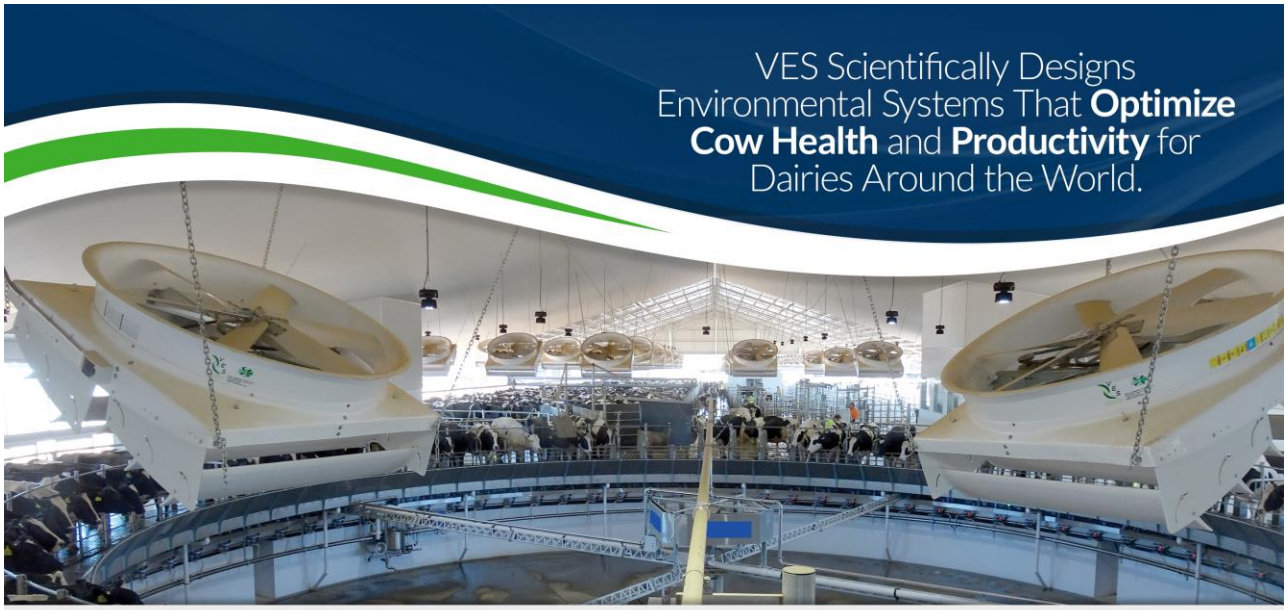


1

# LDPP/SDPP
# &
# Dry Cow Cooling
# Effects on Bovine Physiology

Michael J. Wolf DVM
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# Long Day Photo Period

## LDPP

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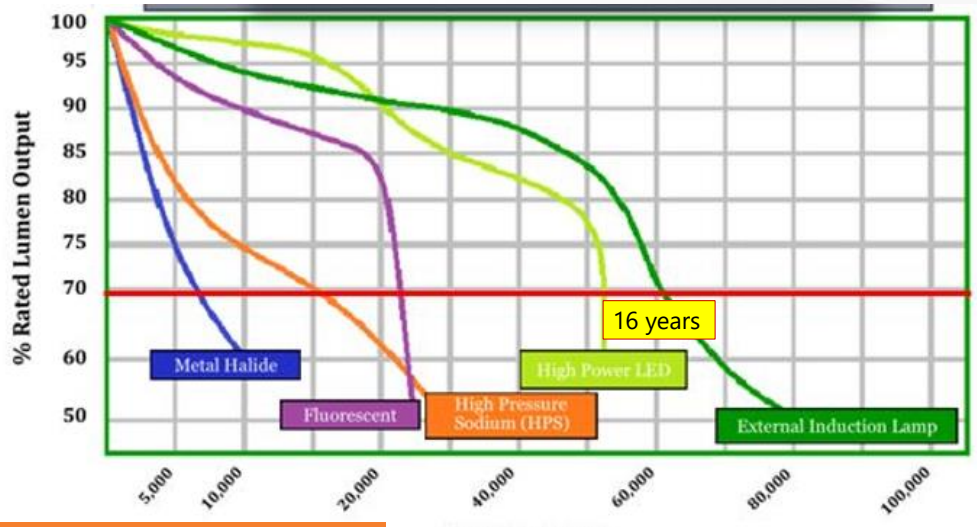
## LDPP

4

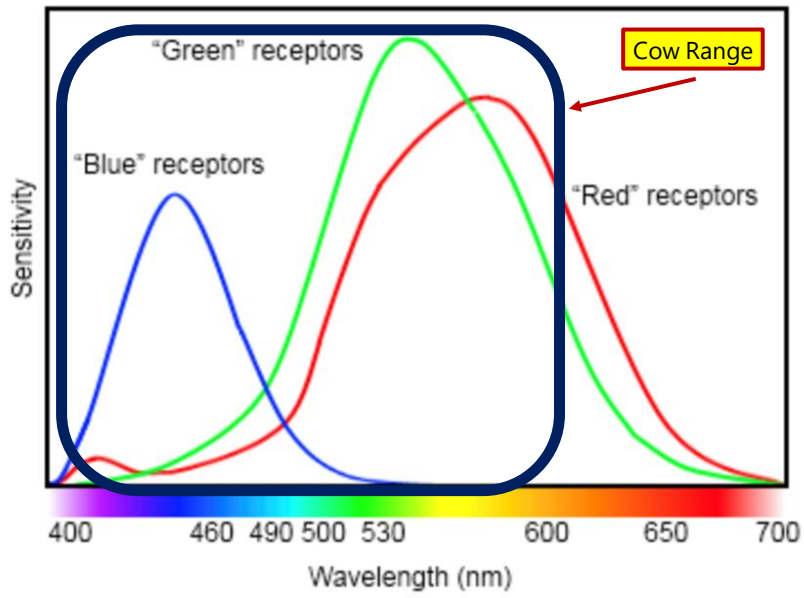
# Light Degradation Curves of Various Light Sources




