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Dairy Sire Selection for Multiple Traits

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There are a large number of traits, including production traits (such as milk yield and milk composition) and functional traits (such as longevity, fertility, udder health, and calving ability), that directly impact the profitability of the dairy production enterprise. Sire selection represents a great opportunity for improving genetically most of these relevant traits. Changes achieved through selection are cumulative and permanent, and hence, it can represent a cost-effective strategy. In this article, alternative methods for selecting dairy sires considering multiple traits of economic importance will be discussed.

One simple method of multiple-trait selection is the use of **independent culling or rejection levels**. For using this method, we have to choose first minimum standards or cut-off values for each of the traits undergoing selection, and then we select only those animals that meet simultaneously all the criteria. For example, we might decide that we will only use bulls with predicted transmitting abilities (PTAs) that are at least +31 for protein yield, +4.3 for productive life, and +2.5 for daughter pregnancy rate. Although this method is quite popular and allows us to select simultaneously for multiple traits using simple rules, it has some important limitations. First, the minimum standards or cut-off values are in general chosen arbitrarily without using any formal approach. In addition, these threshold values may vary over time due to genetic progress and changes in the definition of the genetic base, and therefore, cut-off values that are appropriate today may be too liberal or too restrictive in the near future. Second, this method ignores the genetic relationships between traits of interest; this adversely impacts the efficiency of selection when we want to select for traits that are genetically correlated. Finally, the effectiveness of the independent culling levels decreases rapidly as the number of traits under selection increases; as more traits are considered, fewer bulls meet simultaneously all the criteria, and more importantly, these bulls are probably only marginally superior for each trait.

A better approach for selecting dairy sires considering multiple traits is the use of an **economic selection index**. This method combines multiple traits of interest into a single value, greatly facilitating the identification of the best animals. Individual traits are weighted based on relevant genetic information (such as heritabilities and genetic correlations) and their economic importance; these economic weights are based on current prices for both inputs (e.g., feed and veterinary costs) and outputs (e.g., milk prices) of a dairy production enterprise. These values are updated regularly to reflect current trends in the price of feed and milk. Contrary to the method based on independent culling levels, selection indices perform well regardless of the number of traits under selection, and even more important, these indices allow for selection of animals that are highly superior for one trait and slightly deficient in other traits, which leads to the maximization of the selection response.

Currently there are many selection indices available. For example, the USDA-ARS Animal Improvement Programs Laboratory has developed four different economic selection indices for dairy cattle, namely **Lifetime Net Merit (NM$), Cheese Merit (CM$), Fluid Merit (FM$), and Grazing Merit (GM$)**. All these indices consider simultaneously production traits (including milk, fat, and protein yield), female fertility traits (including daughter pregnancy rate, heifer conception rate, and cow conception rate), productive life, somatic cell score, functional type traits (including udder composite, feet and legs composite, and body size composite), and calving ability. Among these four indices, NM$ is probably the most popular index and actually represents the most appropriate breeding goal for the vast majority of US dairy farmers. Protein and fat yield receive the highest relative weights in NM$, representing 20% and 22%, respectively. Additionally, productive life has a relative weight of 19%, which is the highest relative weight among the fitness traits. Female fertility traits, somatic cell score, and functional type traits receive relative weights of 10%, 7% and 16%, respectively. Finally, calving ability (a sub-index that

includes both service-sire and daughter calving ease and stillbirth), receives a relative weight of 5%. Overall, NM$ has relative weights of 43% for production traits, 41% for health and fertility traits, and 16% for functional type traits.

Table 1 shows the rank correlations of PTAs between NM$ and milk yield, protein yield, fat yield, productive life, somatic cell score, and daughter pregnancy rate. These correlations were calculated using data from recent Active AI Holstein bulls. These results show that NM$ is highly correlated with protein and fat yield, and also with productive life; this is not surprising because NM$ places high emphasis especially on these three traits. Note that milk is positively correlated with protein and fat yield, and hence, it is also correlated with NM$. Furthermore, high NM$ values (high genetic merit for lifetime net merit) are associated with low somatic cell counts (high genetic merit for udder health and mastitis resistance) and high daughter pregnancy rates (high genetic merit for female fertility).

Table 1. Rank correlations of predicted transmitting abilities (PTAs) between Lifetime Net Merit Index (NM$) and Milk Yield (MY), Protein Yield (PY), Fat Yield (FY), Productive Life (PL), Somatic Cell Score (SCS), and Daughter Pregnancy Rate (DPR).

