Urban Small Farms Conference 2019

Thrusday, February 21st, 2019

Time	Animals Operations
8:00	Zoonoses: Can I Get Sick From My Animals? - Kerry Rood, USU **pg. 182**
8:30	Niche Markets in the Beef System - Matt Garcia, USU **pg. 186**
9:00	Dairy Goat Milking and Milk Quality - Dave Wilson, USU **pg. 190**
9:30	Feeding Your Horse - Karl Hoopes, USU **pg. 191**
	10:00 - 10:30 Break
10:30	Critical Issues in Beekeeping - Sheriden Hansen, USU **pg. 195**
11:00	Defend the Flock - Dave Frame, USU **pg. 201**
11:30	Holos: Farm Management Software for Animal Agriculture - Katie Slebodnik, USU and Guests **pg. 206**

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Zoonoses: Can I Get Sick From My Animals?

Attendees will learn about common zoonotic diseases transmitted from farm animals and prevention strategies to minimize human risk. Included will be a discussion about the high risk activity of public petting zoos; a common agritourism event.

Kerry Rood
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Kerry A. Rood, MS, DVM, MPH, DACVPM is associate department head and has served as extension veterinary at Utah State University since 2007. Prior to this academic appointment, he served as the Vermont State Veterinarian and Chief Animal Health Officer. A 1997 DVM graduate of KSU, Dr. Rood has been in mixed animal practice in Oregon and Utah. Kerry has received a number of wards, including Undergraduate Advisor of the Year, Utah's Veterinarian of the Year, Teacher of the Year, and President of the Utah Veterinary Medical Association. As part of a team, Dr. Rood was instrumental in garnering professional, public, and legislative support for the USU School of Veterinary Medicine; a joint regional program between Washington, Idaho, Montana, and Utah. Kerry is from Coos Bay, Oregon and raised on a family owned dairy and beef operation. Dr. Rood married Rachel Taylor in 1989 and they have three daughters.

Zoonoses: Can my animals make me sick?

Dr. Kerry A. Rood

Associate Professor and Extension Veterinarian

Toxocara larval migrans

Beaches at lake closed after roundworm infection

Associated Press - September 19, 2009 4:25 PM ET

SALT LAKE CITY (AP) - Beaches and docks at Oquirrh Lake have been closed for the season after three Utahns were diagnosed with a roundworm infection.
Salt Lake Valley Health Department officials say all three had been at the popular lake at the Daybreak development in South Jordan.

Health officials on Wednesday notified Kennecott Land, which decided to close the beaches and docks a couple of weeks earlier than usual.

Officials say the parasite is common worldwide, especially in areas with no water treatment. The parasite grows in the intestine and can cause pain and malnutrition.

Kennecott Land officials say they routinely test water quality at the lake and all tests have been within acceptable ranges.

Reported outbreaks of enteric disease associated with animals (1991-2005)

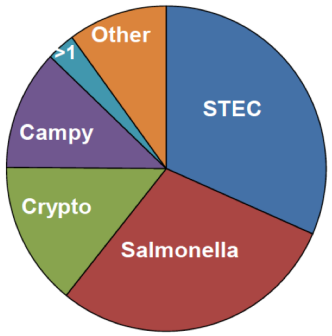
Pathogen	No. (%) of outbreaks
Campylobacter species	3 (5.5)
Cryptosporidium species	4 (7.0)
Escherichia coli O157	32 (58.0)
Giardia species	1 (2.0)
Multiple pathogens	3 (5.5)
Salmonella species	12 (22.0)
All outbreaks	55 (100.0)

Animal Contact Outbreaks in US

Animal Contact Outbreaks in the United States by Pathogen, 1996-2012

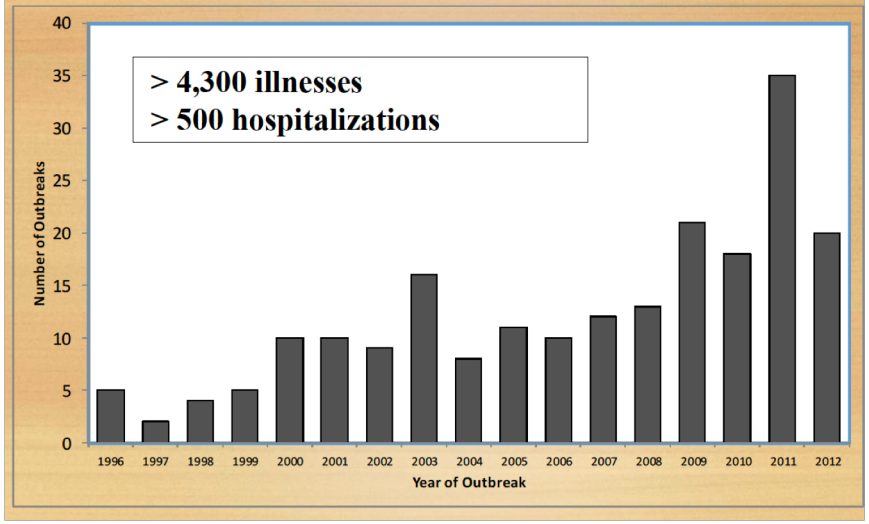
Pathogen	# Outbreaks
E. coli unspecified	24
E. coli O157:H7	33
E. coli other	9
Salmonella	61
Cryptosporidium	30
Campylobacter	25
Multiple pathogens	6
Influenza A (H3N2v)	4
Influenza A (novel H1N1)	1
Q Fever	3
Giardia	2
Orf virus	2
Dermatophytosis	1
Hantavirus	1
LCMV	1
MRSA	1
Mycobacterium tuberculosis	1
Monkeypox virus	1
Psittacosis	1
Rabies	1
Yersinia pestis	1

N = 209



88% of outbreaks caused by *E. coli*, *Salmonella*, *Cryptosporidium*, and *Campylobacter*

Animal Contact Outbreaks in the United States by Year, 1996-2012



Adapted from Klumb, 2016

E. coli O157 & *Salmonella* Prevalence at U.S. Agricultural Fairs

Salmonella:

- 29 (91%) of 32 fairs
- 19.1% of livestock (558/2914)

E. coli O157:

- 32 (100%) of 32 fairs
- 8.0% of livestock (233/2914)
- Persistence > 9 months

Keen JE et al, VTEC 2003, Edinburgh, Scotland

Utah

DESERET NEWS | CHURCH NEWS SUBSCRIBE

Utah health officials investigate rise in E. coli cases

Visits to corn mazes, petting zoos, farms may be to blame

By **Wendy Leonard** @wendyleonards
Published: October 25, 2018 12:55 pm

SALT LAKE CITY — Health officials are investigating an increase in E. coli infections throughout Utah.

The spread of fecal bacteria might be coming from petting zoos, corn mazes and farms that are popular this time of year.

Since Oct. 1, 20 cases have been reported along the Wasatch Front and central and southwestern regions of the state. The caseload is higher than the usual 13 E. coli infections reported to the Utah Department of Health the past five Octobers, according to Kenneth Davis, an epidemiologist with the health department.

"An average of 113 (Shiga toxin-producing Escherichia coli) cases and 25 hospitalizations are reported each year in Utah," he said. "This increase in October is higher than normally expected."

He said cases range in age from 10 months to 71 years and 11 are younger than 18. Six people have been hospitalized, but no deaths due to the bacterial infection have been reported.

Common Transmission Routes

Direct or Indirect Transmission

Fecal – Oral Contamination Common Scenario

Prevention

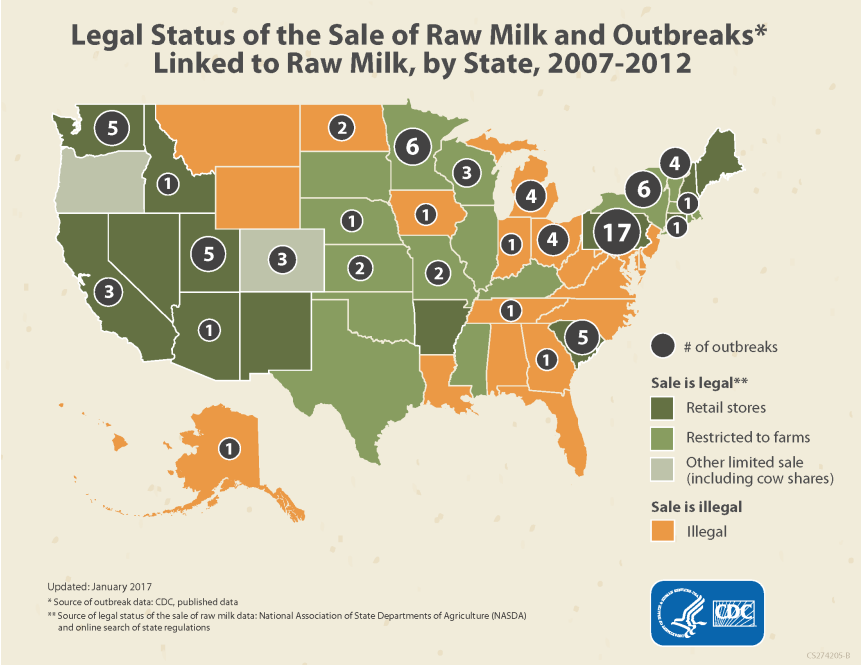
- Washing Hands
- Hand Sanitizers
- Avoid Eating in Barnyard
- Pasteurization
- Inspection

Washing Hands

Hand Sanitizers

Avoid Eating in Barnyard

Pasteurization



FOOD SAFETY ... 0 COMMENTS

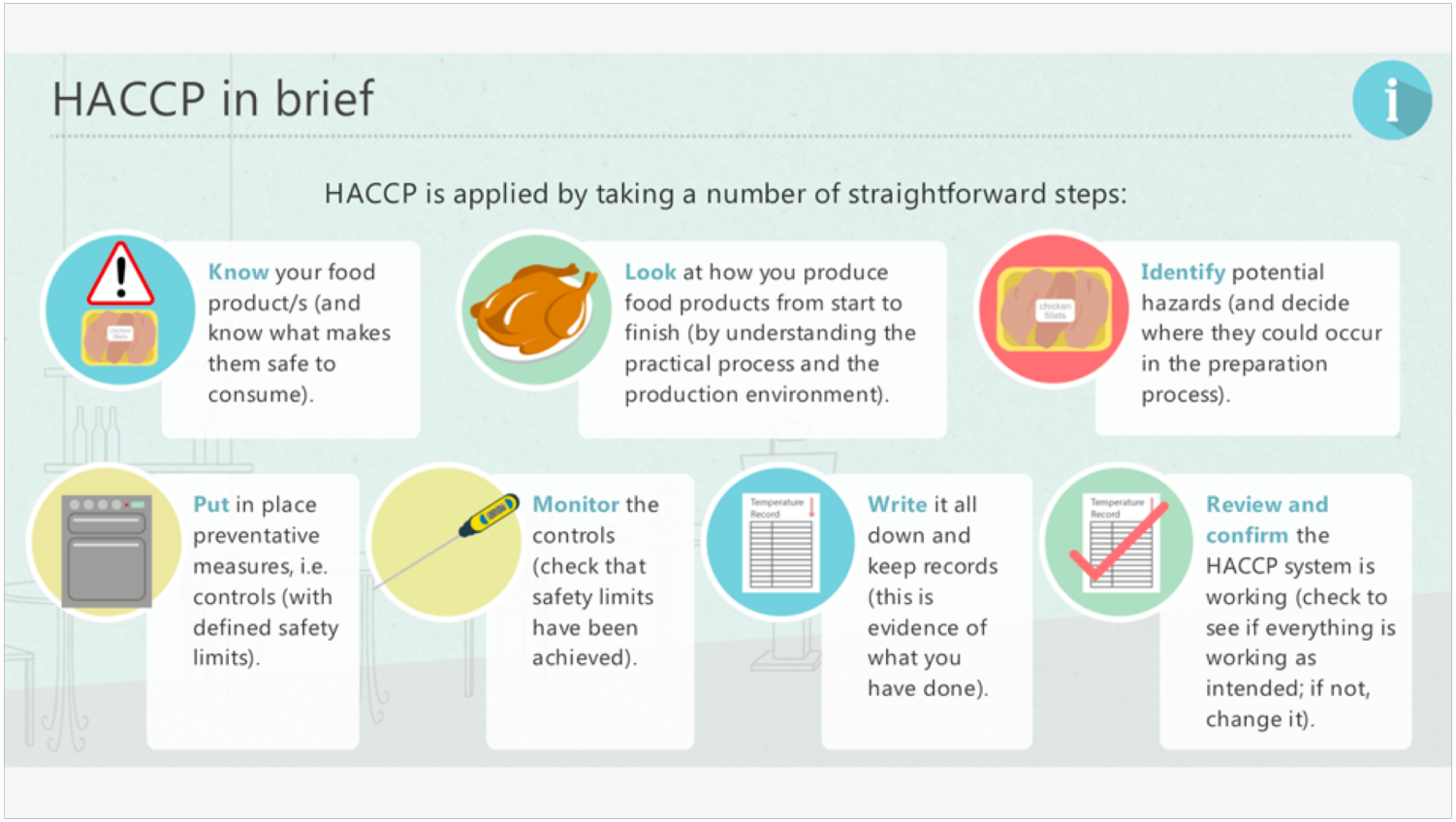
Raw milk from Pa. farm linked to Brucellosis

This type of Brucella is resistant to first-line drugs and can be difficult to diagnose

PUBLISHED ON **FEBRUARY 13, 2019**

The Centers for Disease Control and Prevention and state health officials are investigating potential exposures to Brucella strain RB51 (RB51) in 19 states, connected to consuming raw (unpasteurized) milk from Miller's Biodiversity Farm in Quarryville, Pa. (Wikimedia Commons)

Inspection


HACCP in brief
HACCP is applied by taking a number of straightforward steps:
Know your food product/s (and know what makes them safe to consume).
Look at how you produce food products from start to finish (by understanding the practical process and the production environment).
Identify potential hazards (and decide where they could occur in the preparation process).
Put in place preventative measures, i.e. controls (with defined safety limits).
Monitor the controls (check that safety limits have been achieved).
Write it all down and keep records (this is evidence of what you have done).
Review and confirm the HACCP system is working (check to see if everything is working as intended; if not, change it).

Recommendations

Handwashing Stations with Signage

- Soap and Water
- Hand Sanitizers

No Human Food In Barnyard

Embrace Pasteurization and Inspection

- If food is offered, make sure sourced from inspected and pasteurized sources
- No raw milk to guests

Litigious Society

Raw Milk, Petting Animals and E. coli – No Surprise

By Bill Marler on July 7, 2018

POSTED IN E. COLI OUTBREAKS

The Knox County Health Department (KCHD) is concluding its investigation into a cluster of Escherichia coli (E. coli) O157 infections. Fifteen confirmed cases of E. coli O157 were reported to KCHD recently. All cases were among children, nine were hospitalized and seven developed a complication of the infection called Hemolytic Uremic Syndrome (HUS). Of the children who were hospitalized, one remains in fair condition at East Tennessee Children's Hospital. Lab results from the Tennessee Department of Health have confirmed two different strains of E. coli O157 caused the children to become ill.

Thank you!

Kerry A. Rood, MS, DVM, MPH, DACVPM
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Niche Markets in the Beef System

Critical evaluation and description of what is necessary to produce beef for niche market requirements.

Matthew Garcia
Beef specialist
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I help producers critically evaluate how decisions at one time point affect their productivity upstream and downstream of that decision.

