
Dairy Facts from Hoard's Dairyman 4-H Dairy Quiz Bowl

2000- 2009; updated for January 2011. Compiled by Dr. Tony Seykora (January 2010).

General:

Hoard's Dairyman website address is <http://www.hoards.com>.

The annual index of dairy subjects is found in the December issue of Hoard's Dairyman. Hoard's Dairyman is published in Fort Atkinson, Wisconsin.

A favorite cartoon in Hoard's Dairyman is "Ed and Emma".

Elsie is the Borden Company's famous cow.

2005 was the 75th anniversary of Hoard's Dairyman Judging Contest. The order of the breeds in Hoard's Dairyman judging contest is: Brown Swiss, Holstein, Guernsey, Ayrshire, and Jersey. Supreme Champions in Hoard's Judging Contest were: Holstein, 2001, 2007, 2008; Jersey 2002, 2003, 2004, 2006, 2009; Guernsey, 2005.

The World Dairy Expo is held at Madison, Wisconsin the first week of October each year. The Holstein cows and bulls show on Saturday. The Holstein heifers show on Friday. Lactating Holstein cows show on Saturday.

The National Dairy Cattle Congress was held at Waterloo for over 50 years. The show began to decline in 1965 when breed organizations withdrew their support. Eventually, the shows at the World Dairy Expo completely overshadowed the Congress.

The Champion Holstein at the 2003 World Dairy Expo was Pine-Shelter Cheyenne shown by Molly Alberts of Pine Island, Minnesota.

The Klussendorf trophy is awarded to the top showman at the World Dairy Expo.

The Royal Highland Show is held in Scotland. The All American Jersey Show is held in Louisville, Kentucky.

The People for the Ethic Treatment of Animals (PETA) are generally against the keeping of animals for food production purposes.

In 2004, Hispanics were employed on 13 to 14% of U.S. Dairies.

June as dairy month was started in 1937. Demand for dairy products is lowest in the summer months.

The winner of the Indy 500 drinks a glass of milk.

The Stearns County team from Minnesota won the National 4-H Dairy Judging Contest at the World Dairy Expo at Madison, Wisconsin, in 2007.

Youth:

4-H celebrated its 100th birthday in 2002. The term 4-H Club was used not until 1918.

The 50th National 4-H Dairy Conference was held in Madison, Wisconsin in conjunction with the World Dairy Expo in 2004. The first National 4-H Dairy Conference was held in Chicago.

In 2005, Students from the University of Minnesota finished 1st and 2nd in the National Dairy Shrine Student Recognition Contest.

In 2007, University of Minnesota teams finished 1st and 2nd in Hoard's Dairyman Judging Contest.

The North American Intercollegiate Dairy Challenge began in 2002. The event challenges collegiate teams to analyze a dairy and develop management recommendations.

Genetics and Conformation:

Each bull is AI is assigned an NAAB code. An example is 29HO9558. The first numbers refer to the AI stud that the bull belongs to. The NAAB codes for various AI studs are: Genex/CRI, 1; Select Sires, 7; Alta Genetics, 11; Accelerated Genetics, 14; and ABS Global, 29. The two letters refer to the breed of the bull. "HO" refers to Holstein; "JE", Jersey; "BS", Brown Swiss; "AY", Ayrshire; "GU", Guernsey; "MS", Milking Shorthorn; and "WW", Red and White. The last digits indicate the bull's number within the stud.

Sire Conception Rate (SCR) is a measure of the probability that a straw of the bull's semen will produce a pregnancy compared to straws of semen from other bulls.

Bull fertility increases from 2 to 5 years of age and then declines gradually as bulls get older.

Daughter Pregnancy Rate (DPR) genetic evaluations were published for the first time in February 2003. DPR is calculated from the average days open of a bull's daughters. Cows calving in September have the fewest days open.

The initials TPI stand for type production index. The reliability (Rel) of a bull's genetic evaluation is a measure of its accuracy.

Every five years the genetic base is changed so that the average PTAs of cows born five years previous is "0" for each of the traits. There was a base change in February 2005, with the average genetic evaluation of cows born in 2000 set to zero. At the January 2010 base change, the average genetic evaluations of cows born in 2005 was set to zero.

Countries with the most registered Holsteins ranked from 1st to 7th: Germany, Italy, The Netherlands, Canada, France, Denmark, and the U.S.

Starstruck J-Paradox2-Red-ETN was the first cloned dairy bull commercially marketed in the U.S. He is a Red & White Holstein.

GMO stands for genetically modified organisms.

In 1999, only two Holsteins in the U.S. were classified EX96. In 1999, 1.4% of Holsteins classified were classified in the excellent category.

The USDA ran genetic evaluations four times per year up until 2007 at which time number of runs was reduced to three times per year. Bulls with the highest net merit \$ for November sire summaries from 2000 to 2006 and August summaries after 2006 for three breeds in the last few years are:

	<u>Holstein</u>	<u>Jersey</u>	<u>Brown Swiss</u>
2000	Fatal	Cosmo	Even
2001	Trent	Barkly	Eagle
2002	Ozzie	Mor(gan)	Dalton
2003	Oman	Country	Pronto
2004	Oman	Rebel	Digger
2005	Oman	Abe	Beamer
2006	Oman	Maximum	Beamer
2007	Oman	Impuls	Vigor
2008	Oman	Impuls	Vigor
2009	Freddie	Louie	Vigor

On average, a calf receives one half its genes from each parent, one-fourth from each grandparent, and one-eighth from each great-grandparent.

