SarTec®

Dairy Products Presentation

Introduction to **SarTec**

- **Founded in 1983.**
- **Family Owned and Operated.**
- **A leader in the use of micro-additive equipment in a number of key industries.**
- **A leader in natural products for cattle.**
- **Holds the rights to many U.S. patents for the use of Yucca extracts for grain conditioning and specialized equipment and has more than 10 additional patents pending.**
- **Small enough to care, big enough to serve your needs.**
- ***Mission Statement:***

  To provide high quality, natural products and service to the agricultural industry.

SarTec®

"The **SarTec** APT Program
is a first of its kind program that incorporates what we now know about Yucca extract, vitamins, pro-biotics and egg products and their effects on the microbiology of dairy cattle to increase milk production and herd health."

-Larry McNeff, President

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The Bottom Line

- *Improved Milk Production*
- *Increased Profits*
- *Better Herd Health*

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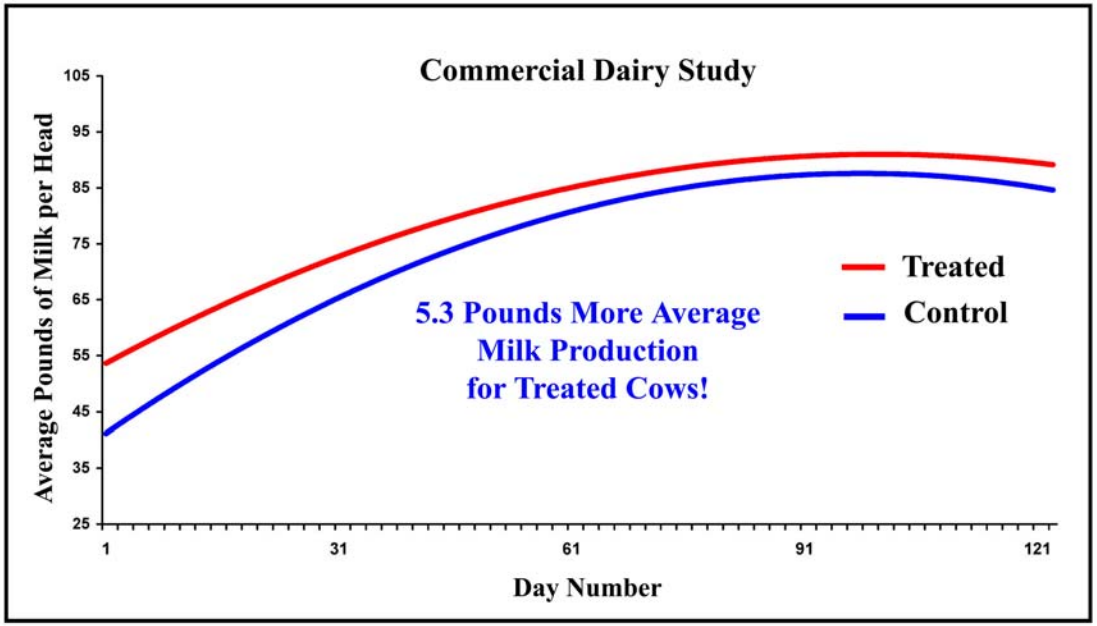
The Proof is in the Tank! The SarTec APT Program* Increases Average Daily Milk Production by 5.3 Pounds**.



- ► All natural yucca extract-based products
- ► University tested
- ► Proven results on top of bovine somatotropin (bST) and Rumensin®
- ► Used for beef cattle for more than 20 years
- ► From a family-owned company you can trust

* The SarTec APT program is patent pending.
** For full study details please contact a SarTec representative at 1-800-472-7832.
Rumensin® is a registered trademark of Eli Lilly and Company and is used for Elanco's brand of monensin sodium.

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The Proof is In the Tank

-Summary of 5 Trials

Name	Location	Dairy Size	Days of Study	Average Increased Milk Production	(Return/Cost)	P-Value
Dairy 1	Colorado	1,000	180	5.1	12.7	0.010
Dairy 2	Colorado	2,000	148	4.4	11.4	0.001
Dairy 3*	Colorado	1,900	221	2.1	6.4	0.001
Dairy 4**	Wisconsin	160	30	4.6	10.7	< 0.001
Dairy 5**	Texas	1,800	77	3.4	6.8	N/A
			Average	3.9	9.6	

*** Lower dosage level**
**** 100cc herd initiation applied**

Conclusion: Summary of 5 trials shows an average of almost 4 pound increase in milk production and a 9.6 to 1 return on investment.

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Benefits of the SarTec APT Program*	
Increased Milk Production	✓
Antiprotozoal	✓
Reduces Methane	✓
Increase VFA production	✓
Increased Milk even with bST and Rumensin Use	✓
Stimulates Feed Intake	✓
Easy to Apply	✓
Not a Drug	✓

* Statements based on results from feeding demonstrations and feeding trials. Full research trial information available upon request.

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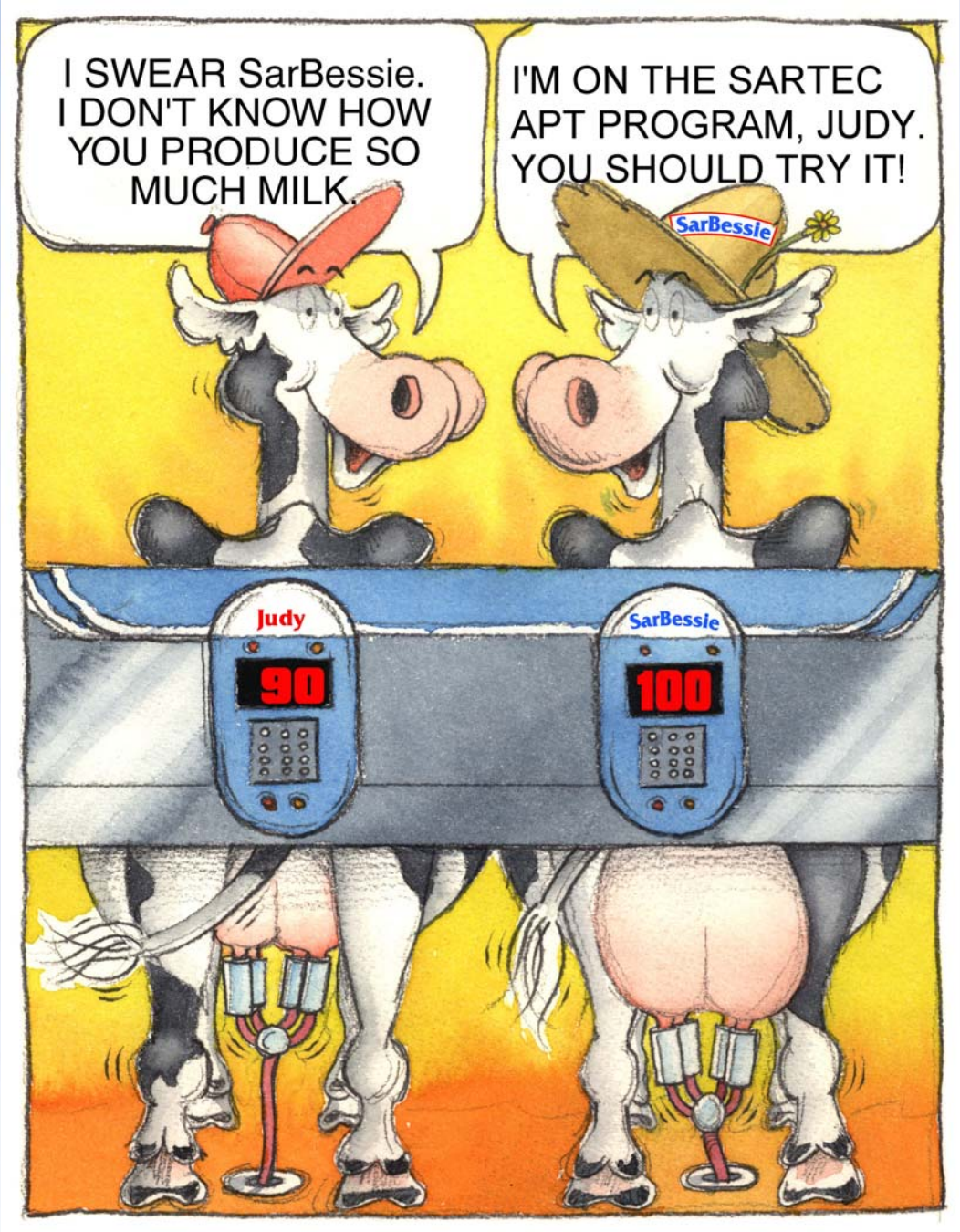
I SWEAR SarBessie. I DON'T KNOW HOW YOU PRODUCE SO MUCH MILK.
I'M ON THE SARTEC APT PROGRAM, JUDY. YOU SHOULD TRY IT!
SarBessie
Judy
90
SarBessie
100

