## How is Adult Dairy Cow Health & Business Sustainability linked in Dairy Herds on Pasture?

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## Dairy Farm Performance on Pasture based systems



## Ideal Stocking Density falls within a window of Opportunity that changes constantly



Stocking Rate on pasture / Supplementary Feeding

# Relationship between Stocking Rate, MS/ Ha @ PGR of 16t/ Ha

- Holmes, 2002

Cows/ Ha	2.75	3.26	3.75	4.28
tDM eaten/ cow/ yr	3.9	3.7	3.5	3.2
tDM eaten/ Ha/ yr	10.8	11.9	13.0	13.9
Kg MS/ cow/ yr	359	328	300	269
Kg MS/ Ha/ yr	991	1069	1128	1152
% Pasture utilization	68	77	81	87
FCE (kg MS/ tDM eaten	92	88	86	84

What does Dairy Business Sustainability mean?

## **Three Transformation Systems**

- 1. Healthy Soil: <u>Soil, Sun, Water</u> → Grow Grass
- 2. Healthy Rumen (cow): <u>Grass</u>  $\rightarrow$  Produce Milk
- 3. Healthy Marketing: <u>Milk</u>  $\rightarrow$  Make Money

Healthy Soil: Soil, Sun, Water → Grow Healthy Grass...& have 80%++ consumed

## Nitrogen Fertilizer Issues in Pastoral Dairy Systems

Pastures only respond to N fertilizer when:

- Moisture levels is adequate around the rhizosphere & soil around the roots
- Soil temperature is above 7°C

Expected yield of 10-20kg DM/ kg N applied

## Rye grass leaf contribution towards Biomass

Leaf Stage	% Contribution towards Pasture Biomass		
1	15-20		
2	30-35		
3	45-50		

<u>NOTE</u>: There is very little difference in ME concentration between the 1<sup>st</sup> leaf and the 3<sup>rd</sup> leaf

## **Making Irrigation more Profitable**

Cost of water (electricity)	No/ little
Cost of irrigation infra structure	control
Amount of <b>pasture grown</b> / unit water deposited	Much control
<ul> <li>0.5-2.0 t DM grown / megaL applied</li> </ul>	

## Potential Loss of Pasture Yield due to Late Onset of Irrigation



## Key Issues on N-fertilization

## 1) Pasture response to N fertilizer improves as:

- We allow it to grow out to the 2½-3 leaf stage,
- We increase the rotation length

## 2) Beyond 1kg N/ Ha/ day:

- Annual Pasture utilization <u>does not</u> increase
- N efficiency (kg DM/ kg N) <u>does not</u> improve

## 3) If "canopy closure" occurs before 3-leaf stage:

 Decrease N application instead of shortening the rotation (increase rotation speed/ reducing grazing interval)

## Irony of Applying Extra N fertilizer

Goal: To increase Pasture growth rate (PGR):

- Canopy closure BEFORE the 3-leaf stage
- Reaction: Speed up rotation to prevent "canopy closure"
- Results in grazing at <2 leaf stage
- Suppression in PGR
- Forfeits value of extra N due to lower PGR
- Decreased grass palatability lower DMI
- Excessive N intake relative to –CHO
- Affects fertility



## The importance of Mg availability

## "Staggers Index" of a pasture:

- (%K ÷ 39) / [(%Ca ÷ 20) + (%Mg ÷ 12)]
- < 1,8: Low/ no risk for poor Mg availbility</li>
- >2,2: High risk for low Mg availability from grass → greater risk of sub-clinical hypocalcaemia, even in later lactation

## Influence of plant [K] & [Ca] on the risk of lower Mg availability ('Staggers Index')

K	4	κ	3	Κ	4	K	4
Са	0,3	Са	0,3	Ca	0,6	Ca	0,8
Mg	0,25	Mg	0,25	Mg	0,25	Mg	0,25
SI	2,9	SI	2,1	SI	2,0	SI	1,7