Genomic testing is the genetics test that analyzes DNA in tissue samples and determines genetic potential. Because more data is available, genomic testing results in the most reliability gain for Holsteins.

The first livestock to be genetic sequenced was a Hereford in 2004. Cows have about 22,000 genes and share about 80% of their genes with humans.

The Estimated Relative Conception Rate (ERCR) ranks bulls for the fertility of their sperm.

Breed Facts:

Ayrshire

- Top Ayrshire Milk Record: Mini-Ayr Charlene C, at 8 years 7 months, produced 69,460 milk, 2,538 fat and 2,189 protein in 365 days. She is also the lifetime Ayrshire producer completing 420,309 milk, 16,358 fat and 13,462 protein in 2002.

Brown Swiss

- The Brown Swiss cow is referred to as “The big brown cow”.
- Brown Swiss are 2nd in pounds of milk production.

- The Brown Swiss and Milking Shorthorn Associations decided to share a national executive secretary in 2002. Jerseys recorded the second largest number of registrations.
- Wisconsin has the most Brown Swiss.
- The first Brown Swiss was imported into the U.S. in 1869.
- Top Brown Swiss milk record: Sun-Made Jetway Shatzi-ET produced 53,460 milk, 2,766 fat and 1,903 protein in 365 days.
- 2008 new record: Lost Elm Prelude Pixy – 58,825 milk, 3,286 fat and 1,889 protein.
- Top lifetime milk production was IE Fabs Maple Sugar – 342,240 lb milk, 13,316 fat and 9,972 protein completed in 1995.

Guernsey

- Top Classified Guernsey: For four consecutive years beginning in 1993, Westlynn Tom Dee, EX-96, was named Grand Champion of the Guernsey show at the World Dairy Expo.
- The first registered Guernsey was imported into the U.S. in 1830.
- Top lifetime milk producer was Lindenhof Agri Beatrice – 250,351 milk, 10,496 fat and 8,402 protein completed in 2001.

Holstein

- Holsteins record the greatest number of registrations; Jerseys are 2nd, Brown Swiss are 3rd.
- In 2005, about 30% of Holstein registrations were animals with less than 100% U.S. Holstein ancestry.
- Holsteins produce the most pounds of milk, fat and protein per lactation.
- Record Production Holstein Cow: In 1997 a Holstein, Muranda Oscar Lucinda, topped the milk and protein production records with a second lactation production record of 67,914 milk, 2,216 fat, and 2,119 lb of protein in 365 days
- John Meyer became National Secretary of the Holstein Association in 2001.
- The top cow for lifetime milk production in North America was a Holstein named Koepke K0017229-1660 with 458,616 lb of milk completed in 2005.

Jersey

- Jerseys have seen the greatest increase in registrations over the last ten years.
- California had the most Jersey registrations in 2001.
- Jerseys and Guernseys are known as the Channel Island breeds.
- The top Jersey for lifetime production was Maplerow Mercury Aron-PTL-P – 301,154 lb milk completed in 1998.
- In 2009, Duncan Hibrite of Family Hill became the lifetime production winner with 340,056 lb of milk.

Milking Shorthorn

- The Milking Shorthorn breed has the fewest registrations of the seven recognized U.S. breeds.
- The Milking Shorthorn produces the lowest pounds of milk per lactation.
- The top Milking Shorthorn for lifetime milk production was Idalee Garnet Topsy-Exp – 318,330 lb of milk completed in 2003.

Red and White

- The Red and White Dairy Cattle Association is headquartered in Wisconsin.

The Net Merit index was updated in August 2006. Traits in the Net Merit Index 2006 and their relative weights are: fat, 23%; protein, 23%; productive life, 17%; SCS, 9%; udder composite, 6%; feet and legs, 3%; body size, 4%; DPR, 9%; and calving ability composite (CA\$), 4%. The CA\$ includes service sire calving ease (SCE), daughter calving ease (DCE), service sire stillbirths (SSB), and daughter stillbirth (DSB). The definition of productive life (PL) changed slightly in August 2006. PL is now a measure of how many months a cow produces milk until she dies. Rankings of the three most common breeds in the U.S. for PL in 2006 shows that Jerseys have the longest PL, followed by Brown Swiss and Holsteins in 3rd.

In 2006, the average stillbirth rate in Holsteins was 12% for first lactation heifers and 5% for older cows.

The Holstein Association changed their classification scorecard in 2005 to Udder, 40 points; Front end / capacity, 20; dairy strength, 20; feet and legs, 15; and rump, 5 points.

From 1995 to 1998 the average number of bulls progeny tested per year by major AI organizations in the U.S. was: Ayrshires, 11; Brown Swiss, 24; Guernseys, 21; Holsteins, 1261; Jerseys, 112; and Milking Shorthorn, 3. Approximately 80% of Holstein AI young sires are from ET. The top five states for progeny test daughters are California, Wisconsin, New York, Pennsylvania, and Minnesota. Minnesota ranks 1st for use of Milking Shorthorn progeny test sires.