SarTec®

A New Program for Increasing Milk Production

SarTec Anti-Protozoa Treatment (APT)*

Step 1: Initial 100cc/head application of SarStart® in the ration.

Step 2: SarStart® Plus - 100 cc/head drench at freshening time.

Step 3: SarStart® LSC - Feed 4 cc/head/day in total mixed ration (TMR) during milk production.

1st Step – Herd Initiation

- **SarTec** personnel will work with your dairy to apply an initial application of SarStart product to your entire herd.
- Application will be achieved by accurate distribution of product directly into your feed ration using accurate SarTec equipment.

2nd Step – Drench at Freshening

- **SarStart Drench**

- **SarStart Pro Drench**

- **SarStart Plus Drench**

3rd Step – Maintenance Dose in the Ration

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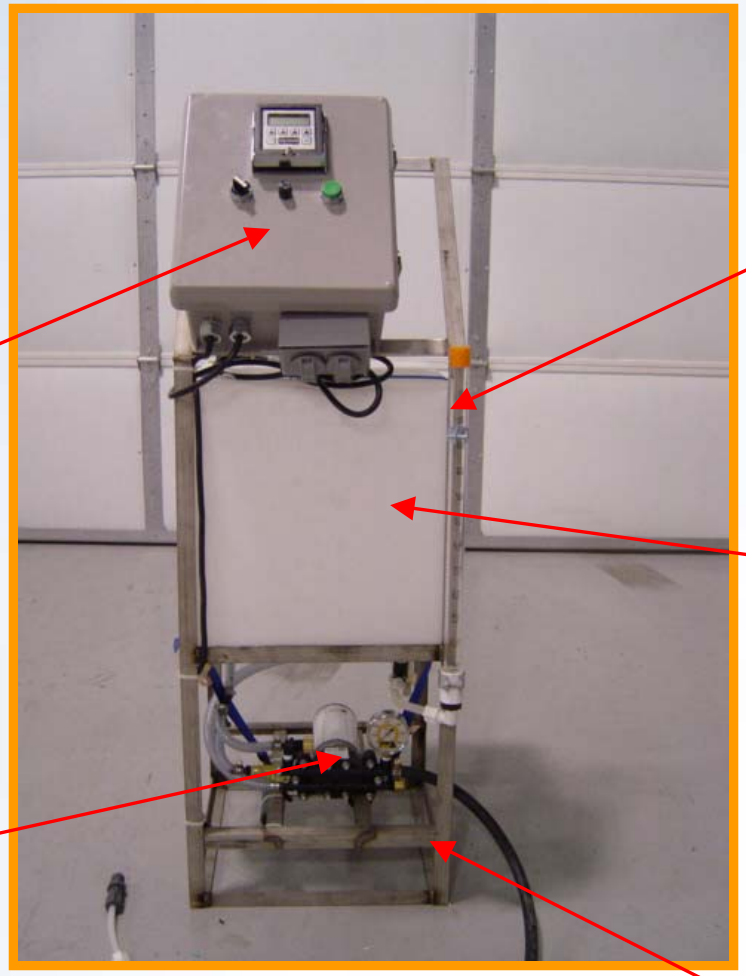
APT Application System



All Yucca Feeding Programs Are Not Equal

- Yucca has been fed to both beef and dairy cattle for decades.
- Previous dairy trials have *small and sporadic improvement in milk production, although health benefits have been well documented*.
- SarTec has now discovered why past programs have not been successful:
  - *Quantity is critical*
  - *Formulation is critical*
  - *Timing is critical*
- SarTec's new APT program is *patent pending*.

How is the Program Applied?

