$6.50/Vial: HeiferPlus™ Dramatically Boosts Heifer Calf Numbers

by Paris Reidhead

Recently I learned of a new artificial insemination procedure for selecting X-chromosome bearing spermatozoa, sperm cells which fertilize bovine eggs, thus resulting in significantly inreased numbers of heifer calves. This procedure, involving a product called HeiferPlus™, was developed by Timothy J. Williams, Ph.D., through his company called EMLAB Genetics.

Here's the remarkable story of a small, private firm that has developed a truly innovative, useful new technology that is superior to the corporate competition. EMLAB Genetics' product is cheaper, more effective, and offers a much wider range of genetic choices to dairy farmers than the competing, government-funded sexed semen sorting technology marketed by the agribusiness giants.

Dr. Williams received a PhD from the University of Wyoming in 1979 specializing in animal and cell genetics. In 1997 he founded EMLAB Genetics. The R&D stage of HeiferPlus™ was completed in 2005; serious marketing of HeiferPlus™ began in 2006. On EMLAB's Web site (www.emlabgenetics.com), I learned that six on-farm breeding trials were done in 2006 and 2007 using HeiferPlus™ to sex bull semen.

Mostly virgin Holstein-Friesian heifers were used in the trials. Normal heifer management practices were followed. Heifers were artificially bred at 12 hours following first observed standing estrus. All inseminations were done with a standard ½ cc single dose of frozen, then thawed, bull semen treated with HeiferPlus™ .

This small vial of HeiferPlus™ will boost the number of heifer calves when mixed with thawed semen and then used to artificially inseminate dairy animals. At $6.50 per vial, HeiferPlus™ is very cost efficient, compared to other sexed-semen technologies.

Trial Results Summary

Here are the results of six on-farm breeding trials. In Trial 1, 20 calves were produced, one (5%) was male and 19 (95%) were female. In Trial 2, 14 calves were born, two (14%) were male and 12 (86%)were female. In Trial 3, 10 calves were produced, four (40%) male and six (60%) female. In Trial 4, there were six calves produced, two male (33%) and four (67%) female. In Trial 5, there were nine pregnancies produced. Ultrasound sexing results at 60 days revealed two males (25%) and six females (75%) and one unknown. In Trial 6, of 10 calves, three (30%) were male and seven (70%) were female. The combined sex ratio from the six trials was 14 (21%) male and 54 (79%) female.

A statistical analysis of the combined results was based on a normal 48% female sex ratio. (Although bovine fertilizations split quite evenly between the genders, throughout gestation slightly more female embryos and feti succumb to *in utero* mortality than do males. Therefore, completed pregnancies, on the average, yield only 48% heifer calves.)

The six studies showed a sex ratio of 54 (79%) heifer calves and 14 (21%) bull calves (as shown above), and this was statistically significant at a probability of P<.01. This means that one can accept the hypothesis, with at least 99% certainty, that the shift in sex ratio was due to HeiferPlus™ treatment of the bull semen. The overall sex ratio of 54/68 (79%) female was a 31% shift from the normal.

If we look at heifers as a crop, using HeiferPlus™ increased the number of heifers per hundred calvings from a norm of 48 to 79; it can be argued that this is actually a 61% increase in heifer frequency. All six producers involved in this research reported normal, or slightly improved, pregnancy rates. However, this data was not statistically analyzed.

Conclusion: These trials were done to test HeiferPlus™ on working dairy farms using normal breeding practices. HeiferPlus™ treatment of semen did shift the female sex ratio by an observed 31%. Of 68 calves produced using HeiferPlus™ treated semen, 54 (79%) were female. This was a significant difference ($p<0.01$) from the expected number of females. Conception rates appeared to be normal when using HeiferPlus™ .

How Does HeiferPlus™ Work?

The purpose of HeiferPlus™ is to increase the percentage of heifer calves born in dairy and beef herds. This product is a spermagenic agent for sexing bull semen. Each dose is packaged in kit form, having been sealed in vials to maintain potency during storage. The unopened HeiferPlus™ vial must be warmed in water to 95-98.6 degrees F (35-37C). The agent is activated by adding semen directly to the HeiferPlus™ vial. It is important to incubate the enriched semen in a warm water bath, maintaining the temperature of 95-98.6 degrees F for 20 minutes. The enriched semen is returned to the original straw and inseminated as usual.

HeiferPlus™ works by accelerating the motility of the X-chromosome (i.e., female) bearing sperm, and by decelerating the motility of the Y-chromosome (i.e., male) bearing sperm. After insemination, the sperm are sorted in the reproductive tract of the dam. The result is more ova (egg cells) fertilized by the X-chromosome bearing sperm. The percentage of heifer calves born is increased by at least 20%, i.e., from a norm of 48% to at least 68%.

