

Dairy Extension Agenda

- Tuesday, August 23, 7 PM, **Dairy Risk Management meeting** at Suwannee Valley Feeds, Trenton, FL. Dr. John Van Sickle will be discussing how the first 2011 crop estimates will affect feed prices. Contact Mary Sowerby at (386) 362-2771 or meso@ufl.edu.
- Thursday-Saturday November 17-19, **Southern Regional Dairy Challenge**, Live Oak, Florida. This event is hosted this year by the University of Florida. Approximately 70 undergraduate students interested in dairy production from some 12 schools in the southeastern US will participate in a dairy herd evaluation contest. To sponsor or get involved, contact Mary Sowerby, meso@ufl.edu or Albert De Vries, devries@ufl.edu.
- Tuesday December 6, the multi-state **Dairy Heat Stress Road Show meeting** series stops at the Okeechobee County Extension Building, 458 Highway 98 North. Time 10 AM until 2:30 PM with a free lunch provided. Speakers from Texas A&M University and the University of Florida. Topics: Cooling strategies during heat stress; Strategies to improve reproduction during summer; Nutritional programs for the heat stressed herd; Economics of heat stress: Implications for management. These meetings are part of a large USDA sponsored program aimed to improve fertility in heat stressed dairy cows. Contact Courtney Davis, Okeechobee County Extension, cbdavis@ufl.edu, (863) 763-6469, or Albert De Vries, devries@ufl.edu.

8. Do you have fans in the parlor for the cows and the workers?
9. Do your calves have adequate shade and plenty of fresh clean water to drink? A 6 week old calf will drink 5 gallons of water a day in hot weather. A 5 quart water bucket won't cut it in the summer.
10. Do your dry cows have access to shade? If not add shade cloth in multiple areas in the lots. Cows like to calve in private. Calving in a non-shaded mud hole in the sun is not a great way to start a lactation.
Contact Dave Bray at drbray@ufl.edu or call (352) 392-5594 ext. 226 for more summer advice.

Strategies to Reduce Silage Spoilage to Enhance the Efficiency of Dairy Production

A.T. Adesogan, O.C.M. Queiroz, and K.G. Arriola

The Southeast Dairy Check Off funded two experiments aimed at comparing different strategies of reducing silage spoilage.

Experiment 1: Additive type effects

Chemicals and bacterial inoculants are frequently applied to forages at the time of ensiling to improve the quality and shelf life of the resulting silage. The objective of this trial was to evaluate the effect of several different chemical and bacterial additives on silage fermentation and aerobic stability. Corn forage was harvested at 31% of DM and chopped. The treatments applied were: 1) **Water** (Control treatment); 2) **Buchneri 500 Combo inoculant** (BUC) from Lallemand Animal Nutrition (supplied 100,000 cfu/g of *Pediococcus pentosaceus* and 400,000 cfu/g of *Lactobacillus buchneri* bacteria); 3) **Sodium benzoate** (BEN) applied at 1% of fresh forage weight; 4) **Silage Savor acid mixture**, (SAV) from Kemin AgriFoods North America, Inc. applied at 1% of fresh forage weight; 5) **Acetobacter pasteurianus** experimental inoculant bacteria (PAS) applied at 1000,000



Southeast Milk, Inc.
Dairy Check-Off

cfu/g; 6) **Gluconobacter suboxydans** experimental inoculant bacteria (SUB) applied at 1000,000 cfu/g; 7) **MTB 100 inoculant** (ECO) from Ecosyl Inc, Byron, IL, applied at 1g/ton; 8) **Silo-King Water Soluble inoculant** (SK) from Agri-king, Fulton, IL, containing *Lactobacillus plantarum*, *Enterococcus faecium* and applied at 6 g/ton; 9) **Biomax V inoculant** (BIO) from Chr. Hansen Animal health and Nutrition, Milwaukee, WI containing *Lactobacillus plantarum* and applied at 1g/ton.

Top Ten Summer Tips

David R. Bray

1. Mow weeds in pastures; careless weeds in the South and thistles in the North.
2. Remove mud from mud holes in lanes, gate areas and calving lots.
3. Keep fly control up on all aged animals, calves and dry cows.
4. Clean fans if dirty in freestall barns.
5. Clean fans and adjust sprinklers or add sprinklers to the holding area; holding area cooling is a great way to cool cows or cook them.
6. Clean condensers on your refrigerated units.
7. Are your parlor chemicals still outside in the sun? If so your chlorine sanitizer is now yellow water. Chemicals should be under shade.

After additive application, each treatment was packed into four, five-gallon laboratory silos, which were sealed for 120 days. Silage samples were analyzed for fermentation products, nutritive value, and bunk life. All silages were well fermented as shown by low pH values (3.7 to 3.9). Treatments did not affect dry matter digestibility. Treatment SAV produced higher ammonia-nitrogen and butyrate concentrations than other treatments suggesting it increased protein degradation. Treatment BEN gave the lowest pH, ethanol, and ammonia nitrogen concentrations indicating that it improved fermentation efficiency and reduced protein degradation. Treatment BUC gave higher acetate concentration than the Control and the longest bunk life (44 hours). This may be because acetate is an antifungal compound that reduces the growth of spoilage organisms. Compared to the Control silage, BUC silage had 64% longer bunk life and BEN silage had 37% longer bunk life but other treatments did not improve bunk life.

In conclusion, chemical and bacterial inoculants can improve the fermentation and aerobic stability of corn silage but the efficacy varies with the additive. In this study, the *Lactobacillus buchneri* inoculant, Buchneri 500 and sodium benzoate were the most effective additives for improving the bunk life of the silage.

