PROCEEDINGS OF THE 45th ANNUAL

FLORIDA DAIRY PRODUCTION CONFERENCE

Hilton University of Florida Conference Center
Gainesville • Florida • April 29, 2008

FLORIDA
DAIRY PRODUCTION
CONFERENCE

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IFAS Extension

Sponsored by the Department of Animal Sciences, Florida Cooperative Extension Service and the Agricultural Experiment Station of the Institute of Food and Agricultural Sciences, with the cooperation of State Dairy Organizations and Allied Industry

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Institute of Food and Agricultural Sciences (IFAS)
Department of Animal Sciences

PO Box 110910
Gainesville, FL 32611
Telephone: 352-392-1981
Fax: 352-392-5595
www.animal.ufl.edu

Gainesville, April 29, 2008

To: **Florida Dairy Producers, Allied Industry and Others**
Re: **45th Annual Florida Dairy Production Conference**

Welcome to the 45th Annual Florida Dairy Production Conference! This conference provides an opportunity for representatives from all aspects of the Florida Dairy Industry to focus on information and ideas for improving profitability and sustainability of the Florida dairy industry.

The planning committee has planned this program in hopes that you will take home some information that will be of benefit in the planning and operation of your business. The speakers have been chosen with careful consideration for subject matter of timely significance. We believe that their information will be useful to you.

The proceedings are provided as a reference and record of the conference. Additional copies are available by contacting the UF/IFAS Department of Animal Sciences. You will also find the proceedings posted on the Florida Dairy Extension website at http://dairy.ifas.ufl.edu.

Thank you for your participation in the 2008 conference. Please feel free to provide any comments that can be used in planning future Florida Dairy Production Conferences.

Geoffrey E. Dahl
Chair, Department of Animal Sciences

Albert De Vries
Coordinator, 45th Florida Dairy Production Conference

45th Florida Dairy Production Conference
Tuesday April 29, 2008

Hilton University of Florida Conference Center
1714 SW 34th Street
Gainesville, FL 32607

Planning Committee

The Florida Dairy Production Conference is organized by the dairy extension specialists and dairy agents at the University of Florida / IFAS. For more information about the Florida Dairy Production Conference, please contact:

Conference Information
Albert De Vries
UF/IFAS Department of Animal Sciences
Phone: (352) 392-5594 * Fax: (352) 392-5595
E-mail: devries@ufl.edu

Conference Sponsorships
David R. Bray
UF/IFAS Department of Animal Sciences
Phone: (352) 392-5594 * Fax: (352) 392-5595
E-mail: drbray@ufl.edu

Conference Registration
Pam Gross
UF/IFAS Department of Animal Sciences
Phone: (352) 392-1916 * Fax: (352) 392-9059
E-mail: pjg352@ufl.edu

These proceedings were edited by Penny Ann Canino and Albert De Vries. Proceedings from past Florida Dairy Production Conferences are available at the Florida Dairy Extension website at http://dairy.ifas.ufl.edu.

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Program Schedule

Tuesday, April 29, 2008

Florida Dairy Production Conference

AM **Century Ballroom, UF Hilton Hotel, Gainesville**

Presiding – Jose Santos, Department of Animal Sciences, University of Florida, Gainesville

9:45 Welcome
Geoffrey Dahl, Chair, Department of Animal Sciences, University of Florida, Gainesville

10:00 Feed Efficiency Opportunities with 2008 Feed Cost
Michael Hutjens, Department of Animal Science, University of Illinois, Urbana

10:50 A.I. Technology is Changing Rapidly!! (Molecular Genetics and Sexed Semen)
David Thorbahn, General Manager & Exec. Vice President, Select Sires, Inc., Plain City, OH

11:45 *Southeast Milk, Inc. Check-Off Summary*
Florida Dairy Youth Program Update
Brent Broaddus, IFAS Extension, University of Florida, Seffner

PM

12:00 Luncheon and Milk Quality Awards

Presiding – Peter Hansen, Department of Animal Sciences, University of Florida, Gainesville

1:00 UF/IFAS Dairy Update
Geoffrey Dahl, Chair, Department of Animal Sciences, University of Florida, Gainesville

1:10 Feeding Management to Reduce the Environment Impact of Dairy Farms
Robert James, Department of Dairy Science, Virginia Tech. University, Blacksburg

2:00 *Southeast Milk, Inc. Check-off Summaries*
Development of a High Fertility Timed Insemination Program for Dairy Heifers
William Thatcher, Department of Animal Sciences, University of Florida, Gainesville

Is Testing Cows for Disease Resistance a Practical Tool for Managing Health in Dairy Cows?
Art Donavan, College of Veterinary Medicine, University of Florida, Gainesville

Effect of Rust Infestation on Silage Quality
Adegbola Adesogan, *Department of Animal Sciences, University of Florida, Gainesville*

2:45 Refreshment Break

3:15 Direct Comparison of Natural Service vs. Timed AI: Reproductive Efficiency and Economics
Carlos Risco, College of Veterinary Medicine, University of Florida, Gainesville

3:45 Sexed Semen Economics
Albert De Vries, Department of Animal Sciences, University of Florida, Gainesville

4:15 Sire Selection and Use of Gender-Biased Semen
Producer Panel – *Participants: Don Bennink, Eddie Fredrikkson, Jacob Larson*
Moderator: *Peter Hansen*

5:00 Reception - Hors d'oeuvres and a cash bar are available for your enjoyment

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Wednesday, April 30, 2008

DRU Open House

UF Dairy Research Unit, Alachua

AM

9:00 DRU Overview
Jay Lemmermen, DRU General Manager

DeLaval Parlor and Afikim Milk Lab
Eric Diepersloot, DRU Herd Manager

Calf Unit
Sherry Hay, DRU Calf Unit Manager

Comparisons of Sand Free Stalls and Dual Chamber Waterbeds
David Bray and Ray Bucklin, Departments of Animal Sciences and Agricultural and Biological Engineering

Using Enzymes to Improve Milk Production by Dairy Cows
Adegbola Adesogan, Department of Animal Sciences

Digester
Ann Wilkie, Department of Soil and Water Sciences

Heat Stress Abatement for Dry Cows: Does Cooling Improve the Transition to Lactation?
Geoffrey Dahl and Bruno Cesar do Amaral, Department of Animal Sciences

Dairy Business Analysis Program
Russ Giesy and Mary Sowerby, IFAS Dairy Extension

Effects of Fatty Acids on Immunity and Reproductive Efficiency in Postpartum Holstein Cows
Lokenga Badinga and Cristina Caldari-Torres, Department of Animal Sciences

12:00 Adjourn

Dairy Production Conference Speakers and Program Participants

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Adegbola Adesogan, Associate Professor, Department of Animal Sciences, University of Florida, Gainesville, FL

Bon Bennink, Dairy Producer, North Florida Holsteins, Bell, FL

Brent Broaddus, Extension Agent II, IFAS Dairy Youth Program, University of Florida, Seffner, FL

Geoffrey Dahl, Professor and Chair, Department of Animal Sciences, University of Florida, Gainesville, FL

Albert De Vries, Associate Professor, Department of Animal Sciences, University of Florida, Gainesville, FL

Art Donovan, Professor, College of Veterinary Medicine, University of Florida, Gainesville, FL

Eddie Fredrikkson, Dairy Producer, ATR Dairy, Mayo, FL

Peter Hansen, Professor, Department of Animal Sciences, University of Florida, Gainesville, FL

Michael Hutjens, Professor, Department of Animal Science, University of Illinois, Urbana, IL

Robert James, Professor, Department of Dairy Science, Virginia Tech, Blacksburg, VA

Jacob Larsson, Dairy Producer, Larson Farms, Okeechobee, FL

Carlos Risco, Professor, College of Veterinary Medicine, University of Florida, Gainesville, FL

William Thatcher, Professor Emeritus, Department of Animal Sciences, University of Florida, Gainesville, FL

David Thorbahn, General Manager and Executive Vice President, Select Sires, Inc. Plain City, OH

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Drew Denman
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455 Daniel Road
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Ph. 417-872-5053
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Fred Scott
Prince Agri Products
4217 Bretdale Run NW
Kennesaw, GA 30152
Ph. 217-891-6715
fredscott@princeagri.com

Steve Coop
Novartis Animal Health US, Inc.
10098 West Ray Thomas Road
Crystal River, FL 34429
Ph 352-516-6680
steve.coop@novartis.com

Terry Creel
West Central Soy Plus
30 Mountain Creek Drive
Rome, GA 30161
Ph 706-766-2177
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Zinpro Performance Minerals
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cgay@zinpro.com

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535 Planters Manor Way
Bradenton, FL 34212
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heath.graham@pfizer.com

Tracey Lamm
Agpro, Inc.
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Paris, TX 75462
Ph 903-785-5531 X 28
agpro@neto.com

Harvey Largen
Select Sire Power
P. O Box 370
Rocky Mount, VA 24151
Ph 540-483-5123
hlargen@selectsirepower.com

Brent Lawrence
Alltech Inc.
350 Davenport Drive
Thomasville, GA 317292
Ph 352-212-6240
blawrence@alltech.com

Bob Nutt
Advanced Comfort Technology and Vally Feed Company
P.O Box 514
Staunton, VA 24402-0514
Ph 540-294-5500
bob@valleyfeed.com

Jake Martin
DairyDesign.Com
6024 SW 89th Terrace
Gainesville, FL 32608-5577
Ph 352-371-4655
jake@dairydesign.com

Elena V. Nielsen
Alta Genetics
14215 97th Road
Live Oak, FL 32060
Ph 386-984-8255
enielsen@altagenetics.com

Jeremy Block
Embogen
2523 SW 23rd Terrace
Gainesville, FL 32608
Ph 352-219-9813
block@embogen.com

Maggie Murphy
Southeast Milk, Inc.
1950 SE County Highway 484
Belleview, FL 34420
Ph 800-598-7866
info@southeastmilk.org

Gary Peoples
Lakeland Animal Nutrition
P. O. Box 24868
Lakeland, FL 33802
Ph 863-559-3315

Chip Blalock
Sunbelt Agricultural Exsposition
290-G Harper BLVD.
Moultrie, GA 31788
Ph 229-985- 1968
chip@sunbeltexpo.com

Will Lloyd
ADM Alliance Nutrition, Inc.
901 NW 118th Terrace
Gainesville, FL 32606
Ph 352-332-5627
will_lloyd@admworld.com

Feed Efficiency Opportunities with 2008 Feed Cost

Michael F. Hutjens
Department of Animal Science, University of Illinois
Urbana, IL 61801
hutjensm@uiuc.edu

With the milk to feed ratio at 2.36 in February, 2008, dairy managers must carefully reviewing feed inputs relative to milk yield. A milk to feed ratio under 3 is a signal to reduce feed inputs. Feed efficiency (also referred to as milk performance efficiency and dairy efficiency) can be defined as pounds of 3.5%FCM (fat corrected milk) produced per pound of dry matter (DM) consumed. Monitoring feed efficiency (FE) in the dairy industry has not been used as a common benchmark for monitoring profitability and evaluating dry matter intake relative to milk yield. The focus on optimizing feed efficiency reflects as cows consume more feed, digestive efficiency decreases and milk production is subject to diminishing returns. The "traditional focus" was that as cows consume more feed to support higher milk production, the proportion of digested nutrients captured as milk is proportionally higher.

Economics of feeding programs

A key consideration when evaluating feeding changes is the impact on profitability. Several measurements are listed below for consideration. Each value can have advantages and disadvantages.

Feed cost per cow per day does not reflect milk yield, stage of lactation, or nutrient requirements. A target value in Illinois is less than $5.50 per cow per day for Holstein cows at 70 pounds of milk. An application of this value is divide the feed components to determine if your costs are optimal for your herd's production and local feed costs (Table 1).

Table 1. Illinois feed costs for a group of cows averaging 70 pounds of milk.

Feed	D.M. (lb/day)	Cost/lb DM ($)	Total Cost ($/day)
Forages	28	0.08	2.24
Grain energy	10	0.09	0.90
Protein supplement	5	0.12	0.60
By-product feeds	6	0.10	0.60
Min/vit/additives	1	0.35	0.35
Consultant time			0.10
Totals	50		$4.79

Feed cost per pounds of dry matter is a useful term when comparing similar regions, breeds, and levels of milk production. A target value in Illinois is 10 to 11 cents per pound of dry matter. In the example in Table 1 for Holstein cows at 70 pounds of milk, the cost is $0.96 per pound of dry matter.

Feed cost per 100 pounds (cwt) of milk has the advantage of standardizing milk yield allowing for comparisons between groups and farms within a region. Milk yield per cow and feed costs will impact this value. A target value in Illinois is less than $7.00 per cwt for Holstein cows (the example in Table 1 is $6.84).

Income over feed costs (IOFC) is a popular value as it provides a benchmark for herd or groups of cows reflecting profitability, current feed prices, and actual milk prices. If dairy managers have calculated fix costs and other variable costs, IOFC can be used to determine breakeven prices, optimal dry off time, and culling strategies. A target value in Illinois is over $11 per cow per day ($18 per cwt). The example in Table 1 is $11.16 per cow per day.

Marginal milk response reflects the profit if additional pounds of milk can be achieved. Generally, this approach is profitable if cows respond to the feeding change because maintenance costs and fixed costs have been covered by previous production. For example if adding one pound of dry matter increases milk yield by two pounds with milk valued at $18 per cwt and dry matter at 10 cents, the marginal milk profit is 26 cents.

Cost per unit of nutrient allows dairy managers to compare the relative cost of a nutrient. If corn is priced at nine cents per pound (dry matter basis), one unit of net energy is worth $0.099 cents per Mcal of net energy. If corn is the base energy feed resource; forages, by-product feeds, and other cereal grains can be compared on their cost per unit of nutrient.

Feed efficiency can be defined as pounds of milk produced per pound of dry matter intake (DMI) consumed. Guidelines for FE are listed in Table 2. In the example in Table 1, the value was 1.4 pounds of milk per pound of feed dry matter.

Table 2. Benchmarks for feed efficiency comparisons.

Group	Days in milk	FE (lb milk/lb DM)
One group, all cows	150 to 225	1.4 to 1.6
1st lactation group	< 90	1.5 to 1.7
1st lactation group,	> 200	1.2 to 1.4
2nd + lactation group	< 90	1.6 to 1.8
2nd + lactation group	> 200	1.3 to 1.5
Fresh cow group	< 21	1.3 to 1.6
Problem herds/groups	150 to 200	< 1.3

Approaches to measuring FE on farms

Option 1. Computer software program. FeedAd was developed by Zinpro Corporation and is available for field application. The software program allows on-farm data that will standardize FE values (similar to management level milk or 150 day milk). Using spreadsheets, managers could enter days in milk, body weight, milk yield, milk fat test, milk protein test, changes in body condition score, environmental temperature, walking distances, and lactation number using research-based and NRC 2001 equations to adjust values.

Option 2. On-farm measurement of FE. This approach collects dry matter intake by group or herd using actual feed amount delivered with automated computer tracking systems (such as Feed Tracker), subtracting feed refusals, and collecting daily milk yield using a group total (such as in-line milk meters) or individual cow production summaries. An Illinois herd is listed in Table 3.

Table 3. Daily data from various groups in a herd of Holstein cows using computer summaries from feed truck and in-line milk meter results.

Pen	Age (group)	Cow (no)	DMI (lb)	Milk yield (lb FCM)	DIM (days)	FE (lb FCM/lb DM)
Pen 1	Cow	390	57.7	116	56	2.10
Pen 2	Cow	399	61.3	111	149	1.87
Pen 3	Cow	393	51.4	82	357	1.30
Pen 4	Cow	402	59.2	103	228	1.70
Pen 5	Heifer	390	51.6	84	218	1.70
Pen 6	Heifer	428	52.7	82	359	1.45
Pen 7	Heifer	386	46.7	80	100	1.77
Pen 8	Mix	56	38.5	93	62 (hospital)	1.17
Pen 9	Mix	32	53.0	103	162 (mastitis)	0.85

Option 3. Estimating and adjusting for FE. Dairy managers and nutritionist are faced with some form of this option due to the following situations or limitations.

- Milk yield is available monthly from DHI or daily bulk tank yields.
- Feed intake by groups or herd is not recorded daily. A feed sheet or ration may be available.
- Weigh backs may or may not be measured.
- No group or pen milk components are available.

Using this approach to estimate FE, the following factors can be used along with bulk tank milk yields and ration summaries. For example, the herd of 100 cows averaged 6800 pounds of milk and consumed 4800 of dry matter a day based on feed ration sheets. The FE is 1.42 for this herd (a low value that requires review of factors that be causing this to occur). The following factors can be used with estimated impact values on FE. Nutritionists and dairy managers may want to adjusted these values as data are not available for several of these factors (modify as desired).

Factor 1*: Weigh back factor.* Estimations of feed refusals can use a bunk scoring system based on a subjective estimate.

Feed bunk score 0 has no feed remaining
Feed bunk score 1 has 1 lb of dry matter
Feed bunk score 2 has 2 lb of dry matter remaining

Factor 2*: Days in milk (DIM).* Add 0.15 FE unit for each 50 days starting at 150 DIM.

Factor 3*: Somatic cell count.* For each linear score change in SCC, add or subtract 2.5 pounds milk to the current production.

Factor 4*: Change in body condition.* If cows are gaining one half body condition score during lactation, this milk equivalent can represent 138 pounds of milk (60 pounds of body condition equals 2.3 pounds of milk per pound). If this occurs over 100 days, adding 1.4 pounds of milk to the base milk yield.

Factor 5*: Exercise/pasture.* If cow walk 100 feet a day, subtract 0.2 lb of milk (two times a day milking and/or walking to pasture resulting in four trips a day averaging 200 feet per trip can increase maintenance requirements by 1.6 pounds of milk not captured..

Factor 6*: Rumen acidosis.* Field reports estimate that FE may drop 0.1 unit if cows experience sub acute rumen acidosis (SARA). Diagnosis could be based on several field indicators.

Milk protein: milk fat ratio over 0.9 (3.0 true milk protein and 3.3 milk fat tests
Lose manure (average manure scores under 2.75)
Average lameness scores over 1.6
Dry matter intakes varies over two pounds per cow per day

Factor 7*: Protein level and form.* Illinois data indicated that level of protein can impact FE. If protein is over 18 percent crude protein or MUN are over 16, shift FE by 0.03 unit.

Factor 8*: Feed additive*. Adding yeast culture/yeast, ionophores, buffers, and direct-fed microbial may increase FE by 0.05 to 0.10 unit per additives that respond.

Factor 9*: Fiber digestibility.* As forage NDF (neutral detergent fiber) digestibility increases one percent point (more digestible), milk yield increases 0.5 pound of milk and dry matter intake increases 0.25 pound.

Factor 10. Heat stress. If cow are exposed to heat stress with no heat abatement intervention, the following declines in FE can occur due to higher maintenance requirements, lower milk yield, and lower feed intake. Cows exposed to 86 degrees F compared to 68 degrees F, reduce FE by 0.1 unit. Cows exposed to 95 degrees F compared to 86 degrees F, lower FE by 0.3 unit.

Fresh cow monitoring of FE

For dairy managers and nutritionists that have a fresh cow pen with daily milk yields, group feed intakes, and days in milk recalculated daily, FE is a useful tool to monitor dry matter intake after calving, comparison of heifer and mature cow fresh pens, and the success of the transition program. A California field study of 50 herds reported the FE for the following groups of cows (days in milk was not reported).

Heifer fresh cow group average 1.47 with a range of 1.19 to 1.87

Cow fresh cow pen averaged 1.75 with a range of 1.26 to 2.26

A low FE can be plus if dry matter intake after calving is optimal. A low FE after calving can reflect low milk production in early lactation, a potential problem. A high FE can indicate cows are achieving high milk after calving (good), low dry matter intake after calving (bad), and/or excess weight losses leading to ketosis and fatty liver development. Table 4 lists dry matter intake guidelines by week after calving and parity.

Table 4. Dry matter intake by week after calving and parity (Hutjens, 2005).

Week after calving	1^{st} lactation cows	2^{nd}+ lactation cows
	----------- lb per cow per day	---------------
1	31.0	36.5
2	35.0	42.5
3	38.0	45.5
4	40.0	49.0
5	41.5	52.5

Economics of feed efficiency

With shifting milk prices, one way to maintain profitability without sacrificing milk production or herd health is by enhancing feed efficiency. Table 5 illustrates that economic savings per cow per day when cows improved in FE while milk remains constant at 70 pounds of milk and feed valued at 10 cent per pound of dry matter.

Table 5. Economic impact of improving FE while maintaining milk yield.

FE (lb of milk/lb DM)	DMI (lb DM/day)	Savings ($/cow/day)
1.20	58.3	
		0.83
1.40	50.0	
		0.62
1.60	43.8	
		0.48
1.80	38.9	

Optimizing feed intake is the “magic” term; not maximizing DMI. Higher nutrient demand for higher milk production led to maximum DMI must be achieved to meet these requirements. The more DMI the cow eats, the more she will milk. Composition of the diet (forage to grain ratio) and dry matter intake (multiples of maintenance) has marked effects on digestibility and subsequent energy values. Diets that do not promote optimal rumen fermentation will result in an over-estimation of energy values.

Fine tuning feed efficiency

Actual and accurate feed intake is critical for an accurate FE value. Feed refusals should be removed (subtracted) as this feed has not been consumed. Weekly dry matter tests should be conducted on the farm to correct for variation in dry matter intake due to changes in wet feeds or precipitation.

Correct for milk components as more nutrients are needed as milk fat and protein content increases. Values reported in this paper are based on 3.5 percent fat corrected milk (3.5%FCM). The following formulas can be used:

Equation 1: 3.5% lb FCM = (0.4324 x lb of milk) + (16.216 x lb of milk fat)

Equation 2: 3.5% lb fat and protein corrected milk (lb) =
(12.82 x lb fat) + (7.13 x lb protein) + (0.323 x lb of milk)

On Holstein farms, use the thumb rule of adding or subtracting one pound of milk for every one-tenth percentage point change above or below 3.5 percent fat test. For example, if a herd averages 70 pounds of milk with a 3.9 percent milk fat, the estimated pounds of 3.5% FCM would be 74 pounds instead of 70 pounds.

Field examples of feed efficiency

Field Study One. A herd of 1200 high producing Holstein cows illustrate herd trends based on parity and days in milk (Table 6).

Table 6. Feed efficiencies in a commercial herd in Wisconsin based on age and days in milk.

Group	DIM (days)	Milk (lb)	DMI (lb)	FE (lb/lb)
1st fresh	27	42	48.4	0.95
1st high	124	79	49.9	1.58
1st preg	225	64	53.0	1.21
2nd fresh	20	60	51.9	1.15
2nd high	80	101	58.1	1.74
2nd preg	276	67	51.0	1.31

Field Study Two*.* A herd of 1800 Holstein cows dropped several feed additives replacing it with a new commercial product. Changes (monitored using Feed Watch and Dairy Comp 305) included an increase in milk yield from 76 pounds to 80 pounds of milk per cow. A drop in dry matter intake from 53 pounds to 51.7 pounds per cow increased feed efficiency from 1.43 to 1.55, and a decline from $5.44 to $4.58 per 100 pounds of milk. Dry matter intake became more consistent along with more uniform manure.

Summary

- Feed or dairy or feed efficiency reflects the level of fat-corrected milk yield produced per unit of dry matter consumed with an optimal range of 1.4 to 1.9 pounds of milk per pound of dry matter.

- Days in milk, age, growth, changes in body condition score, walking distances, body weight, forage quality, feed additives, and environmental factors will impact feed efficiency values.

- Dairy managers should monitor changes in feed efficiency as feeding and management changes occur on their farms to evaluate the impact of the change.

- Several approaches can be used in the field to measure or estimate FE in groups, herds, and feeding / management changes.

Selected references

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Notes

A.I. Technology is Changing Rapidly!!
(Molecular Genetics and Sexed Semen)

David Thorbahn
Select Sires, Inc.
Plain City, OH 43064
dthorbahn@selectsires.com

New Tools Coming In Bovine Genetic Development

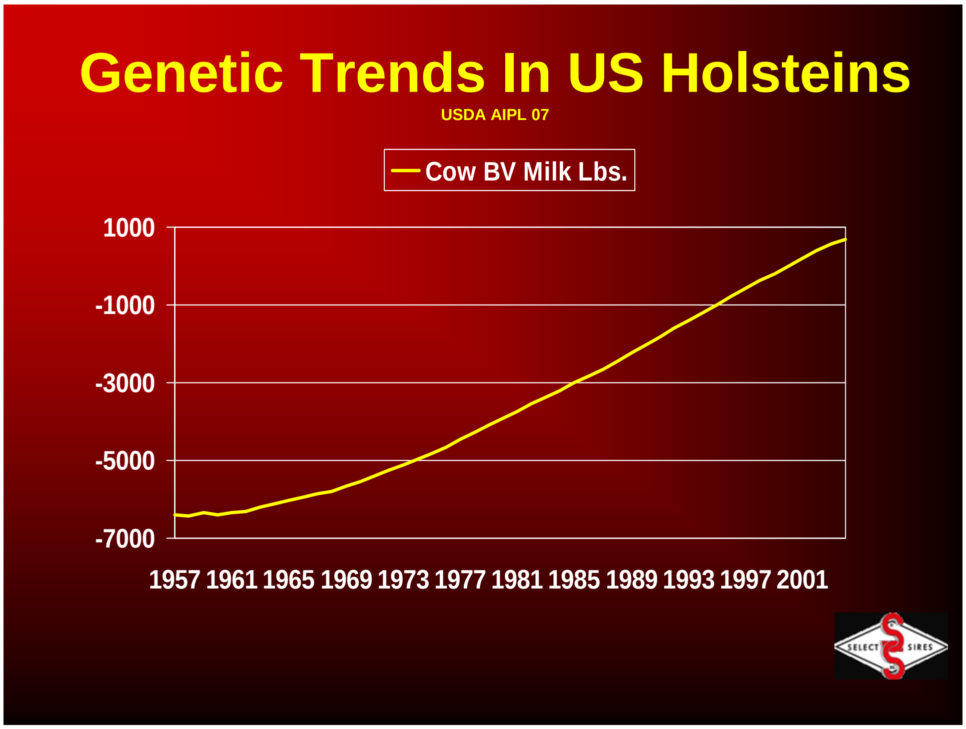
The United States has been a leader in the implementation and development of new genetic tools to advance dairy and beef populations. Today, more dairy genetics are exported to countries from the U.S. than from any other major dairy producing country in the world. I would like to give you a brief history of the advances in genetic improvement and introduce to you the new technology in molecular genetics. Then, I would like to explain some of the work currently underway and close by providing you insight into what tools you can expect to improve the health and production of your herd.

