Aiding selection decisions for dairy females using genomics and sexed semen

J. S. Clay

Dairy Records Management Systems, North Carolina State University, 313 Chapanoke Rd, Suite 100, Raleigh, North Carolina, 27603, U.S.A.

Abstract

With the ready availability and declining cost of low density SNP chips, dairy producers can make important female selection decisions using gPTAs at a reasonable expense. When this technology is combined with the use of sexed semen, the costs of replacement females can be reduced while accelerating the herd's genetic progress.

Through a targeted series of reports and graphs, Dairy Records Management Systems enables producers to identify young heifers to genome test, select breeding heifers based upon gPTA results, track progress of their genome testing program, compare mating decisions of matings from genome-tested vs. non-genome tested heifers and monitor the efficacy of sexed semen use in their herd.

Keywords: selection, females, genomics

Introduction

One of the more important developments resulting from the introduction of genomic testing for dairy cattle is the application of reasonably priced low-density SNP technology to the selection of females to become milk producers and dams of the next generation. Weigel et al. (2012) found that selective genotyping of the top, middle or bottom 50% of animals after presorting by parent averages was cost effective. Many producers who have been suppliers of top genetics for the AI industry began to implement efforts to use the new technology when it first became available in the United States in late 2010.

In February 2012, Dairy Records Management Systems (DRMS) received its first file of genotypes for females, mostly heifers, in herds of their dairy producer clients. This delivery of heifer genotypes opened new opportunities to synthesize heifer genomics results with management information and provide reports that could be used to guide breeding and management decisions. As a result, producers would not be restricted to making their heifer selection and mating decisions based solely on parent averages.

In the United States, female genotypes using a low-density array can be requested on behalf of dairy producers by any of several industry cooperators including breed associations and AI companies at a cost of approximately 33€. After each monthly genomic evaluation, USDA-AIPL distributes the results of the genomic analysis to the requesters, the appropriate breed association and the appropriate DHIA Dairy Records Processing Center.

DRMS processes DHIA records for 14,000+ herds with approximately 2.2M cows, and, for years has delivered genetic indices for milking cows, their sires and dams to DHIA clients. Since the first delivery of genomics data files from USDA-AIPL, DRMS worked with producers and their advisors to design a series of lists and graphs to help with decisions for managing herd genetics.

Producers were surveyed about goals and expectations of their heifer selection and mating programs and their reasons or justifications for genotyping. Almost unanimously, the primary purpose of investing in genomics testing was to identify heifers with high Merit$ values to flush or contract for flushing. Although all producers mentioned the importance of improving the genetic value of their own herd, the primary focus was on identification of superior animals for marketing. These choices probably reflect decisions based upon the current cost of testing and would be adjusted somewhat if genotyping was less costly or if more producers were familiar with this technology. DRMS designed lists that could be used effectively by either breeders of elite genetics or by commercial producers.

Background about the heifers in the current DRMS genomics file

- Herds: 18,495 heifers in 795 herds born in 24 months prior to May 5, 2012
- Breeds: 17,322 Holsteins; 1,092 Jerseys, and; 81 Brown Swiss
- Ages: 74% < six months; 18% = six to twelve months, and; 8% > twelve months
- Known parent NM$: 82% with Sire and Dam; 13% with Sire only; 3% with Dam only, and; 2% with neither parent
- Reproductive status: 29% were bred; and 3% were bred with gender-selected semen
- Herd sizes: 34% of herds were < 100 cows; 50% of herds were 100 to 499 cows; 10% were 500 to 999; and 6% were ≥ 1000 cows
- Milk production of Holstein Herds: 10% of herds were < 9000 kg; 44% of herds were 9000 to 10,999 kg; 38% of herds were 11,000 to 12,999 kg; and 8% were ≥ 13,000 kg
- Rate of genomic testing: 75% of herds tested < 10% of heifers; 3% of herds tested > 50%

Producers have tested heifers with higher than average genetic merit. Approximately 50% had Net Merit$ from Parent Average (NM$PA) higher than $500 (400€) while only 3 percent of heifers had NM$PA of less than $200 (160€). Very few producers have begun testing heifers with unknown parentage, a management practice that will probably become more important when the cost of genotyping is reduced.

