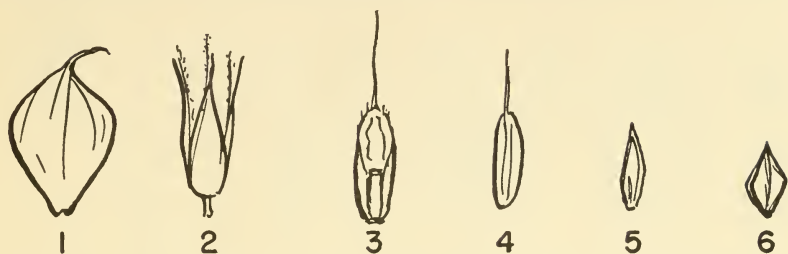
RYEGRASS and Weeds Commonly Found



(1) Wild onions, (2) wild barley, (3) darnel, (4) cheat, (5) ryegrass, (6) dock.

Machines for processing: See Fescue.

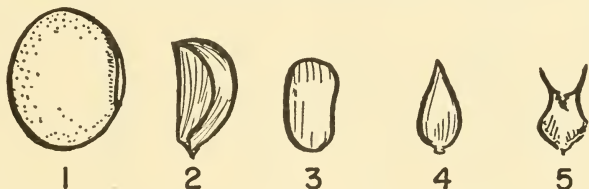
FESCUE and Weeds Commonly Found



(1) Wild onions, (2) wild barley, (3) darnel, (4) cheat, (5) fescue, (6) dock festuca spp.

Machines for processing: Air and screen machine—A large percentage of the above weeds can be removed during the first cleaning operation. Use a 6, 6½, or 7 round hole in the third screen position to remove cheat. Use a 5 triangle in the fourth screen position to remove dock. Disc or cylinder separator—Removes dock, clover and small trash.

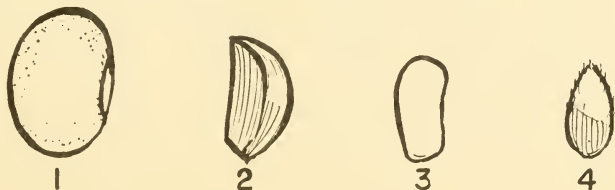
SOYBEANS (LARGE) and Weeds Commonly Found



(1) Soybeans (large), (2) morning glory, (3) coffee weed, (4) Johnson grass, (5) prickly sida.

Machines for processing: Air and screen machine—All the above weeds can be removed when the beans are cleaned. Since soybeans are relatively heavy, a strong blast should be used to blow out light weed seed and trash that was not removed by the screens. Spiral separator—Removes splits from the good beans.

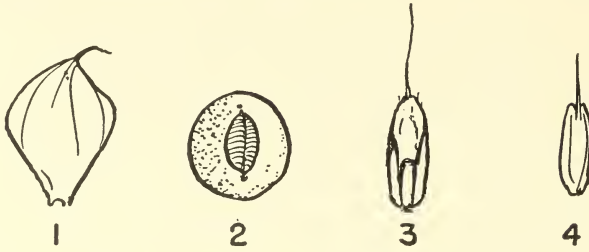
SOYBEAN (SMALL) and Weeds Commonly Found



(1) Soybean (small), (2) morning glory, (3) coffee weed, (4) Johnson grass.

Machines for processing: Air and screen machine—Coffee weed and Johnson grass are dropped through lower screens. A 10 round hole or 11 triangle will drop morning glory.

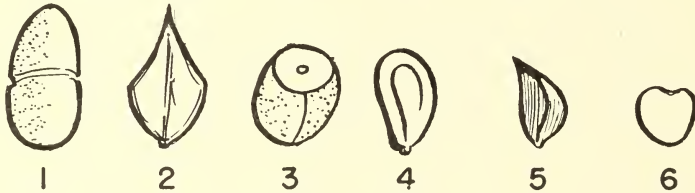
WILD WINTER PEAS and Weeds Commonly Found



(1) Wild onions, (2) wild winter peas, (3) darnel, (4) cheat.

Machines for processing: **Air and screen machine**—Cheat can be removed when the peas are cleaned. A strong air blast should be used. A large portion of wild onions and darnel can also be removed. **Gravity table**—Separates the onions that passed through the screens with the peas. **Disc or cylinder separator**—Separates most of the darnel from the peas. **Scarifier**—For scarifying the seed.