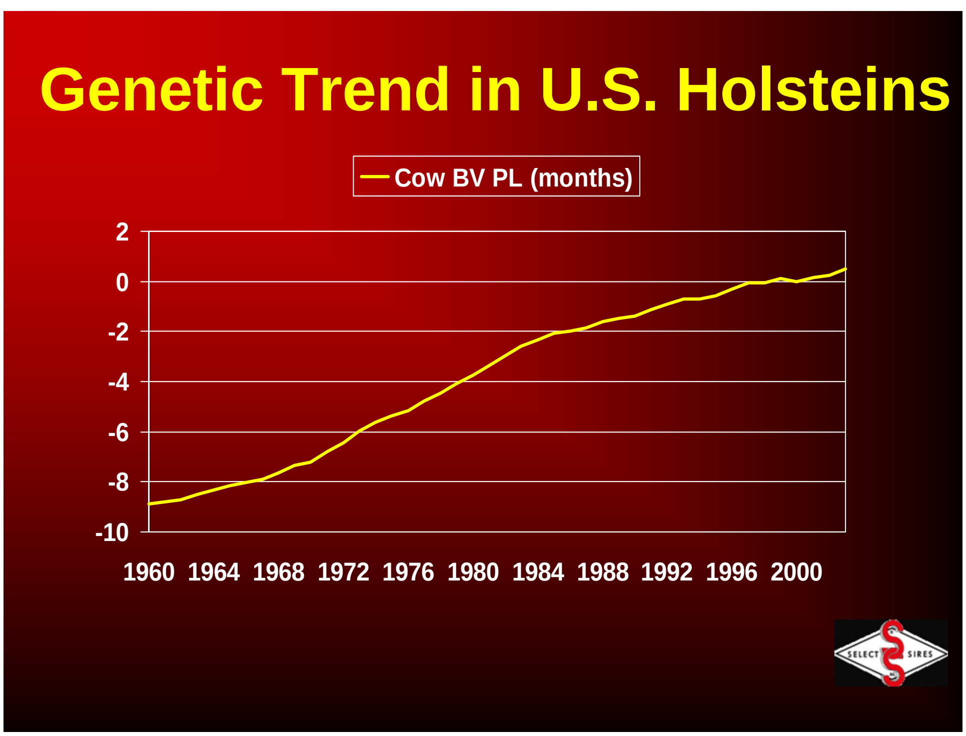
Genetic improvement started in the mid-1800s when European breed societies were formed to track parentage and record characteristics in various dairy and beef breeds. The U.S. followed suit a few years later. In addition, during that time late 1800's and early 1900's bull rings (syndicates) were formed in Europe and the U.S. to allow dairymen the opportunity to afford and share top sires that had traits they wanted to add to their herds.

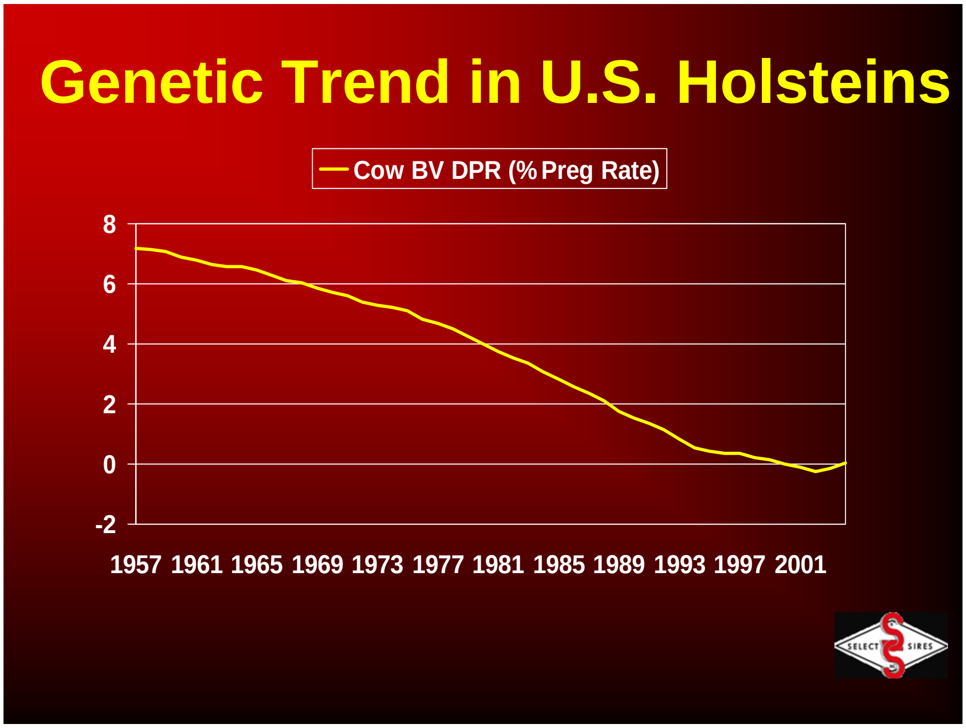
During World Wars I and II, European genetic improvement was disrupted. Some records were lost and destroyed and the rebuilding efforts disrupted progress while the U.S. started to move ahead with implementation of A.I. The advent and implementation of A.I. in the U.S. by the cooperative extension service provided the vehicle to distribute great sires. The first Artificial Insemination station using fresh semen was started in New Jersey in 1938. This allowed many farmers to breed more offspring through semen from top pedigreed bulls. Frozen semen was developed by Dr. Christopher Polled in England in 1951. This allowed for the storage and transportation of semen to greater distances and for greater amounts of time.

The major improvement was finally to be realized with the development of herdmate comparisons using Dr. Lush's idea and implemented into progeny test programs. In 1962 herdmate comparisons were implemented. The first bull and cow indexes were published in 1964 by R.H. Miller. The concepts of linear type was developed by Dr. Paul Miller at Cornell in 1971 and adopted by the Jersey and Guernsey breed associations in 1980. This replaced the previous true-type model that was previously used by most of the associations.

Below you will see the trends in cow breeding values from 1957 through 2001. You can see that progress was slow until the advent of progeny testing that was implemented in the 1960's. Since that time, improvements have been made in the area of evaluation models and increased number of sires to be selected and have allowed the continual increase in the genetic trend for milk production in the U.S.







With the ability to breed for high production, more and more dairymen were requesting animals that could withstand the stress of high production, thus type traits were developed by breed associations to improve udders, feet, legs and total conformation. Low heritability of health traits made those unpopular as a breeding goal but was developed in the late 1990s by USDA. Today's goal for Select Sires and many organizations around the industry is to develop a higher producing animal that is resistant to the many reasons that it would be culled from the herd. The United States Department of Agriculture and the breed associations are measuring over 29 different traits that are available for producers to use to improve the productivity and longevity of US dairy cattle.

However, today there are many challenges to the traditional progeny testing methods in providing genetic evaluations for elite males and females to make improvement and provide elite genetics. The first is the 5-year generation interval which takes a long time to create progress. Progeny testing is costly as to produce a good bull, only one out of 13 bulls progeny tested is selected for active service at Select Sires. In addition, there is slow progress due to low accuracy in low heritability traits that are usually associated with fitness. The new tools of molecular genetics show great promise to create some solutions to improve the speed and success of genetic development for AI companies and US herds to increase the rate of genetic progress by identifying those bulls who received a favorable sample of genes from their parents. So, let me take you through a review of the definitions of molecular genetics and discuss the possibilities.

The present practice of traditional progeny testing is to create a group of progeny (usually around 100 progeny of an animal), measure that progeny's performance and compare it against its contemporary herdmates. This information is to estimate the parents' contribution and create breeding values for the parents of those individuals. To select the animals to test, it is assumed that the genes of that individual are an equal distribution of half from the sire and half from the dam.

Molecular genetics is where we actually investigate, once the embryo is developed, the actual genes that were transmitted from the sires and dams of these individuals. Today, single nucleotide polymorphisms (SNP's) have been mapped in the bovine by the U.S. Department of Agriculture through partnerships with many universities and countries around the world. These nucleotides make up the two strands of DNA that make up a chromosome. Chromosomes come in pairs and there are 30 pairs of chromosomes in each bovine. Where we find a single nucleotide on one strand of DNA that is different from normal, it is called a polymorphism. Polymorphism in its simplest term means different. These differences are then mapped and appear on various spots across the chromosome. The ability to track these differences and correlate their effects with known genetic levels will allow statisticians to develop prediction models to forecast the performance of an animal using these SNPs as they occur across the 30 chromosomes. Thus, the differences between full siblings can theoretically be identified as soon as the animal is created. Therefore, you will be able to predict the differences among various individuals in terms of their estimated transmitting abilities just from these molecular predictions. This information, when combined with the pedigree information, can be used to better predict the transmitting ability of that individual.

In 2001, a Dutch researcher named Meuwissen published a theoretical research study identifying the improvements that can be made using molecular markers to enhance the accuracy of prediction. As you will see in the chart below, the improved accuracy will move a high heritability trait from a pedigree of 40% to an estimated 85% with the additional marker information and a low heritability trait that is .25 to .30 will increase the accuracy of the estimated transmitted ability to .65 to .70.

	High Heritability	Low Heritability
Pedigree	0.40	0.25 - 0.30
Ped + Markers	0.80 - 0.85	0.65 - 0.70

Meuwissen, et al., 2001 (Genetics 157: 1819-1829)

In 2007, Dr. Paul VanRaden did a theoretical simulation using 50,000 SNPs equally distributed across the 30 chromosomes. He identified that the parent average reliability in the pedigree of 36% would increase to 58% to 71% in accuracy making major improvements in the accuracy of that estimate. Improved statistical methodologies such as a Baysian method could increase the reliability of these predictions as these statistical techniques are refined.

Under the direction of Dr. Curt VanTassel, the USDA's Animal Improvement Laboratory is presently undergoing a study in cooperation with NAAB members who participate in the Cooperative Dairy DNA Repository (CDDR). In this research study, 3500 proven animals will be evaluated based on approximately 54,000 different SNPs in Holstein, Jersey and Brown Swiss. Each of these animals will be used to create a haplotype map. The scientists at USDA will develop statistical methodologies to compare their proven information with these SNPs and develop an estimation model for use in these breeds. This information could become part of the national genetic evaluations in early 2009. The contributors to the cooperative dairy DNA repository are Select Sires, CRI, ABS, Accelerated Genetics and Semex.

So, what should we expect to receive from this new marker information in regards to PTA's? First, the PTA's that would be presented would look just like those presented today in either the form of a progeny proof or a parent average PTA. The difference is that the reliability will be higher when the molecular evaluations have been preformed. Conservative initial estimates of Increases in accuracy of production and type estimations of male and female PTA's will go from 30 to 40% in reliability based on the trait to an average of 45 to 60% reliability for most production and type traits. In addition, major improvements in lower reliability traits such as productive life and DPR will move accuracies of a parent average from 15-30% to 40-55% reliability based on the trait. Thus, with the new tools we will know more about a virgin heifer who has had a molecular test, than we will about her mother with two calves and two lactations with no molecular testing. This information will be available in both Jerseys and Holsteins. In addition, as researchers have more time to develop more sophisticated statistical models, we can expect the accuracies of each of these traits to improve over time.

The benefits of this technology will be a better selection of bull dams and young bulls for progeny testing. This will increase the rate of genetic progress especially in improving low heritability traits. Dairy herds will be able to use young bulls with more confidence and less disaster where animals have serious negative assortment of genes. Additionally, dairymen will be able to better select dams from which to flush or save bulls for breeding as well. Faster progress in health traits will be important in all of the major dairy breeds as herd sizes and production levels continue to increase.

One area that has been talked about in major publications is inbreeding. Understanding the sources of genes will give us a better understanding of the level of inbreeding. This tool will allow us to slow or reduce the levels of inbreeding in production herds. The end result is that we should have better tools to make faster progress, higher producing, healthier, long-lived cows, and continue to expand the US influence in genetics both in the US and around the world.

Sources for this presentation: 100 Years of Research and Inquiry by the American Dairy Science Association; Meuwissen, et al., 2001 Genetics 157; 1819-1829; Paul VanRaden, PhD, USDA 2007, Dr. Kent Weigel, PhD, University of Wisconsin – Madison; Mr. Chuck Sattler MS, Vice President Genetic Programs, Select Sires, Inc.

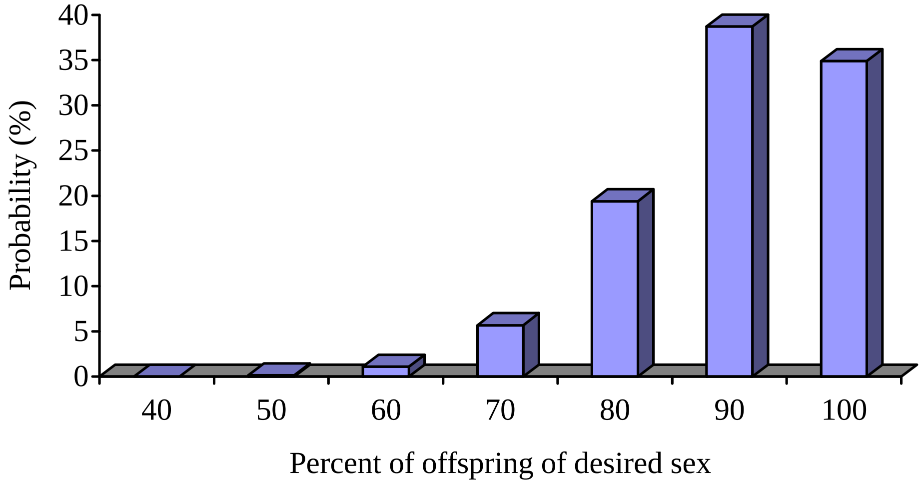
Sexed Semen: Is It Finally a Reality?

Most of us have heard the rumor that sexed semen is "just around the corner" for as long as we have been aware of A.I. Through the years, countless numbers of techniques have been investigated with no potential application in the real world. However, in the 1980's a breakthrough in semen sexing technology was made by USDA researchers in the Lawerence Livermore Laboratory in California. The patents for this technology were licensed to a company named XY, Inc of Fort Collins, CO, which performed extensive research during the 1990's to optimize efficiency of these sorting procedures. In 2001, Select Sires partnered with XY, Inc. to set up field tests on the flow-cytometer processed semen.

Flow-Sorting Technology

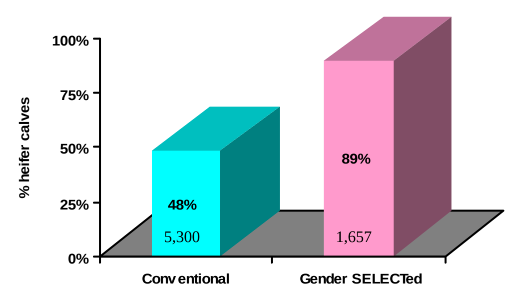
One of only a few repeatable techniques to sex sort sperm at a high level of purity uses a device called a flow-cytometer to detect a 3 to 4% difference in DNA content between male and female sperm and sort them with upwards of 90% purity. The first step in this procedure is to dilute sperm to a very low concentration and stain them with a fluorescent dye. The sample is then sent through the flow-cytometer at 60 mph under 30 to 60 psi of pressure. As sperm pass through the internal laser beam, the fluorescent dye is excited. Because of the larger X chromosome, female sperm emit slightly more light than male sperm, which possess the smaller Y chromosome. Detectors measure the amount of fluorescence and assign positive or negative charges to each droplet containing a single sperm. Charged deflector plates then split the single stream into 3 streams: positively charged particles containing one sex go one way, negatively charged particles containing the other sex are deflected in the opposite direction, while uncharged droplets containing multiple sperm or unidentified sex pass straight through. Confirmed with tens of thousands of offspring born in world-wide research trials, the procedure separates sperm of the two sexes with ~90% purity. However, that still leaves 10% of the undesired sex available to compete for fertilization. The table below illustrates the probabilities of all possible occurrences of offspring generated by 90% pure sexed semen.

Probablities of all possible occurances of offsping gender from 10 pregnancies generated by 90% pure sexed-semen.



Commercialization of sexed semen in the U.S. was initiated with a 2003 license granted to Genetic Resources International (GRI) in Navasota, TX. In late 2004, Select Sires partnered with GRI and sent four proven sires to Texas to begin collection and processing of sex-sorted semen. In 2005-2006, Select Sires conducted a nationwide field test and collected information on over 27,000 services. These trials were conducted in a random sample of herds with average or better reproductive efficiency in order to accurately assess product performance for the "average producer." The resulting calvings have a current data set of nearly 7,000 offspring so far with a gender ratio of 89% heifers when using sexed semen.

Gender Bias of Calves Reported To Date

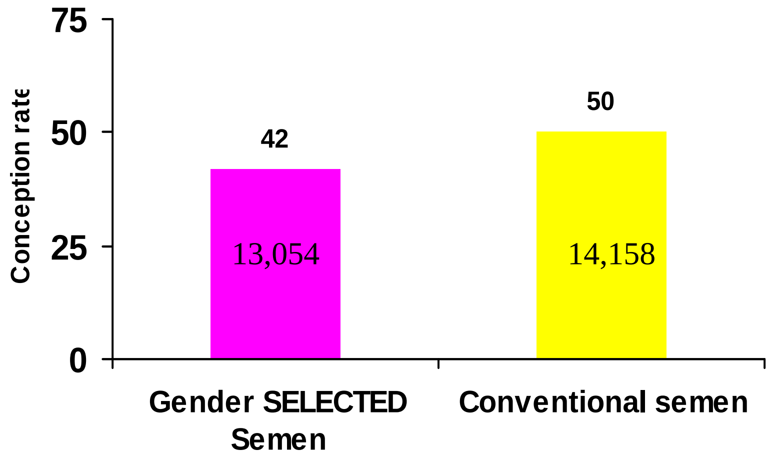


Source: 2005-2006 Select Sires Field Data

Technology Limitations

There are several major limitations that have stifled implementation of sex-sorted semen. Without question, reduced conception rates have been a primary hurdle. As you can imagine from the description above, sex sorting of sperm is a highly invasive procedure that negatively impacts sperm viability and longevity compared to normally cryopreserved semen.

Conception Rates
Gender SELECTed semen: 84% of conventional



Source: 2005-2006 Select Sires

In addition, the procedure is extremely slow and inefficient. To properly sort, sperm must be precisely oriented as they pass through the laser and fluorescence detectors in the flow cytometer. Due to the flat shape of bovine sperm heads, only about 30% are correctly oriented and half of these are female. Thus, only 15% of the sperm going into the machine are recovered as a marketable, sexed product. The high rate of sperm loss precludes use of Select Sires' "most elite" sires for production of sexed semen.

Although the 3,000 to 5,000 sperm of each sex sorted per second sounds like a lot, this translates into ~1.3 hours of sorting to process enough semen for a standard 20 million sperm/straw dosage. Thus, due to the slow sorting speed, commercialization is only possible with very low sperm numbers per dose (~2 million). If these limitations were not enough, the high cost of flow cytometry equipment (~$250,000 per machine) and intensive amounts of highly skilled labor required to sort sperm dictates that sexed semen will not be inexpensive. Because of the low sperm numbers per dose and compromised sperm viability, Select Sires only recommends its use in well-managed, highly-fertile, virgin heifers. While many research herds have realized very acceptable conception rates, averages indicate well-managed herds that achieve 60 to 65%

conception rates in virgin heifers with normal semen can expect 45 to 55% conception rates with sexed semen.

Based on the favorable field results, Select Sires began marketing sexed semen in the fall of 2005. In early 2006, four sorting machines were installed at Select Sires headquarters in Ohio to expand the sexed semen lineup. In the fall of 2006, two additional sorting machines were added to bring the annual production capacity to 350,000 straws. Orders for sexed semen have exceeded our expectations.

What is the return on investment for sexed semen?

The return on investment for the dairy producer depends on a complex interaction between the initial conception rate with non-sexed semen, the percent reduction in conception (if any) due to use of sexed semen, the price differential between sexed and conventional semen, expected gender ratio for sexed vs. conventional, and the value differential between bull and heifer calves. Most of these factors will change considerably from herd to herd, which differentially affects the breakeven value of sexed semen to each respective producer.

To calculate a return on investment (ROI), Select Sires has recently developed a sexed semen calculator in Microsoft Excel format which incorporates more than 20 other variables which will vary from herd to herd. It will assist you in determining how this new opportunity can best be utilized in your individual operation.

Based on the product available today, the best return on investment will be achieved by limiting this product to virgin heifers only and following the "Keys to Success" (see below) to insure optimum probability for conception.

Keys to success

Use of sexed semen will require a breeding gun designed to accommodate the smaller diameter ¼ cc straws. Straws are to be thawed and handled identical to their ½ cc counterparts. However, the smaller diameter and compromised semen quality will make them much more sensitive to cold-shock and errors in semen handling. To maximize potential for success:

- Thaw straws in 95° F water bath for 45 seconds.
- Semen thawing and handling environments should be warm and draft free.
- Warm all semen handling equipment including guns, sheaths, and paper towels prior to contacting straws.
- Only highly experienced technicians should use this product.
- Use only in well-managed, virgin heifers that have achieved greater than 60% of their mature weight by 14 months and in moderate or better body condition.
- Inseminate heifers 8 to 12 hours after observed estrus (AM/PM Rule).
- Use of estrus synchronization and breeding to observed estrus is encouraged, but use of timed-AI in the absence of observed estrus is discouraged.

Other methods of sorting semen

A number of new sex-sorting technologies and companies have recently appeared. Other methods include gender specific antibodies, centrifugation, and free flow electrophoresis. As you evaluate other technologies, please take the time to be wary, and ask numerous questions in order to make informed decisions. If the sex-sorting technology is not based on flow-cytometry and the patents developed by USDA, you should ask for scientific evidence that the procedure can, in fact, sort sperm. Accept nothing short of hundreds of births to assess whether the procedure can effectively produce offspring of the desired sex. Similarly, conception data should be based on thousands of services and should be based on palpated pregnancy data, as simple non-return data may mask results and distort the success that can actually be achieved. To date, only flow cytometry provides the best combination of sorting purity and commercial adaptation.

Summary

There is no question sex-sorted sperm for gender selection is now a reality. The product currently offered by Select Sires is backed by over 5 years of extensive field research and has been rapidly accepted by the U.S. marketplace. Currently, 18 of the 23 proven Holsteins and 2 of the 3 Jersey sires in the Select Sires sexed semen lineup have demand that exceeds the supply.

Because of continuing research, there will likely be improvements to the product and there will be the potential to utilize sex-sorted semen on lactating cows but current fertility results indicate its best fit right now is on virgin heifers.

Sources and Credit for Program and Research: Mel DeJarnette MS, Select Sires Senior Reproductive Physiologist, Clifton Marshall MS, Select Sires Vice President of Research and Quality Control; Dr. Ray Nebel PhD, Select Sires Senior Reproductive Physiologist; Dr. Don Monkey DVM, Select Sires Vice President of Operations

Notes

Florida Dairy Youth Program Update

Brent Broaddus
Department of Animal Sciences & IFAS Dairy Extension, University of Florida
Seffner, FL 33584
broaddus@ufl.edu

The Florida Dairy Youth Program targets youth and volunteer audiences to achieve the following objectives:

For youth to:

- Develop leadership including decision-making skills, citizenship, sense of responsibility, self-confidence and dependability attributes.
- Become familiar with research-based principles and methods required for successful agricultural enterprises.
- Learn about career options in Agriculture and specifically, the Dairy Industry.

For volunteers to:

- Acquire information and skills to help youth develop useful competencies and attributes in the Dairy Science area.

Since 1988 the Florida Dairy Youth Program has helped more than 2000 different individual youth with and without a dairy animal project. Thousands of additional youth have been made aware of and exposed to the Florida dairy industry through school enrichment programs, such as, dairy station's taught in "Ag in the Classroom" events. Some of these school enrichment outreach programs are even taught by the dairy youth themselves as part of their project work. In addition, hundreds of volunteers have been supported in their quest to further develop dairy youth interest in their clubs. Youth gain invaluable experience about Dairy Husbandry through ownership and care of Dairy Animals and through participation in Dairy Judging and Quiz Bowl educational experiences. Participation with an animal develops responsibility and other personal qualities needed for a successful life career, participation in judging, and particularly, giving oral and written reasons, develops leadership, confidence and the ability to make and defend decisions. Fairs and shows provide a venue for youth to exhibit their project work and to exchange information with other youth on what has worked and not worked in their project. Awards provide recognition and incentives to participate in the various programs.

The Florida Dairy Youth Program has six main events that have numerous activities in them to help provide and develop life changing results.

1. State 4-H Dairy Show is the event where the youth come together to show off all aspects of the dairy project in one location each year and be recognized for all their achievements for the past project year. The show is held in Kissimmee, FL in

conjunction with the Osceola County Fair. The youth participate in Showmanship, heifer and cow classes, quiz bowl, judging, county herdsmanship contests, project record books contests and the annually year end awards recognition banquet for all dairy youth events that occur that past year.

2. Dairy judging is where the youth compete at local, regional and state wide fairs and shows. They then compete for space to join the summer dairy judging workout program where they will invest a large part of their summer traveling the state to dairies to develop their evaluation and oral reasons skills. The youth are then placed on one of five different teams that will represent Florida at the following contests:

- Alabama National Fair Dairy Judging Contest (Montgomery, AL)
- Mid-South Dairy Judging Contest (Memphis, TN)
- North American International Livestock Exposition Dairy Judging Contest
- (Louisville, KY)
- All American Dairy Judging Contest (Harrodsburg, PA)
- World Dairy Expo, National Dairy 4-H Judging Contest (Madison, WI)

3. Dairy Quiz Bowl, where the youth compete at regional and state fairs and shows. Youth then also tryout for a summer workout program where they continue to learn and process the concepts and science behind the dairy animal and industry. The youth that are selected to represent Florida travel to compete at the following contests:

- World Dairy Expo Quiz Bowl Contest (Madison, WI)
- North American International Livestock Exposition Dairy Quiz Bowl Contest (Louisville, KY)
- National Ayrshire Dairy Quiz Bowl Contest (different location each year)
- National Guernsey Dairy Quiz Bowl Contest (different location each year)
- National Holstein Dairy Quiz Bowl Contest (different location each year)
- National Holstein Dairy Jeopardy Contest (different location each year)

4. National 4-H Dairy Conference is held in conjunction with World Dairy Expo in Madison, WI. This education conference provides senior 4-H youth the opportunity to learn more about the dairy industry, careers in the dairy industry, develop additional competence in a special-interest area of the dairy industry and practice leadership and group participation skills.

