

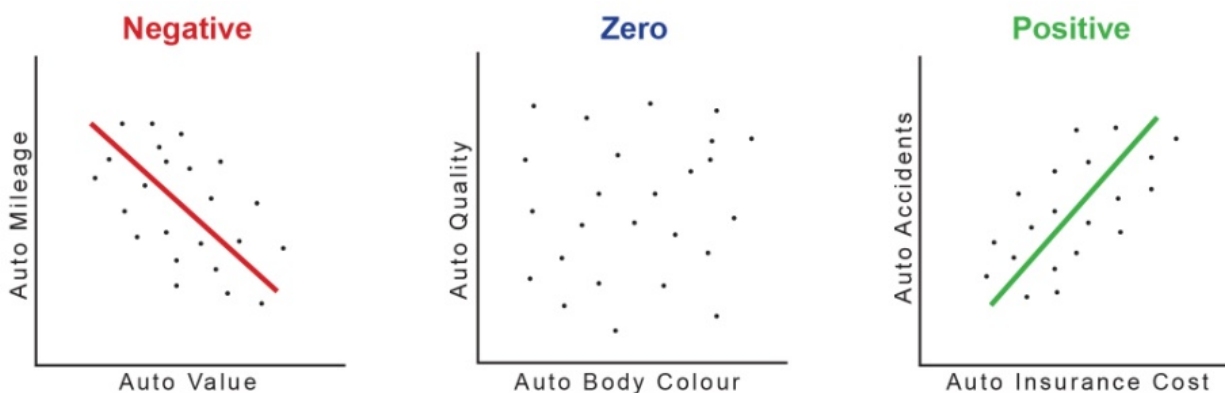
Index Weights: What You See Is Not What You Get!

Did you know traits like milk yield, Conformation, Rump and Calving Ability aren't included in the LPI? Do you feel these traits are important in your sire selection and herd improvement program and SHOULD be included in the LPI formula? Allow us to put your mind at ease - just because some traits aren't included in an index like the LPI doesn't mean you won't make progress for them when selecting for LPI. How is this possible?

Correlations Explained

Examples of correlations can be found everywhere. When a correlation between two things is positive, then as one changes, the other will change in the same direction. In the examples from the auto industry below, as accidents increase, so does the cost of insurance. When a negative correlation exists between two things, then as one increases, the other decreases, as seen below with vehicle mileage and value. In cases when there is no clear relationship between two things, the correlation will be zero, or very close to it.

Figure 1: Examples of Positive, Negative and Zero Correlation



Genetic correlations tell us how much of the genetic influence on two traits is common to both. If the correlation is above zero, this suggests that the two traits are influenced by common genes. Genetic correlations are important because if two traits are genetically correlated, selection for one will cause genetic change for the other as well, and this change could be either desirable or undesirable.

Genetic Correlations and Why They Matter

Estimated genetic correlations among traits, based on official Canadian proofs for Holstein sires, can be seen in Table 1. In this table desirable correlations that are 10% or higher are identified in green while negative correlations below 10% are labeled in red. Basically, correlations that are within 10% from zero are considered not significant. When looking at the box including production traits, it is clear to see that yields are quite highly correlated, especially milk and protein yields, but milk yield is negatively correlated to its components. The same can be seen in the quadrant showing the correlations among the five major type traits, which are all positive. In cases such as these, genetic selection for any one of these traits will also result in a positive correlated response for the others as well.

Table 1: Correlations Among Traits

Trait Name and Abbreviation		FAT	PROT	%F	%P	MR	SCS	HL	MSP	MTP	CA	DCA	DF	BCS	CONF	MS	F&L	DS	RP
Milk Yield	MILK	46%	81%	-47%	-50%	-9%	3%	5%	-10%	6%	12%	1%	-25%	-13%	15%	12%	16%	16%	5%
Fat Yield	FAT		64%	57%	17%	7%	19%	15%	0%	5%	15%	0%	-21%	-17%	22%	18%	22%	19%	9%
Protein Yield	PROT			-12%	10%	-7%	7%	11%	-7%	6%	18%	2%	-21%	-10%	17%	15%	19%	14%	5%
Fat Deviation	%F				63%	16%	16%	11%	9%	-1%	3%	0%	2%	-4%	9%	7%	7%	4%	4%
Protein Deviation	%P					5%	6%	8%	5%	-1%	6%	2%	11%	8%	1%	3%	2%	-7%	-1%
Mastitis Resistance	MR						79%	49%	-17%	-16%	9%	13%	19%	14%	19%	22%	13%	-3%	-1%
Somatic Cell Score	SCS							53%	-24%	-11%	16%	16%	13%	9%	25%	27%	18%	3%	4%
Herd Life	HL								3%	5%	22%	43%	44%	22%	43%	46%	39%	-4%	18%
Milking Speed	MSP									16%	-1%	-3%	-5%	-13%	9%	16%	-2%	-1%	-5%
Temperament	MTP										-6%	0%	2%	-3%	6%	3%	3%	7%	14%
Calving Ability	CA											31%	11%	0%	-7%	2%	4%	-25%	-16%
Daughter Calving Ability	DCA												37%	9%	12%	11%	12%	-3%	11%
Daughter Fertility	DF													25%	-10%	-5%	-7%	-26%	-1%
Body Condition Score	BCS														1%	4%	-1%	-11%	-1%
Conformation	CONF															88%	69%	65%	46%
Mammary System	MS																47%	36%	22%
Feet & Legs	F&L																	36%	23%
Dairy Strength	DS																		46%