When both sire and dam were known, the difference in NM$PA to Net Merit$ from genotype (NM$G) was less than $200 (160€) for approximately 83 percent of the heifers while there was a difference between $200 (160€) and $399 (317€) for 16 percent of the heifers. But the 99 heifers with a difference of at least $400 (318€) probably have attracted the notice of their owners who were pleasantly surprised about heifers with much higher NM$G than expected and probably alarmed about heifers with a much lower than expected NM$G.

Which heifers to genotype?

One of the primary advantages of using genomic results in the selection process is that information can be gathered early in a calf's life. This early infusion of information enables earlier management decisions, including selection, culling and mating. Additionally, with the cost of rearing a heifer in the U.S to two years of age at approximately 1200€, an early decision to cull a heifer can materially improve profitability by reducing costs.

All lists are included sequentially at the end of the article. List 1: Heifers < 6 months – Not Yet Genome Tested delivers the usual tombstone information including sire, dam, date of birth and maternal grandsire (MGS). Heifers less than six months of age are sorted by descending parent averages for expected lifetime profit deviations to yield a list from best to worst. Heifers without parent averages appear at the bottom of the list. Although producers can choose between three measures of expected lifetime profit deviations (Net Merit for most producers; Cheese Merit for producers receiving higher premium for protein, and Fluid Merit when breeding for milk and fat yield), these examples will illustrate only Net Merit (NM$).

A 'Heifer Flag' column provides relative percentile rankings for NM$ of each heifer within the list. Producers have stated that these percentages make it easy to use these ranking to identify elite heifers at the top of the list for flushing for an embryo transfer program. Animals to cull or breed to beef bulls will come from the bottom of the list. Although the appropriate number of heifers to cull is not apparent without extensive knowledge and assessment of elements such as the herd's historical replacement rate, number of available heifers and reproductive rate, if animals can be culled at this point, typically the culls will be in the bottom 10 to 30%.

The Heifer Flag column also identifies heifers with one unknown parent: a suffix of 'D' signifies that only the dam's NM$ contributes to the parent average and an 'S' signifies that only the sire's NM$ contributes. Notice that although a parent might be known, if the animal does not have a NM$ value, it does not contribute to the parent average and is treated as an unknown. These parentage flags inform the producer about the reduced reliability (from approximately 34% to 20%) of NM$PA when one of the parents is unknown which can be factored into decision making.

If both parents have unknown NM$ values, a heifer's record will appear at the end of List 1 and receive a bottom ranking. Although these could be some of the more valuable heifers in the herd, it is unapparent from the available information. Hence, genotyping would provide necessary information for selection decisions, and if the sire or MGS has been genotyped, then true parentage could be discovered from the genomic results.

For herds with multiple breeds, animals are grouped and sorted within breed.

After genotyping, which heifers to keep?

List 2: Heifers < 12 Months – Genome Tested displays information similar to List 1 except genomic PTAs (gPTA) replace parent averages, plus, it includes gPTA Type and genomic inbreeding coefficients. A 'G' adjacent to each heifer's NM$ denotes a genotyped animal, a designation that also will be applied in subsequent lists.

Sorting by descending NM$ facilitates quick identification of each heifer's possible future on the farm. As in List 1, the Heifer Flag enables producers to identify potential flush donors at the top of the list and potential culls at the bottom. Many heifers in the middle will also become breeders or can be used as recipients, depending on the producer's goals. A designation of 'N20' distinguishes heifers with NM$ in the highest 20% nationally and indicates heifers with the greatest potential for a flushing program.

List 2 introduces a new column titled 'Projected Heifer NM$ Rank' which pinpoints each heifer's NM$ as percentile rank with NM$ for the herd's milking cows. This measure indicates the heifer's potential for milk production relative to the potential of the current milking herd. Clearly, animals with low percentiles in the Heifer Flag column compared to other heifers on the list and that are below the midpoint (Projected Heifer NM$ Rank=50) for the milking cows, are candidates for culling or alternative uses.

List 2 also includes appropriate information about carriers for fertility haplotypes which can be used when avoiding mating to service sires that are also known to be carriers.

At breeding age, which heifers to breed, flush or cull?