5. Dairy Camp and Southeastern Dairy Youth Retreat are summer events that provide the youth opportunities to continue to learn about all aspects of the dairy industry and to develop friendships with youth from other parts of the state and beyond that share in their love of the dairy project and industry.

6. The dairy volunteer and leader training workshop is a two to three day event that is held annually to train volunteers how to better work with the youth of today, give them the confidence and expertise to effectively run program and activities in their local communities and to continue to educate them on dairy specific subject matter to then pass on to their local interested youth.

In addition to these six key events the Southeast Milk, Inc. Dairy Check-Off Program also provides undergraduate scholarships to UF and UGA students and collegiate dairy judging team support when needed.

The Dairy Youth Program this year has started a quarterly newsletter called "The Scoop" to help keep everyone informed on the great young people we have in the dairy youth program and all their accomplishments throughout the project year. Also, something new this year, the beginning of the The Florida Dairy Youth Ambassador Program. This program is going to be offered for senior level 4-H members and graduates that have a desire to continue to hone their leadership, communication, public speaking skills and, more importantly share their passion and love for the dairy project and industry. This program's goal will be to take a group of highly motivated young people that have a desire to spread the message about the dairy project and industry, whenever a situation presents itself, to educate the public on what the dairy project and industry is all about and why it means so much to all of us. The young people that desire to join this group will have a series of workshops and trainings that will enhance their leadership skills, media abilities and agriculture advocacy. This program will also help them to think "outside of the box", to harness their natural passion for the dairy project and industry, to educate their fellow youth and public by telling their dairy story.

The Dairy Youth Program has had some great success this past year. Here is just a few of the results from some of the contests that our youth competed in.

Dairy Judging:

- Placed 13th Overall and 8th in Reasons at the National 4-H Dairy Judging Contest in Madison, WI.
- Placed 6th Overall and 6th in Reasons at the All American Dairy Show in Harrisburg, PA.
- Placed 1st Overall, 3rd in Reasons at the Mid-South Dairy Judging Contest.
- Placed 12th Overall, 6th in Reasons at the North American International Livestock Exposition Dairy Judging Contest.

Dairy Quiz Bowl:

- Placed 2nd at the World Dairy Expo Contest.
- Junior and Senior teams placed 3rd at the National Ayrshire Dairy Quiz Bowl Contest.
- Senior team placed 7th at the National Holstein Dairy Quiz Bowl Contest.

Florida State Fair Champion of Champions Program:

- Four of the past seven overall winners of the Florida State Fair Champion of Champions Youth Program have been products of the Florida Dairy Youth Program. In 2008 Sarah Luther of Suwannee County placed 3rd Overall in the program.

The Florida Dairy Youth Program is an awesome program that provides countless life skills to our youth and helps them spread the work about the dairy industry to others. The program continues to grow and remain strong and we are humbled and honored that the Southeast Milk, Inc. Dairy Check-Off Program continues to see the value in our dairy youth and continues to support the program. Thank You!

Notes

Feeding Management to Reduce the Environmental Impact of Dairy Farms

Robert E. James[1] and Beverly Cox[2]
[1]Department of Dairy Science, Virginia Tech
Blacksburg, VA 24061
jamesre@vt.edu

[2]Virginia Cooperative Extension
Rocky Mount, VA 24151

Probably no region of the U.S. has experienced greater attention to impact of agriculture on our environment than Florida. Dr. Jack Van Horn, retired from the University of Florida, was an early advocate of research to demonstrate how dairy production could be good stewards of the environment through improved cropping practices and nutritional management. In recent years the Chesapeake Bay has been a focus point for environmental impact studies along the east coast. It is estimated that 95% of the phosphorus and 87% of the nitrogen entering the Chesapeake Bay arise from nonpoint sources. Agriculture accounts for 29% of the nitrogen and 49% of the phosphorus entering the bay. Concern over the impact of excessive nitrogen and phosphorus entering the Chesapeake Bay led to the signing of the 1987 Chesapeake Bay agreement with the goal of reducing N and P inflows to the CB annually by 40 % (Chesapeake Executive Council., 1987). Although progress was made toward accomplishment of this goal, the reductions were not achieved by 2000. In 2000, a new agreement was signed reaffirming the commitment to 40 % reductions in nutrient loadings to the CB with the additional goal of removing the CB from the list of impaired water bodies under the Clean Water Act by 2010 (CBP, 1999).

Consequently, agriculture is subject to environmental regulations targeted to reduce nutrient losses to water sources. A dairy farm is required by the Code of Virginia to obtain Virginia Pollution Abatement (**VPA**) permits if the operation has in excess of 300 animal units (DEQ, 2007). Such regulations dictate the quantity of manure and fertilizer that may be applied to each plot of land. Manure containing excess quantities of N and P must be applied at reduced rates, potentially resulting in more manure produced than can legally be applied to the land. A New York study found 61 % of N and 81 % of P imports were attributable to purchased feed (Klausner et al., 1998). Surveys have documented routine inclusion of supplemental P and overfeeding of CP in dairy rations in the mid-Atlantic and Southern United States (Bertrand et al., 1999;Dou et al., 2003;Jonker et al., 2002). Reductions in CP content and removal of supplemental P from dairy cattle rations alone have been shown to increase efficiencies of N and P utilization (Cerosaletti et al., 2004). It has been documented that long term P balance is obtainable if the use of on farm forages is optimized (Cerosaletti et al., 2004;Rotz et al., 2002;Tylutki et al., 2004). Accomplishment of net nutrient balance on the farm necessitates a precise feeding program that reduces the amount of overfeeding of CP and P and optimizes use of homegrown forages.

Achieving improved nutrient balance on dairy farms sounds easier than it is. Frequently nutritional consultants are evaluated based upon productivity of the herd. Under these conditions they are more likely to add a margin of safety to the rations by overfeeding nutrients to assure that production goals are achieved. However, several factors are combining to encourage improved nutritional management of dairy herds.

- Research has enabled the development of computer models which enable one to more accurately predict animal nutrient requirements and therefore animal performance under a given set of environmental conditions and ration nutrient contents.
- Improved tools are available to describe the nutrient characteristics of forages and concentrate ingredients.
- New varieties of forages are being developed which foster higher whole plant digestibility.
- The rapid increase in costs of supplemental energy and protein in dairy rations has provided an incentive for improved feed efficiency making overfeeding to provide a margin of safety too costly.

In summary, there has been renewed interest in “precision” feeding of dairy cattle. Actually, precision feeding is a misnomer. Effective nutritional management first involves achieving accuracy, which in the nutritional sense means the nearness of the nutrient specifications of the ration to the desired nutrient specifications as formulated by the nutritionist. Precision means achieving the same results repeatedly. Therefore it’s important that our rations are accurate first then precise.

What can we do on the dairy farm to achieve improved nutrient management and achieve improved whole farm nutrient balance through improved accuracy and precision of our rations? In 2005, the Dairy Science Department at Virginia Tech received grants from Natural Resources and Conservation Service and the Virginia Department of Conservation and Recreation to determine if precision Feeding and incentive payments could reduce nutrient losses from Virginia Dairy Farms. We are currently a little over half way into this three year study. This presentation will summarize the findings of one component of our project called the intensive feed management study.

The objectives of this study were to:

- Determine the impact of precision feeding using feed management software and monthly feed testing on whole farm nutrient balance (**WFNB**).
- Document current levels of accuracy and precision of feeding on Virginia dairy farms and the influence on milk production, body condition score, and income over feed cost (**IOFC)**.
- Determine normal variation in total mixed ration (**TMR**) and individual feedstuffs across a 12 mo period.
- Assess producer perceptions and satisfaction with feed management software.

The impact of feed management software on whole farm nutrient balance (**WFNB**) and feeding management was assessed during the 2006 and 2007 calendar years. Nine treatment and 6 control farms were selected in 4 regions of the Chesapeake Bay Watershed of Virginia. Herd sizes averaged 271 and 390 lactating cows for treatment and control farms whereas milk yield averaged 30 and 27 kg/cow/d, respectively. Crop hectares grown averaged 309 and 310 hectares for treatment and control farms, respectively. Treatment farms purchased and installed feed management software (TMR Tracker, Digi-Star LLC, Fort Atkinson WI) between May and October 2006. Data was collected for calendar year 2005 and 2006 to compute WFNB using software from the University of Nebraska. On treatment farms, up to 5 feed samples were obtained monthly including each total mixed ration (**TMR**) fed to lactating cows. Control farms submitted TMR samples every two months. Standard wet chemistry analysis of samples was performed. Data stored in the software were collected monthly from each treatment farm concurrent with feed sampling.

The use of feed management software did not have an impact on whole farm nutrient balance. Control farms had an excess of 127 kg of nitrogen and 13 kg of phosphorus while those using feed management software retained 140 kg of nitrogen and 6 kg of phosphorus. The lack of differences in nutrient balance was attributed to the fact that some farms had been using the program for less than 4 months when balances were calculated. We are continuing with this study for two more years and have not computed balances for the 2007 year.

Milk production, crop acres grown, crops sold, and percent of homegrown forage in the ration had the greatest impact on nitrogen whole farm nutrient balance. In comparison, crops sold and percent of feed raised on the farm including forages and grains had the greatest impact on phosphorus whole farm nutrient balance.

Although we didn't observe an improvement in whole farm nutrient balance which could be attributed to use of feed management software, we learned quite a bit about management of the feeding program on our cooperator farms. From our studies we have shown that the accuracy and precision of feeding programs has room for considerable improvement. Farms had between one and three milking herd TMR's. Table 1and 2 demonstrate the variability observed in crude protein (CP) and phosphorus (p).

Table 1. Variability in CP content of TMR's

Sample type	N	Mean	S.D.	Min	Max	Range
High group	79	17.34	2.09	11.67	23.39	11.72
Low group	61	17.26	1.55	13.31	19.97	6.66
One group	47	17.14	1.37	12.91	19.76	6.85

Table 2. Variability in P content of TMR's

Sample	N	Mead	S.D.	Min.	Max	Range
High group	77	.39	.04	.29	.51	.22
Low group	61	.39	.04	.30	.50	.20
One group	49	.39	.04	.31	.48	.17

The lack of differences in CP and P between high and low groups demonstrates further challenges in obtaining both accuracy and precision in feeding programs on our cooperator herds. It should be noted that special precautions were taken to obtain a representative sample of the TMR'S fed to each milking group. This included obtaining multiple samples during unloading, followed by thorough mixing of the sample prior to sending it to the forage testing lab. Figures 1 and 2 demonstrate deviation of expected vs. analyzed values for both crude protein and phosphorus.

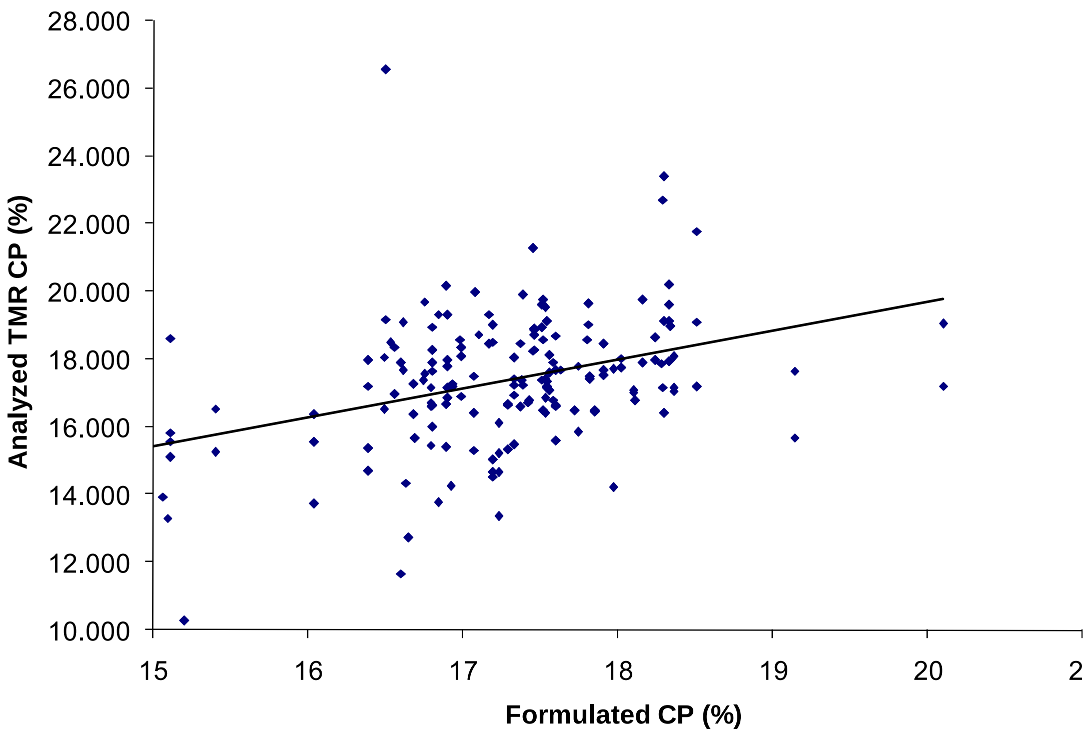


Figure 1. Formulated versus analyzed TMR % Crude protein

Similar results were observed for formulated versus analyzed P in TMR's as shown in Figure 2.

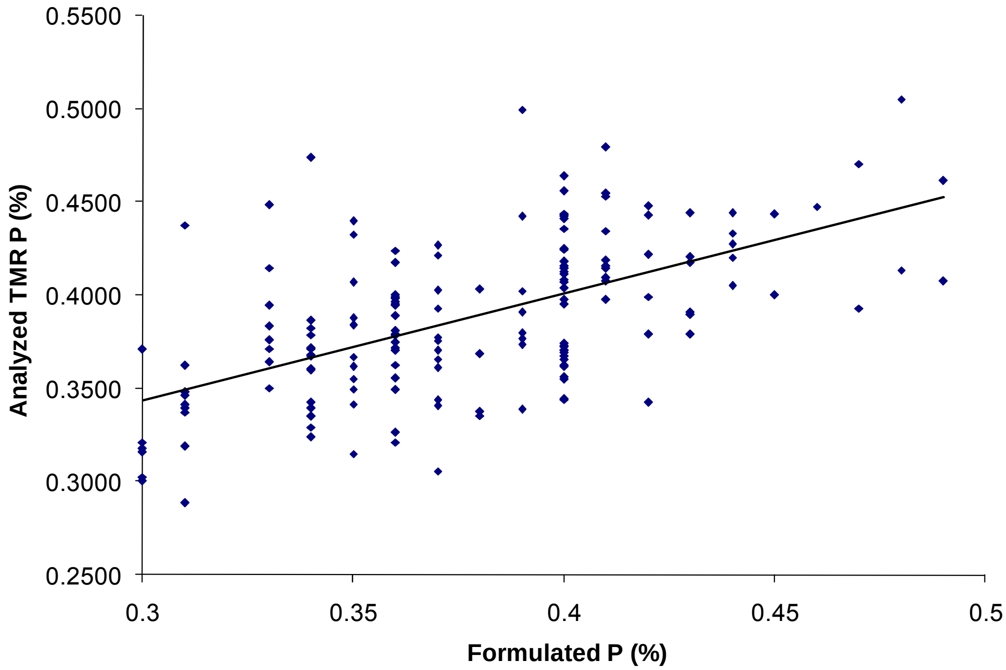


Figure 2. Formulated versus analyzed P in TMR's

Errors in accuracy and precision can be attributed to variability in feedstuffs and / or operator error. Frequent sampling of forages and commodities revealed considerable variability in both CP and P content as shown in Figures 3 and 4.

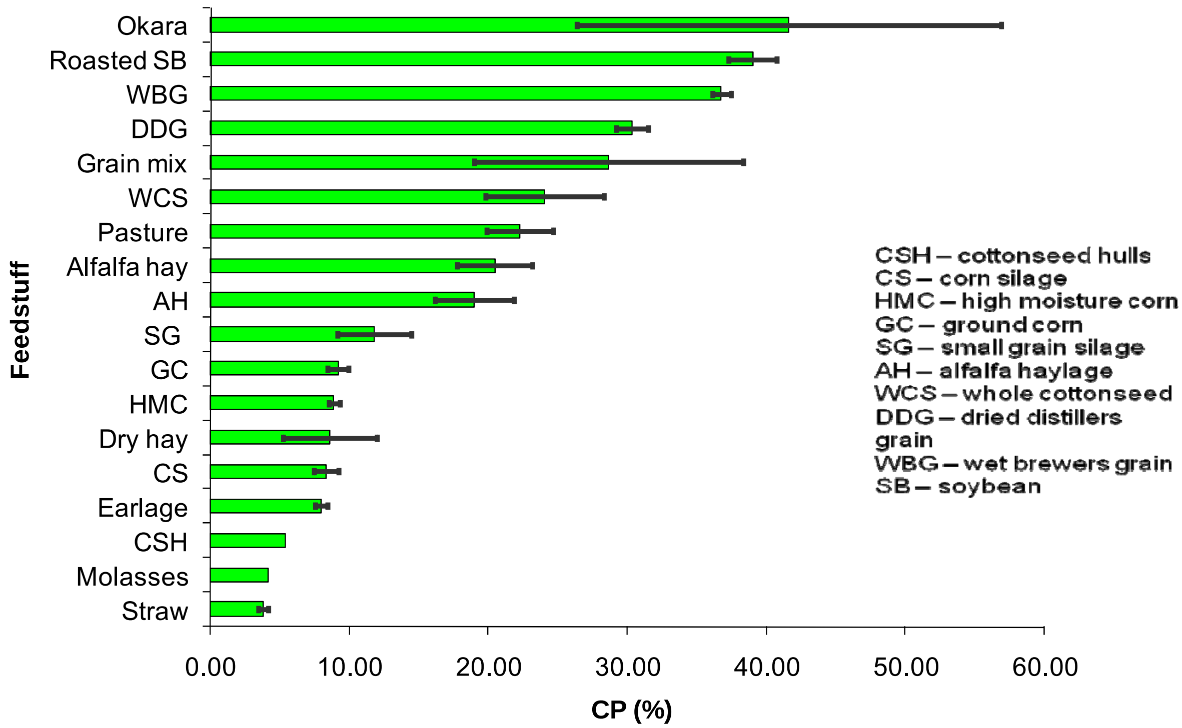


Figure 3. Feedstuff crude protein variability.

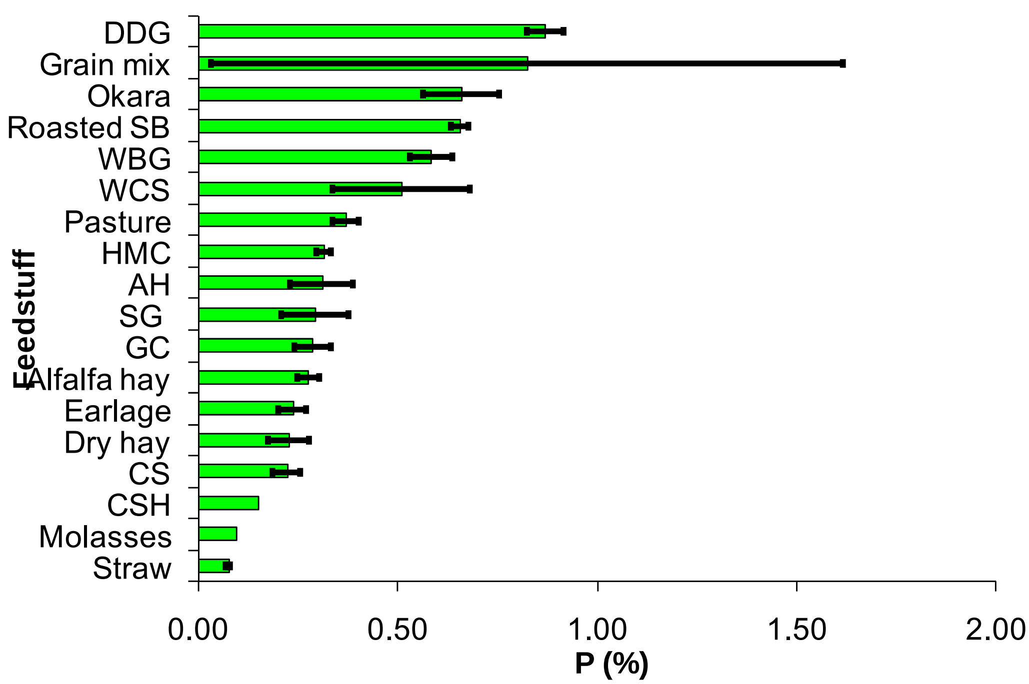


Figure 4. Feedstuff phosphorus variability.

It was expected that variation would be high in grain mixtures as they differed considerably from farm to farm depending on the feeding program. The feedstuff with the greatest variability was Okara, a byproduct from the production of soy milk beverage. Forages and byproducts were also characterized by larger variation in nutrient content. Failure to test these feeds routinely is a potential reason for deviation between expected and analyzed values for nutrients in the TMR's.

Operator error was evaluated by comparing loading and delivery accuracy information obtained from the TMR Tracker software. Mean load deviation was compared feeder and day of the week. No differences could be attributed to day of the week. However, we did observe differences between primary, secondary and sporadic feeders. The primary feeder was responsible for mixing and delivery of the TMR more than 75% of the time. It was expected that the mean load deviations from formulated TMR's would be lower for the primary feeder. However, this was not the case as in most cases the secondary feeder had superior performance. Possibly, the primary feeder developed undesirable habits.

We also noted that certain feeds were more likely associated with certain feeding loading deviations. These relationships are shown in Figure 5.

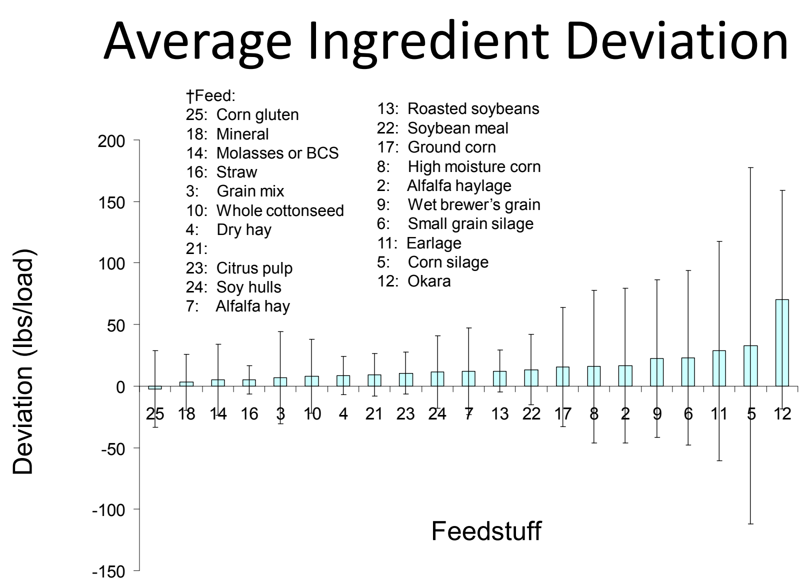


Figure 5. Average ingredient deviation by load

It's important to view not only the average deviations, but also the range in deviations in pounds per load. Greatest deviations were observed for okara, corn silage and earlage. Loading errors can be attributed to the physical characteristics of the feed or possibly its storage location in relation to the position of the mixer wagon. To clarify the latter point, if corn silage is loaded with a bucket loader and the silo is some distance from the mixer wagon, it is tempting for the operator to accept over or under loading to save time.

Significant differences were observed between farms in loading accuracy. This can be attributed to differences in operator ability and diligence, equipment and the physical layout of feed storage facilities. Figure 6 illustrates the average and range in loading errors observed in our cooperator herds.

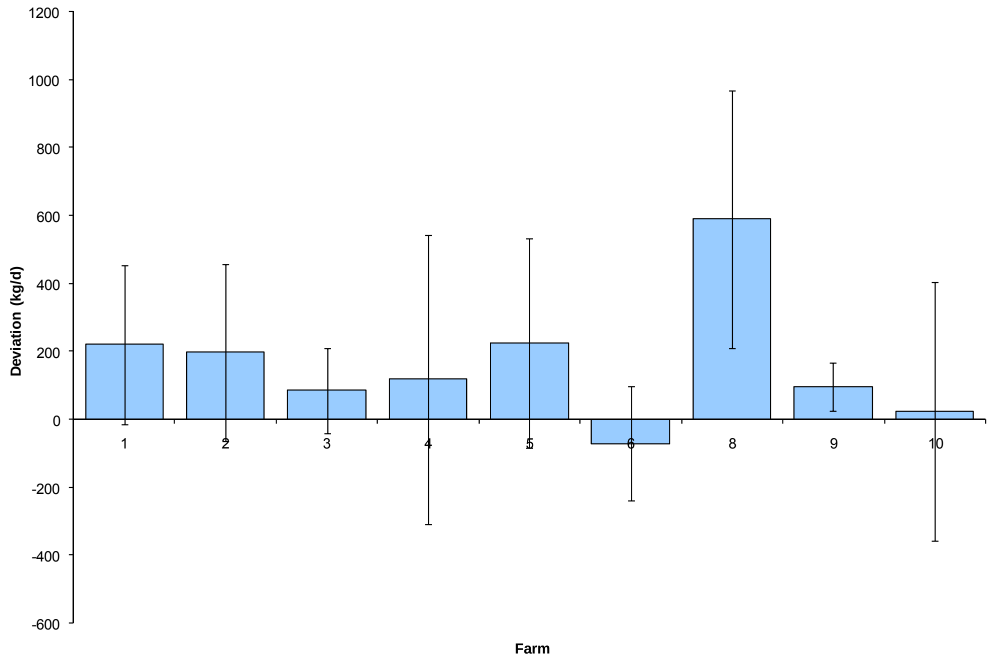


Figure 6. Typical daily errors in loading mixer wagons on 10 different dairies

Accuracy and precision are achieved with the smallest average deviation from the formulated ration and the smallest variation. It might be assumed that herd 10 excelled. However on the average this herd was accurate, but not very precise in that daily variations were quite large. Feeding management excelled in herds 9 and 3 in which the feeding programs were relatively simple and mixing was performed by one person with owner filling in when needed. The greatest problems were observed in herd 8 in which the owner did over 90% of the feeding and assumed that feeding was accuracy without consulting feed management reports. In herd six, all feeds produced on the farm, including high moisture corn and all silages, were stored in concrete stave or bottom unloading silos. Controls for the various silos were located at different ends of the feed room. The indicator was not always visible during loading, necessitating turning unloaders off based solely on alarms signifying a tolerable range was achieved. Accuracy consequently shifted considerably from day to day, leading to more underfeeding than other farms experienced. Another factor in the large amount of underfeeding was the unreliability of bottom unloaders in the bottom unloading silos.

