Risk Factors for *Escherichia coli O157:H7* on Cattle Ranches

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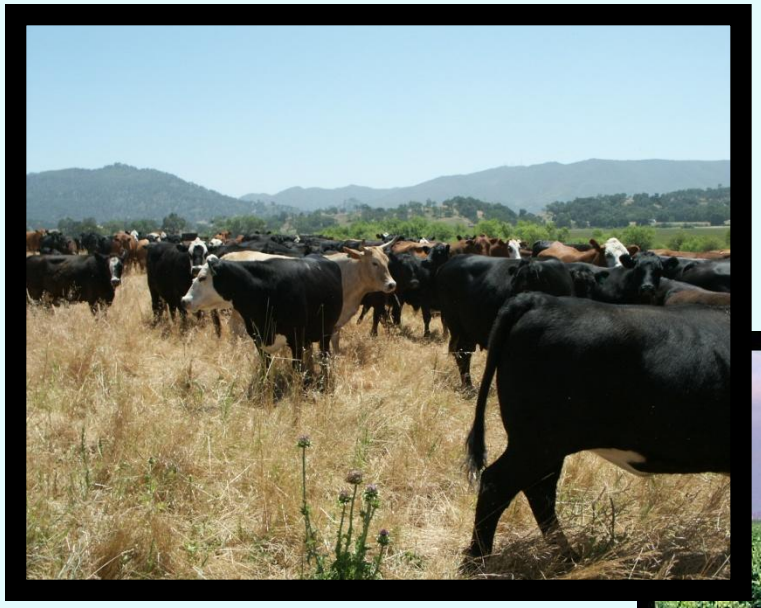
Thanks to all the landowners that allowed us to do this research.

1982 *E. coli* O157:H7 first recognized as foodborne pathogen

Outbreaks are generally from:
Ground Beef - 41%
Leafy Greens (Spinach, Lettuce, Alfalfa Sprouts) – 21%
(increasing number)
Melons
Apple Juice
Orange Juice
Milk
Water
Etc.



CDC (1999 est.) 73,000 infected, 2,170 hospitalizations, & 61 deaths each year.

E. coli O157:H7 in Leafy Greens

1) Infection of humans from lettuce and spinach, Salinas Valley and other regions (Fresno and Kern Co.)

2) Out breaks have been occurring since 1995.

3) 2006 outbreak captured national headlines, 204 reported cases, 102 hospitalized, 3 died.

Investigation of an Escherichia coli O157:H7 Outbreak
March 21, 2007
Prepared by: California Food Emergency Response Team
California Department of Health Services U.S. Food and Drug Administration

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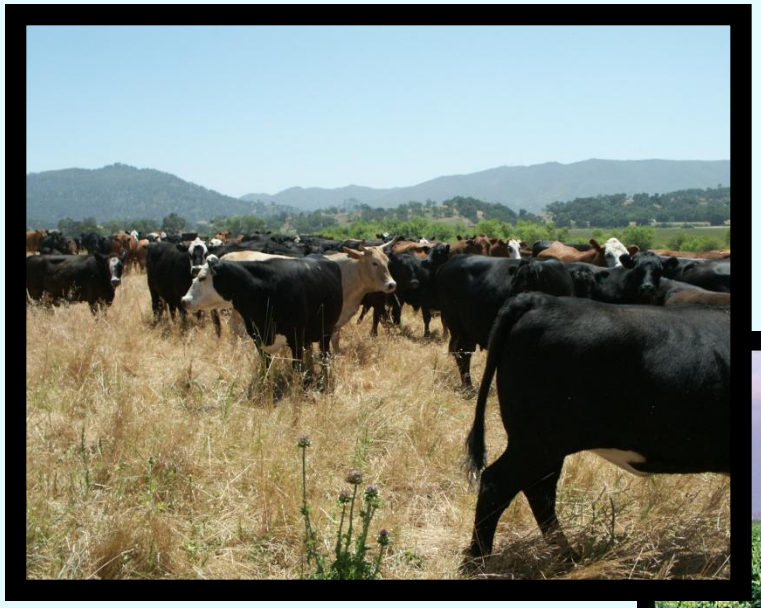
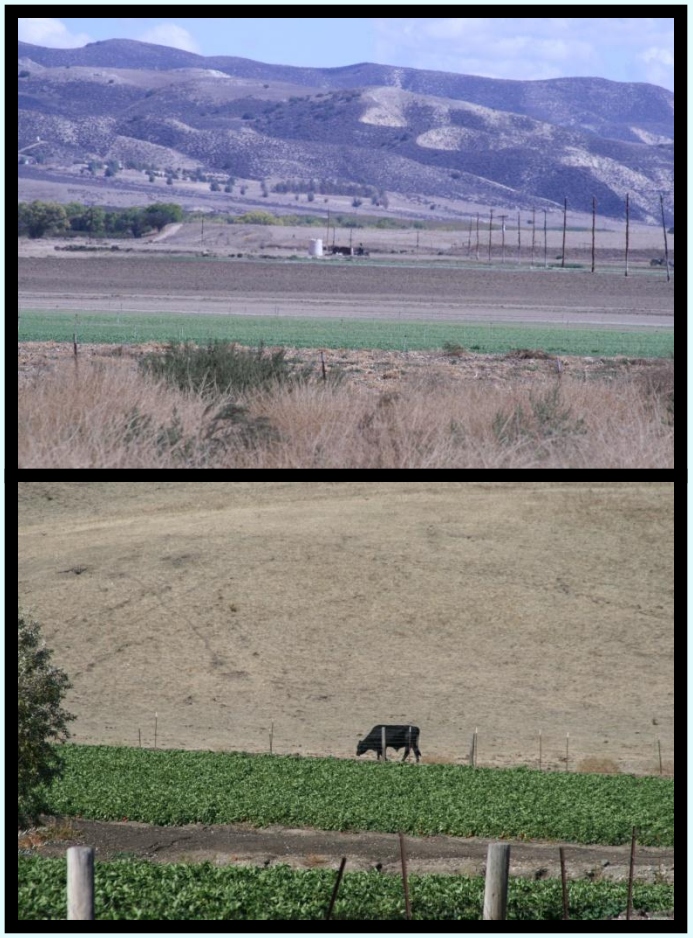




Studies show that *Ec O157* prevalence in beef cattle on rangeland can be 0.7% to 18%, can be higher if in feedlots.

