Wisconsin Agricultural Innovations: Successes and Challenges

Dr. Kent Weigel

Department of Dairy Science

UW-Madison

Renk AgriBusiness Institute
University of Wisconsin-Madison

Wisconsin Farm Bureau Federation

Wisconsin Farmers Union
United to Grow Family Agriculture

2017 Wisconsin Agriculture Outlook Forum

UW Extension
University of Wisconsin-Extension

Office of University Relations
University of Wisconsin-Madison

DEPARTMENT OF DAIRY SCIENCE
University of Wisconsin-Madison

A Century of Excellence in Education and Discovery

L.H. Schultz, D.A. Wieckert, C.C. Olson, W.T. Howard, and D.P. Dickson

DISCOVERY

Nutrition

1898 First publication of Feeds and Feeding (Henry, later by Morrison)
1905 Salt requirement experiments
1924 Generation of Vitamin D activity in foods by irradiation
1940 NPN utilization by ruminants established
1940 Trace mineral salt experiments
1951 Low milk fat test related to changes in rumen acids
1951 Identification of rumen acids (acetic, propionic, butyric)
1951 Propionic acid shown to reduce ketosis
1971 Active forms of Vitamin D discovered
1974 Ammonia requirements for microbial protein production
1993 Use of forage particle length to calculate roughage indexes
1998 Limited hepatic lipoprotein secretion causes fatty liver
1993 Effectiveness of fiber in byproducts quantified
1998 Use of NIR for analysis of forage digestible fiber and degradable protein
2000 Effects of processing corn silage nutritive value
2000 Phosphorus management on dairy farms
2004 Use of choline to prevent fatty liver
2005 Incorporation of milk urea nitrogen analysis and use in management software

Management

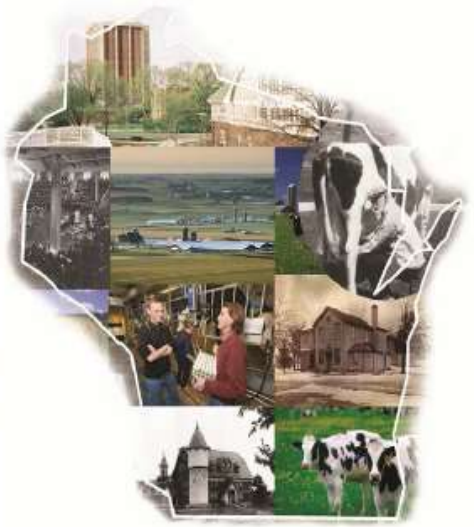
1890 Babcock Test for milk fat introduced
1891 Round silo promoted
1906 First cow test association formed
1941 Initiation of dairy cattle housing and milking parlor research
1950 Research on environmental influences on production in 50 herds
1957 Dairy beef project initiated
1968 Shift from Babcock test to infra-red technology and automated milk analysis
1970 Post-milking teat dip experiment
1973 Computerized ration balancing made available
1975 AM-PM and test interval adjustment factors implemented
1981 Milk yield loss associated with subclinical mastitis as indicated by SCC
1991 Model for marginal increases in feed costs for milk, fat, protein, and lactose
2002 Development of "Milk Money" program to improve milk quality

Physiology

1895 First use of Tuberculin test
1917 First use of diagnostic test for Johne's Disease
1934 Brucellosis eradication program initiated
1939 2000 cows artificially inseminated in Wisconsin
1940 Egg-yolk buffer medium developed as semen extender
1949 Dicoumarol as cause of bleeding in cows fed spoiled sweet clover hay
1949 Research on embryo mortality
1959 Rate of milking studies
1963 Early breeding of heifers studies
1964 Wisconsin Mastitis Test developed
1970 Somatic Cell Test based on DNA developed and used in DHI laboratories
1978 Concept of estrogen receptors in the uterus developed
1982 Bovine placental lactogen isolated and characterized
1984 Development of Ovsynch program
2004 Increased steroid metabolism link in high milk production and reproduction

Animal Breeding and Genetics

1912 First genetics experiments conducted
1935 Sire proving program started
1940 Experimental bull stud established on campus
1953 Inbreeding, line breeding and out-crossing research at Emmons Blaine farm
1951 First successful embryo transplants in cattle
1957 Dairy Herd Improvement records computerized
1980 Non-surgical ova transfer procedure developed
1982 Scoring system for SCC with optimum statistical properties
1989 First sire evaluations for SCC
1991 Genetic markers for milk production identified
2004 Gene identification through crossbreeding experiments



EDUCATION

- about 1300 undergraduates degrees in Dairy Husbandry/Science since 1938
- approximately 350 Master of Science degrees granted since 1938
- nearly 200 Ph.D. degrees granted since 1938
- more than 15,000 students in Farm & Industry Short Course since 1895
- 9 National Dairy Shrine Student Recognition winners since 1969
- 9 National Championship Dairy Cattle Judging Teams since 1916
- 4 Platinum Award Dairy Challenge Teams since 2002
- 3 ADSA Purina Milk Teaching Award winning faculty since 1973
- 4 ADSA Delorel Extension Award winning faculty since 1951
- 12 UW CALS Outstanding Teaching Award faculty

EXCELLENCE

(L-R) I.W. Rupel (1963), R.P. Niedermeier (1977), L.H. Schultz (1983), S.R. Baumgardt (1988), N.A. Jorgensen (1991), L.D. Satter (1997)

- 6 American Dairy Science Association Presidents (pictured above)
- 4 ADSA Award of Honor Recipients
- 5 ADSA Distinguished Service Award Recipients
- 45 ADSA Faculty Awards