These unloaders frequently broke midway through a load, requiring advancement to the next ingredient before loading of the previous ingredient finished. Equipment location and failure were the driving forces behind underfeeding on this operation.

To assess the effect of feeding accuracy on milk production, daily milk shipments were compared via regression to the daily feeding deviation, or error. Daily deviation in total kg fed was negatively associated with milk production, indicating an increase in milk production as feeding accuracy increased. This agrees with the findings of Tylutki et al. (2004) that daily milk variation increased from 0.5 to 2.0 kg/d per cow during periods of inadequate feeding management. Similarly, there was an increase in milk production as accuracy of CP feeding increased. Again, these results highlight the ineffectiveness of overfeeding in increasing milk production and correspond to the 13% increase in production from a 2% decrease in CP documented by Klausner et al. (1998).

Conversely, increasing kg of P fed demonstrated a positive association between milk production and daily percent deviation in P fed. However, while this relationship is significant, this association may be due not to the increased level of P in the diet, but changes in the diet that promote higher production associated with higher P levels. A moderate correlation (r = 0.27) was found between ration NEL and P, indicating increases in NEL concurrent with P increases. It is believed that the association between increased milk production and P content is due to the related increase in energy density of the ration from larger amounts of these high P content feeds.

Loading accuracy suffered as DM content of feedstuffs decreased. Difficulty of handling feeds with more moisture led to more imprecise loading, perhaps associated with the perception low DM feeds are less expensive. Feeding deviation did not differ by feeder or day of the week. Consequently, all employees should be evaluated equally to impact change in feeding deviation.

Process control analysis demonstrated that 4 % of all loads were underfed more than 2 standard deviations, while frequency of overfeeding in excess of 2 standard deviations was 33 %. Implementation of six sigma (Eckes, 2000;Pande, 2002) should begin by reducing this deviation initially to within 1 standard deviation (92kg/load). Utilizing 2006 feeding data as baseline, farms should be evaluated for areas of improvement. Strategies for each individual farm are needed to target specific weaknesses of each operation. Future research efforts should document the adoption and success of six sigma approach to improving feeding management.

All producers surveyed after the first year reported that the software met expectations and if given the choice would invest again. Despite satisfaction, 4 of 9 were uncertain or would not purchase the software without the subsidy provided by the project. All but one perceived feed management software as economically beneficial. All farms reported utilizing the software to monitor operator performance and saw no change in quantity of feed purchased during the first year. Five producers noted improvements in ration consistency following TMR Tracker use. A significant positive correlation (r=0.80) was revealed between changes made to the feeding program due to TMR Tracker and improvements in ration consistency. Of those surveyed, more than half (5 of 9) state training employees as the most challenging aspect of implementing TMR Tracker. A strong negative correlation (r=-0.77) was found between the frequency reports are viewed and the greatest challenge faced from the program. These results indicate that the obstacle to viewing reports was dedicating adequate time to the program. Forty-four percent of respondents attributed most problems encountered to operator error. After two years all cooperators continue to use the feed management software and have discovered additional tools which have proved beneficial including inventory management and more accurate estimation of feed costs and income over feed cost.

Take home message

- We don't do a very good job of managing our evaluating our feeding program.
- Milk production decreased with greater variation and increased protein overfeeding.
- Feed management software provides tools to evaluate:
    - Shrink
    - Personnel
    - Procedures
    - Facilities
- Feed management software provides the tools to enable better control of whole farm nutrient balance if used properly.

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Notes

Southeast Milk, Inc. Dairy Check-Off Report

Development of a High Fertility Timed Insemination Program for Dairy Heifers

William W. Thatcher[A], Carlos A. Risco[B], Jacob Larson[A], Marie-Joelle D. Thatcher[B], Fabio Lima[B] and Steaven A. Woodall[A]

Departments of [A]Animal Sciences and [B]Large Animal Clinical Sciences/College of Veterinary Medicine, University of Florida

Gainesville, FL 32611

thatcher@ufl.edu

Objectives of the present series of experiments were to develop a timed artificial insemination (TAI) program for dairy heifers and to utilize a TAI program to evaluate the effect of flunixin meglumine (Banamine®; Schering-Plough Animal Health Corp.) on pregnancy rate and embryo survival.

In Experiment 1, 247 heifers were assigned randomly to a PGF/GnRH TAI (i.e., 2 injections of Lutalyse® [25 mg, i.m.; Pfizer Animal Health Inc.] given 14 days apart in PM; 60 h after the 2nd Lutalyse® injection heifers received a GnRH injection [Cystorelin®; 100 µg, i.m.; Merial Inc.] and were TAI) or a 5 day-CIDR/Synch TAI (intravaginal insertion of a CIDR® device [Pfizer Animal Health Inc.] and injection of GnRH in the AM; 5 days later in the AM the CIDR insert was removed and Lutalyse® was injected followed by a 2nd injection of Lutalyse® 12 h later; heifers were TAI and injected with GnRH at 72 h after CIDR removal). Blood samples for progesterone analyses were taken 7 days apart prior to initial $PGF_{2\alpha}$ or CIDR insertion from the respective groups to determine cycling status.

- The CIDR/Synch tended to have greater day 32 (53.1>46.2%) and day 42 (50.8 > 43.7%) pregnancy rates than PGF/GnRH (P~0.10); 4/9 non-cycling heifers of CIDR/Synch conceived vs 0/3 of the PGF/GnRH group.

In Experiment 2, 176 heifers underwent the CIDR/Synch TAI protocol. However, 2 injections of cloprostenol (500 µg AM/PM; Estrumate®, Schering-Plough Animal Health Corp.) were used to regress the CL at CIDR removal. Heifers at initiation of the CIDR/Synch TAI protocol were assigned randomly to receive injections of Banamine® (400 mg i.m.) at day 15.5 and day 16.0 (Banamine®) or no injections (Control).

- Banamine® treatment failed to alter either day 32 (59.6% Banamine® vs 59.8% Control) or day 46 (59.6% Banamine® vs 58.6% Control) pregnancy rates. Overall, 4/11 nnon-cycling heifers conceived.

In Experiment 3, 147 heifers underwent a UsedCIDR/Synch TAI protocol utilizing cloprostenol as in Experiment 2. A 5 day used CIDR was employed. Heifers at initiation of the UsedCIDR/Synch TAI protocol were assigned randomly to receive injections of

Banamine® (400 mg i.m.) at day 15.5 and day 16.0 (Banamine®) or no injections (Control).

- Banamine® treatment failed to alter either day 32 (60.5% Banamine® vs 62.0% Control) or day 46 (59.2% Banamine® vs 60.6% Control) pregnancy rates.

Pooled overall analyses of pregnancy rates for dairy heifers receiving the CIDR/Synch treatments (n=451), adjusted for experiments, were 58.3% at day 32 and 57.6% at day 46. In conclusion, Banamine® failed to improve pregnancy rate and or late embryo survival in dairy heifers, and a CIDR/Synch timed insemination program is very effective to optimize pregnancy rate in dairy heifers.

Notes

Southeast Milk, Inc. Dairy Check-Off Report

Is Testing Cows for Disease Resistance a Practical Tool for Managing Health in Dairy Cows?

Jason De La Paz[a], Art Donovan[a], Fiona Maunsell[a], Bonnie Mallard[b], Maureen Long[a], Armando Hernandez[b], Pedro Melendez[a], Timothy Olson[a]

[a]University of Florida, Gainesville, FL 32610

[b]University of Guelph, Guelph, Ontario, Canada

donovana@vetmed.ufl.edu

Periparturient immune suppression is well documented and believed to be at least partially responsible for the increased risk of disease during this period. Several studies have found significant differences in immune responsiveness and resistance to disease with alterations in class I and II MHC haplotypes and gene alleles. Other studies have compared incidence of disease among cows categorized based on their antibody mediated immune responsiveness (AMIR) to a novel antigen.

Wagter et al. (2000) were able to quantify and then categorize an individual dairy cow's antibody mediated immune responsiveness (AMIR) to ovalbumin (OVA). High responders for AMIR had the lowest incidence of mastitis in two of the three study herds; with 136 cows and heifers spread over three herds, they were unable to find results that were statistically significant.

The objectives of our study are to categorize cows based on 1) AMIR to OVA and 2) cellular mediated immune response using delayed type hypersensitivity (DTH) reaction to a novel antigen. We then tested for associations between AMIR/CMIR and disease incidence (namely; mastitis, metritis, retained fetal membrane, ketosis, and displaced abomasums), and reproductive efficiency and milk yield.

All test animals were from a single herd in north central Florida which maintains exceptional record keeping. In total, 875 Holstein cows/heifers in good health with no obvious signs of disease were enrolled into the study at 8 weeks (wk-8) prior to expected calving. Animals were enrolled if reconfirmed pregnant with expected dry period less than 90 days.

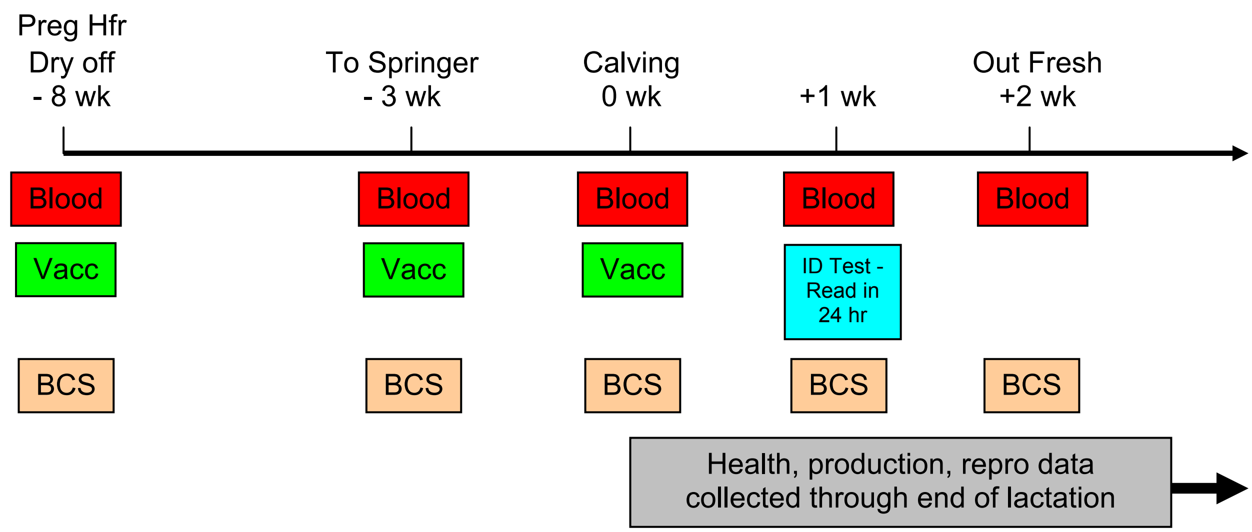

Figure 1 – Schematic of experimental design of a study to determine the association between immune response and clinical disease, reproduction and culling

A schematic of the experimental design is presented in Figure 1. Briefly, test antigens are injected, blood samples collected for antibody titer and body condition scores measured at study enrolment (wk-8), 3 weeks prior to expected calving, at calving and 2 weeks post-calving. Cell mediated immune function was measured at 1 week post-calving. Animals were removed from the study if any data were missing, and if any interval between sampling was less than 12 days. A preliminary analysis was also used to remove an additional 38 animals found not naïve to test antigen. This results in a sample size of 774 with 433 cows and 341 heifers.

Ovalbumin (OVA) was chosen as the antigen to be measured for AMIR due to its inert properties, its ability to stimulate a humoral response, a cow's reduced likelihood of previous exposure and it's previous success as a tool to categorize AMIR. A novel, proprietary antigen was also incorporated into this vaccine to test CMIR.

At 1 week post-calving (wk+1), double skin-fold measurements were taken on the right and left skin folds under the base of the tail using a spring-loaded caliper. The locations of the two measurements were cleaned with 70% isopropyl alcohol. The right side received an intradermal injection of 0.1 mg of novel antigen suspended in 0.1 ml PBS. The left tail fold (control side) received 0.1 ml PBS intradermally. All injections were given with a 28 gauge needle. The exact location of the measurement and injection was marginated with white latex paint. Twenty-four hours later, these injection sites were measured once again to determine the increase in double skin-fold thickness for the right and left side as an indicator for the magnitude of the DTH (CMIR) response.

A cow's specific antibody response to OVA was detected using indirect enzyme-linked immunosorbent assay (ELISA) methods previously described. Some cows developed very high antibody response after the first vaccination (wk-8) and did not have any further increase in antibody titer; this is termed antibody saturation. Other cows became sick between calving and the wk+2 sampling. T account for these phenomena, an index was generated for the categorization of AMIR.

$$y_{total} = OD_{-3} + OD_0 *(1 + I_2)$$

Where: y_{total} = total antibody
OD_{-3} = optical density value at wk-3
OD_0 = optical density value at wk0
I_2 = change in OD between week -3 and week 0

The y_{total} values within parity were then ranked high to low. Cows within the bottom 25% for a respective parity are categorized as low AMIR responders, while cows in the top 25% for a respective parity are termed high AMIR responders. The remaining middle 50% are categorized as medium AMIR responders.

A normal distribution was required for the determination of CMIR categorization; so as a result, log transformations of the measurements were performed. The magnitude of the DTH response was determined by the following:

$$y = \ln(R24) - \ln(R0) \tag{5-1}$$

To extrapolate CMIR categorizations the mean and standard deviation for the "y" values were configured for all cows respective of parity. Cows with "y" values above the mean plus one standard deviation were classified as high CMIR responders. Those cows below one standard deviation less than the mean were classified as low CMIR responders. All animals within one standard deviation of the mean were medium responders.

Identification of disease was performed by farm personnel who were blinded to immune response categorizations. The diseases of interest for this project were; mastitis, metritis, retained fetal membrane, ketosis, and displaced abomasum. All diseases were recorded as yes/no binary responses for the trial period of the current lactation.

Milk yield and reproductive data were gathered from the Dairy Herd Information Association (DHIA) records for the current lactation. Appropriate statistical analyses were performed using SAS. Statistical significance was determined at $p < 0.05$.

Antibody mediated immune response category was associated with occurrence of mastitis and ketosis. High responders had less mastitis and ketosis than medium or lower responders. High AMIR category was also negatively associated with milk yield ($p=0.06$) and pregnancy rate at 150 days in milk ($P<0.05$). Increased risk of mastitis was also noted in medium CMIR responders compared with high CMIR responders ($P<0.05$). Of particular note was the association between CMIR categories and occurrence of RFM. High responders had significantly lower risk of RFM than either medium or low responders. CMIR response was also associated with milk yield (p =

0.049, $\beta = 508.08$). CMIR was not a significant predictor for pregnancy by 150 DIM ($p = 0.77$).

Immune response, either humoral (AMIR) or cellular was associated with some diseases of dairy cattle. AMIR tended to be inversely related with CMIR. High AMIR responders appeared to have lower milk production and took longer to get pregnant. These phenomena could not be explained by this study. Some hypothesize that in high immune responders, more nutrients are required to manage the highly active immune system and less is available for production. Since pregnancy is dependent on the conceptus avoiding the maternal immune system, the highly active immune system of high responders may overwhelm this system resulting in lower conception rates.

Notes

Southeast Milk, Inc. Dairy Check-Off Report

Effect of Rust Infestation on Silage Quality

A.T. Adesogan, O.C.M. Queiroz and, S.C. Kim
Department of Animal Sciences, University of Florida
Gainesville, FL 32611
adesogan@ufl.edu

Southern rust is an aggressive disease caused by *Puccinia polysora* fungi that can destroy a corn field in a few days. It is dispersed by airborne spores that form orange, circular pustules mainly on the upper leaf surface. The fungus diverts nutrients away from the plant causing leaf death. Few corn hybrids are resistant to southern rust and some of such varieties lack the combination of agronomic and nutritional traits desirable for silage production. Certain fungicides can control the disease, but their effectiveness is limited when applied late in the season, particularly under hot, humid conditions (Raid and Kucharek, 2005). In addition to causing crop losses, this disease can predispose the plant to mold growth and mycotoxin infestation. Little is known about the effect of the disease on the nutritional value of corn silage. Less is known about whether microbial inoculants that inhibit the growth of spoilage-causing yeasts and molds can improve the quality of rust-infested corn silage. This project aimed to determine the effect of the level of southern rust infestation of a corn hybrid on silage fermentation, nutritive value and bunk life, and to determine how inoculant application affects these measures of forage quality. A corn hybrid (Pioneer 33V16) grown on a 130-acre field on July 6, 2007 at the Dairy Research Unit was infested by southern rust after taselling. Aerial application of a fungicide resulted in areas with different levels of infestation in the field. Representative samples (220 lb each) were taken from areas classified as having no rust (clean), medium rust (all leaves in the bottom half of the plant were infested), and high rust (all leaves were infested). Each of these was ensiled without treatment (Control) or after applying Buchneri 500 inoculant (Lallemand Animal Nutrition, Milwaukee, WI) at a rate that supplied 4.99×10^{10} colony forming units of *Pediococcus pentosaceaus* and *Lactobacillus buchneri* in each gram of forage. Each treatment was ensiled in four replicate 5-gallon mini silos for 97 days. Concentrations of dry matter (DM) and fiber fractions increased with the level of rust infestation, whereas DM digestibility decreased by up to 13%. These results indicate that the rust dried the silages and reduced their nutritive value. The DM concentration of the high-rust corn silage (58%) was high enough to reduce the effectiveness of packing in a farm-scale silo. High rust silages also had lower neutral detergent fiber digestibility (NDF) than medium rust or clean silages. This effect was greater in inoculated silages because inoculation increased the NDF digestibility of clean and medium-rust silages. Silage pH increased with rust infestation, however, all pH values were below 4. Concentrations of lactate, total volatile fatty acids, and most individual volatile fatty acids decreased with increasing rust infestation in control silages, but such trends were largely absent in inoculated silages. This shows that rust infestation reduced the fermentation but inoculant application reduced this negative effect. Only, high-rust silages contained butyric acid, which is an indicator of undesirable clostridial secondary fermentation.

Mold counts of clean and medium-rust silages were relatively high, but high-rust silages had fewer molds, perhaps because they were drier. Aerobic stability was greater in high-rust silages than silages with less rust infestation. Inoculant treatment reduced mold counts in high rust silages 80-fold and increased their aerobic stability by about 75%. Aflatoxin was only detected in uninoculated, high-rust silages and the levels exceeded the FDA action level (20 ppb), indicating that this silage should not be fed due to the risk of aflatoxin transmission to milk. Surprisingly, zearalenone was only detected in silages with no rust infestation and the levels exceeded those that have caused reproductive problems in dairy cows. In conclusion, rust infestation reduced the nutritive value and fermentation of corn silage, and resulted in high levels of aflatoxin that made the silage unsafe to feed. Inoculant application reduced adverse effects of rust infestation on the fermentation and increased NDF digestibility of clean and medium rust silages. In high-rust silages, inoculant application also decreased mold growth, increased aerobic stability, and prevented aflatoxin production. Silages with no rust infestation had high levels of zearalenone, suggesting that mycotoxin binders may be needed when late-harvested summer corn silages are fed to dairy cows in Florida.

Reference

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Notes

Direct Comparison of Natural Service vs. Timed AI: Reproductive Efficiency and Economics

Fabio Lima[1], Albert De Vries[2], Marie–Joelle Thatcher[1], Carlos A. Risco[1] and William W. Thatcher[2]
[1]College of Veterinary Medicine and
[2]Department of Animal Sciences, University of Florida
Gainesville, FL 32610
riscoc@vetmed.ufl.edu

Introduction

Despite the considerable advantages of artificial insemination (AI), a significant number of dairy producers use natural service (NS) for their breeding program. In a survey on bull management practices of California dairymen, 84 % reported use of NS as a component of their breeding program management (Champagne et al., 2002). The most common use of NS was after unsuccessful AI attempts. In dairy herds located in the northeast region of the US, reported use of NS, as a component of the breeding system, varied from 55 to 74 % (NAHMS, 2002; Smith et al., 2004). In a study that compared pregnancy rates **(PR)** between AI and NS in Georgia and Florida dairy herds, the use of NS alone or in combination with AI was reported to be around 70 % (De Vries et al., 2005). A survey that examined current management practices in 103 herds participating in the Alta Genetics (Watertown, WI) Advantage Progeny Testing Program, reported that 43 % of herds used a clean-up bull. Non-pregnant cows were moved to the clean-up pen after 6 failed AIs or 232 d postpartum. (Caraviello et al., 2006). A common perception among dairy producers that use NS is that more cows are bred by NS compared to AI because human errors in estrus detection are avoided when bulls are used. These producers also contend that a NS breeding program is cheaper and easier to manage than an AI program.

Bulls used for NS are under the influence of nutritional, environmental and management factors that may affect their ability to impregnate cows. Whether or not NS bulls classified as satisfactory potential breeder maintain reproductive soundness during the time that they are used for breeding is not known. With the understanding that bull fertility in an integration of biological as well as management factors, the potential for deviation in reproductive potential is possible.

Pregnancy rate is defined as the number of pregnant cows eligible to become pregnant over a specified period of time (every 21 days) and is the product of estrus detection and conception rate. A high PR at the end of the postpartum voluntary waiting period results in more cows pregnant earlier in lactation, maximizing farm income (Risco et al., 1998). Poor estrus detection is a major factor that contributes to low PR on many dairy farms in Florida and throughout the US. The use of NS and timed artificial insemination (TAI; cows are AI at a fixed time without being detected in estrus) are two options that minimize problems with estrus detection. This paper discusses research that compares reproductive performance between TAI and NS breeding systems.

NS vs. AI at detected estrus

Several studies have compared reproductive performance between AI at detected estrus and NS breeding systems. Seasonal effect on AI and NS fertility in dairy herds was evaluated under field conditions using Dairy Comp 305® (Valley Agricultural Software, Tulare, CA) (Niles et al., 2002). During periods of heat stress (summer), overall PR dropped for cows bred by either AI or NS, and no difference in PR was found between NS vs. AI bred cows during the cool season. In herds with poor estrous detection, NS resulted in a higher PR (Niles et al., 2002). The effects of four combinations of AI and NS breeding systems **(BS)** on production and reproduction responses were evaluated using Dairy Herd Improvement Association   herd summary information (Smith et al., 2004). Herds were assigned to BS by percentage of NS usage as follows: 1) 0 %, 2) 1 to 20 %, 3) 21 to 89 %, and 4) 90 to 100 %. Actual calving interval was shorter in herds that used mostly NS (BS4) compared with other systems. However, herds using a combination of AI and NS or mostly NS had longer dry periods than herds using all AI. Days dry and the percentage of dry periods greater than 60 d were less for herds that used all AI breeding. Overall efficiency assessed by the percentage of cows in milk and herd milk yield was greater for herds that used all AI and declined as the percentage of NS increased. The effects of AI and NS BS on PR by stage of lactation and season over an 8 year time period showed that the use of NS bulls did not result in meaningful advantages or disadvantages in terms of PR over time (De Vries et al., 2005).

In contrast to the previously cited studies, a California study that compared calving to conception intervals for cows in AI pens with cows exposed to NS sires found that cows AI had a higher risk for pregnancy across all days in milk (**DIM**) (Overton and Sischo, 2005).

NS vs. timed AI: a field observation

A field observation is presented that demonstrates the ability of TAI and re-synchronized timed TAI to enhance herd PR in a large commercial dairy herd that utilized extensively NS (Thatcher et al., 2006). The herd was comprised of 2000 cows with approximately 1200 calving per year. Cows were housed in covered barns with self-locking stanchions and free-stalls.

Bulls used for NS underwent a breeding soundness exam and entered the NS program if classified as a satisfactory potential breeder according to the guidelines for the SFT (Chenoweth, 1992). Breeding soundness exams were repeated every 6 months and bulls that graded unsatisfactory were replaced. The BCR was one bull per twenty cows. The ratio in each pen was maintained based upon a monthly diagnosis of non-pregnant cow numbers. Bulls were rested for 14 d after 14 d of cow exposure. Cows more than 127 dim and diagnosed non-pregnant were identified. A decision was made to implement a timed AI program for these cows that were considered infertile (not pregnant by ample time exposure to bulls) in the NS program as described. The average day in milk was 356 for the 245 cows enrolled during the period from January 11 to June 21, 2006. The timed AI program entailed a presynchronization (i.e., two injections of $PGF_{2\alpha}$ given 14 d apart), followed by Ovsynch (i.e., GnRH given 14 d after the 2nd $PGF_{2\alpha}$ injection of presynchronization, followed by $PGF_{2\alpha}$ given 7 d after the first GnRH injection, and a second GnRH injection given 2 d after $PGF_{2\alpha}$ with a timed insemination between 16 to 20 h after the second GnRH), and a resynchronized timed AI with the Ovsynch protocol repeated in cows diagnosed open by ulstrasound at 32 d after the previous timed AI. Resynchronization was repeated twice in which cows went through three possible timed AI. This reproductive management sequence coordinated animal handling to 3 d of the week. As a population of infertile cows to NS, a cumulative PR of 56 % was obtained based upon ultrasound diagnosis at 32 d for the first three TAIs. At 60 d after insemination, 37.8 % of the inseminated cows were diagnosed pregnant via palpation per rectum. Pregnancy losses between d 32 and 60 were 32.5 %, which is substantial and reflects that the cows as a group were indeed sub fertile. Nevertheless, 37.8 % of the cows were pregnant that had not conceived through NS management. Although mean PR declined from first to third service (i.e., 37.5, 28.7 and 14.4 %, respectively), overall PR (i.e., either at day 32 or 60), did not differ for the intervals from 200 to 700 dim. The take home message from this field experience is that reproductive management centered on timed AI resulted in 38 % of subfertile cows becoming pregnant.