 $SI = (\%K \div 39) / [(\%Ca \div 20) + (\%Mg \div 12)]$ 

Denominator



Healthy Rumen (cow): Grass → Produce Milk/ Milk Solids / Ha

### Nitrogen Utilisation by 4-6kg rumen bacteria Liver: Urea $\mathbf{H}_{3} \rightarrow \text{urea (BUN)}$ **NPN** Unutilised N СНО NH<sub>3</sub>Pool Urine Protein N for max. Milk DIP (MUN) microbial Peptides **YIELD** aa. 60%xCP=DIP→microb prot Amino 40% of CP is UIP acids 32gN / 1kg fermentable -CHO

## The Influence of Grazing Interval on Nutrient Value of Perennial Ryegrass

	Leaf Stage (LS) at Grazing			
	1½ LS	2 LS	2 <sup>1</sup> / <sub>2</sub> LS	
% TCP	16	15	13	
% Sugars	10	12	14	
TCP:Sugar	1.6	1.2	(1.1)	
Ratio				
	For rume prot	maximum n microbial tein yield		



Available online at www.sciencedirect.com



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veterinary parasitology

www.elsevier.com/locate/vetpar

## Impact of eprinomectin on grazing behaviour and performance in dairy cattle with sub-clinical gastrointestinal nematode infections under continuous stocking management

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## **Decreased** appetite



Forbes et al. (2004) Vet. Parasitol. 125

# Slower Rumen Passage Rate, lower DMI $\rightarrow$ NEB $\rightarrow$ impaired disease resistance (white blood cell function)



From: Tizard, 2009

## FIRST LINE OF DEFENCE IN THE TEAT CANAL: AFFECTED BY NEB



## Herd Milk Protein Concentration in milk



## Healthy Rumen = Healthy Cow $\rightarrow$ Reproduction Efficiency $\rightarrow$ Fewer Days Open



## Parasites in Dairy Herds in NZ

44th Annual Meeting of the American Association of Veterinary Parasitologists, New Orleans, USA, July 10-13, 1999.

### THE IMPACT OF EPRINOMECTIN TREATMENT ON DAIRY CATTLE REPRODUCTIVE PERFORMANCE

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A study was conducted to evaluate the effect of eprinomectin administered at 500 mcg/kg topically or placebo treatment at calving on reproductive performance and milk production of 742 dairy cattle, comprising 560 cows and 182 heifers, in three New Zealand locations. Animals were pasture-fed on predominantly a single pasture at each location, and supplemental feed was provided as needed, the same for all animals at each respective location. Cows were allocated to treatments within location based on their parity, expected calving date and production worth or breeding worth to replicates of two animals. Improvements in reproductive performance, although not significant (p>0.05), were observed on eprinomectin-treated cattle in terms of fewer matings per conception, 1.64 vs. 1.79, shorter calving to conception interval, 75.1 vs. 78.2 days, higher pregnancy rates at the first insemination, 49.0% vs. 42.0%, and after up to four breedings 83.5% vs. 81.4%. Considering only the first-calf heifers, those treated with eprinomectin had significantly shorter calving-to-conception interval, 79.7 vs. 92.6 days (p<0.05), more became pregnant at the first insemination, 58.0% vs. 38.1% (p<0.01) and also there was a trend towards significance for pregnancy rate, 89% vs. 78% (0.05<p<0.1).

There was also a significant increase (p<0.05) of 0.9261 lb. of milk per day from eprinomectin-treated cattle.

These results suggest that treatment of dairy cattle at calving with eprinomectin can improve their reproductive performance and milk production.

## **NEB & Cow Fertility (Oocyte quality)**



How to achieve >40% 21d pregnancy rate → Fewer days open in cows; Lower cost per pregnancy in heifers

Aggressively inseminate cows at the end of the voluntary waiting period

Increase fertility to first AI

Identify nonpregnant cows and aggressively reinseminate them

Increase fertility to 1<sup>st</sup>, 2<sup>nd</sup> and later Al's

Reproductive performance in anestrous dairy cows following treatment with two protocols and two doses of progesterone

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> <sup>a</sup>Animal Health Centre, P.O. Box 21, Morrinsville, New Zealand <sup>b</sup>Matamata Veterinary Services, 26 Tainui St., Matamata, New Zealand

## Prevalence of anovulation was 25% (1555/6138)

Treatment of cows with 1.56 or 4.7 g of Progesterone resulted in similar reproductive performance

# Why inverse relationship between milk yield and "fertility"???

- For each **500L blood** pumped through the udder, **1L milk** is produced...(*Peeters G. et al. J. Anim. Sc. 1979* 48:1143-1153)
- Or: It takes 125L blood flow through the udder to produce 1 glass of milk (250mL)...
- Sub-optimal contraction by the heart musculature due to lower Ca availability from the skeletal stores will lead to a lower blood flow through the udder → lower milk yield...
- **Blood flow** through the udder must also flow through the liver where steroid hormones are metabolised...

