



The high-capacity DNA sequencer being loaded by geneticist Curt Van Tassell will increase the number of genetic markers available for screening in the dairy population.

The Future Builds on the Past—

Getting More Milk From Fewer Cows

The future of the milk industry may be greatly influenced by the research of Agricultural Research Service animal geneticist Curtis P. Van Tassell. His research project bridges the missions of two key ARS livestock improvement labs—the Animal Improvement Programs Laboratory (AIPL) and the Gene Evaluation and Mapping Laboratory (GEML)—both located at Beltsville, Maryland.

AIPL’s mission dates back to 1895,

when USDA began collecting records of milk and fat production of individual cows to genetically improve the efficiency of dairy cattle. Today, AIPL researchers keep tabs on important yield traits (milk, fat, and protein) and nonyield traits that affect health, vigor, and profitability.

“GEML researchers study genes related to growth, disease resistance, and productivity of the mammary gland,” says Vernon G. Pursel, who leads the GEML. “We are also using genetic map-

ping techniques to increase knowledge of the structure of dairy cows’ genome and to develop technology to select animals based on true genetic merit.

“Van Tassell will wed the findings of both labs,” says Pursel. “He will integrate newly identified molecular markers with existing data sources to determine how to improve the accuracy of estimated genetic merit for evaluated traits and to increase the rate of genetic progress.”

Each year, AIPL scientists estimate

New infectious agent, prions, discovered; proposed cause of transmissible spongiform encephalopathy diseases.

DNA fingerprinting invented.

First 100-percent soybean ink in four colors developed.



First transgenic farm animals born.

The Germplasm Resources Information Network (GRIN) established—the world’s most comprehensive database of agriculturally important plants.

Water Erosion Prediction Project model developed.

the genetic merit of over 16 million dairy cows from data obtained since 1960 through an industrywide dairy production testing and recordkeeping system and through breed registry societies. This requires computer analysis of over 60 million milk records.

“For 35 years, this vital information has been used as the basis for matings to improve the next generation of U.S. dairy cows,” says H. Duane Norman, AIPL research leader. “These evaluations are used by 38,000 U.S. dairy breeders, 100 artificial-insemination organizations, 65 extension specialists, 6 dairy records processing centers, and hundreds of researchers in the United States and many foreign countries.”

AIPL data have helped U.S. dairy breeders increase individual animal yields to record levels. “In spite of the declining numbers of dairy cattle, U.S. milk production has increased and dairying remains a vital industry. Each year, it accounts for \$75 billion in sales of dairy products,” Norman says.

“Today’s dairy farmers are still getting the same price per pound of milk as they did 20 years ago—about 12 cents. However, their gross income has increased yearly because every year the amount of milk produced per cow has

increased. The average annual increase due to genetics is about 250 pounds,” says Norman. The GEML has historical data for 35 families of bulls—mainly from their sons and granddaughters. “Some of these bulls have generated more than \$1 million in sales,” says Van Tassell. “Lab researchers have studied DNA from sperm of more than 900 bulls from 8 of these families. We’re presently using evaluation records from hun-

searchers have discovered.

“Our newly acquired DNA sequencer will help generate genetic marker data and assist us in locating the DNA regions where economically important genes reside,” says Van Tassell.

Research at both labs has resulted in making important individual genes easier to identify and use in breeding programs.

Pursel says that using DNA markers in the selection process can accelerate the rate of genetic improvement of dairy cattle for milk production and other economically important traits, such as healthiness.—By **Hank Becker, ARS.**

This research is part of Animal Genomes, Germplasm, Reproduction, and Development, an ARS National Program (#101) described on the World Wide Web at <http://www.nps.ars.usda.gov/programs/appvs.htm>.

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Animal caretakers George Skinner (left) and Stuart Green collect data on the quantity of milk fat and protein from dairy cattle. Each month, similar information is recorded in dairy facilities across the United States.

dreds of thousands of their daughters.”

GEML researchers are now trying to identify genetic markers for those regions of the cattle genome that are associated with economically important traits. So far, they’ve studied 105 of the more than 1,000 genetic markers for cattle that re-

Starch-encapsulation technique for pesticides developed.



First successful transfer of virus genes to chickens; imparts resistance to avian leukosis virus.

First separation of living farm-animal sperm into male- and female-producing batches.

