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Gravity Table Separations

James Henderson

GRAVITY TABLE SEPARATIONS

Jim Henderson [1]

Some of the things the specific gravity separator can do for the seed conditioner are to:

1. Separate chipped, broken, mashed, deformed, diseased and other lightweight seeds which improves both purity and germination of the good seed.

2. Separate stones, soil particles, sand, nails, cup bolts and other similar objects that are heavier than the seed.

3. Separate weed seeds that other machines "miss".

4. Permits capacity increases for basic cleaning machines because the gravity takes out contaminants that flood over the bottom screens.

5. Cause operators to maintain the correct rate of flow through preceding conditioning machines because the seeds on the gravity are visible and the correct level of operation is out in the open for anyone (including the Boss) to see.

It seems to me that any machine that can contribute in all these ways to the business of conditioning seed ought to be used universally and routinely. But, many seedsmen consider, or used to consider, the gravity to be too slow, too delicate, too difficult to keep in adjustment and just not suited to high capacity plants which condition hundreds of bushels of seed soybeans or seed grain per hour. Yes, only a couple of years ago you might have read comments to the effect that the gravity table was capable of doing highly desirable seed conditioning, but was generally considered too slow to work on soybeans or seed grains. But things are changing. Now, there are numerous installations of gravities in plants doing upwards of 400 bushels per hour. And, the work they are doing just puts "smiles" on the faces of the seedsmen using them. Most would never have believed how much junk they had been putting in the bag B.G. (before gravities).

The first gravity separator I ever saw was being used to upgrade the germination of sweet clover seed. It separated a portion of the lighter weight seed from the mass, and since these lighter seed ger-

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minated very low, the heavier ones gave a higher germination test.

The second gravity I ran across was making a really spectacular separation of wild turnipseed from crimson clover seed. Perhaps the separation appeared so spectacular because of color differences that made it easy to see the black turnipseed being separated from the yellowish crimson clover seed. It was clearly visible and memorable.

Down through the years I've seen gravities in many seed plants, heard many lectures on them here at Mississippi State, and got to know the people who build them. But, I really did not understand them, and might never have learned enough to be invited to talk to you about them, had I not sold one. Having sold one, I was obligated to make it work. With lots of help from Jim Thomas (Oliver Mfg.), we made it work. As I sold more and more gravities, and as the users kept calling me back to reset the machines whenever it was time to change from beans to wheat or whatever, I had to learn more and more about the machines in order to be able to teach my customers about them too, and how to make changes when needed. I'm going to try to explain gravities to you in a way that you can understand and, thus, recognize how valuable they can be in any seed conditioning plant.

Things One Needs to Know About Gravities

A gravity is a sort of vibrating conveyor: angled springs support the deck and eccentrics shakes or vibrate it. Every time the deck "shakes", the materials on that deck make a little "hop". The faster the deck shakes, the faster and further the materials (e.g., seed) hop. The tilt of the deck is adjusted so that the seeds have to hop uphill, with a side slope at right angle to the tilt so that they also tend to curve down the slope at the same time. If there were no air movement through the deck mesh, all the seed on the deck would hop uphill, and try to climb over the top rail and fall off the deck. But, a current of controlled air is either drawn or blown through the mesh of the deck and the layer of seed on the deck. When this current of air is correctly adjusted, the seeds are VERTICALLY STRATIFIED with the lighter ones in the top of the layer and the heavier ones on the bottom in contact with the deck (Figure 1). The heavier seeds in contact with the deck receive the full impetus of the deck motion (shake) and hop up the hill. The lighter seed on top of the layer receive little or no impetus from the deck shake and slide across the layer toward the low end of the slope under the influence of gravity, so that the materials on the deck STRATIFY HORIZONALLY and can be separated (Figure 2).

Gravities are built with different shapes of decks. Perhaps the simplest is the destoner or stoner. The stoner has an elongated diamond shape deck which is fed in the middle. The deck shake makes the seeds try to hop uphill, but the air current floats the lighter particles (seed) so that they slide down the slope and with proper adjustment, only the stones hop uphill. The seeds slide down the slope under the

