Genetic Evaluations Now Include Fertility Measures

Achieving desired reproductive performance is a challenge for every dairy producer. Most agree that success is reached when cows return to normal reproductive status after calving, display visible signs of estrus, conceive when inseminated and maintain pregnancies. Yet, reduced fertility levels challenge dairy producers today as never before.

Why are fertility levels decreasing? While a long list of environmental reasons could be cited, the major genetic reason seems to be selection for high milk production. And, as production levels increase, reproductive success is even more challenging. While we've increased production levels of the Jersey cow more than 60% over the past 25 years, her days open have increased 30 days per lactation *(Figure 1)*.

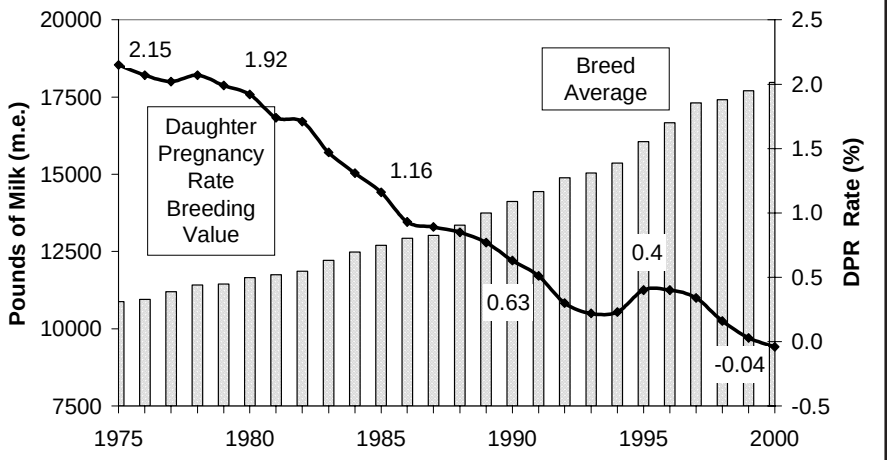

Fig 1. Jersey production (m.e. milk) and average sire DPR breeding value, 1975-2000.

The genetic tug-of-war that exists between production and reproduction is well known. Generally, as milk production increases, so do days open: the genetic correlation between the traits stands at +0.35. Further complicating the issue is the fact that the heritability of female fertility is a low 4%.

There is good news for improving fertility, though. The genetic correlation between milk production and days open is not a perfect +1.0. There is enough variation that improvements can be made. And, even though we haven't directly selected for fertility, we have indirectly selected for improvements through genetic evaluations for length of productive life. There is a tremendous –0.60 genetic correlation between productive life days and days open, nearly double the correlation between productive life and other important traits. Generally, as productive life increases, days open decrease.

The best news for improved fertility, though, is that we now have genetic tools available to directly select for improved fertility.

DPR: A New Fertility Selection Trait

In recent years, many reproductive specialists have recommended using pregnancy rate to measure reproductive success rather than days open. Pregnancy rate calculations are more current because cows that do not become pregnant are more easily included in calculations and because larger, rather than smaller, values are desirable. Additionally, many dairy producers are familiar with pregnancy rates because consultants, veterinarians and herd management software programs routinely use them.

For those who aren't familiar with pregnancy rate, it is defined as the percentage of non-pregnant cows that become pregnant during a 21-day period. Calculation is relatively simple. Choose a recent 21-day time period (the length of a typical estrus cycle), then divide the number of cows that became pregnant during this period by the number of cows that were eligible for breeding. To illustrate, there were 100 cows eligible for breeding from August 1 to August 21. Of these, 20 cows became pregnant, for a pregnancy rate of 20%.

Genetic evaluations of pregnancy rate are expressed as Daughter Pregnancy Rate (DPR) for bulls. The Animal Improvement Programs Laboratory (AIPL) began providing genetic evaluations for DPR in February of 2003. Cows are evaluated similarly with an index labeled Pregnancy Rate (PR).

DPR relies on the traditional days open for its calculation. This is because the most reliable source of cow fertility information still is days open and subsequent calving dates. Issues still exist with days open, because some cows don't calve again and thus cannot have a subsequent verified calving date. As well, some dairy producers do not report insemination or pregnancy data. For these cows, days open is calculated by subtracting 280 days, the length of a typical gestation, from the calving date. Finally, some cows are culled for infertility, so a large value of 250 days open is assigned.

Even though the original data is expressed as days open, DPR can be obtained using a simple approximation. A 1% increase in DPR corresponds to a four-day decrease in days open, and vice versa. For example: +1% DPR equals 4 fewer days open.

DPR can be defined as the amount by which daughters of a particular sire are expected to exceed or fall short of a herd's average 21-day pregnancy rate.

