Optimizing Dairy Farm Livelihoods: Integrating Environment and Economics

Victor E. Cabrera, PhD
Assist. Professor
Extension Dairy Specialist
Thanks!

Go Gators!
Outline

• **Background & Goal**

• **Dissertation Work in Florida**
  • Conceptual Frameworks
  • The Dynamic North Florida Dairy Model
  • Some Results

• **Wisconsin Work**
  • Replacement, Profit, and N Excretion
  • Price Risk Management
  • Reproductive Management
  • Integrated Farm System Model
Professional Background
(my life in one minute)
93’ BS & Engineer

97’ Teacher

99’ MS

01’ Consultant

04’ PhD

06’ Postdoc

08’ Ass Prof

Assistant Professor & Extension Specialist
Goal
...help rural people to improve their quality of life through applied biophysical, socio-economic, environmental research and extension...
What Seemed to be the Problem in Florida
THE SUWANNEE SEWER
Editorial
Gainesville Sun 04/23/04

SUWANNEE RIVER IS NOT SEWER
Letter
Del Bottcher
Gainesville Sun 05/10/04

WATER EFFORTS FEELING STRAIN
State farmers, DEP work together to improve water management partnership
Greg C. Bruno
Gainesville Sun 04/10/04

DEP STRIVING TO PROTECT FLORIDA’S WATER QUALITY
Letter
Colleen M. Castille
Gainesville Sun 05/11/04

3 GROUPS SUE EPA OVER FL WATERWAYS
The lawsuit claims that EPA has failed to protect state waters from pollution
Greg C. Bruno
Gainesville Sun 04/23/04

PUTTING THE NIX ON NITRATES
Suwannee River Partnership and Project 3:9
Chuck Woods
IMPACT Winter, 2001

GILCHRIST DAIRES SEEKING LEAVE
County is operating requirements
Karen Voyles
Gainesville Sun 11/05/02

POLLUTION RULING TO IMPACT FACTORY-STYLE FARMS
All Dundie take toll on Suwannee Cour
Karen Voyles
Gainesville Sun 11/05/02

A WATERSHED FORT
COURT UPHELD DAIRY WASTE RULING
Groups demand more strict protection
The Associated Press
Gainesville Sun 04/03/05

NITRATE LEVELS IN SUWANNEE SOAR
Nutrient load a threat to water
Greg C. Bruno
Gainesville Sun 05/14/2004

THE SUWANNEE RIVER WILL BECOME NOBODY’S SEWER
Letter
Charles Bronson
Gainesville Sun 05/14/04

STATE WATERWAYS STILL POLLUTED
Judge: DEP failing to protect rivers from dairy farms
Bruce Ritchie
Tallahassee Democrat 03/09/04

COURT UPHELD DAIRY WASTE RULING
Groups demand more strict protection
The Associated Press
Gainesville Sun 04/03/05

THE SUWANNEE SEWER
Editorial
Gainesville Sun 04/23/04
N in Dairy Farms in the SRB
Farmers’ Perceptions

North Florida ENSO Climate Phases

Niño

Neutral

Niña

AgroClimate.org
Participatory Problem Solving

The Dynamic North Florida Dairy Farm Model (DyNoFlo)
The Livestock Module
The Crops Module
The Optimization Module
Management Options

M₁, M₂, ..., Mₙ

Levels

M₁₁, M₁₂, ..., M₁ₙ
M₂₁, M₂₂
Mₙ₁, Mₙ₂, ..., Mₙₙ

Scenarios

(M₁₂M₂₁M₃₁...Mₙ₁), (M₁₂M₂₁M₃₁...Mₙ₂), (M₁₂M₂₁M₃₁...Mₙ₃), ..., (M₁ₙM₂ₙM₃ₙ...Mₙₙ)

Optimization

Max Profit

El Niño
La Niña
Neutral

Min N leach

Linear Programming

La Niña
Neutral
El Niño
Some Important Results
Wisconsin: Dairy Cow Replacement, Profit, and Nitrogen Excretion