Complex vertebral malformation (CVM) is a genetic recessive in Holsteins that causes stillbirths, abnormal curvature of the spine, short neck, malformed legs and embryonic death. Bulls shown to be carriers of CVM are designated with the genetic code "CV." Daughters of "CV" bulls have a 50% chance of being carriers of the CVM gene.

Three "new" dairy breeds from Europe are being used for crossbreeding in the U.S. The Normande and Montbeliarde breeds are from France. The Scandinavian Red breed is from Norway and Sweden.

VRC is a new red coat color code to code for the dominant red gene – Champions Mutant. It originated in a red and white Canadian Holstein – Surinam Sheik Rosabel.

Relative to genomics, SNP stands for Single Nucleotide Polymorphisms. With genomics, a young sire without a progeny test had a reliability for PTA milk of about 70% in 2009.

Health:

The ideal outdoor temperature for young calves is about 68° F. Cold stress starts at temperatures below 60° F for calves less than 3 weeks of age. Calves need twice the amount of milk solids when the temperature hits 0° F.

A seven percent tincture of iodine is the most often recommended antiseptic for use on the navel stump of newborn calves. However, a July 2007 ruling by the Department of Justice to prevent

its use for methamphetamine makes it more difficult to obtain. A chlorhexidine solution is suggested as an alternative.

Diarrhea is the biggest health problem in young calves. To help prevent scours in calves, dry cows should be vaccinated against rotavirus, coronavirus and an E. coli toxoid. E. coli is the most common cause of scours in young calves. Diarrhea causes dehydration. Assessing hydration status is most accurately done by looking at the calf's eyeballs. Dehydrated calves' eyes are sunken back into their heads. When you roll the bottom eyelid back with your thumb, you will notice a gap between the eyelid and the eyeball.

Antibiotics should be given to a scouring calf if its temperature is $>103^{\circ}$ or $<100^{\circ}$ F, it has a poor appetite, stands with an arched back, or has more than a streak of blood in the feces, pneumonia, infected navel or swollen joints.

Diseases that can be transmitted between animals and humans are known as zoonotic diseases. The majority of over 1400 human diseases have originated from animals.

Technically, a true breech presentation is when the tail of the calf is presented first while a posterior presentation is when the hind legs come first. In a practical sense however, most dairy personnel refer to all births where the calf comes backward as breech.

According to Iowa State Researchers, calves born in the winter are 36% more likely to be dead within 48 hours after birth than those born in the summer. Enteritis is a calfhood disease more commonly known as scours. Milk should be fed, along with electrolytes, to a scouring calf.

The two most common ways of administering calcium to cows to prevent or treat milk fever are intravenous injection and oral administration (paste, gel or drench).

Tuberculosis (TB) is caused by the bacterium *Mycobacterium bovis*. The U.S. initiated the bovine TB eradication program in 1917 at which time 5% of cattle were infected. Today, incidence of the disease is about 0.0002 percent but has been difficult to eradicate completely because of the presence of TB in white-tailed deer. The tuberculin test is used to diagnose bovine tuberculosis in live animals.

Modified live and killed BVD vaccines are available for cows. Killed vaccines are safer and will not cause abortions but may require additional doses to give good immunity. BVD stands for Bovine Viral Diarrhea. BVDV stands for Bovine Viral Diarrhea Virus. There are two types of BVDV infection – acute and persistent. In acute infections, the cow usually recovers in 2 weeks. The most common source of BVDV infections is a persistently infected (PI) animal. PIs are the result of fetuses becoming infected from 18 to 125 days of age. The PIs immune system does not recognize BVDV as foreign and allows the virus to multiply unchecked throughout the animal's life.

Vaccines give cattle active immunity. Colostrum gives calves passive immunity.

The term vaccine is derived from the Latin word, vaca, which means cow. There are two types of immunity, active and passive.

Brucellosis is sometimes called contagious abortion or Bang's disease. For the milk Brucellosis ring test, a suspension of stained, killed Brucella organisms is added to a milk sample. If the milk sample is from a Brucellosis infected cow, a bluish ring forms at the cream line.

If cows are treated with antibiotics, dairy producers must follow drug-withholding times for milk disposal. The most common cause of bulk tank milk antibiotic contamination is mistakenly saving milk from a treated cow.

Copper sulfate, formalin or zinc sulfate are common chemicals added to water for footbaths.

Heel flies lay their eggs above the heel on cattle. Eggs hatch and larvae (known as grubs) migrate through the animal's body to the back where they pupate and emerge in the spring. Cattle should not be treated with insecticides to kill the grubs in the winter because cattle may have an adverse reaction to dead grubs in their bodies.

If colostrum is thawed rapidly, in a microwave, many of the antibodies will be destroyed. Another name for antibodies is immunoglobins.

Too much potassium in the close-up cow ration may result in increased ketosis and other metabolic problems.

Ketosis results when insulin and blood glucose levels drop too low. Ketosis usually occurs 3 to 4 weeks after calving. It can be treated by giving 500 to 1000 cc of glucose intravenously or drenching cows with 7 to 10 ounces of propylene glycol.

The normal temperature range of a cow is 99 to 103 degrees F.

A cow tested positive for BSE (bovine spongiform encephalopathy) or mad cow disease in Alberta, Canada, in May 2003. In December 2003, a cow imported from Canada in 2001 was diagnosed with BSE in Washington state. As of August 2006, there have been three cases of BSE in the U.S. and 7 in Canada.

