Dairy Research, Teaching, and Extension
UNIVERSITY OF DELAWARE

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DELAWARE DAIRY NEWSLETTER

UDairy Creamery: From the Cow to the Cone

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The UDairy Creamery store and processing facility opened its doors at a ribbon cutting at the college's Ag Day celebration, April 30th, 2011. The Creamery is located between Townsend Hall and the Fred Rust Ice Arena and is home to the store and processing facility.

Through a partnership with Hy-Point Dairy in Wilmington, Del., milk is shipped to a Cumberland Dairy in Cumberland, NJ, where it is pasteurized and made into the ice cream base. The base is then shipped back to the Creamery where it is made into premium ice cream. Currently the creamery sells twelve classic flavors (like vanilla, chocolate, and strawberry) and adds new flavors monthly. The top seller right now is Delaware River Mud Pie -- a vanilla and chocolate cookie ice cream with fudge swirls. Ice cream is sold in cups, cones, pints, half-gallons and milkshakes. Large 3-gallon containers are also sold for private events.

Other products for sale include coffee drinks, bottled sodas and teas, and Creamery branded t-shirts, travel mugs, and plush cows. Also for sale at the Creamery are "Blue Hen Blankets and Yarn" made with the wool from UD's flock of Dorset sheep, as well as "Dare to Bee Honey" from the UD apiary.

In addition to store sales, select Creamery products can also be found at the POD (Provisions on Demand) on campus, the UD Courtyard Marriott, the UD/Barnes & Noble Bookstore on Main Street, and all on-campus markets. Creamery ice cream is on the menu at Vita Nova, UD's student run restaurant, and at the Russell Dining Hall. In addition, Creamery ice cream is sold at Delaware Stadium during home UD football games and will be available during select UD basketball games.

The UDairy Creamery was established to give UD students hands-on experiences involving the principles of science and technology, dairy production, food science

and safety, environmentally sound agriculture, business management and finance, entrepreneurship, and, perhaps most important, how to sustain agriculture in the face of land use change. The Creamery is operated under the direction of a Creamery Manager (a full time UD employee), a student management team (4 student interns), 20+ student workers, and an advisory board.

Out with the Old, in with the New: The Fall of MyPyramid, the Rise of MyPlate

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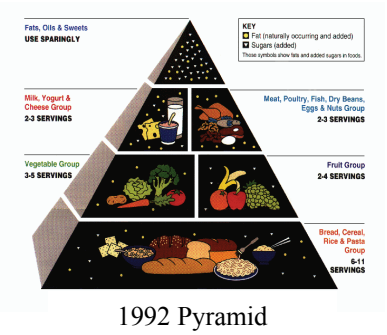
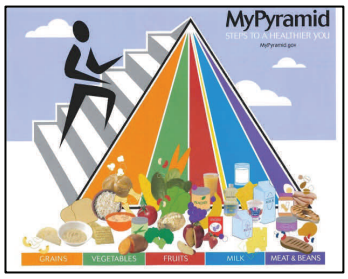
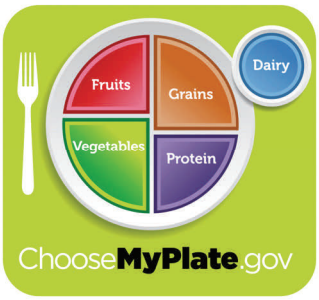
Earlier this summer the USDA switched food guidelines from MyPyramid to MyPlate. The original Food Guide Pyramid started in 1992 with the pyramid divided to represent each food group in relation to portion recommendations. In 2005, the USDA switched to MyPyramid Food Guidance System due to a switch in dietary guidelines. The food groups included: grains (orange), meat and bean (purple), vegetable (green), fruit (red) and milk (blue). The new pyramid still kept with the pyramid visualization but changed its message to variety, proportionality, moderation, and physical activity. The pyramid was color coded for each group to represent the variety of food groups that were supposed to be represented in your diet. Instead of having the food groups stacked on top of each other, they were side by side to stress that each food group is important for a balanced diet.



