Liquid Sampling Systems, Inc.

http://www.Pro-Rata.com

Notes #6

Sampling Statistics Simplified : What the numbers mean and why you need to understand them. Part 1

No matter what you think about statistics, the truth is that your company can never get a handle on its losses or gains without using them.

This is especialiy true when you must depend on product samples. Good sampling is a statistical process, and understanding a few things about the math can make the difference between really knowing where your problems are, and just heIplessly putting up with them.

Accuracy and Reliability

Simply put, "good" samples are those which are both accurate and reliable. An accurate sample is one which truly represents the population it is taken from, such as a bulk tank or a trmsport.

Reliability is often used interchangeably with accuracy to describe "good" samples. More specifically, however, it refers to the repeatability of accuracy, or consistent accuracy over time.

There are many factors which contribute to a sample's accuracy and reliability, rangng from your sampling equipment's design, to the techniques used by the person doing the sampling.

Variability

The reason we have to worry about the math when we take milk samples is that we are taking them from a population (the entire tank of milk) which is not uniform. It stratifies, and it is this variability from place to phce which we have to deal with.

Line 1, shown in Graph A, demonstrates why a single sample taken at different depths would not represent the average of the whole.

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In contrast, line 2. shows a totally uniform product distribution that would test the same at any sampiing depth.

Reducing variability.

When a dipper is used, the accuracy of the bulk tank sample is based entirely on the use of tank agitation to eliminate variability. Put another way, it is an effort (using agitation) to prduce a situation llke that shown in line 2, where it does not matter how the sample is taken.

With raw milk, of course, problems start when the product is not agitated enough to eliminate the variabiliv at different depths. The result is a sample which is neither accurate nor reliable, and which will be biased.

Bias

Bias is an undesirable form of variability which refers to the direction of a sample's variation from the true test of the product. It is expressed as a positive or negative number.

If the true test of a load of product is shown by the vertical line in Graph B, while curve 1. shows a negative bias, while curve 2. shows a positive bias. These are also known as skewed distributions.

Eliminating variability- the more samples the better.

Whether or not a hauler will always use enough bulk tank agitation to eliminate prduct variability before sampling is an unknown. And, although it is possible to reduce the variability of a single sample by using a better sampling instrument, (e.g. our Pro-Rata Stratatm Sampler) you are still relying on a single sample with no reference.

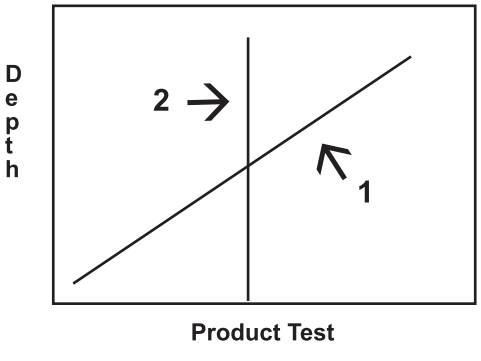
One of the most basic and important laws of statistics is that the more samples you have, the more confidence you can have in your information . This is why you need to have other samples to use as reference and comparision points.

One way to add a sample is to take a last stop sample from the tanker truck. The test of this sample is then compared to the weighted averaged test of all of the individual producer loads collected into the transport. Our 60" Strata Sampler is perfect for this.

This can be a valuable comparison sample, but it is subject to both the performance of the hauler who must collect the sample immediately after the last pickup, and to the sampling device.

A better way to increase the confidence in your samples is to collect a definitive reference sample at the plant intake. This can be done after applying lengthy agitation to product in silos. Or automatically by using a statistical in-line sampler designed for dairy products like our Pro-Rata Line Sampler.

Graph A - Variability



Graph B - Bias