

# Technical Bulletin

DIAGNOSTICS

## Accurate and Scientific Sampling in Swine Herds

Diagnostic sampling for detection of antibodies or antigens to infectious organisms present in swine herds represents a powerful tool that enables practitioners to identify and respond to potential production threats. The ability to conduct rapid on-farm tests greatly expands the ease and reliability of diagnostic efforts while further elevating the value of direct and frequent veterinary oversight of a production facility. However, before employing diagnostic protocols involving the use of diagnostic tests or on-farm kits, practitioners need to be fully informed of critical factors that can make or break successful outcomes.

### Sample size

A major consideration that must be carefully addressed before conducting a diagnostic work-up at any production facility is determining the proper herd sample size (how many samples to collect and process). The value of information gleaned through the use of diagnostic tests and kits is only as good as the samples collected for evaluation. While the collection of too few samples will not provide an accurate assessment of herd status, conversely, the analysis of too many samples will waste diagnostic materials and labor without providing additional meaningful information. Thus, practitioners must be knowledgeable about the proper number of samples to evaluate in a herd to insure their recommendations will prove to be both reliable and cost-effective.

Proper sample size can be easily determined based on three factors: 1) the number of head in the herd; 2) an estimate of disease/infection prevalence; and 3) the desired confidence interval.

### Herd size

Determination of the herd (population) size is an important variable that, while basic, should not be overlooked and must be included in the considerations.

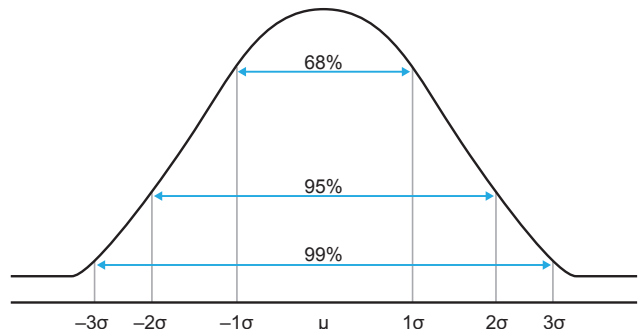
### Disease/infection prevalence

An estimate of disease or infection prevalence can be determined based on historical experience in the facility, or by estimating the percentage of symptomatic pigs.

### Confidence interval, level

In statistics, a confidence interval (CI) is an interval estimate of a population parameter and is used to indicate the reliability of an estimate. The frequency that the CI contains a parameter of interest is determined by the confidence level. This value is expressed as a percentage and corresponds with the level of significance. For example, a 95% confidence interval reflects a significance level of 0.05. Furthermore, a larger sample size normally increases the confidence level and leads to a better estimate of the population parameter.

Most diagnostic procedures are conducted at the 95% confidence level, which includes the mean ( $\mu$ ) plus or minus 2 standard deviations ( $\sigma$ ) as illustrated in Figure 1.



**FIGURE 1:** Plot of a normal distribution or 'bell' curve showing confidence intervals ( $\mu$  = population mean;  $\sigma$  = standard deviation).<sup>1</sup>

## Population, prevalence, sample size

With knowledge of the population (herd) size, an estimation of the disease/infection prevalence rate, and the desired confidence level, the proper sample size required for data collection can be determined using Table 1.

**Table 1: Sample size needed based on population (herd) size and prevalence (assuming 95% confidence).<sup>2</sup>**

POP. SIZE	PREVALENCE RATE (%): PRESUMPTIVE POSITIVE							PRESUMPTIVE NEGATIVE				
	50	40	30	25	20	15	10	5	2	1	0.5	0.1
20	4	6	7	9	10	12	16	19	20	20	20	20
30	4	6	8	9	11	14	19	26	30	30	30	30
40	5	6	8	10	12	15	21	31	40	40	40	40
50	5	6	8	10	12	16	22	35	46	50	50	50
60	5	6	8	10	12	16	23	38	55	60	60	60
70	5	6	8	10	13	17	24	40	62	70	70	70
80	5	6	8	10	13	17	24	42	68	79	80	80
90	5	6	8	10	13	17	25	43	73	87	90	90
100	5	6	9	10	13	17	25	45	78	96	100	100
150	5	6	9	11	13	18	27	49	95	130	148	150
200	5	6	9	11	13	18	27	51	105	155	190	200
500	5	6	9	11	14	19	28	56	129	225	349	500
1000	5	6	9	11	14	19	29	57	138	258	450	950
5000	5	6	9	11	14	19	29	59	147	290	564	2253
10000	5	6	9	11	14	19	29	59	148	294	581	2588

A major factor determining the range of a confidence interval is the size of the sample used in the estimation procedure. As illustrated in Table 2, a decrease in the number of samples will lower the CI. For example, when sample size decreases from 28 to 15 in the 10% prevalence-rate column, the confidence level decreases from 95% to 80%, and the results of testing are less reliable.

By carefully determining the proper sample size before conducting diagnostic procedures, practitioners can fully exploit the benefits of rapid on-farm diagnostic kits and lab-conducted tests, and provide their clients with critical health-status information that can help optimize productivity and profit potential.

**Table 2: Impact of confidence interval on sample size (2000 head).<sup>2</sup>**

CONFIDENCE INTERVAL	PREVALENCE RATE (%)		
	5%	10%	15%
99%	90	44	28
95%	58	28	18
90%	45	22	14
85%	37	18	12
80%	31	15	10
75%	27	13	9

1. Adapted from <http://www-stat.stanford.edu/~naras/jsm/NormalDensity/NormalDensity.html>. Accessed February 2013.

2. Zessin KH. Sampling strategies/sample sizes. Freie Universität, Berlin. 2009.

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