LANDMARK EVENTS

1853 Wisconsin legislature appropriates funding for establishment of an agricultural experiment station
1885 W.D. Hoard publishes first Hoard's Dairyman magazine
1886 First Short Course in Agriculture established
1887 Dean W.A. Henry hires S.M. Babcock
1890 Establishment of the "First Dairy School in the World"
1898 Campus dairy barn and teaching center completed
1938 Dairy Husbandry Department formed (Helzer, Chair)
1954 Dairy Cattle Instruction and Research Center constructed on campus
1955 Sale of Hill Farm research facility results in purchase of Arlington research farm and expansion of research herd
1972 Animal Science building constructed
1981 US Dairy Forage Research Center established on UW campus
2003 Construction of Integrated Dairy Facilities initiated

Historic Moments

Under the guidance of the first professor of agriculture, William A. Henry, the University of Wisconsin provided scientific research to expand the state's dairy industry in the late 19th century. Using the university farm and the newly created experimental station, Henry promoted the use of round silos for storing feed for cattle during the winter. In 1887 Henry hired Stephen Babcock who developed the first test for butterfat content of milk. This simple test enabled cheese makers to give farmers a fair price for their milk. It also allowed high quality butter and cheese to be manufactured consistently. The College of Agriculture also pioneered testing for bacteria leading to practical methods of milk pasteurization.

Working with fellow New Yorker William D. Hoard, Henry helped establish the powerful and progressive Wisconsin Dairyman's Association in Watertown in 1872. The Dairyman's Association provided education in new dairying methods through its publications and meetings even though its primary function was to help farmers market their dairy products.

In 1886 the university offered its first winter agricultural "short course". Stephen Babcock established the first "Dairy School" in the nation in 1890. Created with support from the legislature, these schools were significant in moving farmers from wheat production to dairying. University sponsored "Farmers Institute held across the state brought farmers and scientists together to share ideas.

In 1895, Dean Russell proved to farmers that the recently developed Tuberculin test was accurate. Twenty-eight normal appearing dairy animals from the UW herd that had tested positive for TB were slaughtered before a large crowd of farmers on campus. Russell's dramatic demonstration proved the TB test was effective and reliable. All of the sacrificed animals were infected.

In 1907 UW scientists S.M. Babcock and E.B. Hart set the stage for the discovery of vitamins and essential trace minerals by feeding diets of single grains to 16 dairy heifers. These experiments proved that micro-components other than fats, proteins, carbohydrates, and salts were necessary for life and reproduction. These results changed forever the way scientists look at the diets of animals and humans.

In 1933 a farmer brought a bucket of blood to the UW from a cow that had died for no apparent reason. Professor K.P. Link determined the cause of death was internal bleeding due to the presence of dicoumarol, a blood thinner, found in moldy sweet clover hay. Dicoumarol continues to have extensive use as a rat poison and a blood thinner in humans.

In the mid-1930's, Wisconsin dairy breed organizations petitioned Agriculture Dean C.C. Christensen to establish a Department of Dairy Husbandry at the University of Wisconsin. With the full support of the state legislature, Christensen moved several extension faculty members specializing in dairy from Animal Husbandry to create the new department in 1938. Dr. E.E. Helzer, a Holstein specialist, moved from Ohio to Wisconsin to become the first Chairman of Dairy Husbandry. One of his early decisions was to improve the research and teaching herds by importing two carloads of registered Holstein heifers from Colony Farms in British Columbia. The name of the department was changed to Dairy Science in 1962.

The National Dairy Cattle Congress in Waterloo, Iowa, began experiencing financial difficulties in the mid-1960's. Dr. James W. Crowley, working with several prominent dairy cattle breeders from Wisconsin, made plans to establish a World Dairy Expo in Madison. CALS Dean Glenn Pound wholeheartedly supported the project and offered the services of UW Dairy Science faculty and staff to assist in conducting the show. The first show, held in 1968, and every subsequent World Dairy Expo has had the full support of CALS. Dairy Science faculty, staff, and members of the Badger Dairy Club continue to provide valuable assistance in the operation of the premier dairy exposition in the world.

Dairy-Related Discoveries at UW-Madison

- If something has been discovered that is useful for dairy farmers or helpful to their animals, UW-Madison scientists have probably been involved
- Example: Timed artificial insemination (OvSynch)
  - Saves Wisconsin dairy farmers about $58 million per year
- Example: Genomic testing of dairy calves
  - > 30,000 calves are tested per month on US dairy farms
- We are the research and development arm of the industry!

Challenges

- Slow research and development timeline
  - 10+ years from great idea to useful product
- Increasing costs of carrying out research
  - Graduate students cost 50% more than a decade ago
  - Modern tools of molecular biology are useful, but expensive
- Low rate of intellectual property capture and entrepreneurship
  - Most discoveries are incremental and put in public domain

Challenges

- Traditional attitudes toward university research
  - "We pay taxes"
  - "The dean should spend our tax money on dairy"
- Check-off programs were created for declining industry
  - > $42 million per year collected from Wisconsin farmers
  - Can't be spent on cow biology or dairy farm management
  - Are insufficient advertising and a lack of new products the only things limiting the growth of our industry?
- No research and development investment for dairy farming

Opportunities

- Many investments by dairy-related agribusinesses
  - Sponsored research projects
  - Graduate student training
  - Undergraduate experiences
- Growing interest in new and innovative models
  - Pooled $ to tackle big challenges affecting the whole industry
  - Angel/venture capital $ for risky ideas and entrepreneurship
  - Public-private institute for research and technical training
  - Stay tuned . . .