1. When a drench is possible the program can be applied by an initial application of **SarStart®**, followed by **SarStart® Plus** at freshening and **SarStart® LSC** in the ration via **SarTec's** application equipment.
2. When a drench is not possible the program can be applied directly to the ration alone using the same products and application equipment.
3. A pulse application method is also available that involves periodic application of higher amounts of SarStart products and no daily maintenance inclusion.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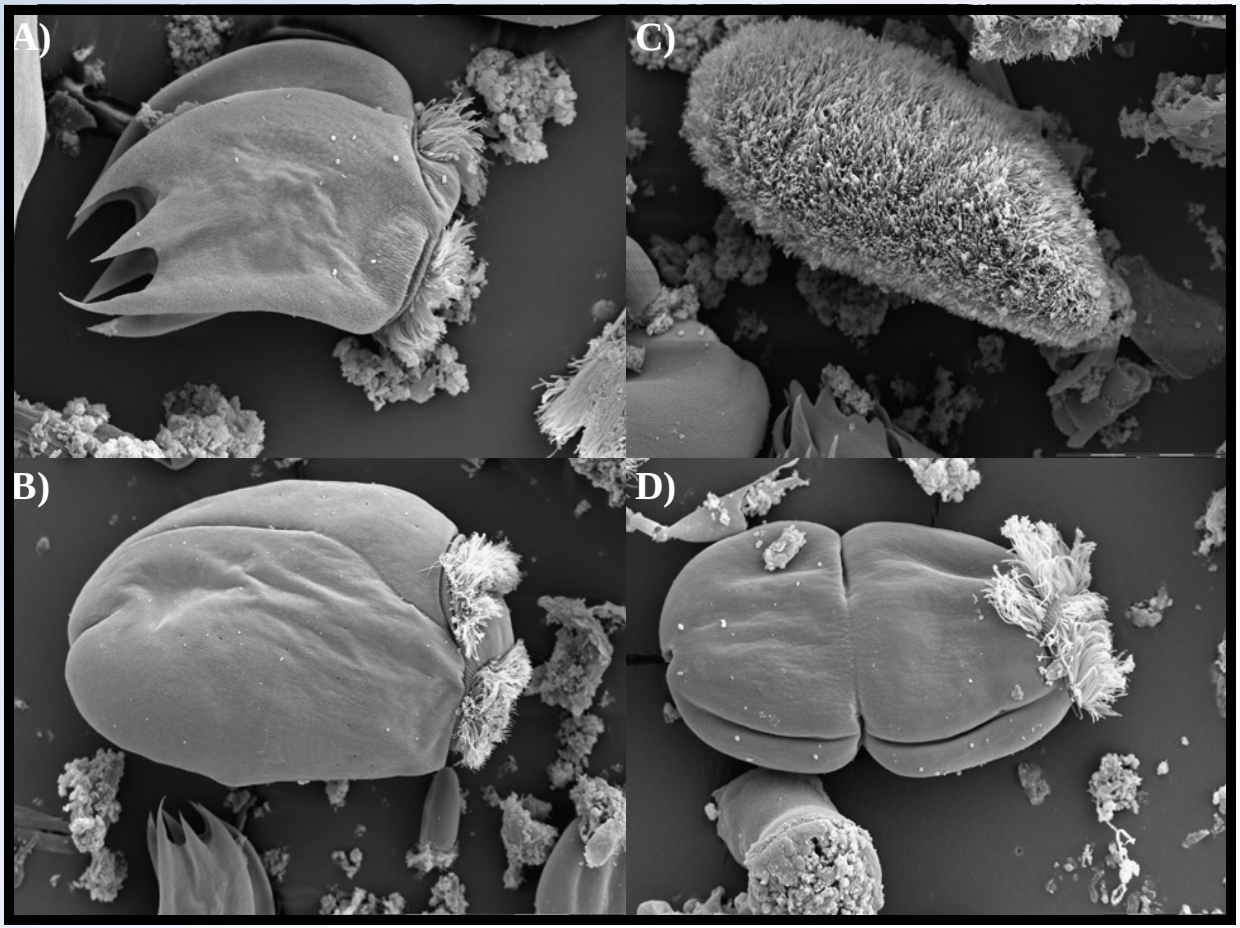
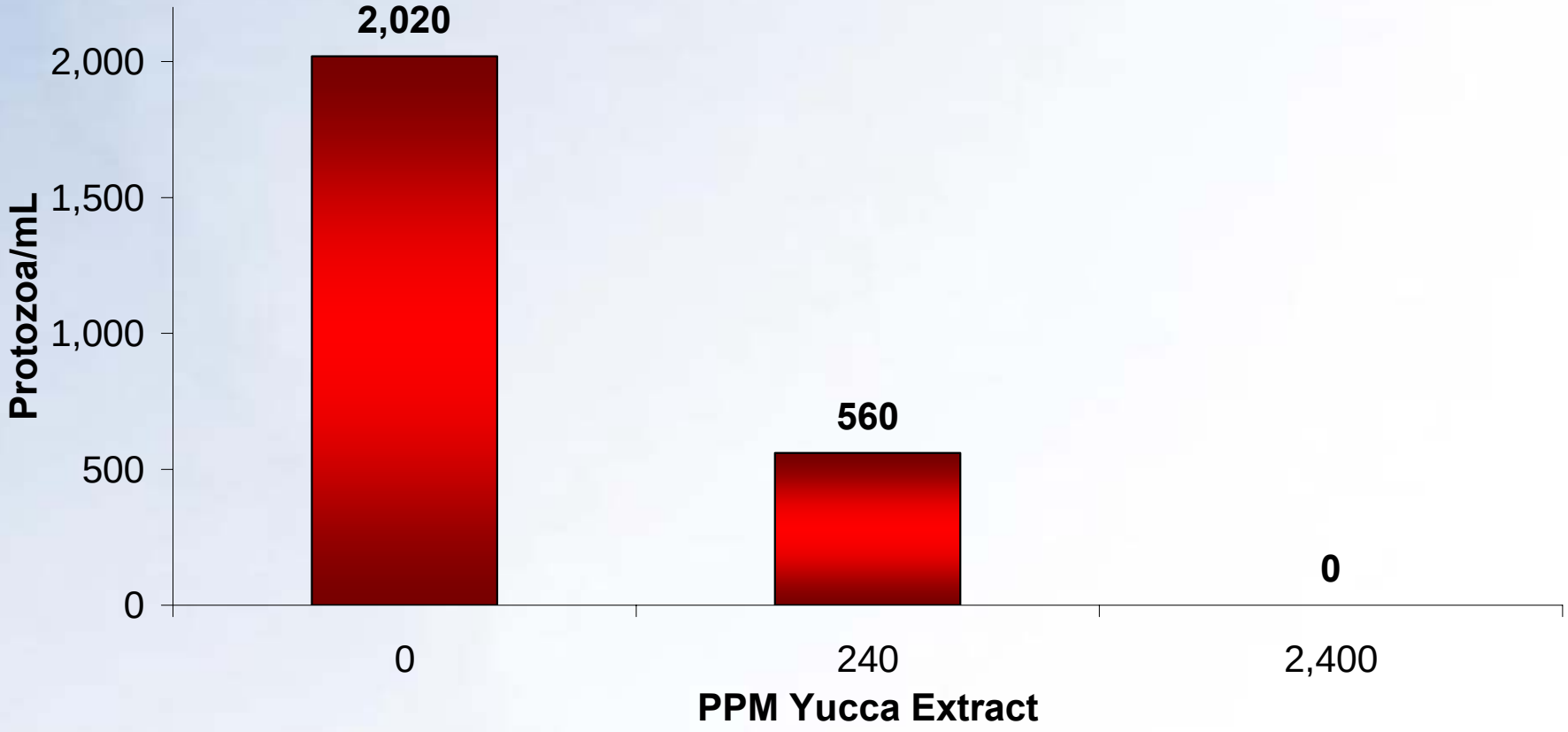
SarTec APT Program Mode of Action

Rumen Protozoa Pictures



Figures above: SEM of Protozoa: A) Diplodinium spp., 1,500x magnification, B) Polyplastron spp., 900x magnification, C) Protozoan *Isotricha* spp. 900x magnification, and D) Protozoan Entodinium spp., 1,600x magnification. Pictures courtesy of Dr. Mark Rasmussen and Sharon Franklin of the National Animal Disease Center, ARS/USDA, Ames, IA.

Yucca Antiprotozoal Activity*



Yucca Extract has shown to be a very effective antiprotozoal agent with in-vitro testing of whole rumen fluid.

* Data provided by Dr. Mark Rasmussen and Sharon Franklin, ARS-USDA.