DPR Values of Jersey Sires

In order to become familiar with DPR, the values of some well-known Jersey bulls with DPR reliabilities greater than 90% are listed in Tables 1 and 2.

Table 1. Highest-Ranked DPR Bulls born after January 1, 1980

		Effect on Days			
Name	DPR	Open	PL	NM$	JPI™
Bret-ET	2.1%	-8.4	2.4	203	71
Belles Expo-ET	1.6%	-6.4	0.9	-11	-5
Mason Boomer Sooner Berretta	1.5%	-6.0	2.5	298	168
OSBS Mister T	1.3%	-5.2	1.2	166	82
Clover Farms Protein	1.3%	-5.2	1.1	30	-1

Table 2. Lowest-Ranked DPR Bulls born after January 1, 1980

Name	Effect on Days DPR	Open	PL	NM$	JPI™
Molly Brook Bold Dan-ET	-2.5%	+10.0	-1.3	139	120
Duncan Duke of Glenwood	-2.0%	+8.0	-0.7	97	73
MVF Bold Venture Daniel	-1.9%	+7.6	1.4	386	221
Lester Venture Peregrine	-1.8%	+7.2	0.6	226	157
Al-Top All American	-1.8%	+7.2	-2.3	168	157

Assume that a herd's 21-day pregnancy rate is 20%. The "Bret" daughters would be expected to have an average 21-day pregnancy rate of 22.1% (herd PR 20% + DPR 2.1% = 22.1%). "Bold Dan" daughters would be expected to have a 21-day pregnancy rate of about 17.5% (herd PR 20% – 2.5% DPR = 17.5%).

Or, assume that the average days open for this herd is 153 days. The "Bret" daughters can be expected to average 145 days open (2.1% DPR x 4 days = 8.4 days; 153 – 8.4 = 145 days). In contrast, "Bold Dan" daughters would be expected to average 163 days open (-2.5% DPR x 4 days = 10 days; 153 + 10 = 163 days).

Daughters of the best DPR bulls will have pregnancy rates one to two percentage points higher than the other cows in the herd, while those from the poorest DPR bulls will fall one to two percentage points below the 21-day pregnancy rate. When expressed as days open, differences between the best and worst fertility bulls span about three weeks.

Where is DPR Used?

DPR information is now included in the AJCA database. The August 2003 Jersey Genetic Summary provides DPR information for the first time on Active A.I. sires (Section II), all summarized bulls (Section III), and cows (Section IV). DPR indexes are also printed on the Top 100 Bulls with NAAB Codes list, published on proof day each quarter. DPR information will be incorporated in the calculation of the Jersey Performance Index™ and included on Official Performance Pedigrees when feasible.

For more information on DPR and cow fertility, visit the National Association of Animal Breeders (NAAB) website at www.naab-css.org/education/CowFertility-0203.html, or the AIPL website at aipl.arsusda.gov/reference/fertility/DPR_rpt.htm.

Key Considerations

Many high-ranking JPI™ and production bulls will have negative DPR numbers. This is due to the fact that production and reproduction are negatively correlated. Relatively few bulls will rank high for both production and reproduction traits. You should **not** eliminate bulls that are average or slightly below average for fertility if they are superior for other economically important traits, like JPI™. First, select a group of bulls for economically important traits, then, fine-tune the list for fertility as it fits your needs.

Net Merit Dollars (NM$) now includes DPR. The calculation of NM$, Fluid Merit Dollars and Cheese Merit Dollars incorporate DPR, so a measure of fertility has been included. Use NM$, or another appropriate index such as JPI™, to select the initial group of mating sires, then screen out extremes for DPR.

Daughter Pregnancy Rate is not the same as Estimated Relative Conception Rate (ERCR). DPR measures the fertility of a bull's daughters. ERCR measures male fertility. It shows a bull's ability to produce fertile semen that will result in pregnancy. Female and male fertility are independent traits, and both are useful in predicting reproductive success.

Most first-crop A.I. bulls will have low reliability values for DPR. Since the heritability of female fertility is just 4%, most recently released bulls will have relatively low DPR reliabilities of 45% to 60%. Pedigree will be a major influence in calculating DPR values for these bulls.

There will be a delay between a bull's first production evaluation and his first DPR evaluation. This delay may be at least three sire summaries. There needs to be an opportunity for a cow to become pregnant before she can contribute to her sire's fertility proof. And, if a cow is in a herd that does not report breedings, a subsequent calving will be needed to contribute information to her sire's proof.

DPR values may change significantly over time, as new information is added. Although additional information typically changes low reliability values for most traits, it is even more significant with DPR values, since breeding, calving interval, and reproductive-cull information arrives at different times during a bull's life.

DPR is a new genetic trait. Take some time to study the DPR values of your favorite Jersey bulls and watch how they change over time. Try to view Daughter Pregnancy Rate as a first step toward genetic improvement of cow fertility.