**NORTH CAROLINA FFA DAIRY CATTLE EVENT**

**October 10, 2013**

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**Background:** Because the amount of revenue gained from increased milk production depends upon the quality of milk produced, it is essential that breeders consider heritable factors affecting quality of milk in addition to selecting for increased milk yield. Sire summaries are provided to give the predicted transmitting abilities (**PTA**) for each measured trait. Now, initial information on many bulls is based on genomics and later supplemented with actual data from daughters in various herds. The heritability of some of the measured fitness traits is relatively low but progress can be made by including such traits in a selection index. The USDA Animal Improvement Programs Laboratory (AIPL) computes three indexes (**Table 1**) to assist producers and others in the dairy industry in comparing the relative economic value of daughters of the sires available through AI. This information is updated periodically and new weightings and economic estimates were used for 2010. Years ago most emphasis was on production (milk, fat, protein) but more emphasis has now been added to fitness traits for udder health, reproduction, and productive life.

One index is **Net Merit$** (**NM$**) which puts 35% of the selection weighting on yield with 19% on protein and 16% on fat but none on fluid milk directly. Milk yield is highly correlated with milk protein yield. The balance of the weighting (65%) is on fitness traits with a negative emphasis on higher somatic cell count scores (SCS= -10%) and bigger cows (-6%). The largest weighting is on productive life (PL=22%) which provides estimates as to how long a bull’s daughters would be productive in the herd. Udder (7%), feet and legs (4%), and body size are composite measures taking into account various type characteristics based on visual appraisal. Daughter pregnancy rate (DPR=11**%**) measures a bull’s daughters’ ability to rebreed efficiently after calving and calving ability is a combined evaluation of calving ease using sire and daughter information.

The second index is **Cheese Merit$** (**CM$**). This index puts more weight on protein (25%) and less on fat (13%) but actually adds a negative weighting on milk volume (-15%). In this case, bulls that sire daughters with higher percentages protein and fat are preferred because of the relationship of those components to higher cheese yields. Because of the total weighting on yields are at 53% on absolute values, less weighting is left (47%) to allocate to fitness and conformation traits.

The third index is **Fluid Merit$** (**FM$**) which has 20% weighting on milk and 19% weighting on fat for a total of 39% emphasis on production traits. This index may be preferred in a milk market where almost all the milk is used for fluid consumption along with some butter or ice cream. In this index, weighting on fitness and conformation traits is very similar to that for NM$.

Ranking of various bulls within breed does differ across the three indexes. For example, a bull with very high components of fat and protein with a low predicted transmitting ability (**PTA**) for fluid milk would rank higher for CM$ than for FM$ if other traits were similar.

Although not included in any of the indexes, the fertility of a bull’s semen based on estimated relative conception rates (**ERCR**) is important to consider in breeding dairy cows. There is also information available on the expected effect that a sire would have on various conformation traits in much more specific categories as well as the expected percentage of difficult births.

For more information, visit <http://aipl.arsusda.gov/index.htm>

**Table 1. USDA Selection Indexes as of 2010**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Trait** | **Heritability estimates** | **Units** | **Standard** **deviation** **(SD)** | **Relative value (%)** | | |
| **NM$** | **CM$** | **FM$** |
| Protein | .30 | Pounds | 22 | 19 | 25 | 0 |
| Fat | .30 | Pounds | 30 | 16 | 13 | 20 |
| Milk | .30 | Pounds | 780 | 0 | −15 | 19 |
| Productive Life (**PL**) | .08 | Months | 2.1 | 22 | 15 | 22 |
| Somatic cell score (**SCS**) | .12 | Log | 0.20 | −10 | −9 | −5 |
| Udder | .27 | Composite | 0.78 | 7 | 5 | 7 |
| Feet/legs | .15 | Composite | 0.88 | 4 | 3 | 4 |
| Body size | .40 | Composite | 0.94 | −6 | −4 | −6 |
| Daughter pregnancy rate (**DPR**) | .04 | Percent | 1.4 | 11 | 8 | 12 |
| Calving ability | .07 | Dollars | 20 | 5 | 3 | 5 |

SIRE SELECTION PROBLEM No. 1

The Jersey bulls listed in the table below are available for use by a dairy farm that plans to specialize in making high quality farmstead cheeses in the North Carolina Coastal Plains. Herd owners manage the herd to calve in December and January and take advantage of grazing cool season annual pastures in the late winter and early spring and then rely on alfalfa-grass mixtures for pasture in the late spring and summer months. The owners want to maintain low somatic cell counts for cheese quality and to maintain seasonality of calving so reproductive success is important. Reliabilities (**REL**) of 90 to 97% are based on daughter performance in addition to genomics and pedigree information.