Experiment 2: Cover type effects

This experiment aimed to examine effects of different silo sealing strategies on the quality, shrinkage and bunk life of corn silage. In particular, we compared using **Silostop oxygen barrier film** instead of **conventional plastic** to cover silage in bunkers. Bruno Rimini company claims their Silo-stop film is up to 60 times more effective at reducing oxygen flow through the film into silage than conventional plastic, and therefore it can increase bunk life and reduce silage spoilage. In a previous study at the University of Delaware, using Silostop improved fiber digestibility of corn silage at the 'shoulders' of bunker silos. The shoulders represent the area that is 4 inches away from the sidewall and in the top 6 inches of the bunker. In a previous study at the Dairy Forage Research Center in Madison, WI, shrinkage (dry matter losses) was greater in the top 6 inches of corn silage covered with conventional 8-mil plastic compared to that covered with Silostop film. These studies suggested that the main benefits of Silostop were at the top layer or near the side walls

In this experiment, we compared the following treatments: 1) Conventional 6 mil plastic cover on the top of the bunker (CONTROL); 2) Conventional 6 mil plastic on the top and sides of the bunker (SIDEWALL); and 3) Conventional 6 mil plastic on the top and sides of the bunker with an added Silo-stop oxygen barrier film on the top of the bunker (SILOSTOP). Three 40-ton silos (14 x 20 x 9 cubic foot) were made for each treatment in the fall of 2010 and these were opened in May 2011. In each silo, twelve 2-lb bags of corn forage in mesh bags were buried during packing at depths of 1 foot and 4 feet from the surface and at widths of 2 foot or 5 feet from the sidewalls. After the silos were opened, the bags were removed and analyzed for shrinkage, bunk life and nutritional value. We also measured the thickness of the darker slimy layer of spoiled silage on the top of the silage in each bunker.

A thick layer of spoiled silage was present on the top of the silage in each of the Control and Sidewall bunkers. However, this layer was completely absent in one of the 3 Silo-stop bunkers. The thickness of the top spoilage layer was about 50% less in the Silostop bunkers than in Control or Sidewall bunkers. However, cover type had no effect on measures of fermentation quality, nutritive value, shrinkage or bunk life of the silage stored in the mesh bags at the different locations. Distance from the sidewall did not affect silage quality, shrinkage or bunk life, perhaps because these were small, narrow silos. Although covering the sidewall with plastic may be important for large silos, our results suggest that it may not be necessary for well-packed silage in narrow bunkers.

Silage in the top 1 foot of bunkers had 90% more shrinkage (DM loss), lower pH, less lactic acid, and more ammonia-nitrogen than silage that was 4 feet below the surface. This showed that the silage in the top layer was poorly fermented and had more protein degradation, but silage in the lower layer was well fermented with little protein degradation. The poor fermentation and greater shrinkage of the silage in the top layer show that it is important to pack silage in the top layer to a greater density than silage in lower layers and to cover it immediately. This may be because silage in the top layer is not weighed down by silage above it. This study also suggests that the Silostop film reduced the amount of silage spoilage in the top layer. This spoiled top layer could contain molds and mycotoxins. A Kansas state University study showed that mixing the spoiled top layer silage with good silage reduced fiber digestibility and feed intake in beef cattle.

The cost effectiveness of using Silostop film will depend on the size of the bunker and the costs of normal plastic and Silostop film. In addition to the financial aspects, producers who plan to use Silostop should note that the procedure avoids the need for tires or tire sidewalls to cover bunkers because sandbags are used to secure the film. However, the sandbags are heavy and could be more difficult to stack than tire sidewalls. The Silostop procedure used in this research is called the 2-step procedure. It involves using just as much plastic as for a conventional silo, but a newer Silostop film from the company that requires less plastic has just been developed (1-step procedure). We hope to test the new and old films on large bunkers in the future.

Contact Adegbola Adesogan at adesogan@ufl.edu for more information.

Fourth of July Sizzlers

David R. Bray

Now that the Fourth has come and gone, are you reaching your goals you had set for your dairy this year? If your goal was to set off the best fireworks display in your county, but if you stored your fireworks outside next to the lagoon in a paper sack, your fireworks was a fizzle. If you did not clean your fans and repair your sprinklers this spring, your cows are probably fizzled out already. If you did not clean out the back of your free stalls either, your mastitis is just exploding and your SCC is booming!

Are you a Stud or a Dud? In the very near future every dairy in the US will have to meet the world standards for milk quality, either by mandate or public opinion. Here in the Southeast United States we have been paying to meet all the regulations for improving water quality for the past 30 years, and most of us have never received any premiums for “quality milk” because we are a fluid market and don’t make cheese. Many have achieved these standards by building freestall barns with fans and sprinklers to reduce the effects of heat stress on milk production and the use of sand bedding to try to reduce mastitis losses and increase reproductive efficiencies. Those of you who have mastered this are paying big money to compete in our new world economy. Those of you who can’t master everything are paying big money to try to survive. The barns cost the same, the electricity costs are the same, and the fans are the same price. If you can’t keep the fans clean, get the sand replaced and kept clean, you are suffering big losses due to heat stress and high cell counts, more clinical mastitis and lower reproductive performance. Freestalls need to be bedded twice a week, leveled every milking if possible, and the back third of the stalls cleaned out and sand replaced as needed. This problem is in the spring before the heat stress, then in the fall after the sprinklers run, or run less. Some people need to use new sand in the summer if they can’t recycle enough clean sand. If your recycled sand smells like “earth” it’s good to be used; if it smells like manure let it sit and drain. When it drains and if it smells like “earth” use it. If your sand smells like manure and has to heat, spread it on the fields, its fertilizer.

