

Genetic Improvement Possibilities

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The operation of a dairy farm business has many facets and each must be managed well if the business is to be successful. The progressive dairy manager should always be seeking improvement in each of these facets. While most of those aspects are obvious such as herd nutrition and feeding, herd reproduction, herd health and milking management there are some aspects that are not so obvious. One such facet is herd genetics.

Virtually every aspect of dairy cattle performance is controlled by genetics – milk, fat and protein yield, reproduction, feed efficiency, length of life in the herd, calving ability, and ability to resist diseases such as mastitis as well as all the dairy cattle conformation traits such as udder, feet and legs and stature to name a few. Each cow in the herd has her own unique genetic makeup.

So what is the importance of the genetics of the animals in the herd? If every aspect of dairy cattle performance is under some degree of genetic control, is there some way we can take advantage of this in our dairy herd?

The answer to the first question is that genetics is only important if you want to make improvements in animal performance in future years. Are heifer replacements that will become better performing cows in future years desirable? If the answer is yes, then knowing what can be done to bring about this improvement will provide the answer to the second question.

Genetic change and hopefully improvement takes place when the parents of the next generation of animals are chosen. For a dairy herd, that means choosing the sires and dams of potential heifer replacements and doing so on the basis of their expected genetic merit. Dairy herds that are enrolled in the Dairy Herd Improvement (DHI) program will be able to get a genetic evaluation of each of their females if they are sired by an AI sire. This genetic information on females and genetic evaluations of dairy AI bulls will provide the herdowner with the information necessary in making the genetic selection decisions on which sires and dams will be the parents of the next generation of heifer replacements. This kind of genetic evaluation information has been available for over 50 years. Because of the selection of AI bulls and cows to become the parents of the next generation of replacement heifers, as an example for milk yield, our Holstein dairy cattle today have the genetic ability to produce about 7,000 more pounds of milk per lactation than they did in 1958. This genetic improvement accounts for just over 50% of the total improvement in milk yield of just over 13,000 pounds of milk per lactation. Genetic improvement of dairy cattle is possible.

In what ways might we want to improve our dairy cattle? Several traits of economic importance in dairy cattle performance were mentioned earlier. These included: milk, fat and protein yield, reproduction, feed efficiency, length of life in the herd, calving ability, and ability to resist diseases such as mastitis as well as all the dairy cattle conformation traits such as udder, feet and legs and stature. In fact, these traits are already included in indexes that are calculated for bulls and cows today by the Animal Improvement Programs Laboratory (AIPL) of USDA. At AIPL, three indexes are already calculated three times per year (February, April and August) from data submitted from across the country through the DHI system.

The three indexes for lifetime profit are Net Merit \$ (NM\$), Cheese Merit \$ (CM\$) and Fluid Merit and (FM\$). The economic weights for the traits in these indexes and their relative values are given in Table 1.

Table 1. Traits in lifetime profit indexes, their economic value per predicted transmitting ability unit (PTA) and their relative value in each index.

Traits	Units	Standard Deviation (SD)	Value (\$/PTA Unit)			Relative Value (%)		
			NM\$	CM\$	FM\$	NM\$	CM\$	FM\$
Protein	Pounds	19	3.41	7.52	0	16	25	0
Fat	Pounds	27	2.89	2.89	2.89	19	13	20
Milk	Pounds	723	0.001	-0.119	0.107	0	-15	19
PL	Months	2.5	35	35	35	22	15	22
SCS	Log	0.23	-182	-235	-91	-10	-9	-5
Udder	Composite	0.90	32	32	32	7	5	7
Feet/ Legs	Composite	1.03	15	15	15	4	3	4
Body Size	Composite	1.03	-23	-23	-23	-6	-4	-6
DPR	Percent	1.70	27	27	27	11	8	12
CA\$	Dollars	20	1	1	1	5	3	5

PL= Productive Life, SCS= Somatic cell score, DPR= Daughter Pregnancy rate and CA\$= Calving Ability \$

If there is selection on either of these indexes what genetic improvement might take place? Table 2 lists the genetic progress which might be expected if the current annual trend of 25 NM\$ continues.

Table 2. Expected genetic progress in the traits included in the NM\$ lifetime profit index.

PTA Traits	Expected Genetics Progress From NM\$	
	PTA/Change Year	Breeding Value Change/Decade
Protein	2.1	43
Fat	3.8	76
Milk	69	1,374
PL	0.5	10
SCS	-0.02	-0.45
Udder	0.04	0.8
Feet/Legs	0.04	0.8
Body Size	-0.05	-0.98
DPR	0.17	3.5
CA\$	1.5	30

There are substantial improvements in most of the traits in the index. Besides the yield traits, there is expected to be a 10 month improvement in genetic merit for productive life and a 3.5% improvement in genetic merit for daughter pregnancy rate. These potential improvements are available to dairy producers who select among their cows the dams of future replacement heifers and mate them to AI bulls selected on NM\$.