## Hormonal metabolism in modern dairy

**COWS** — Wiltbank M







## Programs



DAIRY CATTLE REPRODUCTION COUNCIL

### Albert De Vries and David T. Galligan University of Florida and University of Pennsylvania

Item	\$ days open	\$ breeding	\$ culling	\$ total %	% pregnant @ 270d	\$ pregnancy
Estrus detection	157.39	47.18	84.77	289.34	91	318
TAI – 30% CR	108.86	76.62	40.82	226.30	95	238
TAI – 40% CR	86.69	67.06	26.92	180.67	98	184

## Days open are expensive!!

Adapted from: De Vries, A., and Calligan, D. T. 2009. Economics of timed AI programs. In Proceedings of the Dairy Cattle Reproduction Council Conference, pp.71-81. November 12-13, Minneapolis, MN.

Healthy Marketing: Milk → Make Money...Increase the demand for Milk & Dairy Products

## Kg milk consumption per capita per year – 2007

## WHO Recommendation: 200L (548mL/ day)

- RSA: 57.92 (58 in 2016)
- Namibia: 77.16
- Botswana: 88.89
- New Zealand: 103.79
- Kenya: 120
- Turkey: 138.71
- Australia: 230.92
- Finland: 361

Milk consumption in Africa is currently the lowest in the world, around 37 liters per capita annually, which is 67 liters below the **world** average of 104 liters per capita and only accounts for six percent of world consumption.

# Conjugated Linoleic Acid (CLA)

Milk [total CLA isomers] =  $\pm 83mg/100ml$ 

80-90% of total milk CLA is Cis-9 trans-11 CLA (C18:2)



## CONJUGATED LINOLEIC ACID (CLA) AND THE DAIRY COW

D.E. BAUMAN<sup>1</sup>, B.A. CORL<sup>1</sup>, L.H. BAUMGARD<sup>1</sup> and J.M. GRIINARI<sup>2</sup> <sup>1</sup>Department of Animal Science, Cornell University, Ithaca, NY 14853, USA <sup>2</sup>Department of Animal Science, University of Helsinki, Helsinki, Finland

## Beneficial Health Effects of CLA in milk fat

## **Biological Effects**

Anti-carcinogenic

Anti-atherogenic

Anti-diabetic

Altered nutrient partitioning & metabolism

Immune modulation

Improved bone mineralisation



### **CLA Content in Foods**

Food	Total CLA Content (mg/g fat)
Pasture-Raised Beef	30
Pasture-Raised Dairy	20-30
Lamb	5.6
Homogenized Milk	5.5
Buttermilk	5.4
Mozzarella Cheese	4.9
Plain Yogurt	4.8
Butter	4.7
Sour Cream	4.6
Cottage Cheese	4.5
Ground Beef	4.3
Cheddar Cheese	4.1
Ice Cream	3.6
Ground Turkey	2.5
Chicken	0.9
Pork	0.6
Egg yolk	0.6
Salmon	0.3

[CLA] not affected by processing milk, UHT, storage

### Bepaal die vorm

Hervorm politiggoom
 Better liggoomsbalans
 Help om vet te verbron
 Ondurdruk setteslabsort

- · Vootsisteri sesimekilinisisi
- Moer spierweehet minder

**Conalin** 

CLA

### van jou drome

[Tonalín]\*

#### Minder yet en noer lenige spierel.

Sir 'n wep in oor speing en ne gowlg op die skaal nie met Tonainin welfin, wetenskapfal bewesse dieptanyvilling wat vet verwender en lengen speine vermeerder, alles soeder einen newe-effnisse. Nie meer verstemmend is dat dit bedis goed is vet jour ien wuzzup geen andre dieergel op die mark kan uampraak onde nie. Terwyl ows op die nedewerep van dievrefde en aanvallinge sie, meet mens tennis verste nieter eff. Augendikke besichtnar is.