Niche Markets in Beef Production

Small Urban Farm Conference

Dr. Matthew Garcia

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Niche Markets

- A marketing effort that focuses efforts on a small but specific and well defined demographic willing to pay a premium for a product
- Producing a product that is unique and not mass produced
- Delivering goods or services that are not being addressed by producing agencies
  - Added value
  - Big Fish in small pond

Niche Markets in Beef Cattle

- Grass Fed
- Grass Finished
- Organic
- Natural
- “Backyard Beef”

Grass Fed Beef

- Very large marketing campaign
- Somewhat misleading
- Every cow is grass-fed
  - Even conventional finished
- Certified Grass fed
  - AGA
  - Third party certified

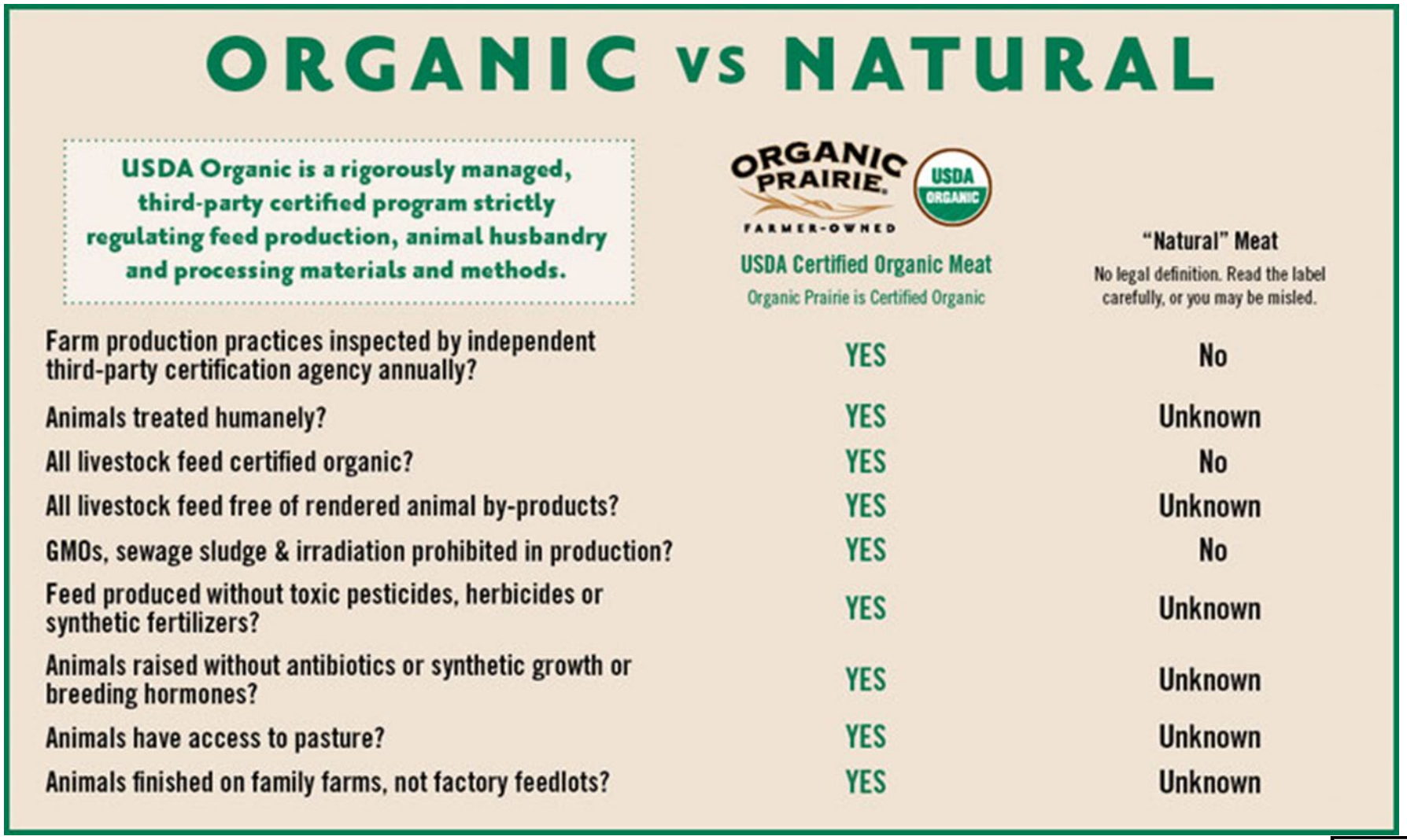
Grass Fed Beef

- AGA certified program is very similar if not identical to Grass finished beef systems
  - Cattle must be born raised and finished on forage based pastures
  - Can graze post harvest crop residue
  - No hormone implants
  - Antibiotics
- Grass finished beef only eats forage from birth to harvest

Challenges of Grass Fed/Finished Beef

- A producer needs more resources to bring an animal to harvest
  - Land mass, water etc.
- It takes longer to raise an animal to harvest
  - 24-28 months to harvest
  - Maturity/quality
- Variability of forage quantity and quality
- Palatability and appearance
  - Difference in flavor

Organic Beef



Organic Beef

- Challenges
  - Availability of organic feed
    - 100% Organic
    - Pastures and rangeland must be managed as organic for 3 years prior to certification eligibility
    - Price of organic feed
  - Third party certified of all processes
  - No Hormones
  - No Antibiotics
  - Animals must have access to pasture for at least 120 days

Organic Beef

- Challenges
  - Long transition time to be certified (2-3 years)
  - Fly and parasite management
  - Initial cost of certification and maintaining certification
  - Any animals requiring treatment must be removed from program

Natural Beef

- Very broad program
- Third party certified vs self certified
  - Hormones can be used
  - Antibiotics can be used at certain time points
- Some can follow grass fed rules
- Some can follow organic rules
- Some are finished in feedlots

Natural Beef

- Very ambiguous
  - Must be minimally processed
  - Not contain artificial flavors, colors, chemical preservatives or synthetic ingredients
- All fresh beef qualifies as natural
  - USDA Food Inspection Safety Service

Backyard Beef

- Raising one or two steers, heifers, cows in smaller pasture systems
  - Now considered a niche market
  - Was more common 3 or 4 decades ago
  - Raising beef for family use

Backyard Beef

- Challenges
  - Small area usually will not provide or meet nutrient requirements
  - Need to supplement animals for growth and health
  - Manure production
    - Must find a way to clean/dispose
    - Neighbors
    - Flies
  - Containment in a more urban environment

Backyard Beef

- May take longer to reach a harvest weight
- Need to find a way to have that animal harvested
  - Neighbors may be shocked
  - Animal will need to be transported
- Much more meat than some people anticipate
- Emotional attachment

Summary

- All niche markets meet a demand for a specific product
- Added value of niche market products
  - Premium paid
- Know what the animal has eaten, how the animal was treated and how your meat was produced
- All niche markets have challenges

Questions?

Dairy Goat Milking and Milk Quality

Milking procedures and other practices to help udder health and milk quality in goats.

Dave Wilson
Dairy Extension Veterinarian, Epidemiologist for the Utah Veterinary Diagnostic Laboratory
Utah State University
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Born and grew up in Wisconsin. Graduated from veterinary school at Ohio State University in 1982. Practiced in mixed practice, mainly dairy, until 1987. Three-year residency and post-DVM MS specializing in mastitis and udder health completed in 1990 from Michigan State University. Worked in mastitis and udder health at Cornell University for 15 years. Came to Utah State University in 2006 as dairy extension veterinarian and epidemiologist for the Utah Veterinary Diagnostic Laboratory. Worked mainly on mastitis, milk quality, stray voltage on dairy farms, high throughput disease testing using milk samples, bovine immunology and Johne's disease.

Dairy Goat Milking and Milk Quality

David J. Wilson
Utah State University
Urban and Small Farms Conference
2019

Introduction

How many dairy goats in Utah?

2012 National Agricultural Statistics Service (NASS)

298 dairy goat farms, 2,463 milking goats

Average of 8 goats per Utah dairy goat herd

Dairy Goat Breeds in Utah

From websites of goat farms, the dairy breeds in Utah appear to be those most common in many states (and my experience as well):

Saanen

Toggenburg

Alpine

LaMancha

Nubian

Milk Production

Milk Production per 305 day lactation

Average 1856 pounds (843 kg)

Some > 3,000 pounds (1360 kg)

Total Milk Sold per day per goat dairy farm in U.S.:

4 - 40 lb 12%

50 - 76 lb 15%

140 - 500 lb 45%

501 - 875 lb 15%

1,300 - 30,000 lb 13%

Goat Milk Processing in Utah

According to combination of NASS statistics and UDAF:

On farm, owner handling milk (2200 goats) 90%

4 raw milk for retail farms (150 goats) 6%

On farm, owner operated milk plant (90 goats) 4%

Much of the marketing is by farms' websites

Dairy Goat Mastitis Pathogens

Intramammary pathogens of dairy goats similar to those in dairy cattle

However:

Most common isolates different

Prevalence of intramammary infections is lower in goats

Relationship between mastitis and somatic cell count (SCC) is different

Dairy Goat Mastitis Pathogens

Coagulase-negative staphylococci (CNS), also called *Staph* spp. (Steward et al., 2017; McDougall et al., 2014) most common in goat mastitis

Culture-negative	73%	(often 85-90%)
Any pathogen	27%	
CNS	23%	
S. aureus	1.5%	
Strep spp. (non-ag)	0.8%	(Wilson, unpublished)

Somatic Cell Counts in Dairy Goats

Somatic Cell Count (SCC) in milk > 90% neutrophil white blood cells (like in other mammals)

However, SCC in goat milk is *weakly related to mastitis* compared to SCC in cows

(Wilson et al., 1995; Jiminez-Granado et al., 2014)

Goat mean SCC (tank) - 835,000/ml

Herds > 1,000,000/ml - mean 1,435,000/ml

(32% of does culture-positive for mastitis)

Herds < 1,000,000/ml - mean 499,000/ml

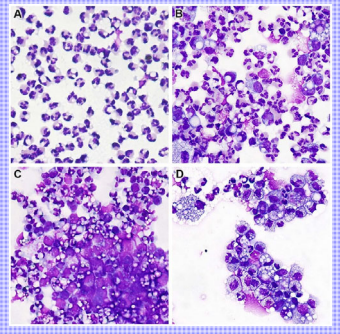
(26% of does culture-positive for mastitis)

Somatic Cell Counts in Dairy Goats

SCC in goat milk is *strongly related* to days in milk (DIM), the number of days since kidding

Many herds have most kids born between March and May

By late summer or especially in Nov., Dec., SCC > 1,000,000/ml not uncommon



Usually not a lot of infected udder halves, and the SCC decreases after herd dries off and kids again

Teat Prep and Disinfection

Surveys and goat producer websites suggest that many goats are milked using one of 3 teat cleaning methods:

Udder wash

Spray "dip"

Teat dip with cup

Udder Wash

Many different recipes, ingredients used

- *Bryonia alba*
- Echinacea
- Lac caninum (dog milk)
- Ruta graveolens
- Sulfur
- Tea tree oil
- Castile soap
- Bleach
- Carbo vegetabilis
- Lachesis (snake venom)
- Phytolacca decandra (poke)
- Silica
- Alcohol (isopropyl)
- Lavender oil
- Dishwashing detergent

However, be aware of a concern - -

Udder Wash

Udder wash is commonly made using drops of the ingredients in quarts or more of water

This results in udder washing essentially with water

No germicide (many of those are not germicides) is effective at such low concentrations (drops per quarts or more of water)

Bleach (Clorox has good pH control) straight or 4 parts Clorox: 1 part water is effective

Predipping- Spray or Cup

Spray dipping is an option, but must cover teats well

Cup dipping is always best at covering entire teat if done properly

Teat dip is not “adulteration of milk with chemicals”

Teat dip is quite remarkable - a strong germicide that can be applied to mammary glands and safe for food contact surfaces

Teat Dips with Good Demonstrated Efficacy

0.5% or stronger chlorhexidine acetate (acetate as opposed to chlorhexidine gluconate)

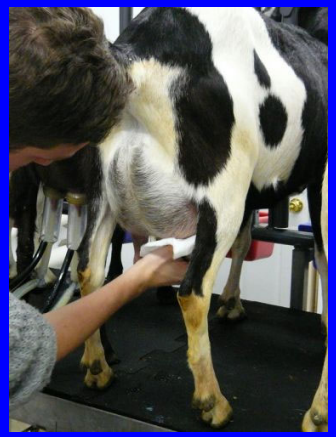
0.5% or stronger titratable iodine (0.5% to 1.0% titratable iodine)

Predip Before Milking

Contact time at least 15 seconds - one minute better

Wipe off with either paper or cloth towels - one per udder half, never use from one goat to another

Wearing nitrile or latex gloves is much cleaner than using bare hands - some humans harbor a lot of staphylococci on skin




PYGMY
GOAT
XING

Postdip After Milking

Cup dipping covers teats more thoroughly and more effectively than spray "dipping"

Frostbite in cold weather? No agreed upon temperature, but best not to dip with liquid when wind chill below 0º F Powder "dip" when cold

However, only controlled study found not as effective

Results-Goat Treatment Practices

78% use IMM infusion antibiotics during lactation

Of those herds:

Cephapirin	32%	Penicillin	12%
Pirlimycin	22%	Amoxicillin	12%
Vet mix	9%	Organic	3%

84% dry treated does (78% all, 6% selective)

Of those herds, 73% used Pen/strep combination

Intramammary Infusion of Goats

Use commercial sterile tubes, disinfect teat ends with 70% isopropyl alcohol first

Drawing out of a multiple use container is risking yeast or other contamination and causing mastitis

Use one tube (not one-half) per udder half at each treatment

only enter 1/8” if possible

Home Pasteurizing Goat Milk

Can do high temperature short time method:

72° C (162° F) maintained for 15 seconds

Some say they don't like the taste

Or can do low temperature long time method:

63° C (145° F) maintained for 30 minutes

Take Home Points

Most goat milk apparently consumed by owners and family (90%)

Consider home pasteurization

Coagulase - neg staphylococci (CNS) most common pathogen (85% of goat isolates)

SCC in goat milk usually related to DIM, not a lot of infected udder halves

Predip, postdip (Cup), dry treat udder halves at end of lactation (one tube per udder half)

Back to Top

Feeding Your Horse

Horse have a unique digestive track that allows them to convert plant materials to energy, however, they are not your typical livestock. My presentation will give a brief look into the basics of feeding your horse as well as some consideration to feeding in cold winter months.

Karl Hoopes
Equine Extension Specialist
Utah State University
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I have been at Utah State University for three years with the role of equine extension specialist, as well as one of USUs veterinarians. I teach Animal Anatomy and Physiology as well as Equine Nutrition and Exercise Physiology. My hobbies include horse racing, trail rides, and hunting.

Feeding Your Horse

Karl Hoopes, DVM, Equine Extension Specialist

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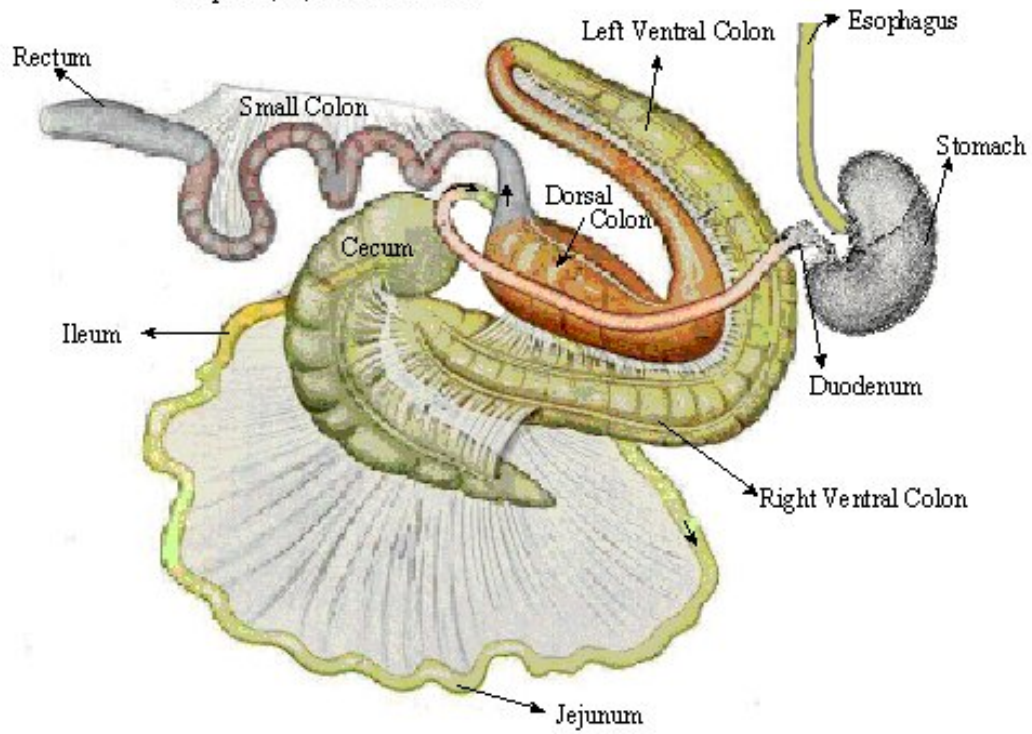
Equine Nutrition

- Equine Digestive Tract
- Fermentation
- Differences from other species
- How much should I feed

Equine Digestive Tract

Reference: Adapted from Atlas of Topographical Anatomy of the Domestic Animals, Popesko, P., W. B. Saunders



