Settled Science

The more you know; the better you'll grow.

Precision Ag begins with the seed, and that means knowing more than just a single number to characterize size and shape for a seed is a lot!

We're not going to enter the global warming fray. We are referring to something that we encounter everyday– gravity. We can all verify that gravity is working all around us, and the good news is that it has never failed us yet. Now let's add in something else that we can all agree on – time. While it always seems to be in short or limited supply, sometimes it is important to take some time and see what happens.

That is the basic principle of the OptiCount design. By putting the seeds on a flat plate, adding vibration to separate and singulate the seeds and giving gravity time to work, each seed will reach its lowest gravitational state. This creates the uniform orientation that we want so that the measurements that we take will be consistent from seed to seed.

Seeds in free-fall can rotate, and inconsistent position means inconsistent dimensions. No matter how accurate the measurement of the object in the image, if the orientation of the object is not known the dimensions can't be compared with other objects in the sample or correlated with screen sizes. Further, making two measurements from opposite sides offers no help in determining the orientation of the seed. Looking at a silhouette from both sides gives exactly the same outline. Unless we have a 3-D camera system these geometric properties in the 2-D image are all that we can measure directly, and unless we know that the orientation is consistent we can't make accurate decisions about the size and shape of the seed.

What can we determine from the measurements when the orientation is consistent? A perfectly round seed would look the same in any orientation – but few seeds are perfectly round. The obvious example is the soybean. It fits the definition of the ellipsoid, having a length, a width and a thickness, which are all different. Drop a handful of soybeans into a tray – as is done thousands of times every day across the industry. The soybeans always roll to a stop with the hilum to the side. In this orientation we measure the length, the longest dimension, and the width, the shortest dimension. This gives us two of the three dimensions for the soybean. However, we know that the third dimension, the thickness, is the smallest and we can estimate the thickness ratio. We have found this dimension to be reasonably consistent and making this estimate allows us to use the ellipsoid formulas to estimate the surface area and volume of each bean in the sample. Many products fit some form of the ellipsoid formula, but surface area and volume can be estimated even for those that are not round.

What can we do with information about the surface area and volume of each seed in the sample? Using count per pound as the only parameter to characterize seed size is like a football coach evaluating an opponent based on the average weight of the entire roster. Since volume is proportional to weight, knowing the volume of each seed and the weight of the sample, we can estimate the weight of each seed in the sample. Knowing the weight and surface area by size fraction allows you to make better decisions on cleaning and treatment setup. Variability is a major challenge in any process. Knowing variability is the first step in dealing with it.