Milk Quality & Mastitis Strategies for Organic Dairy Farms

The Dairy Practices Council – 43rd Annual Conference
Madison, WI *November 8, 2012*

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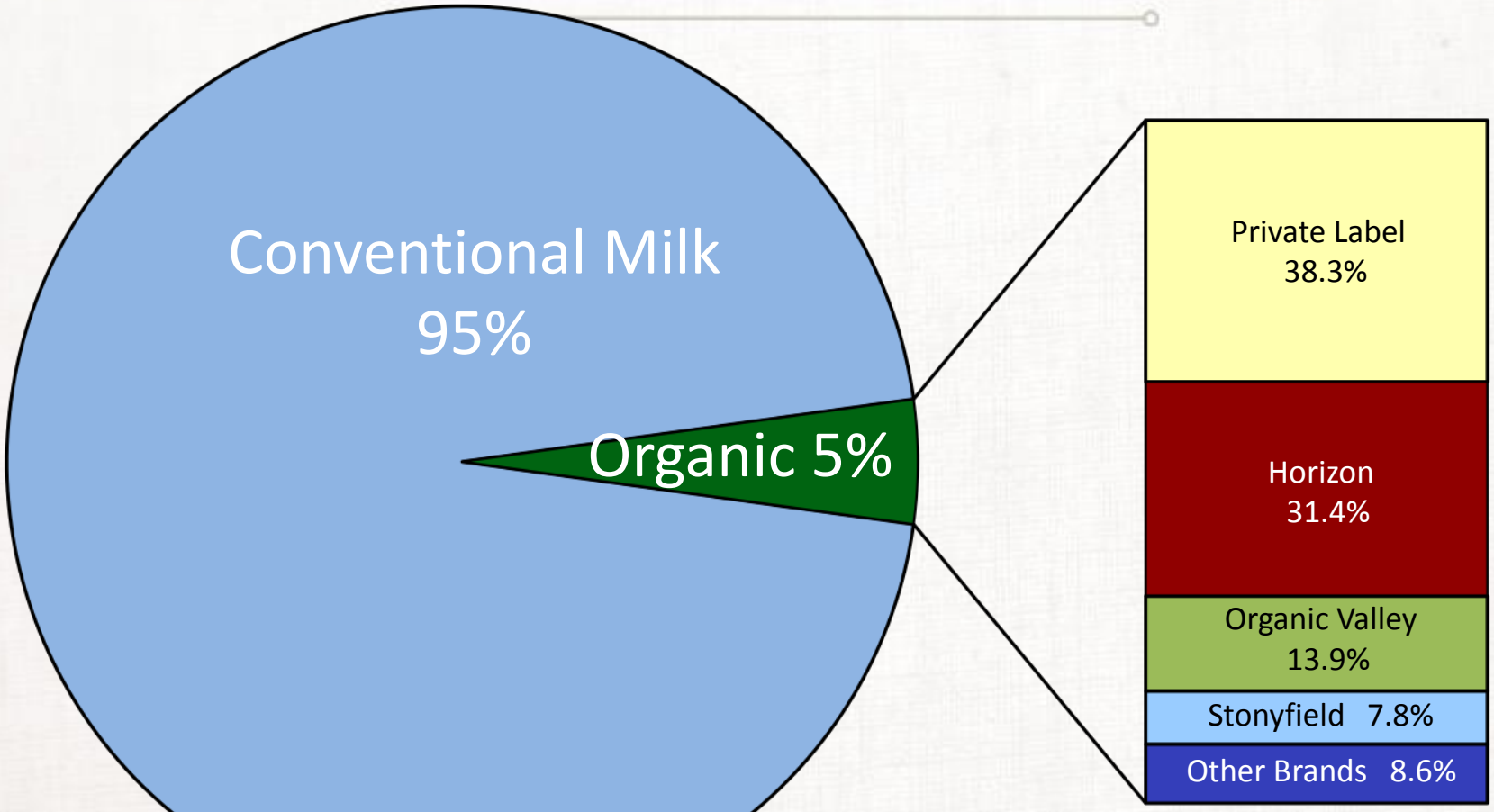
Outline - Topics

- Background – NOP/rules, Organic Valley/CROPP Cooperative and milk quality
- Organic treatment of mastitis
- Mastitis prevention and SCC reduction strategies
- General health promotion (disease prevention) for organic dairy herds
- Questions?