5000 Hrs = 0.75 Yr Running 18 Hrs / Day

5

# Human Retinal Sensitivity




6

# Bovine Retinal Sensitivity

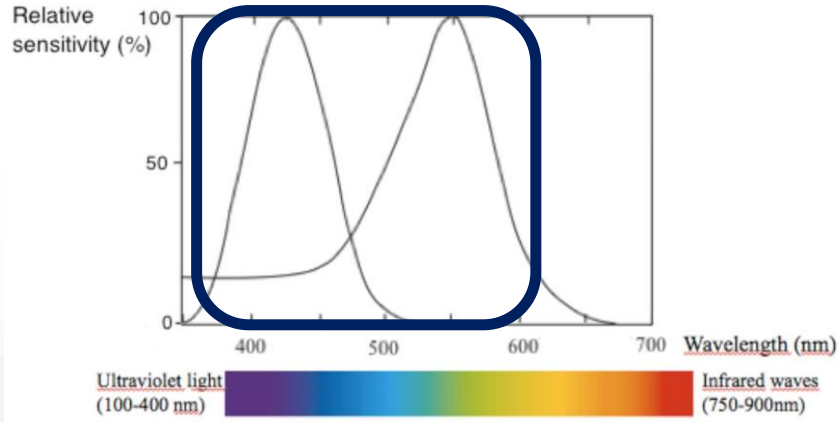
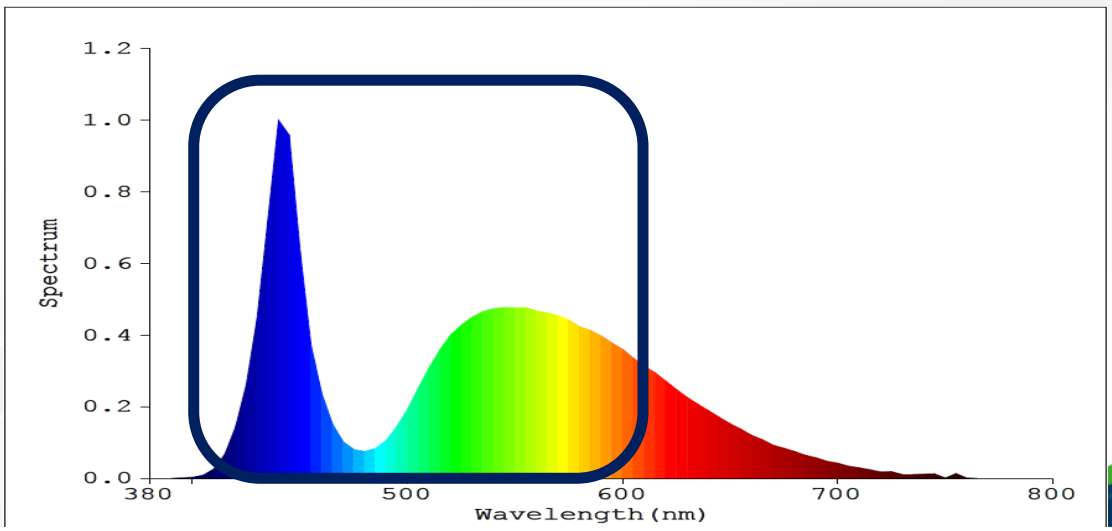



*Fig. 1. Cows two cones sensitivity at different wavelengths and which wavelength that represents which color (Modified after Wallin, 2002 and Sjaastad et al., 2010)*

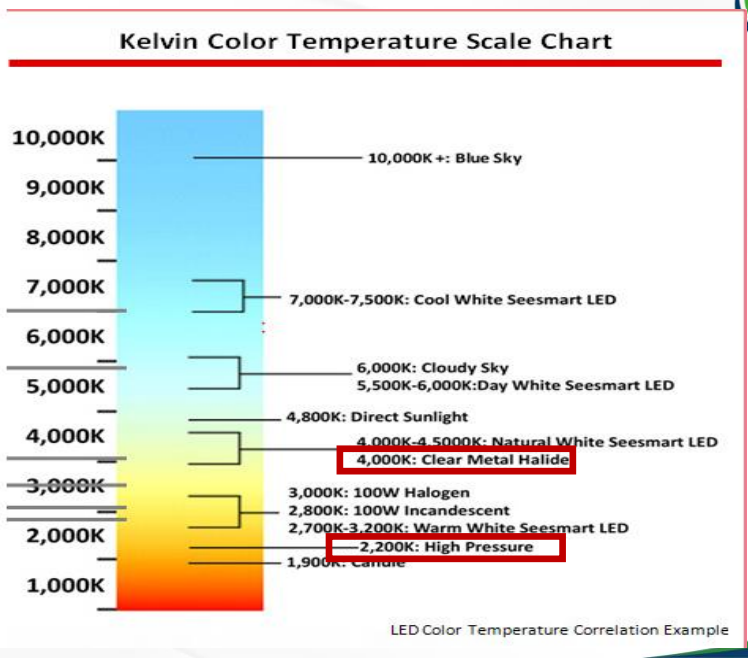
7

# LED Spectrograph vs Bovine Sensitivity




8

**Inductive & LED 6500K**

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# Physiology of LDPP

- **Light Intensity is Transmitted by the Optic Nerve to the Pineal Gland at the Brain Base**
- **The Pineal Gland is the Source of Melatonin in Mammals**
- **Plasma Melatonin Naturally Increases at Dusk as Light Intensity Decreases**
- **As Light Intensity Increases Naturally or by Artificial Sources from 10-20 Fc (108-215 Lx), Melatonin Begins to be Effectively Suppressed**

