


 United States Department of Agriculture | National Institute of Food and Agriculture | Award # 2012-02115 | NIFA AFRI Translational Genomics for Improved Fertility of Animals

Genomic Selection for Improved Fertility of Dairy Cows with Emphasis on Cyclicity and Pregnancy



<http://agrilife.org/afridaycowfertility/>

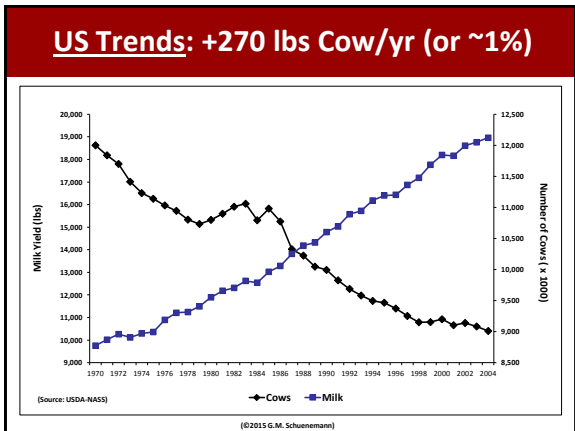


Genomic Selection for Improved Fertility of Dairy Cows with Emphasis on Cyclicity and Pregnancy

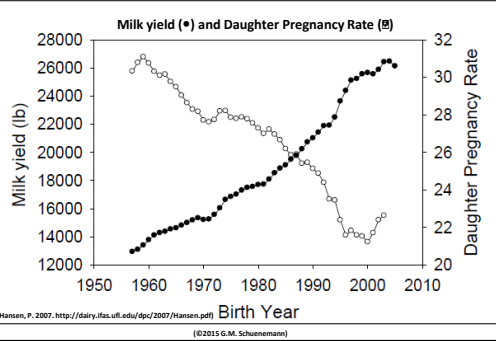
Association of Genomic Selection with Culling and Replacements

P.J. Pinedo, J.E.P. Santos, G.M. Schuenemann, R.C. Chebel, W.W. Thatcher, K.N. Galvão, R.C. Bicalho, S. Rodríguez-Zas, R.O. Gilbert, G. Rosa, C. Seabury, and J. Fetrow





Trends in Milk Yield and Daughter Pregnancy Rate for US Holsteins



What are the Three Largest Expenses of a Dairy Business?

- ➔ Feed for lactating dairy cows
- ➔ Raising replacement heifers
- ➔ Labor



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What is the Largest Expense of a Heifer Raising Operation?

➔ Feed



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What Determines Days on Feed?

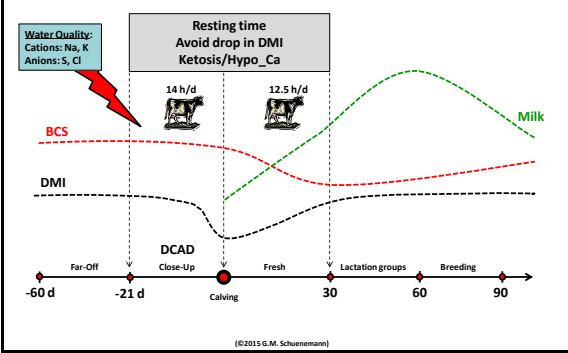
■ **Age at Calving**; which is determined by:

- Nutrition management
- Growth (ADG) & development
- Conception
- ...