Cattle do not show clinical signs of being *Ec O157* positive

Questions:

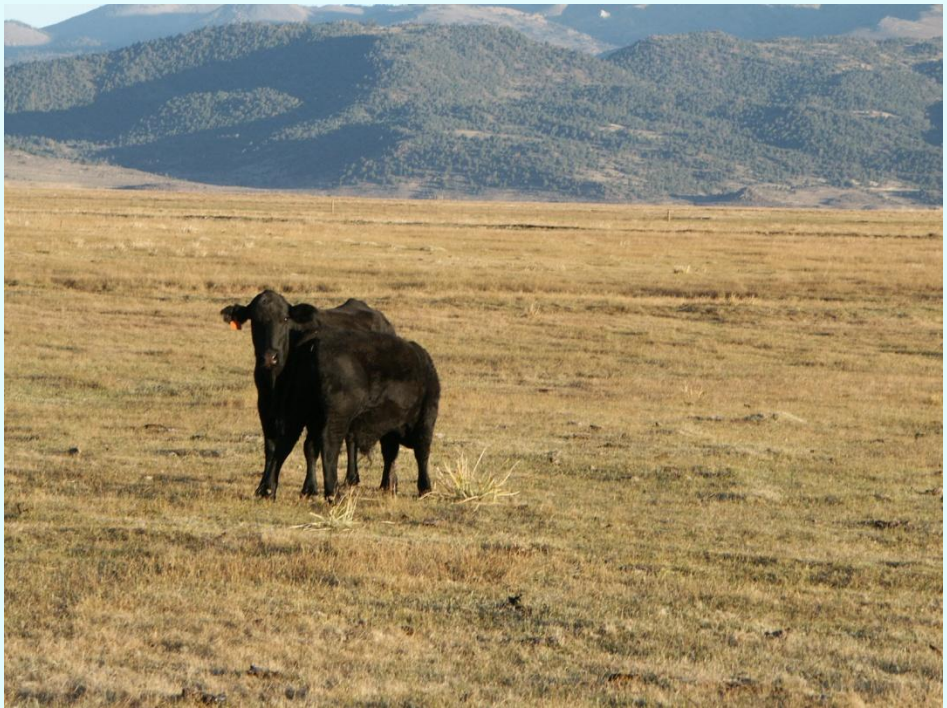
Are cattle or wildlife the source of *E. coli* O157:H7 on Central Coast?

Does *E. coli* O157:H7 move from animals to produce fields?

Objectives

To determine prevalence rates for cow/calf beef operations on the Central Coast

Correlate risk factors, i.e. climate variables and management practices with *Ec O157* prevalence



Methods

8 Different Ranches in MO, SB, and SLO Counties

Sampled while preg checking, or from fresh cow pats

Sampled water and sediment from troughs, streams, ponds, diptanks, and standing water

Fedex overnight to lab at UC Davis, cultured for *Ec O157* and generic *E. coli*

Management practice questionnaires completed each time ranches were sampled

Study took place during summer 2008 – fall 2010.

Collected a total of 2654 fecal samples, 204 water, 93 sediment

Results for Fecal Samples (Draft)

5 of 8 ranches were *Ec O157* positive at least once during study

Proportion of positive fecal samples ranged from 0 – 10% on any given ranch per sampling

Yearly prevalence (all ranches)
2008 0/398 (0%)
2009 49/1322 (5.3%)
2010 19/1322 (1.4%)

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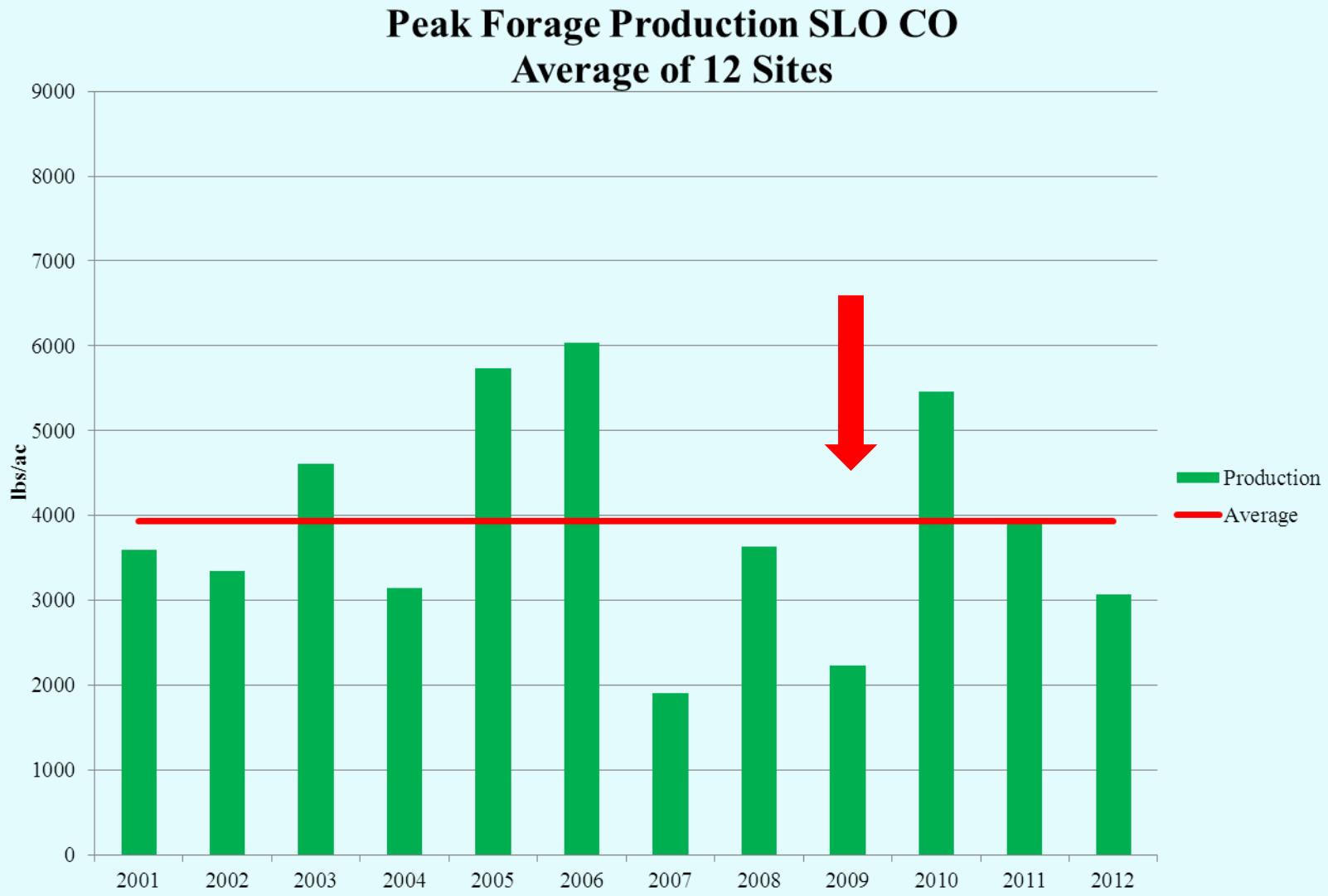
2009	**49/1322**	**(5.3%)**
2010	19/1322	(1.4%)