Alternatives. Florida feed barns have been used for years. They are barns without free stalls. Cows can eat and stay cool with fans and sprinklers during the day but stay outside at night to get off the concrete. Some cows lay on the concrete during the day but this is not a very desirable way to prevent mastitis or prevent feet and leg problems. Cows cool at night and slug feed themselves and get acidosis and sore feet also.

If you’re in the South and freestalls are not kept up, by adding clean sand twice a week, leveled often, then you are going to be hit hard with mastitis, especially Klebsiella. The only highlight to these bacteria is that it does not elevate your cell count. The cow just dies, but the Strep Uberis will be growing very well and your cell count will elevate. If you can’t control your sand bedding in your freestalls, all the fancy milking procedures in the world won’t help much. Keep sand stalls full of clean sand and use good milking procedures to control mastitis.

Feed barns will usually have high Strep Uberis, but if outside pastures have old filthy dirt, remove it every spring and new dirt added keeps lanes to pastures clean; you will do as well as possible. This will also control mycoplasma which lives there also. This applies to dry cow lots also; mud holes and careless weeds in the calving and dry lots are a recipe for a lactation of clinical mastitis.

Wash pens are used on most dairies. Some clean freestall barns don’t use them and the predip/strip/wipe routine does well and saves water also. Feed barns and outside cows need a good working wash pen to have any hope of keeping mastitis and SCC low. Pre-dipping was designed to be used on clean dry teats, not wet sloppy filthy teats. It’s hard to sanitize a cesspool.

A good cow wash pen is designed with enough wash space for each group (14 sq. ft. per cow) and the same sized dip-dry area for each group. Have enough water available to wash the cows, booster pump(s), and rain bird type sprinklers on 4’-5’ centers. A timer is needed to regulate the length and number wash cycles; this saves water and does a better job of cleaning teats, udders and underside of the cow. You can inject a sanitizing “Quat” type product with a surfactant that helps clean and dry the cows udders. Also you can inject a mild soap into the wash cycles(s) that will also speed up the cleaning and drying of the udders. These products are available at all dairy suppliers; they are not cheap but save time and labor.

If your wash pen is too small, water pressure too low, and half of the sprinklers don’t work, you will waste water and milk wet dirty teats. This scenario leads to your milkers having to pre-dip, strip and wipe filthy udders and teats, reaching through filthy legs and tails. Your mastitis rate and somatic cell count is now out of control. Whatever management can do to prevent mastitis before the cows come into the parlor will make you money. If you expect your milkers to try to clean and dry wet filthy udders, apply milking machines with malfunctioning pulsators, and ATOs that haven’t worked in three years to control mastitis – it’s going to be a *l-o-n-g* hot summer.

Summary. Every dairy in Florida can meet the new world standards for quality milk; you just need to keep your animals as cool as possible, don’t screw them up by allowing them to spend their time wallowing in filthy mud holes or unkempt freestalls. New dirt outside that becomes muddy is probably no worse than a filthy freestall. Some may have to improve the wash pens; many will need to cull junk chronic cows and stop making junk cows. Most of the time you have to spend money to make money.

Contact Dave Bray at drbray@ufl.edu or call (352) 392-5594 ext. 226 for more quality milk advice.

UF Students Learned a Lot in the 2011 Southern Great Plains Dairy Consortium Teaching Program

Albert De Vries

Stephanie Kirchman and Lauren Ellison are two UF undergraduate student with an interest in dairy science. They recently participated in the 4th Southern Great Plains Dairy Consortium Teaching program, which was held May 16 through June 25 around Clovis, NM. Here is what Stephanie had to say about her experiences:

“The Southern Great Plains Dairy Consortium is a six week full time course that allows students from all different levels of dairy knowledge and experience the opportunity to learn about the dairy industry and dairy management in Clovis, NM and the surrounding area where some of the largest dairies in the U.S. are located. This course offers two different sessions, with the first session being for new students to the program who may want to return the following year for session two which is for returning second year students in addition to students who have graduated and those with extensive dairy experience.

Each week of the session is based on a new topic which usually involves days split between lecture and practical application of what was learned on a dairy. I was placed into session two during which the modules included Herd Evaluation (Using Dairy Comp and Excel Functions to assess data), Management of Forages and Silages, Genetics, Calf and Heifer Management, Heat Stress Management, Human Resources Development, and Financial Evaluation and Management. We were taught by some of the top professionals in these fields and had the opportunity to visit and network with very successful dairymen as well as allied trade industry representatives.

I very much enjoyed this program and I believe it gives everyone who completes it an in depth understanding of the dairy industry and how they may see themselves contributing to it in the future. I will begin working towards my veterinary degree this fall, and I believe participating in this program has helped prepare me to be a better veterinary student and future veterinarian who understands the industry I hope to work for. I would highly recommend any student who is planning on working in the dairy industry to complete both sessions of the Consortium because it will give you so much knowledge and open up many pathways into their future education and career. If I were asked to suggest a program for dairy science students at the University of Florida I would recommend that they complete session one during the summer of their sophomore year, compete in the Southern Regional Intercollegiate Dairy Challenge that following Fall, return and complete session two in the summer of their junior year, and finish with competing in the National Intercollegiate Dairy Challenge in the Spring of their Senior year."

Lauren Ellison added the following:

"The SGPDC-T was a great experience for me. I was able to get out on many different farms to see and experience new things. Each week we covered a new topic from how to analyze financial statements to milking parlor procedures. They bring in the best of the best faculty to teach us about their field. I would have to say to all dairy science students to take a summer and attend this course. You will come away with a great deal of knowledge and lifelong friends."



