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. The heritability of some of the correlated traits is relatively low. 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.

One index is **Net Merit$** (**NM$**) which puts 46% of the weighting on yield of fat (23%) and protein (23%) and none on fluid milk directly although milk yield is highly correlated with milk protein yield. The balance of the weighting is on fitness traits as shown with a negative emphasis on higher somatic cell count scores and bigger cows. Udder, feet and legs, and body size are composite measures taking into account various type characteristics based on visual appraisal. Daughter pregnancy rate (**DPR**) measures a bull's daughters' ability to rebreed efficiently after calving and calving ability is a combined evaluation of the calving ease estimates from both the service sire and for his daughters.

The second index is **Cheese Merit$** (**CM$**) and this index put more weight on protein (28%) and less on fat (18%) but actually adds a negative weighting on milk volume (-12%). 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 58% on absolute values, less weighting is left to allocate to fitness and conformation traits.

The third index is **Fluid Merit$** (**FM$**) which has 24% weighting on milk and 23% weighting on fat. This index may be preferred in a milk market where almost all the milk is used for fluid consumption and perhaps some butter. 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. Net Merit Indexes as of 2006

Trait	Heritability estimates	Units	Standard deviation (SD)	Relative value (%)		
				NM$	CM$	FM$
Protein	.30	Pounds	22	23	28	0
Fat	.30	Pounds	30	23	18	23
Milk	.30	Pounds	780	0	−12	24
Productive Life (**PL**)	.085	Months	2.1	17	13	17
Somatic cell score (**SCS**)	.10	Log	0.20	−9	−7	−9
Udder	.27	Composite	0.78	6	5	6
Feet/legs	.15	Composite	0.88	3	3	3
Body size	.40	Composite	0.94	−4	−3	−4
Daughter pregnancy rate (**DPR**)	.04	Percent	1.4	9	7	8
Calving ability	06-.09	Dollars	20	6	4	6

SIRE SELECTION PROBLEM No. 1

The Holstein bulls listed in the table below are available for use by a commercial Holstein dairy to breed 200 high-producing cows that calved in September and October. Herd owners are highly concerned about the quality of the udders on their cows but not as concerned about increasing milk production. They also would like to lengthen the productive life of their cows, but only after improvement in udder conformation is attained. The fertility of the semen based on estimated relative conception rates (ERCR) were +1.6, +0.1, +1.8 and +2.0, respectively for bulls 1 to 4. In checking the pedigrees, it was noted that bull 2 is a half-brother to the sires of most of the cows in the group to be bred. Please rank the four bulls below in order of priority for use for breeding this group of cows.

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 Yield	PTA SCS	Udder Composite	PTA PL
1	**+327** **+302** **+341**	86	+1105	+35	-0.02	+40	+0.03	96	2.84	1.90	+0.9
2	**+376** **+401** **+357**	92	+1485	+39	-0.06	+37	-0.03	93	2.86	1.95	+1.8
3	**+412** **+375** **+434**	92	+889	+70	+0.14	+37	+0.04	97	3.00	2.32	+1.3
4	**+497** **+448** **+526**	85	+238	+42	+0.13	+21	+0.05	92	2.99	2.98	+5.3

SIRE SELECTION PROBLEM No. 2

The Ayrshires listed in the table below are available for a commercial Holstein breeder who is interested in taking advantage of hybrid vigor to help the low reproductive success in his herd. Because the selected sires are from a different breed than the cows to be bred, inbreeding will not be an issue. Herd production has been good with a rolling average of 25,000 pounds and the farm is in a good financial state but the herd owners would like to see lower somatic cell scores to improve the quality of the milk.

USDA Evaluations for Available Ayrshire Sires

Sire Number	NM$	REL	PTA Milk lbs	PTA Fat lbs	PTA Fat %	PTA Protein lbs	PTA Protein %	REL SCS	PTA SCS	PTA DPR	PTA PL
1	**+533**	94	+1619	+73	+0.05	+62	+0.06	95	2.79	+2.5	+3.8
2	**+542**	94	+1635	+92	+0.15	+66	+0.08	96	3.15	+2.6	+4.3
3	**+48**	98	+150	+18	+0.07	+12	+0.04	98	3.09	-1.5	-0.5
4	**+573**	81	+1174	+70	+0.13	+59	+0.12	81	2.77	+2.9	+3.5

SOLUTION: SIRE SELECTION PROBLEM No. 1- 2009

The Holstein sires in problem 1 are ranked 4, 3, 1, 2 with cuts of 5, 4, and 6. The farm's first priority is to improve the udder composite. Bull 4 is a clear leader among the group for the traits of interest (udder composite, productive life, Net Merit$, and ERCR). Though his PTA for milk yield is low, the farm already has high-producing cows, so I chose a sire which could help produce better udders and improve Net Merit$. I placed Bull 3 above Bulls 1 and 2 because his udder composite is the next highest after Bull 4 and his ERCR is greater than either Bull 2 or Bull 1. Bull 3's Net Merit $ also helped to place him second. Bull 1 placed over Bull 2 because he does not run the risk of inbreeding and has a much higher ERCR. Bull 2 has merit for PL and milk production and could be used on cows that are not related to him, but he is not recommended for most of this group of cows.

SOLUTION: SIRE SELECTION PROBLEM No. 2- 2009

The Ayrshire sires in problem 2 are ranked 4, 1, 2, 3 with cuts of 4, 1, and 7. With this group of sires and the desire to increase successful reproduction in the herd, daughter pregnancy rate (DPR) should be strongly considered in selection. Also important to this breeder is the somatic cell score. Bull 4 is placed above the rest because of his superior SCS, DPR, and overall advantage in Net Merit $. Bull 1 follows Bull 4 closely in SCS and DPR and is placed over Bull 2 primarily for lower SCS but I acknowledge that Bull 2 has an advantage in PL and a slight advantage in Net Merit $ which makes it a close placing. I placed bull 2 over bull 3 because of a large advantage in Net Merit$ and because bull 3 has a negative DPR, which is undesirable for this herd. Bull 3 also has the lowest Net Merit $, PTA milk, and productive life among the group of bulls and is easily the least desirable choice for this herd.