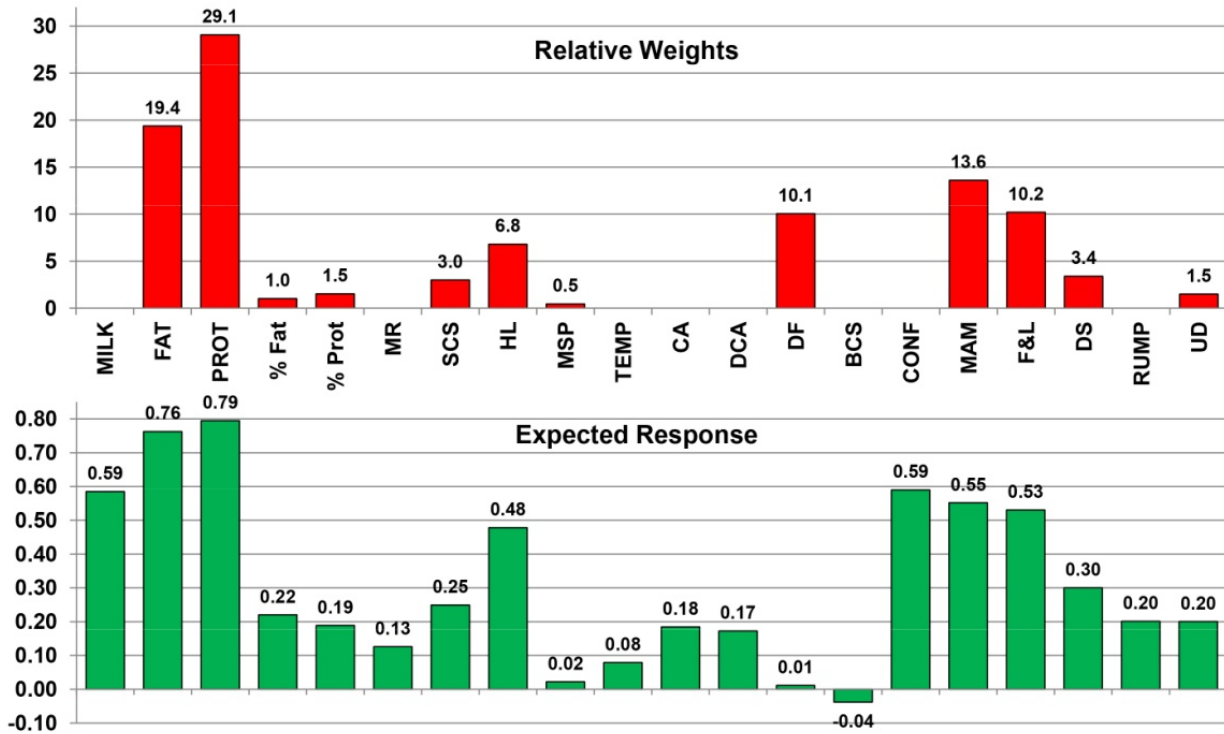
When looking down the column and across the row for Daughter Fertility (DF), you will see that it is negatively correlated with the yields of milk, fat and protein as well as overall Conformation and Dairy Strength. This antagonistic relationship between production yields and fertility is not new. Until fairly recently, dairy cattle breeding schemes in North America and worldwide focused primarily on selection for increased production yields. While great progress was made, an undesirable side effect was reduced fertility in our dairy populations. Not paying attention to the negative correlation between these two traits contributed to the reduced fertility.

Genetic evaluations for Daughter Fertility were first introduced in November 2004 and it became part of the LPI formula soon thereafter in February 2005. As a result of selection decisions based on LPI during the past decade, the downward genetic trend for Daughter Fertility has been brought to a halt while still achieving positive gains for production traits. An index like the LPI allows for simultaneous selection of important traits like production yields and Daughter Fertility such that, with appropriate weights placed on each trait, genetic progress can occur for both despite their negative genetic correlations.

Weights on Traits or Response to Selection?

The LPI is an index made up of weighted traits, with weights adding up to 100. The traits included in the current Holstein LPI formula, and the relative weight on each, are shown in the top portion of Figure 2. The bottom portion presents the response for each trait that is expected based on selection for LPI. The weights placed on the various traits included in the LPI formula don't translate directly into selection response. The reason, again, is because of correlations among traits. Even though traits like milk yield, Conformation, Rump and Calving Ability are not in the LPI formula, selection for LPI will result in progress for them.

Figure 2: LPI Relative Weights and Expected Response to Selection



Our industry spends a great deal of time focusing on which traits get included in the LPI, as well as the relative weights placed on those traits. Clearly, this has led to confusion about breed goals and where we can expect to make progress. Over the upcoming months, discussions about updating the LPI formula as well as consideration of a new profit index will continue. Going forward, extension efforts will focus on the response expected for each trait resulting from selection for an index. After all, index traits and weights look nice on paper, but the response is what will lead to true progress in your herd.

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