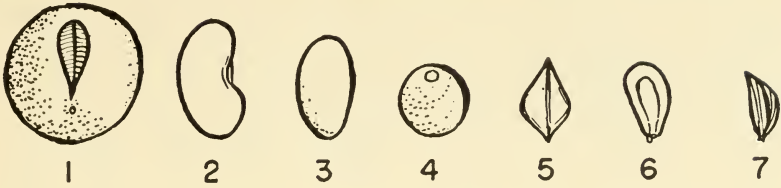
WHITE DUTCH CLOVER and Weeds Commonly Found



(1) Plantains, (2) dock, (3) dodder, (4) peppergrass, (5) evening primrose, (6) white Dutch clover.

Machines for processing: **Air and screen machine**—A large portion of all the given weeds can be removed during the first cleaning. If the clover contains dock, use a 6 x 22 or 6 x 23 wire mesh screen in third position. Blank off the lower section of the screen up to the point where all the clover has dropped through. This will usually be about three-fourths or two-thirds of the screen. Blanking off the lower section of the screen permits an excellent separation since the dock rides onto the blanked off section and has no further opportunity to drop through the screen with the clover. **Gravity table**—Removes plantains, peppergrass, and evening primrose that passed through the screens with the clover. Also, removes sand, light trash and immature seed. **Dodder mill**—Removes dodder and other rough coated seed.

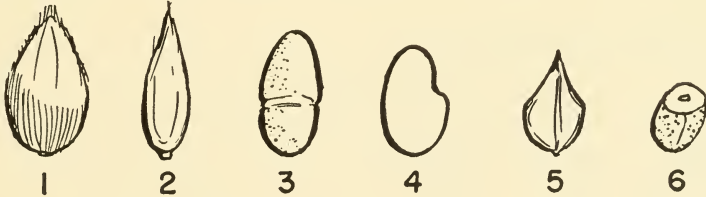
CRIMSON CLOVER and Weeds Commonly Found



(1) Narrow leaf vetch, (2) crimson clover, (3) wild geranium, (4) wild mustard, (5) dock, (6) peppergrass, (7) primrose.

Machines for processing: Air and screen machine—Most all the given weeds, except wild geranium, dock and wild mustard can be removed during first cleaning. **Gravity table**—Separates the wild mustard from the clover. **Dodder mill**—Can be used to reduce the wild geranium content. It is very difficult to remove all wild geranium seed from crimson clover.

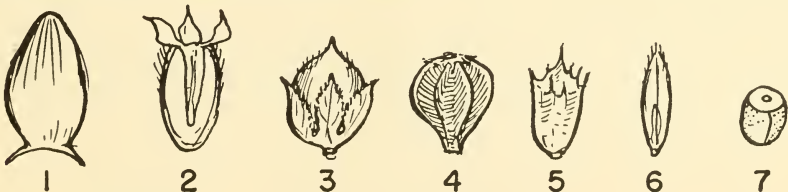
RED CLOVER and Weeds Commonly Found



(1) Johnson grass, (2) canary grass, (3) plantains, (4) red clover, (5) dock, (6) dodder.

Machines for processing: Air and screen machine—Dock and unhulled Johnson grass can be separated during the cleaning operation. A large portion of dodder, plantains and canary grass can be removed during first cleaning. **Gravity table**—Separates plantain from the clover. **Dodder mill**—Separates dodder from clover. **Clover disk or cylinder separator**—Separates canary grass from the clover.

LESPEDEZA and Weeds Commonly Found

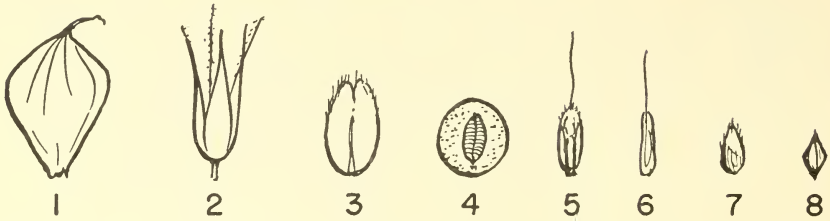


(1) Beggar tick, (2) buttonweed, (3) lespedeza, (4) sump weed,* (5) ragweed, (6) crabgrass, (7) dodder.

Machines for processing: Air and screen machine—Removes beggar tick, button weed, crabgrass, and ragweed. Also, dodder if lespedeza is unhulled. **Dodder mill**—Removes dodder from hulled lespedeza. Separates hulled from unhulled lespedeza.