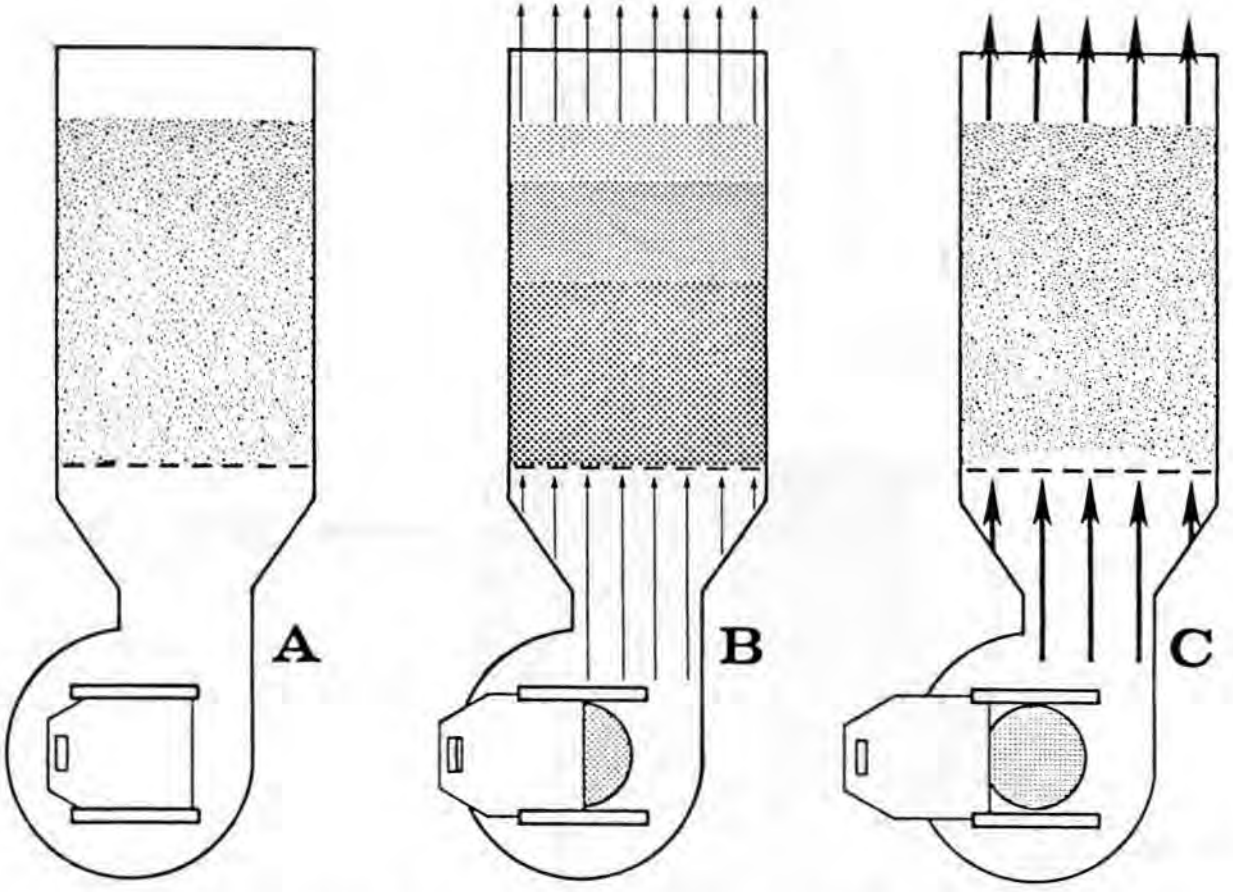

Figure 1. Principles of gravity separation. A - Fan intake closed; no stratification. B - Proper volume of air flowing through the deck; seed stratified by density. C - Excessive volume of air flowing through the deck disrupting the stratification.