1992 Pyramid



2005 MyPyramid



2011 MyPlate

MyPlate was introduced in June 2011 to replace MyPyramid. MyPlate has the same recommendations on what and how much we should be eating for each food group, the layout just changed to reflect a plate instead of a pyramid. This was for ease of viewing and comparing your plate to MyPlate. A few other changes that were made reflected changes that the 2010 Dietary Guidelines had made. MyPlate offers "10 tips to a great plate"

1) Balance Calories- Know what your caloric intake needs to be. Find a balance between food and your physical activity to provide for this caloric intake and increase physical activity in your everyday life. For example, take a 10 minute walk instead of a coffee break (I know on some mornings, this is hard)
2) Enjoy your food, but eat less. Enjoy food as you eat but don't eat when your attention is elsewhere, this could result in over-eating.
3) Avoid oversize portions. Use smaller plates and eat the smaller portion of meals instead of the large portion when you are eating out.
4) Foods to eat more often- Eat more vegetables, fruits, whole grains and milk.
5) Make half of your plate fruit and vegetables. Vary your veggies choosing red, orange or dark green

vegetables (my motto is the more color the better). When eating fruits choose whole or cur fruits instead of juice as your fruit serving. Also try to select fruits that are high in potassium, for example bananas.

6) Switch to fat-free or low-fat (1%) milk. Include milk as your beverage at every meal.
7) Make half your grains whole; for example, switch from white bread to whole wheat.
8) Foods to eat less often- Cut back on foods like cake, cookies and pizza. Try to avoid foods high in added sugars solid fats.
9) Compare sodium in foods. Choose low sodium versions of foods when you can (mainly in processed meals)
10) Drink water instead of sugary drinks

Other tips that the website offers are go lean with the meat and keep food safe by properly storing and preparing foods.

MyPlate is still under development in some ways, there will be new interactive tools up on their website this fall. If you would like more information on MyPlate go to choosemyplate.gov.

After the Hurricane – Now What?

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Most corn harvested for silage has already been ensiled in the Mid Atlantic region. Some of these crops were compromised because of Hurricane Irene and the extremely wet weather that followed. The degree of damage to the crops was highly variable but in the worst instances plants were lodged, fields were flooded, and a significant amount of damage to ears was apparent. Here are some general guidelines for the upcoming feeding season.


Lodged corn 2 wks post hurricane. L. Kung, Jr., UD, 2011.

Allow crops to thoroughly ensile for 4-6 weeks (or more if possible) before feeding. There is strong probability that forages from fields that were flooded will have high amounts of ash from the silt that remained on the plants after flooding (the amount will be dependent on degree of flooding). In particular, these forages may be high in iron, aluminum, and possibly other heavy metals. (High iron may be from wear from the chopper). High levels of minerals may affect palatability and have the potential to be toxic to animals. Even if not toxic, consumption of high levels of minerals more than likely will affect normal metabolism as there are significant interactions among the minerals. Forages suspected to be high in ash content should be analyzed by wet chemistry methods (not NIR) for ash and other standard minerals. Heavily silted forages may be tested for heavy metals. If significant plant damage was evident (e.g. damaged ears), test for mycotoxins.

Many corn fields were lodged because of high winds. Many of these lodged plants were down for 2 to three weeks prior to harvest. If they were harvested for silage, they will also probably be high in ash content. Plants in these fields probably had some degree of decay and were lower in fermentable sugar content at harvest. Plants with physical signs of damage to the ears (e.g. molds, ear rot, etc.) have the possibility of significant mold damage and thus crops made from these plants should be tested for mycotoxins.


Silted corn plants after flooding in Vermont. Courtesy of Dan Hudson, UVM Extension, 2011.

Early reports of corn silages made from flooded fields have ash contents running from 15 to 18%. The normal ash content of corn silage is about 3 to 4%. One sample from a badly flooded field in Vermont contained 28% ash, and over 7,000 and 4,000 ppm iron and aluminum, respectively. The possibility of compromised crops being contaminated with pathogens that may affect the herd is also real, but there are no clear strategies to deal with this issue. Listeria, E. coli, Salmonella, and Clostridia may be found in forages that were flooded with water containing lagoon and municipal waste. Although normal chemical levels of compounds in a silage do not guarantee that the crop is not contaminated with pathogens, more times than not, a normal fermentation profile will probably be associated with low levels of pathogens. Good corn silage in the NE usually has a final pH of about 3.6 to 3.8 and normal concentrations of lactic acid (3-5%) and acetic acid (1.5 to 3%). Good corn silage should have undetectable levels of butyric and propionic acids (or at least less than 0.1-0.2%). Let your eyes and nose do some detective work for you. If it "looks bad", "smells bad" or just seems "off", it is best to consult with your nutritionist before feeding and to decide what tests are warranted. The recommendation to discard "off-looking" feed (e.g., moldy, slimy, rotten, etc.) should be especially practiced under these conditions.


Ear rot. Courtesy of Ernie Vogel, 2011. Delaware.

If possible, limit the amount of extremely damaged forage made into silage that will be fed to pregnant and high producing cows. Gradually introduce suspect feed into the rations. If silages are identified with high mycotoxins or heavy metals, your nutritionist will work with you to establish the best plan for dealing with this material.