U.S. Milk Dollar Shares



Other Brands 8.6%

CROPP COOPERATIVE
organic and farmer-owned since 1988

Source: Nielsen Panel Data
Includes all store formats

Organic Rules in the US

- Certified organic – produced under USDA National Organic Program (NOP), Certifiers
- National Organic Standards Board (NOSB)
- National List – (Approved & Prohibited substances)
- FDA – ultimate authority, AAFCO – feed materials
- State officials – Departments of Agric., Commerce

Milk Quality – Coop. Avg SCC

CROPP COOPERATIVE

2008 - **279**

2009 - **256**

2010 - **244**

2011 - **240**

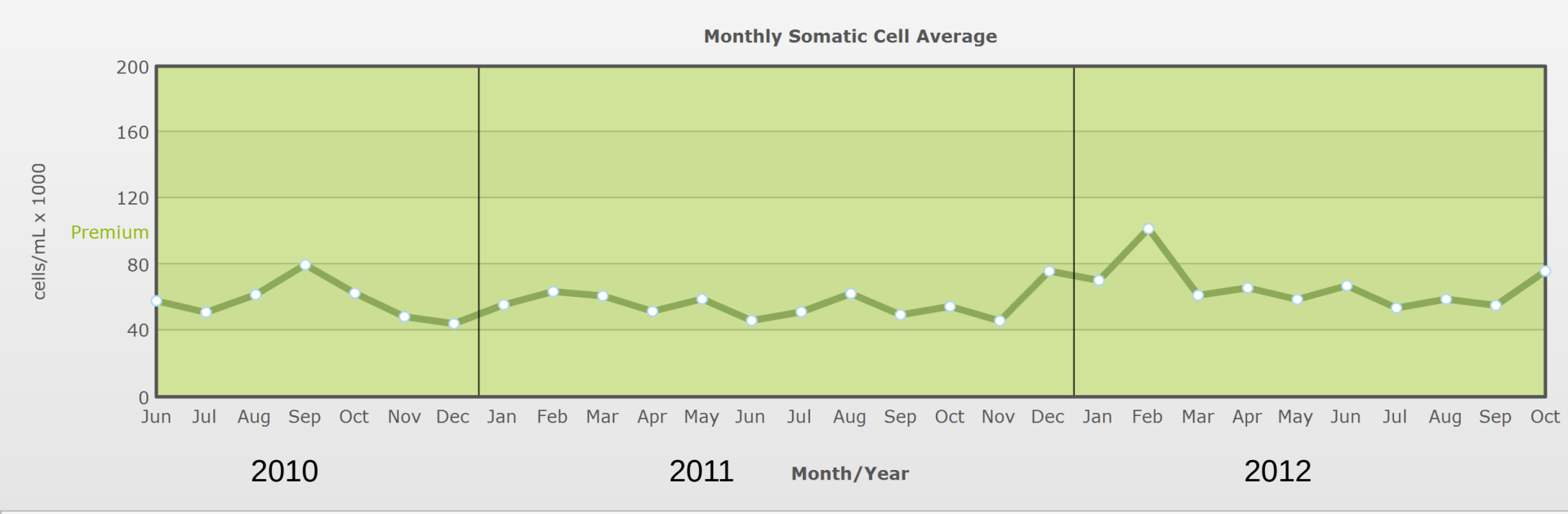
2012 YTD - **223**

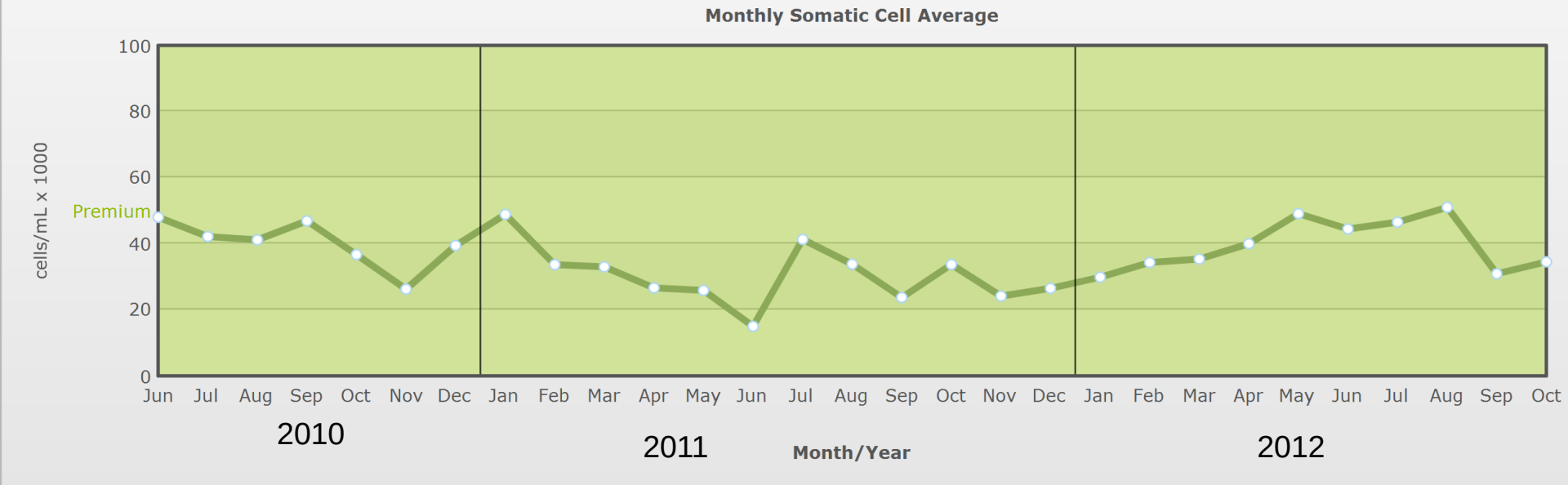
Quality Awards 2011 - 1549 total producers

40	**0-100 SCC avg**	2.50%
138	**101-150 SCC avg**	9%
209	**151-200 SCC avg**	13.50%

387 Total (25% total members) **<200 SCC avg**

