How to Set Goals for Your Breeding Program

Jeffrey F. Keown, Extension Dairy Specialist
Paul J. Kononoff, Extension Dairy Specialist

This NebGuide describes how to determine which dairy cow trait(s) to select for, and how multiple trait selection affects genetic progress.

Dairy producers are often concerned with placing emphasis on different production traits in their breeding program. Selecting only economically important traits should be every producer's objective. The use of artificial insemination (A.I.) sires is the most economical and productive way to increase the herd's genetic potential.

A cow's record is a measure of her genetic potential, which is modified by the environment in which she is kept. Environmental factors that directly influence a cow's record include types of housing, milking equipment, feeds and feeding, veterinary care, mastitis treatment and climatic conditions. Only through control of these factors can the true genetic ability of a cow be expressed.

All environmental factors are in a constant state of change. Therefore, most changes made in the environment that influence production traits are not permanent. These factors must be monitored and adjustments made daily to maintain optimal production. Unlike environmental changes, genetic changes are permanent. You need only to breed to a top production A.I. sire to make genetic gain that is permanent throughout a cow's lifetime. The investment is made only once when breeding your herd.

Genetics is the key that unlocks the door to efficient production. In the current dairy economy, any increase in efficiency without incurring significant added costs is a program that should be followed.

Evaluate Your Selection Goals

If you choose to follow an A.I. breeding program, some questions must be addressed. Two of the most important ones are:

1. How many traits (such as pounds of milk, fat or protein) should you select for?

2. Which traits are the most important?

The first question is rather simple to answer. Select for as few traits as possible. There is a direct relationship between the number of traits in a selection program and the amount of progress that can be made. *Table I* illustrates this.

Table I. Amount of genetic progress in primary selection trait possible when selection is also carried out on secondary traits.

Number of Traits Selected	Progress in Primary Trait
1	1.00
2	.71
3	.58
4	.50
5	.45
6	.43
8	.35
10	.32

Let's suppose that your main objective is to increase the genetic potential for milk production. If this is the primary goal, and it probably should be, then you should select solely for milk production. If you put emphasis only on milk production in a breeding program, then you will make maximum progress for this trait. If, however, you select for two traits at the same time, you have lowered your progress in milk production (the primary trait) to 71 percent of the maximum. Likewise, if you select for 10 traits, you have seriously reduced your potential increase in milk production to only 32 percent of its maximum.

It is not difficult to include more than 10 traits in a selection program. The economic traits most often selected for are the production traits of pounds of milk, fat or protein. Many producers place additional emphasis on functional traits—feet, legs, udder support or teat placement, among others.

Some additional traits placed in selection programs are purely cosmetic in nature—rumps, heads, strength and toplines, to name a few. If a selection program contained all of these traits, the progress that would be made in the economic (production) traits would certainly be minimized.

Always remember this basic genetic principle: *The more traits selected for, the less progress made in the primary trait or traits of importance.*

An excellent method for deciding which traits to select for consists of identifying all of the traits in your breeding program and listing the corresponding income generated from selecting for each trait. If no income is generated from a trait, delete it from your list. An example of such a list is in *Table II.*

Table II. Example of making a list to decide which traits are most important in designing a breeding program.

Trait	Income ($) Generated from Trait
Milk	
Fat	
Protein	
Solids Not Fat	
Somatic Cell	
Feet and Legs	
Teat Placement	
Rump	
Front End	
Topline	
Strength	
Head	

The sole purpose of any breeding program is to generate income for the dairy enterprise. If you do not sell cattle, or just sell an occasional heifer, then the cosmetic traits should immediately be de-emphasized. The estimation of cosmetic traits or type traits are subject to considerably more human error than are production traits. Progress in type traits is less likely to be made, and if progress is made, it will be slower than for the production traits.

If a producer wishes to include non-production traits in a breeding program, they should be added in a way that does not seriously jeopardize the emphasis placed on the production traits. Selection should first be placed on the production traits. Then, mating of individual cows can be based on the non-production traits of those sires of interest. If you initially select sires on non-production traits, it can seriously affect income because of decreased production. Always select on the traits that generate the most income.

Every producer should make a list of income-generating traits yearly so that each trait's true value in the breeding program can be objectively evaluated. The failure to justify your selection goals based on income can jeopardize the financial future of your dairy enterprise. One fact soon learned from this exercise is that great emphasis should be placed on the production traits. Over 95 percent of dairy producers will come to the conclusion that selecting solely on the production traits will maximize income.

Maximizing Genetic Progress

The amount of progress that can be gained from an A.I. program can be divided into four specific areas as shown in *Table III.* Most progress is made in selecting sires to produce the next generation of bulls, with 43 percent of the total genetic progress in this area. The second most influential factor in genetic progress comes from selecting dams of future bulls (33 percent). Selecting a group of sires to breed your cows accounts for 18 percent of the total genetic progress, whereas the selection of dams to produce cows is the least important, accounting for only 6 percent of the total.

Table III. Optimum percentage of genetic progress associated with sire.

Source of Progress	Percentage Possible
Sires of bulls	43
Dams of bulls	33
Sires of cows	18
Dams of cows	6

Selecting sires and dams to produce the next generation of A.I. sires accounts for over 3/4 of the potential genetic progress (43 percent plus 33 percent). Since there are millions of cows and hundreds of sires to select from, this area should receive the most attention when selecting. By selecting the top genetic potential dams and sires, you can greatly increase genetic progress. If you plan to use an A.I. program, it is important for you to know what type of sire program is being used by the A.I. organization to be certain that the organization is maximizing this 76 percent in terms of your goals.

An A.I. organization should base its sire program on the traits that will increase income to the producer. All A.I. organizations should assess their selection goals in relation to the traits that are important to the majority of their members, rather than those traits that are easiest to sell or that can be merchandized at high prices. Once these goals are objectively evaluated, a sound genetic program can emerge. If the A.I. organization you are using has a sound genetic program, 76 percent of the genetic progress you can make is being taken care of for you. You then only need to worry about the remaining 24 percent, 18 percent of which is accomplished by choosing a group of sires available from the A.I. organization that fits your selection goals. The remaining 6 percent involves the selection of cows to produce replacements. The genetic progress from the selection of cows to produce replacement is low because a producer has a limited number of cows to use to produce heifers, thus greatly limiting genetic progress.

Conclusions

When designing a breeding program, each trait's relative importance in the selection program must be evaluated. A dollar figure should be placed on each trait so that its economic importance can be evaluated. Eliminate any trait program that does not significantly affect income. Genetic progress is permanent but environmental progress must be monitored daily if maximum income is to be generated. Genetic potential is the key that unlocks the door to efficient production through proper feeding and management. Genetic progress is controlled by two groups—the A.I. organization and the producer. Seventy-six percent of optimum progress is controlled by the A.I. organization; 24 percent is in the hands of the producer. A genetically sound A.I. young sire program is essential to continued genetic progress.

Additional dairy information can be found at: *www.nebraskadairy.unl.edu*.

UNL Extension publications are available online at *http://extension.unl.edu/publications*.

Index: Dairy
Breeding and Reproduction
1985, Revised October 2006