Highest prevalence occurred during a drought year.



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Overall – Prevalence on Central Cost Cow / Calf Herds was Low

Total 68/2654 (2.6%)

Results for Water/Sediment Samples

River / Stream

Water 3/78 (3.8%) (not significantly different from fecal samples)

Sediment 1/55 (1.8%)

Note: Chances samples being positive for *Ec O157* increased when the drinking source included surface water.

Troughs

Water 0/70 (0%)

Sediment 0/7 (0%)

Results for Weather Variables Related to Samples

Odds = chance of being positive for Ec O157

Increase max soil temp, increase odds

Increase max humidity, increase odds

Results for Management Practices Related to Samples

Odds = chance of being positive for Ec O157

Increase herd size, increase odds (increase in outside cattle being brought in? more chances of cow to cow contact)

Increase percent of unweaned calves, increase odds (more chances of contact, increase young vulnerable?

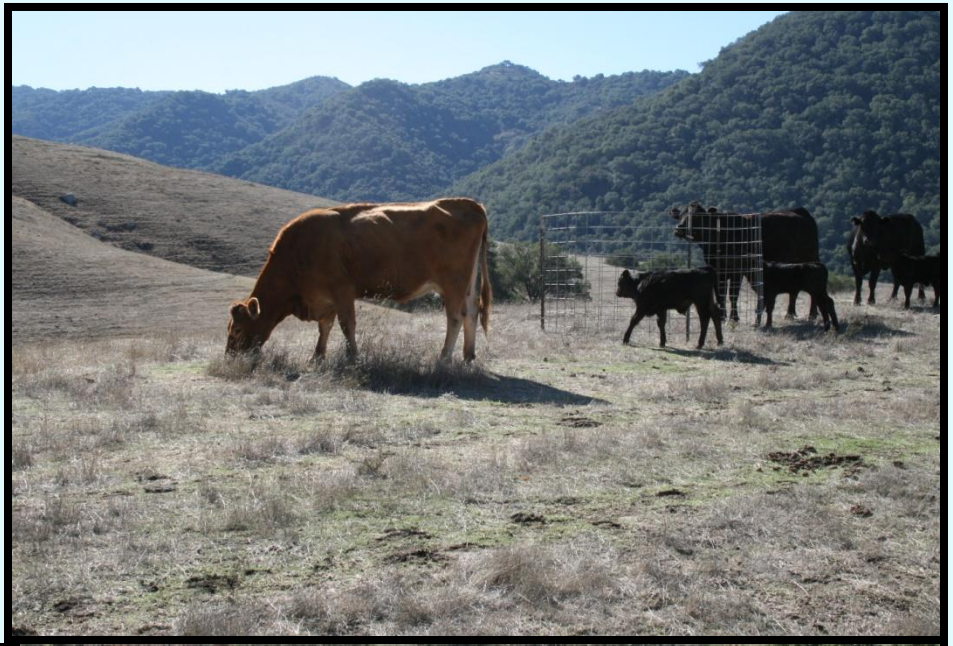
Increase calving season length, decrease odds (decrease contact, decrease young vulnerable?

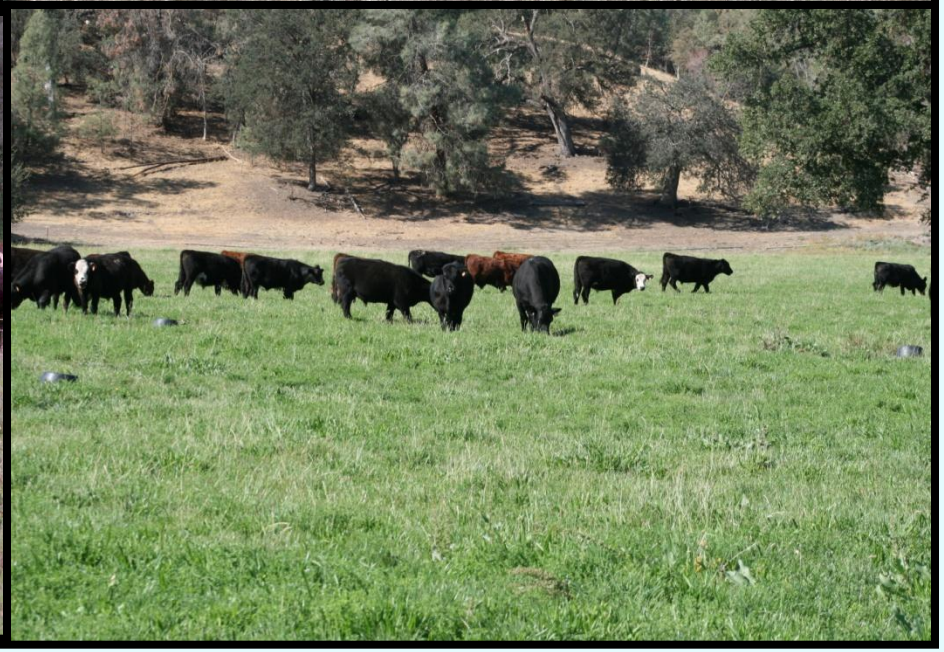
All positive samples were from cow/calf pair being moved after calving (increase stress)