Lauren (far left) and Stephanie (far right) in Clovis, NM, attending the 2011 Southern Great Plains Dairy Consortium Teaching Program

Lauren and Stephanie get credit at UF for having taken this program. Grants and industry sponsorship have thus far covered the expenses of the program, with no cost to the attending students or UF. UF students interested in this program must contact the dairy student advisor Albert De Vries no later than January 2012 to be able to apply for the

2012 program. Due to the success of this program, enrollment may be limited in 2012.

The Southern Great Plains Dairy Consortium Teaching program offers additional opportunities that UF by itself is not able to offer. Nevertheless, UF continues to offer a good foundation in dairy science in specialized and more general animal sciences courses, including a vibrant Dairy Club and participation in Regional and National Dairy Challenge events.

More information about the Southern Great Plains Dairy Consortium Teaching Program is found at <http://sgpdct.tamu.edu>. For more information about the UF undergraduate dairy science experience, contact Albert De Vries at devries@ufl.edu, or (352) 392-5594 ext. 227.

Prediction of the Future Florida Mailbox Price: August 2011 - July 2012

Albert De Vries

Using the Class III future settle prices of August 4, 2011 and an updated University of Wisconsin formula based on historical prices for the association between the Class III settle price and the Florida mailbox price, we predict the Florida mailbox price for August 2011 to July 2012 as follows:

Month	Year	Class III settle price*	Predicted Florida mailbox price
August	2011	21.45	25.30
September	2011	20.16	24.16
October	2011	19.27	23.32
November	2011	18.47	22.61
December	2011	17.60	21.84
January	2012	17.12	20.78
February	2012	16.97	20.65
March	2012	16.99	20.67
April	2012	16.91	19.90
May	2012	16.92	19.91
June	2012	16.90	19.89
July	2012	16.95	21.30

Class III settle price as of August 4, 2011.

How good are these predictions? In the figure, I have plotted the actual Florida mailbox price as well as the predictions that appeared quarterly in Dairy Update since the Summer of 2010. Except for December 2010, the predictions were lower than the actual mailbox price. For April 2011, predictions were \$3.79 to \$5.04/cwt too low! It is possible that the Wisconsin formula, based on a regression of actual Florida mail box prices on announced Class III prices from 2001 through April 2011 is not very accurate. We also know that the ability of the Class III settle price to predict the announced class III price is not flawless.

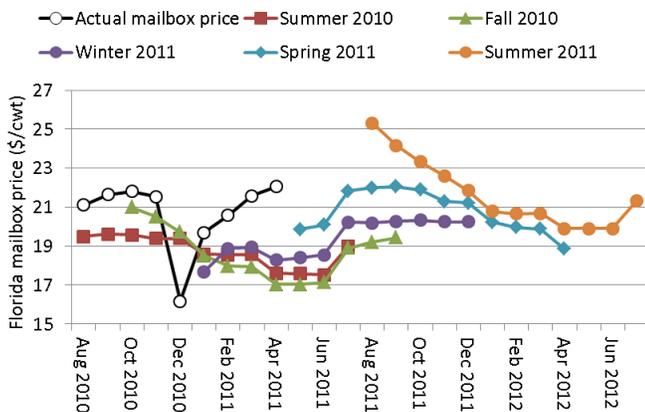
A brief analysis of the predicted and actual mailbox prices for the next 12 months, as predicted in the Summer and Fall 2010, and Winter 2011 revealed that 62% of the prediction error was caused by failure of the Class III settle price to predict the announced Class III price. The other 38% of the total prediction error was caused by the inaccuracy of

the Wisconsin formula to predict the difference between the Class III price and the Florida mailbox price.

It is possible that some of our well-informed Florida dairy managers do a better job than the Wisconsin formula. But what about predicting the announced Class III price? Can people do a better job than the futures markets? There is quite a bit of evidence in the economics literature that in a well-informed (efficient) market, outlook forecasts by (groups of) people are no better than the futures markets. Anybody who believes they can on average beat the futures markets probably should make that their full time occupation.

McCloskey writes in *Cato Journal* 12:23 (1992), as quoted in the *American Journal of Agricultural Economics*, on the art of forecasting by economists:

“An economist who claims to know what is going to happen to the price of corn is claiming to know how to make money. Many models printed for free in journals of agricultural economics imply knowledge of the price of corn. With a little borrowing on the equity of his home or his reputation in for sobriety, the agricultural economist can make enormous sums. If an agricultural economist could forecast the price of corn better than the futures markets, he would be rich. Yet he does not put his money where his mouth is. He is not rich. It follows that he is not so smart.”



Actual Florida mailbox prices and five 12-month forecasts.

For more information, contact Albert De Vries, devries@ufl.edu or (352) 392-5594 ext 227.

UF Dairy Science Club Students Tour a Different Swamp in Louisiana

Mary Sowerby

Five members of the University of Florida Dairy Science Club recently attended the 2011 Annual Meetings of the American Dairy Science Association (ADSA) and the American Society of Animal Science (ASAS), held jointly July 10-14, 2011, in New Orleans, Louisiana. The meetings attracted approximately 100 students and advisors in addition to the nearly 3000 professionals and guests from the US, Mexico, Canada, and beyond.

During the meetings, Lauren Mayo, Lauren Ellison, Stephanie Kirchman and David Kirkland formed the UF team

which participated in the Dairy Quiz Bowl of 12 competing dairy clubs. Amanda Reeg aptly acted as scorekeeper. Lauren Ellison presented a Dairy Production Paper in the undergraduate competition. Lauren Mayo was elected Officer at Large and UF Dairy Club Advisor Mary Sowerby moved into the Second Year Advisor position of the National ADSA Student Affiliate Division. In addition, the students participated in a Career Symposium - a roundtable with professionals representing various aspects of the industry, an awards luncheon (where they received third place for their club scrapbook) and various social activities including, yes, a Swamp Tour. Students also attended symposia, oral sessions and poster sessions presented by professional members of the organizations.