Equine Digestive Tract - Function

Type	Fore Gut	Capacity	% of Gastrointestinal System
Enzymatic Digestion	Stomach	8 - 15 litres	8%
	Duodenum, Jejunum, Ileum (70 ft. or 21 meters)	68 litres	30%
Type	**Hind Gut**	**Capacity**	**% of Gastrointestinal System**
Microbial Digestion	Cecum (4 ft. or 1.2 meters)	28 - 36 litres	15%
	Large Colon (Right Ventral, Left Ventral and Dorsal Colons) (10 - 12 ft. or 3 - 3.6 meters)	86 litres	38%
	Small Colon (10 - 12 ft. or 3 - 3.6 meters)	16 litres	9%

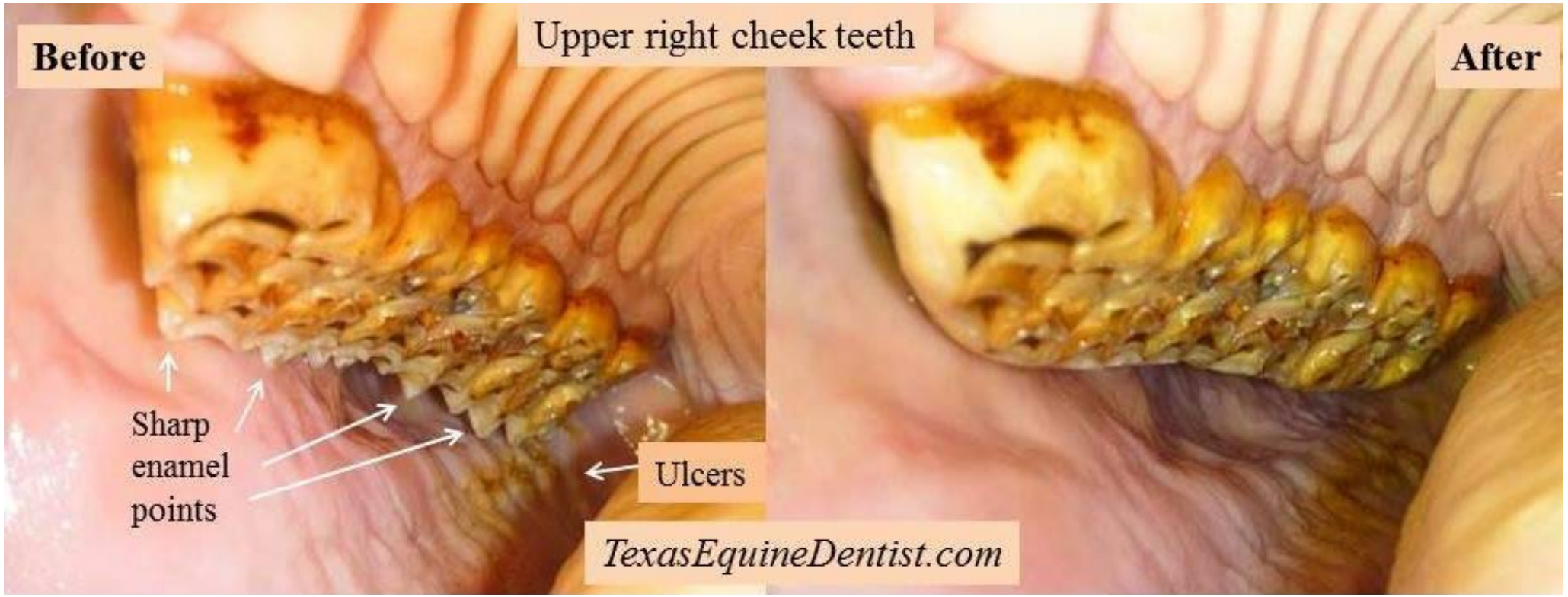
Fermentation

- Animals do not have a natural enzyme to breakdown the beta bonds found in cellulose and hemicellulose, making carbohydrates found in plants unavailable for energy.
- Specialized areas of digestive systems in some animals contain microbes allowing for fermentation to occur.
- Microbes digest the plant material, breaking the beta-bond, producing volatile fatty acids, gas, heat that can then be absorbed and utilized by the animals.

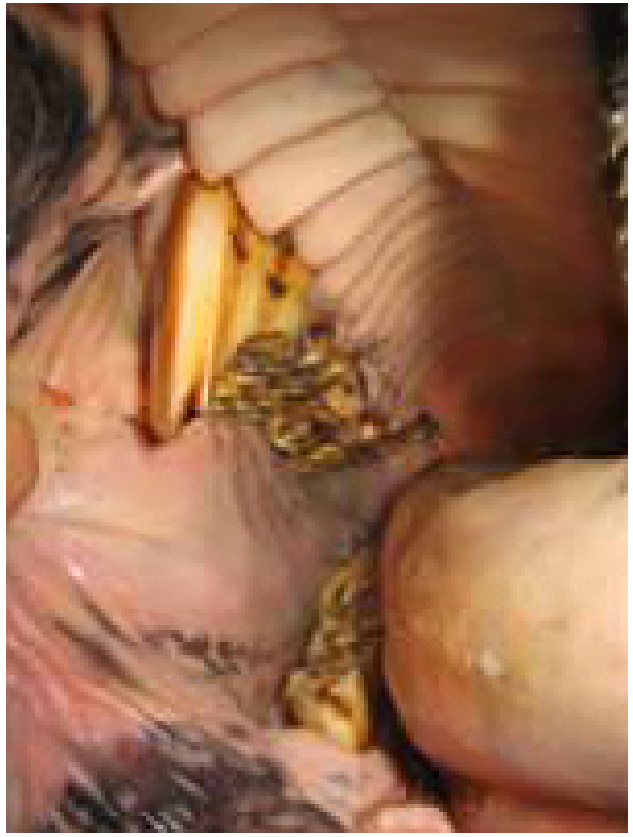
Differences

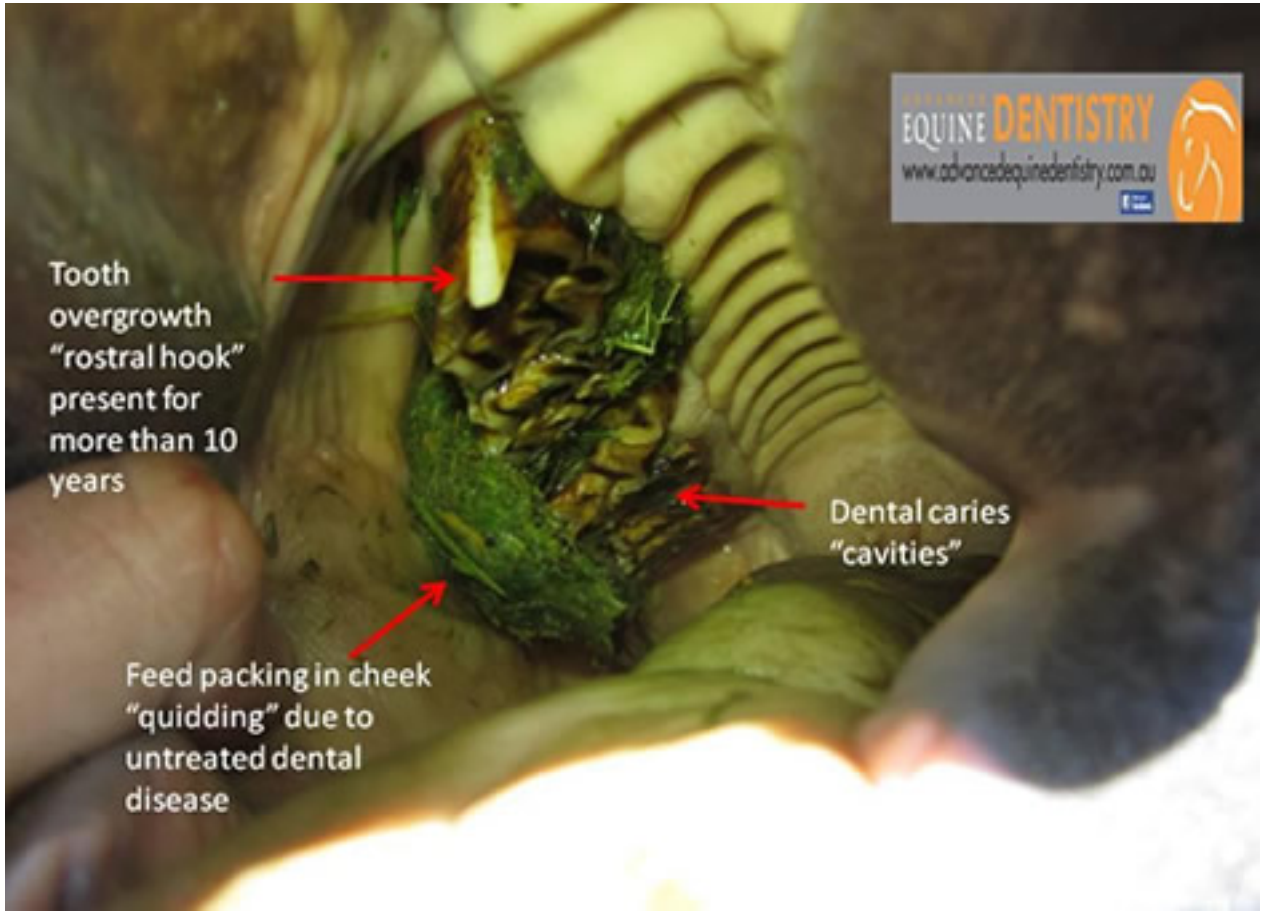
- Teeth
- Small Intestine
  - Rate of Passage
- Large Intestine Fermentation
- Colic

Teeth


Before
Upper right cheek teeth
After
Sharp
enamel
points
Ulcers
TexasEquineDentist.com

Teeth

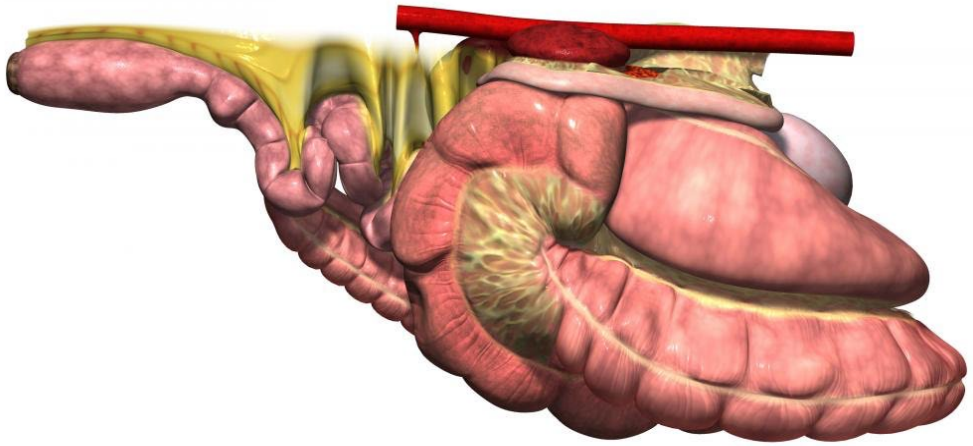


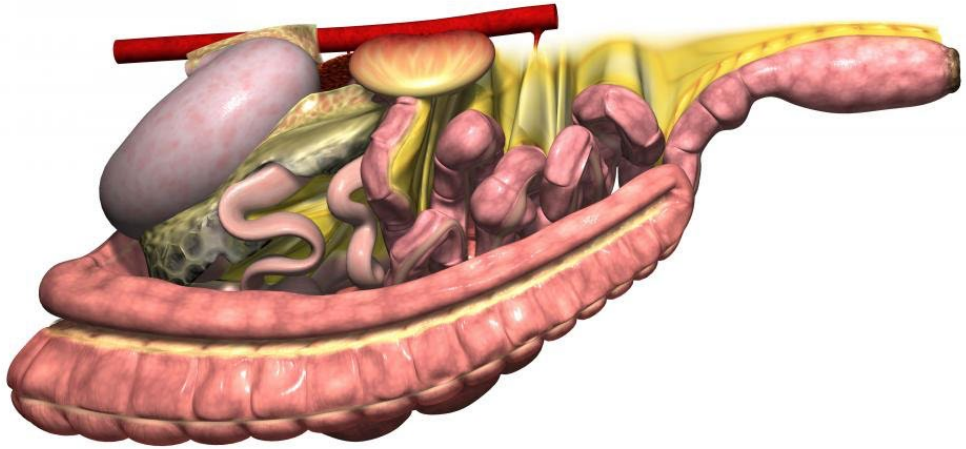

EQUINE DENTISTRY
www.advanceequinedentistry.com.au
Tooth overgrowth "rostral hook" present for more than 10 years
Dental caries "cavities"
Feed packing in cheek "quidding" due to untreated dental disease

Small Intestine

- Rate of Passage
  - 1 foot / minute
  - Hayburners
  - Naturally grazing 20 hours a day

Cecum / Large Intestine Fermentation





Colic

- Very sensitive to abdominal pain

How much should if feed?

- 1.5 % – 3.5 % of their body weight in dry matter per day
  - 1000 lb horse should be getting between 15 – 35 lbs of dry matter per day
  - Pasture vs dry feed
- Body Condition Scoring
  - Assess level of fat storage
  - Scale of 1-9
- Cold Weather - increase feed by 15-20% for every 10°F below
  - 40°F - Growing and pregnant mares
  - 18°F - adult horses

What should I feed?

- Forages
  - Alfalfa
  - grass
- Concentrates
  - Oats
  - Corn
  - Barley
- Water
  - Clean
  - Above 45 °F

What should I avoid?

- Mold
  - Hay or grain
- Dusty Hay
- Feeds developed for other species

January 2018 AG/Equine/2018-01pr

Caring for Horses in Cold Weather

Karl H. Hoopes, DVM, USU Equine Extension Specialist

Introduction

During dark winter months, we often start to worry about our horses being outside in the cold. How do they stay warm? Horses adapt very well to colder weather. During the fall months, as temperatures cool gradually, horses begin to add additional fat and start to grow a longer hair coat. Both the additional fat and the long hair coat act as insulators to preserve body heat. Given the chance to acclimate properly, horses will often choose to be outside during winter and are often better off outdoors.

The thermoneutral zone (TNZ) for horses is defined as the range of temperature in which the horse maintains its body temperature with little to no additional energy expenditure. The lower critical temperature (LCT) is the temperature below which the horse must increase metabolic heat to maintain normal body temperature.[1] The TNZ is influenced by the temperatures that the horse has become acclimated to. Horses have the ability to fully acclimate to new temperatures in about 21 days. There is a wide range of the LCT in adult horses. For example, horses in mild climates have a LCT of 40°F while horses accustomed to extreme cold have a LCT of 5°F. For most horses in good body condition, the critical temperature is around 40°F with a summer coat and 18°F with a winter coat.[1] Horses that are young, growing, or pregnant have a LCT of 40°F. If a horse can stay dry, it can stay outside in very cold temperatures with no adverse health problems. However, when temperatures drop below the LCT of around 18°F, horses need to produce more internal heat to stay warm. Horses do this by consuming more calories in their diet.

Normal Energy Requirements

Horses have differing digestible energy (DE) requirements depending on the stage of life they are in, their size, and the different workloads they perform. Table 1 indicates the different energy requirements of horses at temperatures within the TNZ.[2]

Table 1. Normal Energy Requirements for Horses.

Horse	Daily Digestible Energy Requirement (Mcal)
Adult 1,100 lbs. maintenance	16.65
Adult 1,100 lbs. light work	19.98
Adult 1,100 lbs. heavy work	26.64
Pregnant mare 7 months of gestation	17.89
Lactating mare 4th month of lactation	29.44
Weanling 7 months old 520 lbs.	16.40
Yearling 850 lbs.	19.25

Forages, such as grass and hay, form the basis of most horses diets. Healthy horses should consume between 1.5–3% of their body weight in dry matter (DM) daily. Dry matter refers to material remaining after the removal of water. It reflects the amount of moisture in feeds. For an 1,100-lb. horse that means feeding 16.5-33 lbs. of DM. For a 520-lb. weanling that means feeding 7.8-15.6 lbs. of DM. Most of the dry matter should consist of a good quality forage such as grass, grass hay, or alfalfa hay. It should also be noted that not all hays contain the same amount of DE. Many factors, such as moisture content, time of harvest, and age of hay, all contribute to how much nutritional value the hay contains. Tables 2 and 3 outline the DE contained in different good quality forages and concentrates. As seen in the Tables 1-3, most of the time a horse's energy requirement can be provided through a good quality forage without adding concentrates. However, it should be noted that even in warm weather young growing horses and lactating mares may not be able to consume enough DE with forage alone. They will need to be supplemented with more energy rich feedstuffs. Remember that different feeding practices can lead to feed wasting. Sometimes up to 25% of the feed will be dropped on the ground and mixed with mud or manure making it unavailable to eat.