Hypercalcemia is an excess of calcium.

In 2001, there was a foot and mouth disease (FMD) outbreak in England that caused billions of dollars in damage to the livestock and tourist industry. A symptom of this viral disease is blisters on the lips, in the mouth, and on the feet of cloven-hoofed animals.

According to a USDA survey in 2001, about 20% of U.S. dairy herds were infected with Johne's. Johne's is caused by the bacterium *Mycobacterium paratuberculosis*. According to Hoard's in 2008, 65% of dairy herds may be infected with Johne's and it was 95% for herds over 500 cows. The Johne's bacteria is killed by proper pasteurization. Most animals affected by Johne's were exposed to the bacteria that causes the disease as young calves. Symptoms usually do not appear until the cow is at least 2 years of age. Clinical signs of Johne's are chronic diarrhea, weight loss, excellent appetite up until terminal stages, and low milk production. In 2004, it was announced in Hoards Dairyman that the University of Minnesota had developed a rapid fecal test based on DNA called the PCR (polymerase chain reaction) test. In addition to the ELISA and

PCR tests, fecal cultures and tissue cultures can identify the bacterium. A milk ELISA test conducted through DHIA can test for Johne's.

Hardware disease (traumatic reticulitis) is caused by cows ingesting a sharp metal object that perforates the lining of the reticulum. A magnet (one) may be given to a cow to prevent hardware disease and should be placed in the reticulum. A compass can be held right behind an animal's left elbow to determine if she already has a magnet.

Digital dermatitis or Mortellaro Disease is more commonly known as hairy heel warts. It is characterized by a circular lesion where the skin and heel meet. An abscess in the foot is characterized as a darkened area of the sole in which a pocket of pus is usually found.

Foot rot is characterized by swelling, a foul odor, and redness between the toes. It is also known as Foul or Phlegnon (flæg'mõn).

Laminitis is an inflammation of the sensitive tissues of the hoof.

A sole hemorrhage is a foot problem characterized by a pink, red, black, or yellow area of discoloration on the sole. It is also known as Sole Bruising.

A sole ulcer is characterized by a soft area at the sole-heel junction that is painful when pressure is applied.

White line disease is characterized by a dark discoloration and separation of the white line area between the sole and hoof wall.

Interdigital dermatitis is an infection between a cow's toes. The skin is red and may have cracks with a gray discharge. It is also known as Stable Foot Rot or Scald.

According to 2006 and 2007 Hoard's articles, an average of 25% of cows in freestall barns are lame.

A uterine prolapse is when the uterus turns inside out and protrudes from the vulva after calving. Retained placentas affect about 8% of dairy cows. There is really no good effective treatment. Just monitoring the cow's temperature is the most recommended protocol. If a cow gets a fever, antibiotics may be prescribed.

Metritis is an infection of the uterus.

Displaced Abomasums: On average, 2% of dairy cows get DAs each year. Left DAs account for 80% and right DAs for 20%. About 80% of cows diagnosed with DAs first have had ketosis. Ketosis, of course, is a disorder of energy metabolism. Roll and toggle is a method to correct DAs without open surgery.

Hemorrhagic bowel syndrome (HBS) is a new bacteria disease that causes large blood clots in the digestive tract. The disease is fatal with animals dying from a combination of blood loss, intestinal obstruction, and toxemia and shock.

Straw-itch mites are also known as harvest mites whose natural hosts are small rodents. They are usually most active after harvest, feeding on other insects in harvested straw, hay, and grain. The straw-itch mite targets the face, feet and lower limbs of cattle, causing intense itching. If the cattle can be removed from the source of the mites, they usually get over the mite infection on their own.

Ringworm is a contagious disease caused by a fungus. It appears on the skin of heifers as round, hairless spots with white or gray scabs near the head, neck and shoulders.

Pneumonia is an inflammation of the lungs. The three stages of most pneumonia cases are stress, viral infection and bacterial infection.

Mulefoot, or syndactylism, is a genetic disorder in Holsteins in which one to four feet on the animal have one toe like a horse rather than being cloven-hoofed.

Management:

According to a 2002 USDA survey, 92% of dairy cows are identified by ear tags.

It is recommended that cow free stalls should be 48" wide. About 85% of cows in a group should be lying down if cow comfort is good (those not eating, drinking, or being milked). The average cow rests for 12 to 14 hours per day.

Sand bedding is known as the Gold Standard of bedding because it supports less bacteria growth than other common bedding materials, lessens mastitis, lessens lameness, and promotes higher milk production but it is more expensive than most other bedding materials. According to a 2008 Hoard's article, herds that bedded with composted manure solids had the highest somatic cell count. Ranking bedding materials for cow comfort: 1) composted bed pack; 2) sand; 3) waterbeds; 4) rubber-filled mattresses.

Cows require 100 square feet each in a bedded pack barn.
Covering floors with rubber has been shown to increase cow comfort.

For lactating dairy cows, lights should be kept on 16 hours per day to get the best milk response from long day lighting. Dry cows should be limited to 8 hours of light for maximum production in the following lactation.

Cows need 10 to 14 hours of rest each day for optimal performance.