**A**. Please rank the four bulls below in order of priority for use for breeding in this herd.

**B.** Which sire would rank highest in a fluid milk market?

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| --- |
| **USDA Evaluations for Available Jersey Sires** |

| **Sire Number** | | **NM$**  **FM$**  **CM$** | **REL** | **PTA Milk lbs** | **PTA Fat lbs** | **PTA Fat %** | **PTA Protein lbs** | | **PTA Protein %** | **PTA SCS** | **PTA DPR** | | | **PTA PL** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **579**  **493**  **663** | | 94 | **-**128 | 40 | 0.24 | | 12 | 0.09 | 2.76 | | 2.0 | 5.3 | |
| **2** | **660**  **634**  **699** | | 93 | 1367 | 94 | 0.16 | | 50 | 0.01 | 2.89 | | 1.7 | 4.9 | |
| **3** | **506**  **478**  **532** | | 97 | 820 | 75 | 0.20 | | 26 | **-**0.02 | 3.00 | | 0.8 | 5.3 | |
| **4** | **495**  **482**  **532** | | 90 | 1207 | 84 | 0.03 | | 61 | 0.00 | 3.14 | | -1.0 | 2.2 | |

SIRE SELECTION PROBLEM No. 2

The Holstein sires listed in the table below are available for a registered Holstein breeder in North Carolina who is interested in a balanced selection program for production and fitness traits. The milk market that he uses is primarily a fluid market with small premium on fat percentage and for lower somatic cell count scores (low SCS). Herd production has been good with a rolling average of 26,250 pounds with a 3.5% fat test. The farm is in a good financial state but the herd owners would like to see lower somatic cell scores (currently 3.4) to improve the quality of the milk. The owners take pride in the longevity of the cows in their herd and usually have breeding stock for sale. Maintaining good herd reproduction is also a concern. Bull number 3 has been tested and is a carrier for two of 5 haplotypes which are associated with increased early embryonic mortality within the Holstein breed when mated to cows that are also carriers.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **USDA Evaluations for Available Holstein Sires** | | | | | | | | | | | | |
| **Sire Number** | | | **NM$**  **FM$**  **CM$** | **REL** | **PTA Milk lbs** | | **PTA Fat lbs** | **PTA Fat %** | **PTA Protein lbs** | **PTA Protein %** | **REL SCS** | **PTA SCS** | **PTA DPR** | | **PTA**  **PL** |
| **1** | | **702**  **717**  **683** | | 99 | | 2095 | 43 | **-**.12 | 53 | **-**0.04 | 99 | 2.70 | 1.8 | | 5.9 |
| **2** | | **666**  **677**  **668** | | 99 | | 2126 | 64 | **-**.05 | 62 | **-**0.01 | 99 | 2.97 | **-**0.5 | | 6.2 |
| **3** | | **553**  **566**  **536** | | 94 | | 2245 | 70 | **-**.05 | 57 | **-**0.03 | 91 | 2.66 | **-**2.1 | | 2.4 |
| **4** | | **675**  **711**  **627** | | 99 | | 1898 | 61 | **-**.03 | 40 | **-**0.05 | 98 | 2.67 | 0.9 | | 4.9 |

***SOLUTION:***

***SOLUTION: SIRE SELECTION PROBLEM No. 1- 2013***

**A:** Because this farm is planning to make cheese, use of the Cheese Merit $ index (CM$) would be preferred over Fluid Merit $ or Net Merit $ as a guide to selection. Also, because the herd plans to be seasonal, herd fertility is also very important. The Jersey bulls in Problem 1 include a top pair in Sires 2 and 1 and a bottom pair in Sires 3 and 4. The bulls are ranked 2, 1, 3, 4 with cuts of 2, 8, and 4. Sire 2 places over Sire 1 in a close placing primarily because of having the highest CM$ of the group based on much greater PTA for milk even though the fat and protein percentages are less. I grant that Sire 1 has slight advantages in daughter pregnancy rate (DPR), lower SCS, and higher productive life (PL) but Sire 2 is also above average for those traits. Sire 1 places over Sire 3 in an easy placing with a large advantage in CM$ as well as advantages in higher DPR and lower SCS. The negative PTA for percent protein for Sire 3 contributes to a lower expected cheese yield. I grant that sire 3 has a much greater PTA for milk than Sire 1 which would be an advantage in a fluid market but not necessarily an advantage for making cheese. Finally Sire 3 places over Sire 4 because of advantages in DPR, PL, and a lower SCS. Even though Sire 4 was equal to Sire 3 in CM$, having the lowest DPR and PL and the highest SCS in the group kept him as the lowest priority among this group of bulls.

**B.** Sire 2 has the highest FM$ as well as highest PTA for milk so he would also be first choice for use in a fluid market.

***SOLUTION: SIRE SELECTION PROBLEM No. 2- 2013***

In this situation, the milk market is most compatible with using the Fluid Merit $ index (FM$) to keep a balance between production and fitness traits. There is also a potential issue with increased embryonic mortality related to Sire 3. Therefore, the Holstein sires in problem 2 are ranked 1, 4, 2, 3 with cuts of 3, 4, and 9. In a relatively close placing with similar FM$ and SCS, Sire 1 places over Sire 4 because of higher PTA milk, higher daughter pregnancy rate (DPR), and greater productive life (PL). Sire 4 closely follows Sire 1 and places over Sire 2 because of greater FM$, a lower SCS, and greater DPR. I grant that Sire 2 has an advantage in PTA milk and for PL. In the easiest placing Sire 2 places over Sire 3 with large advantages in FM$, DPR, and PL. Sire 3 does have a lower SCS than Sire 2 but Sire 3 should not be used in a registered Holstein herd aimed at selling breeding stock because of the two genetic haplotypes associated with embryonic mortality. Sire 3 also had the lowest FM$, the lowest DPR (perhaps associated with increased embryonic mortality) and the lowest PL among the 4 bulls being considered.