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# LDPP

- When Melatonin is Suppressed, IgF-1 Increases
- Increased IgF-1 & Other Associated Hormones, Affect Multiple Liver Functions Regarding Glucose, Protein & Triglyceride Metabolism
- More Substrates Are Made Available for Milk Production by the Udder
- >15 Fc (161 Lx) Sufficiently Suppresses Melatonin
- Concentrate Lux Levels 20 Fc (215 Lx) at Feed Bunks & Cubicles
- Designing for 20 Fc (215 Lx) Allows for Light Degradation & Dirt Accumulation on the Lens

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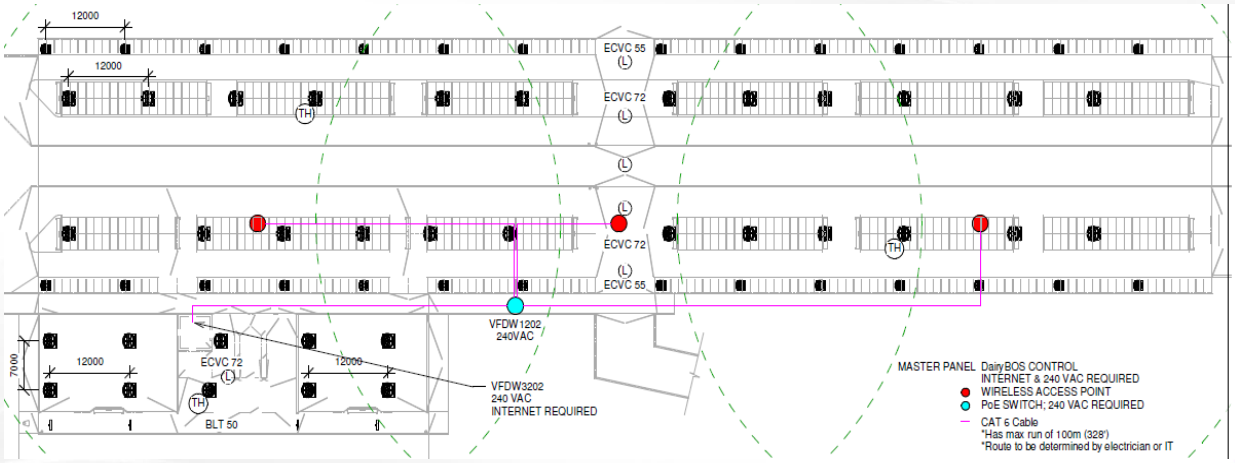
# LDPP

- Cow Time Budget: 20% @ Feed Bunk, 50-60% Laying in Cubicles
- Comfortable Well Ventilated Stalls Encourage Increased Laying Time
- Increased Laying Time Increases Blood Flow to Udder
- >80% of Cow's Living Space Should Be Covered with This Intensity

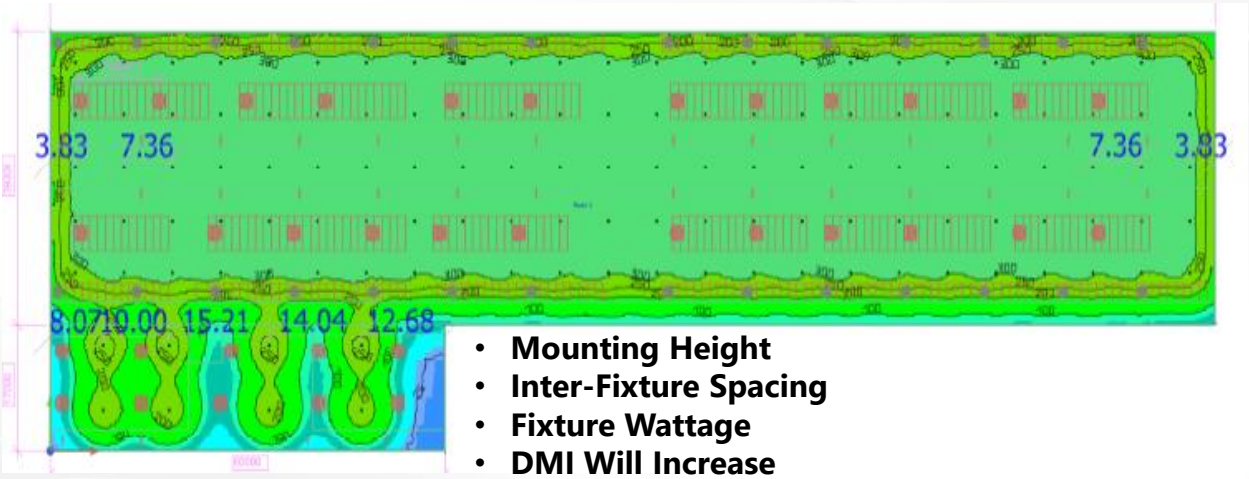
12

# Fan & Light Layout




13

# Dialux Mapping




- **Mounting Height**
- **Inter-Fixture Spacing**
- **Fixture Wattage**
- **DMI Will Increase**
- **Comfortable Well Ventilated Stall**