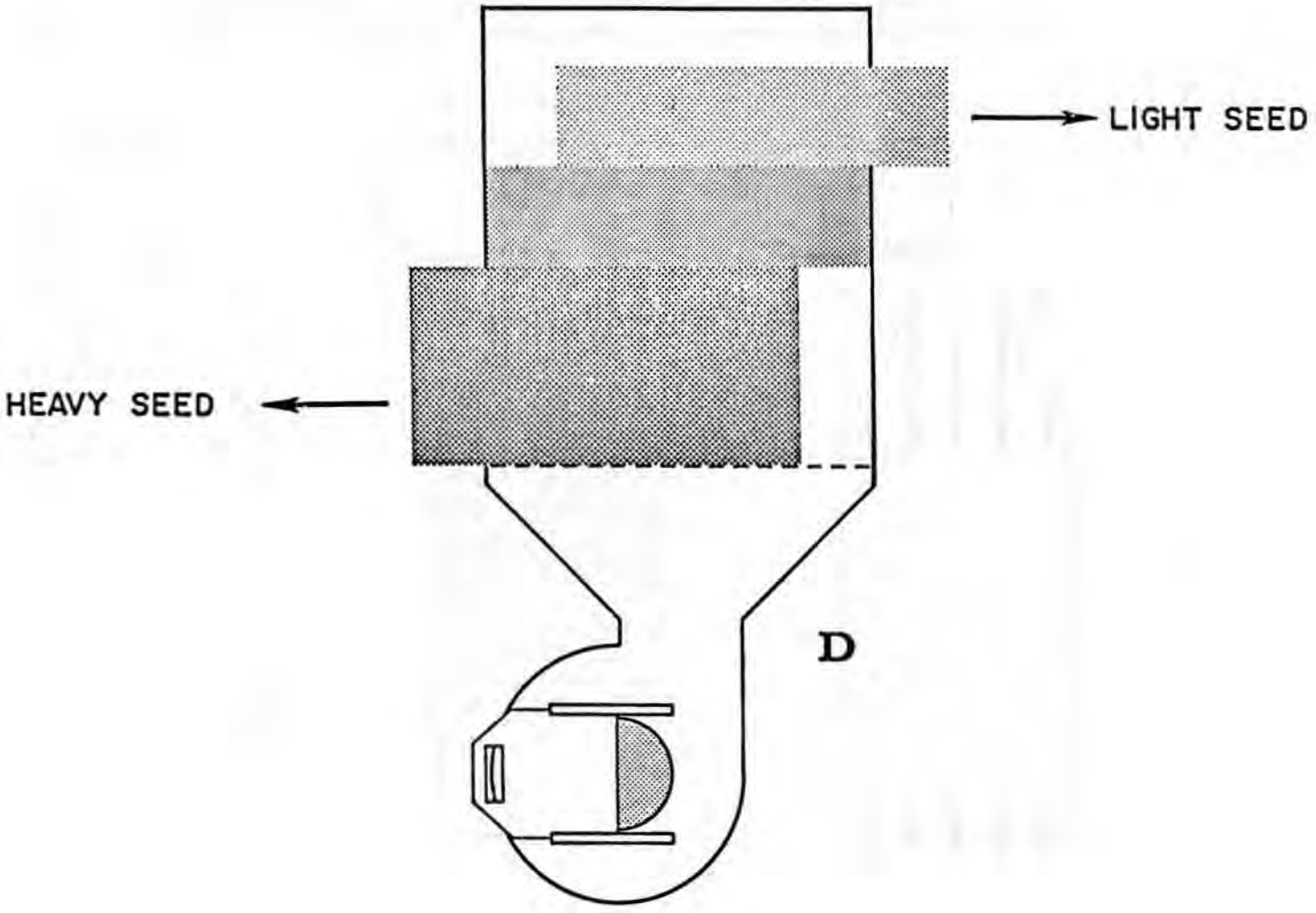

Figure 2. Gravity Table. Once the seed have been stratified, the different layers can be separated

influence of gravity and discharge off the down end.

I have been told that the first gravity was developed as an ore concentrator. It was used to separate a small percentage of ore granules from granulized rock, and so was designed to have the good ore particles move the longest way across the deck for ever increasing concentration. From this machine the gravity with triangular deck evolved, and for a long time was the style used in seed plants. Because of its shape, it does its best work when separating a small percentage of heavy particles from the mass. Frequently, however, the separation most needed is removal of a small percentage of lighter particles from the mass. In their situation, the triangular shape deck is not as appropriate. A rectangular deck is better because it is designed to have the lighter portion of the mass make the long travel the length of the deck and become more and more concentrated; it does its best work when used to separate a small fraction of light weight particles from the mass. Figure 3 shows the shapes of the two deck styles and illustrates how each concentrates the portion it was designed to separate.

In most cases, the heavy seed were the good seed and could be rapidly drawn off the deck through "trap gates" along the upper rail leaving only a greatly reduced percentage of the flow to make the long travel to the discharge end of the deck. The result was a good increase in capacity. Since "drawing off" a large percentage of the seeds (heavies) from the top side of the deck reduced the depth of the layer of seeds on the "lower" parts of the deck, it was desirable to reduce the air pressure for the thinner layer of seeds toward the discharge end of the deck.