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<th>Market and Constraint Conditions</th>
<th>Diet</th>
<th>Month of Replacement</th>
<th>N excretion (kg/cow/mo)</th>
<th>Net Revenue ($/cow/mo)</th>
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<td>Corn $0.19/kg</td>
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<td>12.00</td>
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<td>9</td>
<td>12.00</td>
<td>105</td>
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<td>Replacement $2,000</td>
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<td><strong>2008 Unfavorable</strong></td>
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<td>8</td>
<td>10</td>
<td>11.99</td>
<td>22</td>
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</tbody>
</table>
The Economic Value of a Dairy Cow
Victor E. Cabrera, Department of Dairy Science

**INPUTS - Edit Values in This Block**

**Evaluated Cow Variables**
- Current Lactation: 3
- Current Months after Calving: 5
- Current Months in Pregnancy: 1
- Expected Milk Production Rest of Lactation, %: 100
- Expected Milk Production Next Lactations, %: 100

**Replacement Cow Variable**
- Expected genetic improvement, % additional milk: 0

**Herd Production and Reproduction Variables**
- Herd Turnover Ratio, %/year: 35
- Rolling Herd Average, lb/cow per year: 24,000
- 21-d Pregnancy Rate, %: 18
- Reproduction Cost, $/cow per month: 20
- Last Month After Calving to Breed a Cow: 10
- Do-not-Breed Cow Minimum Milk, lb/day: 50
- Pregnancy Loss after 35 Days Pregnant, %: 22.6
- Average Cow Body Weight, lb: 1308

**Herd Economic Variables**
- Replacement Cost, $/cow: 1300
- Salvage Value, $/lb live weight: 0.38
- Calf Value, $/calf: 100
- Milk Price, $/cwt: 16
- Milk Butterfat, %: 3.5
- Feed Cost Lactating Cows, $/lb dry matter: 0.1
- Feed Cost Dry Cows, $/lb dry matter: 0.08
- Interest Rate, %/year: 6

**OUTPUTS - Interactive Results**

**Value of the Cow, $**
- 625

**Compared Against a Replacement, $**
- Milk Sales, $: 148
- Feed Cost, $: -157
- Calf Value, $: 26
- Non-reproductive Cull, $: -125
- Mortality Cost, $: -24
- Reproductive Cull, $: 12
- Reproduction Costs, $: 45
- Replacement Transaction, $: 700

**Herd Structure at Steady State**
- Days in milk: 224
- Days to Conception: 122
- Percent of Pregnant: 52
- Reproductive Culling, %: 8
- Mortality, %: 3
- 1st Lactation, %: 43
- 2nd Lactation, %: 27
- > 3rd Lactation, %: 30

**Economics of an Average Cow, $/year**
- Net Return, $: 1999
- Milk Sales, $: 3834
- Feed Cost, $: -1522
- Calf Sales, $: 60
- Non-Reprod. Culling Cost, $: -197
- Mortality Cost, $: -38
- Reproductive Culling Cost, $: -58
- Reproductive Cost, $: -80
Wisconsin: Price Risk Management


<table>
<thead>
<tr>
<th>Total Production Covered (%)</th>
<th>Optimal Solution</th>
<th></th>
<th>Non-Optimal Strategy</th>
<th></th>
<th>NET GAIN</th>
<th></th>
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<td>Target guarantee income over feed costs</td>
<td>Premium paid</td>
<td>Target guarantee income over feed costs</td>
<td>Premium paid</td>
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<td>33</td>
<td>66.14 ($/Mg milk)</td>
<td>0.53 ($/Mg milk)</td>
<td>73.51 ($/Mg milk)</td>
<td>1.40 ($/Mg milk)</td>
<td>0.87 ($/Mg milk)</td>
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<tr>
<td>43</td>
<td>88.19 ($/Mg milk)</td>
<td>0.84 ($/Mg milk)</td>
<td>95.83 ($/Mg milk)</td>
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<td>52</td>
<td>110.23 ($/Mg milk)</td>
<td>1.22 ($/Mg milk)</td>
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<td>72</td>
<td>154.23 ($/Mg milk)</td>
<td>2.20 ($/Mg milk)</td>
<td>159.73 ($/Mg milk)</td>
<td>3.05 ($/Mg milk)</td>
<td>0.85 ($/Mg milk)</td>
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<td>81</td>
<td>176.37 ($/Mg milk)</td>
<td>2.79 ($/Mg milk)</td>
<td>180.65 ($/Mg milk)</td>
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<td>90</td>
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<td>3.45 ($/Mg milk)</td>
<td>200.74 ($/Mg milk)</td>
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<td>4.17 ($/Mg milk)</td>
<td>220.74 ($/Mg milk)</td>
<td>4.21 ($/Mg milk)</td>
<td>0.04 ($/Mg milk)</td>
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LGM Analyzer

If you have saved CSV data from a previous run, you can upload it instead of typing in your farm's data again.