When manure is applied to corn land to meet nitrogen needs, phosphorus is usually applied in surplus, which can lead to pollution problems. Over-application of manure can lead to water pollution. Farms need a minimum acreage available per cow to spread manure. For example, if one half acre is needed per cow, then one hundred cows would require 50 acres. The EPA enforces environmental regulations. When considering the carbon footprint of milk production, methane is the green house gas occurring in largest amounts.

Cull rate is the measure of percent of cows leaving the herd. Common causes for culling cows from a herd include poor reproduction, mastitis, low production, lameness and death. About 30 to 35% of cows are culled from herds each year. Reproductive failure is the number one reason for cows leaving a herd.

Extra teats are removed from calves for the following reasons: looks better, extra teat may become infected, and the extra teat may interfere with milking procedures.

Signs of heat stress in cows are: open mouth breathing, excess salivation, decreased dry matter intake, and decrease conception. Cows typically experience the most heat stress in the holding area.

Cows are most comfortable at 50 degrees F. A heifer's body condition score at first breeding should be around a "3". At freshening it should be from 3.5 to 3.7.

In 2003, 42% of the cows and 36% of the dairy herds in the U.S. were on DHI test.

It is recommended the heifers be bred so that they calve no later than 24 months of age. It may cost up to \$2 per day to house heifers at this age. In 2009, it cost \$1649 to rear a heifer from being born to calving age.

Silo gas, otherwise known as nitrogen dioxide, is a lethal gas that has a yellowish-brown color and smells similar to laundry bleach. It is heavier than air.

More labor is required for milking than any other chore on a dairy farm.

Feeds and Nutrition:

Milk forms a clot... Within 10 minutes after milk or colostrum feeding, the liquid forms a clot in the abomasum due to enzymes (chymosin and pepsin) and hydrochloric acid acting on casein (milk protein) and fat in the milk. Chymosin, also known as rennin, specifically binds with casein. Clotting binds much of the casein and fat into a clump, or curd, to be digested slowly by stomach enzymes over a period of 12 to 18 hours.

According to USDA's 2001 Crop Production Report, California is the number one state in tons of alfalfa harvest. South Dakota leads all states in acres of alfalfa. Minnesota ranks 4th in tons of alfalfa harvested.

Forages are generally high in fiber and include corn silage, alfalfa haylage, and straw.

Distillers grains are a popular by-product feed from ethanol production. Other high protein by-products fed to dairy cows include soybean meal and soy hulls from the soybean milling and processing industries. Soyhulls are high in digestible fiber. Beet pulp is a by-product of sugar beet processing.

Black Nightshade (*solanum dulcamera*) is a common poisonous weed in the Midwest. The leaves and green berries are especially detrimental to cattle.

Relative Feed Value (RFV) is based on acid detergent fiber (ADF) and Neutral Detergent Fiber (NDF). ADF estimates digestible dry matter. NDF estimates dry matter intake. Relative Forage Quality (RFQ) uses 48-hour *in vitro* NDF digestibility to more accurately estimate digestible dry matter than the ADF value alone. RFQ is a more accurate measure than RFV in predicting cow performance.

Wisconsin produces the most corn silage each year. California produces the most alfalfa. In 2007, the top three states for alfalfa production were California, South Dakota, and Idaho. Corn should be harvested at 60 to 70% moisture to make silage. Four months of storage are recommended for optimum corn silage fermentation.

The dry matter is what is left over after the water is removed.

When a cow's fat test is lower than her protein test, it may be a sign of acidosis.

Sugars, starches, pectins, hemicellulose and cellulose are all carbohydrates and utilized for energy by the cow. Carbohydrates are made up of carbon, hydrogen, and oxygen. Of the carbohydrates consumed by cows, sugar is most rapidly fermented in the rumen. Corn is highest in starches. Pectins are part of the cell wall that is quickly fermented into acetic acid. Acetate, propionate, and butyrate are the three primary volatile fatty acids synthesized in the rumen. Hemicellulose, cellulose and lignin are also part of the cell walls. Hemicellulose is less digestible than sugars and starches but more digestible than cellulose. Cellulose is about 30 to 40% digestible. Lignin is totally indigestible. Carbohydrates make up about 70% of the dry matter fed to dairy cows.

Fats are also known as lipids.

Feeding drought stressed forages high in nitrates reduces a cow's blood carrying capacity for oxygen.

The calf's rumen is undeveloped until a couple months of age. At the time of weaning, the calf's rumen is about the size of a basketball. Milk and grain leads to faster rumen development in the calf than adding hay to its ration. Feed costs are the biggest single cost of rearing a heifer. In fact, feed costs are the single largest annual expense on a dairy farm. The average cow consumes 25 to 50 gallons of water per day.

The NRC requirement for phosphorus was lowered to 0.38% of the ration. Surplus phosphorus increases the cost of the ration and may cause water pollution.

Surplus protein in the diet results in excretion of surplus nitrogen, which can harm the environment. Most of the surplus nitrogen is excreted in the urine. It is thought that 16.5 % protein in the ration is best to minimize excessive nitrogen excretion without sacrificing milk production.

Amino acids are known as the building blocks of protein. Proteins are made up of a chain of amino acids. Degradable protein is broken down in the rumen into amino acids that the microbes can utilize. The protein not broken down in the rumen is known as bypass or rumen

undegradable protein. The elements that make up amino acids are carbon, hydrogen, oxygen, nitrogen, and sometimes sulfur (contained in three of the amino acids).