Direct comparison of timed AI vs. NS

A large study was recently completed in Florida comparing reproductive performance between two different breeding systems without estrous detection; TAI and NS (Lima et al., unpubl.). One thousand fifty five lactating Holstein dairy cows from a single farm located in north central Florida were randomized at 42 ± 3 d postpartum into two groups TAI (n=543) and NS (n = 512), and cows were blocked by parity (primiparous and multiparous).

Cows in the TAI group were pre-synchronized with 2 injections of $PGF_{2\alpha}$ (25 mg; Estroplan®, Pfizer Animal Health, New York, NY) given at 42 ± 3 and 56 ± 3 d postpartum. Fourteen days after the second $PGF_{2\alpha}$ cows were given an injection of GnRH (100 µg; Fertagyl®, Intervet Inc, Milboro, DE) followed 7 d later by an injection of $PGF_{2\alpha}$, and a second injection of GnRH 56 h after $PGF_{2\alpha}$. Timed AI was performed 16 h after the second injection of GnRH. Eighteen days after TAI, cows received a CIDR insert (Eazy-Breed; Pfizer Animal Health; New York, NY) followed by insert removal and GnRH administration 7 d later (25 d after TAI). Cows were diagnosed for pregnancy by ultrasonography examination at 32 d after TAI. The presence of an embryo with a heartbeat was the criterion for pregnancy. Cows diagnosed pregnant were re-examined by palpation per rectum of the uterus 28 d later (i.e., 60 d gestation) to reconfirm pregnancy status and to identify pregnancy loss. Cows diagnosed not pregnant at 32 d after TAI were administered $PGF_{2\alpha}$, followed with an injection of GnRH at 56 h after $PGF_{2\alpha}$. Timed AI was performed 16 h after GnRH. Cows not-pregnant were resynchronized again with the same protocol until diagnosed pregnant or at a maximum of 223 d postpartum.

Cows in the NS group received $PGF_{2\alpha}$ (25 mg; Estroplan®, Pfizer Animal Health, New York, NY) at d 42 ± 3 and 56 ± 3 and moved to a bull pen at 70 ± 3 d postpartum. The movement of cows into the bull pen 14 d after the last $PGF_{2\alpha}$ treatment (70 ± 3 d postpartum) was performed to synchronize estrus and bull breeding close to 80 d postpartum, i.e. similar to the TAI group. After 42 d of being turned in with bulls, cows underwent an ultrasonography examination to determine pregnancy status. This allowed a diagnosable gestation length in pregnant cows to vary from 28 to 42 d. The presence of an embryo with a heartbeat was the criterion for pregnancy between 28 to 34 d by ultrasonography, and gestation length from 35 to 42 was determined by size of the amniotic vesicle. Cows diagnosed not pregnant were re-evaluated for pregnancy status 28 d later to allow pregnancy diagnosis in cows pregnant < 28 at previous diagnosis (i.e. now 28 to 56 d of pregnancy), utilizing the same criteria described above. This procedure was similar for subsequent groups assigned weekly to the NS group. Cows diagnosed pregnant were re-confirmed 28 d later to identify pregnancy loss. The BCR in the NS herds was one bull per twenty open cows. Bulls were rested for 14 d after 14 d of cow exposure.All cows underwent a body condition score evaluation **(BCS)** at 70 ± 3 d postpartum prior to being introduced with bulls (NS group) or receiving the GnRH injection (TAI group).

Results are presented for data obtained during the cool and warm time of the year (November, 2006 to March, 2008). Outcomes of interest were rate of cows becoming pregnant up to 223 d postpartum. Days postpartum when pregnancy occurred was calculated by subtracting the days of pregnancy from the day postpartum when pregnancy was diagnosed. For example, a cow diagnosed pregnant 32 d at 130 d postpartum was pregnant at 98 d (i.e.130-32 d) postpartum. The interval between services in the timed AI group was 35 d due to the re-synchronization protocol employed. Therefore, for cows in the TAI group, d postpartum when pregnancy occurred to first, second, third or fourth service were classified as follows: d 80 ± 3 first service; d 115 ± 3 second service; d 150 ± 3 third service; and 185 ± 3 d for fourth service. For cows in the NS group, when pregnancy was diagnosed from 28 to 56 d, first, second, third or fourth services were classified at d 70 to 91, d 92 to 113, d 114 to 135 and 136 to 157 d postpartum, respectively. A cow in the NS group diagnosed 40 d pregnant at 150 d postpartum would have conceived at 110 d (i.e. 150 – 40 d) postpartum or at her second service.

Rate of pregnancy by day postpartum was analyzed with survival analysis using Cox's proportional hazards regression model (PROC LIFETEST and PROC PHREG, SAS, 2003 respectively). Categorical outcome variables such as first and second, service conception risk were analyzed using logistic regression PROC LOGISTIC of SAS 9.1; (SAS, 2003) with logit link and the appropriate distribution for dichotomous or count outcome variables (n=1055).

All models for reproductive outcomes included the main effects of treatment (NS vs. TAI), parity (primiparous vs. multiparous), BCS (≤2.75 or > 2.75), and season (Temperature Humidity Index [THI maximum ≥ 72]; Hot, April 22, 2007 to October 22, 2007; Cool, October 23, 2006 to April 21, 2007 and October 23, 2007 to March 13, 2008). Modeling was performed using stepwise selection logistic procedure with the significance level of entering (entry=0.30) and the significance level of stay (stay=0.20). The model fit statistics were performed by comparing the difference in the deviances by the likelihood-ratio statistic test.

Table 1 shows the PR to the first 2 services in cows bred by NS or TAI. During the cool season, first service and second service PR for NS (36.98%, 29.85%, respectively) and for TAI (44.31%, 30.67%, respectively) did not differ. As expected, PR to first and second service was lower during the warm season, but did not differ between NS and TAI (27.36%, 24.04%; 27.06, 29.56%; respectively). This finding agrees with those of Niles et al., 2002 that during periods of heat stress (summer), overall PR drops for cows bred by either AI or NS.

Median times to conception up to 223 DIM estimated from 32 d after breeding for TAI cows and 28 to 56 d for cows bred by NS were 109 d (95 % CI = 104 to 125) and 116 d (95 % CI = 115 to 117), respectively (Figure 1). There was no difference between the treatment (NS vs. TAI) survival curves. However, the rate when cows became pregnant during the first cycle at the end of the VWP between NS and TAI was different. For NS cows, PR to the first service cycle 21 days after bull exposure (70 to 91 DIM), was 33.0 % (cool and warm season) representing a PR of 1.57 cows / day. Conversely, for the TAI group, with a first service PR of 37% (cool and warm season) during the 10 days of the OvSynch and TAI protocol (70±3 to 80± 3 DIM), the PR was 3.7 cows per day. Figure 2 shows that 25 per cent of all pregnant cows conceived for NS at 84 DIM (95% CI=83to 86) and 81 days for TAI (95% CI = 80 to 82). We attribute this finding to the TAI management and not necessarily better fertility from TAI. In the NS group, pregnancy is dependent on the ability of the bull to identify cows in heat, breed, and impregnate them on a daily basis. When compared to NS, more cows are synchronized to be bred at a given acute service period in the TAI group. For the TAI group, it took five services for cows to become pregnant up to 223 DIM. In contrast, the NS group cows had more opportunities to be bred (at least 7 services) due to daily bull exposure and cows re-cycling every 21 to 23 days.

Body condition score for first service and parity to overall PR affected pregnancy. Cows with a BCS ≤ 2.75; had lower odds to conceive (AOR= 0.73; 95 % CI= 0.56 to 0.09; (PR=32.33%) compared to cows with a BCS > 2.75 had PR=38.85%. Primiparous cows had greater odds to conceive (AOR = 1.91; 95 % CI = 1.32 to 2.88 , PR= 87.32%) compared to primiparous cows(PR= 77.69%)

Critical to TAI programs is protocol compliance, semen handling and insemination technique. Pregnancy rates of 37 % to first TAI and 30 % to the re-synchronization (second service) of open cows indicate an acceptable response to TAI in the present study in a large commercial dairy setting that implemented a TAI program for the first time. We attribute the good reproductive performance obtained in the NS group to stringent bull management practices employed: bull selection, periodic breeding soundness evaluation of all bulls, removal of bulls that are not sound, and replacing unsound bullswith sound bulls, allowing for a two week cow exposure followed by a two week rest period, and BCR of 1:20.

Economic comparison NS vs. timed AI

An attempt was made to compare the costs and revenues of the NS program to the timed AI program in the direct comparison study. Partial budgets are in Tables 2 and 3. Labor costs and pregnancy rates in both programs were assumed equal based upon experimental results described above. The net cost of the NS program was a $92.29 per slot per year. For the timed AI program, the net cost was $51.61 per slot per year. Therefore, the NS program cost $40.68 per slot per year more, including an opportunity cost of $13.67 for less genetic progress. Without considering genetic progress, the NS program would cost $27.02 more per slot per year.

Overton (2005) calculated an extra cost of $10.27 per slot per year for a NS program compared to an AI program including 30% timed AI in large western Holstein dairy farms. He also assumed equal pregnancy rates. Overton assumed that for every 2 NS bulls, 1 extra cow could enter the herd. Thus, his AI program allowed for more cows than the NS program. When the number of cows in both programs was assumed equal, the extra cost per slot per year for a NS program was reduced to $3.61.

If there were differences in pregnancy rates between both programs as evaluated in this experiment, they could be easily incorporated into the partial budgets. An increase in pregnancy rate of 1 percentage point (e.g. 15% to 16%) is worth approximately $15 to $20 per slot per year with lower values at higher pregnancy rates (De Vries, 2007).

Conclusion

Cows sired by proven AI sires produced 1400 kg more herd lifetime actual milk and were $148 more profitable when compared to daughters of non-AI sires (Cassel et al., 2002). Despite this economic advantage of AI over NS, use of NS remains popular in many dairy herds. Studies evaluating reproductive performance between AI and NS do not show a clear disadvantage or advantage for using NS over AI. In herds with low PR related to poor estrous detection, uses of TAI or NS are viable options. Both of these breeding systems require strict attention to management compliance in order to optimize reproductive performance. Natural service breeding programs are expensive when direct and indirect costs are considered. Economic analysis within the content of this study showed that TAI is less expensive than NS and allows for immediate submission and a more rapid PR of all animals at the designated waiting period.

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Table 1. Pregnancy rate for first and second service in lactating dairy cows bred by NS or TAI. Season affected pregnancy but there was no season by treatment effect

	First service		Second service	
	NS	TAI	NS	TAI
Cool Season	36.98% (115)	44.31% (144)	29.85% (60)	30.67% (50)
Warm Season	27.36% (55)	27.06% (59)	24.03% (31)	29.56% (47)

Table 2. Partial budget of the NS program

		$ / per slot per year
Cows calving: 88%		
Purchase cost bulls	0.062 x 1148 =	(71.48)
Price per bull: $1148		
Bulls on dairy per cow: 0.060		
Average number of days bull is on farm: 354		
Total bulls needed entering herd per cow per year: 0.0062		
Additional bull cost after purchase	0.062 x 152.50 =	(9.50)
BSE, vaccines, other tests, per bull entering herd: $152.50		
Bull feed cost	(0.028 x 3.30 + 0.033 x 2.37) x 365 =	(61.67)
Cows:bull ratio in breeding pen: 38:1		
Bulls in resting pen: 0.028 per cow, bulls in breeding pen: 0.033 per cow		
Feed cost per day in breeding pen: $3.30		
Feed cost per day in resting pen: $2.37		
Feed cost per bull per year: $1021		
Sale revenues bulls	0.23 x 0.062 x 670 + 0.67 x 0.062 x 1116 =	63.10
23% bulls culled prematurely		
Sale price bull culled prematurely: $670		
Sale price bull culled healthy: $1116		
Labor cost bull management		(2.06)
Pregnancy check cost		(7.09)
Prostaglandin cost cows	0.88 x 2 x 2.035 =	(3.59)
2 shots at $2.035 per injection		
Net returns natural service program		(92.29)

Table 3. Partial budget of the timed AI program

		$ / slot per year
Cows calving: 88%		
Per cow entering experiment:		
Cows not pregnant after experiment: 15%		
Prostaglandin shots: 2.68 @ $2.035		
GnRH shots: 6.21 @ $1.84		
CIDR inserts: 2.68 @ $8.43		
Breedings: 2.68 @ 9.00		
Hormone and breeding cost		
Prostaglandin cost	0.88 x 2.68 x 2.035 x 1.15 =	(4.81)
GnRH cost	0.88 x 6.21 x 1.84 x 1.15 =	(10.09)
CIDR cost	0.88 x 2.68 x 8.43 x 1.15 =	(19.93)
Breeding cost	0.88 x 2.68 x 9.00 x 1.15 =	(21.28)
Genetic advantage AI sires	0.26 x 52 =	13.67
Calvings from 2nd or greater lactation cows: 64%		
Single heifer calves: 48%		
Heifer calves surviving until freshening: 85%		
Calves with a genetic advantage: 64% x 48% x 85% = 26%		
Average net merit AI sires: $361		
Average net merit NS sires: $163 (estimated)		
Time adjusted advantage net merit AI sires: (361-163)/3 x (1/1.08)^3 = $52		
Labor cost TAI		(2.06)
Pregnancy check cost		(7.09)
Net returns timed AI program		(51.61)

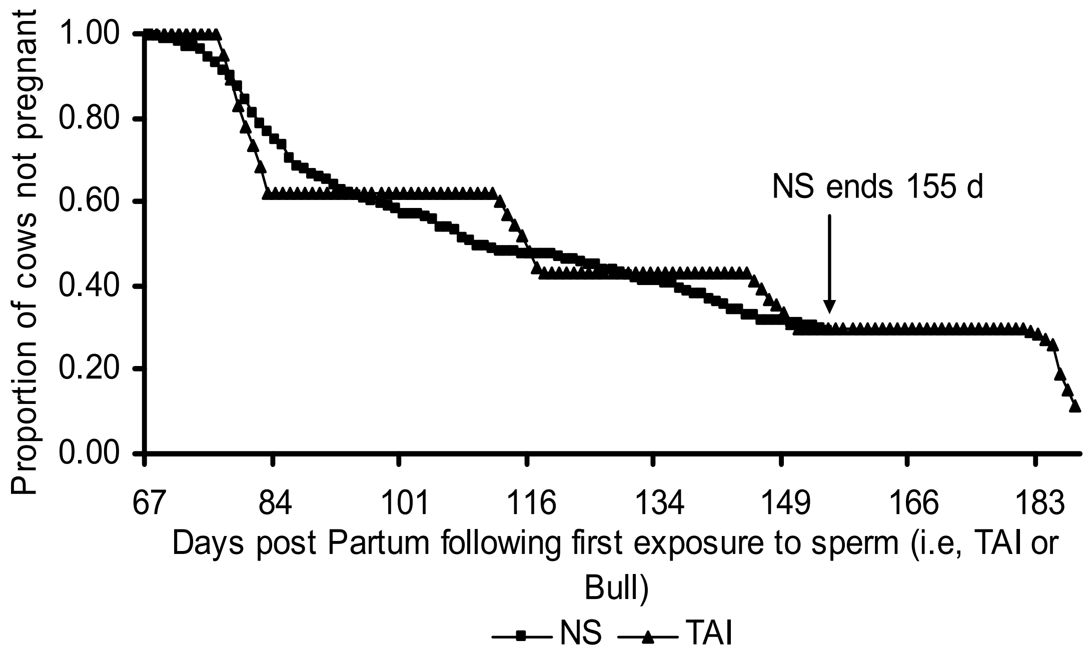

Figure 1. Survival curves for accumulated open cows based on an ultrasound pregnancy diagnosis at D32 for timed AI (▲) cows and cows bred by NS (■) following four services. Median times to conception up to 223 DIM estimated from 32 d after breeding for TAI cows and 28 to 56 d for cows bred by NS were 109 d (95 % CI = 104 to 125) and 116 d (95 % CI = 115 to 117), respectively.

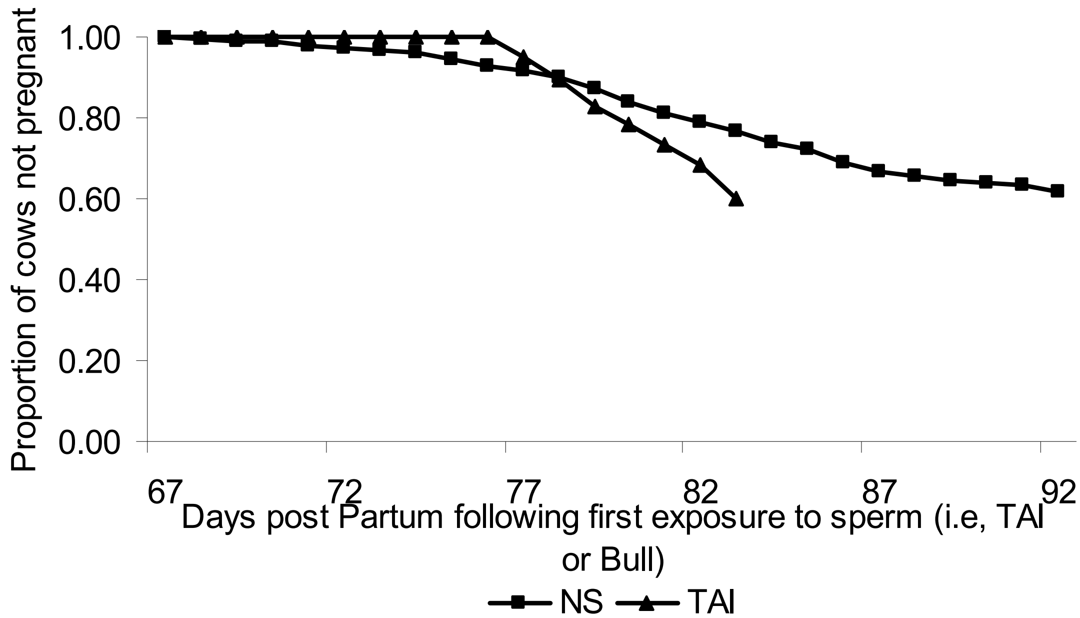

Figure 2. Survival curves for accumulated open cows based on an US pregnancy diagnosis at d 32 for TAI (▲) and d 28-56 for NS (■) for first service. Twenty five per cent of all pregnant cows conceived for NS at 84 DIM (95% CI=83to 86) and 81 days for TAI (95% CI = 80 to 82).

Notes

Sexed Semen Economics

Albert De Vries
Department of Animal Sciences, University of Florida
Gainesville, FL 32611
devries@ufl.edu

Introduction

The goal with sexed semen is to produce a calf of a specific sex. Sexed semen is widely available now and many dairy producers are using it to obtain more (and better) heifer calves. Because of its higher cost per dose of semen, combined with a reduced conception risk, sexed semen is primarily recommended for use in virgin heifers. The use of sexed semen varies widely among dairy producers. Some producers do not use it at all while others use it on heifers only, and some use it on both heifers and cows (Anonymous, 2008). With heifers (and cows), sexed semen is usually used for first and perhaps second breedings, but typically not for later breedings. The economic benefits of the use of sexed semen are different for every dairy farm. This paper summarizes some of the recent literature on sexed semen in dairy heifers and cows. Further, the economics of the use of sexed semen in heifers and cows are evaluated.

Technology

Sexed semen is semen in which the fractions of X-bearing (female) and Y-bearing (male) sperm have been modified from the natural mix through sorting and selection. Sorting is based on flow cytometrical cell sorting for DNA content of sperm (Weigel, 2004; Seidel, 2007). The method works by staining sperm with a DNA-binding fluorescent dye. The bovine Y-chromosome bearing sperm contain 3.8% less DNA than the X-chromosome bearing sperm. Because of the dye, the male and female sperm can be electrically charged differently. This allows for their separation by a fluorescence-activated cell sorter (Seidel, 2007). The method is fairly accurate with ~90% of the sperm containing the desired sex (Garner and Seidel, 2003; DeJarnette et al., 2008). Sexed semen will contain a lower concentration of sperm per straw (approximately 2 million) than non-sexed semen (approximately 20 million) because the sorting process is relatively slow. Because of lower doses of sperm per straw, and possibly a negative effect of the sorting process, fertility of sexed sperm is typically lower compared with conventional sperm (Garner and Seidel, 2003; DeJarnette et al., 2008). Semen cell sorting technology is continuously being improved and improvements in sorting capacity, fertility and reduction of semen cost are expected (Seidel, 2007).

Random chance and sexed semen results

Random chance affects the results of breeding cows with sexed semen in at least two ways. First, when the true probability of conception (conception risk) is say 50%, you may get more or fewer animals pregnant than half. This is the same effect as flipping a coin 10 times and getting more or fewer than 5 heads. The binomial distribution is the statistical law that calculates the chances of binary results when the outcomes are independent and each trial has the same probability of success. For example, if every animal has a probability of conception of 50%, the chances that you will get 5 animals pregnant out of 10 bred animals is only 25%. There is a 42% chance you get 4 or 6 animals pregnant, a 24% chance you get 3 or 7 animals pregnant, etc. There is even a 2% chance you get 0 or 10 animals pregnant. If you bred 100 animals with a 50% probability of conception for each animal, the chance that you get exactly 50 animals pregnant is only 8%. The chance you get between 45 and 55 animals pregnant is 73%. If the probability of conception is only 40%, the chances you get between 45 and 55 animals pregnant decreases to 18%. The chances you get between 40 and 50 animals pregnant is 52%. Such chances are usually not intuitive to most people.

In practice, we usually don't know the true probability of conception, but measure it as number animals pregnant divided by the number bred. When you have few animals bred, you are left with quite an uncertainty about what the probability of conception is if you were to breed more animals. So don't jump to conclusions too fast when you have few animals bred and your conception risk is lower than expected.

Similar probability statistics apply when judging if sexed semen gives you the expected 90% heifer calves. If you had 10 calves born from sexed semen, there is only a 39% chance that 9 of them are heifers and 1 is a bull calf, as you would expect. There is a 35% chance all 10 calves are heifer calves and a 19% chance you get 8 heifer calves. There is even a 16% chance you get at most 4 heifer calves and 6 or more bull calves. Out of a 100 calves born, we expect to get 90 exactly heifer calves only 13% of the time when each calf truly has a 90% probability of being a heifer calf. You have a 94% chance that you'll get between 85 and 95 heifer calves out of 100 calves born.
Sexed semen technology gives on average close to 90% female calves (DeJarnette et al., 2008). But don't be surprised if you see more or fewer than 90% heifer calves, especially when you are using it on a limited number of animals.

Economic considerations

Calf prices

The value of sexed semen comes primarily from a greater chance of getting a heifer calf than a bull calf. Where bull calves may be worth only $50 these days, heifer calves may be worth $450. When heifer calves are not sold, the value of the heifer calf is primarily the difference between the cost to raise a heifer calf to freshening, and the purchase price for a similar freshening heifer. Say you can purchase a heifer for $2000 but raise your own heifer calf for $1600 then the value of the heifer calf is $400. This assumes there is no difference in the quality of the freshening heifer (genetics, biosecurity, age at first calving, value of the calf in the freshening heifer, etc.) and ignores the time value of money as will be shown below. Estimates for heifer calf prices vary a lot, but run typically from $400 to $540 (DairyProfitWeekly, 2008). Bred heifers (7 to 9 months pregnant) are anywhere from $1600 to $2275.

Notice that the value of a newborn heifer calf depends on whether you raise the heifer yourself or sell her and later purchase a springing heifer of equal quality. The time value of money should be considered. For example, if the market value of a newborn heifer calf is $450, the purchase price of a 23-month old heifer is $2300 (and raised one month until calving) and the cost of raising a heifer until 24 months of age is $80.43 per month ($1930 total, or $2.64 per day), then both strategies result in a total cost of $1930, not considering the time value of money. However, if we consider 8% annual interest discounted monthly, then the present value of the newborn heifer calf that you keep to be raised decreases to $264. The advantage for the purchase option is caused by a delay of cash outflow until 23 months from the birth of the calf while there is a cash inflow today from the sale of the heifer calf. The present value of the $2300 for the purchased heifer 23 months from today is only $1974. At 8% interest, the present value of the raising strategy is a cost of $1778 and the present value of the purchasing strategy is $1593. Table 1 lists some values for a new born heifer calf when she is raised or sold. Not considered in these calculations is the risk that a heifer to be raised is being culled for failure to conceive or otherwise; the value of a heifer price decreases then even more.

Table 1. Value of a new born heifer calf when she is either raised (Raised) or sold and a pregnant heifer is purchased back (Sold)

Raising cost ($)	Purchase cost ($)	Value of new born heifer calf ($)	
		Sold	Raised
2000	2300	450	203
1800	2300	450	380
1600	2300	450	557
2000	2000	450	-55
1800	2000	450	122
1600	2000	450	299

Assumptions: 8% annual interest, discounted monthly. Market price newborn heifer calf is $450. Raising cost is equal in each month. Heifer purchased at 23 months of age and raised on farm one more month. Heifers calve at 24 months of age. Culling of raised heifers not considered.

Semen prices

Sexed semen is more expensive than conventional semen. The average premium may be approximately $30 compared to conventional semen (Fetrow et al. 2007; Anonymous, 2008). This varies with sire.

Sexed semen fertility in heifers

When the decrease in fertility with sexed semen is discussed, first pay attention to the difference between a percent and a percentage point. These are easily to be confused.

An example may clarify the difference. For example, a 25% decrease in fertility from a conventional conception risk of 55% results in a 41.3% conception risk (55% - 0.25 x 55%). A decrease of 25 percentage points from 55% is simply 30% (55% - 25%). This is quite a difference! Writers are sometimes sloppy when reporting effects on fertility.