2 OV Member's SCC – WA and VT





2008

GOLD WINNERS

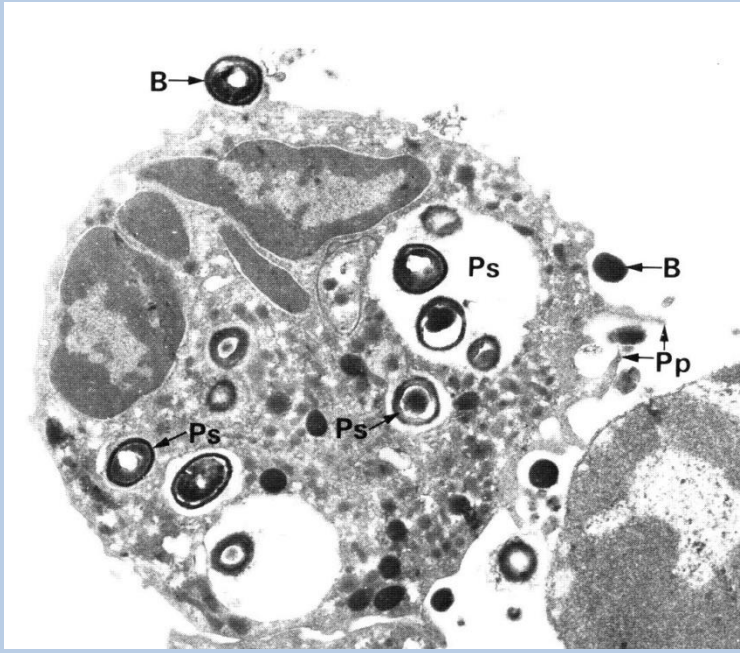
Recipient	Nominator
Jim and Janie Austin, Oakville, Wash.	Rachel Turgasen, Organic Valley
Jeremy and Deseriee Beebe, Whittemore, Mich.	Gerry Volz, Mich. Milk Producers Assn.
Dick Brokish, Hollandale, Wis.	Mike Thousand, Fuller's Milker Center
Siobhan Griffin, Schenevus, N.Y.	Rachel Turgasen, Organic Valley
Jeff and Dan Hill Family, Clyde, N.Y.	Mary Ellen Charter and Dave Wilson, Keseca Vet Clinic
Joe Machado, Sr., Hanford, Calif.	Norm Kedrowski, Land O'Lakes
Kenneth and Kevin Mahalko, Gilman, Wis.	Dave Nyberg, Associated Milk Producers, Inc.
Charles and Julie Nelkie, West Branch, Mich.	Tracy Goodroe, West Branch Vet Services
Kenny and Marlus Schmitz, Norwalk, Wis.	Bob Zielsdorf, Swiss Valley Farms
Philip and Carol Uhlenhopp, Sumner, Iowa	Brian Gomer, IBA

