

SUMMARIES OF SOUTHEAST MILK CHECK-OFF PROJECTS FUNDED IN 2017

Georgia Youth Programs

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Outlined below are youth and collegiate activities that the Southeast Milk Inc. Milk Checkoff Program helped support in 2017:

- In 2017, there were 244 heifers exhibited by 209 young people at the State Livestock Show in Perry, GA (February 2017).
- Gordon County won the State Dairy Judging Contest (March 2017) and represented Georgia at World Dairy Expo on October 2nd. They were recognized as top 15 in the contest and in the top 20 of Guernseys.
- In 2017, the UGA Dairy Challenge team competed at the national contest in Visalia, CA (April 2017). These students were commended by the judges and industry professionals but were not called top two (the only results announced). A second group of students competed in the regional contest hosted by Florida in November of 2017.
- Mary Wright, a Dairy Science major from Yardley, PA, was the recipient of the 2017 SMI Scholarship (May 2017). She is from a small dairy farm, was president of the UGA Dairy Science Club, served as the national American Dairy Science Association Student Affiliate Division's (ADSA-SAD) second vice president, and now currently attends veterinary school at the University of Pennsylvania.
- At the National ADSA-SAD meetings in Pittsburgh, PA (June 2017):
 - Kayla Alward received the Genevieve Christen Distinguished Undergraduate Awards, was the outstanding student member for ADSA-SAD, and won the national Dairy Foods Presentation with her talk on "the potential impact of a novel canned latte on the North American dairy products market". Kayla was the only student in ADSA-SAD history to win national presentations in Dairy Production (2015), Dairy Original Research (2016) and Dairy Foods (2017)
 - Third place National Chapter
 - Second place National Scrapbook
 - Dr. Jillian Bohlen will serve as 3rd year advisor to the national organization
- Oconee County won the State Dairy Quiz Bowl Contest (June 2017) and represented Georgia at NAILE in the national contest on November 3rd – 4th. They were name honorable mention for the contest.
- Georgia had a group of 23 youth and 5 chaperones attend the Southeast Dairy Youth Retreat in Bradenton, FL (July 2017).
- Three young people and one chaperone were selected to serve as delegates to the 2017 National 4-H Dairy conference in Madison, WI (October 2017).

Evaluating Anti-Müllerian Hormone as a Reproductive Tool in Dairy Cattle

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Part 1: The objective of this study was to examine the impact of life events and stage of life at sampling on circulating Anti-Müllerian Hormone concentration in Holstein heifers. Virgin, Holstein heifers (n=105) of breeding age (13 ± 0.8 months) were enrolled prior to first service in the trial. Animals were heat detected using tail-chalk and bred via artificial insemination and pregnancy checked at 32+ days. Serum samples for AMH were collected at three time points: upon enrollment (heifer), at 5-20 days in milk (fresh) and at 45-60 days in milk (pre-breeding). Transrectal ultrasonography was performed upon enrollment (heifer) and at 45-60 days in milk (pre-breeding) to determine antral follicle count (AFC), cyclicity status, and uterine health. Heifers were blocked into a top, middle and bottom third by AMH concentration. LOW (<183 pg/mL; n=36), MID (183-354 pg/mL; n=35) and HIGH (>354 pg/mL; n=34) groupings. Reason for leaving the herd, health incidences, sex of offspring and calving difficulty were also not impacted by AMH concentration ($P>0.05$). AFC and cyclicity had a positive impact on heifer AMH concentration ($P<0.01$). Total AFC for heifers differed by AMH group with the HIGH group having the most follicles (8.76), followed by the MID (5.87) and then the LOW (3.53) group ($P<0.0001$). This confirms previous studies that AFC is directly correlated with circulating AMH concentration. However, AFC was not different by AMH group pre-breeding ($P>0.05$). From the heifer sample to the fresh sample, average AMH concentration dropped from 313.15 pg/mL to 160.01 pg/mL ($P<0.0001$). Average AMH concentration at the pre-breeding sample was 183.23 pg/mL, which was lower than the heifer sample ($P<0.0001$), but not different from the fresh sample ($P>0.05$). AFC and AMH at the heifer sample had a positive impact on AMH at the fresh sample ($P<0.01$). Pre-breeding AMH was positively impacted by both the fresh and heifer AMH concentration ($P<0.001$). Most animals kept their AMH categorization as HIGH, MID or LOW through all two time points with more of the LOW AMH animals maintaining their categorization than the other groups. Although no differences were seen in circulating AMH concentration based on health events, differences in AMH concentration across three time points indicate a drop in circulating AMH concentration post-calving but that animals maintain their AMH categorization relative to herdmates.