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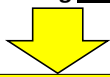
Transition Cow Program



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Basic Physiological Functions to Avoid Transition Cow Diseases

- Resting time (h/d)
- Dry matter intake and adaptation of the rumen to lactation diets (**ketosis**)
- Maintenance of **normocalcemia**
- Maintenance of a strong **immune system**



Determine the Prevalence of both metabolic and infectious diseases

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Serum Ca within 48 h after Calving

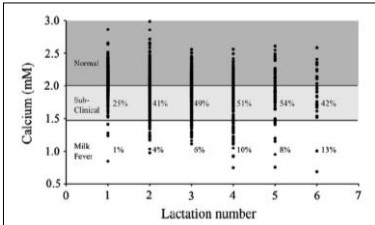


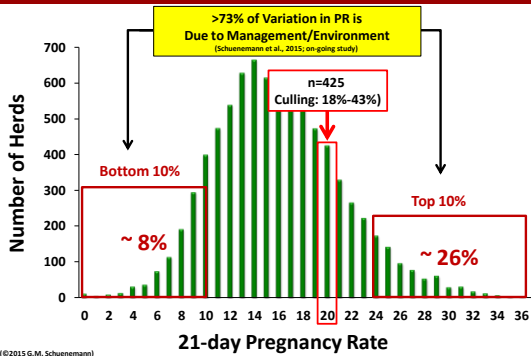
Fig. 1. Serum calcium concentrations were plotted for 1462 cows. All serum samples were collected within 48 h postpartum by lactation number: 1st lactation cows (n = 454), 2nd lactation cows (n = 447), 3rd lactation cows (n = 291), 4th lactation cows (n = 166), 5th lactation cows (n = 72), and 6th lactation cows (n = 32). The percent of cows by lactation number that experienced a clinical milk fever episode which was treated or were subclinically hypocalcemic are shown in the graph.

(Adapted from Reinhardt et al., 2011; Veterinary J. 188:122-124)

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Variation in Dairy Herd Performance

(DMRS 2013; 8,211 herds)



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J. Dairy Sci. 96:2881-2893

<http://dx.doi.org/10.3168/jds.2012-5982>
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Economic comparison of reproductive programs for dairy herds using estrus detection, timed artificial insemination, or a combination

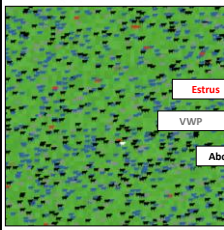
K. N. Galvão,¹ P. Federico,¹ A. De Vries,¹ and G. M. Schuenemann²

¹Department of Large Animal Clinical Sciences and D. H. Barton Reproductive and Perinatal Biology Research Program, University of Florida Gainesville 32610

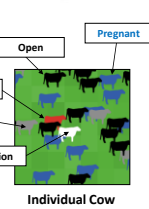
²Department of Mathematics, Computer Science and Physics, Capital University, Columbus, OH 43210

³Department of Animal Sciences, University of Florida, Gainesville 32610

⁴Department of Veterinary Preventive Medicine, The Ohio State University, Columbus 43210



Virtual Herd



Individual Cow

open_date	07
preg_date	0
estrus_date	0
next_date	22.01.051445901845
AI_date	0
vec_date	0
milk_date	157
status	0
estrus	0
pregnan	0
day	0
milk_mg	0
AI	0
abon	0
abonvec	0
milk_production	37.897413481385
milk_tst	7.2710509623026191-164
test	11.18882794154000
lactation	1
bre	530.6912782267089
age	15
dm	15.867151044619415

Cow Record
(attributes and daily status)

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Economics of Transition Cow Management

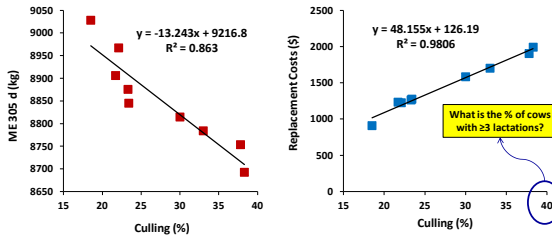
Items	Culling within 60 DIM	
	6%	12%
Pregnant, %	603.00	610.00
Lactating, %	855.00	856.00
Milk, kg/d	29.30	29.00
Milk sales, \$	12905.00	12771.00
Cows sales, \$	470.00	607.00
Calf sales, \$	606.00	635.00
Replace costs, \$	1214.00	1490.00
Breeding costs, \$	319.00	315.00
Feeding costs, \$	4983.00	4963.00
Other costs, \$	2500.00	2500.00
Profit, \$/d	4935.00	4715.00
Profit, \$/yr	\$80,300.00	