Upload a file

**Input**

**Insurance contract month:** 2012 Jan

**Choose your deductible level:** $1.00/cwt

**Feed Values:** Enter Manually Lowest Allowed Default Highest Allowed

**Target NIOFC:** $5.00/cwt

The prices we use for the Gross Margin Calculation correspond to future and option prices retrieved on the trade dates: 2012-01-18, 2012-01-19, 2012-01-20

<table>
<thead>
<tr>
<th>Coverage Month</th>
<th>Production (cwt)</th>
<th>Corn Equiv (tons)</th>
<th>Soybean Meal Equiv (tons)</th>
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<tr>
<td>Month Year</td>
<td>Milk Qty.</td>
<td>Corn Qty.</td>
<td>SBM Qty.</td>
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<td>Mar 2012</td>
<td>4113</td>
<td>95.8</td>
<td>21.1</td>
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<td>Apr 2012</td>
<td>4340</td>
<td>101.1</td>
<td>22.3</td>
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<tr>
<td>May 2012</td>
<td>4188</td>
<td>97.6</td>
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<td>Jun 2012</td>
<td>4240</td>
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<td>Aug 2012</td>
<td>4023</td>
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<td>Dec 2012</td>
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<tr>
<td><strong>Total</strong></td>
<td>41,417 cwt</td>
<td>965 tons</td>
<td>213 tons</td>
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**Save Input**

**Optimize Coverages for Least Cost Premium**
Wisconsin: Evaluation of Reproductive Programs


$1,000,000. 01/15/10-01/14/14. USDA Agriculture and Food Research Initiative. An integrated approach to improving dairy cow fertility. Cabrera, V.E. (PI), Fricke, P.M., Ruegg, P.L., Shaver, R.D., Weigel, K.A., Wiltbank, M.C.
# UW-Dairy Repros

**Location:** Waterloo, WI

## 1. Productive Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Current</th>
<th>Alternative</th>
<th>100% HD</th>
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<td>2,400</td>
<td>2,400</td>
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<td>Involuntary Culling Rate (%)</td>
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<td>14.3%</td>
<td>14.3%</td>
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<td>Mortality Rate (%)</td>
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<td>Stillbirth Rate (%)</td>
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<td>9.4%</td>
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## 2. Lactation Curves

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<td>555</td>
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<td>27</td>
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</table>

## 3. Economic Parameters

- Milk Price: $15.00
- Cost Feed Lactating (DM): $0.10/lb
- Dry Period Fixed Cost: $2.20/day
- Female Calf Value: $300/calf
- Male Calf Value: $75/calf
- Heifer Replacement Value: $1,500/heifer
- Salvage Value: $780/cow
- Labor Cost for Injection: $15.00/hour
- Heat Detection Cost: $15.00/hour
- Artificial Insemination Cost: $17.00/cow
- Interest Rate: 5.5%

## 4. Pregnancy Diagnosis Cost

<table>
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<td>$90</td>
<td>$90</td>
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<td>Ultrasound</td>
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<td>$50</td>
<td>$50</td>
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## 5.2. Hormones Cost

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<tr>
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<td>lutalyhe</td>
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<td>$20</td>
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<td>CIDR</td>
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<td>Trilant</td>
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<td>$5</td>
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## 5.3. Reproductive Program Parameters

### 5.3.1. Service Postpartum

- Double Oxyynch (day 22)

### 5.3.2. 2nd and Subsequent Services

- Double Oxyynch (day 32)

### 5.3.3. Resynch before precheck

- Oxyynch (day 45)