*So far as is known, no satisfactory method has been found for removing sump weed from lespedeza.

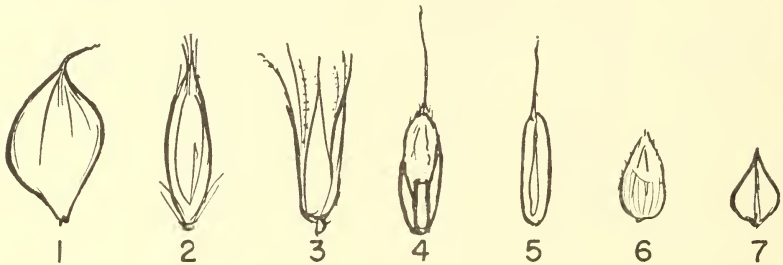
WHEAT and Weeds Commonly Found



(1) Wild onions, (2) wild barley, (3) wheat, (4) wild winter pea, (5) darnel, (6) cheat, (7) Johnson grass, (8) dock.

Machines for processing: **Air and screen machine**—Cheat, dock, Johnson grass, and wild barley are removed when the wheat is cleaned. A large percentage of wild onions can also be removed. A strong air blast should be used to help remove the weed seed and trash. **Gravity**—Removes wild onions that passed through screen with wheat. **Spiral separator**—Removes wild winter peas and vetch.

OATS and Weeds Commonly Found



(1) Wild onions, (2) oats, (3) wild barley, (4) darnel, (5) cheat, (6) Johnson grass, (7) dock.

Machines for processing: **Air and screen machine**—Cheat, dock, Johnson grass, and wild barley can usually be removed when cleaning the oats. A strong air blast should be used as this will remove any wild barley that dropped through the screen with the oats. A large portion of wild onions and darnel can also be removed during the first cleaning. **Disc or cylinder separator**—Removes cheat, wild onions, wild winter peas, vetch and other seeds shorter than oats.

SUGGESTED SCREEN

CRIMSON CLOVER

Screen Location:

- | | |
|---|---|
| 1 | 6 or 1/12 scalps off trash, large weed seed. |
| 2 | 6x23 or 6x22 drops thin seed, small trash, sand, etc. |
| 3 | 1/13 scalps off more weed seeds and trash. |
| 4 | 6x22 or 6x20 drops thin seeds, small trash, and sand. |

LADINO CLOVER**Screen Location:**

- 1 1/18, 1/20 scalps off trash and large weed seed.
- 2 6x32 drops thin seed and sand. 24x24 or 26x26 drops hop clover.
- 3 1/21 or 1/22 for scalping additional trash. 6x21 or 6x22 for removing sorrel.
- 4 6x32 or 6x30 drops small seed.

RED CLOVER**Screen Location:**

- 1 1/14 or 1/15 scalps off trash and large weed seed.
- 2 6x26 or 6x24 drops thin seed and sand.
- 3 3/64 or 5/16 removes ragweed, dock, and hares ear mustard.
14x14 or 15x15 wire mesh if clover contains foxtail or paspalum.
- 4 6x24 drops small seed and sand. 6x22, 6x21, or 6x20 if clover contains buckhorn or plantains.

WHITE CLOVER**Screen Location:**

- 1 1/18, 1/19 or 1/20 scalps off trash and other large seed.
- 2 6x32 or 6x30 drops thin seed, trash, and sand.
- 3 1/20, or 1/21 for scalping off larger seeds and small trash.
6x21, 6x22, or 6x23 if clover contains dock or sorrel.
- 4 6x32 or 6x30 drops thin seed. 20x22 drops small seed such as hulled timothy, hop clover, etc.

FESCUE, Kentucky 31**Screen Location:**

- 1 10 or 8 scalps straw and trash or 3/64x5/16 to scalp off wild onions, dock, cheat, etc.
- 2 6x34 or 6x32 drops thin seed and sand.
- 3 1/22x1/2 or 1/24x1/2 screens out additional wild onions, cheat, dock, etc.
- 4 6x30 drops thin seed and trash. 5 triangle drops small dock, sorrel, clover, etc.