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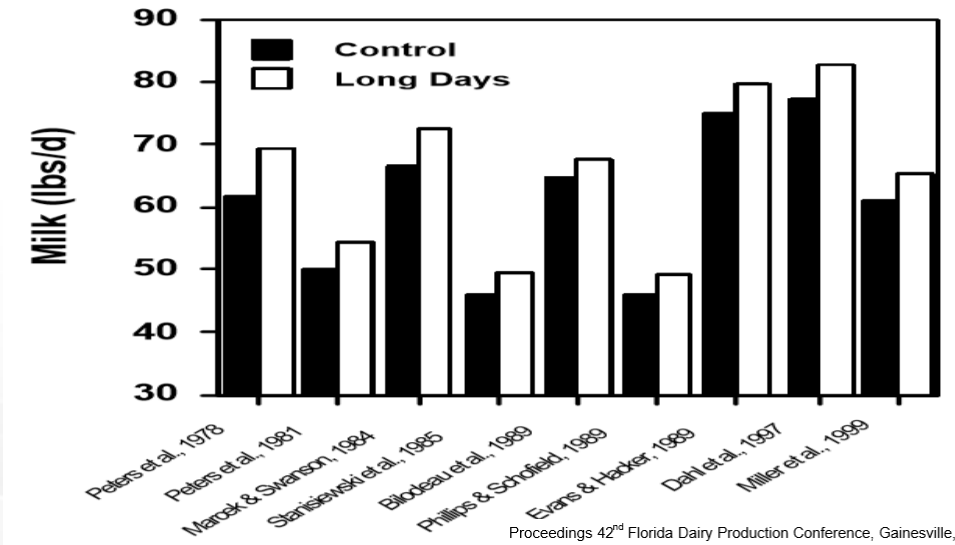
# LDPP Systems

- **Dependable Low Cost LED Fixtures Are Readily Available**
- **Very Energy Efficient Which Enhances ROI**
- **Dimmable Fixtures Available**
- **Photo-Cell Feedback to Control Various Light Groupings**
- **Control Systems to Monitor & Adapt the Lighting Level Required to Achieve the 20 Fc (215 Lx) 1m Above the Floor for 16-18 Hours/day**
- **<2 Fc (20 Lx) 6-8 Hours/day to Support Normal Circadian Rythym**

15

# Lactational Response to LDPP



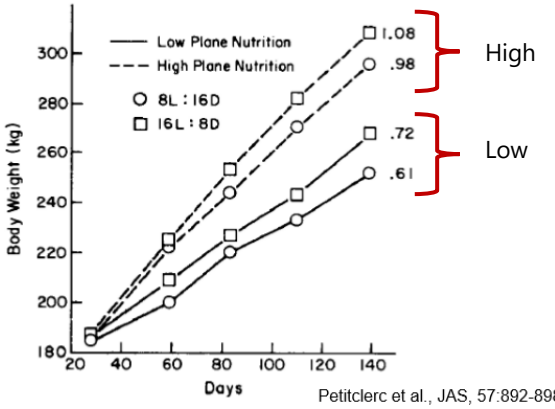

Proceedings 42nd Florida Dairy Production Conference, Gainesville, May 3, 2005

Figure 1. Summary of nine studies reporting the effect of long day photoperiod on milk yield in lactating cows.

16

# LDPP & Growing Heifers

## Long Days Increase Growth – Regardless of Intake




Petitclerc et al., JAS, 57:892-898



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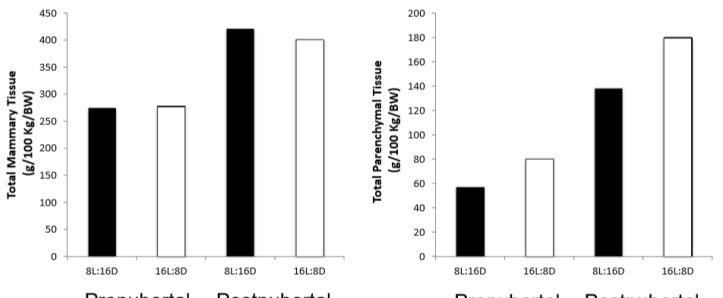
## Long Days Increase Mammary Parenchymal Growth

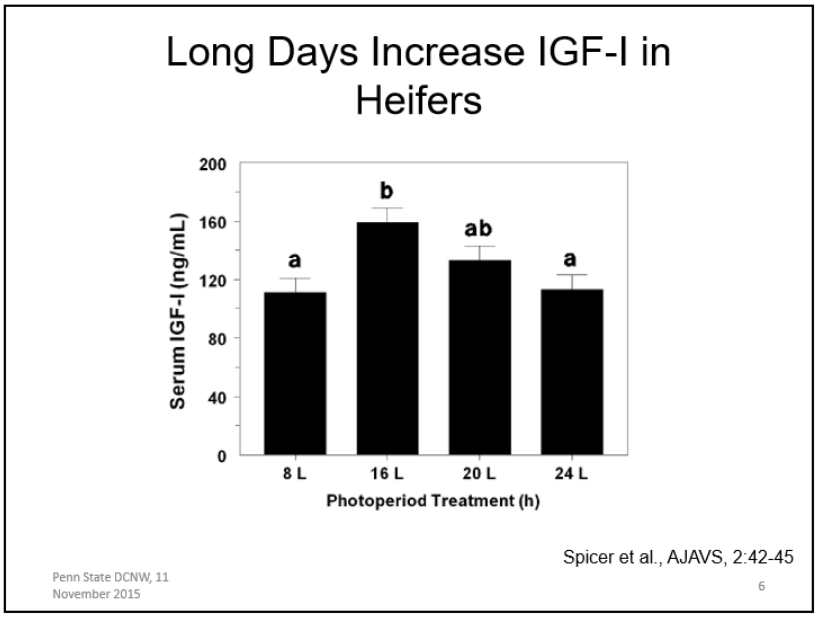



Petitclerc et al., JDS, 68:86-90



18

# More IS Not Better

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# LDPP Effects on Growing Heifers

