**NORTH CAROLINA FFA DAIRY CATTLE EVENT**

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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.

***The various indexes are adjusted every few years to reflect changing economic conditions and relative importance of various traits. The next change in genetic indexes is expected for December, 2014.***For more information, visit <http://aipl.arsusda.gov/index.htm>

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.

**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 foothills of the Appalachian Mountains. Herd owners manage the herd to calve in February and March and take advantage of grazing high quality pastures in the spring and summer months. The owners want to maintain low somatic cell counts for cheese quality and to maintain seasonality of calving. Reliabilities (**REL**) of 53 to 64% are based mostly on 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 likely change rankings the most 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 %** | **REL SCS** | **PTA SCS** | **PTA DPR** | **PTA PL** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **569****480****675** | 55 | 860 | 74 | 0.19 | 49 | 0.10 | 60 | 2.84 | 0.5 | 4.1 |
| **2** | **558****547****588** | 56 | 1225 | 67 | 0.14 | 47 | 0.00 | 61 | 3.13 | -1.1 | 4.5 |
| **3** | **534****500****588** | 59 | 835 | 58 | 0.11 | 39 | 0.05 | 64 | 3.13 | 1.3 | 5.4 |
| **4** | **620****597****667** | 53 | 1537 | 67  | 0.02 | 58 | 0.02 | 53 | 3.14 | 1.0 | 5.8 |

SIRE SELECTION PROBLEM No. 2

The Holstein sires listed in the table below are available for a commercial 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 a small premium on fat percentage. Herd production has been good with a rolling average of 28,000 pounds with a 3.6% fat test and outstanding SCS of 1.5 or less on a yearly average. The farm is in a good financial state but the herd owners would like to see improved reproduction and longer herd life. No close relatives of the available bulls have been used in the herd in the past. The estimated relative conception rates (ERCR) for the semen of the 4 bulls listed are 1.3, -3.0, 2.7, and 1.1, respectively.

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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** | **701****619****795** | 69 | 988 | 75 | 0.19 | 38 | 0.07 | 75 | 2.63 | 1.7 | 5.1 |
| **2** | **697****659****733** | 68 | 1087 | 63 | 0.04 | 37 | 0.02 | 75 | 2.71 | 1.1 | 8.1 |
| **3** | **703****621****786** | 69 | 1003 | 71 | 0.13 | 44 | 0.05 | 75 | 2.58 | -0.4 | 4.9 |
| **4** | **698****612****799** | 71 | 1635 | 83 | 0.10 | 72 | 0.07 | 76 | 2.92 | -1.1 | 2.1 |

***SOLUTION: SIRE SELECTION PROBLEM No. 1- 2014***

**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, important to the producer are somatic cell counts and herd fertility. The Jersey bulls in Problem 1 include a top pair in Sires 1 and 4 and a bottom pair in Sires 3 and 2. The bulls are ranked 1, 4, 3, 2 with cuts of 1, 8, and 2. Sire 1 places over Sire 4 in a close placing primarily because of the lower PTA for SCS along with slight advantages CM$ and percentages of fat and protein. I grant that daughter pregnancy rate (DPR), productive life (PL), and protein yield are advantages for Sire 4. In the easiest placing, Sire 4 places over Sire 3 based on a large differences in CM$, advantages for yields of milk, fat, and protein and a small advantage for PL. Finally, Sire 3 places over Sire 2 in another close placing based on advantages in DPR and PL. I grant that Sire 2 has advantages for yields of milk, fat, and protein but is equal in CM$ and the low DPR keeps him from ranking higher for use in this herd for which fertility in seasonal breeding is important. In this problem, all 4 sires bring substantial merit and having multiple sires available allows for more choices to minimize inbreeding.

**B.** In a fluid milk market, the $ value of Sire 1 would drop from CM$ = 675 to FM$ = 480 or a decrease in value of $195. The others drop in value only from $41 to $80 in a fluid market compared to a cheese market.

***SOLUTION:***

***SOLUTION: SIRE SELECTION PROBLEM No. 2- 2014***

In this situation, the milk market is most compatible with using the Fluid Merit $ index (FM$) to keep a balance between production and fitness traits. There is also a potential issue with low semen fertility related to Sire 2. Therefore, the Holstein sires in problem 2 are ranked 2, 1, 3, 4 with cuts of 4, 3, and 7. Sire 2 places over Sire 1 because of higher FM$, higher PL, and higher ERCR. I grant that Sire 1 had slight advantages for fat yield, SCS, and DPR. Sire 1 follows Sire 2 closely and places over Sire 3 with a large advantage in DPR and otherwise differences were small with some traits slightly favoring each of those sires. Sire 3 is placed over Sire 4 in the easiest placing because of differences in ERCR, DPR, SCS, PL, and FM$. Sire 4 does have an advantage in PTA for milk and fat but has the lowest ERCR, PL, DPR, FM$, and the highest SCS of any of the available sires and is therefore ranked last. He would be least likely to improve fertility and productive life in the herd.