The students attended the meetings as members of the American Dairy Science Association Student Affiliate Division (ADSA-SAD). The ADSA-SAD is a division of the parent organization that works to develop leadership and promote scholarship among students interested in the dairy industry, and to encourage students toward careers in dairy science. There are nearly 500 undergraduate student members in ADSA.

Mary Sowerby is the advisor of the UF Dairy Club, an advisor of the national ADSA Student Affiliate Division, and the Regional Dairy Extension agent located in Live Oak, FL. Contact Mary Sowerby at meso@ufl.edu.

Some Ideas on the Use and Economic Value of the 3K SNP Genomic Test for Calves on Dairy Farms

Albert De Vries, David T. Galligan, and John B. Cole

Dairy producers have had the opportunity to test their female animals with the low density 3K SNP genomic test since September 2010. The 3K genomic test provides an estimate of an animal's genetic merit for many traits, including milk production and Net Merit (NM\$). The 3K genomic test, as one of the several available genomic tests, works by comparing an animal's DNA to a database that associates DNA patterns with genetic merits of traits. A genomic test can, therefore, provide a fairly accurate (reliable) estimate of an animal's genetic merit early in her life without any other data, such as her own phenotypic records or information from parents of siblings. Genomic test kits that help a producer collect a DNA sample and send it to a processing office are sold by various vendors, for example by the Holstein Association USA and Pfizer Animal Health. The genetic merits of the traits of the animal that is tested are then calculated by USDA. The producer gets the results back within a month or two. As of August 2011, approximately 45,000 animals have been tested with the 3K genomic test, most of them females. Still many dairy producers wonder if the 3K genomic test might have value on their operation.

The benefits of using a 3K genomic test include discovering or confirming parentage for mating decisions and selecting candidates for embryo transfer. Our objective in this article is to explore how dairy producers that primarily sell milk might benefit from using a 3K genomic test on young calves by selecting which calves to raise as replacements.

Non-selected surplus calves would be sold at an early age. The increase in reproductive efficiency and use of sexed semen is producing many heifer calves on many dairy farms so choosing which calves to raise based on their genetic merit, among other factors such as early life health events, has become a real option that needs to be considered (How many, if any, heifer calves are surplus is another topic which we'll address briefly later).

Genetic progress is made by selecting superior animals as the parents of future generations. If all heifer calves are raised, virtually no genetic progress is made on the female side (all genetic progress in the herd then only comes from using genetically superior AI sires). But if there is room to select the genetically better heifer calves to be raised as replacements, the dairy producer also makes genetic progress on the female side and total genetic progress increases faster.

An animal's genetic merit for the trait NM\$ is one of the values the 3K genomic test provides. Net Merit is an estimate of the expected lifetime profit of a female compared to the breed base (an average cow born in 2005) in the same environment, directly impacting the income an animal can generate within its lifetime, and later affecting its offspring. The NM\$ index includes economically relevant traits related to milk yield, health, longevity, fertility, calving ease, etc. An animal's breeding value is her genetic merit compared to the genetic merit of the breed base animal. For example, a calf with a breeding value of \$300 for NM\$ is expected to be \$450 more profitable during her productive life (about 3 lactations) than a calf with a NM\$ of -\$150, provided that all environmental factors are the same. So by selecting the calves with the highest NM\$, a direct impact on their profitability as lactating cows is expected. Furthermore, the daughters and later future generations of the selected \$300 NM\$ calf are also expected to have a greater NM\$ (in a decreasing way) as the future generations of the calf with the -\$150 NM\$ genetic merit.

What is needed for genetic progress?

Three factors determine the amount of genetic progress that is made in one generation in a population (the current number of available heifer calves, for example). First, there must be genetic variation in the trait NM\$ in the population of calves. This variation is expressed by the standard deviation. Estimates of the standard deviation of the breeding value of NM\$ vary from approximately \$300 to \$400 (In the analysis below we chose a standard deviation of \$350). If the standard deviation is \$0, that would mean that genetically all animals are the same and no superior animals can be selected regardless of how good the genomic test is.

Secondly, genetic progress depends on how accurately (or reliably) we can estimate the true breeding value an animal for NM\$. This true breeding value is unknown, but a 3K genomic test provides a rather good estimate of that true breeding value with a reliability of approximately 65%. If just the sire of the calf is identified (no genomic test information), the reliability of her breeding value for NM\$ would be about 20%. If a calf's full pedigree is identified, the reliability of her breeding value for NM\$ would be about 34%. These traditional methods of estimating a calf's breeding value for NM\$ are lower than from a genomic test because it is not known which sample of the good or bad genes the calf

inherited by chance from her parents. The reliability is also a measure of how well we can rank animals on their true breeding values based on a prediction of those breeding values, for example provided by the 3K genomic test or information from relatives. Thus, a 3K genomic test buys a better ranking of calves on, among other traits, NM\$ breeding values.

The third component of genetic progress is the selection intensity. This is a function of the fraction of ranked animals that is actually selected. The fewer calves selected, the greater the selection intensity. Obviously if the top 90% of the calves are selected (almost all), their average breeding value will be lower than when the top 50% of the calves are selected. The smaller the fraction selected, the greater the average breeding value of the selected animals. On most commercial dairy farms, the supply of heifer calves will not be much greater than the number that is needed to be raised as replacement animals. Therefore, the selection intensity is low: perhaps only 10% or 20% or 30% of heifer calves could be called surplus and culled.