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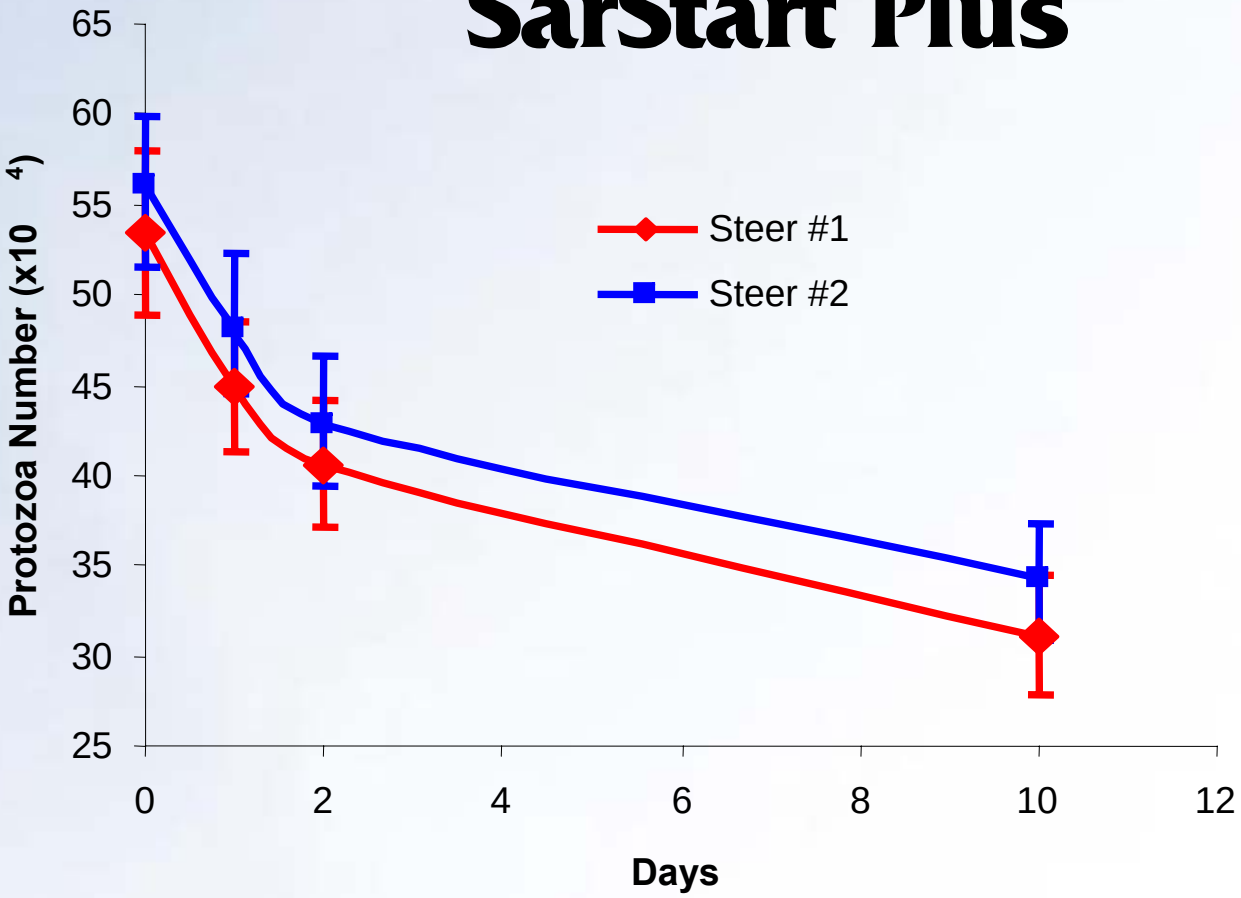
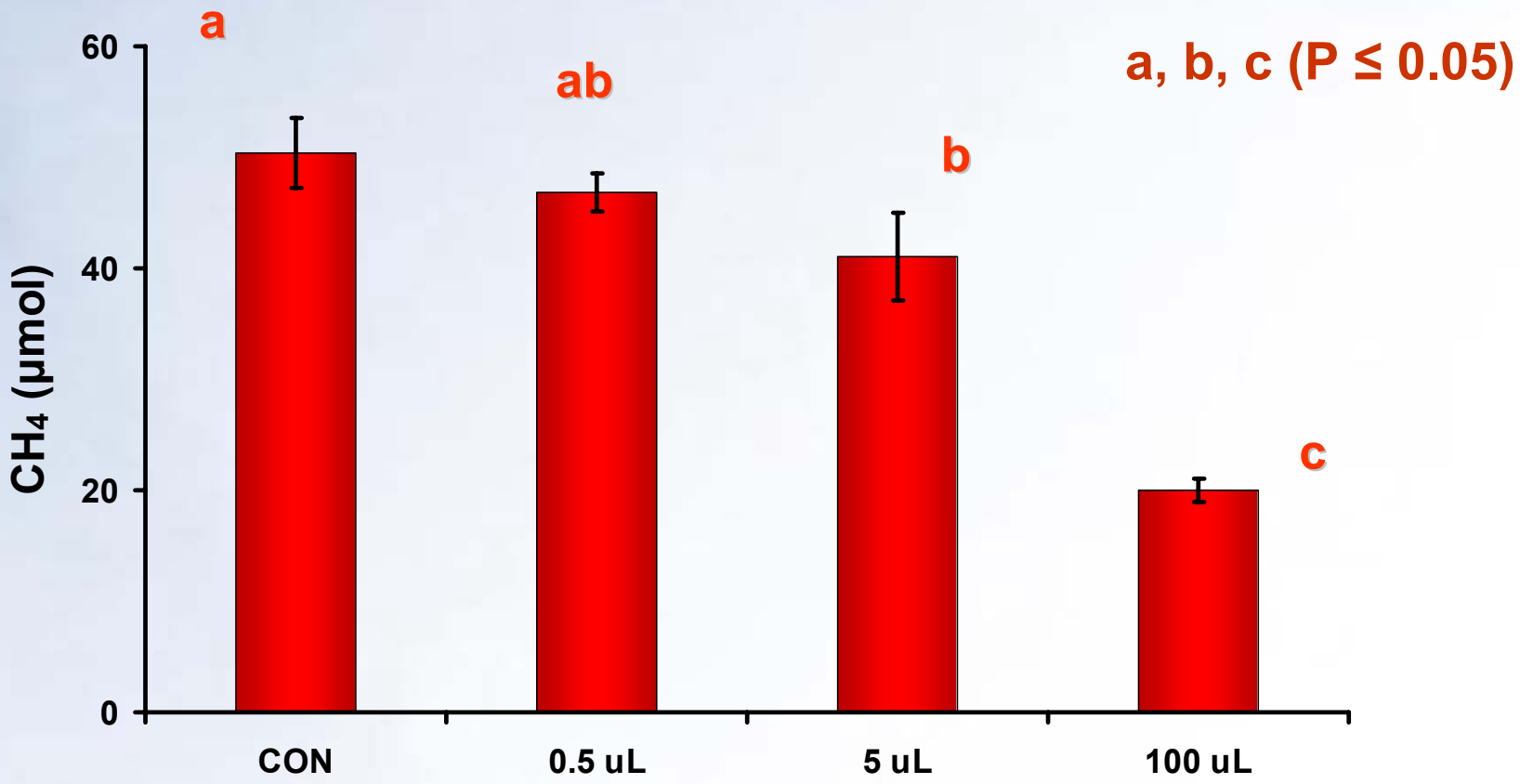
Reduction of Rumen Protozoa in Fistulated Steers Using **SarStart Plus**



This study showed an average protozoan population reduction of 40.3% (STDEV=1.5%) for the 5x dose.