By the time a heifer reaches twelve months of age, most producers will decide each heifer's production and reproductive fate. Twelve months of age is the last reasonable opportunity for a producer to voluntarily cull a heifer for low potential to deliver either milk or a calf with high genetic merit. Although by this age, many of the costs of rearing a heifer have already been incurred, a decision to cull could reduce expenses somewhat. This is also a reasonable opportunity to determine which heifers will produce the next generation of heifers and which heifers could enter the milking herd as recipients.

On List 3: Heifers to Breed or Cull – 12+ Months and Not Pregnant, heifers are ranked by descending NM$ with the genotyped heifers labeled with 'G'. In this list of heifers, the Heifer Flag again reflects the percentile rank of each heifer within the list.

A successful reproductive management program centered on gender-selected semen could enable a producer to focus his replacement efforts on the top 50-75% animals. Daughter Preg Rates can provide additional insights for flushing or mating to improve the odds of delivering a pregnancy from gender-selected semen. Then by coupling the information in Heifer Flag, NM$ and Projected Heifer NM$ Rank, a producer should be able to make reasonable selection decisions.

Although most mating decisions probably will depend on one of the Merit indices using a computerized mating program, it is often helpful to review the Fertility Haplotypes, Inbreeding Coefficients and Daughter Preg Rate.

Monitoring pregnant heifers

Once heifers have been diagnosed pregnant, sometimes a producer's focus might diminish until heifers have been moved to the close-up lot for calving. However, these future milk producers and dams of the next generation should be monitored to ensure that they will be ready to move into the milking herd at calving. List 4: Pregnant Heifers provides a link to this stockpile of genetic potential.

List 4 also aggregates all of the genetic information and indicators from Lists 1 through 3 and adds due date plus the service sire's identity, NM$ and percentile rank. Percentile rank of the service sire's NM$ facilitates an assessment of the producer's mating choices to determine if 'best' heifers have been mated to 'best' service sires. Also, matings to gender selected semen are denoted by an 'S' in the service sire ID field.

Conclusion

Genomic testing is receiving considerable attention in the United States from many in the dairy industry, including producers. However, the potential for improving profitability of a herd through an organized genomic testing program of heifers depends on how well a producer applies the technology. Some DRMS clients with high genetic worth animals are currently using genotyping to identify heifers to flush either for their own herd or to market.

Although few commercial producers are currently genotyping animals to modify their selection program in this setting, this opportunity could improve genetic progress for many herds by increasing genetic intensity when the costs of genotyping declines further.

The four animal lists provide a logical progression for management of the heifer breeding herd. By starting early in the heifer's life, decisions can be made early and rearing costs can be minimized. Each list provides guidelines for specific actions for the heifers that appear on the list. Graphs to track progress of the herd's genotyping program are under development and will be delivered soon.

Reference

Weigel, K.A., P.C. Hoffman, W. Herring, and T.J. Lawlor, Jr., 2012. Potential gains in lifetime net merit from genomic testing of cows, heifers, and calves on commercial dairy farms. J. Dairy Sci. 95:2215-2225.

