

Genomic Selection Drives Martin Dairy's Milk Production for Tillamook Cheese

Martin Dairy uses Infinium[®] BovineSNP50 BeadChip technology to improve breeding decisions and build one of the most productive Jersey herds in the United States.

Introduction

Norman Martin comes from a long line of dairy farmers who made their way from Portugal to California, finally settling in the Pacific Northwest. His farm is on land purchased in Tillamook, Oregon in 1995 to raise and breed Holstein and Jersey cattle. Eventually converting to a 100% Jersey herd in 1998, the herd has grown from 80 to about 2200 cows. Today, Martin Dairy is one of about 100 milk providers to the farmer-owned dairy co-operative, Tillamook County Creamery Association¹, home of world renowned Tillamook cheese.

Working hand-in-hand with the American Jersey Cattle Association², Martin Dairy was an early adopter of genomic technologies to improve dairy selection decisions. Norman first used the BovineSNP50 BeadChip to genotype two cows in March 2009. To stay ahead of the curve and expand its use of the technology for dairy cattle breeding, Martin Dairy continued incorporating new technology and currently uses low-density arrays based on the original BovineSNP50 BeadChip. To date, the dairy has accumulated data on over 90% of its herd. Moreover, the Martin Dairy Jersey herd is the fourth highest genetically ranked herd in the United States, and sells seedstock, semen, and embryos internationally for artificial insemination (AI). Norman attributes his farm's success to the efficiency of the Jersey breed, and the advantages genomic selection provides in accelerating the genetic progress of his herd above breed averages for the economically important traits that are accelerating popularity of the breed globally.

iCommunity spoke with Norman to learn about the intricacies of the Jersey breed and how he has used genomics to maximize profits through increased productivity.

Q: What's the history behind Martin Dairy?

Norman Martin (NM): We moved from California to Oregon in 1995 when we bought 160 acres, but we've added 140 since then. I only brought up 80 cows. At the time, I thought that milking a herd that was half Holsteins and half Jerseys would be the right thing to do, given the milk market here. But after a couple of years I found that I was wrong. Now we are 100% Jersey.



Norman Martin (right) is owner of Martin Dairy in Tillamook, Oregon. He and his son Chad manage a herd of more than 2000 Jersey cows.

Q: How did you begin providing milk to Tillamook Cheese? NM: We've provided milk to Tillamook since we moved the farm up here. All you have to do to become a member of the co-op is own a farm in Tillamook County and then become approved by the board. There's a lot of history that goes into Tillamook. At one time, there were 27 cheese plants in Tillamook County and 800 dairy farms. Now, everybody in the County ships their milk to the co-op, so all the dairy farmers are the owners of Tillamook Cheese. We have one plant and about 100 members. Becoming a member is easy. If you don't meet the quality standards, you'll be out of the co-op just as quickly.

Q: What was it about Jersey cows that made you switch to a 100% Jersey operation?

NM: I kept hearing a buzz about Jerseys while I served as chair of the Holstein Sire Committee for probably about a dozen years. I'd always sit in on the Jersey meetings after mine because I was curious.

Fundamentally, it came down to yield and efficiency. Approximately 80% of all the milk produced in the United States goes into manufacturing—cheese, butter, yogurt, and the like. In order to manufacture these products, you need a high yield of the right milk components. For Tillamook Cheese, our vats are 50,000 pounds. If you fill them with Jersey versus Holstein milk, you end up with 1000 pounds more cheese. When you're processing 28 vats a day, that's 28,000 pounds more cheese at the end of 24 hours for the same amount of time and money. Because they offer a higher yield of the right components, Jersey cows enable us to have a more efficient operation.

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Q: When did you begin using genomic selection tools in your breeding program?

NM: Whenever new technologies come along, I usually get right on them within a short period. It's part my personality, and part surviving in the business world. If you want to stay ahead of the game, you better get on the train quickly.

We did some of the initial genotyping work in late 2007 using some of the first tools, such as microsatellite analysis. Then we took the whole-genome approach and did preliminary testing with the 3K chip. Our first official genomic evaluations for Jerseys were in January 2009 and the first 2 females were genotyped from hair samples in March 2009 using the BovineSNP50 BeadChip. Their first genomic evaluations were produced in April 2009. These 2 cows now have more than 50 combined progeny, 9 sons in Al, and more than 1300 combined grandchildren.

We currently use low-density array systems with content based on the original BovineSNP50 BeadChip. To date, 1991 Jersey males have been genotyped by Martin Dairy, including 85 fourth generation- and 13 fifth generation-bulls. Ninety-four of our bulls have gone to national studs and entered into Al service, with over 10,455 registered Jerseys being sired by a bull originating from our herd.

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Q: How do genomics tools integrate with the new reproductive technologies that you are using to enhance the genetic value of your herd?

NM: We have been using embryo transfer in our cows with the highest genetic value for several years, so we have higher genomic level calves coming through. We genotype all of our heifers and use a genetic merit measurement called a P-Level to select which will enter our sex-sorted Al breeding. We breed about 60 heifers each month, with those having a P > 7 (on a 0–9 scale) bred with sex-sorted semen. These heifers rank in the top 20% of the Jersey breed. Breeding with sex-sorted semen means that we try to breed more females out of the high-level heifers, creating cows with even higher genetic values. With genotyping, we're now able to identify young sires that have higher genetic levels and use those in our next generation with even more confidence than before.