Part 2: To examine the reproductive performance of animals based on variations in breeding programs and Anti-Müllerian Hormone (AMH) concentrations, primiparous and multiparous (n=308) purebred, lactating Holstein cows were enrolled after calving. At 45-60 days in milk (DIM) blood was pulled and analyzed for AMH concentration and transrectal ultrasonography was performed to record antral follicle count (AFC), presence of corpora lutea (CL) and cyclicity status, and any uterine or ovarian anomalies. Animals were then randomly assigned to either an estrous detection (n=155) or a timed artificial insemination (TAI) (n=98) breeding protocol. First service conception rate, days in milk at breeding, as well as 7-day average milk-weight on the day of sampling and breeding were recorded. Animals were blocked by AMH concentration into HIGH (>272 pg/mL; n=103) MID (158-272; n=102) and LOW (<158 pg/mL; n=103) groupings. AMH concentration was positively correlated with AFC, lactation number, age and milk-weights ($P<0.001$). Conception risk to first service was not impacted by breeding protocol, AMH category or DIM ($P>0.05$); however, a numerical difference in conception risk by AMH level was seen with HIGH animal's having a 39.7% conception risk, MID animals being 40.2% and LOW animals only having a 28.8% risk. AMH concentration for animals conceiving to 1st service averaged 276.82 ± 195.20 pg/mL while AMH concentration for open animals following 1st service averaged 245.35 ± 152.75 pg/mL. As lactation number increased, so did the likelihood that animals were bred on an estrous detection protocol vs. the TAI protocol ($P=0.0018$). Cyclicity was positively correlated with lactation number ($P<0.0001$). Though conception risk to first service was not impacted by AMH concentration, this study does potentially elucidate more information regarding variables correlated with AMH that were previously undescribed.

Added value of calf growth, health, and genetics measures to predict lifetime performance including profitability

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Introduction: Prediction of future cow profitability based on early available calf information is a valuable tool to dairy farmers for raising the best replacement heifers. Cow profitability is determined by a combination of genetic and environmental factors. Disease events and reduced calf growth negatively impact the likelihood of a heifer to calve and reduces milk production. Furthermore, genetic predictions are available for calves as the average genetic value of the parents or through genomic testing. For dairy farmers considering culling surplus heifers, identification of the best animals to raise remains subjective. Linear regression models may be used to predict net profit, but linear assumptions may not hold. The machine learning method of random forest (RF) does not assume data distributions and thrives on large datasets with many predictors. Each method can be used to generate predictions to help cull the lowest heifers, however costs are incurred with each piece of additional information. Therefore, our objective was to determine the value of genetic and phenotypic information in early lifetime for prediction of net profit from calf selection with regression and random forest methods.

Materials and Methods: Data were collected on 3,256 heifer calves born between April 2012 and November 2014 that survived beyond 120 days of age from a single farm in Florida. These records contained genetic parent average estimates and genomic estimates, ordinal variables of health treatment records for respiratory, digestive, otitis, other health events and a combination of all health events and body weights. The response variables were survival to first calving and cumulative milk production through the second lactation. Two models were created for each prediction method. A mixed linear regression model was used for the continuous response of milk production through the second lactation for heifers that calved. The second model was a mixed logistic regression model for the binary response of survival to the first lactation. The RF method was trained with the same response variables in the two-model approach for the continuous and binary response. The expected net revenue of milk production through the second lactation from selection is the product of predicted milk production given first calving, the probability of survival to first calving and the fraction of heifers calves retained. Net profit is the expected net revenue from selection minus the cost of information, which is equivalent to the value of information.