Purchasing a 3K genomic test for a heifer calf is an investment. The cost of a 3K genomic test is approximately \$40 per animal. Now the question is clear: Is there value in using a 3K genomic test to better rank animals for their NM\$ breeding values and increase genetic progress given a certain number of heifer calves that need to be selected? More specifically, which calves should be tested, and how does that depend on pre-ranking of calves based on traditional sire-only or full-pedigree information? The value of the increase in genetic progress of the selected calves must exceed the cost of testing the tested calves in order to be profitable. In the analysis that follows, the average value of the kept calves depends on their estimated genetic value, whereas the average value of the not selected calves does not change by their estimated genetic value.

We wrote a simulation program that tested various fractions of calves with the 3K genomic test (for example all calves, the top 30% if calves were pre-ranked, the bottom 40%, the calves ranked 30 to 80% etc.). The genetic progress of the kept calves, as well as the total cost of testing, and the net value of the test was calculated. For example, if 90% of all calves are tested, and 80% of all calves are kept, then the cost of testing per kept calf is $\$40 * 0.9 / 0.8 = \45 . If the increase in genetic progress of the average kept calf is worth \$100 as result of the testing, then the value of the test would be $\$100 - \$45 = \$55$ per kept calf.

Value of the 3K genomic test when calves cannot be pre-ranked on NM\$ breeding value

When calves cannot be pre-ranked on NM\$ breeding value, we assume that we have no information about a calf's genetic potential for milk production, fertility, longevity, etc. Before testing, all calves are considered equal and the calves that are selected (kept) would on average be of the same genetic value as the calves that are not selected. Applying a 3K genomic test to some or all of these calves then has the greatest value to a dairy producer, compared to when pre-ranking is possible with a reliability > 0%.

Table 1 shows the value of a \$40 3K genomic test per kept calf, depending on how many calves are tested, and how many of the available calves need to be kept. The table shows that all calves should be tested to obtain the greatest

net value per selected calf. Testing more calves increased the average genetic value of the kept calves, as well as the cost of testing per kept calf. Yet, by testing more calves, the increase in genetic value is greater than the increase in the cost of testing. When all calves are tested, the value of the test per kept calf is \$32, \$87, or \$137 depending on whether 90%, 80%, or 70% of the tested calves need to be kept.

It would be wrong to conclude from Table 1 that keeping fewer calves is more valuable than keeping more calves. Just how many calves to keep as replacement heifers on a dairy farm requires a complicated analysis. For example, replacing more cows faster also increases genetic progress, and also affects production of the current herd. Further, the availability of excellent reproductive programs and sexed semen allows dairy producers some flexibility in how many surplus heifer calves they can create so selection intensity could vary. Other sources of information that predict a calf's future performance, such as health events early in life, the dam's age or calving difficulty, or season of calving, also should be considered. Alternatively, the expenses of the 3K genomic testing could be used instead to purchase more expensive semen from sires with a greater genetic merit, or could be used elsewhere where the money would result in a greater return on investment. If semen from more superior AI would be purchased, genetic progress would then be increased through the male side instead of the female side. The option of embryo transfer from selected females makes it even more complicated. We are currently quantifying many of these aspects of this complicated but interesting problem. Goal is to provide dairy producers with some guidelines that take all important factors into consideration.

Value of the 3K genomic test when calves can be pre-ranked with 20% reliability

Calves can be pre-ranked for genetic merit when the genetic merit of a relative (or relatives) is known, for example when their sire is known or their full pedigree is known. Applying a 3K genomic test to such calves is less valuable because we can already rank these calves on genetic merit with some accuracy.

Assume that all calves can be pre-ranked for breeding value of NM\$ with a reliability of 20%, for example when their sire is identified. If the top 90% of calves are kept (without applying a 3K genomic test), the increase in breeding value of these selected calves compared to all calves is approximately \$43. When the top 80% or 70% is kept, the advantage in breeding value for NM\$ of the kept calves increases to \$76 and \$108, respectively. This gain comes from having just the traditional sire information available. We assumed no cost for the sire-identification that gave the 20% reliability of the pre-ranking.

Figure 1 shows the value of testing a fraction of these pre-ranked calves with a 3K genomic test. The figure also shows which range of calves to test (0% is the highest pre-ranked calf for NM\$, 100% is the lowest pre-ranked calf for NM\$). These values are a combination of the increase in average breeding value and the increase in the cost of testing with the 3K genomic test when more calves are tested. Not all calves need to be tested with the 3K genomic test because calves that are pre-ranked high are very likely to be good enough to be selected. It does not pay to test them. Figure 1 shows that primarily calves that are ranked in the bottom

50% (pre-ranking 50% to 100%) should be tested. However, the range depends on the number of calves that needs to be kept. For example, if 90% of all calves need to be kept, the best policy is to test the bottom 30% (pre-ranked 70% to 100%) of calves when they are pre-ranked with 20% reliability. The value of testing the bottom 30% with a 3K genomic test is \$15 per kept calf. Testing other ranges (in increments of 10%) is less profitable, although not by much. The fewer calves are kept (70% instead of 90%), the greater the value of testing. Furthermore, the optimal range of calves to test changes with the fraction of calves that are kept. Testing all calves increased the net value of the test per kept calf by -\$10, \$11, or \$30 when 90%, 80%, or 70% of the calves were kept.

Value of the 3K genomic test when calves can be pre-ranked with 34% reliability

Now assume that all calves can be pre-ranked for breeding value of NM\$ with a reliability of 34%, for example when their full pedigree is known. Again, in the current analysis we assumed no cost to obtain the 34% reliability for the pre-ranking. If the top 90% of calves are kept (without applying a 3K genomic test), the average increase in breeding value of these selected calves compared to all calves is approximately \$55. When the top 80% or 70% is kept, the advantage of the average breeding value for NM\$ of the kept calves increases to \$99 and \$141, respectively. This gain from having traditional full pedigree information available is greater than when only the sire is identified. Testing calves with the 3K genomic test is less valuable when pre-ranking is done more accurately. Still, Figure 2 shows that testing the correct range of calves can make the 3K genomic test add value in addition to the pre-ranking. When 90% of calves are kept, at most \$7 per kept calf can be gained. The bottom 30% of calves would be tested. Testing all calves decreased the net value of testing per kept calf by \$24, \$12, or \$3 when 90%, 80%, or 70% of the calves were kept. Testing all calves is therefore not cost effective.