Lysine and methionine are generally the first limiting amino acids in dairy cattle diets.

Dry matter intake decreases about 20% in a dairy cow in the day before calving. A cow will produce 2 to 3 lb of milk for each lb. of dry matter consumed. It is best to feed cows 6 hours after milking to maximize the time they spend eating.

Each day, a cow spends 3 to 5 hours eating (9 to 14 meals), 7 to 10 hours ruminating, 30 minutes drinking, and 10 to 12 hours resting.

In 2004, 54% of dairy farms fed a TMR.

Hybrid seed for alfalfa first became available in 2001. It has the potential of greatly increasing alfalfa yields.

Dairy efficiency or feed efficiency is calculated by dividing lb of component corrected milk by lb of dry matter consumed. The two formulas to standardize for milk components are:

Pounds of 3.5% fat corrected milk (3.5% FCM) = $0.4234 \times \text{lb milk} + 16.0 \times \text{lb milk fat}$.

Pounds of energy-corrected milk (ECM) = $0.323 \times \text{lb milk} + 12.82 \times \text{lb milk fat} + 7.13 \times \text{pounds true milk protein}$.

Lactic acid is most prevalent in properly fermented silage.

A calf will consume 4 lb of water for every 1 lb of dry matter intake or dry calf starter. Cows consume 4 to 5 pounds of water for every 1 pound dry matter. Cows consume the most water right after milking.

According to research at Virginia Tech, it is recommended that feed refusal be at 5 to 10% to maximize dry matter intake for lactating dairy cows.

Cows should be fed a transition diet around calving time.

Cottonseed, citrus pulp and brewer's grains are by-product feeds. Corn grain is not a by-product.

Alfalfa should be at less than 18% moisture when baled as dry hay.

Monensin was approved for lactating dairy cows in 2004. Monensin improves feed efficiency.

A nutritionist may evaluate manure consistency on a 1 to 5 scale with 1 being very watery, runny manure and 5 representing very hard, clumpy manure. A score of 3 is optimal.

A Penn State "shaker box" is used to evaluate a ration for particle size. It is a collection of four boxes stacked on top of each other. Three of the boxes have holes in them to separate the feed by size.

Body condition scoring is a visual evaluation of body fat and is based on a 1 to 5 scale, with 1 being severely underconditioned (thin) and 5 being severely overconditioned. Recommended body condition scores for various stages of lactation are: calving 3.0 to 3.5, breeding 2.5, late lactation 3.0 to 3.5, and dry period 3.0 to 3.5.

Reproduction:

Accelerated Genetics worked with Colorado in 2001 on a field study using sexed semen. Unfortunately, the sexed semen had a significantly lower conception rate in that study. Since that time, sexed semen has become more popular. In 2006, it was recommended that sexed semen only be used on first service heifers. Sexed semen generally produces about 90% heifers. 52.9% of calves from regular semen are bulls.

Signs of estrus in dairy cows include: standing to be mounted, attempts to mount other cows, restlessness, bellowing, poor milk letdown, swollen vulva, and clear crystalline discharge from vagina.

It is best to breed a cow 8 to 12 hours before ovulation or just after estrus to maximize conception.

A difficult calving, subclinical ketosis and calving with twins are all reasons that cows become cystic after calving.

In Holsteins (2008), stillbirth incidence was 6.3% for heifer calves and 10% for bull calves. Stillbirths were 12.6% for first calf heifers and 6.1% for older cows.

The twinning rate for first calf heifers is 1 to 2%. It increases for older cows and averages 5 to 6% for all cows. If embryonic membranes of male and female twins fuse during gestation the resulting heifer calf is usually a freemartin. High producing cows have a higher frequency of twins than lower producing cows. Calves carrying twins usually calve early – before their due date. A cow's subsequent fertility is lower after giving birth to twins.

According to a USDA study in 2004, Jerseys were youngest at first calving, followed by Holsteins as second youngest. Jerseys also had the shortest calving interval of any U.S. dairy breed and have the least amount of calving difficulty. According to a 2007 USDA study, Holstein and Milking Shorthorn had the most calving difficulty. Guernseys have the lowest pregnancy rate.

Metritis is an inflammation of the uterus. Endometritis is an inflammation of the lining of the uterus.

Prolactin is the hormone that is primarily responsible for initiation of lactation.

Frozen semen is merchandised in 0.5 and 0.25 milliliter straws. Sexed semen usually results in lower conception rates.

Pregnancy rate is computed by multiplying heat detection rate times the conception rate.

When scoring calving ease, a “1” is no problem; “2” is a slight problem; “3” is needed assistance; “4” is considerable force; and “5” is extreme difficulty.

A progesterone-releasing implant called a CIDR is inserted into the vagina for 7 days to synchronize estrus.

Heat synchronization protocols:

Ovsynch: GnRH – 7 days – PGF – 48 to 56 hrs – GnRH – 8 to 16 hrs – insemination

Traditional Pre-synch

and Ovsynch: PGF – 14 days – PGF – 12 days – Ovsynch

G-6-G: PGF – 2 days – GnRH – 6 days – Ovsynch

Double Ovsynch: GnRH – 7 days – PGF – 3 days – GnRH – 7 days – Ovsynch

Heatsynch: GnRH – 7 days – PGF – 2 days – ECP – 2 days – watch for estrus and inseminate

With the traditional Pre-synch and Ovsynch protocol, two additional PGF injections are given 36 and 22 days prior to the desired insemination date. With the G6G Pre-synch program, a prostaglandin shot is followed by GnRH 2 days later and followed by the Ovsynch protocol 6 days later. The Heatsynch protocol is similar to Ovsynch except that the 3rd injection is ECP (estradiol cypionate) rather than GnRH and cows are timed-inseminated 24 hours later.