Results and Conclusion: Net profit was very similar between the regression and RF methods in this dataset, indicating similar predictive ability. At low culling levels, the cost of genomic predictions was greater than net revenue, resulting in negative net profit. At higher culling levels, genomic predictions, health and growth combined resulted in the greatest net profit. When 20% of heifer calves were culled, net profit ranged from \$123 to \$256 per retained heifer. Additional sources of information may increase the predictive ability but are cost dependent. This approach can be expanded to better predict lifetime net profit from selection using other data sources from precision dairy farming and improved prediction methods.

Status: Graduate student Michael Schmitt completed this study and we are preparing articles for Extension and a peer-reviewed journal.

Florida 4-H Dairy Youth Program

Chris DeCubellis

4-H Dairy/Animal Science State Specialized Agent

Objectives

Today's youth are tomorrow's citizens, consumers, parents, employees, and leaders. In Florida 4-H, we offer age-appropriate, learn-by-doing educational opportunities to help prepare young people to be thriving citizens that contribute to society, and to have the skills necessary to prepare them for the workforce. The objectives of the youth dairy program are to provide young people with hands-on educational opportunities to positively develop skills in young people to help them mature into productive members of society so that they will thrive as adults; to help participating youth develop subject matter expertise related to dairy science; and to expose participants to career opportunities in the industry. It is hoped that lessons learned and achievements in youth programming will translate into success as an adult.

Methods

In local, state, and national youth dairy programs, young people participate in a variety of educational activities, events, and competitions to help them positively develop life skills and subject matter expertise as they proceed through their dairy projects and dairy related activities. Young people learn a tremendous amount of skills and responsibility through the rearing and daily care of project animals. Farm tours and hands-on clinics and workshops encourage young people to develop an understanding and appreciation for the skills and work necessary to provide dairy products for consumers. Competitions such as dairy quiz bowls, judging contests, public speaking contests, and dairy shows help young people hone technical skills and knowledge related to dairy science, as well as provides them an opportunity to practice life skills such as time management, responsibility, and the establishment of a strong work ethic.

Results

In 2018-19, over 1,200 Florida youth participated in some aspect of youth dairy programs, including farm tours, clinics, dairy product clinics, and dairy projects. Over 270 youth participated in a 4-H dairy project, exhibiting over 350 head of cattle at Florida fairs. Approximately half of the participants at the Southeast Dairy Youth Retreat were from Florida. Florida youth participated in dairy quiz bowl contests at the regional, state, and national levels, excelling in national competitions, including a first place and second place finish. Florida youth participated in state, regional, and national dairy judging opportunities. Florida won 1st place at the 2018 National 4-H Dairy Judging Contest at the North American International Livestock Exhibition in Louisville, Kentucky. Florida also had a Distinguished Junior Member at the 2019 Holstein Convention. Florida youth also participated in speech, tri-fold display, and video competitions related to dairy science at the state and national levels. Adult volunteers passionate about dairy science and developing young people continue to donate countless hours of their time and expertise to supplement youth programs. Florida youth are demonstrating skills in public speaking and decision making, and are gaining knowledge and expertise related to dairy science.

Implications/Conclusions

The number of youths participating in dairy youth opportunities in Florida remains strong, and there is room for continued growth. Young people are on a trajectory to thrive through their participation in youth dairy opportunities. It is hoped that these youth will consider careers in the dairy industry. However, for those who choose a career in another field, the lessons and skills learned today through youth dairy programming will pay off tremendous dividends for the remainder of their lives, and they will mature into productive citizens, and consumers who appreciate the hard work and skills necessary to produce the wholesome and nutritious dairy products they enjoy.