A Guide to Understanding Vitreousness and Prolamins in Corn

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Corn is a Seed: The corn seed is comprised of three basic morphological parts, pericarp, germ, and endosperm. The endosperm represents 75-80 percent of the corn kernel and contains primarily starch and protein. The endosperm of corn is virtually devoid of fiber (ADF or NDF) but contains abundant proteins (albumins, globulins, prolamins, and glutelins) of which prolamins are of primary importance in ruminant nutrition.

Prolamins Make Corn Vitreous: The word vitreous means "glass like" and prolamins are proteins associated with starch in all cereal grains. In corn, prolamin proteins are named zein and comprise 50-60 % of the protein in whole corn. Prolamin proteins cross-link encapsulating starch into a water tight (hydrophobic) matrix. Although less common, floury or opaque endosperm corn types have lower prolamin content as compared to flint or normal dent corn hybrids. Differences in starch encapsulation by prolamins can be seen using scanning electron microscopy Figure 1. Prolamins define differences in the chemical composition between vitreous dry corn (glassy, translucent) and floury or opaque corns although the relationship is not absolute. Starch in vitreous dry corn is more extensively encapsulated by prolamins and is less degradable in the rumen as compared to floury or opaque corns.

Vitreousness or Prolamins Decrease Starch Digestion: Research studies have observed negative relationship between the vitreousness (prolamin) of a feed grain and starch degradability or digestibility. In a University of Wisconsin study total tract starch digestibility was decreased 0.86 percentage units for each percentage unit increase in the grain prolamin content when prolamin was expressed as a percentage of starch.

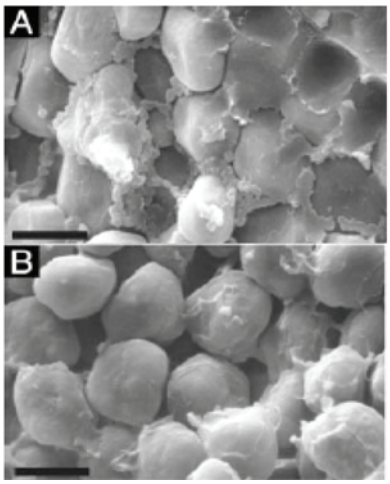

Figure 1. Scanning electron microscopy of starch granules in corn: A) starch granules heavily imbedded in prolamin-protein matrix, B) starch granules in opaque corn with less extensive encapsulation by prolamin-proteins (Gibbon et. al., 2003). Published with permission: *Copyright (2003) National Academy of Sciences, U.S.A*.

Nitrogen Fertility Effects Vitreousness & Prolamins: The nitrogen fertility status of the corn crop during the growing season can affect the prolamin content of the grain. Excessive rainfall can result in N losses from leaching and denitrification. Likewise, lack of moisture during the pollination can result in poor N status. When corn is deficient in N, yield is reduced because the nitrogen sink, which facilitates starch accumulation and increased kernel weight, is altered. Corn kernels from normal hybrids grown under nitrogen deficient conditions may be more opaque and may contain only one-half of their normal prolamin concentration.

Fermentation Degrades Prolamins: Improved starch digestion in high moisture corn or corn silage kernels is dependent on the degradation of prolamins via fermentation. Prolamin degradation is dependent on the length of the ensiling time and the intensity of fermentation. Prolamin degradation is difficult to measure in the laboratory but soluble protein and or ammonia concentration are excellent markers of prolamin degradation in high moisture corn. Prolamin proteins in high moisture corn containing 2
45-65 % soluble protein or 4-6 % ammonia (% of total N) have likely been extensively degraded. Dry corn or unfermented high moisture corn has no ammonia and soluble protein concentrations are typically less than 30 % of total protein.

Evaluating Vitreousness and Prolamins in Corn: Determination of vitreousness requires manual dissection of whole corn kernels and is not routinely performed by commercial feed and forage testing laboratories. Likewise, vitreousness is not viably measureable in ground dry corn or high moisture corn. Vitreousness of mature corn kernels can be indexed on farm by laying mature corn kernels on a background light source and observing translucence (Figure 2).

A commercial test is available to determine the concentration of hydrophobic prolamin proteins that encapsulate corn starch. The prolamin protein assay is available at a number of commercial feed and forage testing laboratories. The prolamin content of dry corns ranges from 2.5-5.5 % of dry matter. Corns > 4.5 % prolamin as a % of DM are likely more vitreous, may contain more flint genes, are short relative maturity hybrids (more flint genes) and had adequate N fertility. Corns with lower prolamin protein < 3.0 % maybe unique opaque-floury hybrids or be grain from N deficient corn. The prolamin assay used in commercial feed and forage testing laboratories is similar to vitreousness in that it indexes corn endosperm characteristics. The prolamin assay does not measure the degradation of prolamin proteins in high moisture corn as induced by fermentation.