KOBE LESPEDEZA**Screen Location:**

- 1 9, 8 or 7-1/2 scalps off trash and large weeds.
- 2 1/14 or 1/15 drops hulled kobe, dock, and dodder.
6x22 or 6x21 drops horsetail, plantain, etc.
- 3 1/18x3/4 screens removes pojo, ragweed, and other large weed seed.
- 4 1/14 or 1/12 drops additional hulled seed and small weed seed.

KOREAN LESPEDEZA**Screen Location:**

- 1 8 or 6 scalps off trash and large weed seed.
- 2 1/18, 1/17 or 1/16 drops small dodder and sand, 6x22, 6x21, or 6x20 drops horsetail, plantain, etc.
- 3 6x15 screens out pojo, spring sida, ragweed, etc.
- 4 1/16 or 1/15 drops hulled seed and dodder.

SERICEA LESPEDEZA (unhulled)**Screen Location:**

- 1 8 or 7 scalps off trash and large weed seeds.
- 2 1/17 or 1/16 drops hulled seed, dodder, plaitain, etc.
- 3 1/18x1/2 or 1/18x3/4 scalps off additional trash and weed seeds.
- 4 1/15 drops dock, dodder, plaitain, buckhorn, etc.

Note: If dodder is present, it should be dropped before scarifying the lespedeza.

OATS**Screen Location:**

- 1 18 or 20 scalps off straw, etc.
- 2 1/16x1/2, 1/15x1/2, or 1/14x1/2 drops thin groats, chaff, and small weed seeds. 9, 10, or 11 triangle drops wild mustard and wild buckwheat.
- 3 7/64x3/4, 8/64x3/4, or 9/64x3/4 screens out other trash, thistle heads, etc.
- 4 1/13x1/2, or 1/14x1/2 drops pin oats and groats.

PEAS (Caley, Singletary, or Wild Winter)**Screen Location:**

- 1 16 or 14 scalps off trash.
- 2 6/64x3/4 drops immature seed, sand, small trash, and weed seed.
- 3 12 or 13 screens out additional trash and long seeds.
- 4 6/64x3/4 or 6-1/2 x 3/4 drops shrivelled seed.

RYEGRASS**Screen Location:**

- 1 10 or 8 scalps off straw and trash or 3/64x5/16 scalps off wild onions, cheat, dock, etc.
- 2 6x32 or 6x30 drops thin seed and small trash.
- 3 1/22x1/2 scalps off additional wild onions, cheat, dock, etc.
- 4 6x30 or 6x28 drops thin seed. 5 triangle to drop small dock, sorrel, clover, etc.

SOYBEANS—medium yellow (Arksoys, Clemson, Ogden, Ralsoys)**Screen Location:**

- 1 24 or 22 scalps off large trash.
- 2 9/64x3/4 or 10/64x3/4 drops small trash, weed seed, splits, etc.
11 or 12 drops morning glory, pigweed, and other small weed seed.
- 3 21 or 20 for close scalping.
- 4 11/64x3/4 drops small beans and splits.

SOYBEANS—Laredo**Screen Location:**

- 1 20 or 18 scalps off pods and trash.
- 2 9 or 10 drops small weed seed.
- 3 8/64x3/4 or 9/64x3/4 screens out large weed seeds.
- 4 1/12x1/2 or 1/13x1/2 drops splits and small beans.

WHEAT**Screen Location:**

- 1 18, 16 or 14 scalps off straw, etc.
- 2 1/14x1/2 drops sand and weed seeds.
11 or 12 drops morning glory.
- 3 12 or 14 scalps off additional stems, etc.
- 4 1/13x1/2 or 1/14x1/2 drops broken kernels, and grass seed.

EQUIPMENT FOR PROCESSING HYBRID SEED CORN

Sheller—A sheller made especially for shelling seed corn is preferable. However, most commercial shellers can be used satisfactorily if the sharp edges on the shelling teeth or bars are rounded off with a file and the sheller operated at approximately one-half of the recommended speed. Since high speeds can cause considerable damage to the kernels, it is important that the sheller be operated at a slow speed.

Air and screen machine—After the corn has been shelled, it should be cleaned to remove large trash, pieces of cobs, cracked grains, and other small material. A two screen machine is usually sufficient. However, if closer screening is desired, a machine with more screens can be used. A strong air blast should be used during the cleaning operation. This helps to remove light kernels and other light material which is the same size as the good seed.

Thickness grader—When only the flat seeds are to be processed, a cylinder type thickness grader can be used to remove the thick and round grains. If the thicks and rounds are to be processed, also, this operation may be omitted.

