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## COMPLEMENTARY SEED CLEANING

Charles E. Vaughan<sup>1/</sup>

Processing is a vital stage between the producer and the user of seed. Most field-run seed have trash, inert material, weed seed or other crop seed in them that would make them illegal to sell, or at least difficult to plant. They are in no condition to be planted, and are not desirable from the buyer's standpoint. Seed processing is the step between the seed producer and the distributor which takes seed as they come from the field, removes undesirable material, and puts them into condition for marketing and planting.

The first actual cleaning and upgrading step is the basic cleaning operation. The air-screen machine is probably the most common basic cleaner. It makes both size separations and aspirates the seed. Seed lots may come from the field in good condition with few contaminating seeds, and will require only cleaning on the air-screen machine.

However, it is usually necessary to send the seed over one or more special separating or upgrading machines to remove a specific contaminant. These complementary machines separate different crop seeds, or crop seed and weed seed according to their differences in a physical seed characteristic. To be separated completely, the crop seed and the weed seed must differ in this physical characteristic widely enough so that the machine can distinguish between each crop and weed seed.

## WIDTH AND THICKNESS SEPARATOR

The first complementary seed cleaner to be considered is the width and thickness separator. Width and thickness, as special size dimensions, are used in several specialized operations. A common use is to size hybrid seed corn into specific widths and thicknesses for space planting. Several seed separations are also made using width and thickness sizings. Width or thickness separations are made by turning the seed on edge or standing it on end to present it's width or thickness dimension to a sized perforation. If the seed is below a certain width or thickness, it will drop through the perforation; if it is above a selected width or thickness, it will not go through the perforation and will be routed out a different discharge spout. A thickness separation is made by passing seed

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over a circular or flat surface in which grooves are pressed into the sheet metal. Slotted perforations are in the bottom of these grooves. The shoulders of the grooves turn the seed on edge. When seeds are presented edgewise to the slotted perforations, thin seed fall through, while thick seed are rejected and ride out a separate discharge spout.

Width separations are made by perforations at the bottom of indents or cup-like depressions. The shoulders of the cup-like indent cause the seed to tilt and stand on end, thus it must present its width dimension to the perforation. If the seed is narrow, it drops through the perforation; if it is wider than the perforation, it is rejected. A series of width and thickness separations can be combined in a single machine to produce several different width and thickness grades in the same operation. For example, corn seed can be graded into different flat and round sizes.

Rice processors in the southern region of the United States also use these machines to separate red rice, a noxious weed, from varieties of long grain rice. Other common uses of width and thickness separators include: (a) the removal of splits from soybeans, edible beans, and peanuts; (b) the removal of chips and splits from sorghum seed; (c) the removal of cheat from wheat; (d) the removal of cockleburs from cottonseed, wild onion from fescue, and the removal of wild oats from barley. Other agricultural, but non-seed, uses include size-grading of barley, oats, wheat, nuts and coffee beans for quality factors important in the feed, food or milling industries.

## LENGTH SEPARATORS

The second group of complementary seed cleaners to be considered are the length separators. Length differences are common between different crop seed and between crop and weed seed. Many processors use length separations to upgrade and improve their seed. The indented cylinder separator and disc separator are widely used to make length separations.

### Indented Cylinder:

The indented cylinder separator consists of a long round cylinder whose walls have thousands of small indents. Inside this indented cylinder are other parts that help the indented cylinder make a separation. These will be an auger or other means of keeping the seed mass level, a liftings trough to remove short lifted material; and an auger to remove lifted seed from the lifting trough.

An end view of the indented cylinder shows the mass of seed inside the cylinder. As the cylinder turns the seed mass turns so that each seed has an opportunity to fit into one of the indents and be lifted. The relationship of the length of the seed and location of its center of gravity to the depth or size of the indent determines whether the seed will be lifted. Long seed will not fit completely into the indent, and as the cylinder rotates they fit into the indents but do not remain in the indents long enough to be lifted. Seeds intermediate in length will be lifted slightly above the edge of the seed mass by the indents. Shorter seed will be lifted higher up the arc of the cylinder's rotation. Therefore, the length of the seed determines the degree to which they fit into the indents. Seed that fit into the indents are lifted up as the cylinder revolves. Shorter seed are lifted higher in the arc of the cylinder's rotation; longer seed fall out sooner.

