

PERFORMANCE INDEXING FOR BEEF CATTLE

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A performance index developed for beef herds enrolled in the California Beef Cattle Improvement Association provides a good estimate of an individual cow's future production potential, based on past production records—whether for one calf or for several.

CATTLEMEN WHO HAVE kept performance records on their cow herd still face a problem in making a legitimate comparison between a cow with one or two calves on record and a cow with six calves—especially if both cows have the same average weaning index for the number of calves each has produced. The formula now being used by the California Beef Improvement Association, as discussed in this article, is based on work begun by Jay L. Lush, Professor of Animal Breeding, Iowa State University, involving the "repeatability" of records. If cows tend to produce uniformly year after year, the production record of a first-calf heifer would be a most reliable estimate of her lifetime production. However, this is not the case, because cows do not produce the same each year. Calf performance is affected by many factors—changes in environment, different sires, or simply chance genetic effects.

Workers in various experiment stations who have studied beef cattle production traits, have estimated a repeatability of weaning weights ranging from 34 to 59 per cent. In each case these workers measured the repeatability as a permanent characteristic of the cow.

Since performance records are only somewhat repeatable, a single record is not a very reliable indicator. By averaging the number of records for each cow, errors are minimized and the variability between cows is reduced.

The measure of repeatability is the coefficient of correlation between records made by the same cow in different years.

With that coefficient, the herd average, and individual records, the real production ability of each cow can be estimated under conditions standard in the herd.

In the California cow production index, 0.5 is used as the coefficient. With that coefficient (0.5 or r in the following equation), the herd average, the number of records a cow has (n in the equation), and the average weaning index of her calves, an equation is possible that provides a reliable estimate of the future performance of any cow under the environment of the herd. The equation follows:

$$\text{Most probable production ability of cow} = \frac{nr}{1-r+nr} \times (\text{her average record}) + \frac{1-r}{1-r+nr} \times (\text{the herd average})$$

Another way to state the same formula is: The most probable production ability of the cow = the herd average + $\frac{nr}{1+(n-1)r}$ X (her own average, minus the herd average).

The fraction $\frac{nr}{1+(n-1)r}$ shows how much trust can be put into the cow's own average as an indicator of her real production ability.

Not until a cow has produced her first calf and has established a record is there an indication of what she will produce in the future. However, if r (the coefficient of correlation) is small, this one indication is not too reliable. With two calves recorded, somewhat greater confidence can be placed in the cow's producing ability. As the number of calf records increases, the cow's average becomes more reliable, and there is less need to use the herd average.

By using the fraction

$$\frac{nr}{1+(1-1).5}$$

with n as the number of records and r as the coefficient of correlation (0.5), the weighting factors for a cow with only one calf on record would be 0.5. Continuing to add to the number of records (n) in the formula would give the following weighting factors for a cow's average record:

2 = .67; 3 = .75; 4 = .81; 5 = .83; 6 = .86; 7 = .88; 8 = .89; 9 = .90; and 10 = .91.

Summary

A cow's performance index is actually an estimate of her future production. It is calculated by using a coefficient (r or 0.5) in the equation and takes into consideration the number (n) of records a cow has accumulated, the average of her records, and the herd average. The coefficient of correlation measures the repeatability of the records, and makes possible an estimate of the real production ability of the cow—taking into consideration the number of her records under conditions standard in the herd. Through the use of this information as described, it is possible to compare the producing ability of cows with different numbers of records.

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