Thickness and width grader—This type grader is used when both the flat and round kernels are to be processed for seed. The corn can be divided into the various grades of thickness and width with a screen type or a cylinder type grader equipped with round hole and slotted screens of different sizes.

With some machines it is possible to get up to twelve different grades in one operation. Two screen arrangements for a screen type grader is given below. These arrangements are commonly used in some parts of the South.

1st position	24 round hole and 13-13-14 slotted
2nd position	22 round hole and 12-12-13 slotted
3rd position	20 round hole and 12-12-13 slotted
4th position	18 round hole and 12-12-12 slotted or 11-11-11 slotted
1st position	22 round hole and 13-13-13 slotted
2nd position	19 round hole and 12-12-12 slotted
3rd position	19 round hole and 12-12-12 slotted
4th position	16 round hole and 11-11-11 slotted

Length grader—The length grader is used to make length separations in the flat grades which have a high degree of variability. It is usually a cylinder type grader similar to the one discussed elsewhere in this bulletin.

Gravity table—The specific gravity separator can be used to remove any rotten kernels that were not blown out by the air blast. When seed corn is harvested earlier, it will seldom contain enough damaged kernels to necessitate the use of this machine.

Picking belts—The picking belt is used when there are off-color kernels that have to be removed from the seed. The seed are fed onto a moving belt and as it travels along the off-colored kernels are picked off by several persons standing beside it. This operation is omitted if there are no off-colored kernels.

Treater—Corn can be treated with dust or slurry (liquid) type treater. However, it appears that the slurry treater is more popular for treating corn.

SUGGESTED SCREENS FOR OTHER CROPS

Commodity	Screens			
	1	2	3	4
Alfalfa	1/13 or 1/14	6 x 24	1/14 or 1/15	6 x 23
Bahia grass—Argentine	8	15 x 15	1/16 x 1/2	1/13
Common	9	12 x 12	1/14 x 1/2	1/15
Pensacola	6	17 x 17	1/18 x 1/4	1/17
Barley	16	1/14 x 1/2	9/64 x 3/4	1/13 x 1/2
Bermuda grass—hulled	1/25	38 x 38	28 x 28	6 x 42
Bermuda grass—unhulled	1/18	32 x 32	6 x 24	6 x 38
Carpet grass	1/13	32 x 32	6 x 22	6 x 40
Clover—Alyce	1/16	20 x 22	1/22 x 1/2	6 x 24
Hop	1/25	38 x 38	22 x 22 or 24 x 24	6 x 38
Hubam—hulled	1/16	20 x 20	3/64 x 5/16	6 x 24
Hubam—unhulled	7	20 x 20	1/14 x 1/2	6 x 24
Sweet—hulled	1/13	6 x 26	1/14	6 x 24
Sweet—unhulled	10	6 x 26	9 or 8	6 x 24
Crotalaria giant striata	8	14 x 14	1/14 x 1/2	6 x 22
Crotalaria intermedia	6	16 x 16	1/15 x 1/2	6 x 20
Crotalaria spectabilis	14	7, 8	1/12 x 1/2	7, 8
Dallis grass	9	4 x 30	6 x 14	4 x 28
Johnson grass	9	1/17	1/13 x 1/2	1/16
Lespedeza—common	6	1/17	6 x 15	1/15
Lupine—blue	24	9/64 x 3/4	21	10/64 x 3/4
sweet yellow	26	12	24	7/64 x 3/4
white	22	12	20	7/64 x 3/4
yellow bitter	20	12	12/64 x 3/4	6/64 x 3/4
Milo, maize	13, 14	1/13 x 1/2	12	1/12 x 1/2
Peas—large cow	22	12	21	11/64 x 3/4
medium cow	18	10	16	9/64 x 3/4
small cow	14	8	12	7/64 x 3/4
Rescue grass	16	1/18 x 5/64	6/64 x 3/4	9 or 10 Tria.
Rye	14, 16	1/16 x 1/2	12	1/14 x 1/2
Sesame	6, 7	17 x 17	1/20 x 1/2	6 x 28
Sudan grass	10, 12	1/15	1/12 x 1/2	3/64 x 5/16
Sweet sudan grass	10, 11	1/12	6/64 x 3/4	1/18 x 3/4
Vetch—Hairy	16	6/64 x 3/4	14	6/64 x 3/4