Traits	MY	PY	FY	PL	SCS	DPR
NM$	0.537	0.679	0.650	0.806	-0.350	0.504

Three alternative indices are available for producers with special milk markets or production systems. For dairy farmers who are paid mainly for milk components, the CM$ is probably the most appropriate index. This selection index places more emphasis on protein yield than the NM$ index. Additionally, milk volume is more penalized in CM$ compared with NM$ indicating that the selection for more milk solids should be achieved by improving fat and protein percentage rather than improving total milk yield. On the other hand, for dairy producers who are paid mainly for milk volume (milk markets where the incentives for milk components are insignificant, such as Florida), the FM$ is probably the most appropriate breeding goal. This index has relative weights of 23% for both milk and fat yield, and it has a relative weight of 0% for protein yield. Finally, pasture-based dairy producers may find the GM$ index as the most convenient selection index; compared with NM$, the GM$ index places roughly the same emphasis on production traits, more emphasis on fertility traits and slightly less emphasis on productive life.

Other selection indices are provided by the breed associations, such as Total Performance Index (TPI) by the Holstein Association and the Jersey Performance Index (JPI) by the American Jersey Association. These indices tend to put more emphasis on some type traits and slightly less emphasis on some fitness traits.

Now, from a breeder's perspective, an important question is whether different selection indices yield different breeding decisions; in other words, the question here is the extent of re-ranking of the sires based on different selection indices. In this sense, rank correlations of PTAs for NM$, CM$, FM$, and GM$ were calculated using data from recent Active AI Holstein bulls. The NM$ index was correlated by 0.995 with CM$, 0.971 with FM$, and 0.980 with GM$. In addition, the correlation between the two most dissimilar indices, CM$ and FM$, was equal to 0.943. Therefore, although these selection indices are somewhat different, they rank the animals in a similar manner.

Overall, the selection of dairy sires considering multiple traits should be based on economic selection indices. For most producers, the Net Merit is the most appropriate index. Recall to use the percentile rank in order to see how genetically superior the bull in question is compared with the rest of the available bulls, and the value of reliability (REL) as a guide to manage properly the risk associated with imprecision in the estimate of the genetic merit.

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UF Students on Winning Teams at Southern Regional Dairy Challenge

Mary Sowerby

The University of Florida had five students participate in the 9th Annual Southern Intercollegiate Dairy Challenge, held in Abingdon, Virginia from November 16-18, 2015. Three were on first or second place teams.

Fifty-one students from 11 universities across the southeast participated in the three-day event. University of Florida was represented by Animal Sciences seniors Chelsea Allen from Hudson, Wayne Garcia from St. Petersburg, Laura Rodriguez from Miami and junior Catalina Mejia from Miami; plus Microbiology major Monika Trejos, who is also a senior from Orlando.

At the Southern Dairy Challenge, students are placed on teams consisting of 4 or 5 students, all from different universities. This year the 12 teams were

divided into two groups who ultimately gave presentations to two sets of judges who determined the top placing teams out of their group of six teams. Hence, there were two first and second places awarded.

On Thursday night, the students met their teammates and were given DHI, financial and a lot of other information about the Southeastern Virginia dairy their challenge was to evaluate and make recommendations for improvements.

Friday morning the students had two hours to walk that dairy to observe facilities, milking practices, herd health, calf and heifer raising, manure management, nutrition, etc., and ask questions of the owners. Friday afternoon the teams were each given a motel room to put together a 20-minute PowerPoint presentation of essentially a SWOT analysis of the farm – strengths, weaknesses, opportunities and potential threats.

Saturday, each team was given their 20 minutes to speak to the judges' panel. They were judged on everything from poise and knowledge to most especially their analysis of the farm and recommendations they made to improve it – ultimately financially.

At the awards' ceremony Wayne Garcia's team received a second place certificate, while both Catalina Mejia and Monika Trejos were honored as a member of the two first place teams.

. . . Next, on to the North American Intercollegiate Dairy Challenge back in Syracuse, New York in April.

Enjoying the Southern Appalachian Mountain scenery are the UF Southern Regional Dairy Challenge contestants. From left to right: Wayne Garcia, Monika Trejos, Catalina Mejia, Laura Rodriguez and Chelsea Allen. Taking the picture was coach Mary Sowerby.

Learn more about the North American Intercollegiate Dairy Challenge at http://www.dairychallenge.org or contact Mary Sowerby at meso@ufl.edu

Dr. Jimena Laporta Joins UF Animal Sciences in the Area of Mammary Gland Physiology and Lactation Biology

Dr. Jimena Laporta joined the Department of Animal Sciences at the University of Florida in February, 2015, as Assistant Professor in the area of mammary gland physiology and lactation biology. Her research focuses on the study of maternal metabolism and mammary gland homeostasis during lactation. She investigates how novel endocrine, as well as autocrine-paracrine factors produced by the mammary gland, can play crucial roles in the regulation of important events in lactation, mammary function, milk synthesis and composition.