It is recommended to give a GnRH injection 15 or 16 days after insemination in a synchronization program. This does not affect conception rates to the first breeding, but improve conception rates for those cows that had to be rebred.

Trade names for Prostaglandin F2 alpha products in 2003 are: Lutalyse, Estrumate, Prostanate, and In-Synch. Trade names for GnRH products are: Cystorelin, Factrel, Fertagyl, and Ovacyst.

According to a 2007 National Animal Health Monitoring System survey, over half of dairy farms still use a bull to breed some cows naturally. Timed AI protocols were used for the majority of females for 1st service by less than 7% of farms.

Pregnancy can be accurately diagnosed with ultrasound 30 days post A.I. A blood test, BioPRYN, can also diagnose pregnancy at 26 to 30 days post breeding. PRYN = Pregnant Ruminant Yes/No.

	Gestation Length	
	<u>1st calf</u>	<u>Later calvings</u>
Ayrshire	281.8	281.7
Brown Swiss	287.3	287.5
Guernsey	284.8	285.8
Holstein	277.9	279.5
Jersey	278.5	280.0

Abortion is highest during the summer season.

To reduce stillbirths, calving pens should be checked at least every two hours.

Hormones in Reproduction:

Estrogen is produced by the follicle on the ovary. It is the primary female sex hormone and causes estrus behavior. ECP (estradiol cypionate) is the estrogen injected in the Heatsynch protocol.

Progesterone is produced by the CL on the ovary. It helps to maintain pregnancy.

Prostaglandin (PGF) is secreted by the uterus and causes the Corpus Luteum (C.L.) to regress.

Luteinizing hormone (LH) is secreted by the anterior pituitary gland and causes ovulation.

Follicle stimulating hormone (FSH) is secreted by the anterior pituitary gland and stimulates follicular growth.

Gonadotropin releasing hormone (GnRH) originates from the hypothalamus and tells the anterior pituitary gland to release LH and FSH.

Milking:

The temperature of the milk when it comes out of the cow is 96° to 98° F and should be cooled to 40° F as quickly as possible in the bulk tank.

During the milk phase, the liner is open and milk flows. During the massage or rest phase, the liner is closed. Most pulsators work with a pulsation rate of 60 cycles per minute. The pulsation ratio is the percentage of time in the milk versus rest phases. A 60:40 ratio is most common, indicating the line is in the milk phase 60% of the time.

There are three reasons to forestrip:

- 1) to keep poor quality milk out of the tank
- 2) to detect mastitis earlier so it can be treated
- 3) to stimulate milk letdown

Pre-dips need to remain on the teat 30 seconds to be effective.

Dirty equipment, dirty udders, and infected udders are the three main sources of on farm bacterial contamination of milk.

Strep mastitis, dirty udders, dirty equipment and improper cooling are the four main causes of an elevated bacteria count in the milk.

Four milking parlor designs are the flat barn, parallel, rotary and herringbone. The rotary enables workers to be stationed in one place.

A robotic milking unit can handle 50 to 70 cows per day. In 2002, The Netherlands had the most robotic milkers of any country, with 500 in use.

The California Mastitis Test (CMT) is used to screen cows for somatic cell count. The CMT reagent causes the DNA in the somatic cells to coagulate. The cost to run a CMT is less than 1 cent.

In 2000, the average somatic cell count (SCC) in the U.S. was 316,000 and decreased to 288,000 by 2006. Minnesota's somatic cell count was higher than the national average at 319,000 in 2006. Cows in Florida tend to run higher than most any other state because of the hot, humid weather. The lowest somatic cell count was Rhode Island. In most states, SCC tends to run higher in the summer months. The legal limit for Grade A milk for Somatic Cell Count is 750,000 cells per milliliter.

A linear score of 4 (200,000 cells per ml.) is generally accepted to indicate that a cow has mastitis.

Mastitis pathogens are generally classified as environmental or contagious. Contagious pathogens are most often found in the udder. Environmental pathogens are most often found in bedding or walkways. The big MP3 or three major mastitis pathogens include *Staphylococcus aureus* (Staph), *Streptococcus agalactia* (Strep) and *Mycoplasma*.

Hyperkeratosis is teat end calluses.

Switching from 2x to 3x milking can be expected to increase milk production by 10 to 20 percent. In 2009, about 1/3 of dairy farms milk 3X.

Cold weather, overmilking, and high vacuum levels all can cause teat end damage.

The median and lateral suspensory ligaments have 60% of their attachments to the body wall and 40% to the pelvis.

Marketing and Dairy Products:

Milk prices tend to be lower in spring compared to the rest of the year.

The standard plate count is a milk quality test when technicians pour milk onto a micro plate, incubate it, let it grow, and then count the colonies of bacteria.

In 2006, organic milk made up about 3.4% of U.S. milk sales.

Bacteria that can survive high temperatures are known as thermotolerants.