- **Parenchymal (milk producing) Cell Number is Greater Pre and Post Puberty with LDPP Lighting**
- **Mechanism of Hormonal & LDPP Mode of Action Causing the Response are Not Fully Understood**
- **Onset of Puberty is Hastened 24 Days Earlier**
- **Increased Wither Height at Freshening**
- **Provide for as Many Days Throughout the Prepubertal Period as Practical**
- **1st Service Date can be Lowered Due to Earlier Puberty and Increased Frame Size**

ECOSISTEMAS Y RECURSOS AGROPECUARIOS

*Valenzuela-Jiménez et al. Photoperiod in dairy heifers 2(4):53-67,2015*

16 HOURS PHOTOPERIOD IN HOLSTEIN HEIFERS IN THE SUBTROPICS: EFFECTS IN DEVELOPMENT AND AGE TO FIRST ESTRUS

20

# Refractoriness

- **Daily Circadian Light Cycling of 6-8 hrs of <2 Fc (20 Lx) Should Be Provided Each Day for Normal Melatonin Levels to Rise**
- **Cows Can Function Very Well in Navigating Their Environment in Complete Darkness**
- **Do Not Use LDPP During the Dry Period**
- **Herds May Discontinue LDPP Mid August Until October 1st to Reset Sensitivity**
- **Adequate Light in Employee Working Spaces to Safely Navigate & Perform Tasks is Necessary**

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# LDPP Economics

- **Consider 8% Milk Increase**
- **Increase DMI 4-6%**
- **Installation Costs**
- **Operational Costs (electricity and bulb replacements)**
- **Pay Back Generally <1 Year**
- **Calculators Are Available**

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# Dry Cow
# Short Day Photo Period

## SDPP

16-18 Hours <2 Fc (20 Lx)
6-8 Hours >15 Fc (215 Lx)

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## Hormonal Effects of SDPP

- **Melatonin Levels Increased**
- **IGF-1 Levels Reduced**
- **Prolactin Levels Drop SDPP & Rise Dramatically Post-Parturition LDPP**
- **Prolactin & Prolactin Receptor Sensitivity Interaction**
- **Heat Stress Increases Prolactin & is Adverse to the SDPP Effect**
- **Prolactin/IGF Interaction Results in Mammary Cell Proliferation**
- **Reduced Post-Fresh Health Issues i.e. mastitis, RP, metritis**
- J. Anim. Sci. 2008. 86(Suppl. 1):10–14 doi:10.2527/jas.2007-0311

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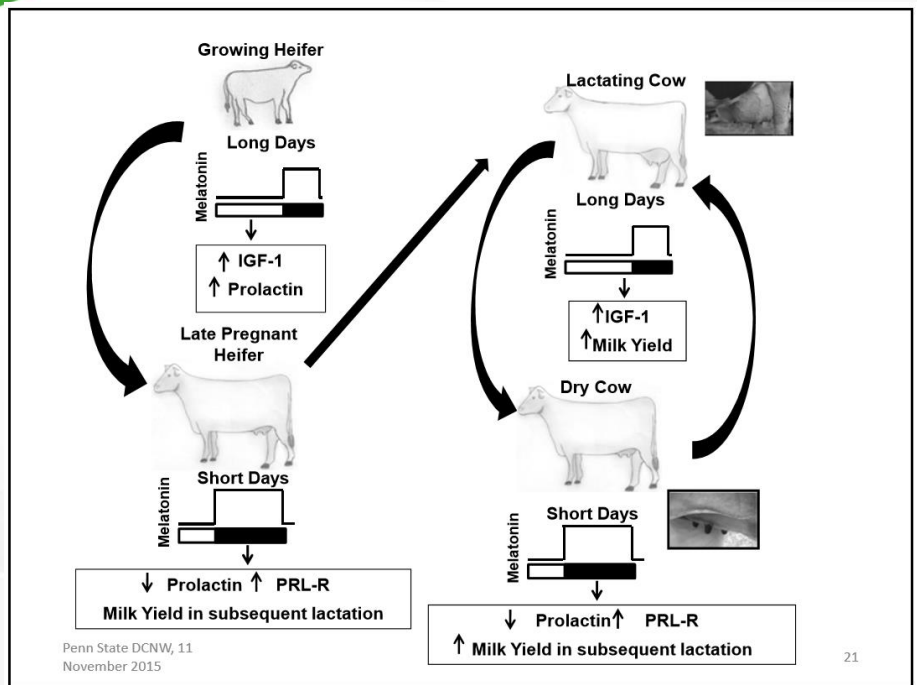


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# How Long Does SDPP Need to Last?

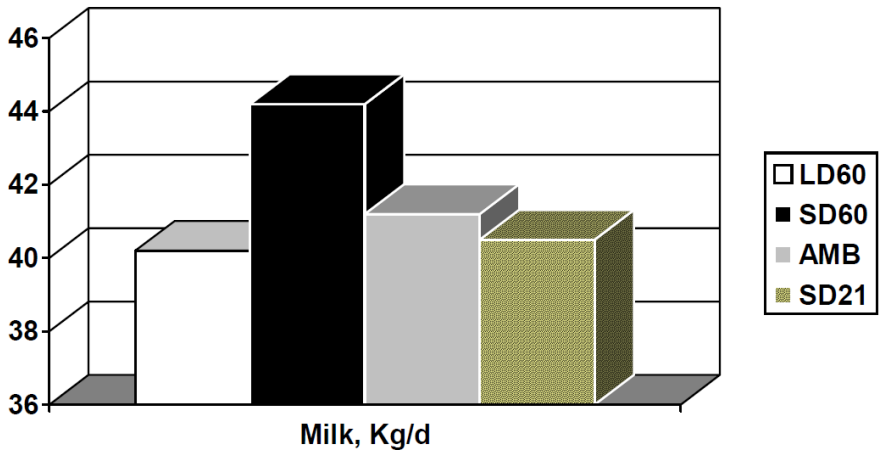


**Figure 1.** Milk yield of cows exposed to SDPP, LDPP, or ambient photoperiod (AMB) for 60 d when dry or to SDPP for only the final 21 d (SD 21) of the dry period.