Developing black oat varieties for Florida dairies

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Black oat (*Avena strigosa* Schreb) is a cool-season annual grass that has Mediterranean origin and has been used in Europe for centuries. Black oat is also successfully used in the southern portion of South America, in regions with similar latitude to Florida. It is best adapted to sandy or loamy soils, but it also grows in heavy clay and soils with low fertility. Compared to annual ryegrass or other cool-season small grains, black oats are more heat tolerant and disease resistant, allowing an early planting in late August/early September. Black oats can also be planted in late winter/early spring and fill another forage gap in April-June. The overall objective of this on-farm, multi-site, and outreach-oriented research was to assess the potential of black oat varieties in different Florida locations, including dairy farms and experimental stations, located in North, Central, and South Florida. The ultimate goal is to release new black oat varieties for the Florida Dairies. Specific objectives included: seed increase and evaluation of 22 black oat lines in a joint collaboration with LSU AgCenter; assessment of yield and nutritive value of black oat lines and contrast with other cool-season forages such as cereal rye (*Secale cereale* L.), triticale (*X Triticosecale* Wittmack), annual ryegrass (*Lolium multiflorum* L.), and oats (*Avena sativa* L.); establishment of on-farm demonstration sites, comparing black oats with other cool-season grasses; and assessment of early planting in July and regular planting in the Fall (Oct-Nov). Our results demonstrated: 1) In South Florida (RCREC-Ona), black oats were better than other small grains (rye, oat, triticale) and annual ryegrass. In Central (UF Dairy in Gainesville and North Florida Holstein in Bell) and North Florida (Marianna), black oats had similar productivity than the most productive oat (Legend 567) and other small grains/annual ryegrass; 2) In Ona, the plant introduction (PI) CI7280 showed the best results, being a promising cultivar for future release; 3) Nutritive value of black oats is high, comparable to other cool-season forages. Average IVOMD ranged from 75 to 80% and crude protein from 20 to 24%; 4) During the Fall, no major diseases were identified in black oats. During the summer planting, leaf spot (*Bipolaris* spp.) was observed not only in black oats, but in all cool-season forages planted; 5) Because of limited seed supply, in 2016-2017 we only tested 10 lines/cultivars of black oats in Marianna and Ona, and only five lines in North Florida Holstein and at the UF-Dairy. We seed-increased 22 lines of black oats. 6) Summer planting was problematic regarding weed management and presence of leaf spot. Fall planting seems more adequate for black oat establishment. Currently, the best black oat lines are participating in regional trials for future release.

Producers and collaborators: 1) Mr. Don Bennink - North Florida Holsteins, Gilchrist County Florida; 2) Mr. Jerry Wasdin - UF Dairy, Alachua County, Florida; 3) Range Cattle Research and Education Center, Ona, FL

Seasonal variation in rectal temperature and milk yield for cows housed in tunnel ventilation barns

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Introduction: New engineering approaches to mitigate effects of heat stress on dairy cattle are based on increasing heat loss via either conduction, convection, evaporation, radiation, or some combination. In some cases, new technology is adopted by dairies before scientific data have been obtained to scrutinize the effectiveness of a new cooling system. In addition, existing housing is sometimes retrofitted so that the cooling system is not engineered to produce optimal results. Therefore, the expected increase in cooling from adoption of a new cooling technology does not always occur. The purpose of the proposal was to evaluate the effectiveness of the tunnel ventilation barn – for reducing seasonal variation in body temperature and milk yield.

Objective: Determine whether seasonal variation in rectal temperature and milk yield is lower for cows maintained in tunnel ventilation barns than for cows maintained in free stall barns.

Results: Rectal temperatures were measured for 1502 lactating Holsteins located on 9 dairies during the summer. Cows on four dairies were housed in tunnel ventilation barns and cows on five dairies were housed in free stall barns with sprinklers and fans. Rectal temperatures were measured between 2:00 and 4:00 PM. Overall, cows in tunnel barns had lower (P-value = 0.014) rectal temperature (101.7°F) than cows in free stall barns (101.9°F). In a second analysis, it was tested whether milk yield during the first 90-days of milk would be greater for cows in tunnel ventilation barns than cows in free stall barns. Milk yield records from 6528 cows on 4 dairies with free stalls and 3 dairies with tunnel ventilation were analyzed. Milk yield was greater (P-value < 0.0001) for cows in tunnel ventilation barns than conventional barns (91.2 lb vs 87.5 lb).

Conclusion: These results indicate cows in tunnel ventilation barns have improved ability to regulate body temperature in summer and greater milk yield during the first 90-days in milk. Additional statistical analysis is underway to further elucidate interactions of housing system with month of calving and to estimate the return on investment of constructing tunnel barns.

Improving Nitrogen Fertilizer Use Efficiency for Cool-Season Forage Production on Southeastern Dairies

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Forage yield gains typically occur when the best genetics are coupled with optimal nutrient management. Although N often limits non-legume forage production on Florida dairies, it is also considered a major potential nutrient contaminant of Florida groundwater and springs.