Mounted in the center of the revolving indented cylinder is a trough with an edge that can be moved up or down to allow seed lifted to a different level to be carried over and dropped into the trough. Seeds not lifted up past the edge of this trough fall back into the seed mass in the cylinder and are discharged out the end of the machine.

A seed's length determines how it fits into the indented pockets in the wall of the cylinder. The location of the seed's center of gravity also effects the seed's fit into an indented pocket. A round, short seed whose center of gravity is near one end will not be lifted.

#### Indented Disc:

The disc separator also separates seeds by differences in length. A disc is a cast iron wheel with many small undercut pockets cast into each face of the disc. As the disc turns through a mass of seed, each seed will have an opportunity to fit in one of these pockets. If the seed is too long, it will fall out of the pocket. If the seed is short, it will sit inside this pocket and be lifted out of the seed mass. Lifted seed are carried up and deposited into a separate discharge spout.

There are square shaped pockets to make separations between different crop seeds; pockets with rounded lifting edges to lift round seed types and pockets with flat lifting edges to lift flat-sided or rectangular seed.

The heart of the disc separator is a revolving shaft on which many different discs are mounted. The seed mass enters the machine at one end, and moves through the center of the discs and comes in contact with the pockets on the side of each disc. These pockets reject or lift out seed as the mass moves through the machine. By using several sections of discs with different pocket sizes on the same shaft, several different length grades can be made as seed pass through the machine.

#### Uses of Length Separators:

The range of each type of machine is wide, and these ranges overlap, giving rise to the question, "Which type of machine should be used?" The answer depends on several factors. However, generally speaking, lightweight seeds, whose bushel weight is less than 45 pounds cannot be separated as efficiently as heavier weight seed. For this reason the cylinder is more practical to use with small grains, corn and soybeans rather than with grasses. Corn, soybeans and similar seed which might wedge in the pockets should not be cleaned in a disc. An explanation of the principles used by each separator in effecting its separation may help answer the question "Which machine should be used?"

Both disc and cylinder separators effect separations on the basis of length, but the principles involved in obtaining results are somewhat different. The disc lifts uniformly shaped and sized under-size particles out of a mass of seed. The machine's speed is relatively constant--it can be varied only a few RPM from its normal setting or the efficiency of the separation is affected. A disc separation is not affected by seed-coat texture, weight per bushel, or moisture content.

Cylinder separators perform similar separations but in a different manner. Cylinders operate on the centrifugal force principle, in which the speed of the cylinder holds seed in the indents, lifting them out of the mass until the indents are inverted to the point where gravity causes the particles to fall. Shape and size of the indents, seed-coat texture, moisture content and weight of seed all combine to affect separation.

Both the cylinder-type and the disc-type machines have their advantages and disadvantages. One advantage of the cylinder-type separator over the old model discs is the rapidity in which the cylinders can be changed. Only a few minutes are required for changing cylinders in most of the cylinder separators. In the old model discs, all the discs have to be unbolted and the shaft slipped out and sometimes several hours are required to change discs. However, in the late model disc separators, the top cover can be removed and the discs and shaft lifted out as a unit.

An advantage of the disc separator is that it is possible to have several different sizes of pockets in the same machine. With this arrangement, a number of separations can be made without having to make changes. Also, with a combination of different sizes, it is possible to make several separations in one operation.

The cylinder separator is more effective for such jobs as oat sizing, rice sizing, length grading of hybrid corn, and separating minute quantities of contaminating material such as traces of dock or sorrel seed in orchardgrass or fescue seed. The disc separator can be used to an advantage where a large mass of material is to be lifted. An example would be the separation of a small amount of Canada thistle from alsike clover. The disc separator is also widely used for removing elongated particles of foreign material such as sticks, stems and straws from seed.

As to comparative capacities, each type of length grader has its own advantages, but in the field for which the disc separator is found to be particularly suited, capacities of the disc type have been found to be much greater.

These, then, are some of the machines available to the seedsmen to complement the basic seed cleaning done by the air-screen cleaner. Often the basic cleaning and further processing by one or more of these machines will remove all contaminants in a seed lot. When this is the situation no further seed cleaning is necessary. However, since these machines only make separations on the basis of certain definite seed characteristics, further processing may be necessary with other special seed cleaning machines.