Recent reports suggests that on average fertility of sexed semen is about 75% (70 to 80%) of the fertility of conventional semen in virgin heifers (a decrease of 20 to 30%) (DeJarnette et al., 2007).

A recently published study compared conception risks of different doses of sexed semen in virgin heifers and cows (DeJarnette et al., 2008). Three bulls were sorted and half of the semen was designed for use in virgin heifers and the other half for use in lactating cows. Participating herds were selected to have the potential to achieve conception risks of ≥ 60% in virgin heifers and ≥ 30% in lactating cows, or both. Sexed semen should be used only in females displaying standing estrus. Results of breedings with conventional semen were not statistically analyzed because of the inconsistencies in use and application of both types of semen (cherry picking among animals, for example). Sexed and conventional semen were supposed to be used randomly within 2 months of delivery. Results were available for 51 herds (2125 services) that used sexed semen in heifers and 56 herds (2369 services) that used sexed semen in lactating cows between days 60 and 150 post calving.

There was a sire x sperm dosage interaction in heifers (dosage had no effect on conception risks in sire C, but was greater with higher dosages in sire A). Average conception risks for the 3 sires were 46%, 41%, and 53% in heifers. Among the 14 herds that used ≥ 50 doses of sexed semen in heifers, conception risks were 47% ± 3.2% (range 33 to 68%). Ten of these herds reported the use of ≥ 50 doses of conventional semen in heifers and had conception risks of 43% ± 3.6% (range 29 to 61%). Note that these conception risks were for a combination of first and later services. Conception risk in 2nd and greater services reduces rapidly in heifers. Therefore, these results do not provide evidence that conception risks with sexed semen were reduced compared to conventional semen.

Sperm dose alone does not explain the reduced fertility, however (Garner and Seidel, 2003). Successful use of sexed sperm requires excellent management of cattle, careful handling of sperm and use of a skilled inseminator (Seidel, 2007). The level of reproductive efficiency plays an important role in the expected conception risk with sexed semen, with larger differences when reproductive management is poor. Weigel (2004) reported on a field trial conduced in 2001 in Wisconsin involving 816 Holstein heifers. Average conception risk with unsexed semen was 58% across herds, while conception risks with sexed semen were 21%, 37% and 34% in herds with below average, average, and above average reproductive performance.

When reproductive management is excellent, risks of conception for breeding heifers are only slightly lower than normal using low doses of sexed semen (Seidel, 2007). Seidel (2003) earlier reported that with excellent management of cattle, fertility with low doses of sexed sperm were 70 to 80% of normal doses of conventional sperm. Some studies reported 90% fertility. With marginal management, fertility of sexed semen could decrease to 50 to 60% of conventional sperm.

It is very difficult to get unbiased field comparisons of sexed sperm with conventional sperm due to likely bias in semen use (Garner and Seidel, 2008; DeJarnette et al., 2008). Without well-controlled studies, dairy producers are more likely to cherry-pick the most fertile animals as candidates for sexed semen.

Recent communications with dairy producers revealed that they typically observe a 10% to 15% percentage point in conception risk (say from 55% to 45%, a reduction of 18%, or from 55% to 40%, a reduction of 28%). Taken together, field research indicates that you can on average expect ~ 45% first service conception risk for virgin heifers with well managed heifer reproduction programs.

Sexed semen fertility in cows

Based on the reduced fertility of sexed semen in heifers, sexed semen is not recommended in for use in cows (Linderoth, 2008). Data on conception risk in cows when using sexed semen are scarce, however. In a Finish study, 306 lactating dairy cows were bred by AI, of which 157 were inseminated with 2×10^6 frozen/thawed sexed sperm and 149 with 15×10^6 frozen/thawed unsexed (conventional) sperm. The average conception risks were 21% for the sexed-sperm AIs and 46% for the conventional control-sperm AIs, a drop of 54% or 25 percentage points (Andersson et al., 2006). This decrease was significantly different, so chance alone most likely cannot explain this decrease.

In a recent small study in the US, 172 cycling lactating Holstein cows were inseminated with units of 10×10^6 conventional sperm or 2×10^6 sexed sperm (Crichton et al., 2006). Conception risks at first insemination were 55.6% for the conventional sperm and 40.4% for the sexed sperm. Due to the low cow numbers, the difference was not significantly different, however. The authors concluded that “successful use of sexed sperm in dairy cows, which approached a voluntary waiting period of 80 days in milk, was achieved with cows that were selected for reproductive status prior to insemination.” But they did not report economics results.

In another recent study, 2197 Holstein cows were either bred with 20×10^6 sperm/dose of conventional semen or 2×10^6 sperm/dose of sexed semen (Schenk et al., 2007). First or second service conception risk were about 25% for sexed sperm and 37.7% for conventional semen, a significant difference of about 12 percentage points. Conception risks for sexed sperm after 84 to 94 days in milk were 7.9 percentage points greater than earlier in lactation (< 84 days in milk) and > 6 percentage points lower in 3rd and 4th lactation cows compared to 2nd lactation cows. There was a real sire effect, with the highest sire having a 6.7 percentage points conception risks greater than the lowest sire. Practically, the authors concluded that sexed semen reduces conception risks by about 12 percentage units and the best conception risks are attained when sexed semen is limited to 1st or 2nd lactation cows after a voluntary waiting period of more than 100 days.

The recent study by DeJarnette et al. (2008) also evaluated the conception risks of sexed semen in cows. Conception risks for different dosages, sires, and parity were not statistically different. Among the 13 herds that used ≥ 50 doses of sexed semen in lactating cows, conception risks averaged 30 ± 2.4% (range 15 to 41%). Among the 26 herds that reported use of ≥ 50 doses of conventional semen in lactating cows, conception risks averaged 30 ± 1.0% (range 21 to 39%). Thus, there was no evidence that conception risks with sexed semen were lower than with conventional semen. Risks of conception with sexed semen in lactating dairy cows can be similar to that of conventional semen if cows have completely normal reproductive characteristics using ultrasound examination, good records, etc. (Seidel, 2007). Such a prescreening of cows is usually impractical.

Effect of service number of heifer conception risks

In a large study by USDA following 537,938 AI services, the average conception risk for Holstein heifers was 56.3% (Kuhn et al., 2006). Approximately 88% of US heifer herds had a 40 to 70% heifer conception risk. They also reported that Jersey heifers actually had lower fertility (52.2%) than Holstein heifers. Conception risk by service number decreases from 53% for first services to 33% for seventh services (Table 2). Chebel et al. (2006) also recently documented this decreasing trend in 6389 Holstein heifers in an Idaho feedlot. The data in these studies were statistically adjusted. Over 60,000 heifer breedings between November 2006 and November 2007 showed that average unadjusted (raw) conception risks from first to seventh service decreased from 56% to 24% (Michael, 2008). Kuhn et al. (2006) reported that the difference in heifer fertility between the 6 major AI organizations providing semen to the US was relatively small at 2.8%, with the average heifer conception risk ranging between 50.3 and 53.1% across the AI organizations.

Table 2. Conception risk (%) and number of breedings by service number in heifers bred with conventional semen in 3 datasets

Service number	Michael (2008)[1]	Kuhn et al. (2006)	Chebel et al. (2006)
1	56 (35,558)	53.3 (341,139)	67.8 (6389)
2	48 (13,841)	52.9 (109,743)	56.3
3	43 (6,032)	49.7 (36,469)	47.7
4	39 (2,263)	47.9 (13,433)	37.2
5	29 (1033)	43.8 (5,119)	
6	25 (601)	39.1 (2,064)	
7	24 (375)	32.7 (907)	

[1] Mostly conventional semen, some sexed semen.

The effect of service number on the conception risk of sexed semen is unclear. A 25% reduction in conception risk would mean that the absolute difference (in terms of percentage points) gets smaller with every service number. A 10% point difference would mean that the relative difference increases by service number.

Age of first calving

The reduction in conception risks with sexed semen will result in a longer breeding period and consequently in a greater age of first calving. The cost to raise breeding age heifers is approximately $2 per day with a range from $1.31 to $2.93 (Kohlman et al., 2008). Thus, the use of sexed semen generally increases the cost of raising the heifer and a delayed entry into the lactating herd.

Another consideration is the effect of age of first calving on the performance as a lactating cow. Heifers that calve too young may produce less milk and have reduced fertility in the first lactation and older heifers might experience more dystocia (Ettema and Santos, 2004). However, the effect of age of first calving depends to a great extend on growth rates. Therefore, it is not likely that extended age of first calving necessarily reduces profitability of lactating cows.

Genetic progress

The effect the use of sexed semen on the rate of genetic progress varies widely and was summarized by Weigel (2004). Without sexed semen, genetic progress is primarily made by the selection of a very small fraction of AI sires. Little selection is possible on the cow side when all heifer calves from cows need to be raised as replacement heifers. Van Vleck (1981) estimated that the rate of genetic progress could increase by 15% if sexed semen was widely available. Later, Baker et al. (1990) suggested that the use of sexed semen in elite cows and sires would have a very minor impact on the rate of genetic progress. The expected annual increase in breeding value from using the Net Merit selection index, not considering sexed semen, is for example 7.6 lbs fat, 172 lbs milk, 0.6 months productive life, and 0.14% daughter pregnancy rate (VanRaden et al., 2006). Sexed semen is usually not available from the best sires.

Most dairy producers do not or cannot rank their heifers for genetic merit. They either breed all heifers, or a random group of heifers, to sexed semen. The generation interval is reduced, however, if heifers become a major supplier of the next generation of animals. The value of increased genetic gain from the female side can often be ignored in practice.

Dystocia

Heifers and cows that calve with female calves have lower risks of dystocia and lower expected dystocia related costs. Fetrow et al. (2007) estimated that the reduced losses from dystocia when sexed semen is used in heifers are about $5.38 per calving. In cows, reduction of dystocia from the use of sexed semen was estimated at $1.48. Cady found that calving heifers with bull calves had a 10 percentage point greater risk of dystocia. At $147 per case, this results in $14.70 per bull calf (reported by Fetrow et al., 2007). They concluded that the reduction in dystocia should probably not be the principal driver for sexed semen use.

Calculations for heifers

Recommendations for commercial application of sexed semen have been primarily limited to heifers, because of the expected lower fertility and higher cost of sexed semen (Garner and Seidel, 2008). It is useful to explore the combinations of assumptions that make sexed semen profitable. A spreadsheet was developed to calculate the value of sexed semen in heifers given sets of assumptions. This spreadsheet is similar to the model by Fetrow et al. (2007), except that it does not include the value of female genetic progress, which in practice can often be ignored.

Table 3. Key default assumptions for heifer calculations

Age at first breeding: 400 days
21-day service rate: 65%
Conception risks conventional semen: 60% first service, a reduction of 5.75 percentage points per later service
Conception risk sexed semen: 75% of the conception risk of conventional semen
Cost to raise heifers: $2 per day
Maximum number of breedings: 8
Number of sexed semen breedings: first 0 to 8 breedings, remainder with conventional semen
Annual discount rate: 8%
Market value raised but culled open heifers: $980 or less
Market value calving heifer (without value of her calf): $1800
Semen cost: $40 sexed, $10 conventional
Value heifer calf: $450
Value bull calf: $50
Death loss per calving: 10%
Heifer calves from sexed semen: 90%
Heifer calves from conventional semen: 48%
Extra dystocia cost: $14.70 per bull calf
Genetic progress not considered

Key assumptions, based as much as possible on the literature, are listed in Table 3. Sexed semen is assumed to have a conception risk of 75% of conventional semen. For example, 75% of a 60% conception risk results in a 45% conception risk with sexed semen, a reduction of 15 percentage points. Heifers that are not pregnant after the maximum number of breedings are culled and generate revenue based on their body weight. Growth and body weight of heifers was taken from Ettema and Santos (2004) with a maximum of 1400 lbs. Culled heifers are replaced by purchased heifers so the number of heifers that enrolls in the breeding program equals the number of heifers that calve.

Table 4. Effect of number of sexed semen breedings on heifer statistics (default assumptions)

Statistic	Number of sexed semen breedings						
	0	1	2	3	4	5	6
Profit/heifer enrolled	266	276	276	273	269	266	262
Cull revenue/heifer enrolled	11	16	20	25	30	34	38
Value of calf/heifer enrolled	214	280	312	329	337	342	344
Value of heifer to farm/heifer enrolled	1766	1753	1741	1730	1720	1710	1702
Raising cost/heifer enrolled	1699	1715	1722	1724	1724	1723	1721
Breeding cost/heifer enrolled	19	54	73	85	92	96	100
Dystocia losses/heifer enrolled	7	5	3	2	2	2	2
Profit/pregnancy	269	281	283	282	279	277	275
Profit/breeding	147	131	121	115	111	108	106
Profit/breeding $	14.71	5.40	3.99	3.41	3.10	2.91	2.78
Avg. age at first calving (days)	703	712	716	718	719	719	718
Breedings/heifer enrolled	1.81	2.11	2.27	2.37	2.42	2.45	2.46
Service per conception	1.83	2.15	2.33	2.44	2.51	2.56	2.58
Breeding cost/pregnancy	10.58	25.72	32.28	35.75	37.88	39.34	40.46
%Calving/heifer enrolled	99%	98%	98%	97%	96%	96%	95%
%Heifer calves/heifer enrolled	47%	66%	75%	80%	82%	84%	84%
%Heifer calves/pregnancy	48%	67%	77%	82%	85%	87%	89%
Average conception risk	55%	47%	43%	41%	40%	39%	39%

Given the default assumptions, Table 4 lists the profit per heifer enrolled for 0 to 6 services with sexed semen. Additional services were with conventional semen. Other statistics are shown as well. Sexed semen increases profit at most by $10.35 after 2 sexed semen services. The first 4 services with sexed semen are profitable. The profit is the sum of the cull revenue, value of the calf, and value of the heifer to the dairy and the costs for raising, breeding, and dystocia. With more services by sexed semen, age of first calving typically increases, as well as cost to raise a heifer. When too many services are with sexed semen, the average raising cost per heifer enrolled decrease because the cull rate of open heifers increases more. More sexed semen breedings clearly increase the number of heifer calves born.

The value of sexed semen breedings in the default situation is with $10.35 per heifer relatively small. The value of sexed semen depends greatly on the heifer price, and to a lesser extent on the sexed semen price, and relative decrease in conception risk (Table 5). When heifer calves are worth $300, few scenarios make sexed semen a profitable choice. When heifer calves are worth $500, almost all scenarios make sexed semen a profitable choice. When sexed semen is profitable in the first service, it typically remains profitable in later services as well, even though the conception risk decreases.

Table 5. Sensitivity analysis of value of sexed semen in dairy heifers

Conv-entional CR (%)[1]	Sexed CR (%)	Sexed semen price ($)	Heifer calf value ($)	Profit per heifer enrolled, conventional semen only ($)	Additional profit per heifer enrolled ($) Number of sexed semen services 1	2	3	4
60	50	35	300	202	5	2	(2)	(6)
60	50	45	300	202	(6)	(14)	(21)	(27)
60	45	35	300	202	(10)	(21)	(33)	(43)
60	45	45	300	202	(20)	(38)	(53)	(65)
50	45	35	300	145	5	4	(1)	(5)
50	45	45	300	145	(5)	(13)	(21)	(28)
50	40	35	300	145	(13)	(28)	(42)	(56)
50	40	45	300	145	(24)	(45)	(63)	(80)
60	50	35	500	287	42	56	59	59
60	50	45	500	287	32	40	41	38
60	45	35	500	287	24	28	24	17
60	45	45	500	287	13	11	4	(5)
50	45	35	500	226	39	53	57	56
50	45	45	500	226	28	36	37	34
50	40	35	500	226	16	16	9	(1)
50	40	45	500	226	6	(1)	(12)	(25)

[1]Conventional semen conception risk and sexed semen conception risk at first service. Both have a 5.75 percentage point decrease in conception risk for every later service. Genetic progress is not considered. ( ) means negative additional profit.

Fetrow et al. (2007) used a similar spreadsheet and found similar results as presented here. The sets of inputs they evaluated were slightly different. In their default situation, losses after 6 services with sexed semen were $35. When only one service of sexed semen was used, the loss was $9. The authors concluded that sexed semen in heifers could only be profitable if there are very small differentials in the price of sexed semen (< $25), small impacts on conception risk (< 10%), and no consideration for genetic progress.

Olynk and Wolf (2007) studied break-even heifer calf prices and break-even insemination costs for sexed semen strategies in dairy heifers compared to a strategy with only conventional semen. When conception risk for first service conventional semen was 58% and decreasing after first service, the profit per heifer enrolled was $208. When conception rates for sexed semen were 75% of those of conventional semen and the first service was with sexed semen, the additional profit was $5. Second and later services with sexed semen were not profitable. Under these conditions, break-even heifer calf values were nearly $500. Break-even sexed semen insemination costs were close to $50. Their calculations were quite similar to the ones presented here and spreadsheet by Fetrow et al. (2006) but default assumptions differed in details.

In an earlier analysis, Seidel (2003) hypothesized that with near normal fertility of sexed semen and a premium for sexing in the range of $10 per dose, sexed semen likely would become economically and environmentally beneficial for most cattle. In an analysis with 90% fertility of sexed semen compared to conventional semen and heifer calve prices of $380, he found break-even premiums for sexed semen to be $44 (60% conventional semen conception risks) and $26 (40% conventional sexed semen conception risks). To have sexed semen widely adopted by dairy producers, Seidel thought these premiums should be considerable less than break-even.

Calculations for cows

Sexed semen is usually not recommended in cows because the conception risk is considered too low. Intuitively, sexed semen cost per pregnancy and cost from additional days open (because of reduced fertility) are greater than the value of the calf. A simple analysis confirms this conclusion for some reasonable inputs (Table 6). For the most part, the math is straight forward. The conception risk, expected sex and value of the calf, and the percentage abortions and dead calves determine the expected calf revenue per breeding. Nonpregnant cow costs were calculated as the percentage that failed to get pregnant times the value of a new pregnancy based on conventional semen. The value of a new pregnancy is the sum of the effects of greater days open, increased culling etc. because a cow failed to get pregnant. Figure 1 shows some values of a new pregnancy by lactation number and stage of lactation. Early in lactation, values for a new pregnancy are typically lower for first lactation cows than for later lactation cows. It turns out that the value of a new pregnancy is not a major factor in the value of sexed semen in cows. The value of genetic improvement is again ignored in these analyses.

Table 6. Simple analysis of the value of sexed semen in dairy cows.

Assumptions	Conventional semen	Sexed semen
Conception risk	35%	25%
Semen cost	$10	$40
% Heifer calves @ $450 per calf	49%	90%
% Bull calves @ $50 per calf	51%	10%
% Abortions and dead calves	10%	10%
Value of new pregnancy	$200	$200
Results		
Expected calf value per pregnancy	$218	$369
Cows not pregnant after service	65%	75%
Calf revenue	$76	$92
Semen cost	$10	$40
Non-pregnant cow cost	$130	$150
Net return	($64)	($98)
Gain (loss) of sexed semen breeding	-	($34)

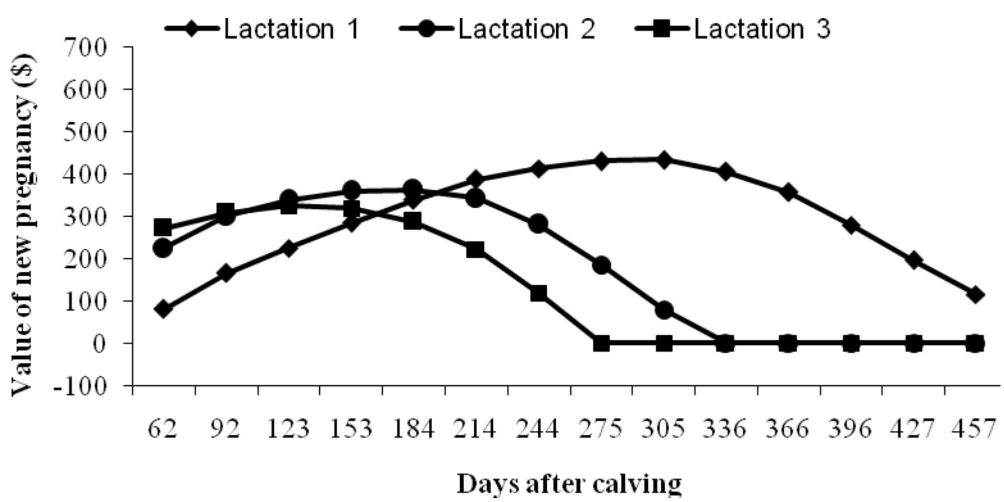

Figure 1. Value of a new pregnancy through conventional semen by days after calving and lactation number (De Vries, 2006).

The sexed semen conception risk must be 31% to make the sexed semen breeding break-even in cost with the conventional semen breeding example in Table 6. Table 7 shows the conception risks with sexed semen in cows needed to at least break-even with the conventional semen breeding costs for a variation of assumptions. Table 7 shows that the break-even sexed semen conception risk is insensitive to reasonable variations in the price of sexed semen, the value of a heifer calf, and the value of a new pregnancy. In the best case for sexed semen, the decrease could be 17% (6 percentage points) when conventional conception risk is 35%, sexed semen costs $40, the value a heifer calf is $500, and the value of a new pregnancy with conventional semen is $100. Therefore, the decrease in conception risk with sexed semen must be quite small under most circumstances to make sexed semen a profitable choice.

Table 7. Conception risks with sexed semen needed to break-even cost with conventional breeding. Conception risks greater than break-even result in an advantage for sexed semen

Sexed semen cost	Value heifer calf	Value of new pregnancy	Conventional conception risk		
			35%	30%	25%
$40	$400	$300	32%	28%	25%
$40	$400	$100	31%	28%	24%
$40	$500	$300	31%	27%	23%
$40	$500	$100	29%	26%	23%
$50	$400	$300	34%	30%	26%
$50	$400	$100	35%	30%	27%
$50	$500	$300	32%	28%	25%
$50	$500	$100	31%	28%	25%

Default inputs: conventional semen: $10; bull calves: $50; abortions and dead calves: 10%. Calculations as in Table 6.

Fetrow et al. (2007) also studied the economics of sexed semen in cows. If the value of sexed semen was based only on getting more heifers, and ignoring genetic progress, then their default loss after one service with sexed semen was $21. This is within the range of a loss of $34 as presented here, given some differences in assumptions. None of their sensitivity analysis showed a positive value of sexed semen without genetic progress.

Other considerations

Fetrow et al. (2007) also evaluated the value of increased genetic gain from the female side in their economic calculations. If heifers can be ranked for genetic merit, then the value of genetic gain was approximately $32 per heifer entering the breeding pool if the top 30% of heifers were bred at least initially with sexed semen and the bottom 70% were bred with conventional semen. Without the value of the genetic gain, the use of sexed semen in 30% of the heifers resulted in a loss of $11 per heifer entering the breeding pool (given a large number of reasonable assumptions about prices, fertility etc.). Therefore, considering genetic gain resulted in a $22 (-$11 + $32) value of using sexed semen per average heifer. The optimum mix was using sexed semen in 40% of the heifers for approximately a $33 value of genetic gain per average heifer entering the breeding pool. Their results show the potential benefit from accurately ranking heifers for genetic merit, using for example parent averages.

Fetrow et al. (2007) also reported that under reasonable assumptions the genetic gain from breeding only top cows with sexed semen still barely overcomes its cost. Therefore, they recommended not using sexed semen in cows.

Earlier, Seidel (2003) reported work by B. Cassell who found that the increased lifetime genetic value imparted to heifers due to selecting from 56% of the cow herd as future mothers (instead of 100% as is typical without sexed semen) was worth about $106. This is approximately $35 annually. If it would take 4 doses of sexed semen to produce a heifer calf that survives and enters the herd, then the genetic premium for the herd per dose is about $9.

Fetrow et al. (2007) and De Vries et al. (2008) discussed a series of other effects from sexed semen that add value that have not been included in most analysis. For example, if the supply of heifers increases greatly, it is expected that the purchase price of heifers reduces to the cost of raising plus a reasonable profit for the seller. This purchase price should be lower than recent high heifer prices because supply is now limited. A greater availability of heifers, or lower purchase prices, also allows dairy producers to cull more low-end cows. Also keep in mind that after a successful sexed semen breeding today, it takes at least 9 + 24 = 33 months before the resulting heifer calf may freshen and start to generate revenues. The heifer market may have shifted from today's prices. Home raised heifers may also have advantages in biosecurity (better immunity, lower incidence of infectious diseases), but these advantages are difficult to quantify. Another factor is the effect of age of first calving on the animal's performance when she has calved. Ettema and Santos (2004) found that heifers that calved too young or too old had lower incomes in their first lactation. In addition, many farms do not have the facilities, feed, labor, capital needed, or permits to raise many more heifers than they are raising now without using sexed semen. The use of sexed semen in in vitro embryo production and embryo transfer was reviewed by Weigel (2004) and is probably quite valuable.

Summary

Conception risks with sexed semen are on average about 25% lower than conception risks with conventional semen, but field trial results have varied widely. A 25% reduction is approximately 10 to 15 percentage points in heifers. When not considering genetic progress, sexed semen is profitable when the value of the heifer calf is generally at least $400 more than the value of the bull calf. The value of sexed semen does not vary much per service number in heifers. Therefore, if a second service with sexed semen is not considered profitable, then the first service is at best marginally profitable. Sexed semen is usually not profitable in dairy cows, unless the fertility is almost equal to conventional semen. If the genetic merit of animals is known, sexed semen could be profitable on the genetically better animals while it is not profitable on the genetically poorer animals. Therefore, the value of genetic information likely increases when sexed semen is considered.