No positive samples if the cow/calf pair were not moved (decrease stress)

Main Conclusions
(final model)

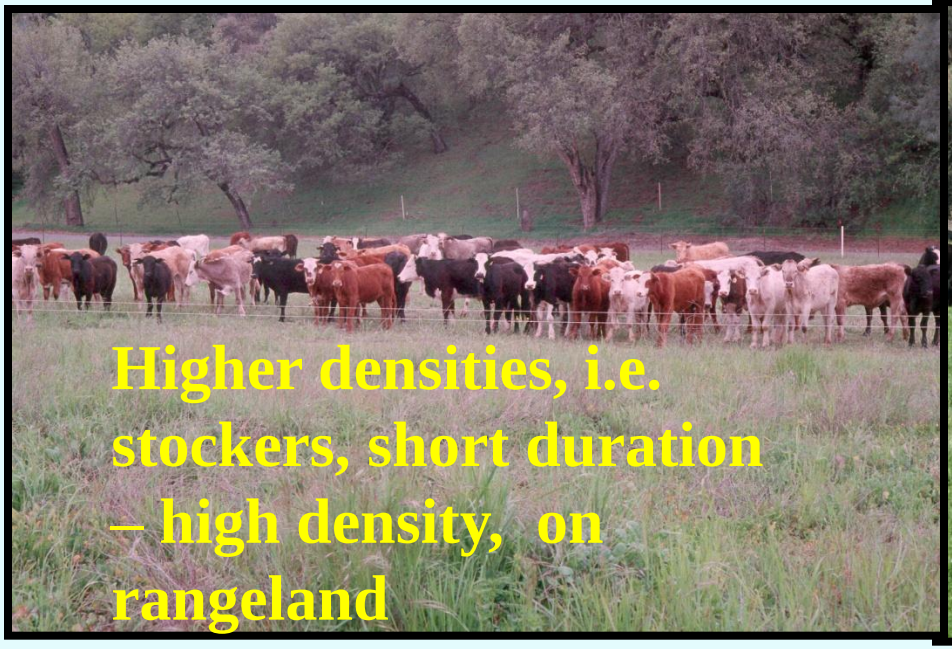
Max soil temp, higher relative humidity, increased herd size, and drinking water source were the main variables leading to increased chance of being positive for Ec O257.





Main Conclusions
(final model)

Type of Management was not Significant

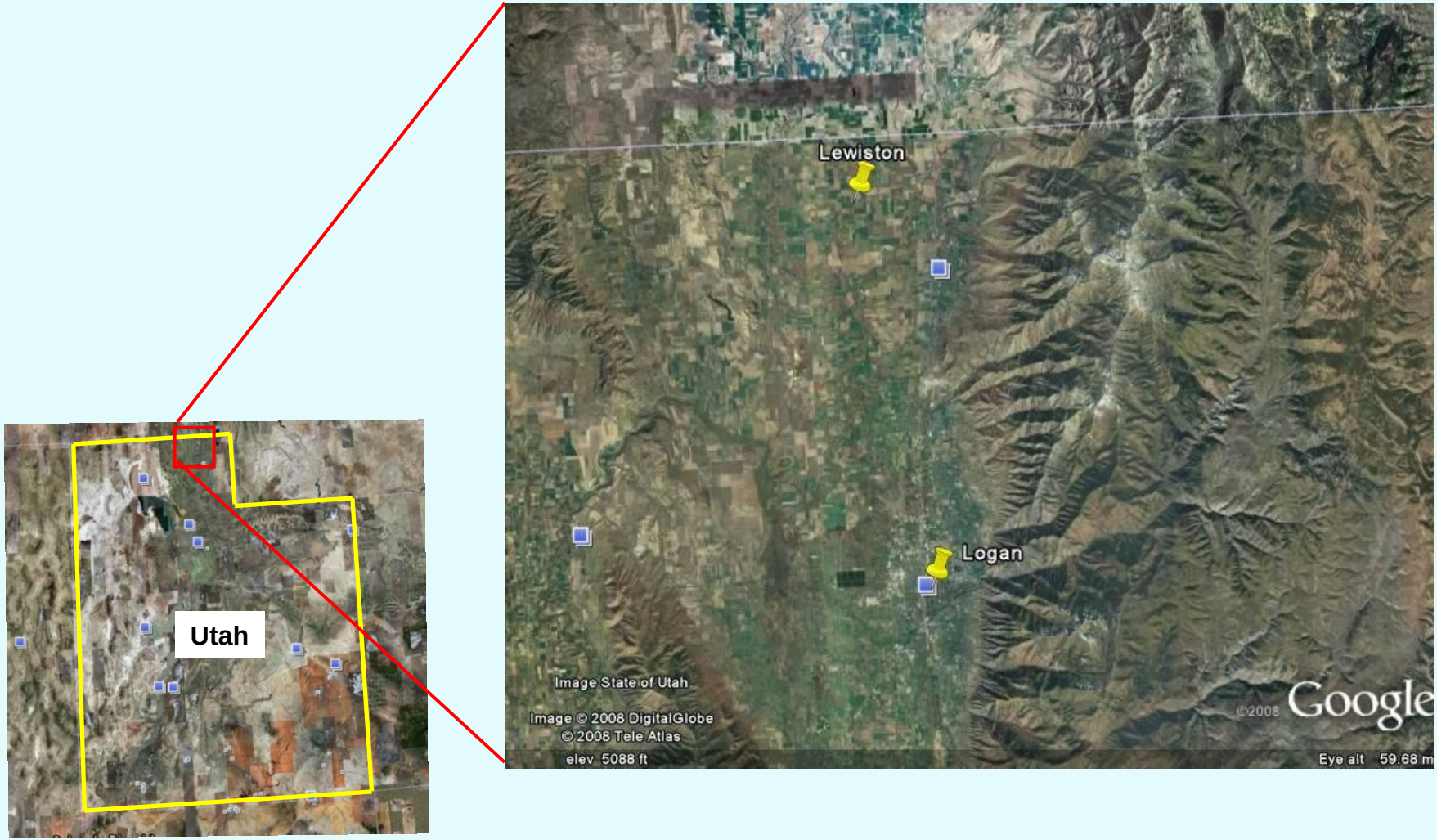


Need more studies? Nutrition? Animal Stress?