Earlier machines had one fan mounted either below or above the deck and had to rely on baffles under the deck to spread and make even the air pressure across the deck. The retangular deck machines were built with multiple small fans under the deck, each blowing air through the zone directly above it and each individually controlled to compensate for the diminishing depth of seed as they travelled down the deck. This individual zone control of air allows the operator to route the flow of the lighter fraction so as to maintain maximum concentration. And, once adjusted for one kind of seed, the machine remains in adjustment with only minor tuning to compensate for changes in size or quality of different lots.

A user recently told me that they ran soybeans seed for three months this winter without changing an adjustment. I call that unusual, but the simple adjustments and their effects are easy to learn. Plus, the little bit of "thinking" needed to operate a gravity causes some to do more thinking about other machines they normally take for granted.

Figure 4 shows the correct and several incorrect flow patterns over the deck and the appropriate corrective actions are indicated. But, there is one incorrect adjustment that I see all too often which is not

well illustrated. It is the use of too much air, and is likly a result of trying to get more from the machine than it can do well. You can tell at a glance when there is too much air: a bursting "bubble" effect is quite evident.

I should mention that there are three and sometimes four flows discharging from the deck (Figure 5): the stones (if any), the good heavy weight seeds, the reruns, and the culls. If there are few or no stones, the gate at the stone trap is left closed and only opened briefly once in a while to draw off whatever stones have collected in the stone trap. If there are lots of stones, the gate should be left open enough to let them out and they can be directed to a destoner to recover any good seeds discharged with them. The rerun portion - often called the middling product - is important to a good operation. The cutting "fingers" or dividers can be set to eliminate culls in the good seed and good seed in the culls letting any marginal seeds go into the rerun. When running fairly good quality seed, the rerun will likely be less than 10%. That percentage can grow when the problem is, for example, separating scabby wheat or moldy soybeans. If there were no rerun the operator would face decisions that would result in good seed being lost or bad seed in the bag. With rerun, a small mix of goods and bads can be recirculated for another pass. The rerun or middling, therefore, is a blessing rather than a curse.

While the seeds that come to the gavity should have been thoroughly cleaned, some of them will still carry dirt and dust on their surfaces which rub loose in handling or are blown free by the fans. The gravity can be hooded with a suction fan to remove the dust, and this is advisable when the machine is in a close area. However, when there is a good open area around it and good ventilation, adequate removal of dust and hulls can be effected by an aspirating feeder using a small fan to draw a current of air through the flow of seeds as they pass from the feeder onto the deck.

Capacity - No Problem

I know you're thinking about capacity - that's no problem. To achieve the 400 bushel per hour capacity plus that I mentioned earlier, a pair of machines is set side by side to split the flow from a "double" capacity cleaner.

Worth Repeating

So, I find it worth repeating that you, as well as many others, are finding, or will find, specific gravity separators to be extremely useful to:

1. Separate chipped, broken, mashed, deformed, diseased and other lightweight seeds with resultant improvements in both purity and germination.

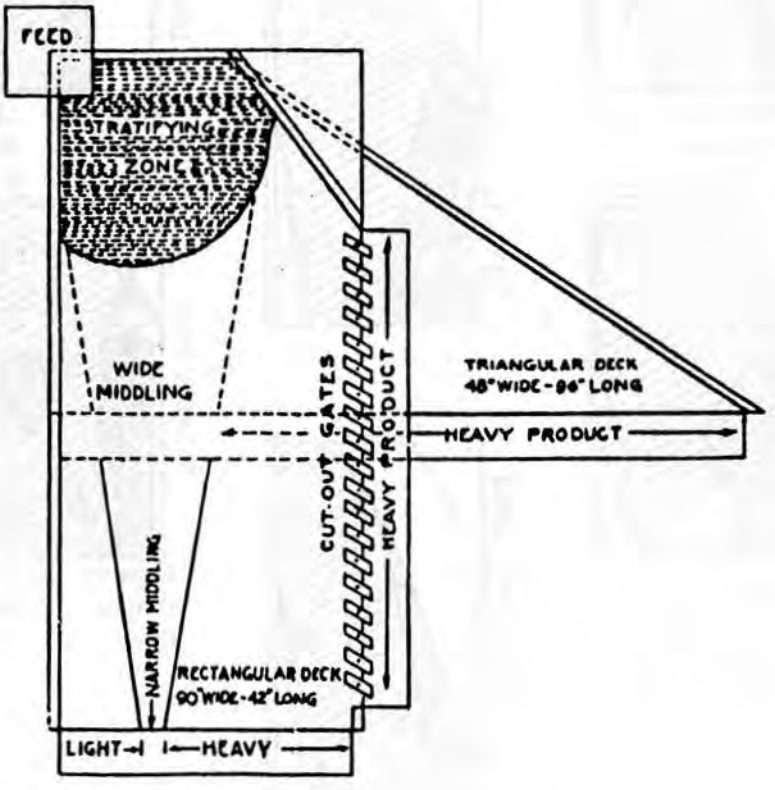

Figure 3. Comparison of retangular and triangular gravity table decks.