2010 and 2011 Winners from Organic Valley = 18 total

110 National Winners – All Dairies in US

18/110 = 16% of NDQ awards – Total of ~1500 member dairy farms

Antibacterial Therapy



"Ultimately, it is the **immune system** that eliminates infections, antibacterial drugs just help make the pathogens more susceptible to attack"

Ron Erskine, DVM, PhD MSU

Tools for Organic Production

- Vitamins and Minerals – feed, inject.
- Allowed Synthetics (Conventional; fluids, aspirin, etc.)
- Vaccines, Biologics – antisera, cell extracts
- *Herbs/plants* – aloe vera, garlic,tinctures
- Topicals- essential oils, etc.
- *Whey products* – colostrum, cytokine
- Antioxidants
- *Homeopathy*

Essential Oils (EO)

- Oil portion of a plant
- Gives each plant a distinct aroma, i.e. pine tree.
- Each EO has hundreds of compound in them (aldehydes, alcohols, esters, ketones, terpenes, etc).
- EO serves as the plant's immune system: protector, healer.

Literature – Studies on Treatments

- **EFFICACY OF ALTERNATIVE TREATMENTS: A SCIENCE-BASED APPROACH IS ESSENTIAL -** John Barlow - University of Vermont - ***NMC Annual Meeting Proceedings (2010) pp. 109-113.***
- Pol, M., P.L. Ruegg. 2007. Treatment practices and quantification of antimicrobial drug usage in conventional and organic dairy farms in Wisconsin. ***J Dairy Sci 90: 249-261.***
- Ruegg, P.L. 2009. Management of mastitis on organic and conventional dairy farms. ***J Animal Sci 87: 43-55.***

Natural MastitisTreatment tubes: Phyto-Mast®

Gaultheria, Glyccyrhiza, Thymol (10%) Radix Angelica sinensis, Radix Angelica dahuricae, Oleum Brassica campestris q.s. intramammary tubes

Phyto-Mast: All ingredients are **GRAS**

- Available in 15cc infusion tubes
- 1-2 tubes 1st dose & 1 tube at the next 2 milkings.
- **Withhold milk: 12 hours**
- **Withhold meat: 1 day**

1) **NC State / FARAD residue study with lactating goats (Student Case Sessions at AABP 2010)**

2) **Aurora Organic Dairy in Colorado and U. of Florida clinical trial with lactating cows (poster at AABP 2010)**

3) **NC State clinical trial evaluating therapy for dry cows (poster at ADSA 2010)**

4) **NC State 2nd dry cow clinical trial (start Aug 2010)**

5) **Wageningen, NL clinical trial on an organic farm with lactating cows**

6) **Michigan State clinical trial using Phyto-Mast as the control and using guava and honey**

7) **UVM and U Conn doing in vitro work**

NC STATE UNIVERSITY
COLLEGE OF VETERINARY MEDICINE

BURROUGHS WELLCOME FUND

Finding Phyto-Mast: Determining Withdrawal Time of a Phytoceutical Mastitis Treatment in Lactating Dairy Goats

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Introduction

- The organic dairy industry is growing at approximately 20% per year and currently comprises about 3% of dairy milk sales.
- Organic dairy animals may not be given antibiotics or dewormers.
- **Producers are not to withhold treatment from sick animals.**
- There are no FDA approved mastitis treatments for organic production.
- Producers use: botanical products, herbal medicine, homeopathy, whey products, vitamin supplements.