HEIFER GENOMICS GUIDE

DHI-428

Test Date: **05-02-2012**

Processed: **05-03-2012**

55-55-5555

Henry Smith

List 1: Heifers < 6 Months - Not Yet Genome Tested

Barn Name	Heifer	Birth Date	Hfr Flag	NM$	Parent Average PTA Milk	Fat	Pro	SCS	PL	DPR	Sire	Dam Barn Name	MGS
SASHA	11111130	1-17-12	P 94	+517	+1049	+32	+34	2.39	4.0	+0.7	1HO08784	SALTY	7HO07839
ELWOOD	11111131	2-24-12	P 86	+509	+1121	+61	+30	2.33	3.4	+0.0	14HO05639	ERICA	29HO12209
869	11111132	2-21-12	P 86	+509	+1121	+61	+30	2.33	3.4	+0.0	14HO05639	ERICA	29HO12209
LILA	11111133	4-24-12	P 78	+469	+1240	+35	+33	2.42	3.4	+0.5	1HO09167	ELAINE	29HO12209
BLANCH	11111134	1-15-12	P 73	+463	+1093	+29	+31	2.45	4.3	+0.0	1HO08778	BOUNCER	7HO08221
TWYLA	11111135	1-07-12	P 68	+429	+1405	+46	+24	2.50	3.4	+0.0	1HO09192	TAMMY	73HO02479
BRETTA	11111136	1-04-12	P 63	+420	+1095	+21	+28	2.53	4.6	+1.1	1HO08778	BUNNY	7HO08175
AGNES	11111137	1-18-12	P 52	+419	+722	+28	+20	2.39	3.6	+0.8	1HO09192	ZANDEE	7HO06782
ANITA	11111138	1-12-12	P 52	+419	+722	+28	+20	2.39	3.6	+0.8	1HO09192	ZANDEE	7HO06782
AZTEC	11111139	1-11-12	P 52	+419	+722	+28	+20	2.39	3.6	+0.8	1HO09192	ZANDEE	7HO06782
LARGO	11111140	1-25-12	P 42	+417	+877	+49	+30	2.42	2.0	+0.1	11HO09647	ELAINE	29HO12209
GWEN	11111141	12-04-11	P 36	+413	+823	+22	+22	2.48	4.3	+1.5	1HO09167	GINGERS	73HO02479
MERCI	11111142	2-12-12	P 31 S	+396	+607	+29	+23	2.52	5.7	+1.2	1HO08784	MAYME	7HO08081
RIPPER	11111143	12-01-11	P 23 S	+353	+823	+20	+24	1.00	3.1	+1.2	1HO09167	ELASTIC	
ROANN	11111144	12-17-11	P 23 S	+353	+823	+20	+24	1.00	3.1	+1.2	1HO09167	ELASTIC	
TORO	11111145	12-29-11	P 15 S	+338	+852	+14	+25	1.00	3.5	+0.8	1HO08778	TAMMY	
MARISA	11111146	4-01-12	P 10	+337	+1450	+35	+23	2.46	2.7	-1.4	1HO09192	MIGHTY	7HO05708
ROSE	11111147	3-13-12	P 05 S	+322	+818	+39	+24	1.00	2.0	+0.3	14HO05639	ELASTIC	198HO00100
MULBERR	11111148	1-07-12	P 00	+43	-98	+18	+0	3.00	0.7	-2.1	7HO08165	MINDY	7HO06758

Heifer Flag		
	P ## = Proj. Merit$ Rank by breed this list	D = Dam Only S = Sire Only