Objectives: 1) test soluble and controlled release (polymer coated) N fertilizers at different proportions, 2) test new forage lines and management at dairies, and 3) support agent-driven, on-farm forage management demonstrations and field day events.

Methods: Three dairies participated in testing the effects uncoated versus coated N fertilizer proportions had on annual ryegrass and small grains production, as well as nutrient export. The polymer-coated urea, Environmentally Smart Nitrogen (ESN, Agrium, Denver, CO) was supplied at 0, 25, 50, 75, or 100% of the total mineral N supplement (40 lbs N/acre) was in addition to dairy N practice. Annual ryegrass (Earlyploid), triticale (Tritale 342), rye (FL401), and oat (FL0567) were tested. Yield, as well as tissue and soil nutrient content were assessed.

Results: Supplementing an additional 40 lbs N/acre at planting increased forage yields across dairies; however, the dairy with the greatest coarse/sandy soil benefitted most. For example, applying 40 lbs N at 100% soluble, increased rye yield 15% and oat yield 30% over not supplementing. Crude protein increased from 8.8 to 12.6% for rye and from 12.3 to 13.3% for oat. In comparison, applying the supplemental N as 50% ESN, resulted in 56% greater ryegrass yield and 25% greater triticale yield, compared to not supplementing. Crude protein increased from 12.6 to 14.5% for ryegrass, but it remained unchanged at 12.4% CP for triticale.

Implications: Supplementing with an additional 40 lbs N/acre (100% soluble or 50:50 soluble:slow-release), increased nutrient export, which helps the environment. An extra 24, 23, and 61 lbs N/acre was exported out of the field via rye, oat, and ryegrass biomass, respectively (but no change with triticale). The supplemental N also increased P exports by 21, 21, 48, and 23 lbs P₂O₅/acre, for rye, oat, ryegrass, and triticale, respectively. When forage genetic potential is realized through good nutrition, less environmental impact is expected.

As of 2019, two cereal ryes and one triticale will soon be released as new cultivars. The releases resulted from our efforts to produce novel cultivars that fit the needs of the southeastern dairy and beef cattle industries and were tested on dairies in 2017 through this check-off. The FL2X 405 cereal rye is a leafier version of FL401 rye, often used in dairy silage production or as an early forage producer in mixtures with ryegrass for grazing dairies. Both, FL2X 406 cereal rye and FL08128 triticale, are excellent full-season forage producers and will fit well in dairy operations, either for grazing or silage. Agent-led field days hosted at dairies were well-attended.

Forage feeding for group-housed dairy calves: Impacts on performance and behavior

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Providing access to forage has been shown to influence feeding behavior and non-nutritive oral behavior in individually housed calves, and these effects may be enhanced or altered in calves reared in social housing. We evaluated the effect of hay provision on the behavioral development and performance of group-housed dairy calves. Holstein calves ($n = 32$) were group-housed (4 calves/group) at 17 ± 3 (mean $\pm$ SD) d of age. All calves were provided milk replacer (8 L/d) via an automated milk feeder and pelleted starter and water ad libitum. Pens were randomly assigned to receive either chopped coastal Bermuda grass in buckets adjacent to the starter trough (starter and hay, STH; $n = 4$ pens), in buckets adjacent to the starter trough, or no additional feed (starter only, ST; $n = 4$ pens). Calves were weaned through a 10 d step down program beginning at 46 d of age. Intake of solid feed and hay were recorded daily and body weights were measured weekly. The behavior of 2 focal calves/pen was recorded continuously from video for 12 h on 2 consecutive days during each of wks 4, 6, and 7 of life, to measure solid feed intake time, grooming, and pen-directed sucking. Hay provision influenced total feed intake, with pens provided hay having greater total solid feed intake in the week prior to weaning (0.79 vs 0.55 kg/d; STH vs ST; SE = 0.19). Average daily gain (ADG) was similar during the pre-weaning period, but tended to be greater during weaning for calves that received hay. Calves in pens provided hay also had fewer unrewarded visits to the milk feeder during weaning (12.5 vs. 21.1 visits/12 h; STH vs. ST; SE = 3.59) and performed less pen-directed sucking (9.11 vs. 19.3 min/12 h; STH vs. ST; SE = 2.86). Self-grooming time and bout characteristics evolved differently between treatments over time, with pens of calves provided hay having a greater increase in the frequency and duration of self-grooming bouts during weaning. Overall, we found that providing hay to pre-weaned calves resulted in behavioral and performance benefits, including greater total feed intake and reductions in pen-directed sucking, suggesting that access to hay may improve calf welfare.