Plant Secondary Compounds Tannins viewed from a different angle (BEHAVE Program)

- ✓Highly reactive compounds
  - *Nutrition – bypass protein* *(better absorption of amino acids)*
  - Health – decrease bloat (trefoil + alfalfa)
  - Health – reduce internal parasites
  - Health – improve immune function

Utah Agricultural Experiment Station
Intermountain Irrigated Pasture Project
Lewiston, Utah



24 yearlings in 2 groups, groups 1& 2

12 pregnant cows in 2 groups, groups 3 & 4

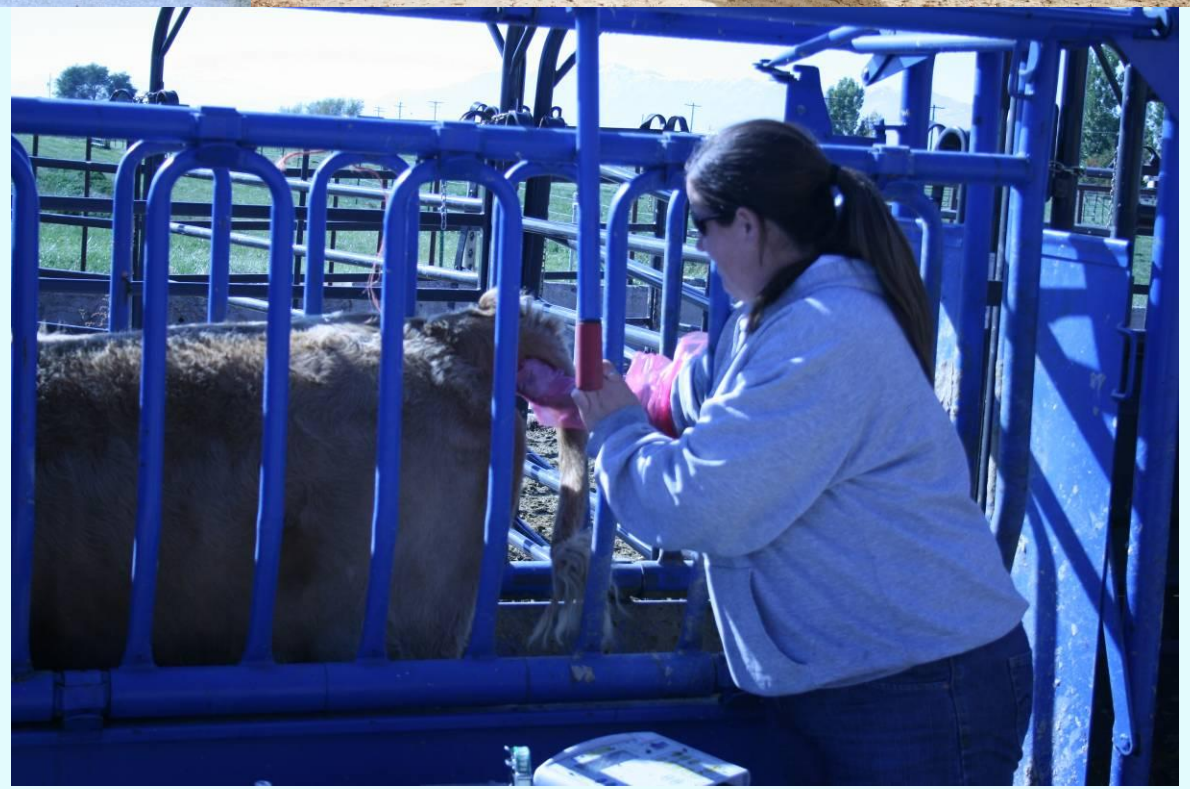
There were 84 cattle, separated into 8 different groups.

24 cows and 24 calves in 4 groups, groups 5, 6, 7, & 8

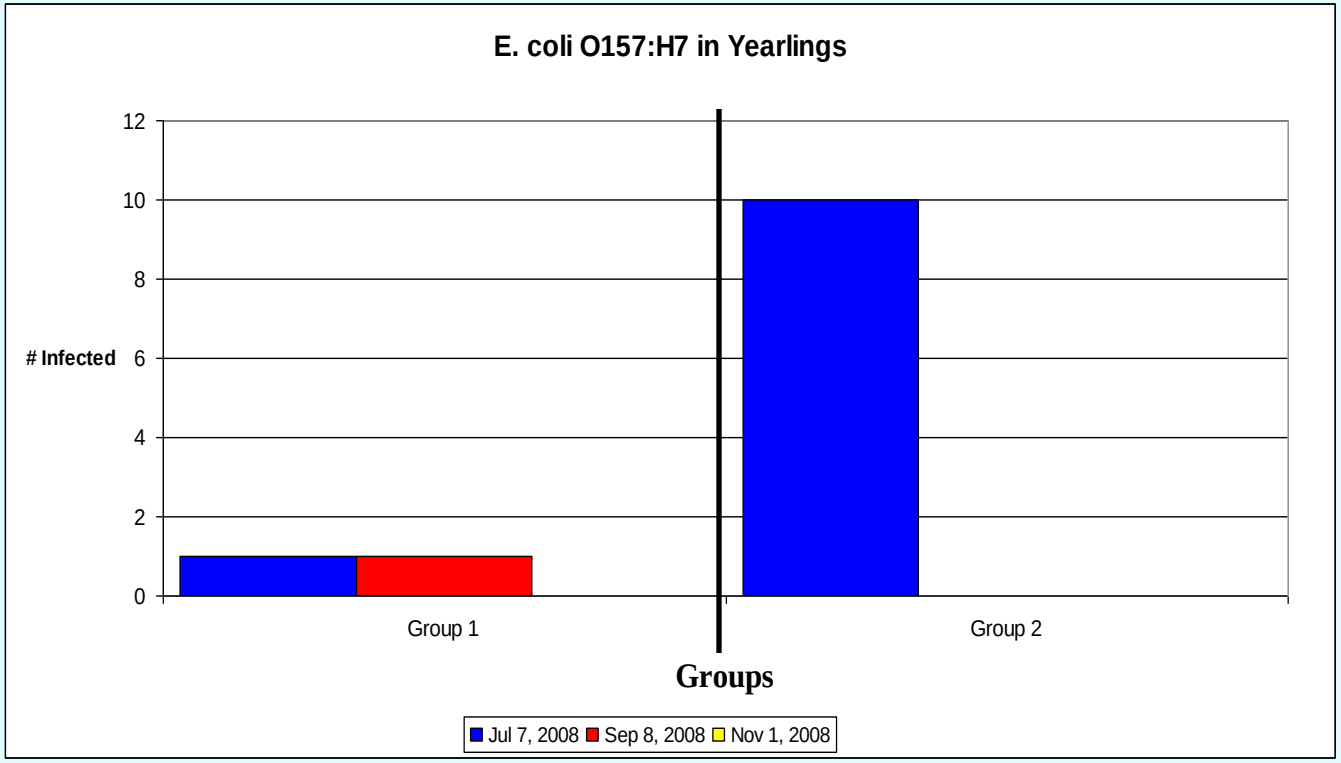
Pastures at the Utah Agricultural Experiment Station