Cold Weather Energy Requirements

Cold weather increases the energy requirement by 0.00082 Mcal DE/kg body weight for each degree Celsius drop below the LCT of the animal.[3] For an 1,100 lb. horse that is 0.23 Mcal energy requirement increase for each degree Fahrenheit drop below the f LCT. Another way to look at it, during cold weather, adult horses require about 15-20% more feed for each 10°F the outside temperature falls below LCT in order to maintain their normal body temperature.[2] For young and growing horses that requirement can be up to 33% more feed.[5] Table 4 provides some different feeding strategies.

Table 2. Digestible Energy of Forages.

Forage (Hay) 20 lbs. (9.1 kg)	Digestible Energy (Mcal)
Grass Hay - Cool Season - Mature	15.57
Grass Hay – Cool Season - Immature	18.04
Alfalfa Hay	17.95

Table 3. Digestible Energy of Grains.

Concentrate (Grain) 1 lb. (0.45 kg)	Digestible Energy (Mcal)
Whole Oats	1.35
Rolled Barley	1.52
Cracked Corn	1.55
Beet Pulp	1.12
Rice Bran	1.38

Table 4. Energy and Diet Requirement Changes for an 1,100 lb. Adult Horse.

Outside Temperature	Energy Requirement (Mcal)	Lbs. of Alfalfa hay
30°F	16.65	19 lbs.
20°F (LCT)	16.65	19 lbs.
10°F	18.95	21.5 lbs.
0°F	21.25	24 lbs.

When feeding an adult horse, most of the additional energy requirements can be met by simply supplying a few more pounds of good quality forage. Forages, which are digested by microbes located in the cecum and large intestine, produce more heat than concentrate mixes, which are digested by enzymes in the small intestine. Although concentrates contain more total DE per pound than hay, the amount of actual heat given off by the digestion process is significantly less. Thus, the best way to increase internal body heat while maintaining a safer, more consistent energy intake is to increase the intake of forages. However, young growing horses require a more energy dense diet. They simply cannot consume enough forage to meet the required energy needs. This becomes even more important when cold weather makes addition energy demands. If the necessary amount of energy is not available, growth will be stunted, and health is compromised. Sometimes, simply adding oats is not enough. Commercially produced diets are available that contain concentrates and fats that provide the needed energy. Care should be taken to use a reputable feed source and feed according to directions given. Many times, care takers will provide free choice forage for young growing horses and supplement with an acceptable amount of concentrate and fats. This ensures that the young growing horse's energy requirements are being met.

Water Requirements

Good quality, palatable water remains to be very important for horses' diets even in cold weather. Adult horses will normally drink between 5-8 gallons of water per day. However, horses eating hay require more water than horses out on pasture. Hay is generally less than 15% moisture as compared to pasture that can be 60-80% moisture. As the amount of hay horses are fed increases for cold weather, the amount of water they need also increases to 9-10 gallons per day. Cold water causes horses to drink less. During winter months, drinking water temperatures should be kept between 45 to 60°F to maximize consumption.[4] Water heaters are a good way to keep water from being frozen or too cold. If a water heater is not available, make sure to check water sources twice daily and remove ice to ensure adequate availability. Colic is a constant fear for horse owners. Impaction colic can be caused by eating hay and not consuming enough water.

Salt Requirements

Salt requirements remain constant even through winter. On average, horses should consume 1 to 2 ounces of salt per day. Free choice salt blocks are a good way to provide this important nutrient. Top dressing salt can also be utilized. Feeding salt will also increase a horse's water consumption.

Shelter

Horses can tolerate the cold pretty well if they can stay dry and get out of the wind. On cold days horses still like to be outside if the sun is shining. When it is windy or storming horses do like to be in a shelter. Horses like to be housed with other horses particularly in cold weather, assuming that the horses get along well together and there is adequate space. During bad weather horses will often turn their tails to wind, lower their heads, and stand close together to preserve body heat. Shelter becomes very important when temperatures are extremely cold with increased wind and moisture.

Blanketing

Most horses should not require a horse blanket in the winter if they are allowed to acclimate normally. The long winter hair coat acts as insulation. If the hair coat becomes wet or muddy this can reduce its insulating value. Keeping the horse dry and free of mud is important for them to stay warm. Snow does not seem to be a problem. Rain, ice and/or freezing rain is much more problematic to keeping horses warm. Horses that require a blanket may include the following:[4]

- Horses that do not develop a good winter hair coat
- Horses that are underweight
- Horses with no additional shelter with temperatures below 0°F.
- Horses that have not been acclimated to the cold
- Horses that have been body clipped
- Horses that are very young or very old

If you decide to blanket your horse, care must be taken to make sure the blanket fits properly and remember to remove the blanket periodically to evaluate the horse. Fungus can begin to grow on the skin of the horse in moist, warm conditions. Also, weight loss cannot be seen beneath the blanket.

Summary

Horses have lived in cold climates for many years. Most of the time they do just fine if they have the things they need:

- Good nutrition, with additional energy in colder weather
- Plenty of warm, palatable water
- Shelter from wind and moisture with extreme cold
- Blankets if necessary

With a little bit of extra care, we can provide a suitable environment for our horses to live outside comfortable and healthy.

References

[1]Kentucky Equine Research. Lower Critical Temperature for Horses. 2011. Retrieved from http://www.equinews.com/article/lower-critical-temperature-for-horses

[2]NRC. Nutrient Requirements of Horses (6th Ed). *National Academy Press*. 2007 http://nrc88.nas.edu/nrh/

[3]Merck Veterinary Manual: Nutritional Requirements of Horses. Retrieved from http://www.merckvetmanual.com/management-and-nutrition/nutrition-horses/nutritional-requirements-of-horses

[4]Hathaway, M, Martinson, K. Equine Winter Care. University of Minnesota Extension. 2017https://www.extension.umn.edu/agriculture/horse/care/equine-winter-care/

[5]Cymbaluk, NF, Christison, GI. Environmental effects on thermoregulation and nutrition of horses. *Vet. Clinics of North America: Equine Practice*. 1990; 6(2): 355.

Critical Issues in Beekeeping

Varroa mite is the largest cause of hive failure. I will discuss what Varroa Mite is, how it impacts bee colonies, and why every beekeeper should be treating for mites.

Sheriden Hansen
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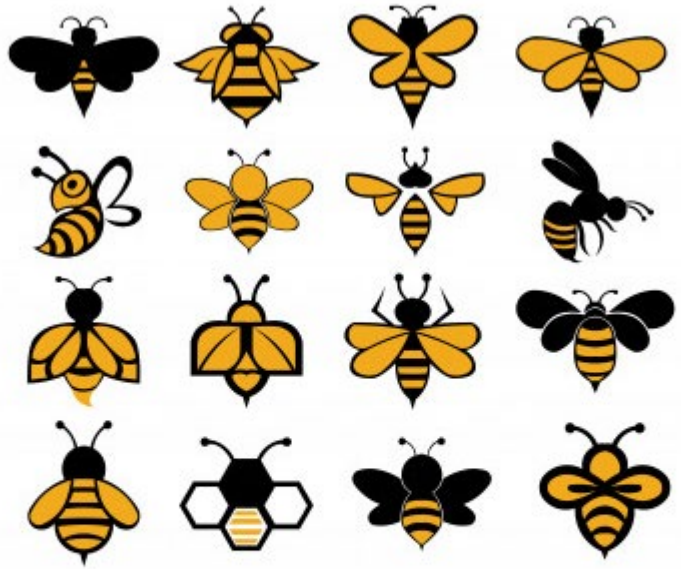
Sheriden Hansen is an Assistant Professor of Horticulture with USU Extension in Davis County, Utah. Sheriden started as a nurse, receiving a BS in nursing from the University of Utah in 2002. After many years working as an operating room RN, she decided to pursue her passion in horticulture. Sheriden graduated from Utah State University with a BS in Plant Science (Summa Cum Laude) in 2015 and a MS in Plant Science with an emphasis in fruit production in 2017.

Critical Issues in Beekeeping



Sheriden Hansen

Assistant Professor, Horticulture

Utah State University Extension

Outline for today

- Honey bee health
- Bacteria and Foulbrood
- Viruses
- Parasites and Varroa Mite
- Varroa Mite Monitoring
- Varroa Mite Treatment

Why add bees?

- How many of you are currently beekeepers?
- How many of you want to be beekeepers?
- What are the main reasons that you have for wanting to keep bees?

Honey bee health

- Why is honey bee health critical?
- Our agricultural productivity is dependent on the European honey bee (*Apis mellifera)*
  - Honey bee as a pollinator
  - $20 billion to the value of U.S. crop production
  - Pollinate apples, cranberries, melons, broccoli, cherries, etc.
  - Almonds completely dependent on the honey bee

Honey bee health

- Estimated 2.7 million colonies in the United States today
  - Two-thirds of colonies travel
  - California almond industry requires 1.8 million colonies to pollinate 1 million acres of orchards

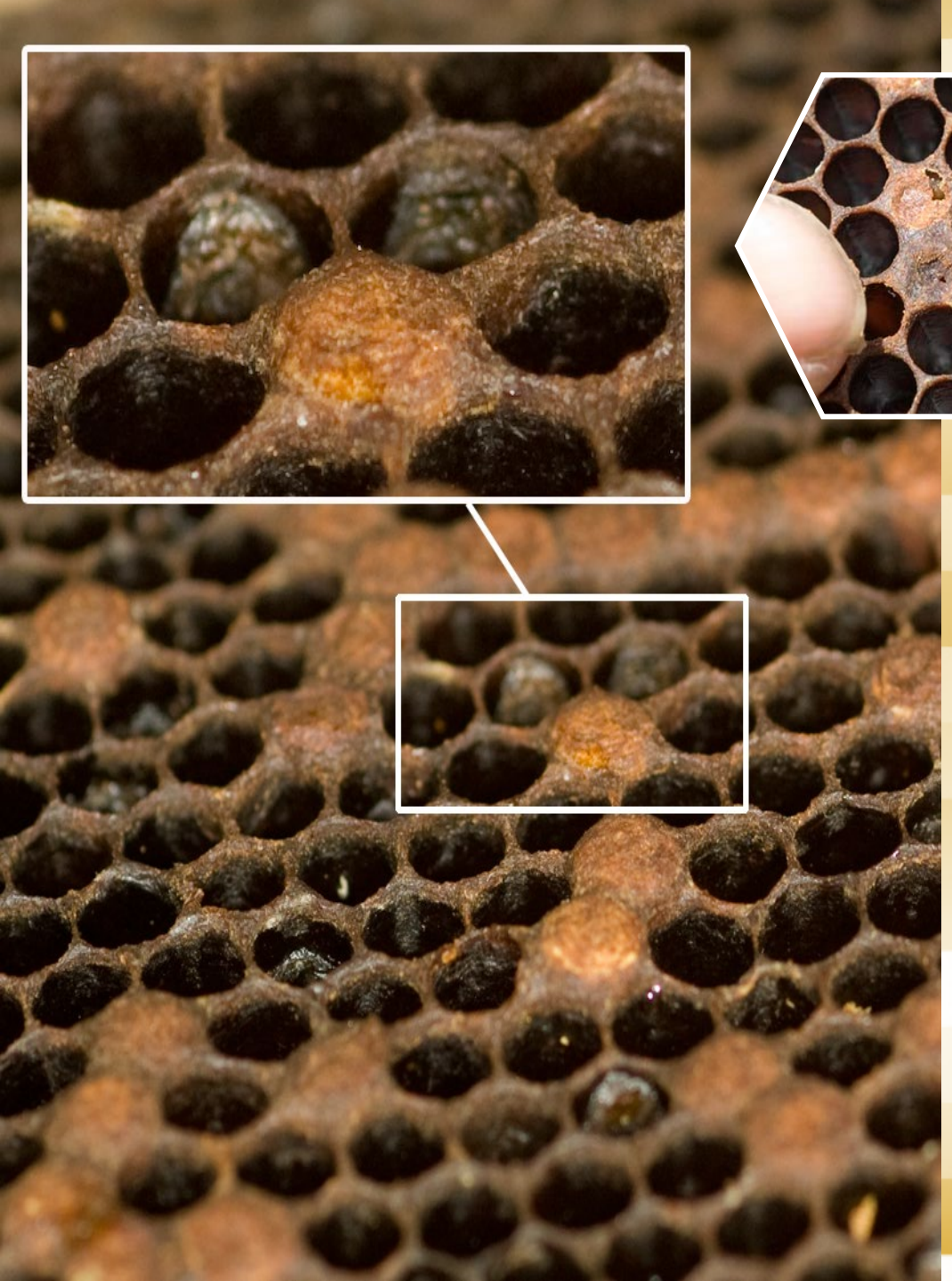
Honey bee health

- Keeping our honey bees healthy is *IMPORTANT!*
- If you are a beekeeper, you need to understand bee health
- Includes understanding of diseases and parasites

American Foulbrood

- Bacterial diseases that kill young bees (brood) inside the comb
- *Paenibacillus larvae*
- Spread by spores – highly contagious
- Disinfect equipment if you are inspecting multiple hives and suspect Foulbrood
- Weak hives are often robbed – this spreads the spores

Top photo courtesy of beeinformed.org



American Foulbrood

- Distinct “fishy” smell
- Spotty brood pattern “shotgun pattern”
- Dark, sunken cappings that may be torn
- Uncapped dead larva
- Pupae form black scale in the cell
- Sticky, gooey, **caramel or coffee colored** larva inside the cells

Photos courtesy of Beeaware.org

American Foulbrood

- Toothpick test:
  - Push a toothpick into the goop in the bottom of the cell
  - Pull the toothpick out
  - If the goop pulls a string or a rope, diagnostic of American Foulbrood

Photos courtesy of Beeaware.org and Department of Ag and Food, Western Australia

American Foulbrood

- Treatment options:
  - Diagnosis must be confirmed, either by a county or state inspector or a veterinarian
  - Can easily become resistant to antibiotics
    - no preventative antibiotics
  - Prescription from veterinarian for antibiotics
    - Terramycin, oxytetracycline
    - Tylosin used for resistant strains
  - Advanced or severe cases, the hive must be burned

American Foulbrood

- Treatment options
  - Phage hunters
  - Groups of viruses that infect bacteria
  - Studies ongoing through BYU
  - Contact the BYU Department of Microbiology and Molecular Biology:

4007 LSB
Provo, UT 84602
(801) 422-2889

American Foulbrood

- Prevention
  - Don’t purchase bee colonies that have previously been treated with antibiotics
    - Mask symptoms
  - Purchase clean and certified beekeeping equipment
  - Don’t switch frames from an infected hive to a healthy hive
  - Sterilize tools and PPE before and after working a hive that is suspected of infection
  - Burn and bury frames and boxes that have been infected with the disease