- Phyto-Mast is a plant-based mastitis treatment used in organic dairy animals (Table I).
- Indicated for use in lactating cows with clinical mastitis.
- Approved by the Ohio Ecological Food & Farm Association (OEFFA).
- Very little is known about the uptake, distribution, and clearance of this product in milk.

Hypothesis

- **Phytoceutical levels in milk and blood are quantifiable using volatile active ingredients as biomarkers of exposure.**

Study Aims

- **To administer Phyto-Mast via intramammary infusion to 2 lactating dairy goats (as a model for dairy cows) and sample plasma and milk for 10-14 days.**
- **To determine approximate withholding time for milk following treatment using gas chromatography with mass spectrometry (GC-MS).**

Materials & Methods

Animals and Treatment

- Two healthy, lactating Alpine dairy goats (as a model for dairy cows).
- Collected baseline milk and plasma to determine background levels of thymol and other active components.
- Treated with phytoceutical (5ml per udder half) via intramammary infusion (figure I).

Sample Collection

- Blood samples were collected at 15, 30, and 60 minutes, and at 2, 4, 8, 24, 36, 48 and every 24 hours for 10 days after treatment.
- Milk samples every 12 hours (figure II), and samples for culture at 0, 24, 72, and 120 hours.
- California Mastitis Test (CMT) at every milking (figure III).
- Goats monitored for changes in vital signs and udder conformation.

Analytical Chemistry

- Developed headspace assay with a 100um polydimethylsiloxane fiber to detect thymol in milk and plasma.
- Samples heated to 37°C and agitated for 5 minutes, fiber exposed to headspace above a 1 ml sample in sealed vial for 20 minutes, then injected into gas chromatograph with mass spectrometry (GC-MS) with a column temperature of 280°C and run for 17.5 minutes (figure IV).
- Purified chemical standards for thymol and methyl salicylate, active ingredients in Phyto-Mast, were used to create a standard curve for quantification.

Figure I. 5ml Phyto-Mast administered via intra-mammary infusion into each teat orifice.

Figure III. California Mastitis test. http://www.infovets.com/demo/demo/dairy/Images/D100-1.JPG

Figure II. Separate milk samples collected every 12 hours from each udder half.

Figure IV. PDMS fiber injected into GC-MS.

Figure V. Milk Production by Udder Half

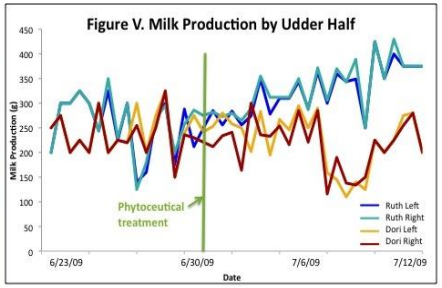
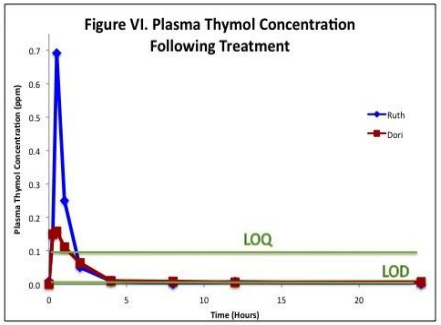


Figure VI. Plasma Thymol Concentration Following Treatment



Results

Following Phytoceutical Treatment

- Animals displayed no clinical signs of illness, and vital signs remained within normal limits.
- No perceptible change in udder conformation.
- Milk samples remained culture negative.
- CMT results were not substantially altered by treatment.
- No marked change in milk production (figure V).

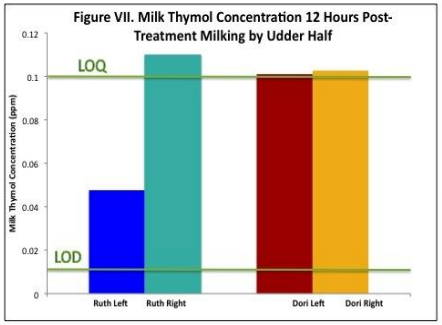
GC-MS Analysis

- Thymol detected at retention time = 7.44 min,
- For thymol, limit of quantification $(LOQ)_{milk\ \&\ plasma}$ = 0.1 parts per million (ppm); limit of detection $(LOD)_{plasma}$ = 0.005 ppm, LOD_{milk} = 0.01 ppm)
- Methyl salicylate detected at retention time = 7.03 min, (LOD = 0.01 ppm). Not detected in any study milk or plasma samples.
- **Thymol detected in plasma samples beginning at 15-minutes post treatment (figure VI).**
- **Maximum plasma levels at 30-minutes post-treatment.**
- **Plasma thymol levels below LOQ after 2 hours, below LOD after 8 hours.**
- **Apparent half-life of thymol in plasma = 30-40 minutes**
- **Thymol only detected in 12-hour post-treatment milk samples (figure VII).**