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Notes

Sire Selection and Use of Gender-biased Semen: Producer Panel

Moderator: **Peter Hansen**
Participants: **Don Bennink, Eddie Fredrikkson, Jacob Larsen**

Notes

2007 DHIA Breed Comparison for Southeastern States

October, 2007

	DRMS Holstein	Southeast Holstein	Southeast Jersey	Southeast Other Breeds
No. Herds	13552	382	58	57
No. Cows / Herd	144	311	153	201
No. 1st Lact	55	114	53	76
% 1st Lactation	38%	37%	35%	38%
Avg Days in Milk	195	215	189	200
% Left Herd	34	34	37	35
%died	9.7	9	6.5	6.6
%left Repro	6	6	3.3	5.8
Milk Price	21.4	22.8	24.2	23.7
Rolling HA Milk	20,934	19,236	14,521	17,234
Rolling HA Fat	779	699	651	649
Rolling HA Prot	640	589	509	545
Summit Milk 1st Lac	69	66	48	58
Summit Milk 3rd+	91	86	64	77
Peak Milk 1st Lac	75	73	54	64
Peak Milk 3rd+	100	96	70	86
Proj 305ME Milk	22,976	21,601	16,101	19,233
Std 150-day Milk	71	65	47	58
SCC Actual	333	455	425	412
SCC Score	3.1	3.6	3.6	3.5
SCC Score 1st Lact	2.7	3.2	3.2	3.1
SCC Score 2nd Lact	2.9	3.5	3.3	3.5
SCC Score 3rd Lact	3.6	4.1	4.1	3.8
% SCC Score <4	60	48	50	51
PregRate Current mo	14.3	11.9	18.3	14.5
Actual Calving Int	14.2	14.7	14.3	14.3
Days to 1st Serv	98	106	96	107
1st Serv Concep Rate	44	49	43	47
# Calvings	145	300	149	196
# calves per 100 cows	83	74	99	77
%Dry < 40 days	16	15	10	16
%Dry > 70 days	24	32	28	34
%Bred to Proven bulls	64	64	60	58
%Bred to non-AI	22	36	20	37
%Heifers with Sire ID	86	78	89	79
%Cows with Sire ID	71	52	90	55

* Southeast - includes 6 southeastern states
** DRMS - includes all herds processed by DRMS

2007 DHIA Data for Southeastern States

October 1, 2007

Holstein Herds	Alabama	Florida	Georgia	Miss	SC	Tenn
No. Herds	16	57	134	24	32	120
No. Cows / Herd	170	880	366	241	231	146
No. 1st Lact	62	322	97	80	93	53
% 1st Lactation	36%	37%	27%	33%	40%	36%
Avg Days in Milk	227	206	217	218	218	210
% Left Herd	32	36	34	33	36	34
%died	7.2	11	8.7	10.5	7.2	9.1
%left Repro	4.9	6.3	6.7	7.2	6.6	4.3
Milk Price	23.8	24.1	23.7	22.5	22.8	21.3
Rolling HA Milk	17,392	18,850	19,110	19,863	20,837	19,275
Rolling HA Fat	582	668	690	702	770	712
Rolling HA Prot	528	561	588	610	645	585
Summit Milk 1st Lac	60	66	65	67	71	66
Summit Milk 3rd+	77	86	86	87	95	86
Peak Milk 1st Lac	66	75	72	75	78	73
Peak Milk 3rd+	85	97	96	97	105	96
Proj 305ME Milk	19,382	21,121	21,393	21,638	23,650	21,795
Std 150-day Milk	60	63	65	65	69	65
SCC Actual	518	448	490	491	388	434
SCC Score	4.1	3.8	307	3.9	3.5	3.4
SCC Score 1st Lact	3.6	3.4	3.2	3.4	3.2	3.1
SCC Score 2nd Lact	4	3.8	3.6	3.7	3.4	3.2
SCC Score 3rd Lact	4.6	4.2	4.3	4.3	4	3.8
% SCC Score <4	40	46	48	45	52	53
PregRate Current	13	7.3	11	12	12.9	14
Actual Calving Int	15.4	14.3	14.8	14.6	14.4	14.7
Days to 1st Serv	132	108	108	94	100	104
1st Serv Concep Rate	47	53	51	40	48	47
# Calvings	165	824	260	227	237	145
# calves per 100 cows	81	58	69	78	91	82
%Dry < 40 days	17	16	15	14	11	16
%Dry > 70 days	31	34	31	23	26	34
%Bred to Proven bulls	65	65	66	72	58	61
%Bred to non-AI	29	35	38	24	30	38
%Heifers with Sire ID	68	67	76	84	85	82
%Cows with Sire ID	47	28	47	66	65	62

Data from DRMS - October, 2007.

2007 DHIA Comparison of Southeast Herds to DRMS Herds

All Breeds	2006 Southeast *	2006 DRMS **	2007 Southeast *	2007 DRMS **
No. Herds	533	13,693	498	15574
No. Cows / Herd	270	135	280	139
No. 1st Lact	97	49	103	52
% 1st Lactation	36%	36%	37%	37%
Avg Days in Milk	203	191	209	193
% Left Herd	35	33	35	34
%died	7	5	8.5	9.5
%left Repro	6	5	6	9.5
Milk Price	14.50	12.74	23.1	21.5
Rolling HA Milk	18,168	20,311	18493	20309
Rolling HA Fat	675	763	687	764
Rolling HA Prot	562	624	573	626
Summit Milk 1st Lac	62	67	63	67
Summit Milk 3rd+	82	88	83	89
Peak Milk 1st Lac	69	74	70	73
Peak Milk 3rd+	91	97	92	97
Proj 305ME Milk	20,613	22,264	20690	22280
Std 150-day Milk	63	68	62	69
SCC Actual	478	350	447	335
SCC Score	3.7	3.2	3.6	3.1
SCC Score 1st Lact	3.3	2.7	3.2	2.7
SCC Score 2nd Lact	3.5	3.0	3.2	2.9
SCC Score 3rd Lact	4.2	3.6	4.1	3.6
% SCC Score <4	47	58	48	58
PregRate Current	11	13	13	14.8
Actual Calving Int	15	14	14.6	14.2
Days to 1st Serv	105	97	105	98
1st Serv Concep Rate	48	43	48	44
# Calvings	261	135	271	140
# calves per 100 cows	97	100	77	83
%Dry < 40 days	14	16	15	15
%Dry > 70 days	30	24	31	25
%Bred to Proven bulls	63	62	63	63
%Bred to non-AI	35	24	36	23
%Heifers with Sire ID	78	85	79	86
%Cows with Sire ID	54	69	56	71

* Southeast - includes 6 southeastern states
** DRMS - includes all herds processed by DRMS

2007 DHIA Production Recognition of High Florida Herds

Production as of September 30, 2007

Producer	City	Milkings	RHA Milk	RHA Fat	RHA Protein	Data Collection Rating - Milk
NORTH FLORIDA HOLSTEINS	BELL	3X	25760	878	770	102.2
WHITE OAK DAIRY	MAYO		24919			95
SHENANDOAH DAIRY	LIVE OAK	3X	24591	913	736	96.5
ELJIM DAIRY	GRANDIN		22980	1032	682	69.9
JEFFCO DAIRY	QUITMAN	3X	22899			96
LARSON DAIRY #5	OKEECHOBEE	3X	22381			54.7
J-LU FARMS	LIVE OAK	3X	21669	822	624	99.2
ATR DAIRY	MAYO		21440			93.8
W B DAIRY, INC	HILLIARD	3X	21225	643	533	97.3
SHIVER DAIRY	MAYO		21116			94
DPS - BRANFORD FARM	BRANFORD	3X	20980	736	617	96.8
T.K. HATTEN DAIRY INC	BROOKSVILLE	3X	20831	497	470	70.2
SUWANNEE DAIRY, INC.	MC ALPIN		20813	703	614	99.2
BRANTLEY DAIRY FARM,INC	MCALPIN		20660			99.6
WALKER & SONS FARMS, INC II	MONTICELLO		20474			99.2
DPS - BELL FARM	BELL	3X	20469	689	618	96.6
V & W FARMS INC	AVON PARK	3X	20381			79.2
PAUL TRAWICK & SON	MAYO		20221	646	601	92.3
MILK-A-WAY	WEBSTER		20185	719	599	95.2
BRIAN MCADAMS	MAYO		20025			94.1

Southeast DHIA – Testing cows in Florida and Georgia

2007 Florida DHIA Herd Performance Averages*

September 30, 2007

	1993	2003***	2004***	2005***	2006***	2007***
No. Herds	55,648	56,366	57,510	54,375	54,978	51,406
No. Herds	122	92	82	71	66	62
Average Herd Size	456	613	698	766	833	829
% Days in Milk	86	84	84	86	85	86
Pounds of Milk	17,761	18,160	18,307	18,987	18,835	19,607
Peak Milk - 1st Calf (lbs./day)	67	70	68	72	72	74
Peak Milk - 2nd & Later (lbs./day)	88	88	87	85	91	94
Fat %	3.5	3.8	4	3.7	3.6	3.6
Pounds of Fat	622	683	672	716	687	705
Pounds of Protein	592	541	546	577	546	566
Value of Milk ($)	2,658	2,579	3,210	3,211	2,982	3,558
Projected Minimum Calving Interval	14.1	16	15.6	15.5	15.7	15.7
Days Dry	69	78	77	75	72	74
% Cows Dry > 70 Days	19	37	36	19	18	20
Days to 1st Breeding	77	107	106	112	110	109
Days Open	148	197	192	193	196	197
% cows Open > 100 at 1st Breeding	14	33	28	31	27	25
No. Breedings per Conception	4.0	3	3	2.8	2.8	3.1
% Possible Breeding Serviced	52	26	25	26	25	26
Age at 1st Calving (months)	25	25	25	26	26	25
Age - All Cows (months)	44	44	43	44	44	45
% With Sire Identity	34	23	25	29	35	36
Average PTA$ Sires	151	86	149	98	119	127
Average PTA$ Service Sires	210	344	354	239	304	291
% Left Herd	40	39	33	31	34	32

* September 30, of the respective year
** Cows in Herds on official types of test (01 - 34)
*** Cows in Herds on all types of test (01 - 74)

Southeast Milk, Inc. Dairy Check-Off Program: Project Summaries

Active and Recently Completed Projects as of July 6, 2007

Project # 267

Title: **Evaluating the Effect of Seasonality on Financial Performance of Southeast Dairy Businesses.** Marvin Hoekema, Roger Natzke, Dan Webb (since 2002 Albert De Vries)

The goal of this project is to study the effect of seasonality found in DHI data on the financial performance of Southeast dairies that participate in DBAP. The 2005 DBAP data has been added to the database. A DHIA data set with records from 1990 through 2006 was obtained from DRMS in Raleigh, NC. Analysis is on-going.

Project # 275

Title: **Construction of a Rotational Shade Circle for Livestock on Pasture or Outside Lots**. K. Bachman

A prototype shade structure has been constructed adjacent to the Animal Science Building. Existing metal support poles were utilized to attach and suspend two parallel wire rope cables (30 feet) in an E -W direction. At the mid-point (15 feet) each E-W cable rested on a hook (additional support post required) to control downward and inward sag. Two cables (16 feet) in N-S orientation were attached to pulleys that traverse the E-W cables. The N-S cables were held separate at a fixed distance (60 inches) using a PVC spacer pipe and T's at the point of N-S cable attachment to the E-W pulleys. Excess cable sag was removed via turnbuckles installed in each cable run. Two pulleys on each of the N-S cables were used to attach and suspend the shade cloth frame (5x10 feet PVC pipe). Distance between the attachment straps affixed to the 10 foot pipes was 60 inches; thus, the shade frame can be oriented E-W or N-S. As configured, the cable and pulley assembly will allow the suspended shade frame to be moved relatively easily to any location within the confines of the outside perimeter cable support posts. However, during movement of the E-W pulleys past the mid-point support hook the E-W cable has to be lifted off the hook and subsequently re-hooked. By using telephone poles and come-a-longs, an up-scaled version of this assembly should provide practical and economical rotational shading and thereby help to reduce the development of mudholes. This project is completed.

Project # 289

Title: **Efficacy of a New Vaccine to Prevent Abortion in Dairy Heifers Naturally Infected with *Neospora caninum*.** J. Hernandez

No summary report submitted.

Project # 308

Title: **Effects of Lameness on Ovarian Activity, Maintenance of Pregnancy, Reproductive Performance, Milk Production and Efficacy of Corrective Foot Trimming Procedures to Prevent Lameness in Dairy Cows (year 1 of 3).** J. Hernandez

No summary report submitted.

Project # 314

Title: **A New Approach and Evaluation for Detection of *Mycobacterium paratuberculosis* (Johne's disease) in cattle**. O. Rae

Objectives: to explore an alternative method for detection of *M. avium subspec paratuberculosis (MAP)* in infected cattle, by sub iliac lymph node biopsy; to assess the sensitivity and specificity of individual and serial test results using different diagnostic methods in Johne's positive cattle; and to explore methods to improve the sensitivity of sub iliac lymph node biopsy techniques for early detection of Johne's disease.

Procedures: About 150 cattle will be utilized (~100 samples are in storage waiting staining and processing). Animals have been selected from Johne's-ELISA tested animals at IFAS research units. Animals are from 2-10 years of age, and may or may not have signs suggestive of Johne's disease. Each study animal is identified by number, age, sex, breed, and evaluated by weight, body condition scores, and previous results of Johne's ELISA tests. Blood is collected for ELISA. A 100 gm fecal sample is cultured for *MAP*. A subiliac lymph node biopsy is taken or a whole lymph nodes taken at slaughter/necropsy. An impression smear of the lymph node cut-section is stained on a microscope slide (Zeihl Neelson) for microscopic evaluation. The remainder of the lymph node is placed in formalin for later histopathological evaluation.

	ELISA test results					
Lymph node	Negative	Suspect	Low Pos	Med Pos	High Pos	Total
Negative	17	16	8	23	3	67
Positive	0	0	0	0	0	0
Pending	7	4	2		4	17
	24	20	10	23	7	84

Tentative results: The causative organism *MAP* has not been detected in peripheral lymph nodes of the 67 animals thus far evaluated. In 8 of 19 study animals that were followed to markets or necropsy, the organism was recovered and identified in gut wall tissue and (or) mesenteric (gut) lymph nodes but not in the peripheral lymph nodes. Because of the results seen to this point in the study, we have discontinued doing biopsies on live animals. We now take samples only from animals going to necropsy or to the packing plant. We will continue to assess these samples as they are collected. The project is ongoing.

<u>Project # 333</u>
Title: **Dairy Herdsman Seminars and Cow College in Spanish**. J. Shearer

No summary report submitted.

<u>Project #339</u>
Title: **Use of Low-Dosage ECP (estradiol cypionate) to Reduce the Financial Risks Associated with 30-d Dry Period When an Earlier-Than-Expected Calving Occurs.** K. Bachman

Milk lactose in the blood of cows indicates that the tight junctions between the epithelial cells in mammary tissue have become leaky. Leaky tight junctions are an early indicator that the mammary tissue has begun to involute or dry-off. Blood samples collected from cows that received various dosages of ECP were tested for lactose to determine the minimal dose needed to initiate involution (dry-off). Categories of dairy animals from which blood has been analyzed for lactose include: 1) heifers <365d old, 2) dry cows > 40d to expected calving date, 3) cows from late dry period through early lactation, 4) cows at dry-off that received or did not receive various dosages of estrogen (ECP) to accelerate involution, 5) cows in lactation that were milked while receiving various dosages of estrogen (ECP or estradiol). As expected, blood from categories 1 and 2 did not contain lactose since the mammary tissue is immature (1) or fully involuted (2) and therefore is not capable of producing lactose. Blood from (3) showed an initial increase in blood lactose as lactose synthesis began prior to closure of the tight junctions. The continuation of milk removal (5) counteracted the involution process and attenuated differences in blood lactose profiles for the various treatments. Category 4 was the best comparison of the effect of ECP on blood lactose. Both 20 and 30 mg ECP elevated blood lactose relative to the cottonseed oil control which itself had an elevated response due to the involution that was initiated by stoppage of milk removal. Based on the blood lactose responses, cessation of milk removal at dry-off by itself initiates involution by 24h and the numerical increase in blood lactose observed with 20 and 30 mg ECP did not differ from the control values except for the 48-72 h post-treatment timeframe within the 240 h study period. Thus, by this criterion, a minimum dose of 20 mg ECP would be needed to hasten involution beyond that which occurs upon cessation of milk removal. This project is complete.

Project #349
Title: **Antibody Response to Ovalbumin as a Measure of Genetic Disease Resistance of Dairy Cows.** A. Donovan

Project update – 1,023 cows and heifers were originally enrolled into the study. Of these animals, 745 were eligible for analysis. These cows have all been categorized based on their immune response to Ova (HIR) as well as their immune response to the intradermal antigen injection (CMIR). This was accomplished by ELISA testing over 3,000 serum samples. The preliminary results of the association between the immune categorizations and the dairy diseases of interest are as follows:

- Low cell mediated immune responders were 12.56 times more likely to have retained fetal membrane at calving compared to high responders. P<.0001
- Low antibody responders were 6.9 times more likely to have a displaced abomassum compared to high responders. P=.011
- Low responders were 4.9 times more likely to get ketosis compared to high responders. P=.013
- Medium antibody responders tended to get mastitis 2.6 times more often than high responders. P=.10
- Low antibody responders tended to get metritis 1.5 times more likely than high responders. P=.10

Additionally we have found there is a significant difference between multiparous and primiparous cows in their ability to respond to the test antigen. Multiparous cows are able to responder faster to antigens used in the study. We also found there are significant differences among milk production levels for high and low responders. It appears low responders produce more milk. For fertility, if considering a cow's ability to get pregnant by 150 days post calving, the preliminary results show that low responders are 2.7 times more likely to get pregnant. The results provided are preliminary and subject to change as statistical models are improved for greater relevance. Along with completing the statistical analysis, I will next need to configure the heritability of this response to our test antigens. I will also complete a pedigree analysis where I will identify sires with pedigrees that influence immune responsiveness.

Project # 363
Title: **The Development of Corn Silage Varieties and a Year-Round Cropping System for Florida Dairy Farms.** B. Scully

Project # 365
Title: **Factors Affecting the Quality of Corn Silage Produced in Florida, and the Risk of Variable Manure Syndrome in Dairy Cows.** A. Adesogan

Check-Off dollars funded a series of experiments aimed at addressing producer concerns about links between the quality of corn silage produced in the southeast and poor productivity or disease problems (particularly Hemorrhagic Bowel Syndrome, HBS) in dairy cattle. An experiment was designed to determine effects of maturity at harvest, hybrid staygreen ranking and rainfall at harvest on the performance of dairy cows and the incidence of HBS. The experiment confirmed that the efficiency of milk production was greater in corn harvested at 35% DM than at 26% DM. The study also showed that high hybrid stay-green rankings were associated with lower feed digestibility and intake and slightly higher rectal temperatures. However no direct link between staygreen rankings and HBS or digestive upsets was found. Indeed several researchers now consider the cause of HBS to be multifactorial. Several factors may contribute to the incidence of the disease including bad silage management practices such as inadequate consolidation, harvesting or ensiling while it is raining, harvesting crops too early, feeding excess levels of readily fermentable carbohydrates etc. The project also showed that high stay green rankings did not influence the immune response of cows or counts of HBS-causing organisms (Aspergillus fumigatus and Clostridium perfringes) in the cows. Although this work has not shown a direct link between HBS and stay-green ranking, it has demonstrated that high stay-green hybrids from some companies have poorer nutritive value than their low stay-green hybrids. Also when high stay-green hybrids are ensiled during rainfall, silage yeast counts may be increased and rumen function in dairy cows may be impaired. This project has been completed.

Project # 366

Title: **Enhancing Nutrient Intake and Digestibility and Performance of Lactating Dairy Cows Fed Diets Based on Tifton 85 Bermudagrass.** J. Bernard

Summary: Forty-four lactating Holsteins were used in an 8 week trial to determine the effectiveness of enzyme treatment on the utilization of diets based on corn silage plus either Tifton 85 bermudgrass haylage or alfalfa hay. The diets were formulated to provide similar concentrations of nutrients and included 12.1% of the ration DM as either Tifton 85 bermudagrass haylage or alfalfa hay. Third cutting Tifton 85 was chopped and ensiled in a bag prior to beginning the trial. The alfalfa hay was grown in the Western US and was purchased locally. The average nutrient content (DM basis) of the Tifton 85 was 14.2 % CP, 38.7 % ADF, and 72.4% NDF compared with 20.1% CP, 31.7% ADF, and 39.4% NDF for alfalfa hay.

There were no differences between treatments in dry matter intake (54.0 lb/d), milk yield (91.2 lb/d), milk fat percentage (3.69%), energy corrected milk yield (90.8 lb/d) or dairy efficiency (1.68 lb ECM/lb DMI). These results indicate that Tifton 85 can be included in rations for high producing cows up to 12% of the total DM without affecting dry matter intake or milk yield. Addition of an enzyme to the TMR did not improve performance of the cows in the current trial.

Economic analyses of the data without regard to the use of enzyme indicate an advantage for feeding Tifton 85 versus the alfalfa. Market prices used for the initial analysis were $45/ton for corn silage, $200/ton for alfalfa hay, $40/ton for Tifton 85 bermudagrass haylage (equivalent to $85/ton hay), $200/ton for ground corn, and $285/ton for soybean meal. The value of milk was calculated using a skim milk price of $14.00/cwt and $1.35 for lb of milk fat. Diets based on Tifton 85 resulted in $0.34/cow/d greater income over feed cost (IOFC) because of the lower total feed cost. Milk price does not alter IOFC because milk and fat yield were similar among treatments. These results are consistent with previous research conducted by West et al. (1997). The magnitude of difference in feed cost will vary depending on cost of feed ingredients.

Publication: Bernard, J. K., J. W. West, and A. T. Adesogan. 2007. Performance of Holstein cows fed diets containing either alfalfa hay or Tifton 85 bermudagrass with or without a cellulase enzyme. J. Dairy Sci. 90 (Suppl. 1): in press (Abstr.). Status: Complete

Project # 368

Title: **Economic Comparison of Ultrasound Versus Rectal Palpation to Detect and Resynchronize Open Cows.** Albert De Vries, Julian Bartolome, and W.W. Thatcher

Objective is to compare the economics of ultrasound versus palpation to detect and resynchronize open cows using an Ovsynch (± CIDR) protocol. A graduate student (Ashley Sanders) was hired in September 2006 to develop a comprehensive tool to make the economic comparisons. Advice and data from experts around the country was sought. This project is actively on-going.

Project # 369

Title: **The use of CIDR Insert Post AI to Decrease Early Embryonic Loss in Heat Stressed Animals and the Efficiency of Reusing a CIDR Insert**. J. L. Fain

The objective of the first trial was to determine if incorporation of gonadotropin releasing hormone (GnRH) and estradiol cypionate (ECP) into the controlled internal drug release (CIDR)-prostaglandin ($PGF_{2\alpha}$) protocol would increase pregnancy rates of dairy heifers using timed artificial insemination (TAI). This study was conducted over a 6-mo period at the University of Georgia Teaching Dairy in Athens. Forty Holstein heifers with an average age of 16 mo were randomly allocated to 1 of 2 treatment groups. In treatment 1, 20 heifers were synchronized by:50 µg GnRH (-9 d), CIDR (1.38 g progesterone, -9 d), 25 mg PGF2α (-3 d), 1 mg ECP (-2 d),CIDR removal (-2 d), 50 µg GnRH (d 0), and TAI (0 d), (OverSynch). A second group of 20heifers (Control) were synchronized by: CIDR (1.38 g progesterone) (-9 d), 25 mg PGF2α (-3 d),CIDR removal (-2 d), and TAI (0 d). Upon CIDR removal, retention rates and discharges were recorded. Estrus activity was monitored using Estru$ Alerts (Universal Cooperatives, Eagan, MN) applied at d -3. Timed AI occurred 48 h after CIDR removal. Pregnancy was determined by ultrasonography at 35 d post AI. For both treatments, CIDR retention rate was 100% and discharge was minimal with no significant effect on pregnancy rate ($P > 0.05$). Pregnancy ratesof heifers synchronized by OverSynch (45 %; 9/20) were similar to those in the heifers synchronized with the control protocol (55 %; 11/20) ($P > 0.05$). In the OverSynch protocol, 16 of 20 (80%) heifers had Estru$ Alerts that were all or partially rubbed while only 11 of 20 (55%) were observed in the control group. Additionally, 55% (11/20) of the Estru$ Alerts on heifers in OverSynch were completely rubbed compared with 15% (3/20) in the control. Signs of estrus synchronization through visual appraisal of Estru$ Alerts was significantly higher in the OverSynch heifers ($P < 0.05$). Although the OverSynch protocol did significantly increase estrus activity, it did not increase pregnancy rates with a TAI.

Two additional experiments were conducted to test the efficacy of using progesterone treatment post AI to decrease embryonic mortality in dairy animals and to resynchronize estrus in dairy and beef heifers. In experiment 1, all animals were synchronized utilizing a single injection of 25 mg PGF2α and were inseminated 12 h after animals were observed in standing estrus. Cows and heifers were randomly assigned to 1) receive post AI progesterone therapy (cow n = 11; heifers n = 13) from d 14 to 21 after AI using the CIDR insert (1.38g progesterone) (treatment) or 2) receive no further treatment post AI (cows n = 5 cows; heifers n = 9) (control). This trial was split and run in the summer and winter seasons to determine progesterone variability. Supplementation of progesterone after AI had no effect on pregnancy rates in heifers or cows, regardless of season ($P > 0.05$). No animals in this experiment diagnosed pregnant at d 35 were diagnosed open on d 60; therefore, no embryonic loss occurred, regardless of treatment. Progesterone concentrations on d 21 in heifers, regardless of treatment, tended to be higher ($P = 0.0651$) than those observed in cows. During both seasons, use of the CIDR maintained progesterone concentrations from d 14 to d 21; however, there were significantly higher progesterone values throughout the winter season when compared with summer ($P = 0.0084$). In experiment 2, beef (n=12) and dairy (n=32) heifers were initially synchronized utilizing a new CIDR insert (1.38 g progesterone) (d -10) with a 5 cc injection of PGF2α at the time of CIDR removal (d -3). Animals were then artificially inseminated at 12 h after detected estrus (d 0). At 14 d post insemination (d 14), all animals received the same previously inserted CIDR for a second 7-d period until removal on d 21, followed by reinsemination occurring 12 h after detected estrus. Pregnancy rate response to initial synchronization was higher in both dairy (52.17%; 12/23) and beef (75%; 3/4) heifers compared with resynchronization, which yielded 51 pregnancy rates of 40% (4/10) and 50% (3/6), respectively. Use of the new CIDR insert significantly increased ($P = 0.002$) progesterone concentrations from d -10 to d -3 in heifers, whereas the used CIDR did not increase progesterone concentrations from d 14 to d 21 ($P > 0.05$). A mean increase in progesterone concentrations from d 14 to d 21 was a significant positive predictor of pregnancy ($P = 0.0133$). Furthermore, on d 21, progesterone concentrations were positively correlated with incidence of pregnancy at d 35 ($P = 0.004$). The use of exogenous progesterone maintains circulating blood progesterone concentrations in heat stressed heifers and non heat stressed heifers and cows. Although a used CIDR does not appear to maintain progesterone concentrations similar to those with a new CIDR, it did successfully suppress and resynchronize return to estrus. This project is ongoing.