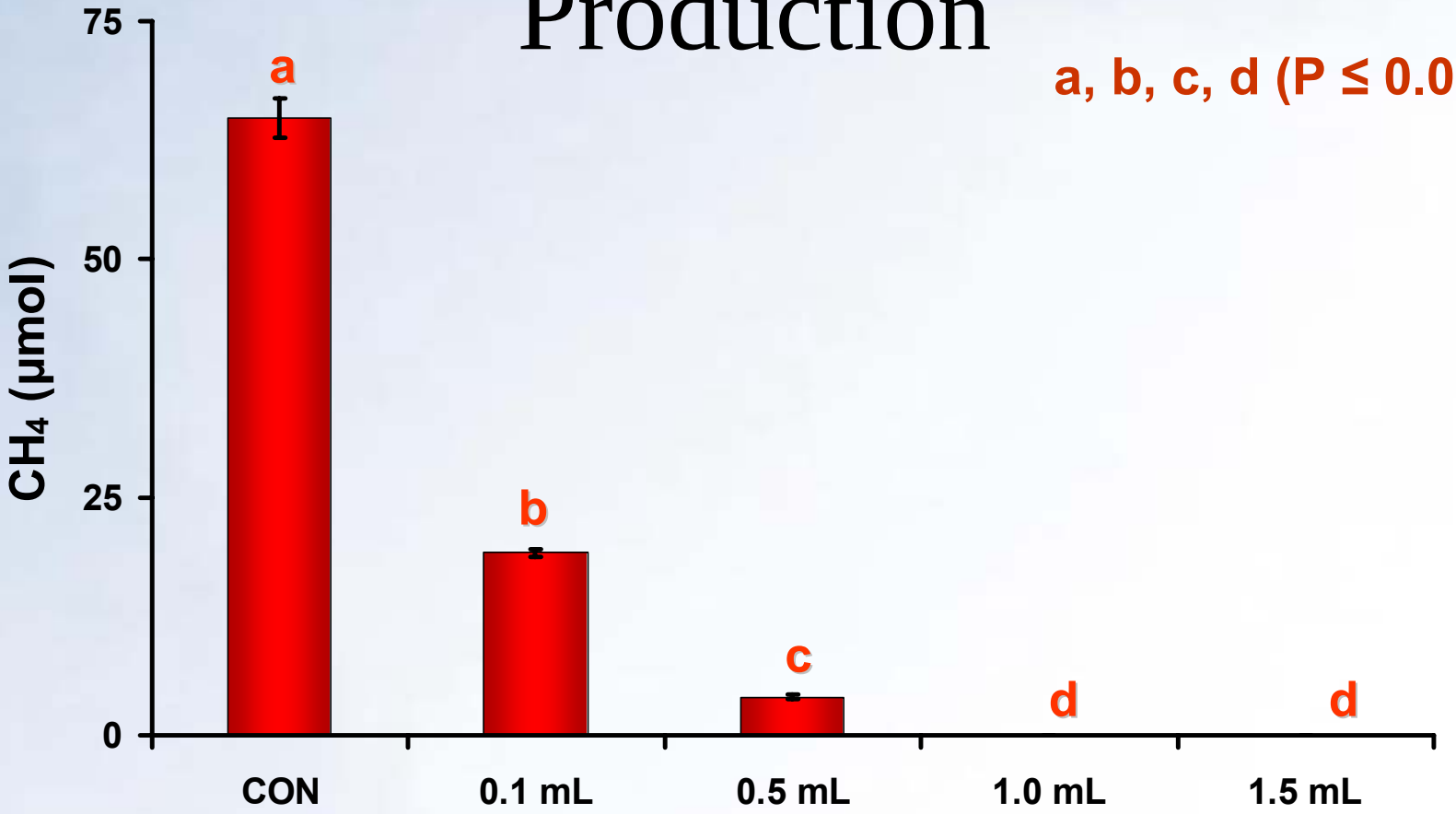
Reduction of Methane Study*



Yucca Extract has shown to be a very effective all-natural way to reduce methane in-vitro. Reduced methane means more feed energy available for beef or milk production.

* Data provided by Dr. Jess Miner and Eric Behlke, University of Lincoln Nebraska, Department of Animal Science.

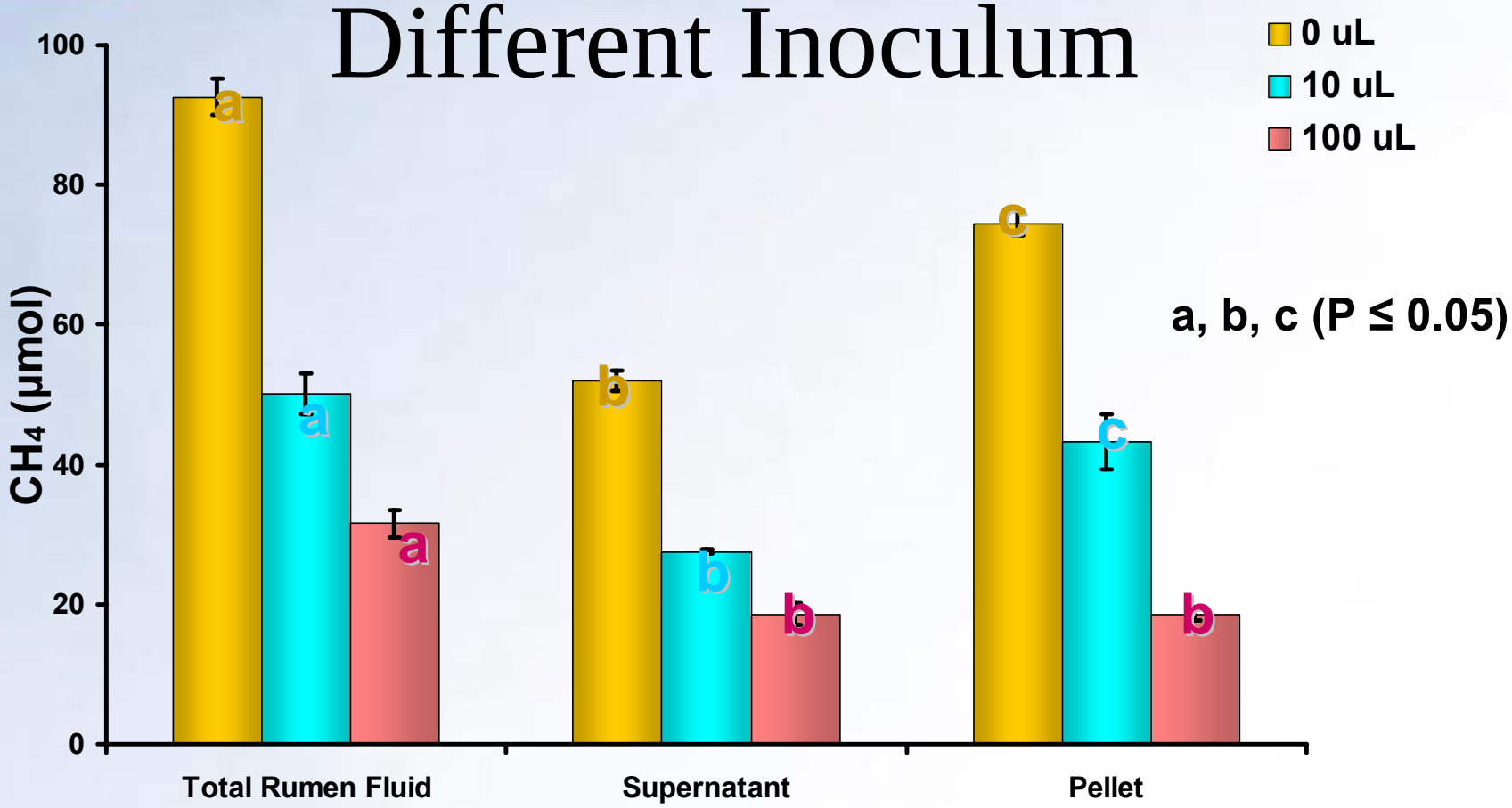
Shutting Down Methane Production



At high enough concentrations in-vitro studies have shown that the action of Yucca extract can completely shut down methane production in whole rumen fluid samples.