UTAH DEPARTMENT OF AGRICULTURE AND FOOD

ABOUT UDAF ONLINE SERVICES NEWS & P

Finding your county inspector

BEEKEEPING COUNTY INSPECTORS

County Bee Inspectors

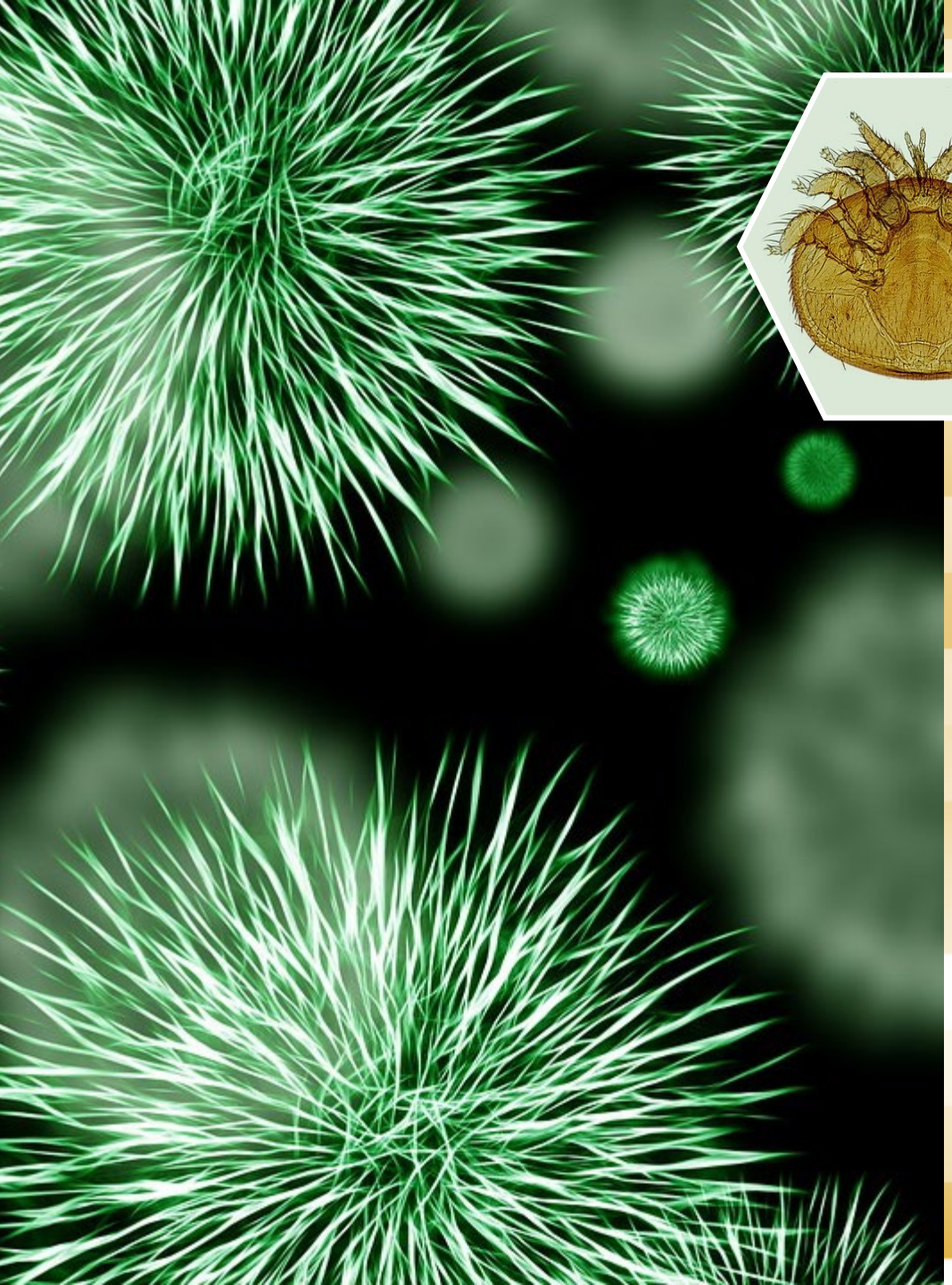
Bee inspectors are available to assist beekeepers in Utah. Contact your county bee inspector or UDAF Apiary Program with questions or concerns. If your county does not have a bee inspector, please contact a state inspector.

UDAF Apiary Program

(801) 538-7184

County	Name	Phone	Email
Box Elder	Martin James	(435) 760-0805	martin@slideridgehoney.com
Cache	Martin James	(435) 760-0805	martin@slideridgehoney.com
Davis	Roman Frazier	(561) 801-6321	rfra358515@bellsouth.net
Duchesne	Vacant	Contact UDAF	
Grand	Jerry Shue	(435) 260-8581	shue.jerry@gmail.com
Iron	Blaine Nay	(435) 590-7569	blaine@nay.org
Kane	Rob Brinkerhoff	(435) 644-8192	rob.brinkerhoff@gmail.com
Millard	Michael Stephenson	(435) 864-5343	stephensonhoney@gmail.com
Salt Lake	Peter Somers	(801) 874-2999	801874BZZZ@gmail.com
Sanpete	John Scott	(435) 283-9457	scottjg@ldschurch.org

- UDAF website that lists the current county bee inspectors
- Gives you email and phone contacts for the county inspector
- http://www.ag.utah.gov/about-udaf/37-plants-and-pests/259-beekeeping-county-inspectors.html



Viruses

- Viruses are spread through a vector
  - Most often Varroa mite
- Usually infected in the pupal stage, but may not be evident until adult stage
- Viruses have been found in pollen and nectar

Sacbrood

- Prevents larvae from shedding the final skin prior to pupation
- Body color changes from white to yellow
- May see holes torn in cell cappings
- Colony may overcome as it builds strength in the summer
- Requeening with hygienic stock is recommended for control

Photos Robert Snyder; Texas A&M, Texas Apiary Inspection Service

Deformed Wing Virus

- Common disease
- Deformed wings are the obvious sign of the disease
- Closely correlated with Varroa mites
- Can be spread through food, feces, queen to egg, and drone to queen
- Control is usually achieved with control of Varroa

Photos courtesy of Max Westby and Klass de Gelder

Chronic Bee Paralysis Virus

TWO TYPES – widespread virus with high mortality

Type 1

- Bees will be flightless and tremble
- Often crawl along the ground and congregate in groups
- May have bloated abdomens, dysentery

Type 2

- Can initially fly, greasy & hairless bees

Parasites

- Biggest issue facing beekeepers
- Prey on bees by attaching to the bee body and feeding on hemolymph
- Weakens colony
- Spreads diseases, viruses
- Two types of mites
  - Varroa
  - Tracheal

Varroa Mite

- The Varroa mite is the single greatest cause for concern for beekeepers
- *Varroa destructor*
- Resemble a tick
  - Brown-red color
  - Round, dome shaped insect
- Parasite of worker and drone bees

Varroa Mite

- Eggs are laid inside the cells of bee larva just before the cells are capped
  - One male egg
  - Several female eggs
- Young mites hatch in the cell and feed on developing pupa
- Mites leave the cell once the bee emerges
- Females then enter another cell OR attach to an adult bee to feed

Varroa Mite

- Newly emerged bees that have been fed on by Varroa are:
  - Smaller at emergence
  - May have crumpled or disjointed wings
  - Shortened abdomens
  - Have a shortened lifespan

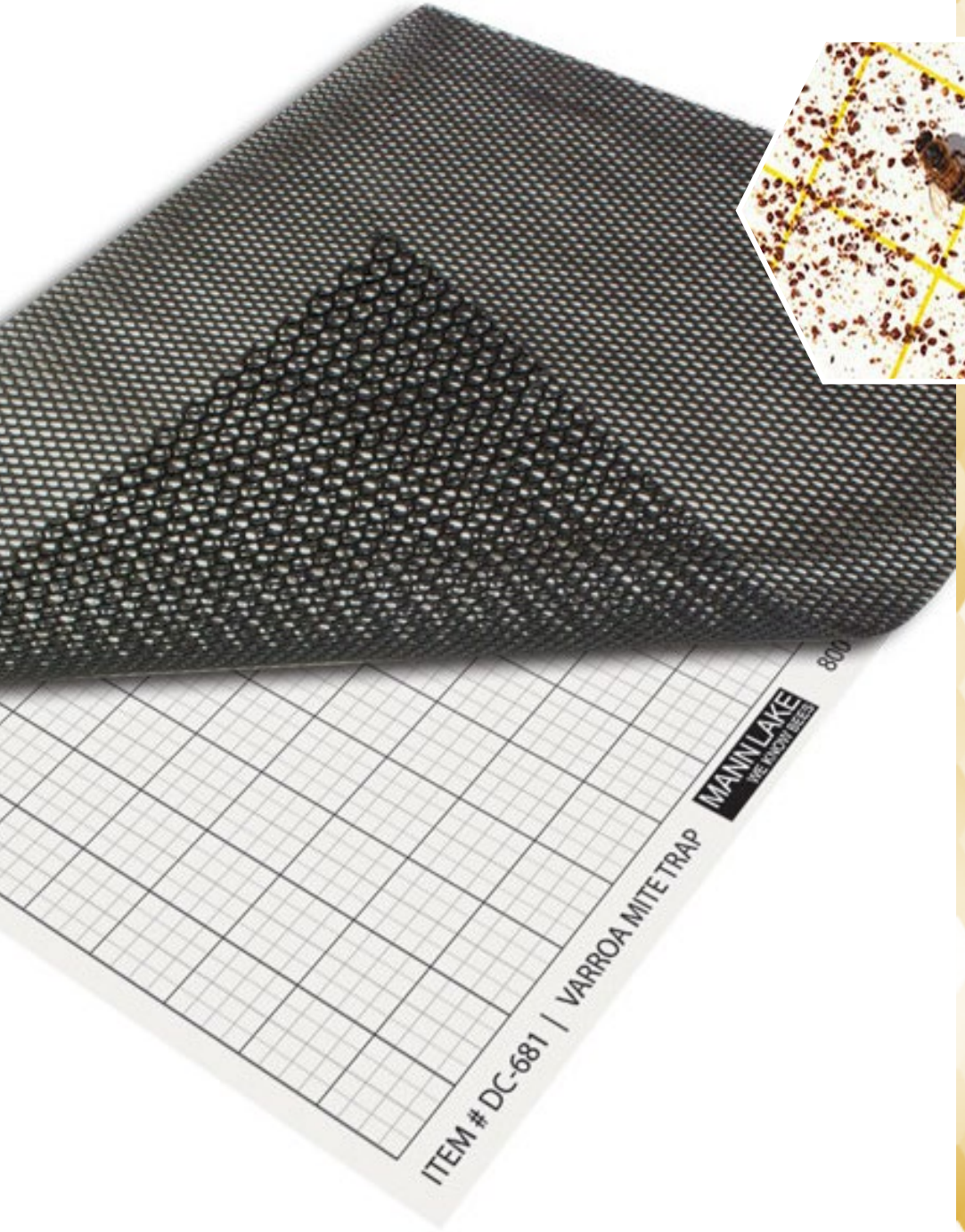
Varroa Mite

- Transferred between colonies by drifting or robbing bees
  - Drones drift between colonies in the late summer and fall
- If you don’t think you have mites… you are wrong!
- Imperative that you test and treat for mites
  - Test bees on brood frames

Varroa Mite Monitoring

- Several methods of detection – can be done spring through late fall
- Alcohol wash
  - ½ cup (appx. 300) bees + alcohol to cover
  - Shake for several minutes
  - Pour out alcohol and count mites
- Sugar roll
  - ½ cup (appx. 300) bees + 2-3 Tbsp. Powdered Sugar
  - Shake for several minutes, allow to rest
  - Shake out powdered sugar and wet to see mites
- Treatment threshold – 5 mites for every ½ cup of bees

Photos courtesy of MSU



Varroa Mite Monitoring

- Sticky board – can be done year round
  - Remove covering of sticky board
  - Place screen on top of board and slide over the bottom board of the hive
  - Non-invasive test
  - After 24 hours check the board and count mites
- Treatment threshold for 8 or less frame hive is 20 mites
- Treatment threshold for > 8 frame hive is 40 mites

Varroa Treatment Options

- Many options - may have temperature restrictions or cannot be used with honey supers in place
- Apiguard - easy to use
  - Thymol based, use when there is no honey flow
  - Temperature range 60-105^{o}F
- Mite Away Quick Strips (MAQS) – spring/fall treatment
  - Formic acid, organic
  - 7 day treatment, kills mites under the cap
  - Do not use if feeding bees
  - Temperature range 50-80^{o}F

Varroa Treatment Options

- Oxalic Acid
  - Good for fall treatments when there is little brood
  - Can be used with low temperatures
  - Remove honey supers
  - Dribble or vaporizer
- Make sure you follow **ALL** label directions and read the label thoroughly before using
- Important to rotate treatments from spring to fall
- Should be monitoring at least spring to **LATE** fall

Questions & Resources

- UDAF Bee Information: http://www.ag.utah.gov/about-udaf/51-plants-and-pests/insect-control/174-apiary-beekeeping.html
- American Foulbrood: https://pollinators.msu.edu/resources/beekeepers/diagnosing-and-treating-american-foulbrood-in-honey-bee-colonies/
- Varroa mite information: http://bees.caes.uga.edu/bees-beekeeping-pollination/honey-bee-disorders/honey-bee-disorders-honey-bee-parasites.html
- Sugar roll how-to: https://pollinators.msu.edu/resources/beekeepers/varroa-mite-monitoring1/
- Alcohol wash how-to: http://beeaware.org.au/wp-content/uploads/2014/03/Alcohol-washing.pdf

Back to Top

Defend the Flock

Presentation will address biosecurity considerations for small flock poultry operators, and introduce USDA's recent campaign, "Defend the Flock."

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A graduate of Utah State University with a B.S. in Animal Science, Dr. Frame subsequently received his DVM degree from Oregon State/Washington State Universities. Dr. Frame then completed an avian medicine residency with the University of California, Davis specializing in poultry pathology and diagnostics. He is board certified in the American College of Poultry Veterinarians. He currently serves as the USU Extension Poultry Specialist with an additional assignment as poultry diagnostician for the Utah Veterinary Diagnostic Laboratory. Dr. Frame has been widely involved in avian influenza field work and has served on various national professional poultry boards, including the American Association of Avian Pathologists and General Conference Committee of the National Poultry Improvement Plan, an advisory board to the US Secretary of Agriculture. He presently serves as editor for the Western Poultry Disease Conference, an internationally renowned poultry disease forum, and is on the editorial board for two professional journals.

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SMALL FLOCK BIOSECURITY

Urban and Small Farm Conference

February 21, 2019

Utah Cultural Celebration Center | 1355 W 3100 S West Valley, UT

David D. Frame, DVM, DACPV
USU Extension Poultry Specialist

General Biosecurity Principles

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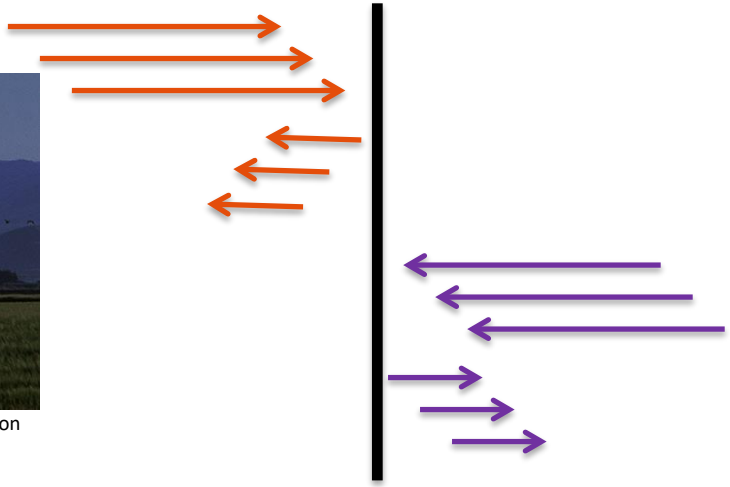
Concepts

1. Protect *your* birds from illness
2. Protect your *neighbor's* birds from illness.

"Keep disease out and keep disease in."

Photo by Jim Belliston



General Biosecurity Principles

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Methods of disease spread:

- People
- Contaminated equipment
- Animals

General Biosecurity Principles

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Basic Concepts

Structural: physical construction and maintenance of coops, pens, poultry houses, family farms, commercial farms, and other facilities.

Operational: practices, procedures, policies that are consistently followed by people.

General Biosecurity Principles

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Effective control only works if you follow proper protocol *every* time!