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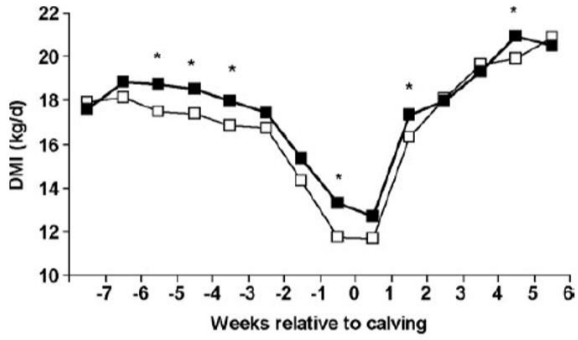
## Short Days When Dry Increase DMI




Velasco et al., JDS, 91:3467–3473

Penn State DCNW, 11 November 2015

16

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- **Through 120 d of lactation, cows exposed to SDPP when dry produced more milk (40.4 ± 1.1 kg/d) than cows exposed to LDPP (36.8 ± 1.1 kg/d).**

**Short-Day Photoperiod Increases Milk Yield in Cows with a Reduced Dry Period Length**
JDSVolume 91, Issue 9, September 2008, Pages 3467–3473

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## SDPP for Dry Cows

- **Has Positive Effects on Subsequent Lactational Milk Yields**
- **Best Results if Maintained Throughout the Entire Dry Period**
- **Ambient Light Intensity Levels Need to be Addressed**
- **Can be Difficult to Create the Housing Environment to Implement the SDPP Lighting Strategy**

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# Dry Cow Cooling

The Often Overlooked Group

30

# Dry Period Heat Stress: Effects on Dam and Daughter

G. E. Dahl
Department of Animal Sciences
Institute of Food and Agricultural Sciences
gdahl@ufl.edu
Penn State Dairy Cattle Nutrition Workshop
12 November 2015

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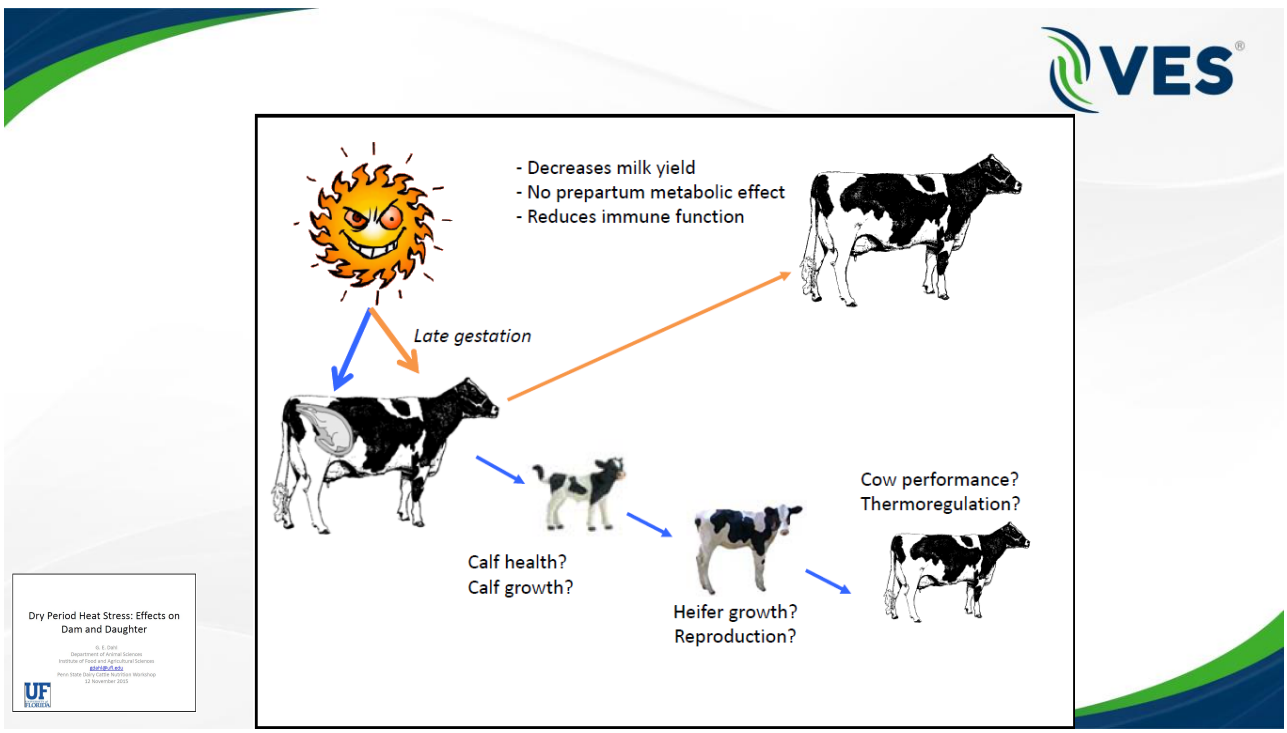


