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Understanding and managing variability

Bob Morrison, DVM, PhD, MBA and John Deen, DVM, PhD

We are all extremely familiar with measures such as 22 pigs weaned/mated female/year, or 0.85 lbs. ADG for nursery pigs, or 3.5% mortality for finishing pigs. We are not familiar with measures of variability such as 4.8% standard deviation for farrowing rate, 53 pigs standard deviation for pigs weaned/week or 2.8% mortality standard deviation. And yet, we hear that reducing variability holds much promise for financial gain. It is very unlikely that we will improve something unless we are measuring and paying some attention to it.

To reduce variability, we should start by understanding how to measure it. There are several common measures of variability.

- range
- percentiles
- variance
- standard deviation

Of these, the standard deviation is most powerful for most data sets. This is because it incorporates every value in its calculation as it measures the spread of the distribution. Basically, the lower the standard deviation (sd), the more predictable the measure is. For normally distributed measures, approximately 66.67% of the data will lie within 1 sd, 95% within 2 sd, and 99% within 3 sd. So if we have a herd with an 80% farrowing rate and a week-to-week sd of 5%, we can expect 66.67% of the weeks to be between 75% and 85%. As you can see, as the sd increases it becomes harder to plan the breeding program to keep the pig pipeline at desired flow.

We have been studying grow/finish mortality recently with the desire to gain greater understanding of the high average and variability that is being experienced. Below are three distributions of mortality from three systems.

Our approach is to understand the expected so that we can:

- detect groups that are experiencing more than expected and intervene; and,
- try to predict groups with risk factors and prevent high mortality.

In our experiences, we as an industry understand relatively little about the risk factors driving mortality in finishing. This makes it very difficult to intervene in a cost-effective manner and, more importantly, to prevent occurrence. The following table summarizes our observations about mortality in pork production systems

We believe that until a system measures and understands the variability in performance attributes, they will experience ongoing frustration in improving performance.

Table 1

	# of groups	Average	SD
System 1	797	2.55%	1.94
System 2	810	5.48%	1.89
System 3	200	6.26%	2.80

Table 2

Average	SD	Explainable (R^2)	Interpretation	Action
1.5%	<1.5%	<.5%	best case	stay the course
3-5%	1.5-2.5%	40%	shows promise	designed intervention trials
3-5%	1.5-2.5%	<10%	dark closet	study to understand variability
>6%	>3%	<10%	worst case	everything in, selective withdrawal