Dirty Area

Photo: Jim Belliston

Biosecurity Barrier

Clean Area

General Biosecurity Principles

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Dirty Area

"Line of separation"

Structural Biosecurity

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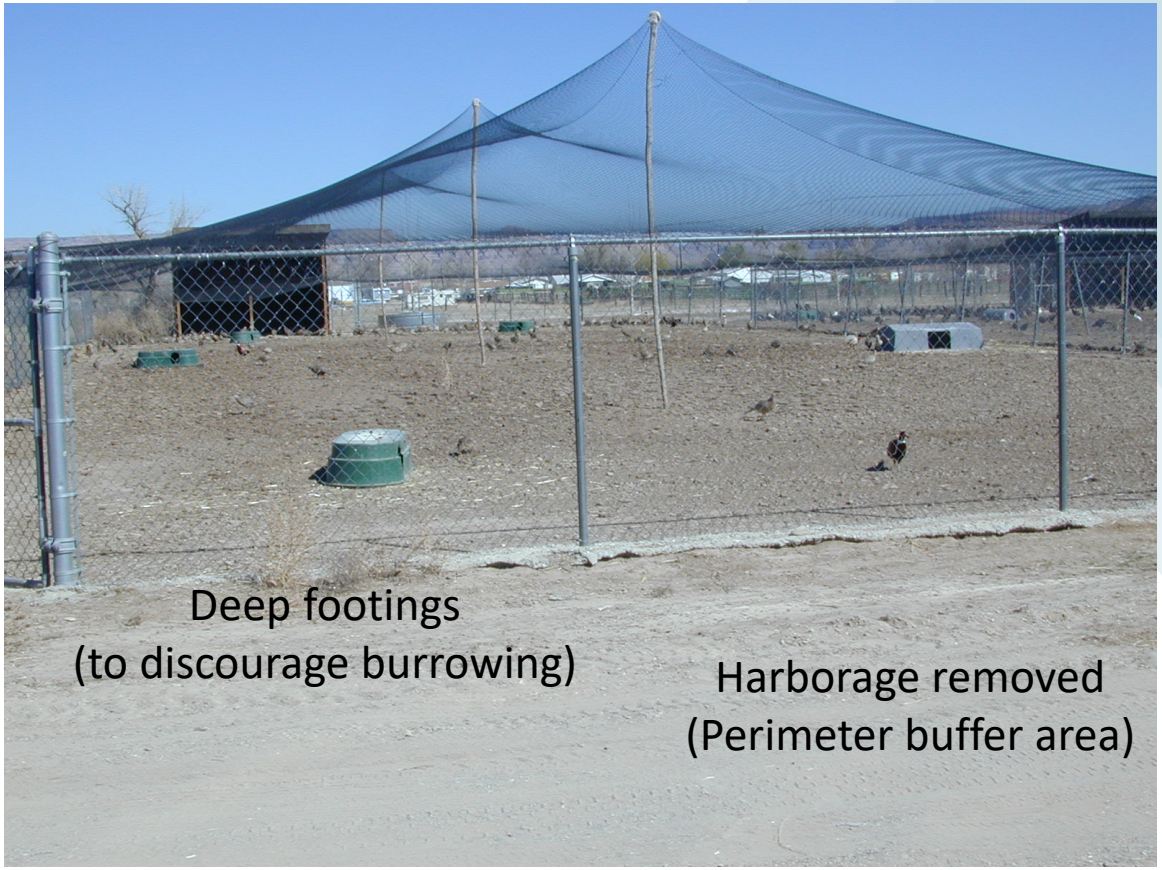
Physical barriers – Lines of Separation (LOS)

Plan so any water flow-through and drainage are upstream from canals and ponds.

Fenced

Netted



Structural Biosecurity

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Physical barriers – Lines of Separation

Fenced and covered coops are optimal.

Operational Biosecurity

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Start with disease-free birds

Operational Biosecurity

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Do not mix species or ages

Photo courtesy of Dr. Nathaniel Tablante

Operational Biosecurity

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Provide clean feed and fresh water

<u>NEVER</u> use irrigation or water from open sources as drinking water!!

Keep feed stored under cover

Operational Biosecurity

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Provide clean feed and water

Operational Biosecurity

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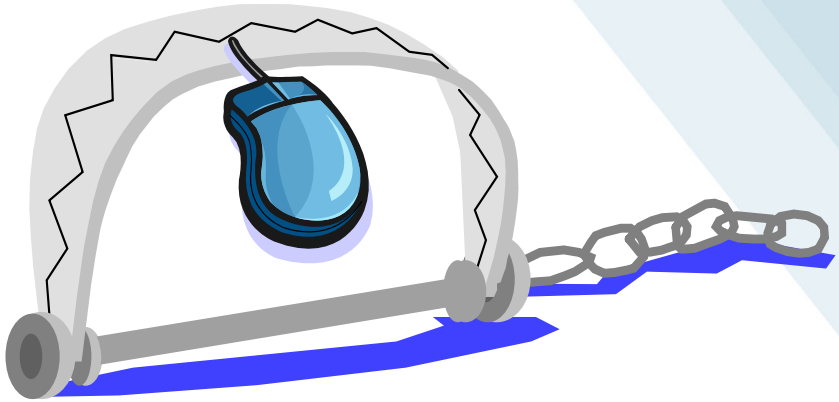
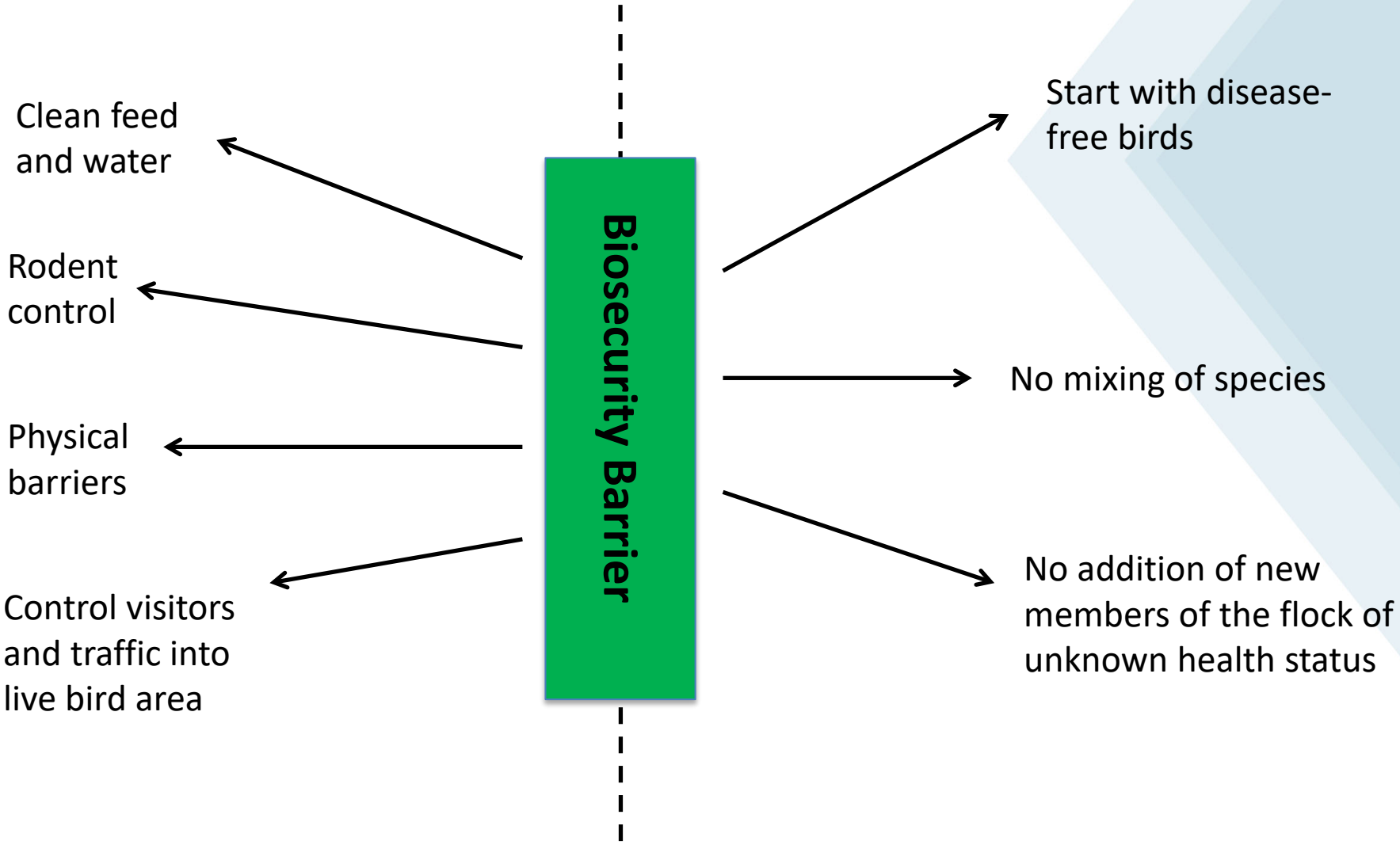
Rodent control

Minimize spills

Use approved methods and appropriate bait/trap placement.



Biosecurity Summary



Personal Biosecurity Practices

Source: Pam Zaabel, CFSPH, ISU

Photo courtesy of Mark C. Bland, DVM, DACPV

Biosecure Entry and Exit

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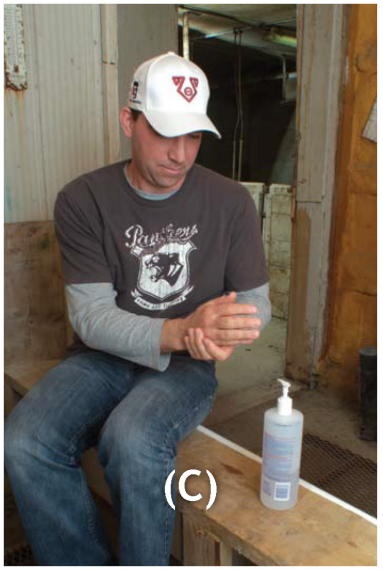

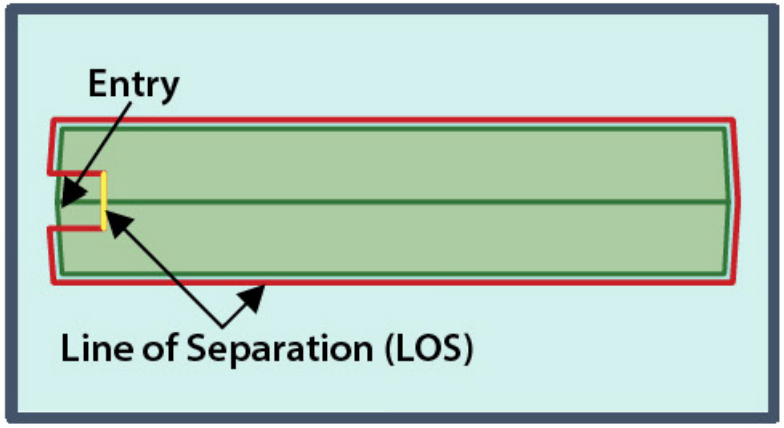

Source: CFSPH, ISU

Source: Pam Zaabel, CFSPH, ISU

Source: Pam Zaabel, CFSPH, ISU

Photos: US Poultry and The Center for Food Security and Public Health, Iowa State University

General Components of a Biosecurity Plan

- Identification of key personnel and emergency numbers
- General movement practices of owners, employees, visitors, and animals
- Designation of physical lines of separation (LOS) and perimeter buffer areas (PBA).
- Wild bird, rodent, and insect control
- Equipment and vehicles – movement, C&D
- Dead bird disposal
- Litter and manure management
- Replacement birds
- Water supply

DEFEND THE FLOCK

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The ***Defend the Flock*** **program** provides information and resources from USDA and other experts for keeping poultry healthy.

It includes practical tips from growers, veterinarians, state agencies, scientists, and industry professionals for practicing biosecurity every day.

Visit the *Defend the Flock* Resource Center for tools and resources to make your daily and seasonal routines do double-duty to prevent the outbreak and spread of disease.

Checklist: Tips to Help Keep Your Flocks Healthy

This checklist is a general guide to practicing good biosecurity, but if you have a site-specific biosecurity plan, please follow it. Commercial growers should be sure their site-specific plans follow the National Poultry Improvement Plan biosecurity principles.

- ❑ **Rinse all surfaces carefully with water.**

- ❑ **Apply disinfectant** according to the directions on the label. Be sure to use a disinfectant that is registered by the U.S. Environmental Protection Agency (EPA) and indicates that it is effective against avian influenza and other poultry diseases.

- ❑ **Leave the enclosure empty** until it is completely dry. Use fans and/or open doors and windows to help speed the drying process. Wet surfaces can be harmful to poultry.

- ❑ **When you're done, remove and discard** your protective gear. If using dedicated clothing and boots, change clothing and clean and disinfect your boots.

- ❑ **Wash your hands thoroughly** with soap andwater. Wash and dry your dedicated clothing.

- ❑ **Wear personal protective equipment** or clothing and shoes that you only use when caring for your poultry. This includes boot covers or boots that can be disinfected. Change into fresh protective gear between poultry houses or coops.

- ❑ **Enclosures must be empty for a thorough cleaning.** If you have a poultry house, wait until the house is empty to start the cleaning process. If you have a coop or other type of enclosure, move the birds to a separate area before cleaning.

- ❑ **Remove all litter, manure, and other debris. "Dry" clean all areas**—brush, scrape, and shovel off manure, feathers, and other materials. Disinfectant will not penetrate organic matter or caked-on dirt.

- ❑ **"Wet" clean all surfaces**—scrub with water and detergent. Work from top to bottom and back to front.

DEFEND THE FLOCK

Below are some examples of disinfectants available on the market. Follow the directions on the label carefully for the best results.

- **Roccal®** Mix one-half fluid ounce (oz) of Roccal per gallon of water.

- **Nolvasan®** (chlorhexidine diacetate 2 percent): Mix 3 fluid oz of Nolvasan per gallon of water.

- **Household bleach** (sodium hypochlorite 6 percent): Mix three-fourths of a cup of household bleach per gallon of water.

- **Lysol®** spray for footwear

- **Purell®** hand pump for hand disinfection

Remember: It's YOUR responsibility to keep your birds healthy!

Protect from wild birds – especially waterfowl

Keep housed, covered, and protected

Control visitors, pets, varmints, and equipment

Wash hands, put on dedicated footwear and outerwear before entering pen; take them off and leave there upon exiting

Don't mix species

Use common sense

https://www.aphis.usda.gov/wps/portal/aphis/ourfocus/animalhealth/

If you suspect illness, contact local veterinary authorities or State Veterinarian's office

Be vigilant *and* diligent!

Back to Top

Holos: Farm Management Software for Animal Agriculture

Kathryn Slebodnik
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Utah State University
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Katie Slebodnik is a second-year masters student studying soil science at Utah State University. She is currently studying the effects of tannin-containing legumes on nutrient cycling and ecosystem services in beef pastures. She has worked closely with researchers at Agriculture and Agri-Food Canada to optimize Holos software for use in the Intermountain West. She graduated with a BS in environmental science with a specialty in soil and watershed management, and a minor in geospatial analysis from the University of New Hampshire in 2017. She hopes to continue her career in soil science working with stakeholders to address conservation issues in agroecosystems.