Degradation of prolamins in high moisture corn should be evaluated using soluble protein or ammonia as markers of prolamin degradation.

Feeding Calves and Heifers for Efficiency and Production

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Researchers have been active in the area of calf early life nutrition and precision feeding older heifers. Higher nutritional levels early and controlled energy, especially post-breeding, have resulted in improved health and performance with lower cost and environmental waste.

An ongoing review of best management practices by scientists and growers has resulted in the Dairy Calf and Heifer Association (DCHA) publishing Gold Standard guidelines (http://www.calfandheifer.org/). Growth goals are:

Birth to 60 days old, double birth weight

61 to 120 days old, 2.2 lbs. average daily gain (ADG)

121 to 180 days old, 2 lbs. ADG

Over 6 months old, 1.7 to 2 lbs. ADG

A meta-analysis of research by Zanton showed optimum milk yield was achieved at 1.75 lbs ADG (range 1.5 – 2) from weaning to puberty. More than nutrition affects growth, however, and Gold Standards for calves from birth to 6 months old, and 6 months old to calving cover health, housing and reproductive management as well.

Proper dry cow nutrition and health sets the stage for successful calf and heifer growth. In a recent Pennsylvania survey of Holstein colostrum quality, Heinrichs noted that mineral concentrations are much higher now than in older data, reflecting improved dry cow nutrition. Zobel reviewed the 2011 ADSA presentation by Bach showing calves from undernourished or stressed dams had reduced performance and immunity, and tied early life calf nutrition to health, growth, reproduction and production in later life.

Calves
In a national survey from Iowa, 30 percent of 827 colostrum samples were below the target 50 mg IgG per ml, with no breed differences. IgG mg per ml was 42, 69 and 96 for first-lactation, second-lactation and third-lactation-or-more cows, respectively. In the Pennsylvania farm survey, average IgG concentration was 47 mg per ml (range 16 – 120). The goal is to provide adequate colostrum amount and quality to result in 10 mg IgG antibodies per ml of serum in calves 2 to 7 days old. Failure to achieve this has resulted in delayed age at first calving, increased disease incidence and treatment costs, reduced ADG, reduced feed efficiency and reduced production in first lactation.

Automatically eliminating heifer colostrum or that from cows producing over 18 lbs. in the first milking, however, may unnecessarily reduce the supply of quality colostrum. While heifer colostrum may have lower levels of antibodies, and higher volumes can lower concentrations, there is a huge amount of normal variation

in colostral IgG concentration. Quality testing is recommended. The "green range" on a colostrometer, or over 22 percent on a Brix scale refractometer, would meet the goal of "quality" with over 50 mg per ml IgG. Work is ongoing with refractometers to calibrate for actual IgG levels in colostrum and calf serum. A refractometer can also be used to troubleshoot digestive upsets. The University of Wisconsin veterinary group indicates more than a 1 percent unit change in solids from feeding to feeding may put calves at risk for bloating, abdominal pain and ulcers.

In the 2011 Pennsylvania survey, only one-third of the colostrum was under the 100 cfu per ml goal for coliform bacteria (median 600 cfu per ml). Only 55 percent of samples were under the 20,000 cfu per ml SPC goal (median 15,300). Submit samples to culturing labs to monitor your herd. The national survey found refrigerated colostrum had the highest bacterial contamination compared to fresh or frozen. Ensure colostrum is stored in small volumes (to facilitate rapid cooldown), fed within a few days and refrigerators are constantly less than 38ºF. Heat-treating colostrum (30 to 60 minutes at 140ºF) will reduce bacterial contamination, some of which may interfere with antibody absorption. Research showed that heat treatment resulted in greater antibody transfer to the calf. You must ensure that you do not re-contaminate the colostrum (or waste milk) with unsanitary handling after heating.

Make needed changes to management to ensure high-quality colostrum in adequate supply. Colostrum-based or plasma-based colostrum replacers can be valuable in a management program if you temporarily don't have enough. Expect products to contain 150 grams of bovine globulin per dose and ask for research showing proper immunity transfer to calves. Research has shown similar results to maternal colostrum for effects on lifetime performance and longevity.

