

Improving Cow Fertility

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Daughter Pregnancy Rate (DPR) evaluations have now been available to dairy producers for five years, which makes this a good time to review what we have learned about DPR and its effectiveness as a selection tool.

DPR is derived from days open records, or the interval from calving to conception. Daughters of a sire with a +1.0 DPR PTA are expected to conceive four days earlier, on average, than daughters of a sire with a +0.0 DPR. The range in DPR for active Holstein sires is currently -4.7 to +3.7, which equates to a difference of over one month in days open.

Fertility Trait Comparison

Days open is a function of days to first service, the ability of the cow to conceive and maintain pregnancy, and the interval between services for non-pregnant cows. Because there are several reproductive events that contribute to a cow's days open, most consultants favor 21-day pregnancy rate as a management tool to diagnose herd reproductive problems. There has also been some concern over the appropriateness of DPR for herds that use timed A.I. because one of the major components of days open (days to first service) is determined by herd management rather than the biology of the cow. It is helpful to compare DPR to other measures of fertility to determine what we can really expect to change when we select for DPR.

A comparison of DPR with fertility traits from 14 other countries has been conducted by INTERBULL¹, and the results are summarized in Table 1. All traits, with the exception of conception rate and number of inseminations, are recorded in multiple countries so a range of heritability and genetic correlation estimates are presented.

Table 1. Minimum and maximum heritability estimates for international fertility traits and correlations with daughter pregnancy rate.

Trait	Heritability		Genetic Correlation	
	Min (%)	Max (%)	Min	Max
Non-return rate	1.5	2.0	0.23	0.41
Number of inseminations	3.0	...	0.77	...
Conception rate	2.0	...	0.68	...
Days to first service	4.2	10.1	0.63	0.72
Calving interval	3.3	5.8	0.80	0.89
Days open	3.1	4.0	0.91	0.93

There are several key observations from Table 1. Heritabilities for conception-related traits (non-return rate, number of inseminations, conception rate) are lower than heritabilities for days to first service. Traits like days open and calving interval, which depend on both days to first service and a successful conception, have heritabilities that are intermediate.

The second observation is that DPR is highly correlated with all of the traits except non-return rate. Non-return rate was the least heritable of all traits and DPR was more highly correlated with the direct conception-related traits (number of inseminations and conception rate). Days open and calving interval are the traits most similar to DPR and were also the most highly correlated with DPR. These correlations indicate that DPR can be expected to improve both conception rate and days to first service.

Is DPR Fitting for Timed A.I.?

There is some concern over the impact of days to first service on DPR in herds that use timed A.I. because biological variation for days to first service is reduced or eliminated in such herds. Evidence has accumulated suggesting this does not reduce the effectiveness of DPR in timed A.I. herds.

Results from a detailed genetic analysis of actual 21-day pregnancy rate were recently reported by University of Wisconsin-Madison researchers². The correlation between predicted transmitting ability for 21-day pregnancy rate and DPR was 0.71 for sires with 100 or more daughters. The relatively strong relationship between DPR and 21-day pregnancy rate is encouraging and indicates that DPR is appropriate for timed A.I. herds.

Are Low Reliabilities a Concern?

A practical concern when selecting for DPR is the low reliability of recently proven progeny test bulls. The low reliabilities are a function of the low heritabilities in Table 1. We can't do a lot to change those reliabilities, but we can spread our risk to help protect against bulls with inaccurate proofs.

I compared DPR evaluations in 2005 to DPR evaluations in 2008. There were 79 bulls that had reliabilities from 45% to 65% in 2005 (which is a typical range for recently proven bulls), and greater than 90% in 2008. Twenty-three bulls had a 2005 DPR of +0.5 or greater. The average DPR of those 23 bulls in 2008 was +0.87 and 13 still had a DPR of +0.5 or more. However, seven of those 23 bulls had a DPR that was negative. If a producer selected only one or two of those high DPR bulls in 2005, he risked the misfortune of selecting those negative bulls and would not have made the progress for DPR he intended. By spreading his risk across more bulls, he would have made out very well on average.

DPR is strongly correlated with a number of fertility traits including days to first service, conception likelihood and 21-day pregnancy rate. Producers can expect daughters of high DPR bulls to have improved fertility regardless of their management system. Because of relatively low reliabilities, some bulls with high DPR will have over-estimated DPR. Producers should consider spreading their risk by using a larger number of bulls with high DPR. There are improvements that can be made to DPR, but it has proven to be a very effective tool to help select for improved fertility.

References

¹Jorjani, H. 2007. *International genetic evaluations for female fertility traits. Interbull Bulletin 34. p. 57-64.*

²Chang, Y. M., O. González-Recio, K. A. Weigel, and P. M. Fricke. 2007. Genetic analysis of the twenty-one-day pregnancy rate in US Holsteins using an ordinal censored threshold model with unknown voluntary waiting period. *J. Dairy Sci.* 90:1987-1997.

Author Bio: Dr. Chad Dechow earned his bachelor's degree from Cornell University, his master's from The Pennsylvania State University and his Ph.D. from the University of Tennessee. He has served as an assistant professor in dairy cattle genetics at Penn State since 2003.