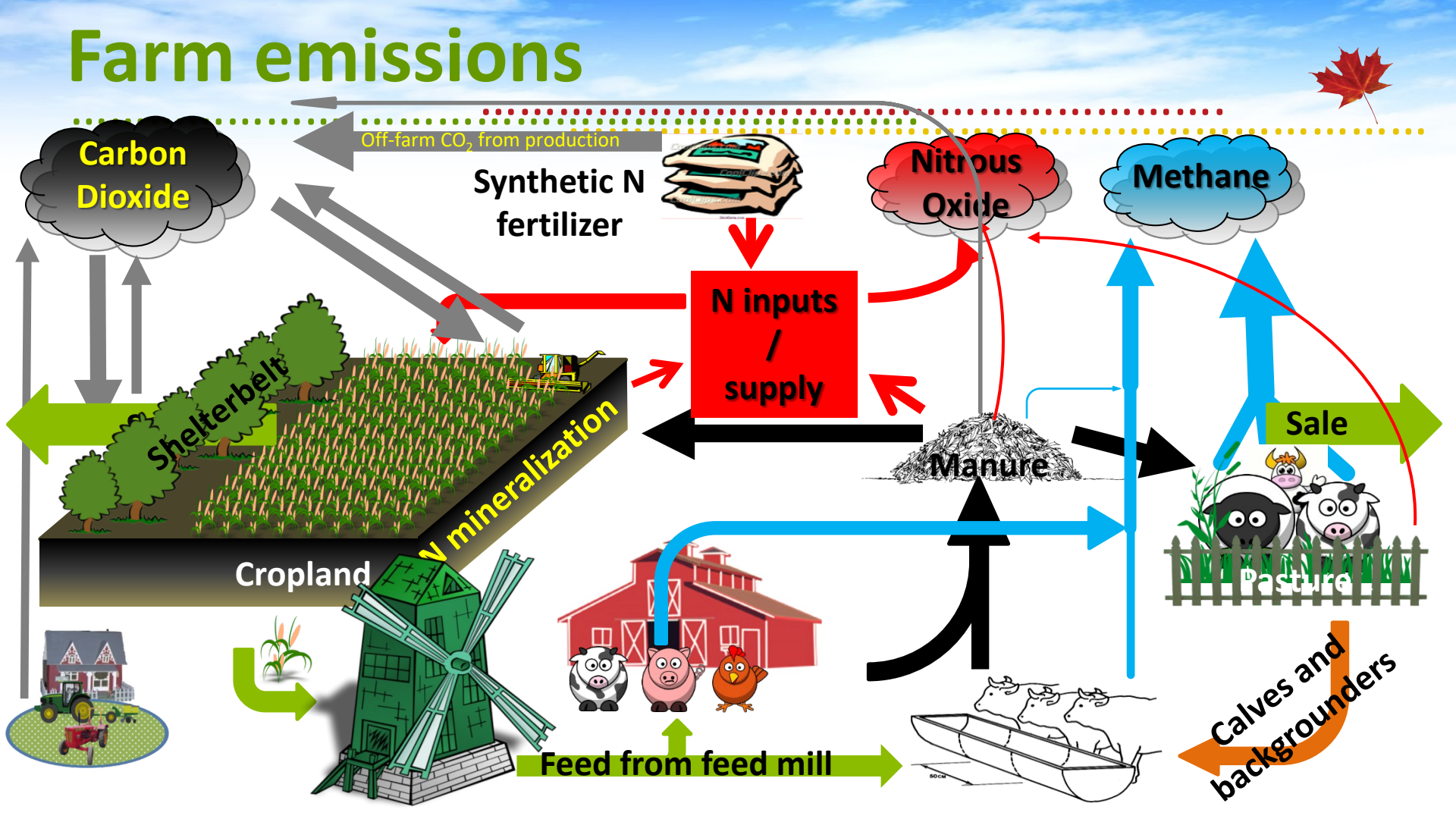
Whole-Farm Model Holos

Applications in Utah

Katie Slebodnik, Utah State University
Roland Kröbel, AAFC Lethbridge

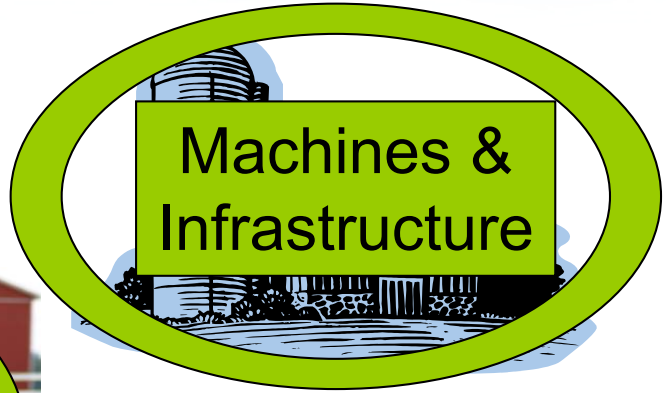
Salt Lake City, Feb. 21st, 2019

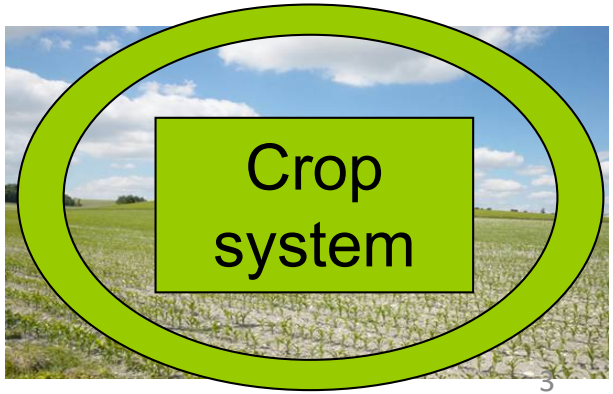
Farm emissions



Estimating impacts?

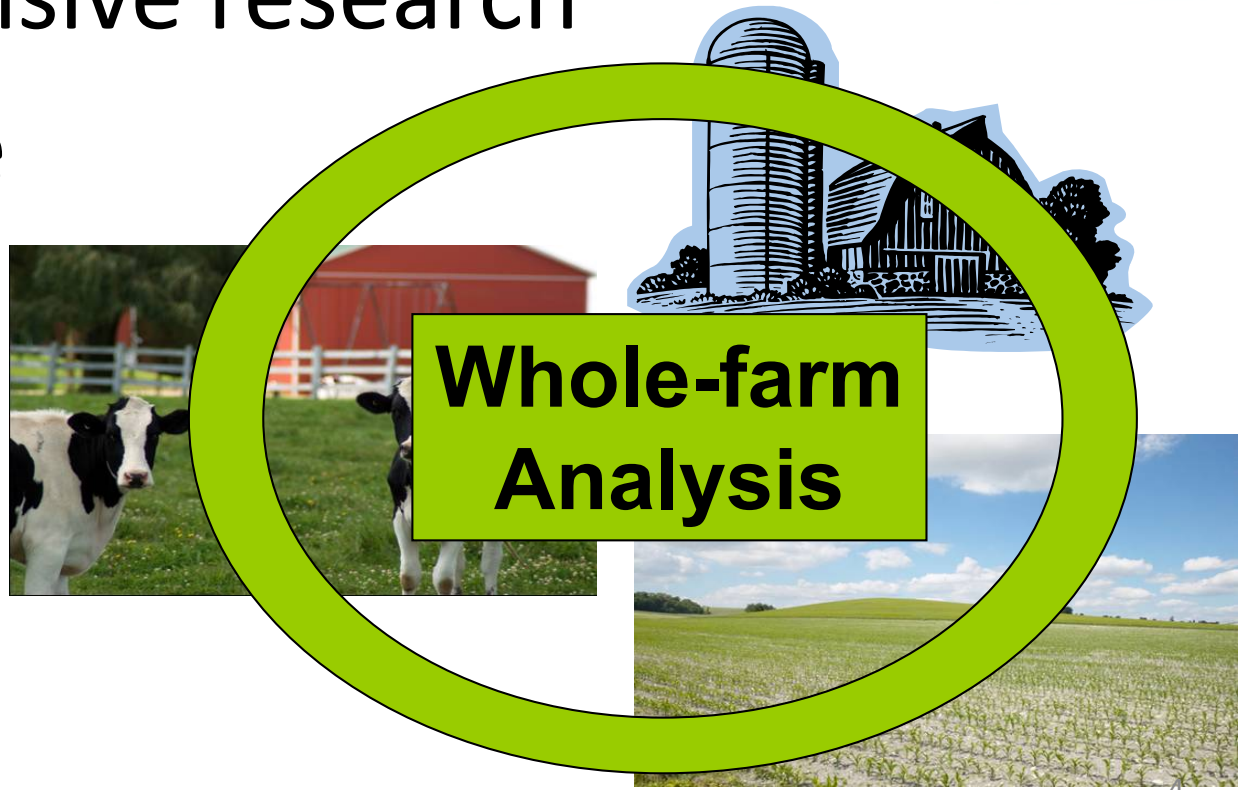
- Multiple sub-systems
- Complex interaction
- Ripple- and trade-off effects





Estimating impacts?

- Comprehensive research
- Collaborate across disciplines



"The whole is more than the sum of its parts"…

Aristotle

Holos

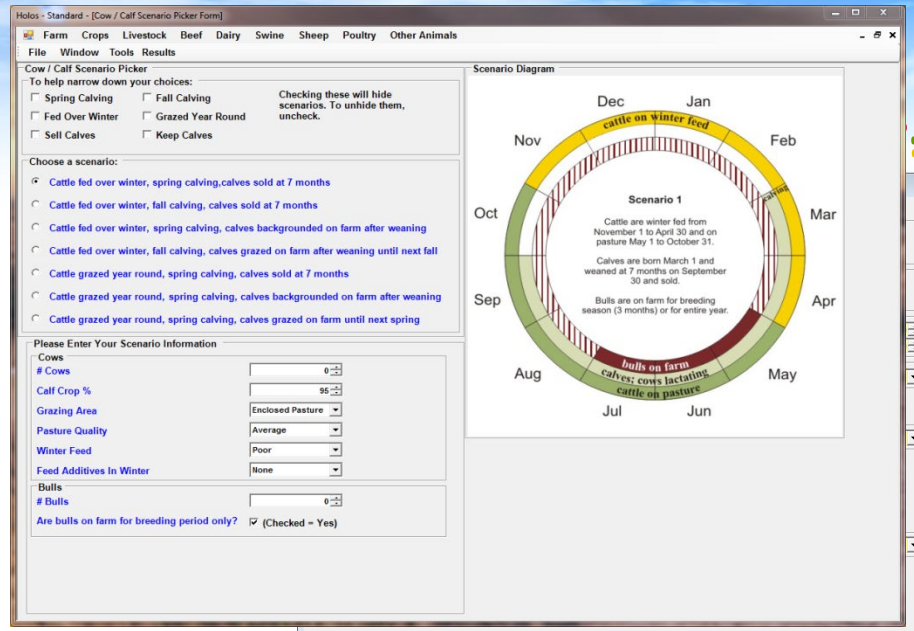
A tool to estimate and reduce GHGs from farms

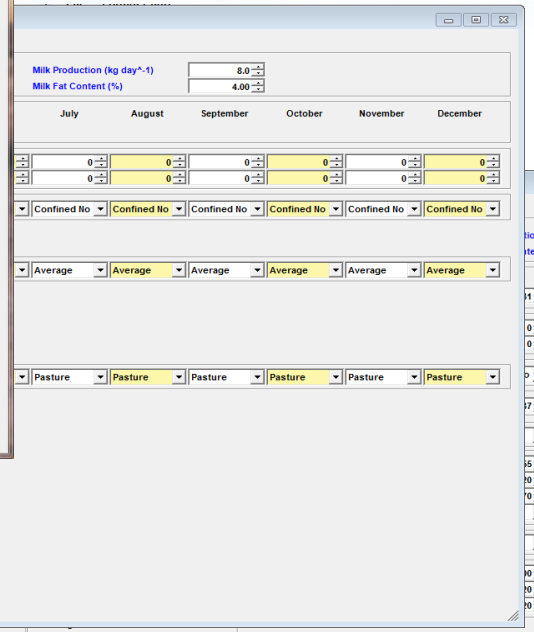
… a Greek word meaning all, entire, total (holistic).

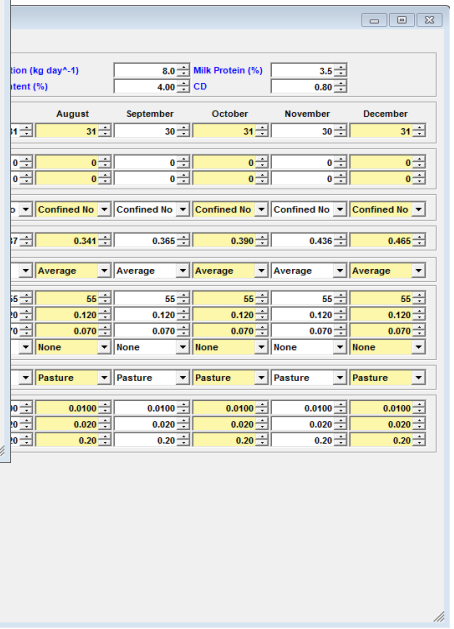
Transparent & Science based

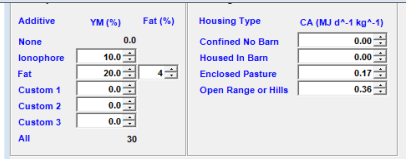
Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

- Science mentors: H.H. Janzen, K.A. Beauchemin, E. Smith
- Software development: S.M. Little, C. Vanin, A. McPherson
- Postdoctoral researchers: A.W. Alemu, S.J. Pogue. M. Cordeiro
- Team (past): B. Helgason, J. Lindemann, J. Barbieri, K. Maclean, M. Martel, L.L. Chai, R. Karimi-Dekhordi









- Simple -> complex
- Holos provides defaults
- User override where needed

Agriculture pressured by metrics

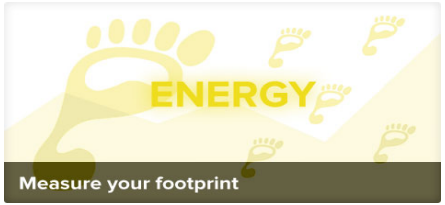
Marketing demand:

- Carbon footprint (= GHG intensity = GHG efficiency)

Next:

- Water footprint
- Energy footprint
- Nitrogen footprint

Water Footprint



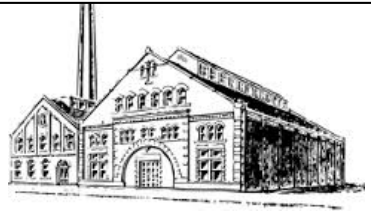
N Print

Annual workshop

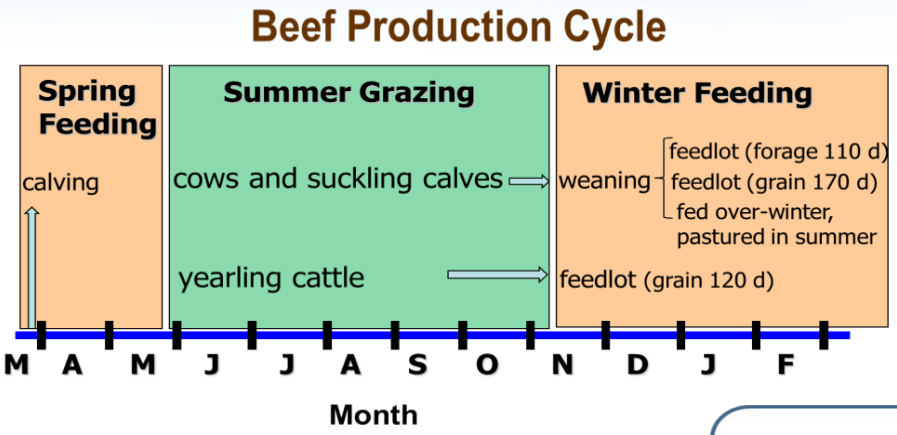
Workshop "Sustainability of Canadian Agriculture"

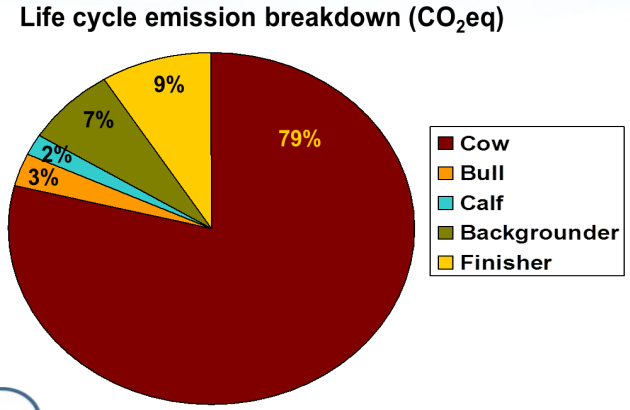
Leduc, AB, March 13 & 14

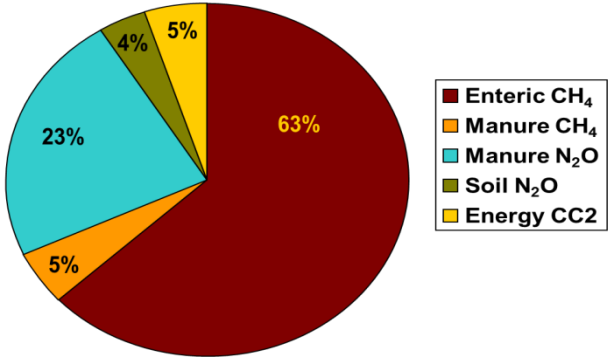
Av. by webinar



GhG from beef production in Western Canada: A case study







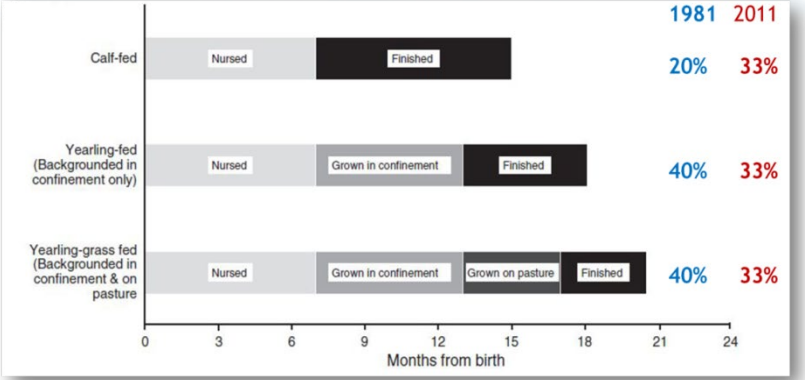
- 120 Angus beef cows
- Calves – replacements or fattened for market (feedlot)
- 4 bulls
- Cropland (grain, bedding)
- Pasture land
- 8 year cycle (6 calvings)

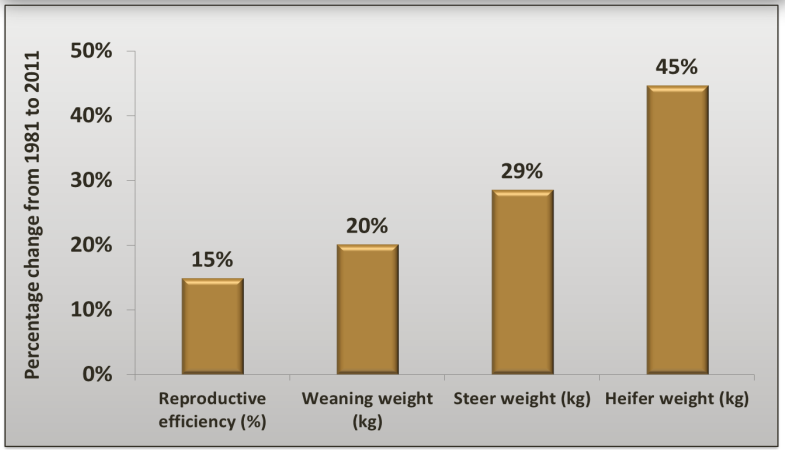
Beauchemin et al. (2010). Agr. Syst. 103:371–379

Canadian Beef GhG in 1981 as compared with 2011

To produce the same quantity now:

- **14% lower carbon footprint** per kg beef
- **29% fewer cattle** are required for breeding
- **27% fewer slaughter cattle** are required
- **24% less land** is required





Legesse et al. 2016. Animal production science 56 (3): 153 - 168

Summary & Application

Whole-farm model to:

- assess management decisions
- teach environmental impacts
- test experimental finding

Modeling projects:

- beef
- dairy
- watershed

Why Utah?