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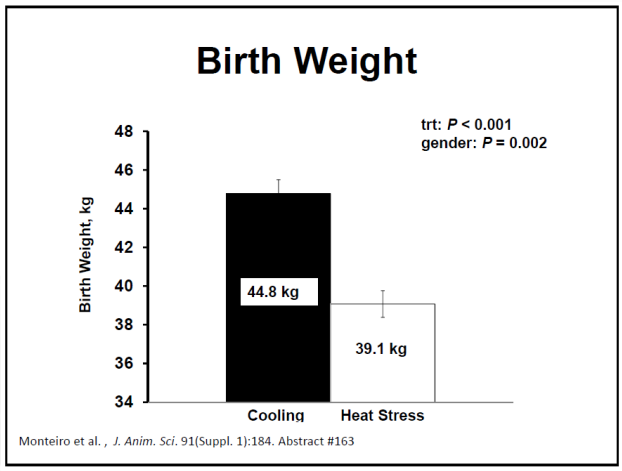
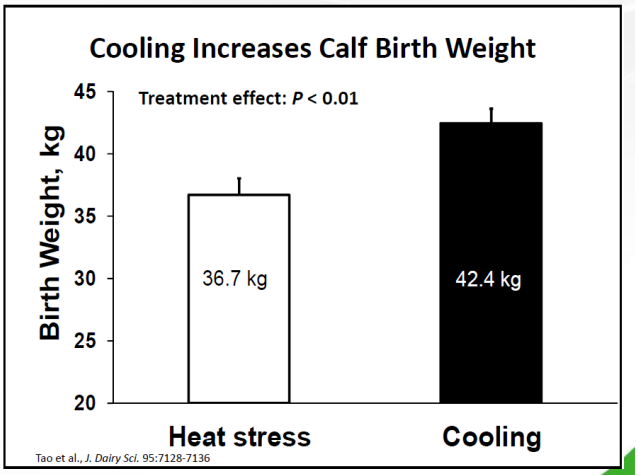
# Birth Weight Studies




Monteiro et al. , *J. Anim. Sci.* 91(Suppl. 1):184. Abstract #163




Tao et al., *J. Dairy Sci.* 95:7128-7136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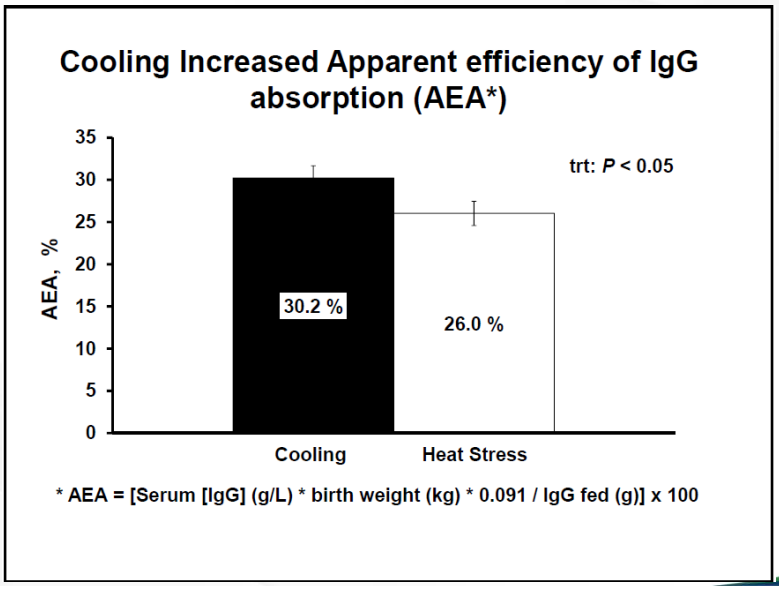
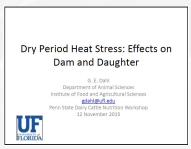
# Cooling & Colostrum Absorption

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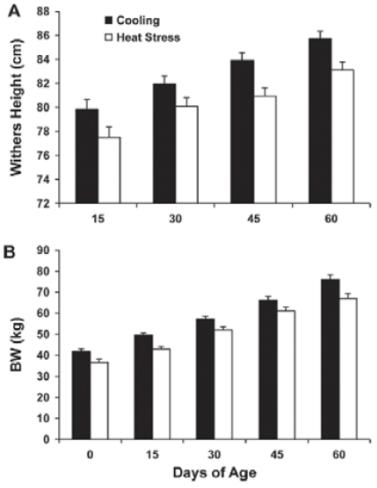
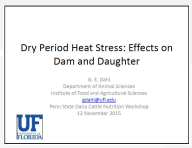
# Weaning Withers Height & Weight

Experiment 1 - In utero heat stress for ~6 weeks reduces body weight and height to weaning




Monteiro et al., *J. Dairy Sci.* 97:6426-6439


Dry Period Heat Stress: Effects on Dam and Daughter

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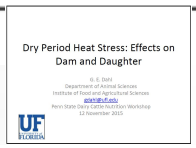
# Reproduction Impacts

**Table 2.** Effect of maternal heat stress (HT) or cooling (CL) during late gestation on reproductive performance before first lactation of heifers born to HT or CL dams

| Parameter | CL | HT | SEM | *P* |
|---|---|---|---|---|
| N | 36 | 32 | --- | --- |
| Age at first AI, mo | 13.6 | 13.8 | 0.2 | 0.32 |
| Services per pregnancy d[1] 30 | 2.0 | 2.5 | 0.2 | 0.05 |
| Age at pregnancy d[1] 30, mo | 16.1 | 16.9 | 0.3 | 0.07 |
| Services per pregnancy d[1] 50 | 2.3 | 2.6 | 0.2 | 0.32 |
| Age at calving, mo | 24.8 | 25.0 | 0.4 | 0.72 |

[1]Days after insemination.