In practice, the reliability of the predicted breeding values of the 3K genomic test results depends on the other information that is available. Calves with full pedigree information would have a slightly higher reliability of the breeding values after the 3K genomic test than when no prior information is available. This difference is small however. In this article we used 65% reliability, regardless of the availability of other information. The accuracy of parent identification also plays a role.

The availability of genomic tests is rapidly changing genetics in the dairy industry. AI companies have been using genomics to select AI sires. Now also commercial dairy producers can find value in testing their calves to help decide which ones to keep.

Albert De Vries is with the Department of Animal Sciences, University of Florida, Gainesville, FL. David Galligan is with the School of Veterinary Medicine, University of Pennsylvania, Kennett Square, PA. John Cole is with Animal Improvement Programs Laboratory, ARS, USDA, Beltsville, MD. Part of the motivation for this study was provided by work of Kent Weigel at the University of Wisconsin-Madison. For more information, contact Albert De Vries, devries@ufl.edu or (352) 392-5594 ext. 227.

Table 1. Value of genetic superiority in Net Merit \$ (Δ NM\$), cost of 3K genomic testing (Cost), and net value of the 3K genomic test (Value), all per selected calf. Value = Δ NM\$ - Cost. The dairy producer has earlier decided to select (keep) 90%, 80%, or 70% of all available calves.

Calves tested	90%	80%	70%	90%	80%	70%	90%	80%	70%
	selected Δ NM\$	selected Δ NM\$	selected Δ NM\$	selected Cost, \$	selected Cost, \$	selected Cost, \$	selected Value, \$	selected Value, \$	selected Value, \$
0%	0	0	0	0	0	0	0	0	0
10%	8	13	19	4	5	6	3	8	14
20%	15	28	39	9	10	11	7	18	28
30%	23	41	58	13	15	17	10	26	41
40%	30	54	77	18	20	23	13	35	55
50%	38	69	98	22	25	29	16	43	69
60%	46	82	117	27	30	34	19	53	83
70%	53	96	136	31	35	40	22	61	96
80%	61	110	156	36	40	46	25	70	110
90%	68	123	175	40	45	51	29	78	124
100%	76	136	194	44	50	57	32	87	137

Assumptions: standard deviation of breeding values is \$350 (multiplied by 1.39 to account for genetic progress in two future generations and 5% annual interest), cost per 3K genomic test is \$40, and reliability of the 3K genomic test is 65%. No pre-ranking of calves.