* Data provided by Dr. Jess Miner and Eric Behlke, University of Lincoln Nebraska, Department of Animal Science.

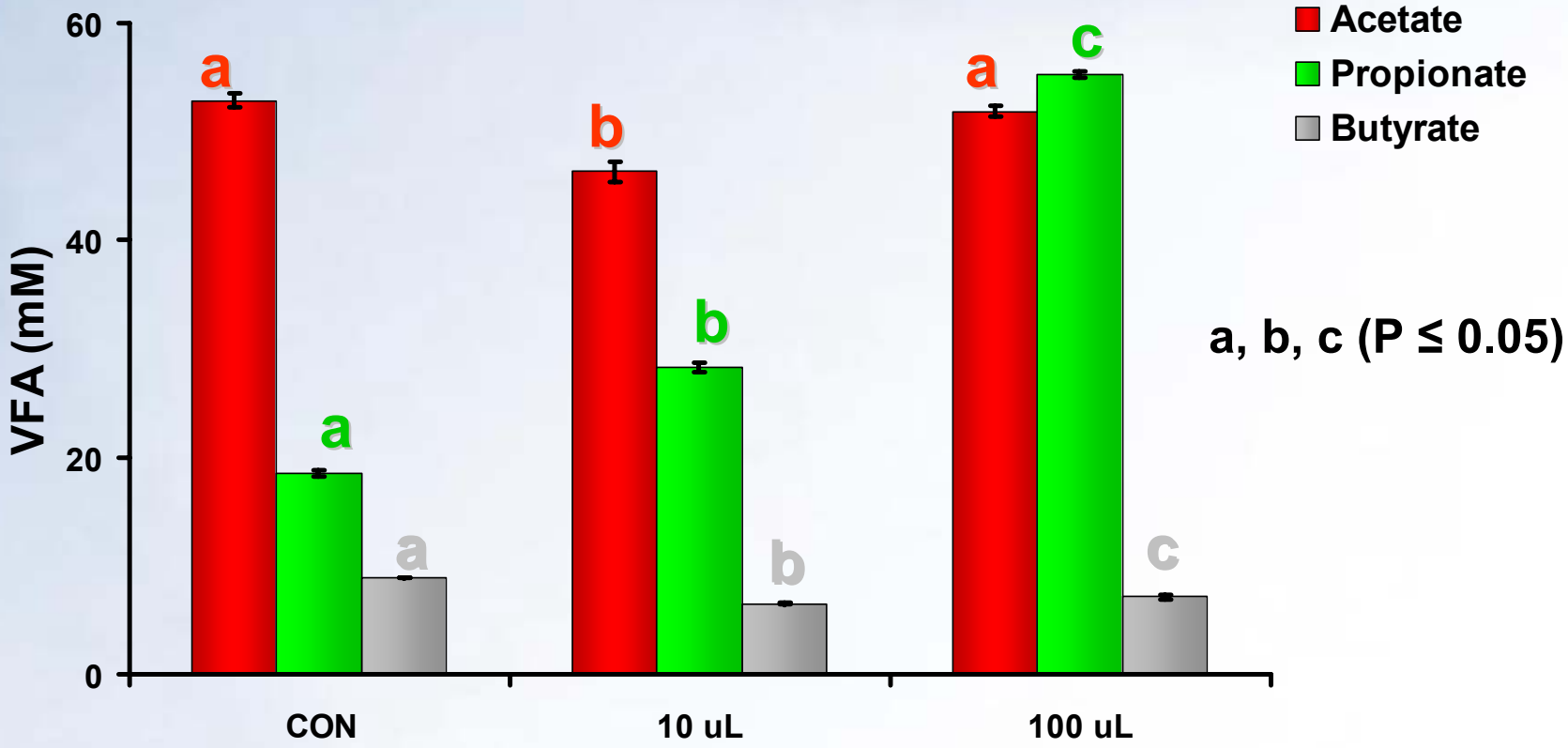
Methane Reduction in Different Inoculum



This study shows that the Yucca extract is effective on total rumen fluid, on rumen fluid supernatant with no protozoa present and on a protozoa pellet. This suggests that it is effective against both protozoa and methanogens directly.

* Data provided by Dr. Jess Miner and Eric Behlke, University of Lincoln Nebraska, Department of Animal Science.

Volatile Fatty Acids



This graph shows that Yucca extract increases propionate production, which can be used by the animal for growth and milk production.

* Data provided by Dr. Jess Miner and Eric Behlke, University of Lincoln Nebraska, Department of Animal Science.

Mode of Action Summary

- Product is delivered at the right time to make a difference in milk production
- Synergy of Yucca Extract, Vitamins, Probiotics, Egg Product
- Reduction of Rumen Protozoa
- Reduction of Methane Production
- Increased VFAs
- More Energy for More Milk and Better Animal Health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Potential Herd Health Benefits

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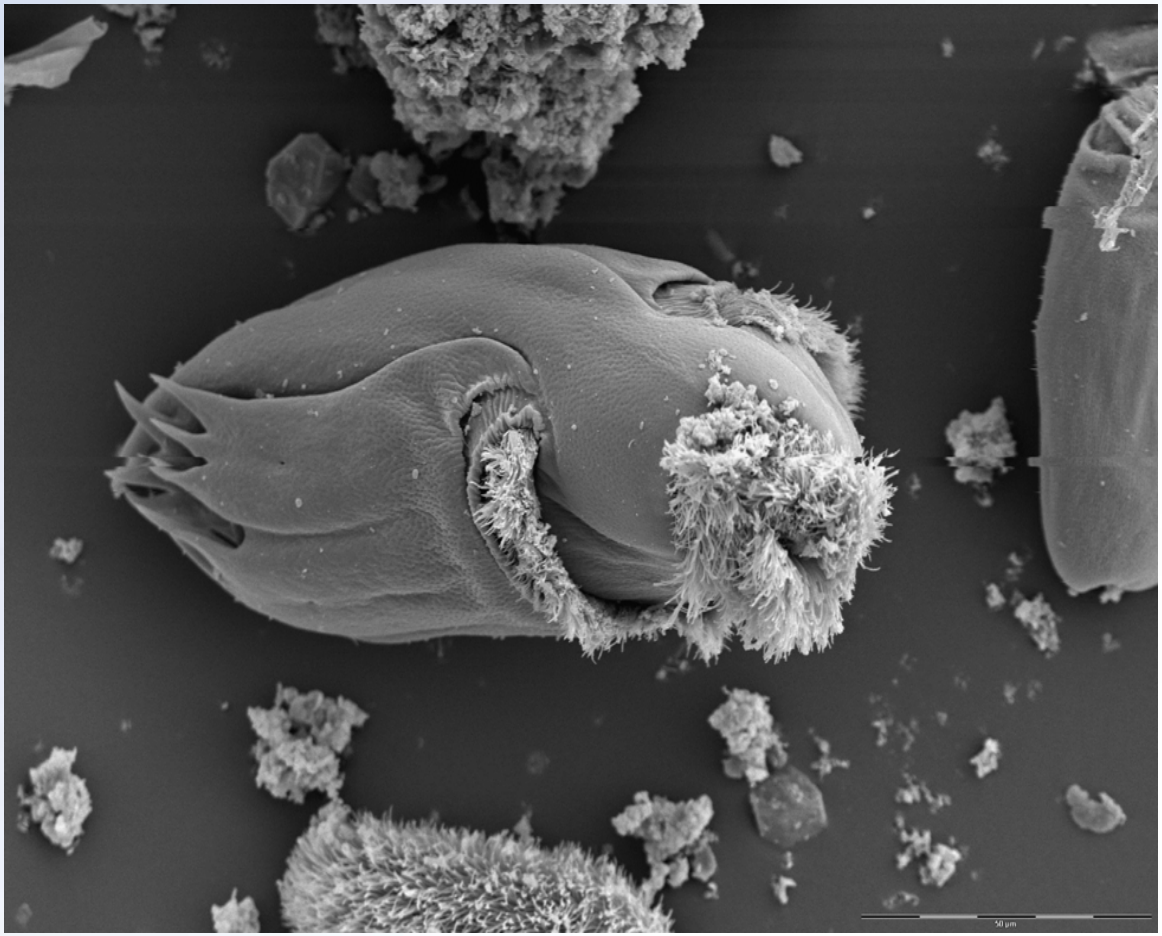
Protozoa as Trojan Horses of Disease



* Picture provided by Dr. Mark Rasmussen and Sharon Franklin, ARS-USDA.