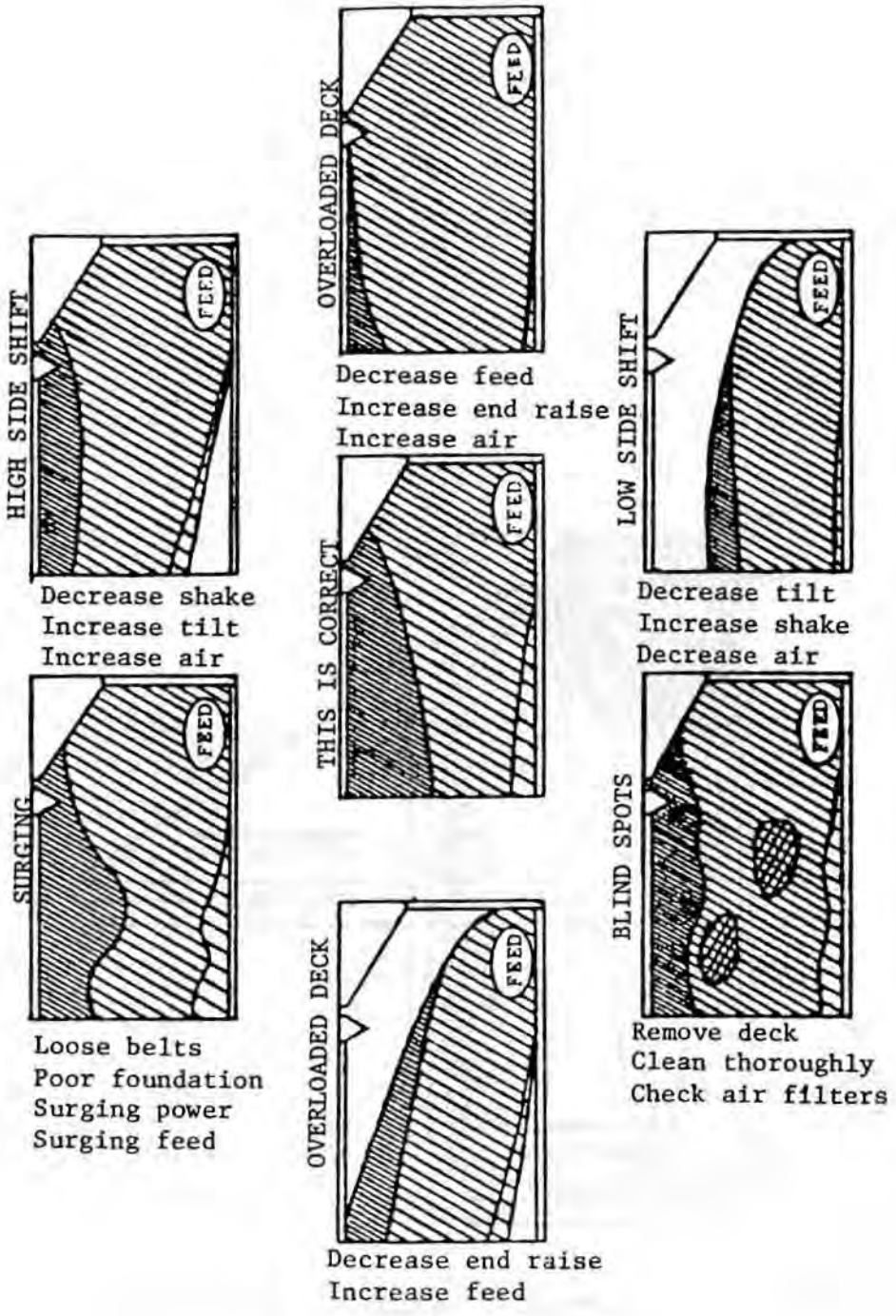

Figure 4. Common operating problems with a gravity separator and suggested corrective actions.

2. Separate stones, soil peds, sand, nails, cup bolts and other objects that are heavier than the seeds.

3. Separate weed seeds that other machines cannot remove.

4. Permit capacity increases from existing seed conditioning machines because the gravity takes out things that get flooded over the bottom screens.