Pasture B, C, D, F, H, and the overflow pastures were used in this experiment.

Fecal samples were taken 3 times and shipped to UC Davis and tested for *E. coli O157:H7*



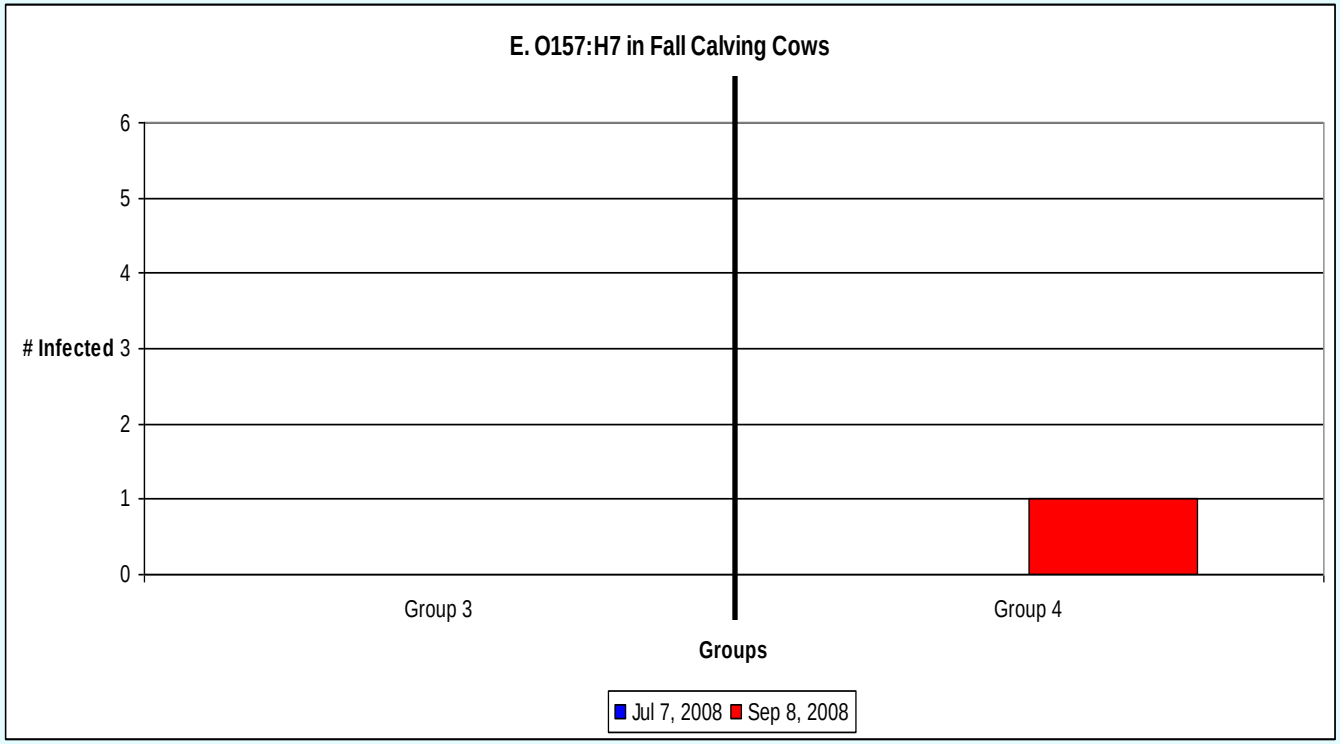
Pasture B.
Sainfoin / Cache Meadow Brome
Yearlings, 12 each group



These groups were in a pasture with birdsfoot trefoil. Group 1 was creep supplemented.

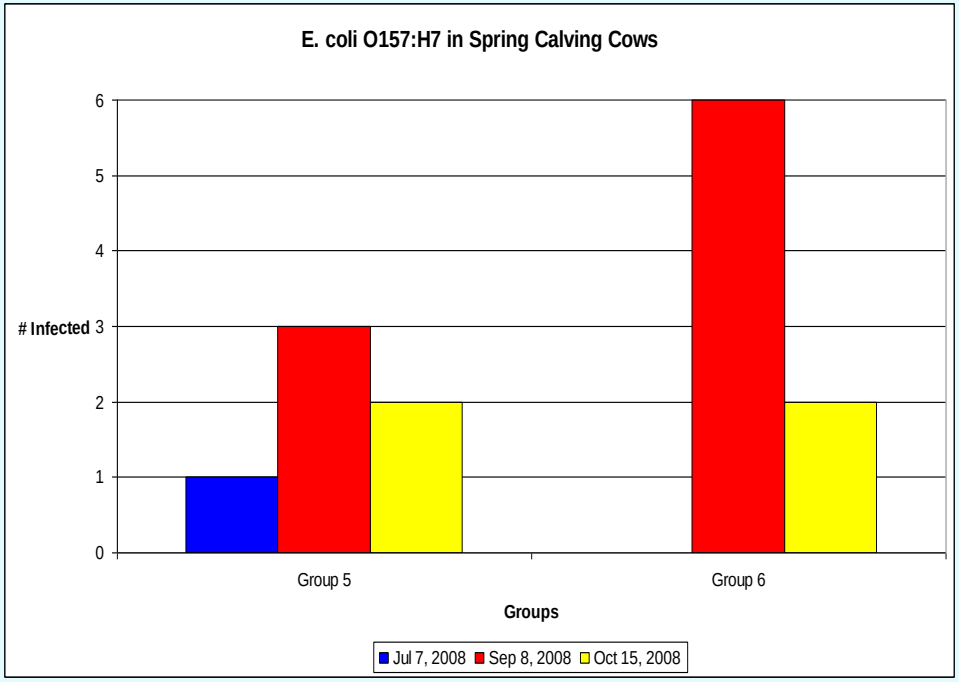
corn hominy (72%), wheat middlings (25%) and limestone (3%).