- Significant animal agriculture
- Need for
  - Improved land management
  - Reduced environmental impact

Why Utah?

- Proposed carbon tax
  - Utah bill HB403 (2018)

Image courtesy of https://priceoncarbon.org/business-society/state-actions/

Why Small & Urban Farms?

- Flexibility for experimentation
- Environmental impact often given higher importance

https://www.du.edu/news/du-increases-offerings-local-sustainable-food-through-real-food-challenge

Benefits of Modeling

- Track complex systems and activities
- Understand management impacts on economic and environmental outcomes
- Compare outcomes of various scenarios
- Optimize limited resources

Why Holos?

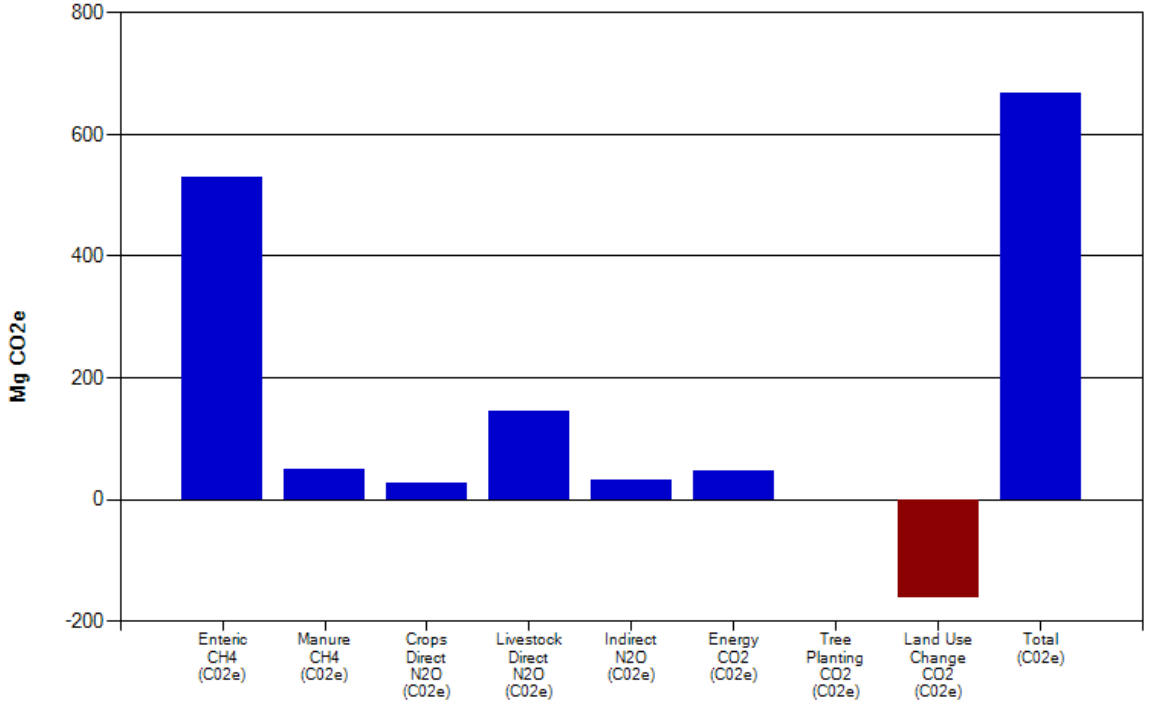
- Flexible:
  - Location/climate
  - Farm size
  - Range of application
  - Mix of animal and annual/perennial cropping systems

Why Holos?

- Accommodates variety of animal agriculture:
  - Beef
  - Dairy
  - Swine
  - Sheep
  - Poultry
  - Goats
  - Llamas
  - Alpacas
  - Deer
  - Elk
  - Horses
  - Mules
  - Bison

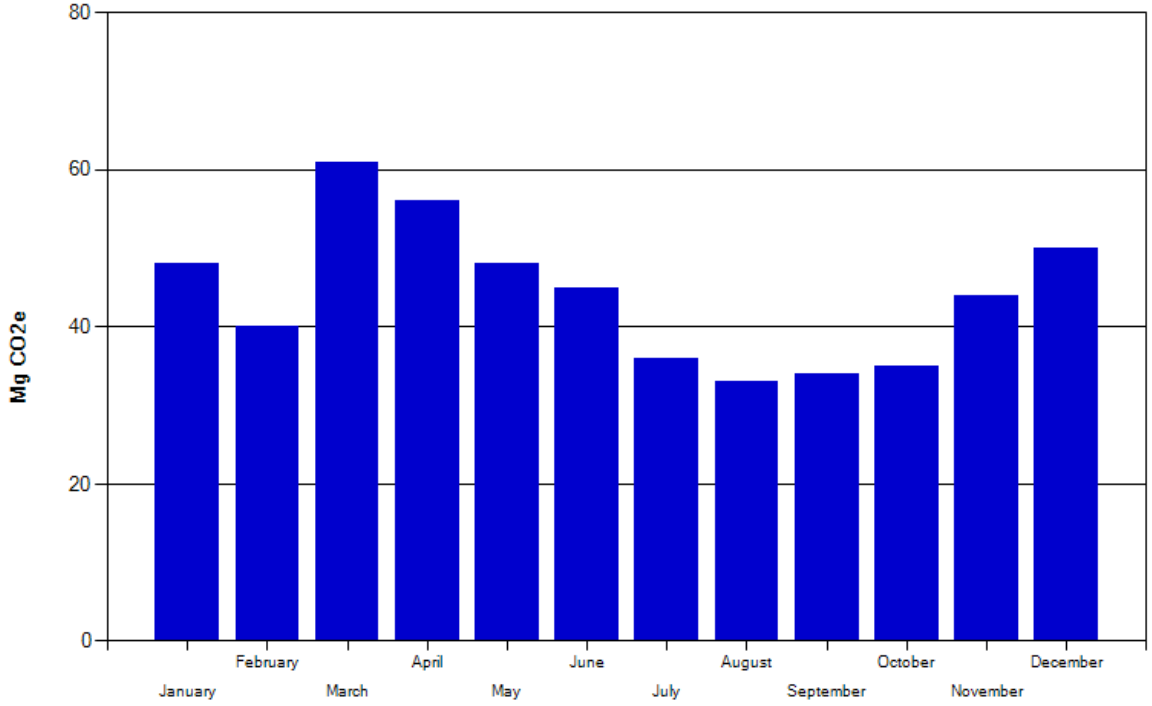
Why Holos?

- Meaningful results



Why Holos?

- Meaningful results



Why Holos?

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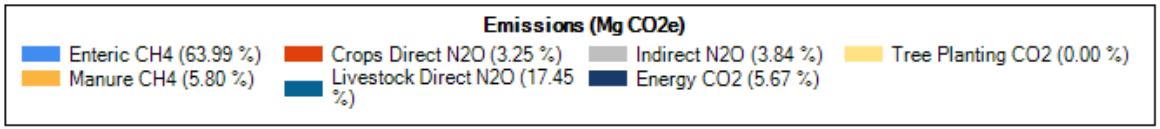


Why Holos?

- Meaningful results

Beef	Land applied manure (kg N)	Beef (kg)
Cow / Calf - Cows	0	N/A
Cow / Calf - Calves	0	N/A
Stockers and Grassers / Steers	0	0
Stockers and Grassers / Heifers	0	0
Backgrounding Group 1 / Steers	106.27	900
Backgrounding Group 1 / Heifers	114.58	900
Backgrounding Group 2 / Steers	0	0
Backgrounding Group 2 / Heifers	0	0
Backgrounding Group 3 / Steers	0	0
Backgrounding Group 3 / Heifers	0	0
Finishers Group 1 / Steers	24.4	370.5
Finishers Group 1 / Heifers	69.52	955.5
Finishers Group 2 / Steers	0	0
Finishers Group 2 / Heifers	0	0
Finishers Group 3 / Steers	0	0
Finishers Group 3 / Heifers	0	0
Bulls	0	N/A
Beef Sub Totals	314.76	3126

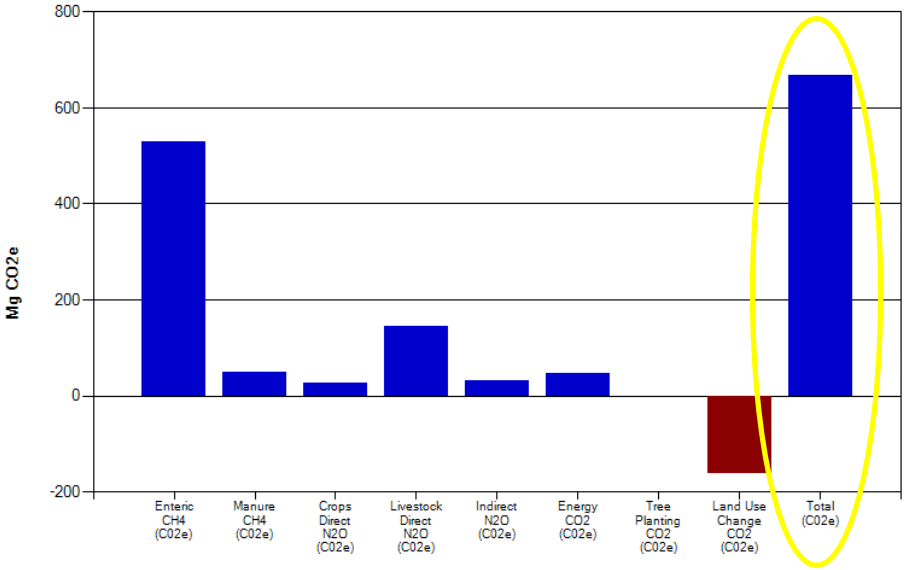
Why Holos?

- Meaningful results

Annuals	Revenue ($)	Fixed Cost ($)	Variable Cost ($)	Labour Cost ($)	Herbicide Cost ($)	N Fertilizer Cost ($)	P2O5 Fertilizer Cost($)	Net Cost ($)	Net Return ($)	Net Revenue per Hectare ($)	Net Cost per Hectare ($)	Net Return per Hectare ($)
Barley	46791.68	8360	11856	1292	3572	4242.17	2276.2	**31598.37**	**15193.31**	**615.68**	**415.77**	**199.91**
Other	37440	990	1404	153	423	956.88	323.46	**4250.34**	**33189.66**	**4160**	**472.26**	**3687.74**
Annual Sub Totals	84231.68	9350	13260	1445	3995	5199.05	2599.66					
Perennials	Revenue ($)	Fixed Cost ($)	Variable Cost ($)	Labour Cost ($)	Herbicide Cost ($)	N Fertilizer Cost ($)	P2O5 Fertilizer Cost($)	Net Cost ($)	Net Return ($)	Net Revenue per Hectare ($)	Net Cost per Hectare ($)	Net Return per Hectare ($)
Hay - mixed	71291	26961.6	22238.4	4329.6	0	0	0	**53529.6**	**17761.2**	**434.7**	**326.4**	**108.3**
Perennials Sub Totals	71290.8	26961.6	22238.4	4329.6	0	0	0					
Grasslands	Fixed Cost ($)	Variable Cost ($)	Labour Cost ($)	Herbicide Cost ($)	N Fertilizer Cost ($)	P2O5 Fertilizer Cost($)	Net Cost ($)	Net Return ($)	Net Cost per Hectare ($)	Net Return per Hectare ($)		
Seeded Grassland 1 - Native	0	0	0	0	0	0	**0**	**0**	**0**	**0**		
Grassland Sub Totals	0	0	0	0	0	0						
Fallow	Fixed Cost ($)	Variable Cost ($)	Labour Cost ($)	Herbicide Cost ($)	Net Cost ($)	Net Return ($)	Net Cost per Hectare ($)	Net Return per Hectare ($)				
No fallow added to farm												
Trees	Cost ($)											
No trees added to farm												
Beef	Revenue ($)	Fixed Cost ($)	Variable Cost ($)	Labour Cost ($)	Net Cost ($)	Net Return ($)						
Cow / Calf	93024	10512	75708.86	19272	**105492.86**	**-12468.86**						
Backgrounding Group 1 / Heifers	48300	440	28214.77	440	**29094.77**	**19205.23**						
Backgrounding Group 1 / Steers	48300	440	27814.59	440	**28694.59**	**19605.41**						
Finishers Group 1 / Heifers	72926.7	833	62355.21	1332.8	**64521.01**	**8405.69**						
Finishers Group 1 / Steers	72926.7	794	58266.18	1270.4	**60330.58**	**12596.12**						
Bulls	0	452.6	4071.6	832.2	**5356.4**	**-5356.4**						
Beef Sub Totals	335477.4	13471.6	256431.21	23587.4								
Totals ($)	Revenue ($)	Cost ($)	Net Return ($)									
	490999.88	**382868.51**	**108131.37**									

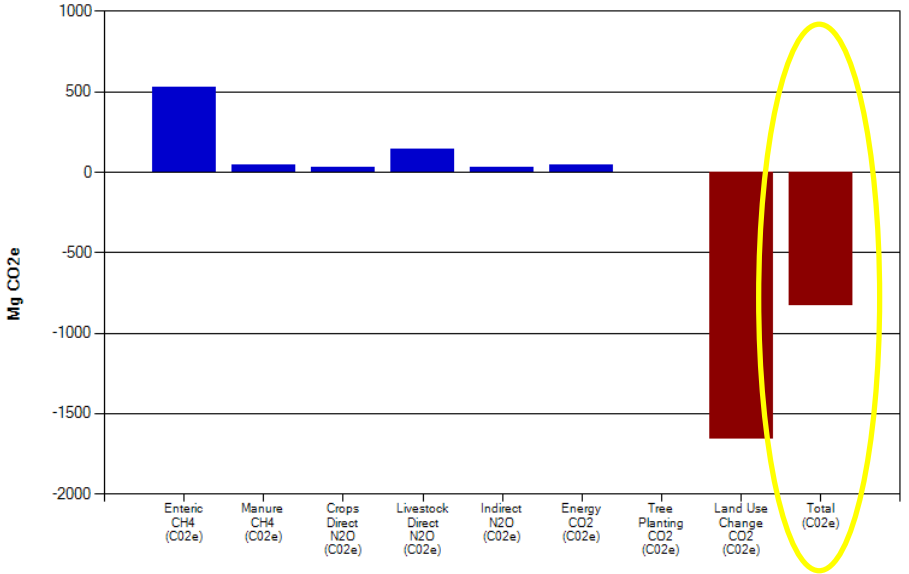
Platform for Comparison

Beef production operation



4,900 acres of native grassland

Net emissions: +668 Mg CO2-Eq



4,900 acres of seeded grassland, est. 30 years ago

Net emissions: -831 Mg CO2-Eq

Interested?

Download Holos:

https://bit.ly/2Gf7ygN

Hands-On Holos Workshop:

Today, 5-7 pm

UCCC Room 201/202

Bring Windows compatible laptop if possible

Thank you!

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