Table I. Phyto-Mast Ingredients and Chemical Bioactivity

Ingredient	Common name	Active chemical	Bioactivity
Thymus vulgaris	Garden thyme	Thymol	Antiseptic
Gaultheria procumbens	Oil of wintergreen	Methyl salicylate	Analgesic, anti-pyretic
Glycyrrhiza uralensis	Chinese licorice	Glycyrrhizin	Anti-inflammatory, demulcent
Angelica sinensis	Chinese Angelica	α-pinene	Anti-inflammatory, circulatory stimulant

Figure VII. Milk Thymol Concentration 12 Hours Post-Treatment Milking by Udder Half



Conclusions

- **Demonstrated that a phytoceutical can be traced in the milk and plasma following intramammary treatment using thymol as a marker.**
- **Headspace analysis with GC-MS is a useful tool in quantifying thymol in biological matrices.**
- **Based on use of thymol as a biomarker, other ingredients in this phytocetucial with similar chemical properties are less likely to remain in the plasma or milk beyond 24 hours.**

Future work:

- Follow pilot study with 4 or 5 more does to ensure repeatability.
- Investigate other Phyto-Mast chemicals in milk and plasma samples, (ie. Glycyrrhizin, Methyl salicylate).
- Trial in dairy cows with recommended dose (12 cc per quarter for 4 consecutive milkings).
- Investigate other products to develop and advocate safe withholding times for mastitis treatments used in organic dairy production.

Approaching the issue of the human health safety of trace phytoceuticals in organic milk would be difficult and costly. A useful alternative is to analyze biological markers in animals following treatment. Understanding the pharmacokinetics of active ingredients used in dairy production will lead to accurate withholding recommendations and improve organic milk safety.

Acknowledgements

- George H. Hitchings New Investigator Award (Burroughs Wellcome Fund)
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- NCSU Metabolism Educational Unit

References

- Organic Trade Association. (2009). "Organic Dairy Production." Retrieved July 6, 2009, from http://www.ota.com/Organic/Dairy_Production.html.
- Ruegg, P. L. (2009). "Management of mastitis on organic and conventional dairy farms." J Anim Sci **87**(13 Suppl): 43-55.
- USDA-Agricultural Marketing Service. (2008). Milk Sales Data, Monthly Reports.

Instead of culling: Nurse cows

(managed as a separate group)

1) excellent way to raise calves
2) reduce labor expense
3) keeps poorer quality milk out of tank
4) keeps contagious cows away from un-infected cows
5) reduce milk being shipped if needed
6) **NEVER use a known Johnes positive cow**

Conventional Wisdom

applies to Organic Systems

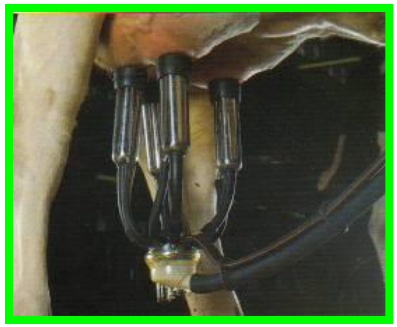
Troubleshooting Herd Health Problems

CROPP COOPERATIVE

Proper Milking Procedures

Pre-dip

- ✓ Requires 100% coverage of teat to be effective.
- ✓ Use individual towels to completely dry teats.
- ✓ The end result should be a clean and sanitized teat.
- ✓ This will reduce bacteria exposure to teat ends – lowering new mastitis cases.
- ✓ Will also reduce bacteria load in bulk tank - resulting in lower bacteria counts.
- ✓ Dipping, wiping and drying will help stimulate a good let-down.