Protozoa Presence in the Rumen

- Long evolutionary history with ruminants
- Distinct and diverse species in different ruminants
- Two types of microbes in the rumen: grazers and predators

  p*rotozoa are predators*

  bacteria and fungi are grazers
- Protozoa can ingest bacteria at a rate of 21,000 per hour!
- Protozoa can account for as much as 50% of the biomass in the rumen.
- There are billions and billions of protozoa typically in a cattle rumen.

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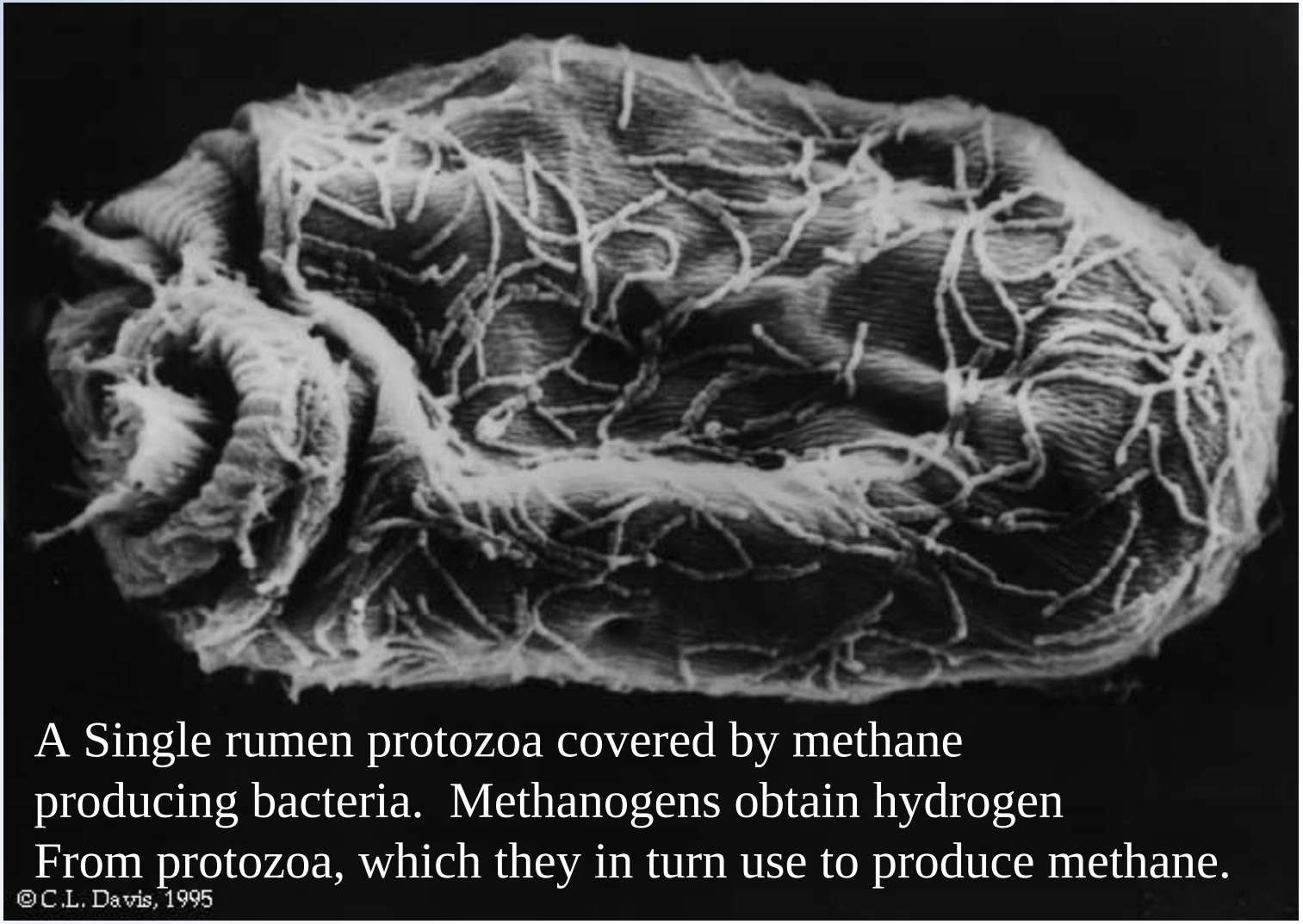
Legionnaire's Disease

- First human infection associated with *Legionella pneumophila* reported in 1976
- L. *pneumophila* are intracellular parasites of free-living protozoa
- Man-made environments resulted in human exposure (cooling towers biofilms) and death
- ***Bacteria escaped chlorination inside biofilm protozoa***
- This case taught us the importance of accounting for pathogens that can be harbored inside protozoa

The Relationship Between Protozoa and Intracellular Bacteria

- Evidence for survival and growth of bacteria in vacuoles of protozoa
- Bacteria are therefore not just a food source for protozoa, but can act as carriers
- Bacteria adapt protective mechanisms (virulence traits) to survive digestion by protozoa
- Pathogens such as *Salmonella* can become stronger and tougher when they are engulfed and released from a protozoa

Rumen Protozoa with Closely Associated Bacteria



A Single rumen protozoa covered by methane producing bacteria. Methanogens obtain hydrogen From protozoa, which they in turn use to produce methane.

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New NADC Research with Salmonella conducted by Dr. Mark Rasmussen and Sharon Franklin

Salmonella enterica serotype Typhimurium

- *Salmonella* bacteria were used to study the effect of protozoan engulfment
  - Phagetype DT104
  - Integron based resistance
- Resistent to: ampicillin, chloramphenicol/florfenicol, streptomycin/spectinomycin, sulfonamides, and tetracyclines

* Data provided by Dr. Mark Rasmussen and Sharon Franklin, ARS-USDA.