Q: What traits are you selecting for with genomics tools? NM: Money is the main trait. I select for cows that will wear well and produce many pounds of liquid cheese that I can ship to the plant. We have many cows that stay around here until they're 8 or 9 years of age and then all of a sudden they get to where they can't compete anymore.

Also, feed efficiency is important to everybody in the dairy business. Feed is our biggest operating cost, and the Jersey breed is the smallest breed. So if you want to look at it as food per pound of cow versus how many pounds of cheese produced, Jerseys are number one in the world.

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Q: Who does the data analysis and how is it integrated with the phenotype information?

NM: The American Jersey Cattle Association, which I'm so proud to be a part of, provides us with all these tools. I'll go through the different AI studs when new bulls come through. I look at their genotypes and pedigrees, make decisions on which ones I want to use, and then I'll send a list of heifers that I'm breeding every month to the Jersey Association and the 15 or 20 bulls that I plan on using. They send me a list back with three different choices, and I make the final decision among the three. Because I run two different groups at a time, I end up with six choices.

It's the genotype that gives me all the information to make breeding decisions and manage inbreeding, which is always an issue. My system gives me all these choices. If I use bull #1, I get this, if I use bull #2 I get that, and if I use bull #3 I get something else entirely, and I make decisions from there. The resulting genetic evaluation uses phenotypic data along with the genomic information. So it's an integrated product in the end when you get a breeding value.

Q: What is the value for you in comparing your herd with other herds or the entire US Jersey population? NM: Like anything else, everybody wants the gold medal. I've always been that way. If someone has a car that can go 200 mph, I want mine to be able to do 202 mph. That's what it's like in the dairy business—production and stayability of cows is where money comes from and that's the reason we're in business.

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Q: As a past board member of the Jersey Association, can you talk about the Association's leadership role in the implementation of genomics to Jersey genetic evaluation? NM: The Association has always been on the cutting edge. But if you'd asked me some of these same questions 40 years ago, I'd have told you that the Jersey breed would likely not be here now. Best I can tell, it's probably without a doubt the fastest growing dairy breed in the world.

A lot of people in the right places have made good decisions about where the breed should go. We've seen other breeds, for instance Guernsey dairy cattle, go from being one of the leading breeds in the United States in the 1940s to now being on the "watch" list of The Livestock Conservancy³.

Q: How much is the genomic data on these young bulls driving the process of selling them into AI now?

NM: Genomic data influences AI decisions more every day. I really believe that. There's always some hesitation when these new things come along, but I'm full bore into it. When most people buy their semen, they are looking at the genomic level of that bull. Everybody has different ways of mating cows; some are more concerned about udders while some might be concerned about feet and legs so selection processes differ as well. About 95% of the bulls that are even being considered for sampling at this point are genotyped. So it's a major driver.

In the early days of genomic testing, I would only use sires that were 'proven sires' based on the production performance of their offspring. That was true even though the genetics were giving me a clear indication of their value. Now, because of the genetic information that I have, my son Chad and I can confidently determine that a highly rated genomic young sire is equivalent to a proven sire and we don't have to wait.

Q: How do you keep track of the mating pairs and progeny?

NM: Every day, every cow that is bred or served on that day gets entered into the computer. If someone from an AI organization asked me right now how many cows I have confirmed pregnant to a specific bull, within about 15 seconds I can tell them exactly how many. How many of those are carrying heifers? Again, same answer. The system I use is Dairy Comp 305⁴.

The Jersey Association that maintains all this data and their services are outstanding. I'm always waiting to see what's coming up next. We used to wait a year to get evaluations on cattle, then we got to where we evaluated them every six months, then it was every quarter. When we got down to once a month, I thought 'wow, it isn't going to get any better than this.' Yet, now we're performing evaluations once a week. I don't think we need to go to performing them daily, but I could be wrong.

Q: What types of reports do you provide when you sell bulls into Al?

NM: We provide the pedigree and everything else there is to know about the animal, and then they run their own genomic tests. It does make us a little money, but it's not a driving force behind our business. We're a commercial dairy operation selling milk to a high profile co-op and cheese label, and that's the first thing we need to be concerned about—providing a high-quality product to our creamery.

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Q: How do you see genomics playing into the future at Martin Dairy?

NM: We'll continue to do what we're doing—pairing the very best with the very best, over and over. It doesn't take much for a mechanic to get a car to go from 45 mph up to 70 mph, but it takes a fine-tuned, savvy individual to get a car to go from 137 to 141 mph and win the Indy 500. The same is true for genomics and cows. As we move farther up the ladder and our genomic scores become higher, our amount of gain each time will be slightly less. So you have to strive a little harder to make each improvement.

I don't see anything negative in shortening generational intervals and speeding up genetic progress. But there is no "ultimate goal," because there is always the next step to take.

It never ends. The selection of dairy cattle has been going on as long as there have been dairy cows on Earth, and the faster it goes, the more information you have to make it go even faster.

Q: What would be your advice to young people today wanting to enter the dairy business?

NM: The most important thing is to be a commercial dairyman first and make your money selling milk. Next, use the best bulls you can afford to use and continue to do that over and over. That's what I've been doing basically all my life.

References

- 1. Tillamook Dairy, www.tillamook.com/
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- 4. VAS DairyComp 305, www.vas.com/dairycomp.jsp

Learn more about the Illumina product mentioned in this article:

 Infinium BovineSNP50 BeadChip, www.illumina.com/ products/bovine_snp50_whole-genome_genotyping_kits. html



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