List 2: Heifers < 12 Months - Genome Tested

Barn Name	Heifer	Birth Date	Age	Hfr Flag	NM$	Genomic PTA (gPTA) Milk	Pro	SCS	PL	DPR	Type	Inbrd. Coef.	Fertility Haplo.	Prj Hfr NM$ Rank	Sire	Dam Barn Name	MGS
NORMA	22222252	10-03-11	6	N 20	+703 G	+778	+37	2.63	6.5	+2.4	+2.22	13.4	3C	99	1HO09167	ENTRY	29HO11614
RABA	22222253	11-15-11	5	N 20	+697 G	+1121	+34	2.77	5.8	+1.7	+2.69	20.5	3C	99	1HO09167	ELASTIC	
GRETA	22222254	11-05-11	5	N 20	+685 G	+1993	+59	2.69	5.3	+0.7	+1.66	14.8		99	1HO09167	EMERGE	7HO08081
LORNA1	22222255	6-05-11	10	N 20	+603 G	+915	+31	2.71	5.3	+2.1	+2.46	14.4		98	11HO09647	APPLE	7HO06782
ESTER	22222256	11-07-11	5	N 20	+591 G	+1664	+40	2.62	4.1	+0.0	+2.32	14.6		98	1HO09167	ERICA	29HO12209
ROBIN	22222257	11-14-11	5	P 80	+557 G	+1388	+42	2.85	3.5	+1.3	+1.24	15.9		97	1HO09167	ELASTIC	
NORENE	22222258	7-22-11	9	P 77	+556 G	+676	+41	2.86	4.7	+0.7	+2.53	11.3		97	29HO13162	ENTRY	29HO11614
836	22222259	10-04-11	6	P 74	+555 G	+1298	+36	2.85	4.8	+1.2	+2.32	18.3		97	11HO09647		29HO11614
Z-ALLIS	22222260	5-04-11	11	P 70	+533 G	+1015	+37	2.67	4.9	+1.5	+2.13	15.6		97	29HO13366	MAYTAG	7HO07334
REBA	22222261	8-25-11	8	P 67	+510 G	+1186	+43	2.93	1.8	+0.3	+1.34	14.4		97	250HO02133	ELASTIC	
KORA	22222262	8-17-11	8	P 64	+507 G	+1403	+38	2.93	3.7	+0.8	+2.75	16.0		97	11HO09647	ERWIN	29HO11614
ERTANA	22222263	6-20-11	10	P 61	+500 G	+810	+31	2.68	3.6	-0.3	+1.85	10.3	1C	97	7HO10604	ERICA	29HO12209
ELIE	22222264	8-05-11	8	P 58	+499 G	+759	+26	2.59	3.9	+0.3	+2.00	13.5	3C	96	11HO09703	ERICA	29HO12209
CANARY	22222265	9-22-11	7	P 54	+484 G	+1120	+38	2.97	3.2	-0.8	+2.59	13.5	3C	95	1HO09167	CANDY	7HO08221
LOUANN	22222266	6-01-11	11	P 51	+481 G	+726	+24	2.64	3.8	+1.1	+1.89	14.7		95	29HO13366	APPLE	7HO06782
ELECTRA	22222267	8-05-11	8	P 48	+479 G	+117	+2	2.62	5.2	+0.8	+2.40	11.9	3C	95	11HO09703	ERICA	29HO12209
NEEDLE	22222268	10-29-11	6	P 45	+462 G	+868	+27	2.77	3.9	+0.2	+1.87	13.2		94	29HO13162	ENTRY	29HO11614
ELLA	22222269	11-15-11	5	P 41	+459 G	+1121	+26	2.61	3.4	+0.9	+2.00	12.9		94	1HO09167	ERICA	29HO12209
KAYLEE	22222270	6-06-11	10	P 38	+435 G	+1392	+36	2.88	2.8	+0.5	+1.79	15.4		94	11HO09647	ERWIN	
ELITE	22222271	9-07-11	7	P 35	+431 G	+1497	+37	2.74	2.3	-1.1	+1.87	13.5		94	7HO08747	ERICA	
NIPPER	22222272	9-23-11	7	P 32	+420 G	+447	+24	2.88	3.8	+1.1	+1.74	14.4		93	29HO01362	ENTRY	29HO11614
NELLIE	22222273	7-28-11	9	P 29	+408 G	+606	+24	2.94	3.7	+0.4	+1.66	10.1		91	29HO13162	ENTRY	29HO11614
ENRICA	22222274	5-23-11	11	P 24	+372 G	+1186	+35	2.85	1.5	-0.8	+2.76	13.4	1C	90	11HO09647	ERICA	29HO12209
EXPLODE	22222275	11-11-11	5	P 24	+372 G	+1023	+22	2.73	2.6	+0.5	+2.62	13.8	1C,3C	90	1HO09167	ERICA	29HO12209
Z-ASTER	22222276	8-01-11	9	P 19	+368 G	+1209	+25	2.87	2.7	-0.1	+2.81	17.1		90	1HO09192	ZANDEE	7HO06782
ADALINE	22222277	9-24-11	7	P 16	+323 G	+522	+16	2.84	2.5	-0.4	+2.21	12.5		86	1HO09192	ADEEN	7HO07853
Z-AGNES	22222278	7-09-11	9	P 12	+296 G	+897	+16	2.85	2.5	-0.4	+1.45	11.3		85	1HO09192	ZANDEE	7HO06782
Z-ALIVI	22222279	7-15-11	9	P 09	+295 G	+160	+4	2.69	3.3	+0.7	+2.48	12.1		85	1HO09192	ZANDEE	7HO06782
NEVA	22222280	7-08-11	9	P 06	+294 G	+859	+30	3.02	1.5	-1.6	+1.48	11.4		85	29HO13162	ENTRY	11HO08195
LUELLA	22222281	5-22-11	11	P 03	+289 G	+534	+18	2.90	2.9	+1.1	+1.75	14.1		85	29HO13366	APPLE	29HO12209
ASHER	22222282	10-01-11	7	P 00	+157 G	+1062	+10	2.90	1.8	-1.0	+2.43	18.7		48	1HO09167	ASHLYN	7HO08221