(Schuenemann and Gahdo, 2014 JDS 97:288)

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For Each Unit of Culling Increment:
 - Milk Yield Decreased 13.24 kg/cow/yr
 - Replacement Costs Increased 48.15 \$/day

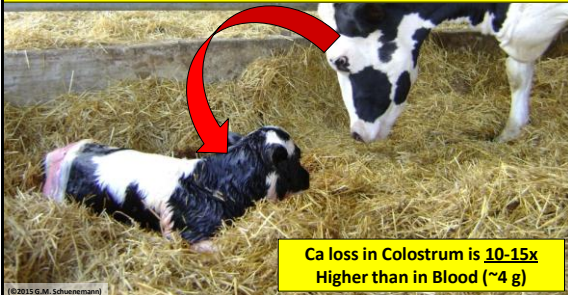
For 1000-Cow Herd with $\geq 30\%$ Culling, Losses (\$) May Offset the Milk Genetic Progress (~1% per Yr)



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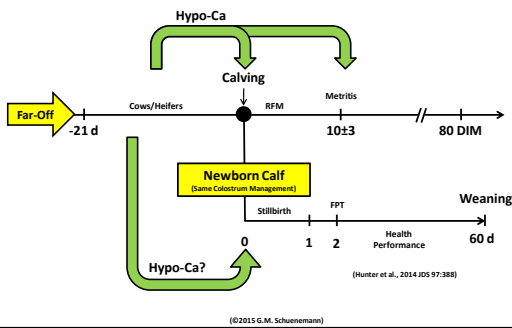
20 Lbs of Colostrum: 11 Mcal of energy, 140 g of protein, 23 g of calcium, 9 g of phosphorus, and 1 g of magnesium

(Goff and Horst, 1997 JDS 80:1260-1268; Kehoe et al., 2007 JDS 90:4108-4116; Tsioulpas et al., 2007 JDS 90:5012-5017)



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Calcium Status of Dams at Calving is Associated with Calf Diarrhea





J. Dairy Sci. 94:336–341
doi:10.3168/jds.2010-3170
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A prospective study of calf factors affecting first-lactation and lifetime milk production and age of cows when removed from the herd¹

A. J. Heinrichs² and B. S. Heinrichs
Department of Dairy and Animal Science, The Pennsylvania State University, University Park, 16802

Risk Factors for Lifetime Performance of Replacements:

- Each unit of calving difficulty: **-195 kg** ($P=0.05$)
- Weaning Age: **-463 kg** ($P=0.02$)
- Days ill: **-126 kg** ($P<0.01$)
- Wean DMI (for every 1 kg DM): **+286 kg** ($P=0.02$)

...

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Lactating Cows: Final Remarks

- Milk yield increases as lactating cows age (2nd and 3rd lactations); BUT older cows are at greater risk for transition diseases
- Culling offers an opportunity to replace unproductive animals, BUT $\geq 30\%$ culling may offset the milk genetic progress

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Replacement Heifers: Final Remarks

- Events (dystocia, diarrhea, days treated, and ADG) within the first 2-months of life (weaning) reduce first-lactation and lifetime milk production
- Genomic selection offers an opportunity to select superior replacements, BUT “management” early in life determines the lifetime performance regardless of genetic merit

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Health is KEY for Milk and Reproduction

- Can I select for those “traits” that best address the challenges of transition cows without compromising MILK?
- If I can select for those “traits”, what do I need to do from a management standpoint to capture the economic benefits of those “traits”?
- ...

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Gustavo M. Schuenemann
Email: schuenemann.5@osu.edu; Ph: 614-292-6924

THANK YOU!



United States Department of Agriculture National Institute of Food and Agriculture