One definition of "Economical" is "managing without waste."

In most all plants processing grass seed, corn, oats, vetch, clover, etc., the gravity separation is the final clean-up unit in the operation. At this crucial point the product either go to waste or to the treater before bagging. This product is usually combined with the aspirated products and screenings and then sold to another seed cleaning plant for further processing.

In order to hold the final product to specifications, it is necessary to cut a middling product from the gravity table. In most cases of gravity table operation this is the point where the processor gets into trouble. The middlings have to go somewhere so each processor develops his own system of handling this product. In most cases the processor tries to blend the middlings back into the circuit to eliminate costly rehandling or capital investment for a middling circuit.

The Separation That Can Be Made By The Gravity Separator

(1) The gravity separator will separate products of the same size, but of different densities. (2) The gravity separator will separate products of the same density, but of different size. (3) The gravity separator will not separate a mixture of sizes and densities, unless the products being separated has a different particle shape.

What Is A True Middlings

A. A true middling is an overlap of two products of the same size but of different densities.

B. A complex middling is tailor-made or built into the process middling by mixing sizes and densities.

1/ Mr. Moore is associated with Sutton, Steele & Steele, Inc., Dallas, Texas; engineers and manufacturers of specific gravity separators, aspirators, air-float stoners, dry concentrating tables and electrostatic separators.
middling can be classified as a large light product, reporting with a small, heavy product. We can safely say that an unclassified product consisting of a wide screen range and varying densities is not an ideal feed for the gravity separator (because it contains high percentage of middlings).

**Ideal Feed For A Gravity Separator**

The ideal head feed for the gravity separator should be a classified product with limitations to balance out process as well as tonnage of each classification.

If the head feed to the gravity table is split into two products prior to tabling, conditions for uniformity of quality with very little loss is much more favorable.

With some products it would be impossible to use the gravity table directly behind the screen machine because there has to be other steps in the process. There are products that can be split into coarse and fine on the air screen and go directly to the gravity table to be run individually.

In small operations a single shoe screen machine and two storage bins accessible to the gravity table would be necessary for a complete circuit.

A larger operation might have a coarse and fine gravity table circuit with the two products blending together prior to treating.

**Functional Operation**

The gravity separator is like a teeter balance in that it fluidizes and stratifies. After stratification the heavier particles are carried forward because of the oscillating movement of the deck in which they have contact. The light material, which is the upper stratum of the fluidized bed is held back and slides over the heavier material in movement. The adjustable side-raise and end-raise, plus the air setting should be balanced so that a graduated bulk density will range from heavy to light along the table discharge.

The chosen deck for each commodity is very important to the separation. The open area, as well as the hole diameter, must be directly proportioned to the bulk density of the product as well as the size range classification of the product.

**Balance Of The Bottom Air Throughout The Gravity Separator**

The bulk density of the discharged products from the gravity table
varies continuously from heavy to light. This means that the release of air from the chest through the porous deck must be adjusted according to the position of the bulk density of the moving bed. This air controlling the fluidization and stratification should be controlled in two ways.

A. Adjustable openings control the amount of air passing from the air chest to the porous deck.

B. A cellular structure directly below the deck directs the measured air through the designated areas. This cellular structure also acts as a block to keep the air from running up and down underneath the deck seeking the lowest point of resistance to be released.

If the air passing through the deck is not controlled there is a mixing rather than a separation. This creates a large middling on any head feed.

The Use Of Upper Air In The Separation

By using a semi or totally enclosed Duo-Flo Hood with controls, the upper air can be balanced with the bottom air. The bottom air stratifies the bed, forcing the lights to the top. On some products this light material has a tendency to ride the heavier layer of stratification some distance up the deck before returning to the light end for discharge. This is usually true when one is working a large tonnage and a deep deck load. This situation will cause a wide middling. In using the controlled upper air as holding air this situation can be corrected. Immediately after bed fluidization the upper air holds the top stratified lights, positioning them for discharge, while the lower stratum is moved forward by the oscillation of the deck. This push-pull system of bottom and top air working simultaneously on the gravity table bed is beneficial in the following ways:

A. Sharper separation
B. Completely controlled balance of the process
C. Cleanliness of operation

The balance of feed rate, motion, side raise and end raise can be more easily established by the operator with proper head feed classification and air balance controls.

Benefit of Proper Operation

A. Uniformity of quality
B. Low cost per pound operation
C. High yield per dollar of capital expenditure
D. Maximum yield on off season hard to clean crops
E. Cleanliness of operation
Figure 1 - Six-cylinder Simon-Carter Precision Grader