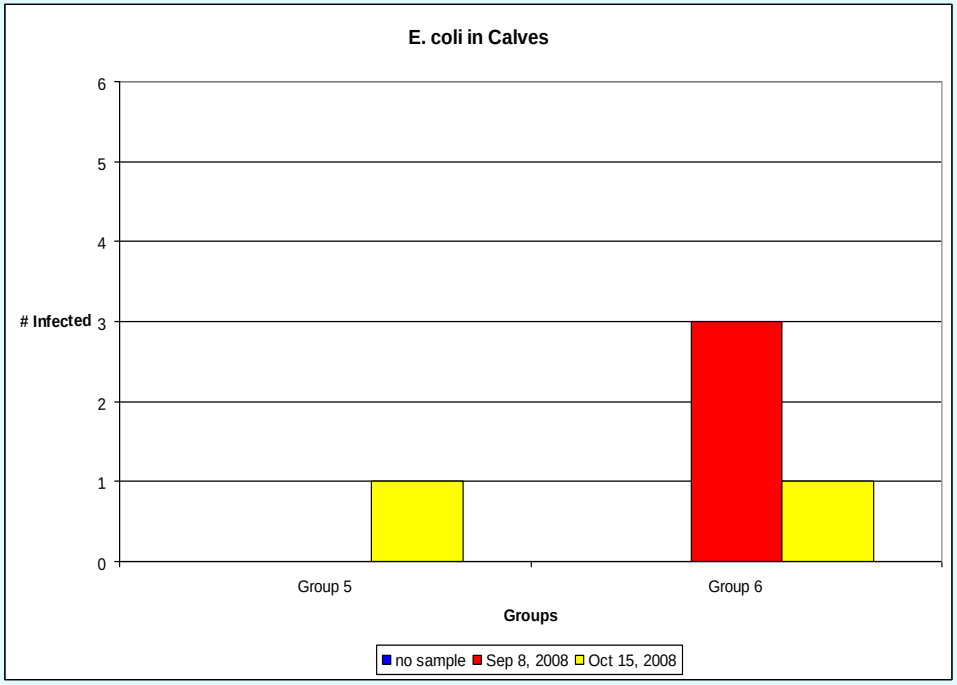
Pasture H.
Tuschany II Tall Fescue / AC Grazeland Alfalfa / Birdsfoot Trefoil
6 pregnant cows each group



Groups 3 and 4 had access to birdsfoot trefoil most of the time. Group 3 was creep supplemented.

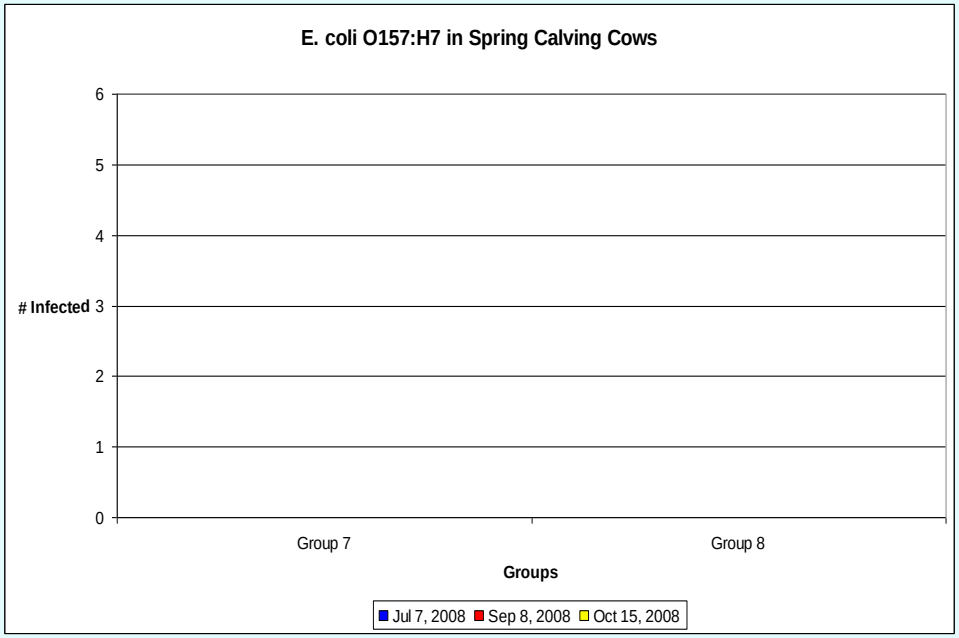
Pasture C.
Monoculture of Seine Tall Fescue
6 cows – 6 calves in each group