Additional studies are being conducted with heifers to evaluate combing the Ovulation and CIDR synchronization protocols with both timed AI and heat detection. The authors would like to thank the Committee for their support.

Project # 371
Title: **Use of Radio Frequency Identification (RFID) for Dairy Cattle Management**. D. Webb

This project is considered complete. See renewal project #380 for summary.

Project # 373
Title: **Multi-Lingual Training Videos for S. E. Dairies.** D. Bray

Over 15 videos have been produced in English and Spanish. This project is completed.

Project # 374
Title: **Environmental Modifications for Reducing Summer Stress on S. E. US Dairy Farms.** D. Bray

Comparisons were made again between various number of ultra high pressure fog coolers in a calving barn, the lower the temperature in the barn the more moisture was on the bedding , which was not a problem since the sand bedding was replaced every 4- 5 days, this still seems to be a economically way to cool sand bedded calving barns. Strip spray nozzles were installed at the DRU to provide a constant spray of water in the back free stall alleys of the barns, this provided back alley cows to be cooled when the feed face area was full of cows, on extremely hot days these cows body temperature dropped about 1 degree F, it also provided entertainment for 'boss cows" to play in the water. This project is completed.

Project # 375
Title: **2006 Florida Mastitis and SCC Reduction Study.** D. Bray

We have evaluated free stall bedding for pathogens at various depths at the front and rear of the stalls, rear stalls were higher in moisture and pathogen numbers than the front of the stalls, which demonstrates the need to remove the sand from the rear of the stalls at least once a year. Changing from 3X milking to 2X milking increased leaking milk between milkings, which increased pathogen levels in these stalls, thus cleaning material from the back of stalls is needed more often in fresh pens. This project is completed.

Project # 376
Title: **Support for Florida and Georgia Youth Programs, 4-H Dairy Activities and Youth Events, Dairy Judging Team Support, Undergraduate Programs and Scholarships, Participation in 5th North American Intercollegiate Dairy Challenge, State 4-H Dairy Show.** B. Broaddus

No Summary Required

Project # 377
Title: **Dairy Business Analysis Project-Georgia-2006.** L. Ely

Financial data for the year 2005 were collected from participating dairy farms and screened for completeness and validity. Each dairy farm then received a benchmark report detailing its financial results compared to the average results for the other participants and the six dairy farms with the highest net farm income per cwt. This benchmark report is discussed with the dairy farms to identify challenges and opportunities for improvement.

Twenty-one dairy farms were included in the summary results. Of these, 15 were located in Florida and 6 in Georgia. The average herd size of the participating dairies was 1045 cows and 538 heifers with 18,322 lbs. milk sold per cow. The average culling rate was 36%. The average milk price was $18.24. Average total revenues were $20.73 per cwt. milk sold. Total expenses averaged $20.20 per cwt. sold. The largest items were purchased feed, $7.22, and personnel costs, $3.50. Net farm income from operations averaged $0.53 per cwt. sold. Net farm income per cwt. was $0.07. The herds were divided into 3 equal groups on size, <446, 446 to 670 and >670 cows. The average number of cows and heifers by group was 261 cows and 50 heifers, 562 cows and 348 heifers and 2,312 cows and 1,218 heifers. Milk sold per cow was 15,777, 19,225 and 19,963 pounds by group. Culling rate was highest (42%) for the smallest herd size and lowest (31%) for the largest herd size. Milk revenue increased with herd size ($17.95, $18.14 and $18.63 per cwt) but total revenue was highest ($21.57 per cwt) for the smallest herd size. Total expenses decreased with increasing herd size ($22.22, $20.75 and $17.65 per cwt). This resulted in the highest net farm income from operations ($2.79 per cwt) and net farm income ($2.79 per cwt) for the largest herd size. The largest expense item was purchased feed for each group but it decreased with increasing herd size. Labor costs were highest for the smallest herd size and decreased with herd size. The herds were divided into 3 equal groups on pounds of milk sold, <17,300, 17,300 to 19,500 and >19,500. The average pounds of milk sold, cows numbers and heifers numbers for each group was 14,950 pounds of milk, 1,117 cows and 363 heifers; 18,420 pounds of milk, 447 cows and 215 heifers; and 21,594 pounds of milk, 1,571 cows and 1,038 heifers. Culling rate was highest for the lowest production group (44%) and lowest for the highest production group (29%). Milk revenue was nearly equal for each group ($18.32, $18.08, and $18.32 per cwt) but total revenue was highest for the lowest yield group and lowest for the highest yield group. Total expenses decreased with increasing milk sold ($21.78, $19.86 and $18.98 per cwt). This is resulted in the highest net farm income from operations ($1.31 per cwt) and net farm income ($1.19 per cwt) for the highest production group.

Data collection for 2006 has been started and 5 Georgia dairies have been collected so far.

<u>Project # 378</u>
Title: **Milk Check-Off Recovery.** G. Hembry

No Summary Required

<u>Project # 379</u>
Title: **The Development of Corn Silage Varieties & A Year-Round Cropping System for Florida Dairy Farms**. B. Scully

<u>Project # 380</u>
Title: **Use of Radio Frequency Identification (RFID) for Dairy Cattle Management.** D. Webb

Objectives: To determine usefulness of electronic identification for collection of dairy cattle information including: heifer body weights, milk weights on test-day, reproduction and veterinary checks, health data and group movement.

Progress so far: Our group has been working to determine usefulness of electronic identification for collection of dairy cattle information including: heifer body weights, milk weights on test-day, reproduction and veterinary checks, health data and group movement. Animals were tagged with ear tags containing the RFID chip. Cows are identified in the chute or lockup stanchions by waving a wand near the ear, which transmits to a hand-held computer (Palm PDA). Using the palm version of PCDART from Dairy Records Management Systems, management data can be entered and automatically attached to the cow's data file. This electronic identification can reduce labor required for record keeping and improve accuracy of records.

After the initial tagging of young animals, we have tagged all animals at the University of Florida, Dairy Research Unit including 527 adult milking cows, 354 heifers and 47 bulls. Since the beginning of the project, 1108 animals have been tagged with RFID at UF's DRU. At two other cooperator herds, 760 cows and 568 heifers have been tagged.

Readability of tags has been variable. Our standard procedure was to apply the tag then read it with one of the wands, immediately. All of the tags except one, read successfully, immediately after tagging. So far, we have used five different wand readers: 1) AgInfolink's Blue tooth, 2) Digital Angel Blue tooth, 3) Allflex stick reader (wired), Allflex stick reader – Bluetooth, Idology vibrator wand. All five wands have given satisfactory reads, but the Allflex stick reader has performed the best in our study. The wand from Idology has one advantage in that it gives a vibration upon successful read of a tag. This is helpful in noisy situations. Evaluation criteria included distance from the tag and successful read on first try.

Having RFID on all heifers has enabled us to evaluate the electronic weighing system manufactured and marketed by TruTest. We have used the XR3000 with the companion load bars and the Allflex stick reader. While heifer weighing at the DRU is usually associated with treatments and other management, we have been able to evaluate the system for collection and retrieval of body weight data. In our facilities, the weighing sequence goes like this: 1.heifer enters the approach chute; 2. we open the gate which allows her to enter the platform scale; 3. Identification is read by the wand; 4.press the button to record; 5.open gate to release heifer.

We are beginning to evaluate the use of RFID with TruTest's Data Handler, a hand-held unit for collection of test-day milk weights. It can be used with and without RFID. This project is ongoing.

Project # 381
Title: **Investigation of Strategies for Increasing Milk Production from Bermudagrass Silage and Reducing Nitrogen Pollution on Dairy Farms**. A. Adesogan

In order to enhance the utilization of tropical grasses in dairy cow rations, this project aims to determine the influence of maturity (regrowth interval length) of bermudagrass silage and dietary enzyme supplementation on the performance of dairy cows.

A 30-acre Tifton-85 bermudagrass pasture was cut on May 30, 2007 to stage the forage for the experiment. On June 27, half of the pasture (4-week regrowth) was harvested, but the remaining half was not. Therefore on July 25, which is the anticipated harvest date for the trial, half of the pasture will be a 4-week regrowth and the other half will be an 8-week regrowth. Both of these regrowths will be ensiled in separate12 foot-wide Ag bags for at least 21 days. Subsequently, the forage in each of these bags will be fed with or without supplementation with a fibrolytic enzyme to 60 dairy cows in a 56-day experiment. The feeding trial will be conducted as soon as the facilities required for the experiment become available. This project is ongoing.

Project # 382
Title: **To Evaluate Strategies for and the Benefits of Adopting a Shortened Dry Period.** K. Bachman

The Goals of this proposal were to identify factors that dairy producers need to consider when adopting use of the shortened dry period because these factors can affect milk production, health and economic benefits. This proposal was approved in 2006 and the funds provided were to be co-mingled with additional funds available to support personnel to carry out this project over a 12-16 month time period. Because of an unexpected delay in arrival of the key member of the research team, the timing to accumulate sufficient cow numbers to meet project goals made it impossible to undertake this project. The appearance of published research that meets many of the goals of the proposed research reinforces the current decision of the Investigators to withdraw the proposal and return the financial support awarded to the check-off committee. Some results and conclusions of the published research and reference citations are provided as information to the dairy producers. Portions of their results have appeared in various dairy related publications.

Recent large field studies have evaluated the effect of dry period length on health, production and reproduction of Holstein cows (Watters et al., 2006. J. Animal Science, (Suppl. 1), 89:213,288. These studies used 772 cows managed on a large commercial dairy to evaluate dry periods of 34 or 55 days. Milk production through 150 days in lactation was slightly greater for cows given the longer dry period. Cows in their 3rd or greater lactation produced more milk but the amount produced was not affected by length of the dry period or the parity of the cows. Slight differences in fat and protein percentages were detected due to dry period length and parity, but not the yields of fat or protein. The incidences of mastitis, displaced abomasum, ketosis, metritis and retained placenta were not affected by dry period length. Based on their studies, cows given the shorter dry period also had fewer days to first postpartum ovulation and first service, but service conception rate did not differ. The proportion of cows pregnant during the first 150 days in lactation was greater for cows given the short dry period. Overall, the shorter dry period appeared to improve reproduction by decreasing the days open and the greater number of cows pregnant with no negative effects on milk production or composition. This project is being withdrawn.

Project # 383
Title: **Effects of Dietary Trans Fatty Acids on Uterine Infection and Interval to First Breeding in Early Postpartum Dairy Cows.** L. Badinga

This project was planned for the Fall semester of 2006. However, due to hurricane damage to Monsanto barn last year and the time needed to repair the barn, several animal experiments at the Dairy Research Unit have been delayed. We are now in the queue and the paperwork (project protocol, IACUC, etc.) has been finalized to conduct this experiment between January and April 2008. The Dairy milk check off committee will be briefed as soon as the project is completed. This project is ongoing at this time.

Project # 384
Title: **Effect of Dry Matter Content of Ryegrass Silage on Intake and Performance of Lactating Cows.** J. Bernard

The ryegrass silage was harvested in March; however, only two of the three dry matter concentrations were achieved because of equipment problems. Because of this, the project was delayed until the check-off advisory committee could be consulted. After consulting with the committee and Dr. Dahl, the project will be conducted this summer. Treatments will include a comparison of ryegrass silage harvested at two moisture concentrations (31 and 41% DM). Results will be available by the end of the year. Status: Ongoing

Project # 385
Title: **Alternative to Sand Bedding in Freestall Barns.** D. Bray

We have installed over 100 Dual Chamber water beds at the DRU, and have about 75 other stall surface materials waiting to be installed, we are in the process of comparing the waterbeds with sand stalls for usage, cow cleanliness and leg and hock health. This project is ongoing.

Project # 386
Title: **Development of an Interface between PCDART and an Excel Spreadsheet that Optimizes Breeding and Culling Decisions.** Albert De Vries, Adriane Bell, Jose Alfredo Villagomez-Cortes, Dan Webb, and Peter Hansen

A program has been developed that optimizes economic decision making about breeding and culling decisions for individual dairy cows. The program ranks cows for breeding and culling decisions. The program works currently in Excel. The program needs cow-specific data currently available in PCDART. Thus an automatic routine is needed to bring data from PCDART into Excel. This involves development of an interface between both pieces of software. Once that is completed, the program is ready to be implemented on dairies that have both PCDART and Excel. This project is actively on-going.

Project # 387
Title: **Anionic Salts Pre-Partum and Supplemental Fat Post Partum to Improve Health and Productivity of Lactating Dairy Cattle.** M. Froetschel

The project is ongoing; however, the starting date of the experiment was delayed, resulting in less multiparous cows being available at once to complete the animal feeding experiment as initially intended. The animal feeding portion of the experiment was conducted in the last 6 months using 50% of the intended animal numbers. A second group of transition cows will be used to complete the animal feeding portion of the experiment next Fall. Although this will require the use of additional funds, it is hoped that extra funds secured from another recently completed project will be available and enough to complete the animal experimentation.

The starting date of the experiment was delayed approximately six months because of renovations to the free-stalls associated with the calan-gate feeding area of the UGA Dairy in Athens. The delay resulted in missing a group of multiparous cows with Fall calving dates. The animal experiment started December 2006, 24 multiparous cows with calving dates from January to April were identified and placed into pre-arranged treatment groups based on their previous milk production records and parity in an attempt to balance their milk production potential amongst the four treatment groups. The four treatment groups were designated as: 1) Control/Control: without anionic salts pre-partum and without supplemental fat post partum 2) DCAD/Control: Anionic salts pre-partum and without fat supplementation post-partum, 3) Control/ Fat: without anionic salts pre-partum and fat supplementation post-partum and 4) DCAD/Fat: Anionic salts pre-partum and fat supplementation postpartum. Cows on anionic salt treatment were fed to receive approximately 3lbs of BIO-CHLOR® (Church and Dwight Co., Inc. Princeton, NJ) per head per day for 2 weeks pre-partum based on their expected calving date. Urine pH collected prepartum indicated that their anion-cation status was altered by as intended. Cows on the fat treatment were fed 4% supplemental fat as Ca salts of fatty acids (Megalac-R®, Church and Dwight Co., Inc. Princeton, NJ).

It became apparent after the onset of the animal feeding experiment that it was not possible to attain the numbers of multiparous transition cows (24: 6 per treatment) originally intended during January through April season. Several cows were dropped from the experimental schedule. Cows were excluded due to changes in calving dates and health problems in early lactation. Several cows had complications related to displaced abomasum, mastitis or lameness. In order to capitalize on the progress completed thus far, it was decided to assign at least 3-4 cows per treatment and intensify the sampling of these cows to insure a representative but incomplete set of data with cows calving from January through April. Plans are in place to complete the experiment during the Fall with a second group of multiparous transition cows. It is hoped in the Fall season, that more multiparous cows will calve within a closer time period enabling the second group of cows to start and finish more as an entire within the 12 week feeding period.

Complete intake and milk production data were collected on twelve cows from January through July. Daily intake and milk performance data was obtained on these cows 2 weeks pre-partum and through 12 weeks post-partum. This data is being statistically analyzed. The post-partum sampling routine was intensified by obtaining hourly feed intake observations and blood samples on these cows for 24h periods during week one, four and eight post-partum. Blood is currently being analyzed for glucose, insulin, non-esterified fatty acids and ionizable calcium. Weekly composite milk samples are being analyzed for compositional analysis. Weekly composites of the silage and TMR fed and weigh-back are being analyzed for dry matter, neutral detergent fiber, crude protein fat and ash. Cows were fed .4% chromic oxide during week 5-6 and week 11-12 as a digestibility marker. Feed and fecal samples collected during week 6 and 12 from all the cows at 12 times throughout these weeks to represent each 2 h period of a 24 h day. Feed and fecal samples from week 6 are being analyzed for chromic oxide, dry matter, neutral detergent fiber, crude protein, fat and gross energy. These samples are being processed and analyzed to determine the ratio of nutrients and marker in feed and feces will be used to determine nutrient digestibility and energetic efficiency.

We hope that these results will eventually confirm our previous findings that indicate that anionic salts improve the animal's ability to utilize ruminally inert fat in early lactation. Although the outcome of the experimentation has been delayed, we have strived to maintain our experimental objective of measuring the regulation of nutrient metabolism in transition cows fed supplemental fat as influenced by their calcium status. We still hope to prove that using a combination of anionic salts and ruminally inert fat in transition cows will have health, reproduction and productivity benefits for dairying in warmer climates.

Project # 388
Title: **Does Heterosis Occur for Crossbred Embryos?** P. Hansen

For this proposal, we hypothesized that one aspect of reduced reproductive performance in Holsteins is the increase in early embryonic losses due to inbred embryos that have a decreased potential for development. If so, crossbred embryos should develop better than purebred embryos. Therefore, the goal was to test the idea that crossbred embryos have superior development using a relatively inexpensive in vitro culture system. Embryos were produced using Holstein oocytes and sperm from either Montebeliard, Swedish Red or Holstein bulls. Problems were encountered with sperm quality and the number of observations were less than optimal. Based on the data obtained, there was no evidence that crossbred embryos developed better than purebred embryos. This project is complete.

Project # 389
Title: **Embryo Transfer in Summer Using Embryos Produced by In Vitro Fertilization with Sexed Semen.** P. Hansen

The purpose of this experiment is to evaluate the effectiveness of sexed semen for producing pregnancies using embryo transfer. Embryos are being transferred to lactating cows following timed embryo transfer. Currently, most transfers were performed during heat stress. To date, the proportion of cows pregnant and pregnancy rates are as follows:
AI - 10/46 = 22%
ET - control semen - 11/41 = 27%
ET - sexed semen - 6/30 = 20%
This project is ongoing.

Project # 390
Title: **Evaluating Ryegrass Cultivars for Improved Dairy Silage and Water Quality.** C. Mackowiak

Annual ryegrass is an excellent quality winter forage for dairy greenchop and silage. It has high digestibility and energy. In addition, ryegrass offers a means for utilizing lagoon wastes from confinement dairy operations because it can accumulate large quantities of nitrogen (N) and phosphorous (P).

There are a number of commercial varieties available and they differ in yield, disease resistance, and seasonal forage distribution. Some of the better yielding and more disease resistant varieties have twice the number of chromosomes (tetraploid types) than the more common varieties (diploid types). There are reports of differences in soluble sugar content between diploid and tetraploid “perennial” ryegrasses. However, little is known about potential quality differences between annual ryegrasses, which predominates acreage in the southeast US.

We investigated the nutrient removal and forage quality parameters of four (2 diploid and 2 tetraploid) annual ryegrass varieties. Studies were planted in the fall of 2006 at 3 locations:

1. Cultivated field located at a private dairy, grown under lagoon waste fertigation
2. Overseeded on a bermudagrass sod located at the University of Florida Dairy, Hague, grown under lagoon waste fertigation
3. Cultivated field located at the NFREC, Marianna, grown under dryland conditions and using mineral fertilizer

The tetraploid varieties out-yielded diploid varieties at all locations. Unfortunately, the variability (differences) among replicates of the same species for soluble sugars was greater than differences among varieties. Therefore, we were unable to verify if ploidy (chromosome number) influenced annual ryegrass soluble sugar content. Other forage quality parameters were similar among the diploid and tetraploid varieties. However, the tetraploids tended to have greater crude protein. Greater crude protein (N) in combination with greater biomass, led to over 30% more N removal. The tetraploids also tended to have greater ash content, which reflects nutrient removal. From this, it can be concluded that the tetraploids were better able to remove and accumulate nutrients from lagoon effluents than were the diploids. The greater nutrient capture and removal through plant uptake lessens the potential for nutrient leaching losses.

This research is continuing under a 2007 Milk Check-Off grant award, comparing small grain options in terms of yield, forage quality, (including soluble sugars) and nutrient removal under dryland, and dairy effluent fertigation systems. Determining the performance of several different small grain species and cultivars will aid the dairy producer in his/her decision making process regarding timing and forage selection to fill specific needs.

Project # 391
Title: **Non-Esterified Fatty Acids (NEFA) and Calcium Concentrates at Calving to Predict Lactation Performance of Transition Dairy Cows.** P. Melendez

The study is still in progress. We are in the phase of analyzing serum samples from 750 cows for NEFA and calcium. We are expecting to have preliminary results in 2 months and hopefully a first draft of a manuscript for publication at the end of this year. This project is ongoing.

Project # 392
Title: **Dynamics of Breeding Soundness and Physical Parameters in Holstein Bulls Used for Natural Service in Dairy Herds**. C. Risco

Dynamics of breeding soundness and physical parameters in Holstein bulls used for natural service in dairy herds. C. A. Risco, M. Benzaquen, R.L. de la Sota, M. J. Thatcher and L.F. Archbald

Objectives of the study are: 1) to evaluate reproductive and physical traits of bulls used for natural service (NS) in a dairy herd during a one year breeding period. 2) To compare accumulated pregnancy rate by days post partum in two different breeding systems without estrus detection; timed artificial insemination and NS.

The project began in December 2006 and will continue through October 2007. The calculated sample size for animal (bulls and cows) assignment to the project has been attained. Analysis of data is expected to be completed by late 2008.

Project # 393
Title: **Use of a Reproductive Management Program to Evaluate Reproductive Performance of Lactating Dairy Cows Without or With Subclinical Endometritis that are Treated Intrauterine with Ceftiofur Hel**. C. Risco

A graduate student coming to UF on a Fulbright Scholarship has been recruited to conduct this project. The student will begin classes and project in fall 2007.

Project # 394
Title: **A Reproductive Management Program in Spanish.** J. Shearer

Project # 395
Title: **What are the Effects of Formulating Diets for Low or High Heat Increment on Efficiency and Cost of Production During Heat Stress?** J. West

Preliminary results from earlier work: A study funded by the Milk Check-Off in 2005 compared diets with high and low heat increment (HI) diets, plus cows that were on a low HI diet and were restricted in their intake to the same calorie (energy) intake as those on a high heat increment diet. Preliminary results showed that cows with restricted intake had lower respiratory rate and improved efficiency of yield compared with other treatments. Efficiency of yield were similar for the low and high heat increment diets, suggesting that the high heat increment diet was used relatively efficiently. Since the diet was lower cost, it suggests that the high heat increment diet might be more cost effective.

Procedures for the current study: The study was conducted during the summer of 2006 at the UGA - Tifton Campus Dairy Research Center, and ran from July 6 to August 15.

Diets and cows: Four diets were formulate for theoretically low and high HI from concentrates and from forages. Treatments were arranged as indicated in Table 1.

Table 1. Arrangement of low and high heat increment (HI) concentrate and forage combinations.

	Low HI Concentrate		High HI Concentrate	
	Low HI Forage	High HI Forage	Low HI Forage	High HI Forage
Treatment #	1	2	3	4

Low HI concentrates included higher levels of corn and fats (Megalac) and high HI grains contained more by-products (cottonseed hulls) and less fat. Low HI forage blends contained higher concentrations of corn and ryegrass silages, while high HI forage blends contained bermudagrass hay in lieu of ryegrass silage. The forty lactating Holstein cows (ten per treatment) were housed in free stalls and fed behind Calan doors.

Results: Preliminary results are included in Table 2. There was a concentrate by forage interaction for DMI, where cows consuming the low HI concentrate consumed more feed when offered the high HI forage blend, while cows receiving the high HI concentrate consumed the least feed when offered the high HI forage blend. A similar trend, though not significant occurred for milk yield. It appears that the cows fed the combination of high HI concentrate and forage had the worst DMI and milk yield, likely due to the high fiber content and potentially lower digestibility of those diets. These diets also have the potential for greater heat production in the cow and lower efficiency of use.

Table 2. Production response of dairy cows to diets with low or high theoretical heat increment (HI) for concentrate mixes and forage blends.

	Low HI[1] Concentrate		High HI Concentrate		Effect
	Low HI Forage	High HI Forage	Low HI Forage	High HI Forage	
DMI, lb/d	49.8	52.1	51.0	45.7	C[2] x F[3], P<.02
Milk, lb/d	72.8	75.2	71.9	66.6	NS
ECM[4], lb/d	68.8	66.7	70.7	58.7	NS
Milk/DMI, efficiency	1.42	1.47	1.35	1.52	NS
ECM/DMI, efficiency	1.33	1.30	1.35	1.35	NS

[1]Heat increment
[2]Concentrate
[3]Forage
[4]Energy-corrected milk

Dairy efficiency measures, in this case measured as milk yield per DMI or energy-corrected milk per DMI, did not differ statistically. However the results trended toward improved efficiency for the high HI concentrate and forage blend. This was likely due to the lower DMI for these treatments, without as large a decline in milk yield. This could be due to greater efficiency of use for these diets, or due to the use of body reserves by cows mobilizing tissue to support milk yield in these groups. Further data analysis should address this issue.

Additional analysis is currently being conducted on body weight changes, body temperatures, and respiratory rates to determine treatment effects on these measures. These additional analyses should help determine if improved efficiencies resulted from HI of the diets.

Project # 396

Title: **Effects of Disease Infestation of Corn Hybrids on Crop Survival, Silage Quality and Performance of Dairy Cows.** A. Adesogan

This project seeks to determine the effect of disease infestation of corn hybrids on crop survival, silage quality and milk production by dairy cows. Tropical corn hybrids will be infested with rust spores this summer at the 4-8 leaf stage. A control area will be treated with a fungicide. Crop survival and health will be monitored and forage from both treatments will be ensiled in mini silos to determine rust infestation effects on silage quality.

The second half of this experiment would have involved feeding control and rust-infested corn silage to dairy cattle over several weeks to determine rust infestation effects on dairy cow performance and milk quality and safety. However, if the rust infestation results in contamination of the milk, the cost of dumping the milk would be prohibitive. Therefore, we are currently investigating the possibility of using dairy goats as an alternative to dairy cows for this part of the experiment. This project is ongoing.

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Notes