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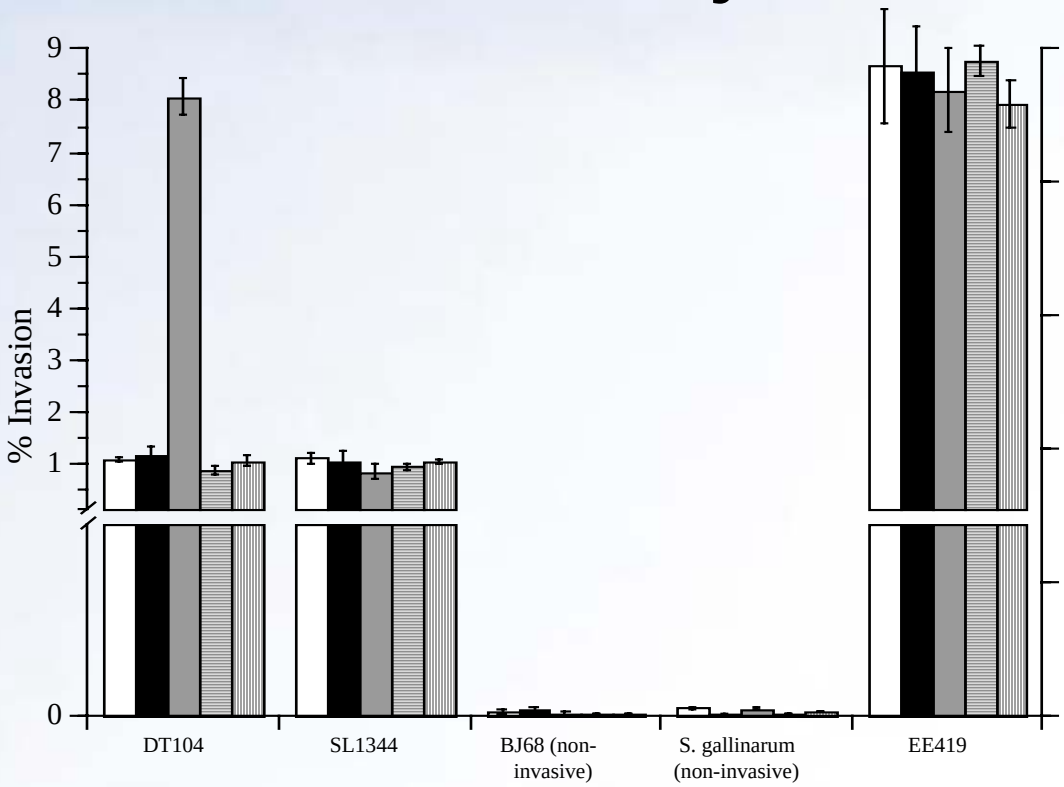
Experimental Procedure

- Protozoa are obtained from whole rumen fluid extracted from fistulated cows
- *Salmonella* and protozoa were allowed to commingle (feeding period)
- Engulfed *Salmonella* were recovered from protozoa engulfment by mechanically disruption of the protozoa
- *Salmonella* were recovered from the protozoa and tested for their virulance

* Data provided by Dr. Mark Rasmussen and Sharon Franklin, ARS-USDA.

Salmonella Invasion Assays

- White: buffer control
- Black: culture media control
- Gray: protozoa treatment
- H bar: lysed protozoa
- V bar: cytochalasin treatment



Protozoan engulfment increased virulence of DT104 Salmonella strains by 8-times! The increased virulence was as much as known hyper-invasive strains (shown on right).

* Data provided by Dr. Mark Rasmussen and Sharon Franklin, ARS-USDA.

In vitro Summary

- Protozoa exposure enhances invasiveness of some *Salmonella*
- Invasiveness was linked to presence of an integron
- Integron is linked to protozoal resistance
- This Invasiveness testing technique can be used as a measure of increased virulence due to protozoan engulfment of pathogens

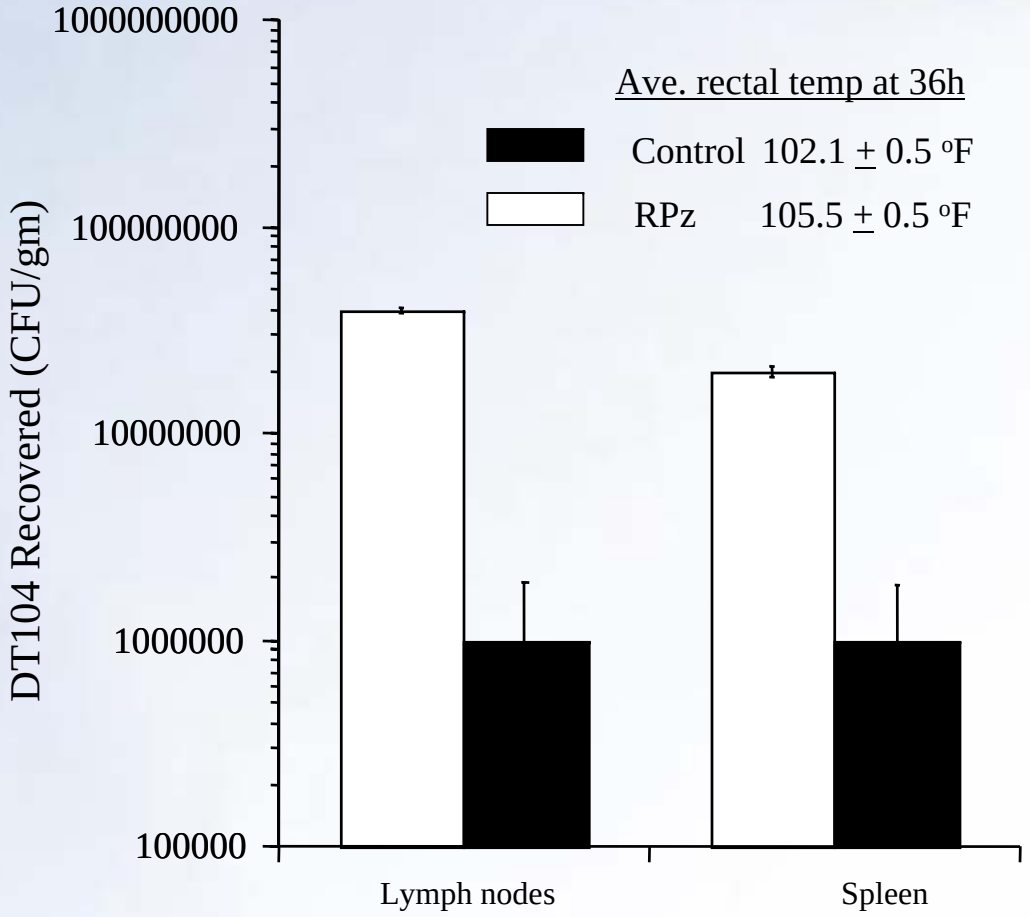
* Data provided by Dr. Mark Rasmussen and Sharon Franklin, ARS-USDA.

In vivo Determination of Increased Virulence

- Suckling calves were used to test the virulence of protozoan engulfed Salmonella and non-protozoan exposed Salmonella
  - Treatment: DT104 recovered from protozoa
  - Control: non-protozoa exposed DT104
- Suckling calves were exposed by contaminating a milk drench with the two bacteria types

* Data provided by Dr. Mark Rasmussen and Sharon Franklin, ARS-USDA.

Increased Virulence in Calves of Protozoa Engulfed Salmonella



Calves exposed to the engulfed protozoa had much faster disease progression than non-protozoa exposed Salmonella.

* Data provided by Dr. Mark Rasmussen and Sharon Franklin, ARS-USDA.

A New View of Protozoa Has Resulted as Pathogen Training Camps

- The survival of *Salmonella* within rumen protozoa has been studied
- Increased virulence of *Salmonella* has been shown in invasiveness testing
- Increased virulence of *Salmonella* has been shown in calves with protozoa-engulfed bacteria
- *Yucca extract has been shown to be very antiprotozoal and therefore may be a useful tool in eliminating a potential "safe harbor" for pathogens in cattle*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