Heifer Flag	
	N 20 = Top 20% Nationally (< 2 yrs) P ## = Proj. Merit$ Rank by breed this list

Projected Heifer NM$ Rank
The heifer's NM$ rank within the current milking cows having NM$

'G' in Merit$ = Genomically tested

List 3: Heifers to Breed or Cull - 12+ Months and Not Pregnant

Barn Name	Heifer	Birth Date	Age	Hfr Flag	NM$	Genomic PTA (gPTA) or Parent Avg. PTA								Prj Hfr NM$ Rank	Sire	Dam Barn Name	MGS
						Milk	Pro	SCS	PL	DPR	Type	Inbrd. Coef.	Fertility Haplo.				
MUFFIN	33333373	1-05-10	27	P 97	+503 G	+955	+34	2.99	4.7	+0.5	+1.79	16.6		97	7HO08081	MOLLIE	7HO05375
MELODY	33333374	4-16-11	12	P 94	+495	+929	+31	2.46	4.9	+0.2				95	29HO13846	TICKLE	7HO08081
TRACY	33333375	3-17-11	13	P 91	+457 G	-247	-4	2.72	6.7	+1.4	+2.17	17.7		94	29HO11614	TABBY	200HO03101
ELATE	33333376	12-24-09	28	P 89	+441 G	-102	+9	2.67	3.2	+1.4	+1.83	12.1	1C	94	7HO07853	ERICA	29HO12209
ESKIMO2	33333377	4-03-11	12	P 86	+432 G	+823	+18	2.57	3.6	+0.1	+2.43	16.2		94	29HO14142	EVA	29HO12209
EASTER	33333378	11-23-10	17	P 83	+431 G	+578	+32	2.90	3.0	-0.3	+2.34	12.2		94	14HO04929	EVA	29HO12209
ALOHA	33333379	1-10-11	15	P 81	+415 G	-277	+9	2.81	3.9	+2.2	+2.49	16.5		91	29HO14942	ZANDEE	7HO06782
ANCHOR	33333380	3-15-11	13	P 78	+412	+1126	+26	2.45	5.0	-0.6				91	7HO08081	AUDRY	7HO07844
TEXAS	33333381	3-26-10	25	P 75	+380	+384	+10	2.49	3.0	+0.8				90	7HO08361	TARA	29HO09023
EXTREME	33333382	12-26-09	28	P 72	+370 G	+868	+22	2.83	2.0	-0.2	+1.09	11.5		90	7HO07853	ERICA	29HO12209
EDITH	33333383	6-26-10	22	P 70	+353 G	+1142	+41	2.77	1.1	-1.9	+2.17	19.7		88	14HO04929	EVA	29HO12209
TISHA	33333384	8-25-10	20	P 67	+350	+433	+10	2.43	3.0	-0.4				88	7HO07853	TIGER	11HO08195
GLORIA	33333385	10-05-10	18	P 64	+347	+612	+24	2.48	3.0	+0.6				87	11HO09317	GINGERS	73HO02479
VETCH	33333386	5-01-10	24	P 62	+304	+1142	+21	2.47	2.4	-0.4				86	7HO08477	VIBRANT	7HO07156
TIPSEY	33333387	12-21-09	28	P 59	+297	+182	+5	2.37	2.1	-1.2				85	7HO08221	TINSEL	7HO07536
BRAZIL	33333388	1-20-11	15	P 56	+296 G	+590	+15	2.81	2.2	+1.0	+2.01	13.2		85	7HO10219	BEVERLY	200HO00044