#### Non Waarpin Touslin?

- Donallin is die enigste produk waarvan die aanspesie understaan word deur 14 gepublissende klimiese unders
- · Tonalin bied die brogan CLA-commulting beskikbene (80%)
- Tonalin is die oorspronklik gepatentsonde CLA-produk wfmiktwyd
- Tomin word writer so suffloered/e on nur ait sceneblometer nie. Somebiomalie het 'n kommittanie van 60% CLA mwyl auffloerdie 80% CLA het

 Timatir word bowar in die selbeizende VioSol-glaubonet wit altravioler- hij uitpluit en sourietarivervandering verboeit oor sodoende makeimen strekte te verseker

### Numklerig7

Summarvorate inoleformure (Conjugated Linoleic Acid) is a vetrain wat vertry an improvement word ust of naturalize innerflowing of affrodose. The term's vetrate range mms liait data and 'o doff net die potensiaal on vetrag on weik genomokient is heventike, ugs is die termongestelde semilik waar.

Waarone viorsien ous diect nie die CLA wot ons nodig het nie? One veersiens bist had CLA behoeften an nie oorsteelige einer van Wais en nieweigmelichte gekry. Besau het wear op huise buart CLA uit der gens witt hulle, vien verkry. Met moderne berederymanisées et eregewoonen het die automitiek termigdoop verander. Meeste beente word gevoer met graan en aan versione gesonstheiduredes oft met minder Viets en susseigendukte. Dit het titt gevolg dae ens instantlike CLA langung uit solve jav die NS verminder bet

### Ontdekking

CLA se vermoe on yet to vermindet, is outdek deur Michael W. Partra, PhD, - In weitenskaplike and die Universiteit van Wiaconaat – tydens sy navnening in verhind met die ootwikkeling van kankergewonse. Gedarende die provest bei die navveers wittek dat CLA die extension beid mit spierwerhet is vermeerder en terneifdertyd, vetweerhei te verminder, 'n natuorikie pronie om die luggaan of 'n nove heeld is gint. Met sportwerhet gebruik vere kalviet aus is in finalssoneer, wit verbrunding van verweerhet fan anzenp en die luggaan sodieende verslank. Die gevong – oortuchige ver word op die regie plieke erestend

### Wat our yast Tonalin to verwag?

By mag dalk me in diministent attainin in priving size size, maar joolingnamissioni on die grieene van joo klein sid die verandering anteen. Drie en vier maawde se genetide gebruik sid 'n sterker liggaam met nier spisiekrag en bronz nontrating, wet wirder verheier werd indien 'n oordenlikundige distet en oefenprogram gevolg word. Die metabolisme sid verbeite en lamgerpyne sid tuttaarlikkrewy verminder Daarby in Tonalin ontwerp vij permanene verberlies wern sy spurboukemmette word die gevoende klimoteffek wat algement in andre desegroppingen of -pille workom, utgeskni Omment net in opwindend, is Tomfin se potential om goeie geonnlinei altinet te bevonder. More a 200 ondies wiersidwyd bewyd dat CLA dat vorktenen van beerkmiker kan verninder, an verbeter, allengiet verstinder en 'n gebalanseerte bioesteniderij handhaaf. CLA tan ook in groot nit geeel in dat behaadeling v nie manteenfhantilike diabete en bederming teen hartsiekter in deur andrelige cholosserol te verminder. Tur fanne besit CLA

Tonalin

CLA RO

### Wonderpil?

Timalin is nie 'n wonder-empil nie, maar zy vele voordele laat he kop en skouers uitstaan bo elle ander soortgolyke produkte. Die migste dang wat jy met Tonalin verfoor, is vet!

# Daily CLA intake by humans: You have 2 choices...

## Commercial CLA supplement

- 500mg capsule = 375mg CLA
- Cost: <u>**R1-36**</u>
- <u>Excludes</u> 542mg Ca and 14,7g protein

## **Full cream milk**

- [CLA] = 0,083% m/v, or
   0,83g/liter (R4-50), or
- 375mg CLA/452ml (±2 glasses)
- Cost: <u>**R2-03**</u>