Effects of calcitriol treatment on resolution of mastitis in dairy cows

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¹ University of Florida; ² Michigan State University

Students: Teri Williams, Michael Poindexter, and Mercedes Kweh

Background: Recent reports have indicated vitamin D₃ facilitates induction of innate host defenses in cattle and may have critical implications for defense against mastitis. We hypothesized that vitamin D signaling in the mammary gland improves resolution of intramammary infections. The objective of this study was to determine the effect of intramammary 1,25-dihydroxyvitamin D₃ (calcitriol) treatment on indicators of inflammation during an intramammary bacterial infection.

Procedures: Lactating dairy cows received an intramammary challenge with *Streptococcus uberis*. After the onset of mild or moderate mastitis, cows were randomly assigned to receive 10 µg of calcitriol (n = 7) or placebo (sterile PBS; n = 6) after every milking for 5 days. Data were analyzed by ANOVA with mixed models using the MIXED procedure of SAS with significance declared at $P \leq 0.05$.

Results: Milk somatic cells, mastitis severity scores, rectal temperatures, and milk bacterial counts were not different between treatments. Percentages of neutrophils in milk were decreased ($P \leq 0.05$) in calcitriol-treated cows compared with placebo. The antioxidant potential and concentrations of 8-iso-15R isoprostane, a marker of inflammation, in milk of infected quarters also were decreased ($P \leq 0.05$) in calcitriol-treated cows compared with placebo. Transcript abundance for the 25-hydroxyvitamin D 24-hydroxylase and inducible nitric oxide synthase were greater ($P \leq 0.05$) in milk somatic cells of calcitriol-treated cows compared with placebo.

Conclusion and implications: Although administration of 10 µg of calcitriol had no effect on clinical signs of severity, the percentage of neutrophils in milk and indicators of redox activity were decreased by intramammary calcitriol treatment. Use of vitamin D metabolites offer the potential to decrease severity of mastitis on the basis of inflammatory indicators observed in this project.

Additional funding was provided by the Michigan Animal Health Alliance to Lorraine Sordillo

Milk Check-Off Veterinary Student Scholarship

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Objective:

The objective is to encourage and recognize junior and senior veterinary students who have shown outstanding leadership qualities, scholastic abilities and proficiency in dairy cattle production medicine.

Background:

The Food Animal Reproduction and Medicine Service (FARM Service) in the College of Veterinary Medicine (CVM) has developed a Certificate in Food Animal Veterinary Medicine (FAVM), which is offered to encourage the development of students capable of providing professional service to the area of food animal medicine upon graduation. Students participating in the certificate program are mentored through didactic, clinical and extracurricular activities that provide a strong entry level training in food animal veterinary medicine. Faculty mentors play an important role in helping students clarify and pursue their career goals and set the path for their completion of certificate requirements.

Students who successfully complete the certificate program receive a University of Florida certificate and accompanying transcript annotation that documents their directed training in FAVM. The certificate identifies a new graduate veterinarian as capable and ready for an entry-level position in a food animal practice or a food systems profession. The certificate provides students an edge in employment readiness because of their dedication, work ethic and commitment to the certification process. They are better prepared to provide leadership in the area of food systems veterinary medicine. This process also prepares the way for specialty training in an internship and (or) residency program and (or) advanced training in a graduate education (MS, PhD) program.

This scholarship is awarded to a certificate candidate who has met the following criteria.

Criteria:

The award is to be made to a junior or senior student who have shown outstanding leadership qualities, scholastic abilities and proficiency in dairy cattle production medicine. Special consideration is given to students that have an interest in the practice of food animal medicine in Florida after graduation.