Timing of prep vs. unit attachment

- ✓ Cows should be prepped 60-90 seconds before milker is attached.
- ✓ Milk should be at full flow soon after unit is attached.
- ✓ Good udder prep will result in a fast and complete milk-out.

Proper unit alignment and removal

- ✓ Milker unit should hang so all quarters milk evenly.
- ✓ Unit should be removed before every last drop is milked out.
- ✓ Over-milking will cause teat-end damage and increase infection rates.

Post-dip

- ✓ Most effective tool to control contagious mastitis.
- ✓ Provides protection until teat canal can close after milking (usually takes 30-90 mins.)

Troubleshooting Herd Health Problems

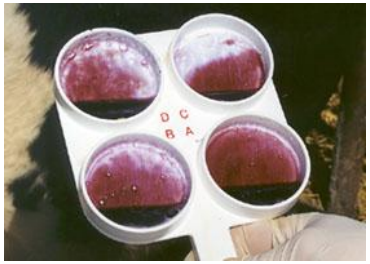
CROPP COOPERATIVE

High SCC and Mastitis Detection

Fore strip or strip cup – Look for abnormal milk….Watery, flakes, clots, etc.

- ✓ Why does most high SCC milk still look normal?

California Mastitis Test (CMT)



- ✓ Immediate cow side results.
- ✓ Simple and affordable….Complete kit = $15.00 Refill = $8.00
- ✓ Not as accurate as lab testing, but very effective.
- ✓ It's easy to become a CMT "expert".

Mas-d-tec

- ✓ Immediate cow side results.
- ✓ New unit will cost around $300.00
- ✓ Easy to use.
- ✓ Requires diligent care to maintain accuracy.

Lab SCC testing – DHIA or similar herd type testing.

- ✓ Very accurate.
- ✓ Labor intensive and costly.
- ✓ Immediate results not available.
- ✓ Excellent way to gather long term data on individual cows.

Mastitis Prevention

- *Mastitis Triangle* – Man – Environment – Machine

Milking Procedures – udder prep, unit attachment, on-time and post-dipping

Environment – Clean, Dry & Comfortable (*EMF Stress*)

Equipment – regular maintenance, performance checks – vacuum level, pulsation, dynamic tests ***during*** milking

<u>Other Factors</u>;

Nutrition – balanced diet, trace minerals & vitamins

Milking Order – infected cows = last, culling

Monitoring – treatment and culture records, SCC

Dry cows and heifers – environment and nutrition

(+fly control for heifers)

#1 People

Milking Procedures;

Udder prep, proper unit attachment & removal,

Post-milking teat dipping

#2 Environment

Which cow is more likely to get mastitis?

Troubleshooting Herd Health Problems

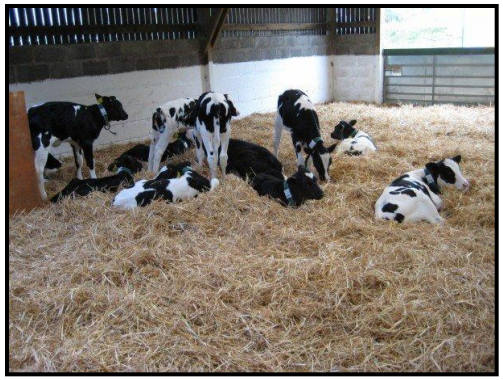
CROPP COOPERATIVE

An ounce of prevention is worth…??

In the Organic Dairy world, prevention is everything.

It's more cost effective, labor efficient, and humane to prevent new mastitis cases, instead of trying to heal infected cows. Limit the exposure to bacteria and you will greatly reduce the risk of new udder infections.

Clean and Dry --- all the time.



#3 Equipment Function

Check System - both Static and Under Load

Prevention - #4 – Soils & Nutrition

Animal Health on Organic Dairies

Based on Disease Prevention

The Three Most Important Factors;

1. High Forage Diet
2. Grazing
3. Soil Mineralization & Biology

Grazing Promotes Health

Principle

Excellent grazing management ;

1.) Provides high quality forage

2.) Minimizes disease (i.e. parasites)

3.) Increases beneficial nutrients in meat and milk

4.) Promotes healthy soil

5.) Improves profitability


The End


Questions??