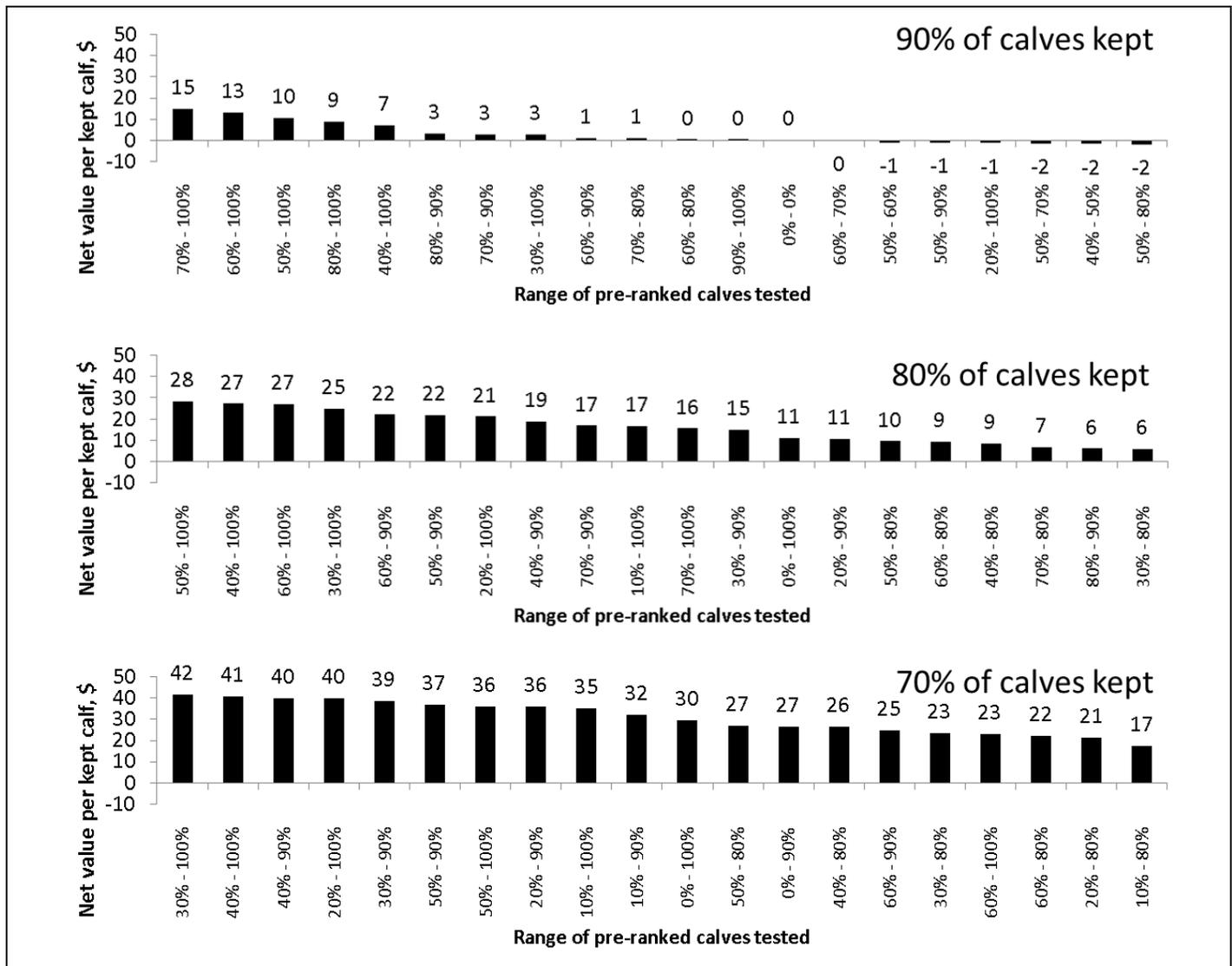


Figure 1. Value of the 3K genomic test per kept calf, depending on how many calves are kept, and the range of pre-ranked calves tested with the 3K genomic test. All calves are pre-ranked for breeding value of NM\$ with **20%** reliability. The 3K genomic test is applied to a fraction of the pre-ranked calves (0% is the highest pre-ranked calf for NM\$, 100% is the lowest pre-ranked calf for NM\$).

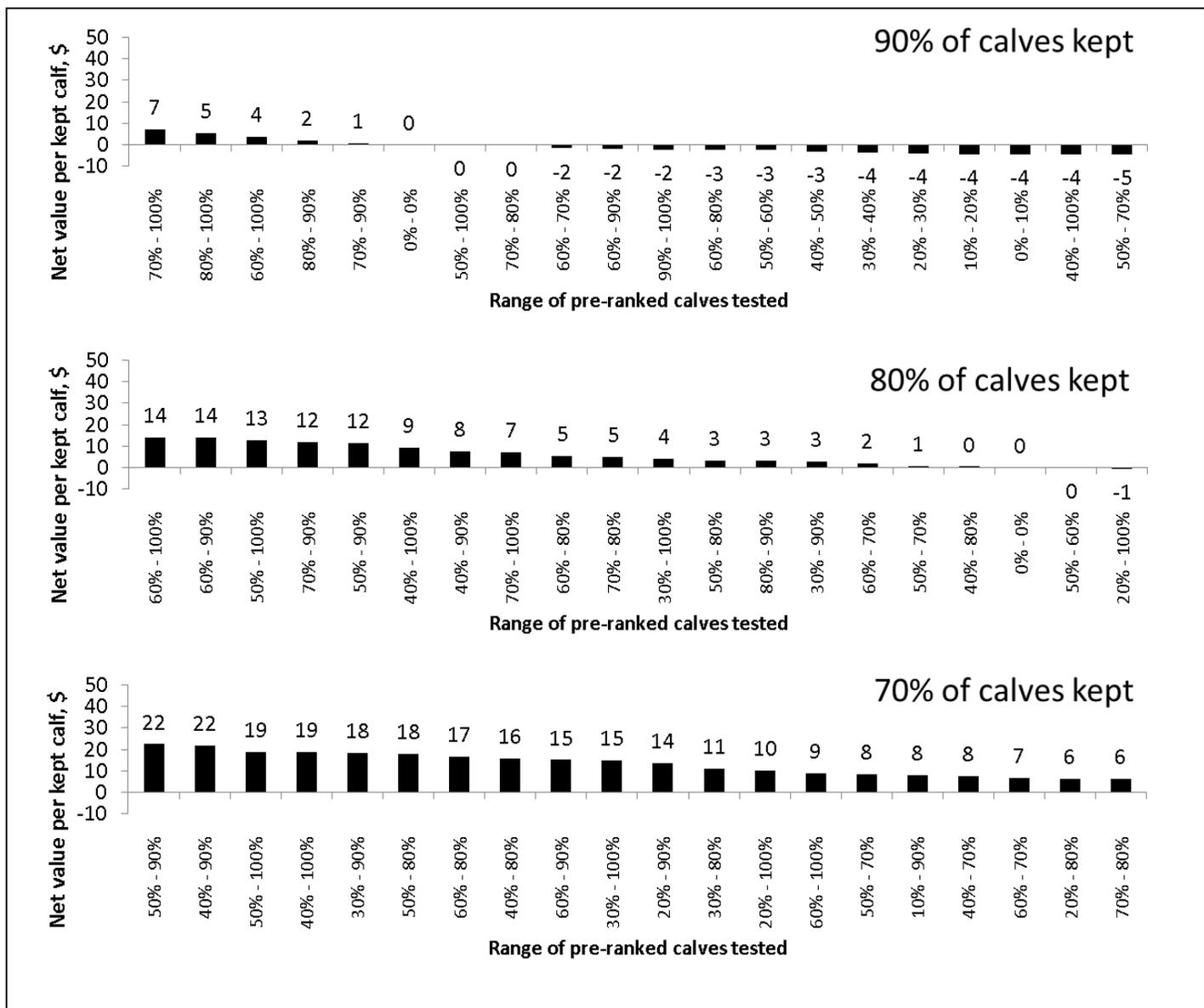


Figure 2. Value of the 3K genomic test per kept calf, depending on how many calves are kept, and the range of pre-ranked calves tested with the 3K genomic test. All calves are pre-ranked for breeding value of NM\$ with **34%** reliability. The 3K genomic test is applied to a fraction of the pre-ranked calves (0% is the highest pre-ranked calf for NM\$, 100% is the lowest pre-ranked calf for NM\$).

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