Jimena is originally from Uruguay, where she received her B.S. degree in Biology and Genetics in 2008, and her M.S. degree in Animal Science in 2011, both from Universidad de la República. During her M.S. in Uruguay, Dr. Laporta obtained a strong training in metabolism, endocrinology and molecular biology, investigating the hepatic regulation of beef cows in the interaction between nutrition and reproduction during the gestation and lactation cycle. During her Master's she was also involved in a series of projects with lactating dairy cows that motivated her to follow her studies in this area.

Jimena continued her graduate studies at the University of Wisconsin-Madison focusing on dairy cattle lactation and mammary gland physiology. Under the mentorship of Dr. Laura Hernandez, she obtained her Ph.D. in Dairy Science in December, 2014. During her Ph.D. she studied the biology that underlies the role of *serotonin* in the regulation of glucose and calcium homeostasis during the peri-partum period using different mammalian models, including dairy cows. Dr. Laporta's research has contributed substantially to the understanding of maternal glucose and calcium regulation during early lactation.

In her current position, Dr. Laporta's research efforts are multifaceted but mostly centered on mammary-derived *parathyroid hormone-related protein* and *serotonin*, and the exploration of opportunities for manipulation of these pathways with the goal of developing new and complementary methods for the prevention of transition-related disorders in dairy cows, such as hypocalcemia and ketosis. In addition, Dr. Laporta investigates the role and function of these and other molecules and factors, which are present in maternal colostrum and milk, and their potential implication(s) for calf immunity, growth and future performance. Dr. Laporta is also interested is

understanding how environmental factors, such as heat stress, alter cellular and molecular processes of the mammary gland, and in exploring nutritional and management practices to alleviate their negative impact(s) on milk production.

The ultimate goal of Dr. Laporta's research program is to integrate the knowledge of mammary gland physiology with advances in management, nutrition and reproduction to strengthen animal health, and increase the overall efficiency of milk production. Alongside her research program, Jimena is currently developing undergraduate and graduate level courses introducing students to concepts in the lactation and mammary physiology with an emphasis on livestock species. Contact Jimena Laporta at jlaporta@ufl.edu

Dairy Extension Agenda

- Friday **February 11**, 2016: **Milk Quality, Transition Cows and Labor Management workshop** in Citra, Florida. This event will be held at the Frank Stronach Plant Research & Education Unit located at 2556 W Hwy 318 in Citra, Florida from 8:30 AM through 4:00 PM. The cost is $25 per registration which includes food and seminar materials. You may register online at http://qualitymilkalliance.com/events/ or contact Dr. Mary Sowerby at 386-362-2771 or meso@ufl.edu.
- **February 15 - 17**, 2016: 27th annual Florida **Ruminant Nutrition Symposium**, Gainesville, Florida. More info at http://dairy.ifas.ufl.edu/rns/info.shtml
- Saturday **March 19**, 2016. **Family Day at the Dairy Farm**. This is the University of Florida Dairy Unit open house for the general public. More information at https://www.facebook.com/familydayatthedairyfarm
- Wednesday **April 6**, 2016. 52nd Florida **Dairy Production Conference**. Info: http://dairy.ifas.ufl.edu/dpc/info.shtml
- **May 4 - 6**, 2016. 65th Annual Florida **Beef Cattle Short Course**. Location: 2142 Shealy Drive, Gainesville, Florida. Info: http://animal.ifas.ufl.edu/beef_extension/bcsc/2015/short.shtml

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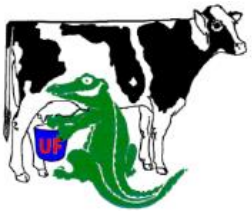
Prediction of the Future Florida Mailbox Price and Future All Milk and Feed Prices: January 2016 - December 2016

Month	Predicted FL mailbox price ($/cwt milk)	2014 Farm bill formulas	
		Predicted All-Milk price ($/cwt milk)	Predicted feed cost ($/cwt milk)
Jan-16	17.98	15.36	7.79
Feb-16	18.20	15.53	7.76
Mar-16	18.43	15.73	7.73
Apr-16	17.78	15.41	7.76
May-16	18.25	15.86	7.79
Jun-16	18.63	16.25	7.82
Jul-16	20.26	16.59	7.85
Aug-16	20.68	17.01	7.89
Sep-16	20.99	17.32	7.92
Oct-16	21.33	17.97	7.95
Nov-16	21.20	17.86	7.99
Dec-16	21.15	17.81	8.03

Based on futures prices of January 19, 2016.

The Predicted All-Milk price and the predicted feed cost have been added to the table since the Fall 2014 issue of Dairy Update (see http//dairy.ifas.ufl.edu/dairyupdate). These predictions are based on the formulas in the 2014 Farm Bill. Daily updated Florida mailbox price predictions are found at http://future.aae.wisc.edu/predicted_mailbox/?state=Florida Feed costs are found at http://future.aae.wisc.edu/tab/costs.html#94. Contact Albert De Vries at devries@ufl.edu for more information.



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