HeiferPlus™ is not a restricted drug. It is a non-prescription biopharmaceutical agent. As such, Federal law does not require that this product be used by, or on the prescription of, a licensed veterinarian. The product is lyophilized (freeze-dried) in vial sizes of 0.25 ml and 0.50 ml; thus it is in powder form.

Superior to the Competition

Other technologies compare poorly. I studied the literature for HeiferPlus™ at great length, and tapped into the EMLAB GENETICS Web site. This research put me on better footing to ask questions of Dr. Williams, who is President and CEO of the company. Williams, whose company began developing this technology almost 10 years ago, is very familiar with the "Johnny-come-lately" sexed semen sorting technology, known as Advanced Gender Selection. This form of isolating sperm cells by gender was analyzed (negatively) at length in the September 2007 issue of *The Milkweed*.

Several corporations are promoting the newer semen sorting technology which resulted from joint R&D efforts by the USDA and land grant institutes. Monsanto Corporation soon became "leader of the pack" with its technology product called Advanced Gender Selection. This in turn is marketed through AI stud services under the brand name Decisive™. Genex-CRI was the first national stud service to begin distributing Decisive™.

Because of the USDA's role of background development of Advanced Gender Selection, the U.S. Government receives a royalty whenever Decisive™ semen is marketed.

The equipment to process Decisive™ semen is expensive, over $200,000 a pop. Also, the Decisive™ conception rates run 30-40% less than conventional AI. This figure comes from Chris Sigurdson, director of sales and marketing for Trans Ova Genetics of Sioux Center, Iowa. Collectively, AI studs agree that each straw of Decisive™-sexed semen costs about $30 more than semen from the same bull that has been processed conventionally. (Compare this to $6.50 perHeiferPlus™ treatment.)

When I interviewed Dr. Williams by phone, I asked him if there was reduction in fertility with the HeiferPlus™ technology sperm sexing agent. He said there was

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Cost for Each Additional Heifer Calf Resulting from Sexed Semen
Conventional AI vs. Decisive™ vs. HeiferPlus™

	Conventional AI	Decisive™	HeiferPlus™
% 60-90 Day Non-return	70%	45%	70%
Cost/Service	$30	$60	$36.50*
Increase in Number of Heifers Per 100 Calvings	0	37	31
Number of Services per 100 Successful Impregnations	143	222	143
Total Cost of Breeding Program	$4,290	$13,320	$5,148
Total Increase Cost of Breeding Program	0	$9,030	$858
Investment for Each Additional Heifer Born	0	$244	$28

*Each HeiferPlus™ Treatment Costs $6.50

Data analyzed by Paris Reidhead

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$6.50/Vial: HeiferPlus™ Dramatically Boosts Heifer Calf Numbers, con't

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not. So I determined that if a dairyman experiences 70% 60-90 day non-returns with his conventional AI breeding program, he can expect the same results with Williams' technology.

According to Williams—and this is a significant advantage—the dairy producer performs the procedure on his farm and gets to choose any desired sire. Breeders are not limited to whatever few bulls Genex-CRI (or ABS Global, etc.) may decide to use for their Advanced Gender Selection.

Referring to Advanced Gender Selection, Tim said: "They're really not making genetic progress with such a limited selection of sires. Particularly when you consider that they won't use superior sires, just because they don't want to lose such valuable semen to the 30-40% reduction in fertility. At best they're producing a few more heifers with little or no positive genetic contribution to the dairy cow population."

He continued: "The big players approached me, offering to buy my technology. I told them it wasn't for sale. I want to stay independent. Then one scientist from XY Inc. [an AI stud service actively pursuing producing more heifer calves] said for me to come on board with them. I told them no. Then they said they might just try to copy my patent."

Williams said that with the cost of each additional heifer resulting from Decisive™ being so high, "I just can't believe anyone would actually buy into it."

Comparing Costs

I wanted to express cost comparisons of the Decisive™ and HeiferPlus™ technologies, comparing both to a control, i.e., normal situation where the dairyman uses neither sexed semen technology. (70% is an average national value for 60-90 day non-returns, based on all dairy breeds and all numbers of freshenings.)

Not Only That…

…These comparisons don't even take into account the genetic advantage of being able to select semen from an almost unlimited roster of excellent (high predicted difference) sires. The ability to choose from the full spectrum of available semen with HeiferPlus™ compares most favorably to very limited amount of sires used in the Decisive™ procedure.

According to Rice *et al*. in *Breeding and Improvement of Farm Animals* (McGraw-Hill Publishers, 1970), if the number of sires influencing a population is small, this tends to reduce the standard deviation in the trait in which genetic progress is being sought. So if the standard deviation is lowered, so is the potential for genetic progress. This shrinking gene pool also increases the likelihood of undesirable recessive genes surfacing.

Clearly the U.S. dairy industry does need more heifers—for domestic use, as well as exports. Selecting between the two semen-sexing technologies, so as to achieve that goal, is a no-brainer.

Paris Reidhead is a organic agriculture activist who lives in Hartwick, New York.

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