Van Amburgh reviewed calf maintenance requirements and concluded they are higher than previously reported, especially for small breeds (higher surface area-to-volume ratio). For calves 0 to 3 weeks old, supplemental energy is needed when temperatures are below 68ºF. This can be achieved by a third daily feeding (which also provides another opportunity to introduce warm milk). Addition of digestible fat to the milk replacer is another, less expensive option. Deep-bedded straw (can't see calves' legs when lying down) or calf blankets can help moderate cold temperatures and reduce the need for added energy. We've introduced a "double blanket" to allow flexibility for temperature changes.

Minnesota workers fed the same total MR 4x vs. 2x and, while not statistically different, 4x-fed calves ate more starter and were 11 lbs heavier at 56 days. At Wisconsin, research showed calves fed the same total milk replacer 3x a day had greater gain and hip height, ate more starter, had better feed efficiency and were more likely to enter lactation than those fed 2x. Animals fed 3x started lactation 16 days earlier and had a projected 305-day ME milk yield 1,100 lbs higher. Acidification of milk (or milk replacer) and more frequent computer-controlled feeding to group-housed calves are gaining popularity in New York and elsewhere. Weaning can be a challenge due to lower starter intake.

Feeding milk replacer at 2.2 lbs. of powder versus 1.5 resulted in less starter intake and digestibility and rumen development in trials at Penn State and in Spain. Most "intensive" milk replacer feeding programs recommend reduced powder feeding the week before weaning to encourage starter intake and ease weaning transition. We offer a higher protein non-medicated milk replacer with MOS and functional proteins formulated for a 1.9 lbs. of powder intake. This approach, adapted from large calf ranches, increases growth and health while encouraging more normal starter intake and easier weaning.

Keep starter feed fresh and free of fines. Calf starter grains that are coarse-textured are preferred for intake, growth and rumen development. A rolled/cracked vs. flaked grain may reduce fines and result in better growth.

Penn State and Minnesota research work showed that whole corn resulted in similar growth to rolled corn. Use of medications (possibly excepting ionophores and anti-coccidials) in milk replacer is being scrutinized by regulators. Some vocal consumer groups are asking for fewer antibiotics in food production. Higher levels of nutrition improve growth and immunity. Clean, dry and well-ventilated housing reduces pathogen load. We recommend enhanced nutrition and management to minimize antibiotic use.

Van Amburgh summarized 10 trials where increased milk or milk replacer was fed versus control and found an average first-lactation production increase of 1,700 lbs. per heifer (range 0 to 3,000). Field trials with similar results were reported. Heinrichs summarized many of the same trials and cited questions of applicability and lack of statistical significance in some. His review concluded no effects of intensive milk replacer feeding rates on milk production.

Heifers

Overconditioned heifers have higher maintenance costs, lower feed efficiency and typically cost more to feed. Older heifers on lower-digestible forages may have a feed-to-gain ratio of 8-to-1 or worse. Higher-digestibility forage and/or grain-fed heifers may improve efficiency to 6-to-1. Weaned calves and young heifers can be 3- to 4-to-1. Digestibility and nitrogen efficiency of feed is higher and manure output is lower with higher-quality forage and grain intake. Use ionophores and yeast/A. oryzae products to improve ration digestibility and/or feed efficiency. Heifers in good facilities with limited exercise and high-quality feeds may need to have controlled energy intake to avoid overconditioning.

Considerable research (particularly in Pennsylvania and Wisconsin) has focused on precision feeding to control excess body condition score (BCS) in heifers, especially post-breeding. Initial recommendations were to ensure feedbunk space to allow every animal to eat at one time. This may be the case if the trough is empty more than six hours a day. It may, however, be possible to meet needs by feeding 80 to 85 percent of unlimited feed intake. With feed available 20 hours a day, animal access should be okay. Monitor growth and watch for individual variation on these programs. A recent meta-analysis of precision feeding trials by Zanton showed that animals precision fed for similar ADG produced similar milk and component yields in the first lactation.

While the greatest numbers of Pennsylvania heifers still calve at 24 months, in 2010 the proportion of heifers calving at 23 months exceeded the number calving at 25 months, an improvement since 2002. In 2010, heifers calving at 22 or 23 months had the highest production. In 2002, production was similar for those calving from 23 to 27 months old. Production is greatest in heifers with a pre-calving weight of 1,300 to 1,375 lbs.

At www.calfnotes.com and www.tinyurl.com/calfinfo you'll find hundreds of short, practical notes on calf feeding, health and management. Penn State provides multiple management tools for colostrum, calves and heifers at http://www.das.psu.edu/research-extension/dairy/nutrition/calves.

A management focus on colostrum and milk replacer feeding, proper nutrition with correct energy post-breeding, housing, health and reproduction is generating progress in growing healthy, efficient and productive heifers.

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