VIPER	33333389	2-08-11	14	P 54	+263	-6	-2	2.41	4.2	+0.7				80	29HO11614	VERMONT	71HO01469
ALMIRA	33333390	1-11-11	15	P 51	+256 G	+862	+33	2.87	1.5	-1.6	+3.07	15.8		80	29HO14942	ZANDEE	7HO06782
DEBRA	33333391	2-27-10	26	P 47	+248	+717	+14	2.60	1.7	-2.1				77	7HO07712	DEWDROP	7HO06758
VALENTI	33333392	10-20-10	18	P 47	+248	+354	+16	2.43	1.1	-0.8				77	7HO10219	VIRUS	71HO01469
MALLARY	33333393	10-20-10	18	P 43	+247	+381	+12	2.52	2.0	-0.6				77	7HO10219	MARVEL	7HO05708
EJECT	33333394	11-30-08	41	P 40 S	+246	+188	+11	1.00	2.0	+0.8				75	198HO00100	EVA	
BELL	33333395	9-06-10	19	P 37	+217	+324	+8	2.87	2.4	-1.4				68	7HO08165	BLIMP	7HO07712
SIZZLE	33333396	9-09-09	31	P 35	+200	+619	+8	2.54	1.3	+0.6				65	11HO07965	SATURN	7HO07156
PRINCE	33333397	7-13-10	21	P 32	+196	+156	+5	2.60	1.5	+0.2				65	7HO09879	PATRINA	29HO09023
TWITTER	33333398	4-11-11	12	P 29 S	+189	+937	+17	1.00	1.3	-0.2				62	7HO08477	TICKLE	
PENNY	33333399	10-07-09	30	P 27 S	+186	+384	+13	1.00	0.7	-0.5				61	7HO07536	PEARL	
INEZ	33333400	6-13-09	34	P 22	+179	+778	+8	2.54	2.6	+0.9				59	7HO07466	IDAHO	73HO01965
Z-ASPIN	33333401	4-05-11	12	P 22	+179 G	+612	+11	2.87	2.0	+1.3	+2.02	16.0		59	7HO08477	ZANDEE	7HO06782
DAISY	33333402	4-28-10	24	P 18	+172	+888	+21	2.95	0.3	-2.0				54	7HO08165	DANIELL	29HO12209
VANILLA	33333403	5-02-10	24	P 16	+160	-198	-1	2.54	3.3	+0.6				50	14HO04481	VIRGIE	73HO02239
ELLEN	33333404	7-24-10	21	P 13	+144 G	+963	+37	3.08	-1.9	-1.4	+2.18	13.8		46	14HO04929	EVA	29HO12209
MARION	33333405	9-19-09	31	P 10	+122	+709	+22	2.49	-0.4	-1.6				39	536HO00348	MELISSA	73HO01384
Z-AMAND	33333406	4-06-11	12	P 08	+98 G	+577	+0	2.77	1.3	+0.2	+1.50	16.8		33	7HO08477	ZANDEE	7HO06782
TANSY	33333407	1-23-11	15	P 05	+79 G	+557	+12	2.89	0.5	-0.6	+2.32	22.6		30	7HO10219	TORPEDO	29HO10808
PEGGY	33333408	12-23-10	16	P 02	+14	+156	-1	2.63	-0.9	-1.4				22	7HO08221	POLLY	39HO00518
685	33333409	12-11-09	28	P 00	-160	-729	-13	2.51	-0.7	-0.5				0	7HO04879	CARLA	39HO00453