Dry Period Heat Stress: Effects on Dam and Daughter

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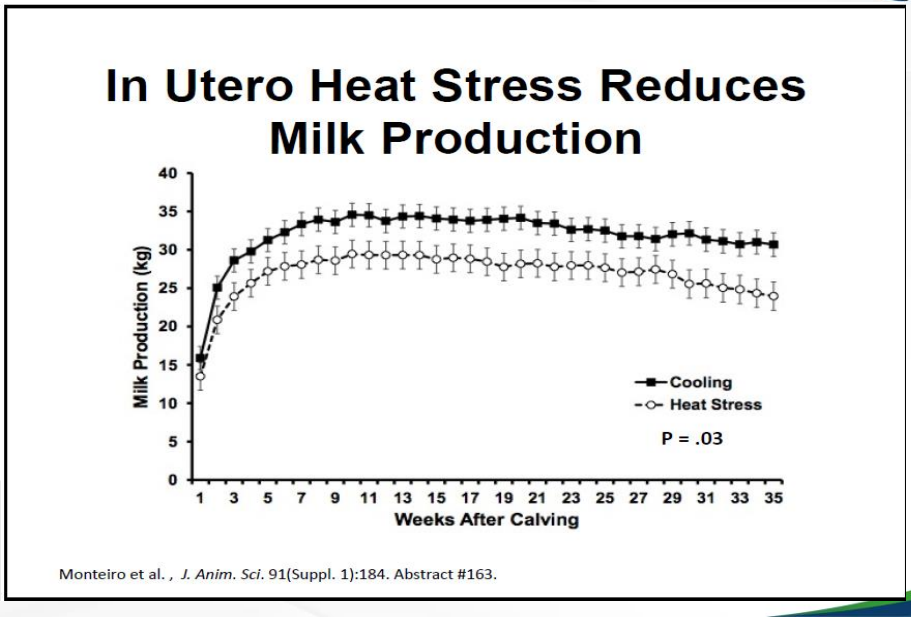
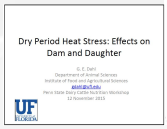
# 1st Lactation Milk Production Results




Monteiro et al. , *J. Anim. Sci.* 91(Suppl. 1):184. Abstract #163.

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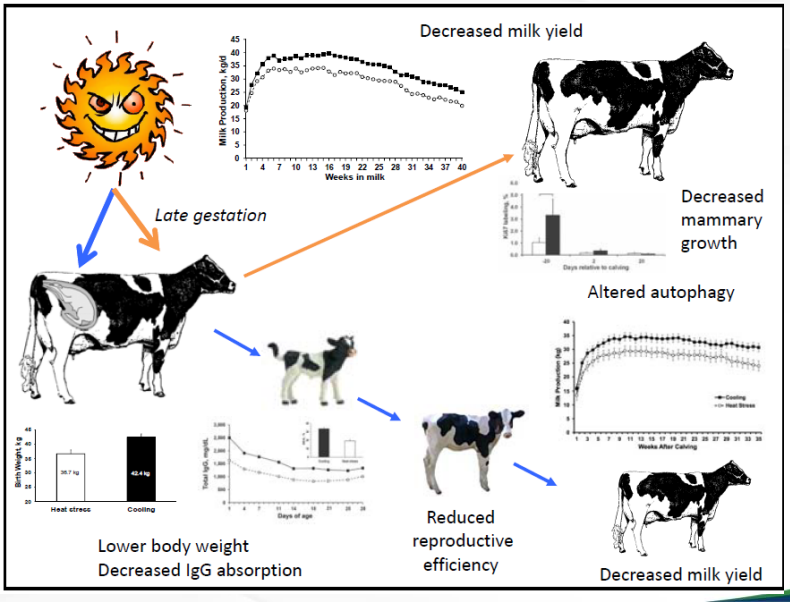
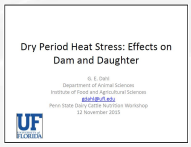
# Dry Cow Cooling Summary

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# Dry Cow Cooling

- Though Dry Cows Do Not Generate the Btu/Hr of a High Producing Lactating Cow, Cooling Provides Other Benefits to Through Her Transition Period & Her Offspring
- Very Capital Cost Effective
- Every Cow & 1st Lactation Heifer that Will Freshen on the Dairy Will Receive the Benefit of the Investment
- Incorporate Feedline Soakers &/or High Pressure Fog Systems Appropriate for the Local Climate as Discussed in Previous Webinar Sessions with Professional Guidance is Important for Success
- Remember to Incorporate an Effective Air Exchange & Airflow to be Between 2.5-5+ mph (2-4+ m/s)

40

# References:


- TRIENNIAL LACTATION SYMPOSIUM/BOLFA: Late gestation heat stress of dairy cattle programs dam and daughter milk production1 G. E. Dahl,*2 S. Tao,† and J. Laporta*
- J. Dairy Sci. 89:1244–1253 © American Dairy Science Association, 2006.Major Advances Associated with Environmental Effects on Dairy Cattle R. J. Collier,*1 G. E. Dahl,† and M. J. VanBaale* *Department of Animal Sciences, University of Arizona, Tucson 85721 †Department of Animal Sciences, University of Illinois, Urbana 61801
- Department of Animal Sciences Institute of Food and Agricultural Sciences gdahl@ufl.edu Penn State Dairy Cattle Nutrition Workshop 11 November 2015


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# Thank You!

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