## 5.4. Injections and Pregnancy Diagnosis Labor Cost: Current Program

<table>
<thead>
<tr>
<th>Inject. Laborers</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
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</tbody>
</table>

| Cows Treated     | 165 | 45  | 0   | 0   |

| Preg. # Cows     | 45  | 0   | 0   | 0   |

| Diag. h/r/d      | 2.75| 0   | 0   | 0   |

## 5.5. Injections and Pregnancy Diagnosis Labor Cost: Alternative Program

<table>
<thead>
<tr>
<th>Inject. Laborers</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
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<tbody>
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</tr>
</tbody>
</table>

| Cows Treated     | 195 | 40  | 20  |

| Preg. # Cows     | 49  | 0   | 0   |

| Diag. h/r/d      | 2.75| 0   | 0   | 0   |

## 5.6. Heat Detection Labor Cost

<table>
<thead>
<tr>
<th>Heat Detect. Laborers</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
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</tr>
</tbody>
</table>

| Preg. # Cows | 50  | 0   | 0   | 0   |

| Diag. h/r/d | 2   | 0   | 0   | 0   |
Wisconsin: Integrated Farm System Model

Start

Read Input

Initialization

Setup Machinery

Read Weather

Spring Operations

Growth and Harvest

Storage

Herd and Feeding

Manure Handling

Fall Operations

Economic Analysis

Another Year?

Annual Loop

Yes

No

Summarize Output

End

Farm Parameter File

Machinery Parameter File

Weather Data File

Files

Weather Data File

Farm Parameter File

Machinery Parameter File

Annual Loop

Output Files

System/Methodology/Title/Description

Dairy Management

UNIVERSITY OF WISCONSIN-EXTENSION

University of Wisconsin—Extension
Case Study
Some Additional Info

Crops and Soils

- **Alfalfa**: hay and silage. 54 N and 138 P.
- **Grass**: hay and grazed.
- **Corn**: silage and grain. 130 N, 13 P, 5 K, and manure.
- **Oats**: grain and bedding. 100 N.
- **Soybeans**: grain. No fertilization.
- **Soil water holding**: 2.36 in
- **Soil evap. Coeff.**: 74.92 lb/ft³
- **Soil pH**: 6.5

Herd & Manure

- 43% first lactation
- Grain and silage fed with loader and mixer
- Diet formulated to 100% NRC requirements
- Forage to grain ratio: low
- Bedding type: straw (5.4 lb/day)
- Manure hauling average distance 1 mile
- No exported or imported manure
- …
Average results

Crop and Milk Yield

- Crops (Ton DM/ac)
  - Alfalfa: 3.32
  - Corn silage: 4.56
  - Corn grain: 4.88
  - Oats: 0.73
  - Soybeans: 0.92

- Milk (lb/cow/year)
  - 22,825

Economics and Environment

- Net income over feed and manure cost
  - $77,920/year
  - $1,039/cow/year

- N lost by leaching
  - 64.1 lb/ac

- Green House Gas Emission
  - 1,027,050 lb CO₂e/year
  - 13,694 lb CO₂e/cow/year
INCOME OVER FEED COST

$/year

15000 20000 25000 30000 35000 40000 45000 50000 55000 60000 65000 70000 75000 80000 85000 90000 95000 100000 105000 110000 115000


IOFC
IOFC & ENSO

Multivariate ENSO Index

$\text{\$/year}$


IOFC
Wisconsin: Decision Support Tools
Dairy Management

Dairy Management site is designed to support dairy farming decision-making focusing on model-based scientific research. The ultimate goal is to provide user-friendly computerized decision support systems to help dairy farmers improve their economic performance. Dr. Victor Cabrera focuses on model-based decision support in dairy cattle and in dairy farm production systems. Dr. Cabrera’s primary interest is to improve cost-efficiency and profitability along with environmental stewardship in dairy farms. His research uses simulation techniques, artificial intelligence, and expert systems. Dr. Cabrera’s research and Extension programs involve interdisciplinary approaches towards the creation of user-friendly decision support systems. As an Extension Specialist, Dr. Cabrera works in close relationships with county-based Extension faculty, dairy producers, consultants, and related industry.

Latest Projects
- Dairy Cow Fertility
- Strategies of Pasture Supplementation
- Success for Small Dairy Farmers
- LGM-Dairy
- Dairy Economic Decision Support System

Important Announcement
- New Graduate Student Position

Contact

TOOLS

Dairy Management Tools
Click to find out more about tools provided by DairyMGT

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Professional Page

Admin Portal
Click Above to reach the Administrator Portal.
Thanks!