

## Testing A.I. Sires for Fertility

by Dr. Gamal Abdel-Azim

Research Geneticist, Genex

We know conception rates differ across artificial insemination (A.I.) sires, but how do we properly estimate sire conception rates (CR)? Many herds simply rely on their herd's internal CRs from a particular sire. Unfortunately, this within-herd estimate of CR is biased for many reasons. First, on a given sire there is limited conception data available in one herd. Limited data in one herd produces estimates of sire CR that are extremely variable across herds.

To give you a feel of the magnitude of within-herd CR variation, I accessed the Genex fertility database and picked a bull with over 80,000 services. I then categorized herds into five categories according to the number of inseminations available from this sire (table 1, column 1). As seen in the second column, within-herd CR variation goes up as the number of services goes down. Notice the association with wider ranges of within-herd CR (column 3).

Table 1. Within-herd variation and ranges of raw conception rates according to number of inseminations (from one sire<sup>1</sup>) per herd.

Number of Inseminations	Variation of within-herd CR <sup>2</sup>	Range of within-herd CR <sup>2</sup>	Probability of hitting the bull's true CR <sup>2</sup>
<10	0.032	0%-100%	1.00%
>10 ≤ 50	0.024	16.7%-100%	1.20%
>50 ≤ 100	0.017	34.4%-100%	1.52%
>100 ≤ 500	0.017	34.4%-88.7%	1.84%
>500	0.009	40.8%-69.4%	3.50%

<sup>1</sup>HOUSA000130161253 <sup>2</sup>Conception rate

The first row tells us if there are 10 services from any sire in your herd, the percentage of successful inseminations from this sire could be anything from total failure (all services failed) to total success (every service resulted in a pregnancy). But because you can get any number between zero and 100 percent success, your probability of hitting the bull's true CR just by luck is one percent (one divided by the range). It is interesting that even if there are greater than 500 services in one herd, your probability of coming up with the bull's correct CR is just 3.5 percent. The 3.5 percent probability of luckily obtaining the correct CR by calculating within-herd percentage of successful inseminations becomes more conceivable if you notice the calculated within-herd CR ranged from 69.4 percent to 40.8 percent, a wide range of 30 percentage points across herds!

Dairy business should never be run this way, otherwise you would be making less money than a gambler having fun in Vegas. Here we should also warn against farm software programs that report numbers similar to within-herd CR.

There are many other reasons for avoiding a naive calculation of successful inseminations within a herd. Among these reasons are differences in conception rates because of:

- Year and season of the insemination
- Parity of the inseminated cow
- Skill of the inseminator
- Age of the bull at collection time
- Fertility of the inseminated cow

These factors complicate sire CRs because, for example, if the percentage of heifers breed to the sire in a herd is large, upward bias will occur in calculating the CR. Other types of bias will similarly occur because of the other factors listed above.

What is the proper way of assessing CRs of service bulls? The answer is a statistical approach that adjusts for variation across herds along with the other factors that effect CRs. Fortunately, you do not have to go through these statistical complications yourself; The United States Department of Agriculture, through its research Animal Improvement Programs Laboratory, periodically reports proper numbers to rank bulls for fertility. The numbers reported (commonly referred to as ERCR or Estimated Relative Conception Rates) are adjusted for all factors mentioned above. In addition, our research team at Genex established GenCheck™, which is a fertility evaluation system connected to a huge database of more than 9,000,000 services. The [advantage of GenCheck](#) is not only in ranking service bulls for fertility, but also in its ability to estimate correct CRs adjusted for inaccuracies caused by limited services on a bull in any particular herd. Bottom line, using internal herd data to make decisions on the fertility level of a sire is risky at best!

**Author Bio:** Gamal Abdel-Azim earned his master's and Ph.D. in genetics and statistics at Iowa State University. He then joined the Genex dairy genetics department where he is in charge of research and data analysis.