5. Cause operators to maintain the correct rate of flow through preceding conditioning machines because the seeds on the gavity are highly visible.

Summary

The gravity is a unique and versatile separator. Its effective use does require a bit of thinking, but so does (or should) all conditioning equipment and operations. More and more seedsmen are finding that the gravity is important, even essential, in turning out the kind of seed product they want associated with their company name or brand. Try the gravity. Learn to use it properly. If you do, it'll become one of the key machines in your operation.

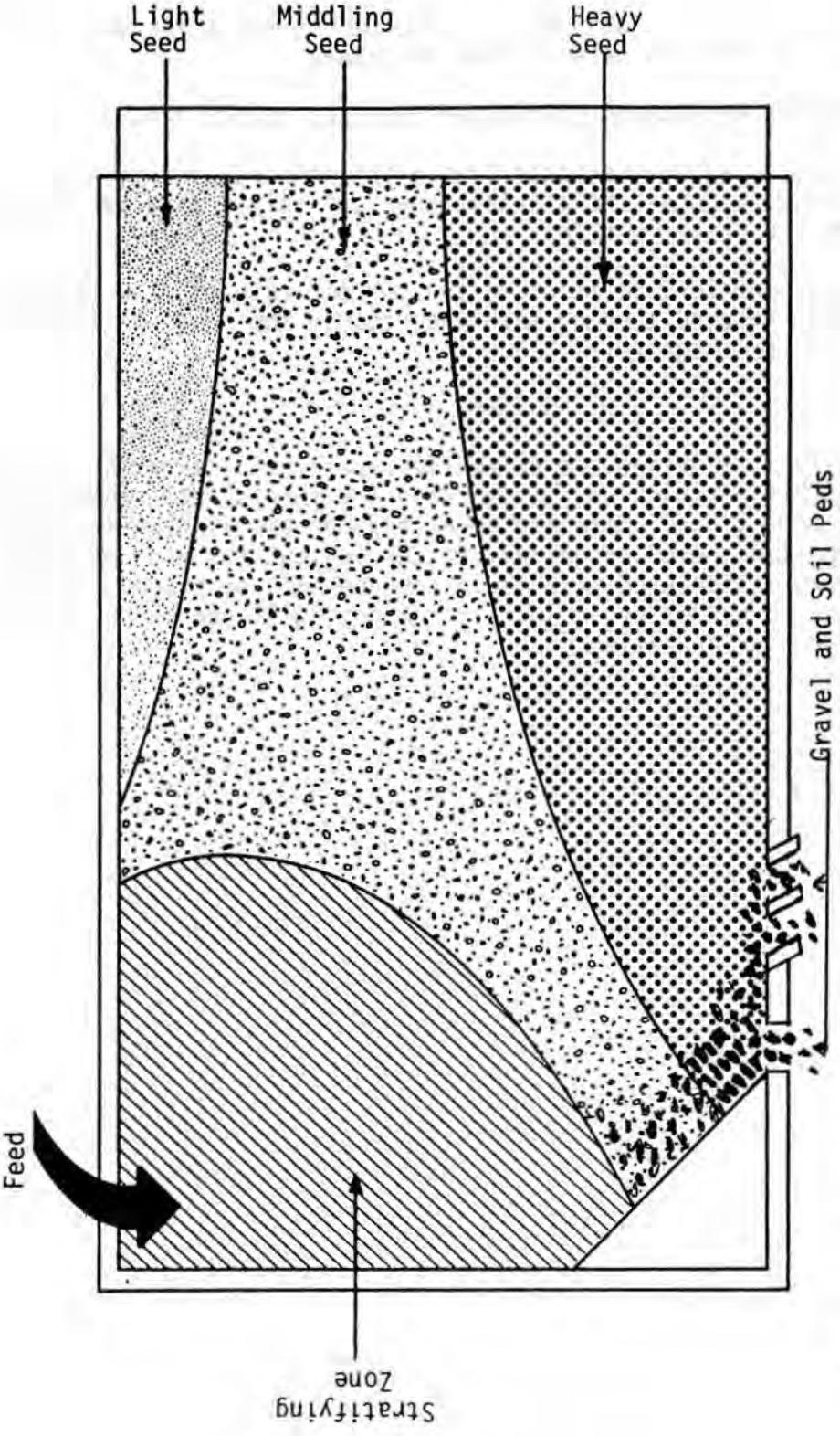

Figure 5. Top view of gravity table showing flow pattern of different types of material across the deck.