Justification:

This scholarship award is in support of annual scholarships in the UF/College of Veterinary Medicine

Requested: \$1,000.00

Recipient for 2019: Wayne Garcia (Class of 2020)

- Active and leader in the UF CVM Food Animal Club and the UF Dairy Science Club
- Florida native
- Dairy externships in New York, New Mexico, Florida
- Recipient of the American Association of Bovine Practitioners Amstutz and Zoetis Veterinary Scholarships.
- Participated in the US Dairy Education and Training Consortium
- Participated in several dairy research project,
 - *Using honey to treat udder cleft dermatitis (2017)*
- Participant in the Regional and National Dairy Challenge (2016)

Identification of causal variants underlying sire conception rate

Francisco Peñagaricano

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Background: Fertility is arguably a very important economic trait in dairy cattle. Most studies have investigated cow fertility, while service sire fertility has been largely overlooked. However, recent studies have shown that service sire has a considerable impact on herd fertility. The goal of this research project was to perform a comprehensive genomic analysis of dairy bull fertility including gene mapping and genomic prediction.

Methods: Sire conception rate (SCR) was used as a measure of service sire fertility. The analysis included 11,500 U.S. Holstein bulls with SCR records and about 300k single nucleotide polymorphism (SNP) markers spanning the entire genome.

Results: Five genomic regions located on chromosomes BTA8, BTA9, BTA13, BTA17 and BTA29 showed significant effects on bull fertility. Most of these regions harbor genes, such as *ADAM28*, *DNAJA1*, *TBC1D20*, *SPO11*, *PIWIL3* and *TMEM119*, that are directly implicated in testis development, male germ line maintenance, and sperm maturation. Interestingly, the inclusion of these five major markers as fixed effects in predictive models increased predictive correlations to 0.403, representing an increase in accuracy of about 20% compared with the standard whole-genome model.

Conclusions: This study contributes to the identification of genetic variants and individual genes responsible for the genetic variation in bull fertility. The inclusion of markers with large effect markedly improved the prediction of dairy sire fertility. This research is the foundation for the development of novel genomic tools that could help the dairy industry make accurate genome-guided selection decisions on service sire fertility.

Outcomes: Scientific papers published with this grant:

- P Nicolini, R Amorín, Y Han, and F Peñagaricano (2018) Whole-genome scan reveals significant non-additive effects for sire conception rate in Holstein cattle. *BMC Genetics* 19: 14.
- JP Nani, FM Rezende, and F Peñagaricano (2019) Predicting male fertility in dairy cattle using markers with large effect and functional annotation data. *BMC Genomics* 20: 258.

Building capacity for use of genomics to advance dairy science research

UF/IFAS Dairy Cattle Research Group

Background: The advent of genomics has revolutionized dairy cattle research. The identification of genomic regions, individual genes and specific mutations controlling economically relevant phenotypes have multiple benefits, including better understanding of the biology underlying these complex traits, promote the development of new management practices, and contribute to the design of novel genomic methods for improving dairy cow profitability via selective breeding. Additionally, in dairy cattle research, genomics can be used to properly design and analyze experiments.

Objectives: The goal of this proposal was to build capacity for use genomic data in our dairy cattle research programs. Specific aims: (1) develop a database of genomic information on heifers born at the UF/IFAS Dairy Unit for use by all investigators; (2) create a DNA bank from heifers born at the UF/IFAS Dairy Unit that can be used to exploit new genotyping or sequencing technologies in the near future.

Results: We genotyped around 130 heifers with this grant. Heifers were genotyped using CLARIFIDE® Ultra Plus, a commercially available genotyping platform with roughly 62,000 genetic markers across the entire bovine genome. Now, since 2015, we have been genotyping every heifer born at our dairy research herd using a variety of funds, including federal, industry, and milk check-off grants. Our current database has almost 2,000 genotyped animals.

Outcomes: Some research performed using genotype data from the UF/IFAS Dairy Unit:

- HA Pacheco, S da Silva, A Sigdel, CK Mak, KN Galvão, RA Teixeira, LT Dias, F Peñagaricano (2018) Gene mapping and gene-set analysis for milk fever incidence in Holstein dairy cattle. *Frontiers in Genetics* 9: 465.
- A Sigdel, R Abdollahi-Arpanahi, I Aguilar, F Peñagaricano (2019) Whole genome mapping reveals novel genes and pathways involved in milk production under heat stress in US Holstein cows. *Frontiers in Genetics* (in press).