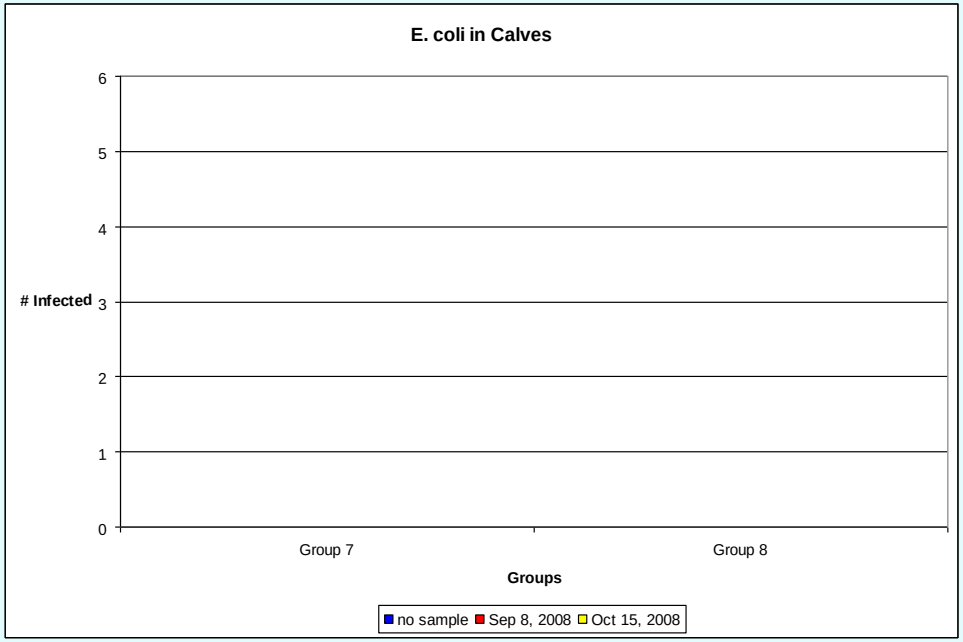




Groups 5 and 6 were in a pasture with birdsfoot trefoil from July 1 – July 7, then moved to a pasture with the monoculture of tall fescue. The calves in group 5 were creep supplemented.

Pasture D.
Seine Tall Fescue / AC Grazeland Alfalfa / Birdsfoot Trefoil
6 cows – 6 calves in each group





Groups 7 and 8 were on pastures with birdsfoot trefoil all the time, except for 1 week. Calves in group 7 were creep supplemented.

Shedding of *E. coli O157:H7* in cattle on different pastures at the Lewiston Ag Experiment station, Utah 2008.

In this observation:

Statistically different at $P < 0.02$

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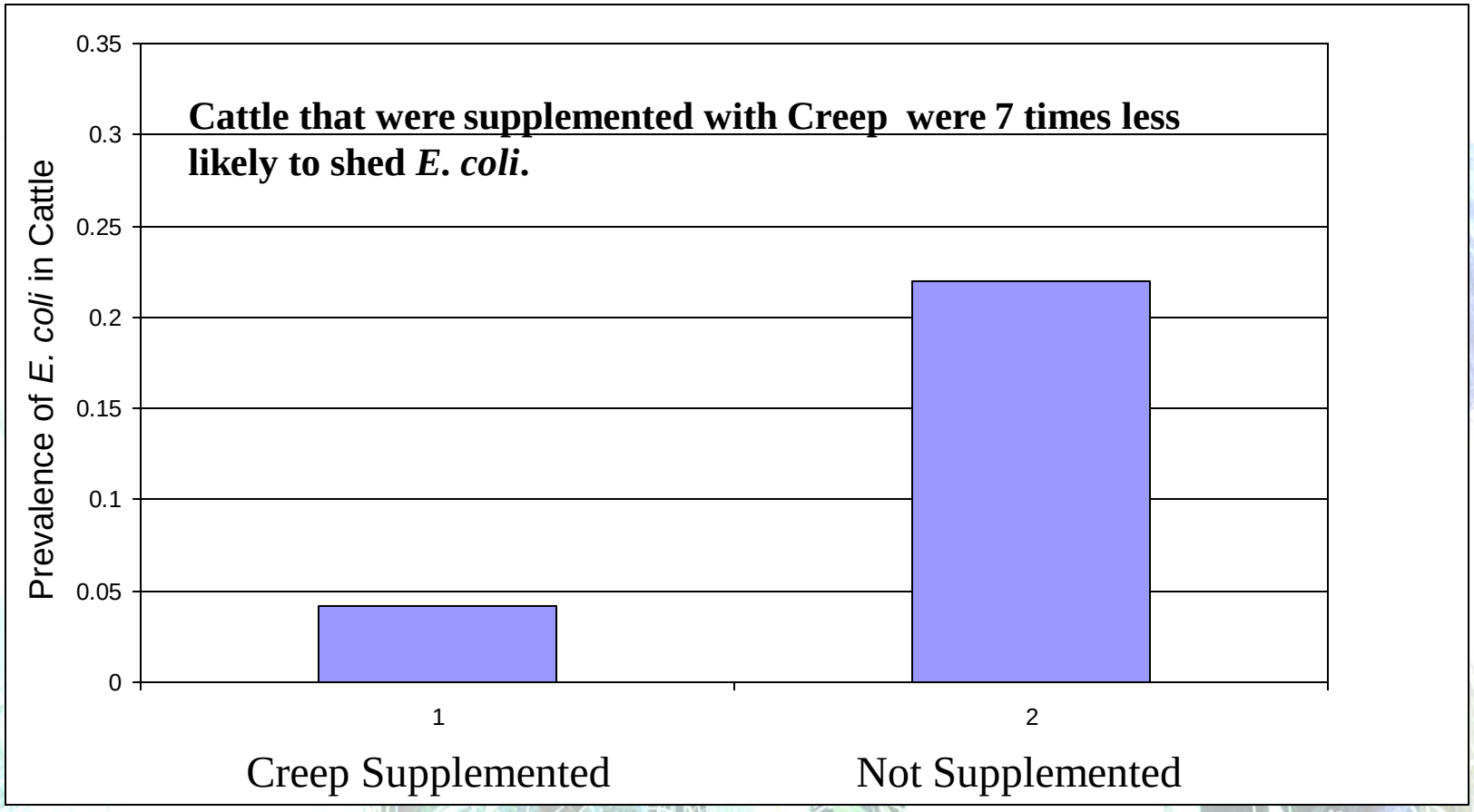

Statistically different at $P < 0.05$

Tannins viewed from a different angle (BEHAVE Program)

✓Highly reactive compounds

- Nutrition – bypass protein (better absorption of
- Health – decrease bloat (trefoil + alfalfa)
- Health – reduce internal parasites
- Health – improve immune function

Other Research has shown

- **Phenolic acids (tannins) – decreases *E. coli* in feces**
- ***para*-coumaric acid (tannins) increases *E. coli* death rates in feces**
- **Phenolic acids (tannins) from cranberry concentrates decreases *E. coli* in hamburger**

Questions