Laboratory pasteurized count (LPC) is the amount of bacteria in pasteurized milk.

Pasteurization destroys 90% of the BST found in milk.

PIC (preliminary incubation count) is a milk quality test used to determine if a high bacteria count is due to faulty cooling.

Milk was utilized for the following products:

	<u>2001</u>	<u>2007</u>
Cheese	42%	43%
Fluid milk	27%	23%
Frozen dessert	7%	5%
Butter	7%	7%
Specialty products	6%	
Nonfat dry milk	3%	4%
Other dairy products		17%

The two most popular cheese varieties in the U.S. in 2006 were Mozzarella and Cheddar.

Butter can be stored up to 6 months in the refrigerator before losing flavor.

In the year 2000, the average milk production per cow in the U.S. was about 18,200 lb. Total milk production increase each year in the U.S. from 1997 to 2002. In 2003, average milk per cow in the U.S. was 18,749.

Milk is high in calcium and often fortified with vitamin D to help prevent rickets in children.

Dairy Farmers of America (DFA) is the nation's largest milk cooperative (2000-2008). The Capper-Volstead Act of 1922 made farm cooperatives legal.

Land O'Lakes, a Minnesota based cooperative, was ranked 3rd for volume of milk in 2000-2008.

The largest dairy processing company in the world in 2006 was Nestle.

Dairy farmers are assessed fifteen cents per cwt of milk for milk promotion in the U.S.

Australia and New Zealand produce about 4% of the world's milk. India has more cows than any other country.

Elsie, the Borden Company's famous marketing cow, originated in 1939.

Dairy producers in Florida received the highest price per lb. of milk among producers in the 48 states.

In 1999, 97% of the milk in the U.S. was produced as grade A.

In 1999, Ireland had the highest consumption of fluid milk per capita, while France had the highest per capita consumption of butter. Greek people led the world in per capita consumption of cheese in 1999. In 2002, Denmark had the highest per-capita consumption of cheese at 63 lb per person.

Milk is 86 to 88% water. Milk is 5% carbohydrates (lactose).

Wisconsin led the nation in cheese production in 2001. Washington State produced the most milk per cow in 2000, 2001, 2003, 2004 and 2005. Arizona produced the most milk per cow in 2002, 2007 and 2008. Colorado produced the most milk per cow in 2006. Production per cow tends to be lowest in the Deep South. Minnesota ranked 23rd for milk production per cow in 2007 and 2008, and usually ranks in about the middle of the out states.

In 2007, the world's largest dairy herd was located in India.

In 2000, per capita production of milk in the U.S. was 596 lb per person; 576 lb per person in 2005; 625 lb per person in 2008. Alaska had the fewest cows until 2003, at which time Rhode Island was ranked last for number of cows 2003 to 2005. Alaska had the fewest cows in 2006 to 2008.

New Food Pyramid (2005) guidelines recommend 3 servings of dairy products per day.

One percent of milk is sold in vending machines.

California has the most cows on DHIA test. Stearns County leads Minnesota counties in milk production.

After the un-hairing and tanning process, the animal's skin is known as leather.

Irradiated ground beef is rapidly gaining consumer acceptance. Irradiated beef was first approved by the FDA in 1997 to kill pathogens. Dairy Queen was the first fast food chain to use irradiated beef.

In 2006, the top four states for number of dairy herds in order were: Wisconsin, Pennsylvania, New York and Minnesota.

In 2002, Wisconsin had the most dairy farms at 17,366. Pennsylvania was 2nd, Minnesota was 3rd, and New York was 4th. The average number of cows per herd in 2002 in the U.S. was 130 cows and this increased to 147 in 2006. In 2006, Hawaii had the fewest number of herds.

New Zealand's dairy cow population has reached 3.5 million cows (2002) and is projected to 5 million in 5 to 8 years. Currently, 56% are Holstein-Friesian, 21% are Holstein-Jersey crosses, 15% Jerseys, 1% Ayrshire, and 7% others.

Cull dairy cows make up 7% of the beef production in the U.S. but provide 18% of the hamburger according to 2007 USDA figures. Veal calves are sent to slaughter at 475 to 500 lb. In 2006, 8% of all cattle slaughtered for beef were Holstein.

A new milk advertising campaign was kicked off in 2006 called, “Body by Milk.”

Dairy cow populations (2007):

1) India	119,600,000
2) Brazil	37,515,000
3) China	14,700,000
4) Russia	9,400,000
5) U.S.	9,224,000

Total cows’ milk production (2008):

	<u>Billion lb</u>
1) USA	190.4
2) India	92.6
3) China	83.7
4) Russia	72.1
5) Germany	63.2
6) Brazil	57.3
7) France	55.5
8) New Zealand	35.9

Top milk producing states:

	<u>2000-2002</u>	<u>2003-2006</u>	<u>2007</u>	<u>2008</u>
California	1	1	1	1
Wisconsin	2	2	2	2
New York	3	3	3	3
Idaho	6	5	4	4
Pennsylvania	4	4	5	5
Minnesota	5	6	6	6
Texas			8	7
New Mexico			9	8
Michigan			7	9
Washington			10	10

Canadian dairy producers have a quota system with a capped price of \$22,750 per cow in 2009. A unit of quota permits a dairy producer to sell 60 lb of 3.8% fat per day.