Heifer Flag		
	N 20 = Top 20% Nationally (< 2 yrs)	D = Dam Only
	P ## = Proj. Merit$ Rank by breed this list	S = Sire Only

Projected Heifer NM$ Rank
The heifer's NM$ rank within the current milking cows having NM$

'G' in Merit$ = Genomically tested

List 4: Pregnant Heifers

Barn Name	Heifer	Age	Hfr Flag	NM$	Genomic PTA (gPTA) or Parent Avg. PTA							Prj Hfr NM$ Rank	Sire	Dam Barn Name	MGS	Service Sire			
					Milk	Pro	SCS	PL	DPR	Type	Fertility Haplo.					Due Date	ID	NM$	NM$ Rank
MAPLE	44444465	27	P 95	+616 G	+1761	+55	3.00	5.0	+0.1	+1.93		98	7HO08173	MOLLIE	7H006349	10-22	507HO10849 S	+851	99
ALINA	44444466	15	P 91	+511 G	+333	+19	2.71	5.3	+0.8	+2.57		97	29HO14942	ZANDEE	7HO06782	1-04	29HO13664	+686	99
TRIXIE	44444467	18	P 87	+461	+1335	+29	2.50	4.6	+0.9			94	1HO08778	TAMMY	73HO02479	10-27	14HO05639	+645	98
ELAPSE	44444468	29	P 83	+435 G	-48	+7	2.60	3.9	+0.8	+2.17	1C	94	197HO00100	ERICA	29HO12209	10-09	11HO10928	+799	99
JILL	44444469	25	P 79	+375	+450	+12	2.33	2.6	+0.2			90	7HO07853	ERICA	29HO12209	5-04	29HO14961	+701	99
ESTA	44444470	18	P 75	+374 G	+1495	+40	2.82	2.3	-0.2	+2.19		90	1H008778	EVA	29H012209	10-08	507HO10849 S	+635	86
738	44444471	20	P 70	+368	+867	+32	2.51	3.6	+0.0			90	7HO08081	391	72HO00753	10-09	1HO09192	+613	97
EMMA	44444472	22	P 66	+344 G	+853	+29	2.79	1.0	-0.6	+2.41		87	14HO04929	EVA	29HO12209	5-30	7HO10721	+749	99
AMY	44444473	18	P 62	+335 G	+158	+15	2.93	1.5	-0.9	+2.18		87	7HO10219	ADEEN	7HO07853	10-23	7HO09501	+590	96
ELATA	44444474	16	P 58	+317 G	+234	+10	2.92	2.7	+1.1	+1.61		86	29HO11614	ECLIPSE	7HO07536				
ELVA	44444475	21	P 54	+313 G	+1387	+47	2.87	1.1	-1.5	+2.34		86	14HO04929	EVA	29HO12209	5-30	507HO10849 S	+851	99
MADORA	44444476	19	P 50	+289	+688	+7	2.46	4.4	-0.4			85	29HO11614	MIGHTY	7HO05708	10-08	11HO10928	+799	99
726	44444477	22	P 45	+272	+210	+18	2.54	0.9	+0.7			82	7HO08559	531	29HO10808	5-30	7HO10721	+749	99
710	44444478	25	P 39 S	+258	+160	+5	2.46	4.0	+1.0			80	29HO11614	324					
TIMBER	44444479	21	P 39 S	+258	+140	+13	1.00	1.7	+1.2			80	7HO08559	THUNDER		10-08	11HO10928	+799	99
MARLA	44444480	17	P 33	+256	+355	+18	2.49	1.2	-0.7			80	7HO10219	MELISSA	73HO01384	12-13	7HO08081	+736	99
BRENAE	44444481	24	P 29	+250	-23	+12	2.47	1.0	+1.1			78	7HO08559	BULLET	7HO06758	11-23	7HO08081	+736	99
TEMPO	44444482	19	P 25	+199	-32	-3	2.90	2.7	-0.6			65	7HO08165	TWINKLE	73HO01965	12-14	7HO11314	+857	99
BRINDLE	44444483	15	P 20	+179	+326	+13	2.51	0.4	-0.7			59	7HO10219	BOOTS	7HO07744	12-14	7HO11314	+857	99
HICKORY	44444484	19	P 14	+120 G	-496	-20	2.96	3.0	+0.8	+1.27		38	29HO11614	HOPEANN	29HO12209	9-13	14HO05639	+645	98
LAVA	44444485	19	P 14	+120 G	-496	-20	2.96	3.0	+0.8	+1.27		38	7HO08747	ELAINE	39HO00453	10-22	7HO11452	+793	99
EGO	44444486	19	P 08	+90 G	+1268	+21	2.79	-1.5	-1.6	+1.92		32	7HO08747	EVA		10-09	1HO09321	+558	95
BECKY	44444487	20	P 04	+89	+1138	+9	2.53	1.0	-1.3			31	7HO08477	BLAZER	7HO05708				
VOLETA	44444488	24	P 00 D	-22	+225	-4	1.47	0.3	-1.3			14	94HO01405	VALLEY	7HO05708	11-23	7HO08081	+736	99

Heifer Flag		
	N 20 = Top 20% Nationally (< 2 yrs)	D = Dam Only
	P ## = Proj. Merit$ Rank by breed this list	S = Sire Only

Projected Heifer NM$ Rank
The heifer's NM$ rank within the current milking cows having NM$

'G' in Merit$ = Genomically tested
'S' in Service Sire ID = Sexed Semen